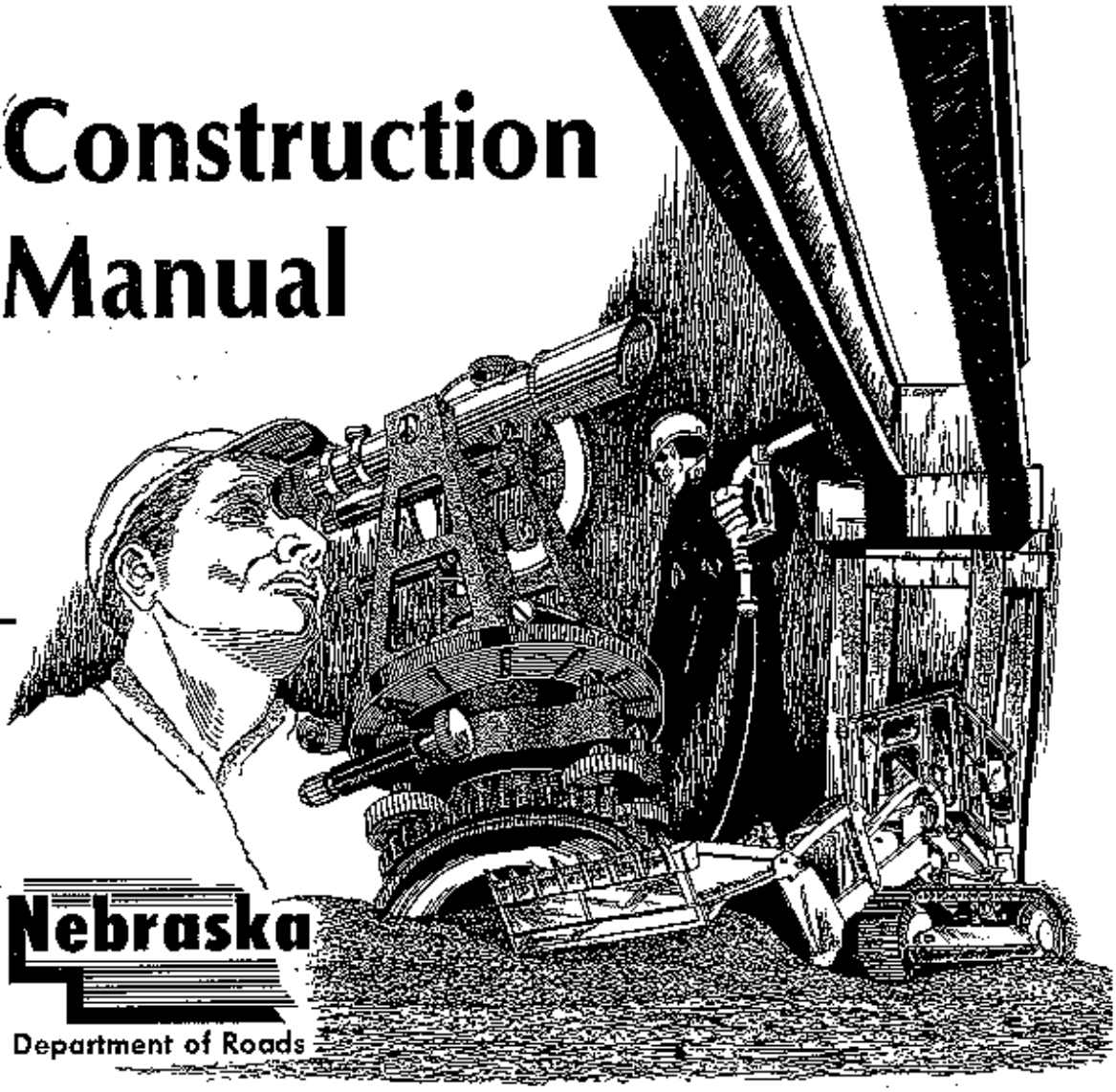
Construction Manual



Nebraska

Department of Roads

SUMMARY OF TABLE OF CONTENTS

100	**Contract Administration**
200	**Earthwork**
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Construction Manual

1998 Version
2002 Update

April, 2002		
Page	**Action**	**Description**
TOC 100-1	**Change**	Reverse of a Changed Page.
TOC 100-2	**Add**	Added in 4 More Subcategories.
TOC 100-3	**Add**	Added in Calendar Day Category and FHWA/Cert. Acceptance Category
TOC 100-4	**Add**	Added in Field Sitemanager Category to Replace Field Notebooks
TOC 100-5	**Delete**	Removed Filling Out the Form and Line-by-Line Instructions Categories.
TOC 200-1	**Add/Delete**	Added categories of Rounding of Hinge Points and Erosion Control; deleted “and Embankment” from 205.00 Excavation; Added Nebraska Game and Parks Commission Approval of Borrow Sites; Added Tentative Acceptance Categories.
TOC 300-1	**Change**	Reverse of a Changed Page.
TOC 400-1	**Change**	Reverse of a Changed Page.
TOC 400-2	**Change**	Reverse of a Changed Page.
TOC 500-1	**Add**	Added in Adjusting Asphalt Cement Contents; Section 502.40.5 and 2 subcategories; 502.40.6a.
TOC 500-2	**Add/Change**	Section 502.50.3 and 4 Subcategories; Section 507.00 and 5 Subcategories (formerly 502.40.4)
TOC 600-1	**Change**	New Table of Contents Page But No Change.
TOC 600-2	**Change**	New Table of Contents Page But No Change.
TOC 600-3	**Change**	New Table of Contents Page But No Change.
TOC 700-1	**Change**	New Table of Contents Page Complete Chapter Reorganization
TOC 700-2	**Change**	New Table of Contents Page Complete Chapter Reorganization
TOC 700-3	**Change**	New Table of Contents Page Complete Chapter Reorganization
TOC 700-4	**Change**	New Table of Contents Page Complete Chapter Reorganization
TOC 800-1	**Add**	Added in 807.02 Filter Fabric
TOC 800-2	**Change**	New Table of Contents Page But No Change.
TOC 900-1	**Change**	New Table of Contents Page But No Change.
TOC 1000-1	**Move/Add**	Moved Access Commands to 1002.02 from 1003.02 and Now the Rest of the 1003 Sequence is Renumbered. Added in 1003.05 and 1003.06
TOC 1100-1	**Change**	New Table of Contents Page But No Change.
TOC 1100-2	**Change**	New Table of Contents Page But No Change.
TOC 1200-1	**Change**	New Table of Contents Page But No Change.
TOC 1300-1	**Change**	New Table of Contents Page Complete Chapter Reorganization
TOC 1300-2	**Change**	New Table of Contents Page Complete Chapter Reorganization
3	**Change**	Changed Labor Compliance Phone Number
4	**Change**	Grammatical Corrections
15	**Change**	Updated FHWA Notification Limit to $50,000.00
17	**Change**	New Title For “Deputy Director”
18	**Added**	DBE Subcontract Approval Check
19	**Change**	Field Approval Level For Subcontracted Work Raised To $50,000.00
28	**Deleted**	Removed Paren. Phrase Referring To CICS3.
32	**Change**	Grammatical Corrections

Page	Action	Description
33	**Change**	New Railroad Insurance Procedures In SiteManager
42	**Change**	Additional EEO Noncompliance Requirement
43	**Change**	Grammatical Corrections/New 1391 Location On NDOR Website
44	**Added**	PM Will Report EEO Violations To EEO Section For Investigation
47	**Added**	Form-298 Now On NDOR Website.
50	**Change**	New Phone Extension For EEO Posters
54	**Change**	New DBE Notification Procedure
55	**Added**	Added DBE Commercially Useful Function
56	**Change**	Grammatical Corrections
57	**Change**	New DBE Notification Procedure
58	**Change**	New DBE Notification Procedure
59	**Change**	Page Formatting Correction
66	**Change**	Grammatical Corrections
79	**Deleted**	Deleted Outdated Reference To Old COFA file For Change Orders
81	**Change**	Updated The FHWA Limit On Oversight Projects
82	**Change**	Updated Change Order Procedures With Site Manager
83	**Change**	Grammatical Corrections
88	**Change**	Updated Documentation Procedure To Require SiteManager Entry
89	**Change**	Updated Sign Deduction Requirements
90	**Change**	Update English (metric) Position.
93	**Change**	Updated Documentation Procedure To Require SiteManager Entry
102	**Change**	Updated English/Metric Units
103	**Change**	Revised Cancelled Items Procedure To Meet SiteManager Requirements
104	**Change**	Revised Measurement & Payment Items Procedure To Meet SiteManager Requirements
105	**Change**	Revised Measurement & Payment Items Procedure To Meet SiteManager Requirements
106	**Change**	Revised Contractor Estimate Procedure To Meet SiteManager Requirements
108	**Change**	Revised Contractor Estimate Procedure To Meet SiteManager Requirements
122	**Change**	Updated Appendix Reference
123	**Change**	Revised Final Quantity Procedure To Meet SiteManager Requirements/Changed Reference To Logistic Division
124	**Change**	Changed Reference To Logistic Division
129	**Change**	Clarified Acceptance Of Plan Quantities
132	**Deleted**	Deleted Requirement For Bridge Deck Survey Following Repairs
136/137	**Change**	Updated Contractor Evaluation Procedures
138	**Change**	Deleted All Text and Moved Text Forward.
139/140	**Deleted**	Deleted Contractor Evaluation Text
141	**Changed**	Changed Title “Letter Of Transmittal—Finaled Projects”
158	**Added**	Added Requirement To Install Silt Fence Before Grading Starts
160	**Added**	Clarification Of Tree Circumference Included In “Clearing & Grubbing”
161	**Change**	Update English (metric) Position.
162	**Changed**	Updated the Estimated Quantities Requirements
211	**Change**	Update English (metric) Position.
212	**Change**	Updated Flagger Requirements

Page	Action	Description
221	**Change**	Update English (metric) Position.
222	**Change**	Update Sign Deduction Procedures
241	**Change**	Relocated Tack Coat Requirements
242	**Added**	Added Clarification On Test Strip
243	**Change**	Update English (metric) Position.
244	**Added**	Added Explanation Of Tender Zone
245	**Added**	Added Policy For Placement Of Template Correction
245a	**Changed**	Additional Page Required To Accommodate Template Correction
260a/260b	**Change**	Relocation Of Tack Coat Emulsion
270	**Added**	Added 5th Cylinder Requirement
295	**Added**	Updated Tining Requirements
296	**Added**	Added Tining Requirements
315-434x	**Change**	Complete Rewrite/Reorganization Of Division 700—Bridges, Culverts, And Related Construction
451a	**Added**	Added Filter Fabric Details
452/452a/ 452b	**Added**	Added Bale Check Requirements
455	**Added**	Added Silt Fence Details
455a	**Added**	Added in this Page for Overflow of Previous Page.
455b/456	**Added**	Added in this Page to Maintain Page Numbering/ Update English (metric) Position
466	**Change**	Revised Guardrail Checklist
467	**Change**	Grammatical Correction
468	**Added**	New Shop Plan Requirements For Guardrail End Treatments
469	**Change**	Grammatical Correction. Changed Measurement Specs in Rail Height.
470	**Change**	Moved End Anchorage & Bridge Connection Paragraphs
471	**Change**	New Location For End Anchorage & Bridge Connection Paragraphs. Added Text to Paragraph Above End Anchorage Section.
478	**Change**	Moved Approved Products Access Commands
480	**Change**	New Location Of The Approved Products List On The Website. Moved 1003.02 to this page from page 481.
481	**Added**	Added Requirement On White Pigmented Curing Compound Documentation. Moved Section 1003.02 to page 480 and Changed 1003.03 to 1004.01 and Added 1004.00 PCC Requirements.
481a & b	**Added**	New Concrete Cylinder Policy. Changed Section Numbering.
481 c	**Added**	New M & R Final Review Procedures. Changed Number to 1005.00.
481d	**Change**	Changed Phone Number.
495	**Change**	Revised 404 Determination Checklist
497	**Change**	Grammatical Correction.
498	**Deleted**	Deleted Water Well Requirements.
499	**Added**	Added Reference to NDEQ Website.
500	**Change**	Changed Reference to DEQ to SFM and Changed Tank Removal Procedures.
501	**Change**	Changed Reference to DEQ to SFM and Sampling Requirements.
502	**Added**	Added “No Smoking” Requirement & reference to DEQ Pamphlet on USTs.
503	**Change**	Changed reference to English (metric) numbers
504	**Added**	Added requirement to send copy of closure report to SFM and changed

Page	Action	Description
		reference to DEQ to SFM.
505	**Change**	Changed reference to DEQ when fuel is released.
506	**Added**	Added Clarification on soil; requirement for street address; Closure Assessment Report requirements
507	**Change**	Changed Soil Disposal reference; Changed Contaminated Soil Reporting requirement; and Construction Division reporting requirements.
508	**Change**	Changed reference to DEQ to SFM.
510	**Change**	Grammatical Correction
512	**Change**	Grammatical Correction
518	**Change**	Updated Storage Of Waste Paint Requirements
527	**Added**	Added SiteManager Guidance
528 & 528a	**Change**	Updated SiteManager Support List
530 to 590	**Change**	Complete Rewrite/Reorganization Of Division 1300—Project Surveys

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DIVISION 100

CONTRACT ADMINISTRATION & INSPECTION PROCEDURES

DIVISION 100
CONTRACT ADMINISTRATION & INSPECTION PROCEDURES

101.00 -- CONSTRUCTION ORGANIZATION

101.01 PURPOSE OF MANUAL

- Establish uniform policies and procedures for contract administration and inspection of construction projects, and provide interpretation and clarification of specifications.

- Serve as a collecting point for new instructions and guidelines relating to administration and inspection of construction projects.

- Describe the role of District Engineers, District Construction Engineers, Project Managers, Construction Technicians, and others assigned to supervise and inspect construction projects.

101.02 ENGINEER'S DUTIES AND AUTHORITY

I. Authority of the Director

A. General - The specifications are the Engineer's authority to decide questions as to quality or acceptability of material furnished, work performed, manner of performance, rate of progress of the work, and interpretations of the plans and specifications.

The authority exercised by the Engineer as provided in *SSHC Subsection 104.02 and Subsection 105.01* includes the following:

1. Authority to enforce specific requirements and provisions of the plans and specifications.

2. Authority to interpret the requirements and provisions of the plans and specifications in cases of questionable or doubtful application.

3. Authority to authorize (approve) revisions or modifications in the plans or specification requirements and/or to authorize or establish new or additional plans or specification requirements.

4. Authority to suspend the work under certain conditions.

B. Delegation of Authority

General - The Director, exercising the responsibilities given him/her by the statutes regarding the control, management, supervision, administration, and direction of the Department of Roads, assigns and designates to various engineering, management, and technical

personnel the responsibility for the performance of certain functions of the highway construction operations.

The assignment and designation of responsibility for the performance, supervision, or completion of any task by this Construction Manual also includes the authority necessary to complete that task.

101.03 CONSTRUCTION DIVISION

The Construction Division is the eventual authority for all your unresolved contract and construction related questions. It provides:

- Direction and consultation to District Engineers, Construction Engineers, Project Managers, Construction Technicians, and other central offices relating to specifications, methods, techniques, and policies on highway construction, inspection, and contract award and administration.

- Final decision capability for all disputes or questions regarding contract administration.

The Construction Engineer is directly accountable to the Deputy Director for Engineering. The organizational chart for the Construction Division is shown in Figure 101.1.

Responsibility for administering construction contracts on the roads, highways, and interstate systems rests with the Construction Engineer. Responsibility for actual construction work is delegated to the District Engineer and ultimately rests with the Project Manager.

Construction Division

Construction Engineer (Oie – 4532)

Office Manager (4532)

Asst. Construction Engineer for Pavements (Henrichson – 4451)

Final Plans Review Coordinator (Brill – 4568)

Spec. Provisions (4568)

Time Allowances (4529)

Spec. and Estimate Analysis (4568)

Scheduling (4568)

Traffic Control Estimates (4568)

Asst. Construction Engineer for Grading, Bridges, and Structures (Caples – 4452)

Construction Manual and Specifications (4452)

Finals Review Districts 1, 4, 8 (4456)

Finals Review Districts 3, 5 (3838)

Finals Review Districts 2, 6, 7 (3891)

Earthwork Comps (3891)

Plan Revisions (3830)

Labor Compliance (3830)

Payrolls (3830)

Asst. Construction Engineer for Administration, Specifications, and Field Coordination (Bartos – 4455)

Change Orders (4458)

Equipment Rental Rates Blue Book (4458)

Pay Estimates (4428)

Contractor Evaluations (4458)

Flagger Certification (4455)

Subcontract Approval (4428)

Notices to Proceed (4428)

Fuel Costs (4429)

Time Extension Documents (4458)

Construction Data Retrievals (4429)

Asst. Construction Engineer for Contracts (Fredrickson – 4528)

PS&E (4556)

Estimating (4873)

Qualification & Letting (4451)

Advertisements (4451)

Bid Packages (4525)

Award and Execution of Contracts (4851)

Contracts and Bonds (4851)

External EEO & Minority Business Coordinator (Kisicki – 3813)

Contract Compliance (4514)

DBE Certification (4844)

External Training (4844)

TRNS•PORT Coordinator (Daugherty – 4559)

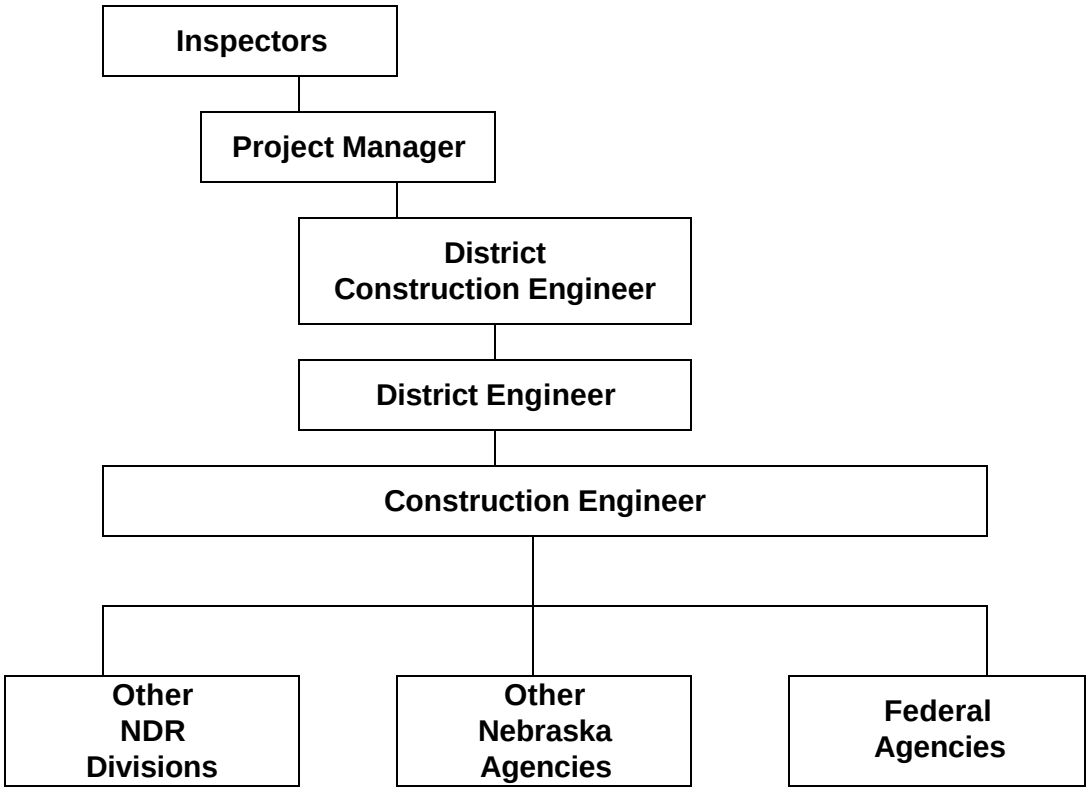
Construction Web Site (4453 or 4454)

TRNS•PORT Modules Support CES, PES, LAS, CAS, BAMS/DSS, SiteManager, Expedite (4453, 4454)

Figure 101.

101.04 CHAIN OF COMMAND

The normal chain of command for questions and business operations is as follows:



101.05 CONSTRUCTION ENGINEER

The Construction Engineer provides guidance to District Construction Offices to insure compliance with Specifications and established policies and procedures in the timely completion of NDR projects. The District Engineer, through the Project Manager, has
@ direct responsibility for construction projects. The Construction Engineer is the next level of authority on approval of substantial change orders and the resolution of contract disputes when District Engineer decisions are appealed.

Interpretation of Specifications

The Construction Division provides consultation and advice on construction problems concerning the application and interpretation of Specifications and other contract requirements. Providing this guidance on a statewide basis is intended to insure uniform and fair contract administration.

101.06 DISTRICT ENGINEER (DE)

101.07 DISTRICT CONSTRUCTION ENGINEER - The District Engineer is responsible to the Director for the proper administration and completion of each contract for highway construction in his/her District.

The District Engineer has the responsibility and the authority to:

a. Manage the field staff that provides construction and materials inspection on highway projects within each NDR District. This responsibility includes oversight on contract administration issues, compliance of materials, quality of work performed, and approval of most change orders.

b. Enforce specific requirements of the plans and specifications in the completion of contracts for highway work. (Generally, he/she will actually delegate this responsibility and authority to the Project Manager.)

c. Interpret or rule on disputes over requirements of the plans and specifications and decide questions which may arise in all cases when such interpretations and decisions will result in completion of the work in accordance with the intent of the plans and specifications.

d. Prepare and recommend revisions and modifications in the requirements or provisions in the plans or specifications, or prepare and recommend additional requirements in cases where construction conditions appear to warrant revisions or additional requirements. See *SSHC Subsection 104.02* for alterations which can be approved by the District Engineer.

e. Delegate the direct responsibility for the engineering supervision and inspection at the project level, generally through the District Construction Engineer to Project Managers in the field.

DEs also provide field input into construction related problems for process improvements. It is imperative that DEs maintain a close working relationship with all central offices.

101.07 DISTRICT CONSTRUCTION ENGINEER (DCE)

The DCE is responsible for management of the field staff that provides construction and materials inspection on highway projects within each NDR District. This responsibility includes oversight on contract administration issues, compliance of materials, quality of work performed, and approval of most change orders. DCEs also provide field input into construction related problems for process improvements. It is imperative that DCEs maintain a close working relationship with all central offices. The DCEs report to the DE.

The District Construction Engineer is responsible directly to the District Engineer for the direct and close supervision of the construction work and the supervision of Project Managers at the project level, as assigned to him/her by the District Engineer.

The District Construction Engineer has the same authority as listed for the District Engineer when carrying out and discharging the responsibilities assigned to him/her by the District Engineer.

101.08 PROJECT MANAGER (PM)

The Project Manager, working directly under the supervision of the District Construction Engineer (DCE), is responsible through the DCE to the District Engineer for the construction of the project in accordance with the requirements of the plans and specifications. The Project Manager is responsible for and has the authority to assign or delegate the supervision, staking, or inspection of construction work phases or operations to engineers or construction technicians working under his/her direction.

The Project Manager is the key person in the field organization. The Project Manager's diligence, knowledge, and integrity are important in carrying out the work of planners and designers. The assignment demands judgment, courage, ingenuity, foresight, and tact. Its reward includes priceless experience in the arts of supervision, organization, engineering, and public relations. It also furnishes pride and satisfaction in a job well done.

In assuming the responsibility for proper fulfillment of assigned construction work, the Project Manager is also accountable for:

- Maintaining good relations with contractors, affected property owners, and the general public.
- Assigning personnel to inspection and survey operations on the project, along with providing the supervision and instructions necessary to assure proper performance of assigned duties.
- Keeping the District and Headquarters Office informed as to construction progress, status, etc.
- Maintaining a complete record and proper documentation of all quantities and transactions relative to the project.
- Assuring proper use of equipment and materials used in the performance of assigned duties.

While Project Managers have responsibility for general supervision of the work, their main concerns are compliance with specifications and project completion. It is not their responsibility to direct the everyday activities of the contractor, **and they should not do so**.

The Project Manager is authorized to assign or delegate the inspection and record keeping required for the project. The Project Manager must monitor the delegated tasks to insure they are being properly performed.

In cases of questionable application of plan or specification requirements, the Project Manager may decide such questions or make interpretation of specification requirements if the decision or interpretation will clearly result in the completion of the work in accordance with the intent of the plans and specifications.

If the intent of the plans or specifications is not clear or a dispute over interpretation of plan or specification requirements develops, or if the provisions are clearly unworkable or impractical, the Project Manager shall submit the question or problem to the District Construction Engineer or District Engineer for determination.

If an immediate decision must be made, or question resolved, and the District Engineer or the District Construction Engineer is not available, the Project Manager is authorized to contact and consult the Construction Engineer or the appropriate Assistant Construction Engineer who will, if required, contact the appropriate division engineer concerned (Design, Bridge, Materials and Research, or Right of Way) for a determination. Exceptions to the foregoing are questions considered routine in nature concerning materials, in which case the Materials and Research Division may be contacted directly.

Delegation of Responsibility

The Project Manager cannot and should not expect to retain all the duties and responsibilities assigned. In an efficient organization, each employee should be delegated authority in line with their responsibilities and duties. The Project Manager must check to see that duties delegated to the Construction Technicians are properly performed.

Responsibility for inspection and surveying on a project should be delegated to one or more experienced employees. This includes the responsibility for documentation of quantities and administrative work necessary for preparation of the final estimate. Inspectors must have authority to direct and coordinate activities of inspection or survey personnel assigned to them.

All employees should be encouraged to accept delegated responsibility and to make decisions within the authority delegated to them.

101.09 CONSTRUCTION TECHNICIAN (CT)

Construction Technician must review and understand the Plans, Special Provisions, Specifications, utility agreements, railroad agreements, and municipal/county agreements. A CT will be assigned to monitor or inspect specific construction operations by the Project Manager. The CT will be responsible for and directly accountable to the Project Manager for the proper performance of the task assigned.

The CT has the authority to inspect all work performed and materials furnished and to enforce all specific requirements of the plans and specifications involved in the operations to which he/she is assigned.

In cases of questionable application of plan or specification requirements to the work in progress, and if an immediate decision is needed, the CT should, if the CT judges the intent of the requirement to clearly warrant a reasonable interpretation, make such an

interpretation. The CT should, when time permits, initially take such matters to the Project Manager for interpretation. If an immediate decision is necessary and is made by the inspector, the CT should have the Project Manager review and confirm the decision or interpretation at the earliest opportunity.

If the intent of the plans or specifications is not clear, or if the provisions are unworkable, the CT shall consult the Project Manager.

102.00 -- GENERAL RESPONSIBILITIES

102.01 PROMPT EXERCISE OF AUTHORITY

The three most common complaints of contractors are:

1. Often it is not clear to the contractor which of our personnel is responsible for the inspection of various operations.

2. CTs do not exercise their authority to make decisions.

3. CTs do not promptly advise as to acceptability of the materials or work. This results in delay to the contractor's operation while awaiting decisions on such matters.

Clearly, the contractor is entitled to prompt decisions and prompt notice as to acceptability or failure of the work or materials to conform to specified requirements.

All CTs should understand their duties, responsibility for the performance of the assignment, the authority of the assignment, and the authority to carry out the responsibility.

Making decisions is exercising authority. Decisions as to the acceptability or failure of work or materials should be made promptly and as near to the actual site of the work as possible. Accordingly, the large proportion of decisions and the largest exercise of authority will be made by the inspector and the Project Manager at the site of the work. These engineering personnel are on the site of the work in actual contact with the work operation and with the contractor. If the work is not being performed or produced to meet the specified requirements, they have the responsibility and the authority to advise the contractor (or material producer), reject the material, suspend the improper operation, or take remedial or corrective measures.

It is obvious that the decision of the Project Managers and the CTs are of primary and the greatest importance in the completion of quality construction work. Failure or delay in the exercise of assigned and delegated responsibility and authority can result in inferior or unacceptable work or materials.

102.02 APPEALED DECISIONS

Authority exercised will sometimes be questioned by an appeal of the decision or interpretation which was made. This procedure can be expected in the case of:

1. Decisions made or instructions given which are contrary to or inconsistent with the plans or specifications.

   Obviously, decisions should not be made or instructions should not be given which are contrary to design requirements, the plans, or the Specifications. However, through lack of knowledge, inadvertence, or complication of application of the proper requirements, such decisions or instructions are sometimes made.

In such cases, the decision or instruction should be rectified, whether by appeal or otherwise, and without prejudice.

2. Decisions made in cases of conflicting plan or specification requirements or interpretation made in the case of questionable application of plan or specification requirements.

   It will be realized that in cases of conflicting requirements or questionable application of plan or specification requirements, the decision or interpretation must be made on the basis of engineering analysis and judgment, precedent, or policies previously established. In most cases, the engineer at the site of work will be able to make a decision which will be supported by these factors. However, in a few cases he/she may make a decision based on a limited knowledge of the factors involved. Appeal of the decision may show that additional factors or elements which were not known to the Project Manager may make it necessary to overrule the original decision. This situation can be compared to appeals of court decisions to higher courts where additional study and comparison of preceding cases will sometimes result in reversed decisions. Accordingly, an engineer making decisions or giving instructions in the case of plan or specification requirements of questionable intent or application may occasionally have such decisions or instructions appealed, overruled, or reversed. The engineer should understand, however, that when such decisions are necessary, they are made without prejudice to himself/herself or to the other parties involved.

102.03 INTEGRITY OF EMPLOYEES

Complete integrity on the part of all government employees is essential. Integrity is defined as "moral soundness; honesty; uprightness".

The wide national publicity given to the few inefficient or dishonest employees discovered in the selected investigations, audits, and inspections make it necessary to officially recognize and emphasize that complete integrity is an essential and required qualification. It is also considered necessary to direct the attention of all our engineering employees to the "conflict of interest" statutes, listing specific items which may be prohibited by such statutes or which are incompatible with complete integrity.

Examples of serious conflict of interest acts which are forbidden:

1. Solicitation or acceptance of a cash loan or a gift of value from any contractor, contractor's representative, or contractor's material supplier doing business with the Department.

2. Performing engineering work or services for, or receiving compensation for such work or services from, any contractor, contractor's representative, or contractor's material supplier doing business with the department.

3. The Project Manager and all inspectors shall report to the District Engineer any salvage materials that will be required to be removed from

the limits of the project but are not indicated on the plans. This may include, but not be limited to, such items as: trees, fence, fence posts, structures, crops, or any other item that may or may not appear to have value. These materials are the property of the state and cannot be removed and disposed of for personal gain.

The "conflict of interest" portion of the "Regulations for the Administration of Federal Aid for Highways, effective May 11, 1960" reads in part as follows:

> "No engineer, inspector, or other person performing services for a state or a governmental instrumentality in connection with a project shall have, directly or indirectly, a financial or other personal interest, other than his/her employment or retention by a state or other governmental instrumentality, in any contract or subcontract in connection with such project."

All contracts for construction on Federal-Aid highway projects include a statement in the contract Special Provisions called:

"FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS"

This provision says the contractor, Project Manager, inspectors, and all others can be fined not more than $10,000 or imprisoned not more than five years, or both, for making false statements.

The Project Manager and inspector should realize that as an employee of the public, his/her conduct must be exemplary and merit the full confidence and appreciation of the public. Accordingly, he/she should avoid conduct or acts which may seem harmless, but which could be misinterpreted or appear questionable. Examples of conduct that could possibly be classified as incompatible with complete integrity are:

1. Excessive fraternization between the Project Manager (PM) or Construction Technicians (Inspectors) and the contractor or his/her supervisory personnel;

2. Excessive fraternization between the PM or CT and the contractor's material supplier or material promoter.

It is essential that all PMs and CTs be familiar with these requirements and comply with the specific requirements of the regulations and statutes and conduct themselves with complete integrity.

Removing Materials from Projects

NDR personnel are not allowed to remove any construction related materials from a project during or after work hours for any reason other than official sampling and testing. Such actions could be misconstrued by the public as accepting favors from a contractor or private use of public property.

Construction materials are defined as, but not limited to, pile cut-offs, old plywood, broken tools, piles of aggregate, erosion control materials and plantings, concrete test

beams, samples of aggregates or other materials, and the products of project site clearance.

Complete cleanup of the construction area or plant site, including test materials, is the responsibility of the contractor.

102.04 PRESENCE ON SITE

As the Department's representative on the project, it is essential that the Project Manager be available at all times to the contractor, his/her subordinates, and the supervisor. The PM should never be absent from the job without his/her whereabouts being known to someone, so that he/she may be contacted if necessary. The Project Manager's absence from the project will certainly compromise his/her efficiency and can be most embarrassing to his/her superiors.

102.05 PLANS AND WORKING DRAWINGS *(SSHC 105.02)*

"All authorized alterations affecting the requirements and information given in the approved plans shall be in writing". Such alterations will generally be authorized by revised plans, and the Project Manager should only authorize alterations on that basis.

102.06 PLAN ERRORS/OMISSIONS

The Project Manager, upon discovering or suspecting an error or omission in the plans, will immediately send an e-mail note to the District Construction Engineer and the Construction Division in Lincoln. The note should provide all available information. This would include:

- A description of the problem and reasons for concluding a plan error or omission.
- The sheet number(s) where the error is located.
- What alternatives are available.

The Construction Division will contact the Section Head responsible for the work where the error or omission is suspected and determine if a problem exists.

- For consultant designed plans, the Section Head must notify the consultant and Project Development’s Agreement Engineer if a problem with the plans exist.
- The consultant must be included immediately in the discussion and resolution of the problem. They may have a workable and less costly solution.

The final solution to the error or omission will be an agreed joint decision by the Construction Division, the District, and the responsible Section Head, and the consultant (when applicable).

For consultant designed plans, the District must send the Agreements Engineer a signed copy of the “Contractor Change Order/Supplemental Agreement.”

102.07 ENGINEER RELATIONS

102.08 PUBLIC RELATIONSHIPS

General Project Supervision

The PM should have the correct crew for each job.

Meeting the public with courtesy is always possible and will usually encourage a willingness to cooperate. The general public will exhibit a natural interest in work performed by or under the supervision of the Department of Roads, and employees should carefully refrain from making any unauthorized interpretation of policy or careless comment concerning the organization and its policies.

Project Managers and inspectors are among the most important individuals in development of good public relations. Located throughout the state, they can contribute toward a better understanding of the highway program and construction operations by volunteering to appear before local civic organizations. Acquainting the public with interesting details of highway construction is a proactive approach and usually avoids or diffuses criticism.

Residents Along Construction Projects

Project Managers and their staffs and the contractor's representative should contact residents and businesses along the roads that will be under construction. Before work is started, an effort should be made to advise these people of upcoming construction and discuss the probable effect on their operations. This gives them an opportunity to arrange their operations to fit the construction schedule. Both the Project Managers and the contractors have a large interest in promoting local goodwill. Construction schedules can always be arranged so that the least inconvenience will result to local residents and businesses.

Highway construction operations can cause a major change in daily traffic patterns of residents and business people. Most have no conception of road construction problems but accept some inconvenience for the welcomed improvement.

Occasionally, Project Managers may encounter individuals that are critical of the construction inconvenience. Their viewpoint must be understood to deal patiently with their demands and criticisms. Give these individuals a chance to state the problem. Sincere and courteous consideration could avoid development of ill feeling and anger.

Services Relationships

Many services such as mail delivery, school buses, fire protection, etc., may require special attention. People in charge of these services should be advised of upcoming construction and, where possible, arrangements made to provide a detour or access across or through the project for services that must be continued during construction.

News Media Relationships

Consult the Communication Division's *Media Guide* before making any public comments.

Good relations with news media can help develop and maintain good public relations. When time permits, always contact the Communication Division before going on the record. While reporters may have very little knowledge of road construction, they are well known by local residents and could have a big influence on attitudes of people living along or otherwise affected by the construction project. News media contacts should be professional and positive to maintain a good public image for the Department.

RULE #1: Never criticize another NDR division or employee in public (i.e., Don't say the design was bad.)

The Project Manager represents a public agency spending public money and is not entitled to withhold information from the public press. The Freedom of Information Act of 1983 opens most of our files to public scrutiny. Sensitive material should be cleared with the NDR Assistant Attorney General prior to release to the public or outside attorneys.

Information should always be presented in as favorable and factual form as possible. Project Managers should confine remarks to those areas over which they have personal control. Any questions directed toward NDR policies or public criticism of their superiors should be politely turned aside.

Relations with Cities and Counties

Cost overruns on projects where other governmental entities (cities or counties) bear a portion of the cost, particularly County Federal-Aid Secondary projects, can cause an unexpected financial burden for that governmental entity. On past occasions these situations have provoked feelings of ill will against the Department of Roads when the governmental entity was billed for the unexpected overrun of costs for which they had not budgeted.

Accordingly, the Project Manager should maintain a watchful eye for this particular situation and, if it becomes apparent that a significant overrun in engineering or construction costs will occur, notify the governmental entity in writing of the approximate amount of overrun.

When consultant engineering is used, the State's representative needs to insure that the Federal/State aid is being properly spent. Any doubts or problems should be discussed with the consultant/county's Project Manager. If it cannot be resolved at this level, a letter detailing the problem must be sent to the chairman of the county board or village/city council.

102.09 CONTRACTOR (PARTNERING) RELATIONSHIPS *(SSHC Section 113)*

Under the contract system used in highway construction, contractors aim to perform the work contracted and NDR Engineers see that the work performed is done according to project plans and Specifications. Since these aims are essentially the same, Engineer-contractor relations should be conducted in a spirit of mutual cooperation within the framework of the Specifications and with the best interest of both contracting parties. Establishing a cooperative and collaborative working relationship with contractors may result in improved quality and fewer unresolved contract issues. This is the goal of "Partnering."

Contractors should do no less than required by contract, nor should they expect compensation for work done that was not required.

Good contractor relations can be promoted by keeping an open line of communication and advising contractors when they are doing unacceptable work before such work is completed.

- Good Project Managers know how the contractor should construct the project. They go out of their way to make sure the contractor starts each phase of construction using proper methods and the correct materials.

- It is 1,000 times easier to correct a subgrade problem with the grading crew than with the paving crew.

The most common construction problem is the contractor being notified <u>after the fact</u> that the work was not done according to the Specifications.

In general, relations with the contractor should be fair, firm, courteous, and based on sound judgment under the guidance of specification requirements.

102.10 FHWA & OTHER OUTSIDE AGENCIES RELATIONSHIPS

FHWA has oversight authority only. FHWA representatives have the right to examine any phase of work, including methods of testings, project records, material reports, etc., to review performance of State inspection personnel assigned to the project, and to check work for compliance with plans and specifications. Their responsibility or authority does not extend to supervising or directing Project Managers or contractor forces.

Reports covering their inspections are forwarded to the Construction Division and then are made available to the District Engineer and Project Manager.

Relations with FHWA personnel should be conducted in a spirit of cooperation and courtesy, extending any assistance or facilities available. The FHWA Engineer should be informed of anticipated plan changes or extra work when the value exceeds $50,000.00, on full oversight projects (usually Interstate System with a contract value of $1,000,000 or greater).

@

Inquiries from other state or government agencies should be given prompt and courteous consideration.

102.11 EMPLOYMENT OF CONSULTANTS FOR CONSTRUCTION ENGINEERING AND INSPECTION

From time to time, and with increasing frequency, various governing bodies hire consultant services. Governing bodies could be cities, counties, or the State.

Agreement Responsibilities

Responsibilities of a consultant may be limited to providing professional advice to the governing body on the best means of satisfactorily accomplishing the work or may include specific project level engineering and/or inspection responsibilities. These guidelines will address engineering and/or inspection responsibilities. The consultant's contract should define respective authorities and responsibilities of the full-time publicly employed project administrator in charge of the project and consultant's staff.

Under federal-aid regulations, however, prime responsibility for general supervision of construction remains with the governing body. The state (county or city under agreement with state) cannot be relieved of its responsibility to insure that work is performed in accordance with project plans and specifications, even when we hire a consultant to do the inspection or design.

Project Manager

When a consultant has been engaged to provide engineering and inspection services, a Project Manager designated by the Department should also maintain working knowledge of the project.

The designated Project Manager is responsible for being thoroughly knowledgeable of day-to-day operations of both contractors and consultants providing the construction inspection/engineering services. Knowledge of day-to-day operations is construed to mean:

- Knowledge of current project status.
- Involvement in decisions relative to conditions which require change orders or supplemental agreements.
- Involvement in authorization of progress payments even though the consultant may furnish measurements or computation of quantities.
- Making periodic inspections, visits, or on-site reviews of the project; frequency dependent upon the magnitude and complexity of the project.
- The PM must verify that the consultant understands what records are required, how to record the data, and who can sign/verify each document. This is also true when a city or county does the project engineering.

- In regard to projects utilizing consultant inspection services, some misunderstandings have arisen when our acceptance date preceded a date when the county board "accepted" the project.

- Consultants utilized for engineering and inspection services must be given written notice regarding project completion dates. The consultant agreements usually specify the time allowed for the preparation and submittal of As-Built Plans and other final records, and the consultants need to be told when the clock has started. The consultant agreements state "The State will provide written notification of construction acceptance to the Consultant." At least one consultant has reported they do not receive the required notice.

- Feel free to be somewhat flexible in "starting the clock," but do put it in writing – and **send a copy of the letter to Lee Pavel in Project Development** so that he may begin his end-of-project paperwork, too. The consultant services agreements and payments are audited by the Department, and it is important to have the notification documented.

102.12 PERSONNEL

102.13 EMPLOYEE POLICIES

Some of the personnel references that employees should read and follow include:

- Classified System Personnel Rules & Regulations
- Nebraska Association of Public Employees Labor Contract
- Employee Safety Manual
- Nebraska Department of Roads' Operating Instructions
- Davis-Bacon Act

102.14 STAFF REQUIREMENTS

A definite need exists to develop and maintain procedures to properly manage engineering staff requirements necessary for highway construction projects. Proper planning and staffing procedures provide the means to estimate staffing needs based on anticipated workloads.

Field Estimates

District Construction Engineers provide an estimate of staffing needs to the Deputy
@ Director for each construction season. Each Project Manager analyzes their particular workload according to the production schedule, and District Construction Engineers collect and combine the data to determine minimum staffing for the upcoming construction season. These figures provide a guide for temporary employee hires (usually submitted in January or February each year).

Adjustments

@ As necessary throughout the year, the District Construction Engineers review their personnel requirements with the Deputy Director.

Field Personnel Duties & Staff Requirements

The District Engineer and District Construction Engineer are responsible for providing the Project Manager with a sufficient number of engineers and construction technicians to adequately and properly supervise and inspect the construction operations. The personnel furnished will have such education and experience, which, together with instruction, training, or direction by the Project Manager, will qualify them for the proper performance of the inspection or other duties assigned to them. It is the responsibility of the Project Manager to assign and utilize such personnel effectively and economically to obtain completed work of good quality and meeting the requirements of the plans and specifications.

102.15 SUBCONTRACTS

Subcontract Request And Approval

All subcontracts are subject to the requirements of *SSHC Subsection 108.01*, and FHWA 1273 (when included in the contract documents), and approval of contracting authority before they are recognized as valid. Subcontracts are required for independent trucking companies when hauling is covered by the provisions of Davis-Bacon wages (*Construction Manual 102.26*). Field forces shall not allow work to proceed without prior approval of the District Construction Engineer or District Engineer. Contractors are expected to make their application for subcontractor approval sufficiently in advance to allow time for processing and approval. On rare occasions, this may not be possible. Under these circumstances, a Project Manager may provide verbal approval provided the contractor has submitted a written application for approval of the subcontract. If the contract has a DBE goal on it, you shouldn't assume the DBE subcontract has been approved just because their name appears in the subcontract area. One way to tell is to
@ open up the subcontract record. If no approval date has been entered, the subcontract has not been approved.

A. Contractor's Requirements

The prime contractor must initiate a letter requesting to sublet items in the contract. This letter must be sent to the Construction Engineer and shall include the following information:

1. Subcontractor's name, mailing address, and telephone number.

2. Prime contractor's identification number (used on employer's quarterly federal tax return, U.S. Treasury Department Form 941).

3. A check off indicating whether or not the subcontractor is registered with the Division of Labor.

4. Estimated starting and completion dates of the subcontractor's work.

5. Items to be subcontracted with descriptions, quantities, unit prices, and amounts of non-specialty and/or specialty items. Unit prices shown must be the contract unit prices except when "labor only" or "place only" items are subcontracted. In such cases, indicate that the "item unit price" is approximate.

   When a subcontracted item is used to satisfy a DBE goal, the amount paid to a DBE must be shown and verified with signatures of the prime contractor and the subcontractor. These signatures will document the agreement for payment between a prime contractor and their subcontractor and eliminate the need for a copy of a DBE subcontract/agreement. Note the additional guidelines on the administration of DBE subcontracts that follow.

6. It has been common practice for subcontractors to include appropriate mobilization costs in their unit bid prices. Prime contractors may have encouraged this practice. However, adjustments in unit prices due to overruns or underruns will have to meet the test of "significant change".

To reduce the risk resulting from changes in quantities which are not subject to price renegotiation, appropriate use of the mobilization item for subcontractors is encouraged. On all subcontract requests, mobilization must be listed for the item even if the dollar amount listed/subcontracted is zero.

7. The Subcontract Request and Approval letter shall include the following statement: ***"It is clearly understood by both the prime contractor and the subcontractor that all terms of the prime contract shall apply."*** When "Required Contract Provisions" (Form FHWA-1273) are part of the contract documents, the prime contractor is responsible to see that a copy of this form is physically attached to the subcontractor's copy of all subcontracts. The prime contractor is responsible for fulfilling terms of the contract, including construction work completed by approved subcontractors, plus completing all required forms or reports. Refer to *SSHC Subsection 108.01* for requirements and limitations on contract subletting.

B. Project Manager Involvement

If a Subcontract Request is received by the Project Manager, it should be forwarded immediately to the Construction Division.

The Project Manager is responsible to make sure a subcontractor performs the kinds of work described in the approved subcontract.

Occasionally, contractors may have to rent additional equipment and hire extra employees to complete their work. However, when the entire crew and equipment of another contractor is used to complete the work, the prime contractor is violating the intent of *SSHC Subsection 108.01* and is considered brokering a project. If the District Engineer or the Project Manager observe work performed by anyone other than the approved subcontractors, the Construction Division should be notified. Assistance will be provided to investigate the circumstances.

At the preconstruction conference, it will be beneficial to discuss methods of keeping subcontractors informed of the work status. Although the prime contractor is responsible to make progress payments to a subcontractor, numerous incidents in the past have indicated a lack of timely progress payments from the prime contractor to the subcontractor. Subcontractors may review a copy of the "Contract Construction Progress Estimate" in the District office.

C. Field Approval of Subcontract Work

@ The District Engineers can approve a subcontract request for work up to a maximum amount of $50,000 for each occasion. This is done on DR Form 42, "Field Approval of Subcontract Work."

There are some specific items that need to be kept in mind at all times when considering a request of the prime contractor to have certain work performed by subcontract. These are as follows:

1. The contractor being considered to do the subcontract work must have been approved by the Department to perform as a subcontractor. A contractor is considered approved if he/she is prequalified to bid work; or is presently a prime contractor on a current project; or is an approved subcontractor on a current project; or has performed subcontract work in the past under the same company name. This information is available on CICS-3.

2. The subcontractor being considered must have current insurance. This information is available on CICS-3.

3. The aggregate total of all work to be subcontracted cannot exceed 70 percent of the contract amount.

If you are not able to determine the status of any of the above or have a question concerning the completion of the form, please contact Steve Bartos or Sharron Magnuson (402-479-4455) in the Construction Division.

D. Exemptions from Subcontract Requirements

The following items of work may be exempted from the normal subcontracting requirements: (It should be noted, however, that these exemptions do not prohibit the contractor from executing a subcontract if he/she chooses to do so.)

Materials

1. Small amounts of asphaltic concrete. When small amounts of material are needed to complete the work, such as for wedges at bridge ends, tying into existing surfaces, etc., the contractor will be permitted to obtain asphaltic material (and placement) from another contractor's portable (or commercial) plant without the need for a subcontract.

2. Tack or prime oil. When small quantities and/or irregular areas are involved, the contractor may obtain this material from another contractor without the need for a subcontract. This exemption in no way relieves the contractor from furnishing material which meets the requirements of the specifications.

Equipment

1. Tree spading

2. Concrete pumping

3. Bump grinding. Equipment used for corrective grinding on asphaltic or portland cement concrete pavement may be hired without the need for a

subcontract. A subcontract is still required for any anticipated milling or grinding on a project.

4. Fertilizer spreading

5. Unanticipated horizontal boring

6. Sawing loop detectors

7. Profilograph. In emergency situations only, the contractor may employ another contractor or company without the need for a subcontract. In those cases where a contractor elects not to perform the surface testing himself/herself on a regular basis, a subcontract will be required.

Services

1. Plumbing. A subcontract will not be required for miscellaneous plumbing services (e.g., hook-ups, tap-ins.)

2. Sprinkler system work. A subcontract will not be required for those situations where minor repairs or adjustments to existing sprinkler systems are required. A subcontract is still required for the installation of new equipment.

3. Dewatering and Well Drilling. No subcontract will be required for this work. Pre-watering, however, is still subject to the normal subcontracting requirements. (Permit requirements still apply.)

4. Engineering and Testing. Work performed by an outside engineering firm, such as for the relocation of section corners or conducting a mixer performance test, will not require the need for a subcontract.

Other miscellaneous items of work may also be considered for exemption from the normal subcontracting requirements. Please contact the Construction Division if you have an item of work which you think may be eligible.

Regardless of whether or not work is exempted from the normal subcontracting procedures, contractors should be reminded that they are still responsible to see that all insurance and safety requirements are being met.

The work of producing and hauling materials by any party other than the contractor may, or may not, be considered as subcontracting, depending upon the classification and ownership of the materials and/or trucks used in hauling the materials. The work of hauling and/or producing materials under any of the conditions specified below shall not be considered as subcontracting.

1. The production of materials from recognized commercial pits or plants.

2. The hauling of materials from recognized commercial pits or plants in trucks owned or operated by the owner of the pit or plant.

3. Any hauling of materials by a recognized commercial hauling company.

4. Any bona fide lease agreement between the contractor and the truck owner.

A recognized commercial pit or plant shall be considered to include any pit or plant which was producing or processing materials for sale prior to the date of the award of the contract.

The term "recognized commercial hauling company" shall include any common or contract carrier who has obtained an "RC" permit to operate as such.

To determine if a barricade or signing service company is doing work requiring subcontracting approval, the following guidelines will be used.

If the barricade or signing service company only provides and delivers the materials to the project site, he/she is considered to be a material supplier and a subcontracting approval is therefore not required. This has been interpreted to also include the work of replacement of batteries, lights, etc., on a routine basis. If, however, in addition to the above, the barricade or sign service company also performs any work of installation, maintenance, or removal and salvaging of signs, posts, fasteners, etc., on the project site, subcontracting approval is required.

In the event a prime contractor elects not to subcontract but to "carry the workers on the payroll", the question will arise that an unauthorized subcontract may actually exist. The Project manager should then perform the following checks:

1. Check the prime contractor's payrolls to determine if the workers in question and their supervisor(s) are included on his/her payroll, except for those men working for and listed on an authorized subcontractor's payroll.

2. Request to see, on a random basis and prior to distribution, the payroll checks of the workers in question who should be included on the prime contractor's payroll to determine if the checks are drawn against the prime contractor's account. (This could be done by a direct request to the prime contractor or by requesting Department of Roads' auditors to check on this.)

3. Request a copy of the lease agreement on equipment to ascertain that compensation is on a time period basis rather than the amount of work accomplished.

4. Check material supplier invoices or billings to ensure that the prime contractor is or will make payment for the materials used in the work in question.

If all the above conditions are satisfied, it can be assumed that an unauthorized subcontract does not exist. However, if any or all of the above conditions are not

satisfied, the matter should be immediately brought to the attention of the District Construction Engineer for further handling, and the prime contractor should be immediately notified of the unsatisfied condition or conditions.

The conditions referenced above can only be met concurrently or after work on the project has started. A condition may arise where work has been performed prior to approval of a subcontract, thereby making such work ineligible for payment. It is, therefore, vital that in addition to a discussion of subcontracting requirements at the preconstruction conference, the contractor be informed that the above mentioned checks will be made in the event that he/she elects to place the workers on the payroll rather than subcontract.

102.16 DETOUR REPORT

During the construction season, detour and shoofly maps are prepared every month to show roads closed for construction or under construction but open to traffic with restrictions. You should forward information for these maps to the Communication Division via Lotus notes by the 20th of each month.

The District Engineer or his/her representative is responsible for identifying when project work will begin and end, restrictions in vertical and horizontal clearance through the work zone, and other information identified on the Detour Report. *It is extremely important that the information provided be current and accurately represent all traffic restrictions and detours in effect.* This information should be reported as soon as the construction schedule is known so the information is available for Motor Carriers when applying for truck permits.

102.17 CONTROL NUMBERS AND CONTRACT NUMBERS

DOR-OI 10-2 requires that, with the exception of letters for the Governor's signature, correspondence relating to a specific highway project will include the project number, location, and control number.

102.18 PROJECT DOCUMENTS DISPOSITION

Contract Compliance Review

FHWA Form 86 Case File of review to determine compliance with equal employment opportunity and affirmative action contract requirements. Kept in EEO for one year from the compliance review, then sent to Archives. Dispose of after three years of receipt in Archives.

Contract Payrolls

Salaries and wages paid to individual employees of contracting firm that receives low bid awards. In District Construction Office for varying lengths of time depending on FHWA. Stored on the Hill for three years. Dispose of three years after FHWA has paid off.

Contract Records

Including the following: prequalifying prospective bidders, qualifying low bidders, advertising of bids, engineer's estimates, awards of contract and concurrences, agreement estimates, anti-collusion, certifications for force account construction, award and execution correspondence, letting information (such as plan orders, etc.), and any similar records considered necessary to document the contract. Retain two years plus current year in Contracts Office – to Archives – microfilm annually and destroy original, security microfilm, transfer to security storage; dispose of after 25 years.

103 -- PRECONSTRUCTION

103.00 PRECONSTRUCTION

103.01 PRECONSTRUCTION CONFERENCE

As soon as practical after a contract is awarded, the Project Manager will arrange a preconstruction conference with the contractor. The number of people attending this meeting will depend upon the complexity of the job. Usually it includes:

- Project Manager and assistants in charge of the project
- District Engineer
- District Construction Engineer/Assistant DCE
- Design Engineer
- Prime contractor
- Subcontractors (have prime invite them)
- Utility and railroad companies
- Local government (city and county) when associated with project

The following agencies may, on certain projects, be invited:

- Federal Highway Administration division office
- Law enforcement - highway patrol, sheriff, or city police
- Construction Office
- Minority Business Office

The conference is usually conducted by the Project Manager. During introductions by the Project Manager, a form for names, addresses, and phone numbers of those present should be circulated. Minutes of the meeting should also be kept by the Project Manager and copies sent to all interested parties.

The purpose of the conference is to discuss:

- Safety of employees and the public (*SSHC Subsection 107.07*).
- The project plans and specifications.
- Unusual conditions and constructability.

- Utility requirements (*SSHC Subsection 105.06*).
- Erosion Control Plans
- Contractor's plan and schedule of operation (*SSHC Subsection 108.07*).
- Type and adequacy of equipment.
- No materials are to be incorporated in the project until approved by the PM. All electrical materials must be approved by the Construction Division before any electrical work begins.
- Material Suppliers
- Sources of labor and labor requirements.
- Maintenance of traffic and business access.
- Other pertinent items that will result in a better job understanding.
- Partnering opportunities.

103.02 ADMINISTRATION DETAILS

Before discussing any project details, Subsections 103.00 to 103.61 of the *Construction Manual* may be distributed to the contractor and subcontractors at the Project Manager's option.

Administrative issues to be discussed at the preconstruction conference include:

A. Change Orders

Before commencing any work not covered by the contract, the contractor and the Project Manager must agree on the price or prices to be paid for the work (or the method used to determine them). Extra work performed before this agreement is reached cannot be considered for payment. The basis of payment for the cost of extra work follows four general categories:

- Contract unit prices
- Agreed unit prices
- Agreed total prices
- Force account

On force account work, the contractor is required to prepare payrolls and invoices, in duplicate, for labor, equipment and material furnished, using a "Force Account Agreement" (DR Form 58). This form shall be signed by the inspector and contractor's representative at the end of each day's work. Both the contractor and inspector will retain a copy.

B. Contract Documents

Contractors must see that copies of plans, specifications, and special provisions are available at all times to their representatives on the project.

Plan revisions will be mailed to the contractor as soon as they are issued. Contractors will be responsible for keeping their field representatives informed and supplied with such revisions. If contractors feel such revisions require extra work, they should immediately advise the Project Manager.

C. Wage Rates (Federal Aid Projects)

All wages paid must conform to wage and hour provisions prescribed in the contract. Crafts must be listed exactly as shown in the wage decision. Crafts not listed but needed shall be requested by the contractor through the Project Manager. Required payrolls must be submitted weekly and within seven days after the last day covered by the payroll.

It is suggested that the prime contractor collect, sign, and submit all payrolls of approved subcontractors, as a group, to the Project Manager.

The Project Manager may withhold progress estimates if payrolls are more than two weeks behind schedule.

D. Postings

The contractor shall be responsible for erecting and maintaining required postings as outlined in *Construction Manual* Subsections 103.21 to 103.24.

E. Stockpiled Material

If contractors want payment for stockpiled material, they should provide receipted bills showing the actual cost of the material stockpiled. For payment of stockpiled material, refer to *Construction Manual* 105.06.

F. All plants shall be labeled.

The information on each plant's label shall described the plant's:

(1) Botanical genus.

(2) Species.

(3) Common name.

(4) Size or age.

Legible labels shall be attached by the nursery grower to individual plants, boxes, bundles, bales, or other containers to insure that all species and varieties are identified.

G. Subcontracting

1. On all projects, prime contractors must submit their subcontract requests to the Construction Division in a letter or FAX.

2. The prime contractor is responsible for EEO and minimum wage compliance by all subcontractors.

3. All subcontractors must be approved by the Construction Division prior to the subcontractor starting work.

4. In the event a prime contractor elects not to subcontract and instead "carry the people on the payroll", the District Engineer and/or his/her authorized representative may perform the following checks:

   a. Request to see on a random basis and before distributing the payroll checks of the people in question.

   b. Request a copy of the lease agreement on equipment to verify that compensation is on a time period basis rather than the amount of work accomplished.

   c. Check material supplier invoices or billings to insure that the prime contractor is or will make payment for the materials used in the work in question.

   d. Check the prime contractor's payrolls to determine if the people in question and their supervisor(s) are included on the payrolls.

H. Project Supervision

The prime contractor shall submit in writing, to the Project Manager in charge, the name of an authorized representative on the project. Representative will be empowered to coordinate with all operations of subcontractors and negotiate with the Project Manager any questions concerning extra work, including extra work performed by a subcontractor. If the prime contractor wishes, this representative may be a subcontractor's employee that is present when work on the project is being performed.

I. Weekly Report of Working Days

When working time is being charged, the Project Manager will prepare and furnish the contractor the "Weekly Progress/Working Day Report" showing working days charged that week. Objections to days charged must be made in writing by the contractor within ten calendar days after receipt of the report. Objections based on delays due to unavailability of materials should be accompanied by copies of orders placed, acceptance of orders, and promised dates of delivery. All other objections must be accompanied with documentation of the reason for objection. The Project Manager will respond to the objection, indicating acceptance of the claim or reasons for rejection.

J. Right-of-Way

All parties are reminded that highway right-of-way abuts upon private property. Any infringement or trespassing upon such private property could cause damage that would become a liability to the person or organization involved. Maintaining good relations with the public (especially private property owners) is very important.

K. Safety

Contractor must comply with provisions of the Federal and State Occupational Safety and Health Acts.

L. Nebraska One Call Notification System shall be explained by the Project Manager. The Diggers Hotline of Nebraska phone number is 1-800-331-5666.

M. Contractor has 48 hours to file notice with county sheriff when burial sites are discovered.

N. Water Pollution & Wetlands

The contractor's schedule and methods for control of water pollution and protection of wetlands should be reviewed. For more information, refer to Construction Manual Division 1100.

All disposal sites require NDR approval.

O. EEO Requirements (Federal Aid Projects)

1. Forms PR-1391, Manpower reports required. (Distribute sample form)

   A. The Contractor (prime and subs) shall send two copies to State Contract Compliance Officer.

   B. Submit by 10th of August.

   C. Needed for the week of July 15th only.

   D. If no minorities or women employed - explain why.

   E. Required of subcontractors, also, with subcontract of $10,000 or more.

2. All subcontract and purchase agreements must include E.E.O. provisions.

   A. <u>All</u> sections of Form PR-1273 must be attached to these agreements.

3. Not allowed to maintain segregated facilities of any kind.

4. Must pay comparable wages.

5. Contractor must adopt an EEO policy statement.

   A. Post it on job site and in home office.

   B. Send it to outside referral sources.

6. Designate an E.E.O. Officer.

   A. Should be in writing and signed by policy officer of the company.

   B. Send the notice of designation to NDR project manager.

   C. Post this designation where employees can see it.

   D. E.E.O. Officer must be someone with authority.

7. Conduct E.E.O. meetings with supervisory personnel before the job starts.

   A. Review all the requirements of the contract.

   B. Meetings must be held at least every six months.

   C. Document and keep records of these meetings. (Can be formal minutes or diary notes).

8. Disseminate E.E.O. policy to employees.

   A. If done by meetings, document and record. (Diary Notes acceptable)

   B. May be done by pamphlets or other handouts.

   There is no set way of doing this. The contractor may use whatever system works best for the company. However, the company must be able to document that employees are told about E.E.O.

9. Put up E.E.O. posters.

   A. Two required - Federal and State.

   B. Must be at job site and home office.

10. When advertising for jobs, he/she must include the notation "<u>An Equal Opportunity Employer</u>". Should keep copies of ads.

    A. When advertising, place ads in local commuting area of job site.

B. Use newspapers and other media likely to yield minority and female applicants.

11. When hiring, the contractor should show some active recruitment in local commuting area of job site.

A. Make personal recruitment visits to organizations, agencies, etc. in the commuting area of the job site.

B. Write letters of recruitment to organizations and agencies in the local commuting area.

C. Keep records of all recruitment activity (diary notes are acceptable for personal visits).

12. Must show that some attempt is made to analyze the labor market where the job is located.

A. Determine number of minorities and women in the commuting area of job site.

B. Analyze staffing pattern of crew at job site.

C. Set up some type of goal or objective for utilizing minorities and women on that particular job. If minorities and women will not be utilized, be prepared to explain why. Keep records of this analysis activity.

13. Will need to show that personnel actions are reviewed by top management for discriminatory effects.

A. If a minority or women is discharged at the job site, make sure that the home office knows about it and that the company E.E.O. Officer gives the facts surrounding that discharge.

B. If a minority or women is transferred or promoted, the E.E.O. Officer should know about it.

We are not advocating that contractors establish a highly formal procedure for this, because in some cases, it would not be practical or feasible. However, it is the contractor's responsibility to show that this is being done regardless of the method used.

14. Must show some type of training activity. Must advise employees about training opportunities available and encourage minorities and females to participate.

A. Document progress of trainees.

When training is given on an informal basis, the contractor will need to show that it is given. Records of case histories should be kept, subject to being verified by interviewing the trainee involved. Keep records of all training activity.

15. Letters must be sent to known minority contractors regarding any subcontract work. Documentation must be kept on the efforts made to solicit minority businesses.

16. Keep records of the following:

A. Number of minority and women applicants referred and where they come from.

B. Number of minorities and women hired - if not hired, reasons why.

C. Number of minorities and women transferred, terminated, promoted, etc.

17. Identify minority and women employee files after hire.

Note: Each Federal-Aid project will stand by itself when being evaluated for affirmative action. In other words, affirmative action on one project will not satisfy the requirement of affirmative action on another project. The contractor should satisfy himself/herself that the foregoing actions are taken and that records are kept for <u>each</u> and <u>every</u> project under his/her control.

103.03 PROJECT DETAILS

A. On many projects it may be necessary for the Project Manager to prepare and present an enlarged plan or map for showing:

- Location.
- Terminal points.
- Type of construction involved.
- Special areas of concern, including installation of public utilities to be fenced or marked if hazardous or sensitive.
- Restrictions due to lack of right-of-way or defined by right-of-way agreements.
- Detours and staging of construction for traffic.

B. Contractor must present his/her detailed construction schedule, or else postpone preconstruction conference.

1. Starting Date _____ Completion Date _____

@ Any date before Notice to Proceed must be approved in writing by the Construction Division.

2. Staging Schedule and/or Sequence of Operation.

3. Items to be sublet and names of subcontractors.

C. Sampling and material testing requirements shall be discussed.

D. Contractor Insurance requirements shall be verified.

E. Railroad Protective Insurance

The contractor must have appropriate insurance in force when working on the railroad right-of-way.

@ The Controller Division will enter the effective dates of railroad insurance policies in SiteManager. However, the Project Manager must, in the Key Dates area of SiteManager, record the date that construction started and the date when construction in the railroad right-of-way is complete. **Check to make sure that Railroad Protective coverage is in force**. If not, do not allow the contractor on the right-of-way and do give Controller Division (402-479-4631) a call so that they can verify that insurance has, in fact, not been received. When work has been completed on the railroad right-of-way, the same procedure should be used to record the ending date.

F. Utilities and Law Enforcement Attendance

At major project preconstruction meetings, attendance of utilities and law enforcement personnel is highly beneficial to all concerned. The Project Manager should expend extra effort to assure attendance or open communication with utilities and appropriate law enforcement agencies.

Relocation of utilities is of extreme interest to all concerned in the progress of the project. For safe control of traffic, the ability to discuss traffic control with both contractors and law enforcement could be highly beneficial. The State Patrol, local sheriff, or police should be invited to attend preconstruction meetings when appropriate. The State Patrol can be contacted through the State Patrol District Office charged with responsibility for the area of the project being discussed.

It is beneficial to discuss utilities relocation, project staging, and/or traffic control early in the meeting before more detailed and time consuming construction matters are approached. You may excuse utility companies early.

G. Plan and specification omissions must be discussed.

H. Traffic Control (PM shall present the NDOR Traffic Control Plan.)

In addition, the following must be verified:

1. Brand and model of barricade light proposed to be used are on the Approved Products List.
2. Maintaining spare parts on project.
3. Checking barricades and signs at frequent intervals daily.
4. Phone number of person to call at night if barricades, or signs or devices are down or not working.

   Name and Number _____ _____-_____

   Name and Number _____ _____-_____
5. Notify Project Manager before picking up signs and also at first notice of damaged or stolen signs.

I. Prompt Submittal of Certificates of Compliance, Certified Analysis etc. to insure payments.

J. Location of Field Laboratory and Field Offices

K. Subcontractors must be approved before they can begin working on project. We need to be notified when they are going to be working on project.

L. Contractor's Borrow Pits – Approval

M. Payrolls – Prime Contractor needs to check subcontractors

N. Welding on girders not allowed without written permission.

O. Labor, Payrolls, Wage Rates, Training & E.E.O.

E.E.O. Officer _____
Safety Officer _____

P. Extra Work Orders

Before commencing any work not covered by the contract, the contractor and the engineer must agree on the price or prices to be paid for the work. Extra work performed before this agreement cannot be considered for payment.

103.04 ADDITIONAL TOPICS FOR DISCUSSION

- Anticipated work starting dates.
- Clean up of cast-in-place concrete structures.
- Staging schedule.
- Falsework plans and falsework removal.
- Presentations by various utility representatives
- Please remind contractors at the preconstruction conference that they or their suppliers are required to furnish 2 (two) 2.0 m (6 foot) sample lengths of reinforcing bars whenever such samples are called for in the *Standard Specifications* or *Materials Sampling Guide*.
- Signing, barricades, pavement marking, warning lights, and other temporary traffic control devices according to:
  - Department responsibilities (*SSHC Sections 422 and 423; Subsections 104.05, 105.01, 107.07, and 107.14*).
  - Contractor responsibilities (*SSHC Sections 422 and 423; Subsection 104.05, 105.05, 107.07, and 107.14*).
  - Contractor's work plan (*SSHC Subsection 108.07*).
- Project Lighting (if applicable).
- Remind contractor when ordering piling, he/she must tell manufacturer to stamp the heat number on the piling. (*SSHC Subsection 703.02*)
- Presentation by county or city representatives.
- Names and chain of command for state or county forces assigned to project.
- Authority and duties of inspector. (*SSHC Subsection 105.05*)
- Assignment of contractor's personnel for:
  - Person responsible to maintain traffic control devices (24 hour call number). (*SSHC Subsection 422.01*).
  - Person authorized to make decisions and sign extra work orders, etc.
  - Project safety officer.
  - EEO officer.
  - Project supervisor (SSHC Subsection 105.05).
  - Disadvantaged business enterprise liaison officers.

- Discussion of items to be sublet, names of subcontractors, and commercially useful function of DBE subcontractors, suppliers, and manufacturers should be discussed.

- Construction staking requirements.
  - The contractor must avoid destroying stakes
  - The contractor must advise Department 48 hours in advance of requirement.

- Equipment to be used - contractor should identify equipment with greater than legal axle loads that is to be moved across bridges or pavements that will remain in place. Equipment with greater than legal axle loads (*SSHC Subsection 105.11*) must be either loaded on an appropriate trailer or specifically exempted. Requests for exemptions will be analyzed on a case-by-case basis by the Construction, Bridge, and Maintenance Divisions.

- Special notes on plans or proposals and special or unusual provisions that apply.

- Safety precautions and compliance with:
  - Posting of OSHA Form 200.
  - Public Convenience and Safety (*SSHC Subsection 107.07*).

- Contract quantity settlement.

- Frequency of estimate vouchers (normally once or twice each month).

- Covers on trucks hauling on highways when necessary.

- Specified working period.

- Contractor's submittal of work plans for:
  - Control of water pollution and erosion (*SSHC Sections 201, 204*, and *Division 800*).
  - Control of fugitive dust.
  - Compliance with storm water discharge requirements (*Construction Manual 1100.30*).

- Equal Employment Opportunity responsibilities for statement of compliance and required postings (Construction Manual 102.23).

- Statements by Federal Highway Administration and visiting Commission personnel.

- Pre-concreting conferences.

- Value engineering incentive proposals submitted by the contractor (*SSHC Subsection 104.03* and *Construction Manual 103.09*).

- Partnering Opportunities (*SSHC Section 113*)
  - Workshops/Training
  - Dispute resolution procedures
  - Meeting schedule/location

103.10 ONE CALL NOTIFICATION

It is the law; anyone who digs a hole, pushes a pipe through the ground, or even moves a stockpile of gravel must contact Diggers Hotline first. The Diggers Hotline phone number is 1-800-331-5666.

Fiber Optic Cable Buried on Railroad Right-of-Way

Railroad Points of Contact for Location of Fiber Optic Cable

Burlington Northern Santa Fe Railway.....800-533-2891
Nebraska Central Railroad Company.....800-336-9193
Nebkota Railway.....308-282-1550
Nebraska Northeastern Railway Company.....402-748-3535
Nebraska Kansas Colorado Railnet.....817-571-2356
Union Pacific Railroad.....800-336-9193

Most railroad lines have fiber optic cables buried in the right-of-way.

The Union Pacific Railroad has an "800" number available 24 hours a day to determine if fiber optic cable is buried on their right-of-way.

The number is 1-800-336-9193. Anyone calling the "800" number will need to give the railroad milepost number to the operator.

When we have a construction project that may involve railroad right-of-way, a railroad special provision will be added to the bid proposal. The contractor will be required to call the appropriate "800" number before working on railroad right-of-way. The railroad milepost number will be included in the special provision.

Project Managers should confirm that the contractor knows how to get clearances.

103.11 UTILITIES AND RAILROAD REHABILITATION

A. General - Work by utility companies and railroads in making necessary rehabilitation of their facilities for our project construction will often require certain advance preparations by the Project Manager and cooperation with the firm during the progress of their work. In many cases it will be necessary that our right-of-way be defined by setting of stakes prior to beginning rehabilitation work. Grade stakes may be required at railroad crossings or in connection with pipe line or pole line work on the project. The firm involved will generally be responsible for furnishing their own stakes needed for the actual rehabilitation but will need basic information from which to work. Cooperation with these firms will assist in getting their facilities out of the way of our construction.

B. Preventing Damage to Utility Properties - The Project Manager should document that proper precautions are taken to protect and prevent damage to the property

of railroads, underground or overhead utilities, and pipelines in connection with highway construction work.

No excavation will be permitted in the area of underground utility facilities until all such facilities have been located and identified to the satisfaction of all parties. The excavation must be accomplished with extreme care in order to avoid any possibility of damage to the utility facility.

C. Beginning Rehabilitation - The utility firm will generally begin work shortly after they have been notified to proceed. The Project Manager should provide them with information regarding the contractor's schedule as soon as possible if the facilities will be a material delay to progress of the construction. This will allow the firm to schedule rehabilitation work in an order of priority over other rehabilitation.

The Utilities Section of the Project Development Division tells the utility companies to advise the Project Manager by letter when they begin work, their tentative progress schedule, the name and address of their person in charge of the work. The Utilities Section of the Project Development Division also tells the utility company to furnish the Project Manager (and copy to utilities officer) with the completion date of the revision work. These letters are to be confirmed with appropriate field book entries.

D. Inspecting Rehabilitation Work - Whenever an agreement provides that certain items of work are to be performed by a municipality, railroad, or utility, contact with the work should be maintained. If the work is to be done at state expense, the Project Manager shall keep a record of the work in sufficient detail to enable him/her to determine that the charges are justified and in accordance with the agreement. However, on most work of this nature, it would be difficult to keep a detailed record of each and every item without involving considerable expense. The Project Manager should consult with a representative of the organization involved and arrange to obtain information as the work progresses on the labor, equipment, and material used in the work and the material salvaged for future use.

In some cases, such as the placing of pipeline crossings, ditching and backfilling in the roadway area may require inspection to insure that compaction of the backfill is properly performed.

The Utilities Engineer no longer requires that you keep and submit a separate field notebook for all utility agreements. He/she does, however, ask that you notify him/her of the completion date for all utility work on your projects.

Notification should be made using the UTILDONE program available on VMS (as per Mark Ottemann's letter to District Construction Engineers on September 12, 1994).

Your inspection and documentation of utility rehabilitation work should be limited to the amount necessary to complete the information required when using the UTILDONE program.

103.12 HAUL ROADS (*SSHC Section 107*)

Prior to beginning any work, the contractor is required to meet with all involved local governmental entities and advise them of any intentions to use their local roads. The contractor shall be responsible for resolving claims concerning damage to local roads caused by his/her operation.

The contractor shall protect and indemnify the State and its representatives against any claims or liabilities arising from damage to local roads caused by the contractor's operation.

103.20 CONTRACT ADMINISTRATION (SEPARATE HANDOUT FOR ALL CONTRACTORS)

This section provides instructions and guidance to contractors and Project Managers for administration of construction contracts. Instructions include information on required reports or forms, equal employment opportunity, wage reports, training program, minority recruitment, and subcontracting. Copies of all NDR forms mentioned in the *Construction Manual* are included in *Appendix 1* -- NDR forms or *Appendix 2* -- Federal Forms) and can be copied as needed. (However, use stock forms when possible to cut reproduction costs.)

103.21 NEBRASKA & FHWA FORMS & REPORTS - PREPARED BY CONTRACTOR

Form No.	Title	Reference Section	Office Where Forms are Available
DR 298	Special Training Provision Monthly On-Job-Training Report	102.24	DBE Office
DR 439	EEO Contractor's Self-Analysis	102.23	DBE Office
FHWA-1391	Annual EEO Report (July)	102.23	DBE Office
FHWA-47	Statement of Material & Labor	102.25	Construction
WH 348	Statement of Compliance	102.25	District Const. Office
Standard Form 1444	Request for Authorization, Additional Classification and Rate	102.26	Construction

Postings

At the preconstruction conference, the Project Manager will supply copies of the posters listed below:

a. <u>Federal-Aid Contracts</u>

Federal Poster - Equal Employment Opportunity is the Law
State Poster - Equal Opportunity Commission
WH-1420 - Your Rights under the Family and Medical Leave Act 1993
WH-1462 - Notice: Employee Polygraph Protection Act
FHWA-1022 - False Statements Notice
FHWA-1495 - Wage Rate Information

b. State Funded Contracts

State Poster - Equal Opportunity Commission
WH-1420 - Your Rights under the Family and Medical Leave Act 1993
WH-1462 - Notice: Employee Polygraph Protection Act
USDOL-1088 - Your Rights - Federal Minimum Wage

Examples are included in *Appendix 2*. Additional copies, if needed, can be obtained from the Project Manager or the Construction Division (Mr. Dan Necas, 4453). In addition to postings noted above, a copy of the Policy Statement shall be posted.

All required site postings shall be in a location that is easily accessible to all employees. They may be fastened to a bulletin board, tool shed, or job office trailer and protected from weather by glass or clear plastic. Postings that become soiled, faded, or otherwise illegible should be replaced. More than one posting may be necessary if there are multiple locations where workers report for work. Such cases typically occur on complex or long projects involving several different crews and/or subcontractors.

103.22 OCCUPATIONAL SAFETY AND HEALTH

Occupational Safety and Health Act (OSHA) regulations (federal and state) apply to all construction projects. (Federal OSHA regulations are codified in *29 CFR, Sections 1910* and *1926*.) Contractors are responsible for compliance with OSHA regulations and shall maintain a safe work site. Therefore, contractors and their employees must be familiar with the health and safety requirements of the act.

- As an employer, contractors are required to keep employee occupational injury and illness records at the location where their employees usually report for work. The "Log and Summary of Occupational Injuries and Illnesses" (OSHA Form 200) must be completed within six days following a recordable occupational illness or injury. A copy of the completed form must be maintained at the work site. In addition, OSHA Form 200 is to be completed at the end of each calendar year and posted at job sites before February 1. Detailed instructions are printed on the back of each form.

- A poster entitled "Safety and Health Protection on the Job" must be displayed in a prominent place at all times.

Contractors can obtain OSHA forms and posters from:

Regional Director-OSHA Federal Office Building Lincoln	or	Administrative Safety & Labor Standards Division Department of Labor Lincoln

103.23 EQUAL EMPLOYMENT OPPORTUNITY (EEO) (*SSHC Subsection 102.09*)

A. Contractor's Responsibility

Contractors and their staff who are authorized to hire, supervise, promote, and discharge employees or recommend such action must understand the requirements of applicable EEO specifications including "Required Contract Provision", Form FHWA 1273, and Executive Order 11246 in the Special Provisions.

Policy Statement and Compliance Letter

All contractors must formally adopt an Equal Employment Opportunity Policy Statement which:

- Prohibits discrimination of any kind or for any reason.
- Encourages employment of minorities and women.

Examples of minimum acceptable policy statements for both federal and nonfederal aid projects appear in *Appendix 2*. When posted, these policy statements must be on company letterhead.

A sample of an EEO proof of compliance letter, which lists the EEO requirements and postings, is in *Appendix 2*. Written proof of compliance will not be required for material suppliers, manufacturers, truckers, and surveyors.

B. Project Manager Involvement

Responsibility for complying with EEO requirements is solely the contractor's. However, the Project Manager has oversight involvement to ensure that contractors comply with these requirements and that proper forms and/or letters have been received. When a contractor is not in compliance with EEO requirements, the Project Manager shall advise the contractor, in writing, and make a diary entry, that continued negligence in EEO requirements will result in the withholding of progress payments. The Project Manager will also inform the Contract Compliance Officer of the contractor's noncompliance. The Contract Compliance Officer will investigate all reports of noncompliance and make a recommendation as to what the contractor must do to be in compliance. If the contractor still fails to take corrective action relative to EEO noncompliance, the Project Manager may, with concurrence from the Construction Engineer (Lincoln), suspend work. All suspensions shall be documented in writing and sent to the contractor.

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@

1. Contracts and Subcontracts Over $10,000

a. Site Inspections

As soon as a major part of contract work is underway, an EEO project site inspection must be completed by the EEO Office relative to work in progress. A representative of each affected company shall be present and accompany the inspector during an EEO inspection.

@ b. Training Program

Contractor training special provisions requires the contractor to have a formal employee training program. During an EEO inspection, the training program should also be checked.

c. Required Posting

During the inspection, all required postings should be checked. Project Managers shall check to see that correct names and addresses appear in the boxes on posters entitled "Wage Rate Information Federal-Aid Highway Project" (FHWA-1495) and "Notice" (FHWA-1022). Copies of these forms are provided in *Appendix 2*.

d. Reports

- "Federal-Aid Highway Construction Contractors Annual EEO Report"

Contractors and subcontractors (with contracts over $10,000) shall provide the Contract Compliance Officer in the Construction Division two copies of "Federal-Aid Highway Construction Contractors Annual EEO Report" (FHWA-1391). A blank copy is provided in *Appendix 2*. 1391's can also be obtained off the NDOR website under Contractor's Corner – DBE Information.
@ These forms are to be completed for all federal-aid contracts for which work was performed during the week of July 15th.

NOTE: If Prime or Sub submit the 1391 to the Project Manager, return them and tell the Prime or Sub that the 1391's must be submitted directly to the Contract Compliance Officer to avoid double counting.

@ A copy of Form FHWA-1391 is provided in Appendix 2. Copies can be ordered from:

Construction Division
Nebraska Department of Roads
1500 Hwy. 2
P.O. Box 94759
Lincoln, Nebraska 68509-4759

Instructions for completing this form are provided by the Construction Division on a yearly basis. Contractors are cautioned to be sure they have the CURRENT instructions. If there is any question about revision dates, contact the Construction Division in Lincoln (402) 479-4514.

Distribution: Route one copy to the Construction Division, Lincoln, and retain one copy in project file.

2. Construction Contracts and Subcontracts $10,000 and Less

An EEO project site inspection is not necessary for these construction contracts.

3. Maintenance Contracts

On maintenance contracts, an EEO project site inspection is not necessary regardless of contracted amount.

4. Complaints of EEO Violations

@ The Project Manager will report all complaints of EEO violations to the Construction Division's EEO section for investigation.

103.24 TRAINING & TRAINEE PROGRAMS

Contractor's Responsibility

1. Training Program

All prime contractors and subcontractors (with contracts over $10,000) must develop, or have, an approved training program in accordance with the *Specifications*. The Contracts Office (EEO Section) approves these programs and can be contacted [(402) 479-4514] for answers to questions or assistance in developing an approved program.

Shortly after a contract is awarded, the Contracts Office will verify that the successful bidder has an approved training program on file. If not, the contractor will be advised that a formal training program must be approved by the Contracts Office within 30 days. Failure to submit a training program will be considered noncompliance with the Specifications. A contractor who does not comply may be refused bidding proposals for future lettings until requirements for a training program are met. (Typically, contractors adopt and use the Associated General Contractors' (AGC) training program. It is acceptable in Nebraska.)

An acceptable training program shall include information covering:

- Method of trainee recruitment.
- Crafts to be trained and upgraded.
- Number of expected trainees per year and what part of total will be female, minority, and disadvantaged.
- Training procedures, including approximate training time.
- Commitment for keeping up-to-date records to summarize total time each trainee is trained in each classification.
- Proposed use of trainee upon successful completion of training program and commitment to issue a certificate or statement of successful completion of training.

- Number of total work force (Nebraska operation).

2. Trainee Program

Contractors responsible for fulfillment of reimbursable training hours on federal-aid projects must obtain written approval from the Construction Division's EEO Section for each trainee prior to the trainee's enrollment in the program.

a. Contractors shall submit their written requests for trainee approval to the Construction Division, attention EEO Section, with a copy to the Project Manager. Requests must include job classification, number of hours to be fulfilled, trainee name, race, sex, address, phone number, and social security number.

b. If additional trainees or replacements for terminated trainees are needed, crafts and classifications must be approved by the Project Manager with a follow-up letter to the EEO Section. Hiring of non-minority trainees to replace semi-skilled or skilled workers may not be used to establish eligibility for federal reimbursement since the trainee program is designated for members of female, minority, or disadvantaged groups.

Note: Changes to the number or class of trainees initially requested must be submitted and pre-approved by the Construction Division.

c. Trainee Reimbursement

In order to qualify for trainee reimbursement:

- Trainees must be registered in the appropriate program.
- Wage determination decisions of the Davis-Bacon Act are used as the basic rate on any project involving federal aid.
- Minimum starting wage will be 60 percent of the rate established for a craft or classification for the first half of a training period. This percentage will change to 75 percent for the third quarter, and 90 percent for the last quarter. Certified payrolls shall specifically identify each individual in trainee status, their base rate, and applicable reduction percentage.
- After a trainee has completed his/her training program, the trainee's base wage rate shall be increased to Davis-Bacon's wage determination for that job classification.

- 3. Trainee Recruitment

The contractor's trainee program outline must include method of recruitment.

Occasionally, it may be impossible to recruit members of minority groups due to minority unavailability at the project location. When this occurs, contractors must have documented their efforts in attempting to recruit minorities. The Project Manager and the Construction Division EEO Section should be informed of recruitment problems. Recruitment which results in an inadequate number of minority trainees does not eliminate a contractor's responsibility to fulfill the requirements of the "Trainee Reimbursement bid item.

If minority recruitment results in less than the required number of qualified individuals, the contractor shall then recruit non-minorities or use some of their own employees for the training program. Any non-minority substitution requires preapproval of the Project Manager and the Construction Division (EEO Section).

4. Reports

- "Reimbursable Trainee Training Record"

  Each month the contractor must submit a DR Form 298 "Special Training Provision Monthly On-Job-Training Report."

- If no trainees are employed during the early phase of work, the contractor shall so advise the Project Manager and the Construction Division (EEO Section).

Project Manager's Involvement

1. Training Program

Project Managers shall have a copy of the approved training program. Copies may be obtained from the contractor or the Construction Division (EEO Section). Since training programs have been standardized by AGC, any preapproved program can be used as a model for evaluating a particular contractor's program during inspection.

For convenience, training program inspections will be made concurrently with EEO inspections. An inspection will include interviews with individuals enrolled in the training program. Also, the contractor's training program will be spot-checked. A copy of the contractor's program shall be available for review.

The Construction Division shall be notified if:

- A contractor does not have a training program.

- The contractor's program is deemed inadequate.

- Other training deficiencies are noted during the inspection.

It is the Construction Division's responsibility to work with the Project Manager and contractor to rectify noted discrepancies. If after a reasonable time a contractor fails to meet training requirements or ignores requests for corrective actions, the Construction Division, working through the Project Manager, may request suspension of work until corrective action(s) are implemented. Suspending work will be used as a last resort. However, the offending contractor's bidding ability on future contracts could be restricted until such time that compliance with training is demonstrated.

2. Wage Rates

Wage rate interviews may also be completed during the EEO inspection.

- Interviews should be conducted a minimum of every six months for each contractor and subcontractor.
- Projects whose duration is less than six months should have one interview with each contractor and subcontractor.
- Each District must keep interviews on file for three years.

3. Reports

a. "Reimbursable Trainee Training Record"

Shortly after a letting, the Contracts Office (EEO Section) will prepare and forward a letter listing projects that require a "Special Training Provision Monthly On-Job-Training Report" (Form 298) along with a supply of these forms. Additional forms can be obtained off of the NDOR website under
@ Contractor's Corner – DBE Information.

Monthly, the contractor will be sending one completed Form 298 for each trainee employee until training for that employee is completed or terminated. The Project Manager will review, initial, copy, and forward the original Form 298 to the Construction Division, EEO Section. The copy will be placed and retained in the project file.

b. Occasionally, contractors train employees on contracts that do not have a line number for trainee reimbursement. In this case, Project Managers are not responsible for monitoring that program and Form 298 is not required.

103.25 WAGES AND EMPLOYMENT

A. In order to comply with the requirements of the Freedom of Information Act regarding protection of personal privacy, all requests for access to certified payroll records shall be forwarded to the Construction Division. Requests must be in writing, and if not made on behalf of an individual, the request must indicate the name of the organization making the request.

B. Access to or copies of payrolls shall not be permitted until authorization has been received from the Construction Division. (Adherence to these procedures during investigation by the Department of Labor or FHWA is not required.)

C. All contracts for highway construction work have certain requirements on wages and conditions of employment. These requirements vary between Federal-aid and State-funded contracts.

D. Some laws or regulations provide specific requirements in the contract documents, while others may be cited by reference. Section 107 of the Standard Specifications requires compliance with all laws and applicable regulations, and accordingly, compliance is required whether or not specific listing or reference is made in the contract.

E. Labor Laws Cited

1. Section 107 of the Specifications calls attention to certain State laws and provides that additional regulations and restrictions will be set forth in the special provisions in the contract. These additional regulations are normally included in the required provisions or the special provisions. The enforcement of contract provisions such as these cannot be ignored. However, the inspection, reporting, and enforcement requirements vary between contracts. A basic knowledge of the laws and the exercise of good judgement and diplomacy are required when any enforcement action is taken. Project Managers are advised to contact the Construction Division for decisions on labor complaints for which answers are not readily available. Knowledge concerning these problems is to be handled in confidence, and complete records are a necessity. Certain standard requirements are made a part of all contract provisions. These are as follows:

   a. A minimum employment age of sixteen years and the restricting of employment of persons whose age or physical condition is such as to make his/her employment dangerous to themselves or others.

   b. A provision prohibiting the employment of anyone currently serving sentence to a penal or correction institution (this shall not be interpreted to prohibit the use of persons on a bona fide work release program).

   c. A provision prohibiting discrimination on any grounds against workers who are qualified for the work by training or experience, and who are not disqualified by Paragraphs a. and b.

2. These regulations are required by State law, but often are duplicated or made more restrictive by Federal laws.

3. *SSHC Section 110* refers to State law restrictions of hours and labor. This would include the State Fair Labor Standards Law which is cited in the Special Provisions in each State-funded project and requires the contractors to comply with such a scale of wages and conditions of employment as are paid and maintained by at least 50 percent of the contractors in the same business or field of endeavor. Contracts for State-funded projects do not contain an established scale of minimum wage rates; however, no wages paid can be below the minimum wage of the Fair Labor Standards Act. Questions which arise concerning the payment of proper rate should be referred to the District Office, or to the Construction Division (Mr. Dan Necas, 4453).

103.26 DAVIS-BACON AND RELATED ACTS REQUIREMENTS (Payrolls)

A. General Information

1. On selected contracts containing Federal-aid funds, Federal laws (Davis-Bacon Act) and regulations require the Secretary of Labor to issue a determination for minimum wage schedules to be included in each of these Federal-aid contracts. Special instructions to the contractors are issued by the Construction Engineer prior to the construction operations. A copy of the current instructions are available in *Appendix 2* (FHWA Forms) under Form WH 348, "STATEMENT OF COMPLIANCE."

2. Project Managers or their assistants shall conduct wage rate interviews (Report of Labor Compliance Interviews DR Form 98) on the selected Federal-aid projects in order to determine whether contractors and subcontractors are properly classifying employees and are complying with the minimum wage rate requirements of the Special Provisions.

3. The Project Manager is to make systematic spot interviews with the contractor's or subcontractor's employees when he/she feels it is necessary. As a matter of courtesy, the contractor's superintendent or foreman should be advised that personal interviews with employees will be made. The Project Manager shall select the employees to be interviewed and these should be of different payroll classifications if possible.

4. The number of different employees and classifications to be interviewed shall be at the discretion of the Project Manager to ascertain compliance with these requirements. If violations are discovered, the frequency and number to be interviewed shall be increased and corrective action taken until such violations have been eliminated. Depending on the size of the crews, an attempt should be made to avoid repeating interviews with the same individuals.

5. Employees should be privately interviewed; that is, without the presence of other employees or their supervisor. The employee being interviewed must not be informed of wage rates reported by fellow employees, but is entitled to know the minimum rates specified for his/her classification.

6. Any apparent violations of labor classification or wage rates are to be called to the attention of and discussed with the contractor's or subcontractor's superintendent. In such cases, the Project Manager and the superintendent, considering all the facts and conditions involved, must reach agreement on the proper labor classification. The wage rate paid must be at least the minimum specified for that classification. If a violation in either proper classification or minimum specified wage rate is involved, the contractor or subcontractor shall be directed to correct the classification and/or wage rate being paid and to make any retroactive payment necessary to provide strict compliance with the requirements.

7. In all cases of apparent violations of proper classification or minimum wage rates paid, and the Project Manager and superintendent having reached agreement on the proper classification or minimum wage rate specified, the employee shall then be contacted and notified as to his/her proper classification and the minimum wage rate specified for that classification.

8. In unusual cases involving apparent violations, the Project Manager and the superintendent may not be able to agree on the proper classification of work performed by the employee. In such cases, the matter may be submitted to higher authority, through proper channels, for decision. The current Standard Labor Classifications and Descriptions for Highway Construction shall be used in determining the proper classifications. (See *Appendix 2*, Form WH 348, "STATEMENT OF COMPLIANCE)".

9. The interviews shall be recorded on DR Form 98, "Report of Labor Compliance Interviews" and transmitted to the District Engineer for review and distribution. The report should be submitted regularly, showing the interview information as found, indicating any apparent existing discrepancies. Information concerning the handling of such discrepancies shall be shown, by means of an appropriate note, on that report or in the subsequent report.

10. Any classification not covered by the wage determination included in the contract will require the Project Manager to initiate Standard Form 1444, "Request for Authorization of Additional Classification and Rate."

@ 11. The Construction Division (ext: 3830) will supply each District Office with current applicable wage rates to be posted for each individual Federal-aid contract and labor and E.E.O. posters.

12. Regardless of the source of funds, highway construction is associated with interstate commerce and, therefore, is covered by the Federal Fair Labor Standards Act. It has specific requirements for payment of a

minimum wage rate and time and one-half for overtime over 40 hours in a week, with certain supervisory or administrative employees exempted.

13. Contractors on selected Federal-aid contracts are permitted to employ trainees and apprentices that are paid below the wage decision included in the contract provided the following information is supplied:

    a. Proof of certification by the Department of Transportation for programs other than Nebraska and Iowa A.G.C. training programs.

    b. Proof of registration of trainee in said program.

    c. Proof of the number of previous hours of training the employee has received.

    d. The employees are listed as "trainees" on the payrolls.

14. The Nebraska and Iowa Associated General Contractors Manpower Development and Training Programs have been approved by the Department of Transportation.

B. Payrolls

1. On selected Federal-aid contracts, the contractor and each subcontractor are required to submit to the Project Manager a certified copy of each weekly payroll and Statement of Compliance - Form WH 348 or a contractor's form with identical wording. The payrolls and Statement of Compliance are to be submitted within seven days after the date the employees are paid. The Project Manager may withhold progress estimates until all delinquent payrolls, with attached Statement of Compliance, have been received.

2. Required Contract Provisions Federal-Aid Construction Contracts - Form FHWA 1273 requires us, as a contracting agency, to perform a certain amount of checking of the submitted payrolls to comply with our oversight responsibilities. The FIRST payroll received from any contractor or subcontractor should be THOROUGHLY checked. (The Project Manager may use some discretion in deferring this thorough check for several weeks, such as in the case when only a few employees appear during the first week or two of a project.) Random checking of all other payrolls is approved.

3. The Project Manager should check the payrolls for:

   a. The employee's full name, mailing address, and Social Security number. (The employee's Social Security number need only appear on the first payroll on which his/her name appears. The employee's mailing address need only be shown on the first submitted payroll on which the employee's name appears, unless a change of mailing address necessitates a submittal to reflect the new address.)

   b. Each classification, title, and equipment capacity rating must be verified to assure that they are the same (or recognizable abbreviation) as listed in the Contract Wage Rate Decision Schedule, with no deviations permitted.

   c. Each employee's hourly rate must be verified and checked with a red pencil mark indicating that at least the minimum hourly rate and correct overtime rate has been paid for the listed classification.

   d. All deductions other than the allowable ones are explained.

   e. Payroll computation (with the exception of the electronic machine computations) shall be spot checked to verify accuracy.

   f. Payrolls once transmitted to the Project Manager cannot be returned to the contractor for correction of errors. Photocopies of the payrolls may be made and appropriate notes placed on the copies to explain the error(s) to the contractor. The contractor must submit revised certified payrolls or other forms of applicable evidence which provides documentation of the correction(s).

   g. The Project Manager is to retain all payrolls until notified by the Controller Division that they may be destroyed. When the payrolls are complete, the Project Manager is to send a letter to the Construction Division Final Review Section in Lincoln, indicating the date the last payroll was received.

4. Most subsequent payrolls will require only a very cursory review. The Project Manager is encouraged to consider such things as the length of the project and the number of errors encountered on the first thorough examination when determining how many additional thorough payroll checks are performed.

5. On DR Form 84, "Record of Contractor Payrolls Received," the Project Manager should pay particular attention to the column head "Date Received" and to the "Payrolls Completed (Date)". A delay in submittal of payrolls will negate payment of interest on retained monies until receipt by the Project Manager.

6. The contractor and subcontractor payrolls are to be retained until three years after the District Engineer is notified by Controller Division that the final vouchers have been submitted to the Federal Highway Administration.

   (Each District should establish a central location for storing payrolls.)

C. Interpretation

1. The interpretation is taken from the U.S. Department of Labor Field Operations Handbook dated June 1, 1987. (A copy of this manual is available at each permanent field headquarters.)

2. Application of labor laws often becomes a matter of interpretation, such as may be involved in instances when furnishing materials must be classified as subcontracting and subject to highway contract labor regulations. This usually applies to labor involved in producing materials from local pits but is not necessarily limited to that operation. The following are examples of elementary rules that may be used in this determination. It is requested that these rules be followed in enforcing the minimum wage requirements of the Special Provisions.

   a. The contract labor standards provisions are not normally applicable to employees of "established material suppliers" engaged in the production and delivery of aggregates or materials to the contractor, either to stockpiles or on the road. An "established material supplier" is normally considered to be an aggregate production plant, quarry, concrete plant, or asphalt plant which has been established for commercial production not making more than token amounts of sales to other Federal-aid projects.

   b. When a contractor produces and hauls aggregates for his/her own use from a previously established pit or quarry from which he/she had been producing and selling aggregates immediately prior to the award of the contract, his/her production and hauling operations will be considered to be as an "established material supplier" and the minimum wage rates will not apply.

   c. When a new pit or quarry is opened or production equipment is moved into a previously opened pit or quarry for the purpose of producing material for a specific contract, none of the operations will be considered to be commercial and the minimum wage rates and conditions of employment shall apply to all labor employed in producing and hauling the aggregate to the work.

   d. The work of producing or loading material from a local pit shown in the plans, or from a source substituted by the contractor for a local pit shown in the plans, and the work of hauling materials from such sources is considered to be part of the work

contemplated in the contract. As such, the minimum wage rates shall apply to all operations performed by the contractor or his/her subcontractor in processing, loading, and hauling the materials.

e. The minimum wage rate requirements do not apply to bona fide owner-operators of trucks who are independent contractors. The certified payrolls including the names of such owner-operators need not show hours worked nor rates allegedly paid, but only the notation "owner-operator".

f. The contractor is required to pay the minimum wage rates to drivers which he/she employs to operate trucks which he/she owns or leases from another party.

D. Apprentices

1. The contractor is not required to submit the Standard Form 1444 "Request for Authorization of Classification and Rate" for apprentices if verification is received that the employee is registered in a bona fide apprenticeship program.

E. Various outside agencies may request copies of payrolls under The Freedom of Information Act. The FHWA processes these requests. If you receive a request for copies of payrolls, have the person who is requesting a payroll contact the FHWA. The FHWA will request the payrolls from the Construction Division. The Construction Division will tell the PM to forward requested payrolls to the FHWA. The FHWA will remove any personal information such as name and Social Security Number before forwarding the information to the requesting agency.

103.27 DISADVANTAGED BUSINESS ENTERPRISE (DBE) SUBCONTRACTOR

A. Contract Award

On Federal-aid projects with predetermined DBE participation goals, all bidders will be required to submit a required DBE Participation Form (see bid proposal package) with their bid. This form identifies DBE subcontractors, suppliers, transporters, and/or manufacturers that will be used to satisfy the DBE goal. The DBE Participation Form shall also include work or items to be subcontracted, and dollar amount committed to each DBE.

@

Upon execution of a contract, the prime contractor becomes committed to those DBEs goals listed on the form. This commitment is therefore a contractual arrangement between the State and the prime contractor with the same enforcement as any other provision specified in the contract documents. A prime contractor is required to enter into a contractual arrangement with each DBE listed by formally executing a written subcontract agreement specifying the work to be performed and appropriate compensation for that work. This two-tier process, which contractually obligates the prime contractor to both the State and each participating DBE, formalizes implementation of all DBE contract provisions.

@

The DBE Office will review the low bidder's "Required DBE Participation Form" to assure that certified DBEs are being used.

@ The successful bidder must then submit a letter and copy of the DBE Subcontract to the Construction Division to get subcontractors approved.

B. Commercially Useful Function

@ (1) A DBE performs a commercially useful function when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing and supervising the work involved. To perform a commercially useful function, the DBE must also be responsible, with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material, and installing (where applicable) and paying for the material itself. To determine whether a DBE is performing a commercially useful function, you must evaluate the amount of work subcontracted, industry practices, whether the amount the firm is to be paid under the contract is commensurate with the work it is actually performing and the DBE credit claimed for its performance of the work, and other relevant factors.

To meet commercially useful function requirements of the regulations and contract, the following statements are applicable:

- DBE firm must manage the work contracted. Management shall include scheduling work operations, ordering equipment and materials (if materials are part of the contract), preparing and submitting payrolls and all other required reports and forms, as well as hiring and firing employees, including supervisory employees.

- DBE shall perform work with employees normally employed by and under the DBE's control. In all instances, the DBE shall be responsible for payroll and labor compliance requirements concerning all workers under their control. DBEs may use other means to perform work on a limited basis when the contract requires specialized knowledge, skills, or equipment. A DBE may
@ be allowed to augment their work force with personnel which normally work for another firm. If the request can be approved prior to commencing work.

  NOTE: All arrangements must be presented in writing and
@ pre-approved by the DBE Office.

  - DBE must supervise daily operations of their portion of contracted work. The only two acceptable ways for a DBE to supervise daily operations are:

    1) The DBE owner may act as the superintendent and directly supervise work, or

    2) A skilled and knowledgeable superintendent employed and paid wages by the DBE must directly supervise that work.

    If the latter is used, the DBE owner must be actively involved in making operational and managerial decisions of the firm. Basically, this means that all administrative functions shall be performed by personnel responsible to, or employed by, the DBE at facilities or locations under the DBE's control.

  - DBEs shall supervise and perform contracted work with workers on their payroll and under their direct supervision. The DBE and the superintendent must, on a full-time basis, supervise and control contracted work. Supervision of contract work by personnel normally employed by another contractor or by personnel not under the DBE's control constitutes failure to perform a commercially useful function.

(Responsibilities include minimum requirements for DBE manufacturers,
@ dealers, transportation services, and subcontractors.) DBE subcontractors that indicate work which will be performed by employees

@ of another firm or with leased equipment should be questioned. The DBE Office shall be notified in all cases where there is a question regarding "commercially useful function".

3. Partial Subcontract of an Item

It is not unusual for DBE subcontractors to be involved in only part of a contract item.

For conditions where a subcontract does not exist but a DBE firm is manufacturing, supplying, or trucking materials to the job site, this dollar value will not be used to determine the percent subcontracted as specified in the *Specifications*.

Inspection staff must monitor work performed and periodically inform the Project Manager as to which individuals and equipment actually worked so payrolls can be spot-checked.

C. Construction Period

The Project Manager and inspectors must review work subcontracted to DBE subcontractors to assure work is being performed and that DBEs are performing a commercially useful function. Where work is performed by any other contractor or with equipment not owned by the DBE, the inspector shall issue a noncompliance notice citing violation of *Supplemental Specifications for Specific Affirmative Action Responsibilities*. This noncompliance shall be immediately
@ reported to the Project Manager, who will in turn immediately notify the DBE Office.

Prime contractors will be given credit toward the DBE contract goal only when a DBE performs a commercially useful function. The requirements for a commercially useful function are outlined in the previous section "Subcontract Approval."

A DBE may lease equipment consistent with standard industry practice provided a rental agreement specifying the terms of the lease arrangement is approved
@ prior to a DBE starting work. If equipment is of a specialized nature, the lease may include an equipment operator. No credit will be given for the cost of equipment leased or rented from the prime contractor.

DBEs shall negotiate cost, arrange for delivery, and pay for materials and supplies required for their portion of the contract work. Invoices for materials shall be invoiced to the DBE firm and not to a prime contractor.

A prime contractor may occasionally find it necessary to ensure that payments are made to suppliers for materials used by subcontractors. When such a joint check payment arrangement is pre-approved by the Highway Civil Rights Coordinator, counting the cost of materials actually incorporated into the project by a DBE subcontractor toward DBE participation will be allowable provided the DBE:

- orders and schedules the delivery of materials, and
- is fully responsible for ensuring that materials meet Specifications.

When the DBE office approves such payments to be made by the prime contractor, payments must be made by preparing jointly endorsed checks signed by the DBE and supplier.

No credit shall be allowed toward the DBE goal for cost of materials placed by a DBE subcontractor when payment is made by deducting this payment from the prime contractor's payment to the DBE.

Project Managers must evaluate and document performance of the DBE's activity on all projects as part of the normal project contract compliance monitoring. On-site project monitoring by field personnel shall include employee assignments, equipment used, and supervision of the work. All irregularities must be documented in the field books and immediately reported to the prime contractor, and the Contract Compliance Officer in the DBE Office.

Project Managers shall not allow a prime contractor or another contractor to perform work that has been committed to a DBE subcontractor without prior written approval from the DBE Office.

In situations where a DBE subcontractor cannot (or is not) performing, the prime contractor must follow all steps described in *Supplemental Specification for Specific Affirmative Action Responsibilities*. Upon receipt of a signed statement from the DBE and documentation where the prime contractor will satisfy the goal with other items or DBEs, the Project Manager may recommend to the DBE Office that the commitment be waived and the required goal adjusted. The DBE Office must provide written approval of all substitutions before any changes in subcontracted work are performed.

D. Post Construction

Prime contractors shall submit a completed "Identification of DBE Goal Achievement" (DR Form 441) with the final project documents to the DBE office. The subcontractor submits DR Form 442 "Identification of Work Performed." Blank forms are provided in *Appendix 1* and at the website. These forms certify the dollar amount paid to each DBE. DBE Office must compare the dollar amounts on Forms 441 and 442 to dollar amounts committed to a DBE on "Required DBE Participation Form." The prime contractor will be assessed a penalty by change order for failure to satisfy the DBE commitments. This penalty may be reduced when conditions described in

@ *Supplemental Specification for Affirmative Action Responsibilities* are satisfied. Project Managers must include a written explanation describing situations, background, and findings which resulted in reductions or adjustments.

Unique problems have been noted with the goals and variables of the DBE program. Documentation of any activity related to the program is important and must not be overlooked. Record all telephone or personal contacts noting time, place, and details.

The DR Form 440 Contractor EEO Compliance Record has been eliminated. These records are no longer to be maintained.

103.28 LEASE OF PROPERTY BEYOND THE HIGHWAY RIGHT-OF-WAY

The NDR has found that it is more cost effective and quicker to have the contractor make most land use agreements for areas outside the highway right-of-way. This means borrow sites, plant sites, storage areas, parking lots, and so forth are the contractor's responsibility to lease.

103.29 CONTRACTOR'S USE OF HIGHWAY RIGHT-OF-WAY

Occasionally a contractor requests permission to establish a plant site or a material stockpile on highway right-of-way. In reviewing these requests, the District Engineer must consider the impact of vehicles (trucks or equipment) entering and leaving these sites on public traffic. In situations where these vehicles must enter an open ramp or lane at a point where access is not allowed to the general public, the request shall normally be denied. On two-lane roads if an access permit can be obtained and public convenience and safety is not adversely affected, the request may be approved. On closed sections of the highway, right-of-way may be used as long as trucks can enter and leave the closed road safely.

Many times a contractor will have to exit a controlled-access facility to deliver materials such as mulch, subdrain, guardrail, etc. These stockpiles may be allowed as long as the material is to be used in the general vicinity where stockpiled and is stored beyond the “clear zone”.

NOTE: In these situations, the contractor will be responsible to initiate and provide a storm water permit for their operations in that area.

103.30 “CONTRACT QUANTITIES”

The Project Manager and the contractor may agree to a final payment for an item based on contract quantities, i.e., plan quantity. The Project Manager shall verify that the plan quantities are reasonably accurate. If the contractor concurs with the final quantities as shown on the PM Final Estimate, the Project Manager will forward this concurrence to the Construction Division with a copy to the contractor for information.

Final review corrections should be limited to errors of $150.00 or more per pay item. Do not waste time and money making small corrections.

103.31 CONTRACTOR'S SALES TAX EXEMPTION

When a NDR contract is awarded, the Contracts Section of the Construction Division will issue the prime contractor a "Purchasing Agent Appointment" (DR Form 2-A) and an "Exempt Sale Certificate for Contracts" (DR Form 2-B). These forms allow the contractor to purchase materials that are to be incorporated into a highway project without paying any sales tax. The prime contractor is allowed to make copies of both forms and provide them to the project subcontractors for their use. The prime contractor must contact the Contracts Section [(402) 479-4851] to obtain an extension. The Contracts Section completes the extension by issuing a new "Purchasing Agent Appointment" (DR Form 2-A).

103.32 LOTUS NOTES – NOTIFICATION

Field personnel are strongly encouraged to open their electronic mail daily. The Construction Division (and others) use it regularly and expect messages sent to be messages read.

Any time a plan error/omission is discovered or if for any reason the contract must be changed, the PM should send a Lotus note with appropriate details to the designer (Bridge or Roadway), Construction Division, and if necessary, to Materials & Research.

103.33 PRIME CONTRACTORS/SUBCONTRACTORS

Project Managers should be reminded that correspondence pertaining to a subcontractor should be directed to the prime contractor.

103.40 FREIGHT RATES

Nebraska does not regulate freight rates on bulk containerized materials like cement, fly ash, and asphalt cement; and, therefore, the Construction Division will not make freight rate adjustments.

103.50 BARRICADES, DANGER, WARNING, AND DETOUR SIGNS

SSHC Subsection 107.07 provides for furnishing, erection, and maintenance of necessary barricades, lights, signs, and watchpersons, in accordance with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways (each Project Manager should have a copy) and taking necessary precautions for the protection of the work and safety of the public by the contractor. The contractor must erect advance warning signs for traffic hazards created by his/her operations, and at points where the work crosses or coincides with an existing road, in accordance with the plan requirements.

Signs which have been furnished to the contractor at no cost for placement on projects under construction must be returned to the appropriate NDR location in reusable condition when they are no longer needed. A charge will be made to the contractor for the value of signs damaged or not returned. The office issuing the sign will determine the charge for damage or loss.

103.60 SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

Nebraska provides job safety and health protection for all workers throughout the State of Nebraska.

The Labor Department is responsible for administering safety policy. The Nebraska Labor Department adopts federal occupational safety and health standards as State of Nebraska standards. Employers and employees are required to comply with these standards. The OSHA requirements are enforced by the Federal Government. The Nebraska Department of Labor will, upon request, conduct consultation visits of the job site.

103.61 Responsibility of Contractor

Contractors shall be responsible for initiating, maintaining, and supervising all safety precautions and programs for their employees in connection with the work. Furthermore, contractors are responsible to provide a safe work site for NDR employees.

Safety Inspections

The contractor may conduct safety inspections at the start of all major phases of the project. The contractor is to document inspections and provide a written report to the Project Manager.

Postings

The contractor is required to have four documents regarding safety posted on the project bulletin board:

- Job Safety & Health Protection (OSHA 2203)
- "Log and Summary of Occupational Injury and Illnesses" Poster (OSHA Form 200) (11 or more employees)
- Emergency Action Fire Prevention Plan (See *Appendix 3*)
- Emergency Phone Numbers (i.e., 911, Poison Control, etc.) (See *Appendix 3*).

Checklist Safety Program

- Does the contractor have a definite safety program?
- Does the program have the active and continued support of company management?
- Has responsibility for safety been assigned to a specific top company official? Is there a staff for full time safety work?

- Does the contractor know the governmental safety regulations and consider carefully the cost of safety in bidding and executing the work under contracts?

- In dealing with labor, subcontractors, and material and equipment suppliers, does the contractor make clear the safety responsibilities and requirements to be met?

- Does the contractor make frequent safety inspections of operations on the project? Does this include subcontractor operations?

- Does the contractor train his/her employees to recognize and to avoid unsafe conditions and practices related to their individual work assignments?

- Are all accidents investigated, recorded, and reported?

- Does the contractor keep in touch with responsible officials and organizations concerned with standards and with enforcement of occupational safety and health requirements?

This checklist may be used when discussing Safety at the pre-construction conference.

Crystalline Silica Exposure & OSHA Notification

The Occupational Safety and Health Administration (OSHA) has expressed some concerns to the Department regarding the health hazards of exposure to crystalline silica dust.

The Project Manager must notify OSHA of any project where any of the following types of work are anticipated at some time during the life of the project.

1) Lead paint removal when the removal is identified in the Special Provisions as being a hazard.
2) Sandblasting
3) Concrete removals done with a jackhammer
4) Concrete sawing
5) Concrete drilling

Notification will consist of furnishing OSHA:

1) The project number and general location
2) The project manager's name and phone number.
3) A copy of the contractor's schedule (one of the four required by Subsection 108.07 of the *1997 Standard Specifications*). Delete all references to any contractor on the project.

Notification should be made to:

Bernard Hauber, Industrial Hygienist
Occupational Safety and Health Administration
Overland-Wolfe Building, Suite 100
6910 Pacific Street
Omaha, NE 68106

After the original notification has been made, it will be OSHA's responsibility to determine if and when they choose or desire to make an on-site inspection.

104.00 -- CONSTRUCTION INSPECTION

104.01 CONTRACT TIME DETERMINATION (*SSHC Subsection 108.02*)

Tentative Beginning Date - The proposal will show a tentative date on which it is anticipated that the contractor may begin operations.

In most cases, the tentative beginning dates are established several weeks in advance of the letting date by determining the latest possible date the Department would like to see the work completed and backing out the estimated number of days required to complete the work. Consequently, any requests to delay the start of work on a project are examined very carefully before being approved. Additionally, the approval to delay the start of work on a project may be made contingent upon certain concessions by the contractor (such as the imposition of a disincentive payment for a late completion).

In the case of contracts involving multiple time allowances, extensive utility relocation, or work to be performed by others (e.g., railroads, cities, counties), it may be necessary to delay the start of work for several weeks after the tentative starting dates shown in the proposal.

If the tentative beginning date shown in the proposal appears to be earlier or later than believed possible or practical due to job, weather, traffic, or other conditions relevant to the project, the Construction Engineer should be notified promptly.

Notice to Proceed - The contractor will be given a Notice to Proceed by the Construction Division, and work should not begin until the notice has been issued (or at least verbally acknowledged) by the Construction Division.

Normally, the Notice to Proceed date will coincide with the tentative beginning date shown in the proposal; and the Notice to Proceed will automatically be issued after the contract is in place, usually a week or two prior to the starting date. In some cases, however, such as for seeding or landscaping projects, the Construction Division will check with the District Construction Engineer to verify that the site is ready for work to proceed before issuing the notice. The issuance of the Notice will also be delayed when a project is let far in advance of the tentative starting date -- almost always resulting in a request for an early start by the contractor.

It should be noted that in SiteManager, the Notice to Proceed date is recorded in SiteManager under “Key Dates” as the “Notice to Begin Work” date. SiteManager’s “Notice to Proceed” date is actually the contract execution date.

Some contracts contain an “early start provision”. For those projects, the contractor may begin work prior to the tentative starting date by notifying the District Engineer of his/her intent to begin work early. The notice must be given two weeks prior to the intended starting date and is not subject to review by the Department. When such notice is given, the District should notify the Construction Division of the need to issue the notice and the date for which it should be issued.

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For those contracts which do not contain the “early start provision”, requests to begin work prior to the tentative starting date should be made by the contractor directly to the Construction Engineer in Lincoln. In many cases, such requests are made following issuance of the original Notice to Proceed. If the request is approved, a revised notice will be issued.

Requests to begin work after the tentative starting date shown in the proposal should be made by the contractor to the Construction Engineer in Lincoln.

Beginning the Counting of Working Days - The counting of working days or calendar days must begin on the date established in the written Notice to Proceed or on the actual beginning date, whichever is earlier. Accordingly, working day report entries should be made beginning with the established beginning date or actual beginning date – whichever occurs first. Entries should continue for each and every day (seven days per week) until the project has been tentatively accepted. Reports may be suspended when the work is suspended for an extended period.

Under specified conditions, some items of work may be performed for which working days or calendar days will not be charged. Even under these circumstances, however, working day reports must be created to document that work was performed without the charge of working days or calendar days. Work subject to this rule is listed in *SSHC Subsection 108.02*.

Calendar Day - *SSHC Subsection 101.0313* gives the definition of a calendar day.

Working Day - *SSHC Subsection 101.0399* gives the definition of a working day.

Current Controlling Operation - *SSHC Subsection 101.0326* gives the definition of the current controlling operation.

While the counting of calendar days is quite straightforward and is usually dependent only on the passage of time, the counting of working days requires a determination of the current controlling operation. A basic test for the determining the current controlling operation on any given day is whether or not the non-performance of that operation will delay the completion of the work.

The contractor's project schedule can be a very useful tool in determining the current controlling operation. The specifications require that the critical path activities be shown on the schedule; and those activities, in essence, are the controlling activities. Because the specifications allow several types of schedules and because contractors possess varying degrees of skill in preparing the progress schedule, it is strongly recommended that the Project Manager and Project Superintendent discuss the project schedule and come to some mutual agreement concerning the path of critical activities - as may be the case when a bar graph shows several activities occurring at the same time.

The contractor has the right to object to the charge of working days, and those kinds of objections will be minimized if there is an "up front" agreement regarding the controlling operation. There usually will be little dispute regarding whether or not the work was performed.

The current controlling operation should be shown in the Project Manager's diary and on the working day reports. Any discussions or agreements with the contractor regarding it should also be documented in the diary. The assessment of working days is a very important task for the Project Manager, but should not be considered extremely difficult. Common sense and fairness should prevail.

Following are the basic criteria for determining the charging of working days:

1. Weekdays, Monday through Friday, except for Martin Luther King Day, Presidents' Day, Arbor Day, Columbus Day, and Veterans Day, are to be counted as working days -- whether the contractor works or not -- if he/she is not prevented by weather, soil conditions beyond his/her control from proceeding on the current controlling operation for at least 50 percent of the hours in a normal schedule with 80 percent of the normal work force. Martin Luther King Day, Presidents' Day, Arbor Day, Columbus Day, and Veterans Day -- regardless of whether or not the contractor works -- are never counted as working days.

2. Saturdays will not be counted as working days, except for certain cases when New Year's Day, Independence Day, and Christmas Day fall on Saturday and the contractor works (any work) **and** inspection or engineering work by the Department is required.

3. Sundays will not be counted as working days unless the contractor works (any work) **and** inspection or engineering work by the Department is required.

4. New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the day after Thanksgiving Day, and Christmas Day will not be counted as a working day unless the contractor works (any work) **and** inspection or engineering work by the Department is required.

It is emphasized that if the Project Manager does not count working days because of delays "beyond the contractor's control", the situation involved should be clearly beyond the contractor's control. The Project Manager should be thoroughly familiar with the provisions of Specification 108.02. For example, Paragraph 7 provides consideration will not be given to possible "loss of efficiency" due to prosecution of the work during the winter months in the charging of working days when the special provisions require performance of work during cold weather periods. The following example illustrates the application of this provision:

On a clear, cold day in January, a pile-driving operation may be 80 percent as efficient as it would be on a fair, warm day in July. Under this provision, a working day would be counted against the current controlling pile-driving operation even though the relative efficiency of the operation was reduced. When bidding on work that is to be accomplished during the winter months, the contractor is presumed to have accounted for the loss of efficiency. However, if sufficient snowfall or extremes of wind or temperature make it physically impractical to prosecute the pile driving operations, working days would not be counted under such conditions.

Shortages of material delaying prosecution of the controlling operation would not normally be considered beyond the contractor's control. Unusual, extensive, or industry-wide situations (strikes, transportation tie-up conditions, industry-wide shortages) may constitute delays beyond the contractor's control if the contractor has used due care and planning in ordering and scheduling delivery of the materials. The

Project Manager investigates and determines when shortages of materials are beyond the contractor's control.

Shortages of labor are specifically eliminated as justification for an extension of time (*SSHC Subsection 108.02, Paragraph 9)*.

SSHC Subsection 108.05 requires the contractor to employ sufficient equipment of adequate size and in such mechanical condition as to meet the requirements of the work. Accordingly, delays resulting from breakdown or malfunction of the contractor's equipment are not considered to be beyond the contractor's control.

Working Day Report and Diary Record - *SSHC Subsection 108.02, Paragraph 5* provides that the contractor will be furnished with a copy of the weekly report of working days. These reports are generated, compiled, and mailed from the Lincoln office at mid-week, so it is very important that the working day information is entered promptly following the completion of the week's work. Special efforts should be made to impress upon consultants employed by the Department or other governmental agencies that they must submit their working day report information without delay at the beginning of each week.

In addition to our contractual requirement to furnish a copy of the working day report to the contractor, these reports are reviewed by one or more individuals in the central office. The following information should be included on each report:

- Notice to Proceed date (Notice for Work to Begin)
- Actual starting date (Work Begin)
- Current Controlling Operation
- Hours Worked on the CCO
- Hours worked on non-CCO work if CCO hours are zero
- Reason for charge or non-charge of a day if the charge is not what might normally be expected. (Such comments must be entered into the "CCO" field in SiteManager to be visible on the report.)

It is the contractor's obligation to review the working day report when it is received and promptly file any objections to it. The Project Manager is obligated to promptly review the objections and rule on their validity. When such reviews are delayed until the project is complete, there is too great a risk that the details affecting the decision can be forgotten. Whatever the result, the decision should be documented -- either by letter (preferably) or diary entry when the objection is denied or by the issuance of a Time Extension Document when an adjustment to the time allowance is justified.

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Although the contractor is required to file an objection to the working day count within 14 days, claims often fail to surface until the latter stages of a job when the remaining working days are few. For this reason, it is especially important that a complete and accurate diary record be maintained. For purposes of making the initial assessment of working days -- and any subsequent review -- the following information, if applicable, should be recorded or documented daily in the Project Manager's diary:

1. The current controlling operation
2. The weather
3. The work performed
4. Unusual or adverse weather or soil conditions encountered
5. Other unusual occurrences impacting work on the project
6. The times that major work operations halted and resumed and the reasons why
7. Changes in the work force effecting work on the controlling operation
8. Major deviations from the contractor's approved progress schedule
9. Conversations pertaining to any of the above

The need for this information isn't always apparent until the work is completed or until a request has been made for reconsideration of the charging of working days.

104.02 CHARACTER OF WORKPERSONS, METHODS, AND EQUIPMENT

The Project Manager may have the contractor remove intemperate or incompetent superintendents or workers (*SSHC Subsection 108.05*). The PM may also order the removal of unsatisfactory equipment (*SSHC Subsection 107.01*). However, the contractor should be given complete latitude in the supervision, methods, and equipment used in performing the work unless the specifications specifically prescribe the methods and equipment to be used.

104.03 TEMPORARY SUSPENSION OF WORK (*SSHC Section 108*)

Specification Provisions - If weather or other conditions are such as to clearly determine the unsuitability of prosecution of the work for more than two weeks, the Project Manager should discuss the situation with the District Construction Engineer, and with his/her approval, temporarily suspend the work and the counting of working days. The working day report should be clearly marked "Work Temporarily Suspended". The condition or situation which makes the suspension necessary should be briefly described under "Explanation of Delays" in the report which will constitute the written order suspending the work. The term or estimated length of suspension should be included in the explanation. Typical explanations are listed:

1. "One-half application of detour gravel placement completed. Work and working day reports are suspended until approximately (date) when second one-half application will be placed."

2. "Bituminous base (or mat) surface course operations and working day reports are suspended because of lateness of season. The consideration of working days resume approximately (date) with the return of weather conditions favorable to the prosecution of this work."

3. "Grading operations and working day reports suspended until approximately (date) when progress of the bridge work will permit backfilling and finishing around the structures."

4. "Bridge operations and working day reports suspended until approximately (date) when progress of grading work will permit construction of concrete approach slabs and guard rail at the bridge locations."

5. **Winter Work Provision:** When the contract includes special provisions allowing work through the winter without the charging of working days, reports must be submitted showing the hours the contractor worked even though working days are not charged. If the contractor suspends operations on the project, reports may be suspended; but they must resume on the date specified in the special provisions for the end of the winter work season or when the contractor resumes work, whichever is first.

Specialty Items, Time Suspensions - There have been inquiries regarding the propriety of temporarily suspending the work for short or limited periods of time, in the performance of minor, specialized work items which are usually performed by subcontractors or specialized personnel or technicians, rather than with the contractor's own forces. Examples of such work items would be small quantities of electrical, traffic control or lighting work, the painting of one or two small bridges, etc. Small quantities of normal work items which are outside the contractor's field of skill and qualification would also be included. Examples of the latter would be minor quantities of concrete items, sodding, waterway protection, etc. included in a grading contract or minor items of grading work included in a contract for bridges or for surfacing.

It is recognized that at times the contractor may have difficulty in getting the specialized personnel or subcontractor, skilled in performing minor specialized items of work, to

schedule and perform such work precisely when the site is available. Accordingly, it is considered proper to authorize a temporary suspension of the work in such cases, subject to the following:

1. The work is minor, specialized work, which is to be performed by specialized forces rather than the usual work forces.

2. The suspension will be for a limited, reasonable length of time; that such suspension will not adversely affect the scheduled use of the completed facility by the state; and that the suspension will not delay the work of any other contractor.

3. The contractor should make written request for such suspension to the Project Manager, listing the reasons for and the length of the proposed suspension.

The Project Manager should discuss the matter with the District Construction Engineer and may, with his/her approval, make such temporary suspension of the work, subject to meeting the conditions listed above.

104.04 PROGRESS OF WORK (*SSHC Subsection 108.07*)

The Project Manager should monitor the contractor's progress in relation to his/her progress schedule and the requirements of *SSHC Subsection 108.07*. If a contractor's progress falls seriously behind the schedule necessary to complete the work in the allotted time, the Project Manager and the District Construction Engineer should review the possible causes for this situation. If the contractor's progress is behind in proportion to the working days charged, one of the three conditions listed will probably be the cause.

1. Working days are being improperly charged. Weather or other adverse conditions or conditions beyond the contractor's control may be preventing the contractor from working with 80 percent of forces or from working on the controlling operation. If work days appear to have been improperly charged, the matter should be discussed with the Project Manager; and, if necessary, revised working day reports or Time Extension Documents should be prepared to correct the working days charged.

2. Work is being delayed by causes beyond the contractor's control. It this is true, it should be documented by letter from the contractor and also in field records (diary). The District Construction Engineer must approve an extension in the time allowance.

3. The contractor is not prosecuting the work with sufficient forces and equipment to complete the contract within the specified time allowance.

Progress is considered not satisfactory if the work falls 10 percent behind the contractor's work schedule. When this occurs and condition three appears to be the cause, the District Construction Engineer shall immediately notify the contractor in writing of the steps considered necessary to expedite completion of the work in a satisfactory manner. The Construction Division will maintain a log of this action and, if necessary, shall have the responsibility of taking further action as provided under the specifications.

104.05 WINTER WORK (Special Provision)

Determination of contract working days charged during the winter is made according to the rules set forth in the Specifications unless the proposal contains what is commonly referred to as the Winter Work Provisions. This special provision will generally permit the contractor to work without the charge of days during the months of December, January, February, and March. (Days near December 1 and March 31 may be selected to delimit the period so that the affected period of time begins and ends on a Sunday or Saturday, respectively.)

The “winter work” provisions are usually included in contracts where the Department anticipates work to carry over from one construction season to the next. They may be added to a contract by preparing a supplemental agreement to that affect, but they should not be added automatically. For example, a contractor should not be rewarded with the winter work provisions when he or she has failed to complete a project as scheduled because of inadequate prosecution of the work.

On the other hand, a contractor desiring to start a project early or a contractor delayed for reasons beyond his or her control should probably be granted the winter work provisions as an encouragement to pursue the work.

The Project Manager may require the contractor to place temporary materials prior to a suspension in the following situations:

- A project (or a required intermediate portion) is not completed within the allowed contract time, **and**
- Work continues (or is required) after November 30th, **and**
- Due to weather conditions, work cannot be completed.

Typically, temporary materials will be required for safety or soil erosion considerations. All temporary materials shall be furnished, placed, and removed (if required) prior to start-up at the contractor's expense.

Project Suspensions

If work is suspended, with approval of the District Engineer, working days would not be charged.

104.06 WEEKLY REPORT OF WORKING DAYS

Working day reports are maintained in and generated by SiteManager.

104.07 RENTAL RATE GUIDELINES (*SSHC Subsection 109.05* and *Section 919*)

Contractor-Owned Equipment

The following guidelines apply to the determination of rental rates for contractor-owned equipment used on an "extra work" basis.

1. a. The *Rental Rate Blue Book for Construction Equipment* should be used to determine the hourly rental rate of the equipment in question.

   b. In order to determine the proper rental rate, equipment should be identified as completely as possible (make, model, year of manufacture). When practical to do so, it may prove helpful to examine the *Blue Book* before beginning the task of identifying the equipment. Such an examination may lend some insight into the identifying characteristics of the equipment (such as bucket capacity, horsepower, fuel type, etc.) and the potential equipment attachments that may qualify for additional payment.

   c. The *Serial Number Guide for Used Construction Equipment* may be helpful in identifying the age of a piece of equipment.

2. The hourly rental rate shall be calculated by dividing the monthly rental rate shown in the *Blue Book*, including that of attachments actually used, by 176.

3. The hourly rental rate shall be:

   a. increased or decreased by the regional/climatic ownership factor published in the *Blue Book*. The *Blue Book* publishes an individual table in each section showing the adjustment factor for each state. The tables showing the regional/climatic factors are usually located at the beginning of each section with other rate adjustment tables.

   b. decreased (or allowed to remain the same) by the age factor found in the *Blue Book*. (See 1.c. above)

4. The estimated hourly operating costs, including those of attachments used in the prosecution of the work, shall be determined from the information shown in the *Blue Book*. Adjustments due to age or regional/climatic conditions ARE NOT applied to the estimated hourly operating costs.

5. a. The total hourly rate (sum of adjusted hourly rate and estimated operating costs) shall be increased by 15% to compensate the contractor for overhead and profit. (See "Additional Considerations")

   b. The *1995 Metric Supplemental Specifications* have already incorporated this change in policy (as will the *1997 Standard Specifications*). By this directive, dated March 28, 1997, authorization is granted to pay the additional 15% for overhead and profit on contracts being built under the *1985 Standard Specifications*. A change order will not be required.

6. a. Equipment operators, when applicable, shall be compensated according to the rules set forth in the *Specifications*, average hourly wages being calculated by dividing the total hours worked during the week, including overtime, into the gross wages earned during the week.

   b. Equipment may be shown as "fully operated" by adding an amount equal to 150% of the operator's average hourly wage to the rental rate. When this method is chosen, the equipment rate will be eligible for the additional 15% for overhead and profit; the adjusted operator's rate is not.

7. a. The number of hours of "equipment rental" for which payment will be made for each item of equipment must be determined on a case-by-case basis.

   b. In general, when equipment is already on the project, payment hours shall be limited to the actual hours of use, with no deductions being made for minor interruptions of the work. If the equipment has been dedicated to another operation and was actively being used in that operation when it was reassigned to the "extra work", consideration may be given to paying for "standby time" for idle periods exceeding two consecutive hours which are not the fault of the contractor.

Rented or Leased Equipment

The following guidelines apply to the determination of rental rates for rented or leased equipment used on an "extra work" basis.

1. When it becomes necessary for the contractor to rent or lease equipment to complete extra work, the contractor shall be compensated 115% of the actual invoice cost of the rented or leased equipment. This procedure provides compensation for overhead and profit.

2. a. The rental or lease rate shown on the invoice may be compared to rates published in the *AED Green Book* to determine if it is reasonable.

3. Because the estimated hourly operating costs shown in the *Blue Book* include costs associated with the maintenance and replacement of items such as tires, pumps, and other components which are the responsibility of the owner, the operating costs shown in the *Blue Book* shall not be included for payment. However, if the contractor itemizes and documents the daily costs incurred for fuel, lubricants, etc., those costs can be included for payment.

4. a. Equipment operators, when applicable, shall be compensated accordingly to rules set forth in the *Specifications*, average hourly wages being calculated by dividing the total hours worked during the week, including overtime, into the gross wages earned during the week.

b. In some cases, where the invoice provides a convenient way to do so, equipment may be shown as “fully operated” by adding an amount equal to 150% of the operator’s average hourly wage to the rental rate.

Additional Considerations

1. Mobilization

   a. If the equipment needed to perform extra work is not located on the project, the contractor is entitled to compensation for mobilizing and demobilizing the equipment. Labor and hauling equipment used to transport the equipment to and from the project is eligible for compensation. The equipment needed for the extra work is eligible for compensation at “standby” rates if it is transported during normal working hours.

   b. Reasonable costs associated with readying the equipment for transport (assembly and disassembly) shall also be allowed.

2. Standby Time

   a. If the contractor is required to idle equipment engaged on “extra work” and the equipment was:

      1) already located on the project site and engaged in other productive activities, or

      2) brought onto the project for the specific purpose of performing extra work,

      he/she may be entitled to compensation for “standby time”. The equipment must be idled due to reasons beyond the contractor’s control and not be used for the performance of other work.

   b. When payment for standby time is justified, payment for the idle hours should be made at one-half of the established rental rate (excluding estimated operating costs).

   c. Additional compensation for overhead and profit shall not be made for any equipment considered to be “on standby”.

   d. Operators of idled equipment are eligible for compensation according to the procedures previously described provided they are not reassigned to other duties or taken off the payroll.

   e. The sum of “active” and “standby” time for any piece of equipment or its operator will <u>generally</u> be limited to 8 hours per day, but must be monitored to insure that an unreasonable limitation is not placed on the standby hours. For example, if a piece of machinery is utilized from 8:00 to noon, stops for lunch until 12:30, and then resumes working until 2:30

when an unavoidable delay stops activity on the “extra work” until the next morning, the standby time should be limited to 2 hours -- the hours which would have been utilized to complete an 8-hour day.

3. Reconciliation of Records

It is highly recommended that the Department’s records and the contractor’s records of labor, equipment, and materials used on any “extra work” be compared, reconciled, and documented daily.

@ **104.08 CHANGE ORDER - SUPPLEMENTAL AGREEMENTS**
(*SSHC Subsection 104.02*)

Change Orders are used to:

- Change the authorized quantity of a contract item. This includes increases, decreases, or deletions to contract quantities.
- Add a new item or material to an existing contract. Often this is a result of plan revisions or a change in scope from what was originally envisioned at time of letting.
- Serve as a source document for the Controller Office.
- Officially document changes to the contract documents. CO/SAs and work orders are written orders to a prime contractor which are initiated and prepared by the Project Manager. Once signed by all parties, these documents become a legally binding part of the contract ordering a specific change to the original contract.

Policy for Change Orders

A. Contractor Markup

Subcontracted Items. Extra work performed by a subcontractor entitles a prime contractor an allowance to cover administration expenses. This markup is not to apply to incentive payments. The percentage allowed for administration expense is discussed in *SSHC Subsection 109.05*.

Contract Unit Price. Change orders covering an overrun/underrun (*SSHC Subsection 104.02*) of items at contract unit prices are NOT eligible for any additive like an allowance for administration expenses. This includes work which was done by a subcontractor. The contract unit price should have already considered any necessary additives for administrative expenses.

The contractor may request a change order when additional work differs materially in kind or nature from the work included in the originally proposed construction.

A major item of work is defined as an item whose total original contract cost exceeds 10 percent of its original group total amount. The price for a pay item may require adjustment when a major item is increased in excess of 125 percent or decreased below 75 percent of the original contract quantity. Any allowance for an increase in quantity shall apply only to that portion in excess of 125 percent of the original contract item quantity, or in case of a decrease below 75 percent, to the actual amount of work performed.

A contractor may request a price adjustment to recover lost administration expense for underruns amounting to more than 25 percent of the bid amount for a major item of work. A contractor is allowed to recover only that portion of lost administration expense represented by the underrun.

By the same reasoning, a like price adjustment may be made to reduce the cost of major items of work which overrun by more than 25 percent, since the contractor should have already included overhead expenses in their bid. Overrun price adjustments apply to only that portion/quantity which is more than 125 percent.

Agreed Unit Price. Extra work orders based on an agreed price or lump sum should have overhead considered as a part of the negotiation. The agreed unit price may include the cost of overhead for handling subcontracted items. It may be included in lump sum items if justified. However, if negotiations specifically excluded markup, the item may be shown as a separate entry on a cost work up sheet.

Force Account. (*SSHC Subsection 109.05*) Specified force account percentages for labor and material are intended to cover all costs that a contractor may incur due to the work, regardless of who does that work (prime or subcontractor). Force account work to a subcontractor will be authorized for additional administration percentage to a prime.

Plan Revisions

Often, plan revisions result in Change Orders having to be negotiated. Processing Change Orders resulting from plan revisions is sometimes delayed due to disagreement on prices, lack of success in obtaining qualified subcontractor(s), or various other reasons.

It is imperative that Project Managers actively pursue Change Order negotiations to an early conclusion, especially if proposed work involves public safety (guardrail, safety enhancement, etc.) or work related to a prolonged detour. Obviously, agreement on unit prices is desirable. However, there are times that work will have to proceed on a Force Account basis. In all cases, documented agreements on the Method of Measurement and Basis of Payment for extra work items must be obtained before the Change Order is written. NOTE: No work can begin until the contractor has either agreed to a Change Order or agreed to a basis of computing force account costs.

Change Order Approval Limits

Contracts are awarded for a specific dollar amount. Overruns or change orders expend additional funds and can only be authorized by specific people.

FHWA/Certification Acceptance

FHWA projects that have full oversight have “FHWA” stamped in red on the front page of the proposal. The Contracts Section makes the determination and affixes the red stamp.

@ On FHWA oversight projects, current rules require that expenditures in excess of $50,000 be discussed with the FHWA.

The following table shows the Department's approval limits:

APPROVAL LIMITS	
Deputy Director	Over $150,000.00
Construction Engineer	$50,000.00 to $150,000.00
District Engineer & DCE	$0 to $50,000.00

Preparation of Change Order

The following instructions are applicable in the preparation of a Change Order-Supplemental Agreement:

- Create a brief description of the work not in the contract.
- Show reasons for the change; or, if the document is a combination change order-supplemental agreement, show purpose of the agreement. When the work to be performed is not covered in the specifications, the name of the items shall be worded to define the work to be performed. References should be made to similar items in the specifications or plans and the method of measurement and basis of payment definitely established.
- Show the basis of the unit prices established, such as comparison with unit prices for similar contract items or the previous year's average contract unit prices.
- Include statement as to the determination of a change in the contract time allowance.
- @ Show the name of the FHWA engineer and date of discussion with him/her when the Change Order is for more than $50,000.00 and the federal-aid contract is for more than $1,000,000 and on the Interstate.
- Enter estimated increased and decreased changes in quantities of items of work. Use standard item numbers and standard specification/contract wording, when applicable, for the new item description you define.

All Change Orders (CO) and Change Order-Supplemental Agreements (CO/SA) shall address the subject of additional working days or calendar days, if any, to be added to the contract time allowance.

The original working day or calendar day allowance is calculated by assigning some average rates of progress to the various items of work and then making some assumptions as to which items might tend to overlap during the actual performance of

the work. The system is not perfect; but, regardless of the result, it does provide all bidders with a time frame upon which they can estimate a schedule for completion of the work and prepare a bid.

The performance of extra work should not be cause to suspend the working day or calendar day count. Working days or calendar days should be assessed for all extra and originally contracted work according to the guidelines for doing so, and then any relief to which the contractor might be entitled should be granted by issuing a time extension document or addressing the time in a CO or CO/SA.

@ In SiteManager under Reference Tables/Standard Definitions there several option clauses to be added to the Change Order. Four of the options pertain to working/calendar days. They are further described below:

1. No additional working days or calendar days to the contract time allowance are being granted. Additional working day or calendar day consideration is not applicable to this change.

2. "_____" additional working days or calendar days to the contract time allowance are being granted.

3. Additional working days or calendar days to the contract time allowance shall be granted on the basis of the actual working days or calendar days charged for performing the work under this agreement, provided that said work is judged to be the controlling operation.

4. Additional working days or calendar days to the contract time allowance, if any, shall be granted on the monetary value in accordance with Paragraph 10. of Subsection 108.02 of the Standard Specifications.

The writer of the CO or CO/SA must use some judgment when determining which note is appropriate. In fact, there may be instances when it will be necessary to write more than one CO/SA because the items to be added to the contract do not all subject themselves to the same rule. A little extra work, perhaps; but the right thing to do. The discussion that follows should be helpful in determining which note to select.

Note 1 - No additional days

No additional working days or calendar days to the contract time allowance are being granted. Additional working day or calendar day consideration is not applicable to this change.

@

@ This note could be used on any CO/SA which addresses subjects which are not financial in nature. An example would be an early starting date coupled with the conditional addition of the winter work special provision to the contract. A condition might be that the contractor not make any claims for delays due to utilities not being out of the way --- thus the need for a supplemental agreement requiring the contractor's signature. The work remains the same, however; and no change would be made in the contract time allowance.

This note should also be used on any CO/SA that increases the value of the contract but does not necessarily require additional time to perform the work. An example might be the substitution of one type of asphaltic concrete for another. The concrete actually used might be more expensive; but the time to mix, haul, lay, and roll it remains the same. (This does not, however, preclude the granting of some additional time due to an overrun of the final quantities.)

In general, this note could also be used on a CO/SA that has a negative financial impact on the project. An example might be the substitution of an 18" culvert pipe for a 24" pipe. The cost of the pipe and excavation is probably going to result in a savings to the project, but it is not the Department's policy to reduce the contract time allowance.

Note 2 - Specified number of days

"_____" additional working days or calendar days to the contract time allowance are being granted.

This note is the preferred note in many cases and should be utilized whenever possible. The Construction Division will rarely question the number of days granted, no calculations are required by the Final Reviewers, and the fact that the CO/SA is signed by the contractor leaves little opportunity for it to be contested. Obviously, the use of this note is restricted to situations where the supplemental agreement is created after the work is performed and the number of days required is known.

This note can appropriately be used in cases where the extra work is determined to be the controlling operation when it was performed. It definitely should be used when the time required to perform the work is grossly disproportionate to its monetary value. As an extreme example, it may take just one day to add a million-dollar traffic controller on a fifty-thousand-dollar project. Determination of an additional time allowance on the basis of cost would obviously not be correct.

This note can also be used on a CO/SA that is more administrative in nature. As an example, the contractor and the Department may negotiate some changes to the contract for which a time adjustment is a condition of the agreement. This note is a proper method to document the adjustment to the contract time allowance. It functions in the same way as would a Time Extension Document.

Note 3 - Unspecified number of days (controlling operation)

Additional working days or calendar days to the contract time allowance shall be granted on the basis of the actual working days or calendar days charged for performing the work under this agreement, provided that said work is judged to be the controlling operation.

This note should be used in situations similar to those described for Note 2 when the CO/SA is completed prior to the work being performed. When it can be anticipated that the additional work will be the controlling operation or the value of the work is disproportionate to the time required to perform it (especially when the work takes a long time to complete but is not very expensive), this note should be used. In some cases, it may be appropriate to grant some additional time on the basis of monetary value for extra work performed when the work is not the controlling operation for the entire time required to complete it.

The Project Manager should closely monitor the work when choosing this method of calculating an increase to the contract time allowance. The completion of other work is certainly not discouraged or prohibited, but the contractor should not be allowed to intentionally slow the progress of the extra work to gain the advantage of allowing other contract work to be completed concurrently during the time period being added.

Note 4 - Unspecified number of days (monetary value)

Additional working days or calendar days to the contract time allowance, if any, shall be granted on the monetary value in accordance with Paragraph 10. of Subsection 108.02 of the Standard Specifications.

This note serves to cover those situations not addressed by Notes 1, 2, or 3. It is an inexact method, but is usually a fair way to provide additional time to the contract time allowance when the methods associated with Notes 1, 2, and 3 are clearly not more appropriate.

It should be used to address those additional items of work which are similar in nature to other items of work in the contract but for which it is difficult to determine or monitor the actual amount of time required to complete. An example might be additional work performed sporadically over a long period of time or the addition of more work of a type already in the contract --- such as may be added by a plan revision.

The use of this note does require the Finals Reviewers to calculate the amount of extra time to be granted. The calculation should be done on the basis of the monetary value alone, and no consideration should be given to whether or not working days or calendar days were charged during the performance of the work. If the extra work to be added by the CO/SA could have been anticipated prior to the letting, time certainly would have been allowed for it; and it is only fair that an additional time allowance be considered after the fact.

The Project Manager should have the best feel for the type of working day or calendar day consideration that is most appropriate. He/she is encouraged to make a fair

evaluation of the situation and select the method that fits. As indicated in the discussion above, the use of Note 2 is encouraged.

Cost Overrun/Underrun Notification (DR Form 74)

When project costs overrun or underrun by $50,000 or more and the change in cost is not reflected in a "Change Order/Supplemental Agreement", the Project Manager shall prepare and send a "Cost Overrun/Underrun Notification" (DR Form 74) to Laurie Burling (BURLING) as an attachment via Lotus Notes. Laurie will print the form and circulate it for the appropriate approval signatures.

DR Form 74 is available on Server 50 in the folder titled DORFORMS. Space is provided in the identification block in the lower-left corner to provide a unique identification before saving the file. The Project Manager's name must be shown in the "Prepared by" window, but an actual signature is not required to submit to the DR Form 74 to the Controller Division.

Please note that the net change in the total project cost --- not an individual group --- shall be the determining factor when deciding if an event should trigger the preparation of DR Form 74. Caution is necessary as it is not always apparent when the costs have overrun by more than $50,000. However, as soon as an overrun/underrun of $50,000 is noticed, then a DR Form 74 must be initiated by the Project Manager.

Work Orders

(*SSHC Subsection 109.05*) - If there is sufficient time to execute a change order-supplemental agreement or force account agreement prior to beginning the extra work, no work order need be issued. The change order-supplemental agreement or force account agreement shall provide the basis for authorization and payment for extra work. The change order-supplemental agreement and force account agreement shall be prepared in accordance with the instructions in this manual. The work order shall state that the work will be done either by change order-supplemental agreement or by force account agreement.

If prices can be agreed upon at the time of writing the work order (see *SSHC Subsection 109.05*, Paragraphs 8 and 9 regarding rental rates), but insufficient time exists to permit execution of a change order-supplemental agreement, a work order shall be prepared authorizing such work and then be followed by a change order-supplemental agreement formalizing the prices or basis of payment stated in the work order.

If negotiated prices cannot be agreed upon at the time of writing the work order, the work will be done by force account. Under certain circumstances, when approved by the Construction Engineer, this may be changed at a later date to a change order-supplemental agreement.

The work order shall be signed by both the Project Manager and the contractor or his/her superintendent.

The Project Manager and District Office shall implement the following procedures to expedite payment for extra work.

1. The Project Manager shall keep a file of work orders issued on a project and shall take the necessary steps to get agreements consummated.

2. The Construction Division shall track the change orders progress.

3. Contractors must furnish back-up information to justify prices they quote for extra work. Contractors should notify the state immediately of items of work that they do not think are covered in the contract.

4. The introduction of any new item of work not included in the contract items, no matter how small the quantity, must be covered by a change order-supplemental agreement establishing a unit price for the new item.

5. Canceled items (materials furnished by the contractor and not used due to a change in plans) will require the Project Manager to prepare an Imprest Inventory Form 329 and a Change Order-Supplemental Agreement when the material involved is to become the property of the State. Most often involved are pieces of culvert pipe ordered but not installed. In some cases the contractor may wish to retain the materials and no further action need be taken when this is true. (See *SSHC Subsections 109.06* for further information.)

Force Account Agreements and Statements (*SSHC Subsection 109.05*)

Force Account Agreements - It is necessary that force account agreements be executed when the nature of the proposed work is such that the costs involved cannot be accurately estimated or when there are no similar items included in the contract which may be used as a basis in determining unit prices.

Before beginning the work or preparing the agreement, the Project Manager should have a definite understanding with the contractor's representative regarding the labor, equipment, and materials to be used and the manner in which the work is to be prosecuted, and the rates to be paid for the equipment. If a satisfactory understanding cannot be reached, the matter should be referred to the District Engineer.

In preparing the agreement, the Project Manager should be very careful to include rates for all labor and equipment that may be used in the work. If it becomes necessary to use labor or equipment for which rates are not established in the agreement, the Project Manager normally shall negotiate the rental rates and shall immediately prepare and submit for approval a force account agreement supplementing the original agreement and establishing the rates to be paid for such labor and equipment. However, it will not usually be necessary to issue supplemental force account agreements for additional labor rates if the original agreement covers a rate range from the minimum required by the detailed schedule listed in the contract Special Provisions to the rate the contractor is paying or which he/she anticipates he/she will pay due to future rate increases.

Equipment rental rates are negotiated or determined as indicated in *Construction Manual Section 104.07*.

The approved rental rates shall only apply to equipment used under the following conditions:

The contractor's equipment that is available on the project. If equipment not available on the project is needed only for the extra work, it may be necessary to pay rates in excess of the approved rates or to pay compensation for the cost of moving in the equipment. (Mobilization is explained in *Construction Manual Section 104.07*.)

If it is necessary for the contractor to rent equipment for the extra work from a third party, the rate established shall be the actual rental cost plus fifteen percent for overhead and profit.

Equipment used on extra or additional work performed under normal working conditions on a force account or contingent item basis.

If the equipment is to be used under working conditions involving abnormal expenditures for maintenance, fuel, or service, it may be necessary to pay rates in excess of the approved rates.

If major quantities or extended amounts of work are involved, it may be equitable and necessary to negotiate rates at less than those indicated above.

The approved rates shall be paid only for the time actually used in the performance of the work ordered by the Project Manager. Standby time, time involved moving to and from the work and repairing and greasing time shall not normally be included for payment.

If the contractor is required to hold equipment which he/she has brought in specifically for the extra or additional work "on standby" because of circumstances beyond his/her control, consideration may be given to payment for normal schedule "standby time". In such cases, it will be necessary to negotiate lower hourly rates with the contractor which will not include compensation for fuel, oil, grease, repairs and other costs which would not be incurred on the equipment "standing by".

The Project Manager should be careful to obtain the correct name, model size, series number, and type of the equipment and major attachments - (loader or dragline bucket, etc.) involved for each item of equipment for which a rental rate is to be established. This information should be furnished to the District Office and they may then determine the approved rate from the "Rental Rate Blue Book". Complete information is needed to determine the proper rate since the rates vary considerably depending on the model, series, etc. The name of the established item should be descriptive but brief, for example, "Crawler Tractor Loader, 1 Cu. Yd." The body of the force account or supplemental agreement should then include all of the information necessary to determine and verify the correct rate, for example "Caterpillar, Model 955 'H', 100 horsepower, 1 Cu. Yd."

If fully operated rates, including operators' wages are to be established, the rate paid the operator shall be increased by 50 percent to cover insurance, social

security taxes and profit and added to the approved rental rate, rounding to the nearest five cents. When such rates are established, the words "fully operated" shall be included in the equipment rental item.

The Project Manager should call or write to the general office of the contractor advising him/her of the nature of the proposed work to be performed on a force account basis and request that they advise by letter regarding their insurance premium rates for workmen's compensation, public liability, and property damage. Request that the contractor send copies of his/her letter to the District and Construction Engineers. The letter stating the insurance rates should be attached to the force account agreement to be filed as a part of the permanent records. The agreement may also be prepared without the insurance rates and sent to the contractor's office for signature with instructions that the contractor place the rates on the agreement.

The reverse side of the agreement form must contain the "Estimate of Cost". This itemized estimate of the cost of the work shall include an item for each class of labor or piece of equipment for which a rate is established in the agreement. The estimated number of hours that it is contemplated that each item of labor and equipment will be employed shall be shown, extended at the established rates, and totaled. Allowances for insurance, social security taxes, and profit shall be shown and included in the total cost. In the event that the contractor will be required to furnish materials in performing the work, the quantity and estimated cost of each item of material should be shown and included in the totals.

The hourly labor rates to be used in the itemized estimate shall be the average rates that would be earned, including overtime, if the laborer worked a full week. Such rates shall be referenced with asterisks to the following note to be entered below the estimate:

"Average rates earned at the established basic rates in a 40 hour week."

The heading of the "Estimate of Cost" on the reverse side should be on the same end of the sheet as the signatures on the face of the form so that it will not be obscured when it is placed in the Lincoln Office file.

Force Account Statements - A force account statement, signed by both the Project Manager and the contractor's representative, is required for each calendar week during which work is performed. These reports should be prepared and signed weekly. In the event that overtime payment is involved and the agreement requires that reimbursement be made at the average hourly rate earned during the week, the statement shall be prepared and signed on the Monday following the week in which the work is performed.

A daily record of labor, equipment and materials used on force account work shall be
@ kept in SiteManager. Work on force account and contract items will often occur at the same place at the same time. It will be the duty of the Project Manager or inspector to record his/her estimate of the force account labor and equipment hours and check with the contractor's foreman each day.

A receipted invoice is required for all items of expense incurred by the contractor except insurance, social security taxes, and the items for which rates are established in the force account agreement. The quantity or amount of such services furnished or materials used during each week may be included in the statement for that week, or the total quantity or amount for all materials or other expense covered by the same agreement may be included for payment on a later statement, substantiated by receipted invoice. Payment cannot be made for such items until the receipted invoices are received.

The contractor shall furnish the Project Manager with a copy of his/her weekly labor payroll which contains the names of those personnel working on force account items. The hours worked and the rates paid to labor on force account work shall be compared with this transcript. Any discrepancies should be investigated and corrected to insure the accuracy of the force account statements. See Pages 492 through 497 for instructions and examples of force account agreements and statements.

Alterations of Plans or Character of Work (*SSHC Subsection 104.02*)

This subsection in the specifications authorizes the Department (Project Manager) to increase or decrease quantities of contract items for which there are unit prices included in the contract, if changes in plans or alterations of construction make such increases or decreases necessary or desirable.

A CO/SA may be necessary when there is a significant change in the character of the work. A "significant change" is defined in Subsection 104.02. A CO/SA will not be required if the Project Manager and contractor agree that the additional work can be done
@ at the bid price. Such agreement, preferably including the contractor's initials or signature, should be documented in SiteManager and in the Project Manager's diary.

@ **Sign Deductions**

The change order for sign deductions must indicate that "State Funds Only" shall be used.

104.09 VALUE ENGINEERING (*SSHC Subsection 104.03*)

In accordance with *SSHC Subsection 104.03* a contractor may submit a value engineering proposal to the Project Manager with copies to the District and Construction Division. The purpose of value engineering is to encourage alternative, cost effective measures which produce equal or better quality end products.

Value Engineering proposals will not be accepted for:

- Changes in basic design of a bridge or pavement type. For example: Value engineering a project from PCC to ACC will not be acceptable. Changing a designed bridge to a box culvert is not acceptable.

- Changes which the contracting authority may already be considering.

- Basing a value engineering proposal on, or similar to, existing standard Specifications, Special Provisions, or design plans and standards adopted by the contracting authority. For example: A plan was let using 15 foot (4.6 m) PCC joint spacing. A value engineering proposal would not be accepted changing this to 20 feet (6 m) because Roadway Design Division standards have included this spacing as an acceptable standard.

@

The written proposal shall have sufficient detail to be evaluated for compliance with the requirements. The detail provided must also allow for reviewing how a proposal impacts the entire project. It shall include:

- A description of existing requirements and proposed changes

- All affected contract items, including new, extra work items and supporting justification for that extra work

- Unit prices requested for the work

- Effects on crew, equipment, and production needs for the project

- Impact on the construction period

- Schedule for obtaining all required materials

It is very important to pursue these requests quickly to maximize potential savings. Once a proposal is received, the Project Manager should (a) discuss the merits of the VE proposal with the District Engineer, and (b) initiate an office review and forward review comments to the Construction Division within a week. The Construction Division will coordinate the review with other offices, including selected section leaders (Design and/or Bridge) and the FHWA, if appropriate. Following this review, the Constriction Division will notify the District and Project Manager of approval or disapproval and any special considerations or requirements. Following notification from the Construction Division, the Project Manager will prepare a written notification to the contractor outlining the review and conclusions of that review.

If a proposal is acceptable, this notification will form the basis for issuing a Change Order and Supplemental Agreement to implement conditions of the value engineering proposal. Therefore, a notification should include:

- A restatement of any changes
- All costs involved, and how costs will be addressed
- Any Specification requirements which result from changes or modifications to the existing contract
- Details pertaining to special requirements for materials inspection and testing, if applicable
- Any other special considerations or conditions

If a proposal is not approved, the notification needs to include reasons for rejection.

The Construction Division has established a goal of ten days to complete the entire review and notification process.

104.10 PLANT INSPECTION

Portland Cement Concrete Paving Plant (*SSHC Subsection 1002.02*)

The National Ready Mixed Concrete Association Quality Control Manual, Section 3, *Certification of Ready Mixed Concrete Production Facilities* lists the minimum monitoring requirements. A plant inspector (Construction Technician) will normally be assigned to each project with duties split between plant and grade inspection. Plant inspectors should schedule work so the plant can be visited daily during production. The amount of time spent at the plant will depend on the overall quality control at the production plant.

Structural Concrete Plant

Ready mix tickets shall be prepared and signed by the person batching the concrete or the plant inspector.

Asphaltic Concrete Paving Plant Inspection (*SSHC Sections 503*, and *1028*)

Table 502.40.1 lists the ACC plant monitoring requirements. A plant monitor will normally be assigned to each project with duties split between plant and grade inspection. The plant monitor should schedule work so that the plant can be visited daily during production. The amount of time spent at the plant will depend on the overall quality control at the production plant. The contractor's QC inspector will be providing production and placement information to be entered on the daily plant report. Visits of the plant monitor to the plant laboratory for exchange of information and book work will normally be done daily.

The plant monitor will be responsible for witnessing core sampling and performing verification density tests.

Testing Equipment and Supplies

Necessary plant inspection forms will be furnished to the producer at no cost. The producer can request these through the Materials & Tests Engineer or Project Manager. It is a good idea for the plant monitor to carry a supply of forms and make these available to the producers as needed.

NDR plant monitors can utilize contractor furnished equipment for testing required at the plant site.

Samples

The contractor's inspector and NDR plant inspectors should indicate on the sample submittal form the field lab telephone number and hours they can be contacted for test results.

For QA/QC projects, the contractor is responsible for field sampling. The project monitors should witness sampling to the extent that they are assured the samples are taken properly. Additional witnessing of obtaining, identifying, splitting, testing, and storing samples will be as directed by the QA/QC Specification.

104.11 PLANT REPORTS

The Project Manager should make arrangements with the contractor's plant inspector for timely receipt of plant reports. The original and all copies of the plant report shall be kept at the plant until all documentation is completed. Normally, this will be the day following the end of the reporting period. Review and distribution of the reports will be made by the Project Manager. This distribution will include a copy to be returned to the contractor's plant inspector. Prompt consultation between the plant inspector and the NDR plant monitor shall follow any significant error or omission.

Documentation

@ A separate field book entry in SiteManager should be set up on each project to document plant inspection. Some flexibility in the suggested format may be necessary depending on project size, type of plant, and if the QA/QC Specification applies. It is important to document discrepancies and corrective action taken by the contractor.

104.20 FIELD TESTS

104.21 FIELD TESTING ON CONSTRUCTION PROJECTS

Materials

All sampling, measuring, and testing for construction project quality control shall be performed as prescribed in the NDR Materials Sampling Guide and the NDR Standard Method of Tests.

Project Acceptance Sampling and Testing

Both construction inspection personnel and the contractor are responsible for the field sampling and testing portion of project acceptance tests. The Project Manager must review inspector assignments and maintain a program of continuing training for personnel and training of additional employees if required. Samples taken by inspectors and submitted to District or Central materials laboratories must be properly and completely identified on "Sample Identification Form" (DR Form 12) or other appropriate forms as required.

The *Materials Sampling Guide* shows the minimum required frequency of tests for various types of work. Additional tests should be made as necessary for adequate project control. Reports showing test results must include all tests made.

Reports do not need to be included in field books or diaries.

Assurance Sampling and Testing

SSHC Section 1028 discusses the requirements related to asphalt assurance sampling and testing, most of which are Materials and Research Office responsibilities. Occasionally, assurance samples have not been taken on some projects because timely notification of ongoing work was not made. This has been more common with test cylinders from bridge deck pours and culvert projects.

While the actual taking of assurance samples remains the responsibility of Materials and Research personnel, it is of equal importance that project inspectors provide timely notification regarding available dates for testing.

104.30 TRUCKS/HAULING OF MATERIALS

The Motor Carrier Permit Office is responsible for the monitoring and enforcement of truck weights on roadways outside the project limits and on roadways within the project limits utilized to maintain through traffic. Our involvement in monitoring hauling units in these situations should normally be limited to notification of the appropriate Motor Carrier Permit personnel if obviously overloaded trucks are suspected. The primary focus of our attention should be insuring compliance with legal axle loads on pavements and structures on roadways within the project limits that are closed to the traveling public.

104.40 SCALES

Aggregates are generally measured in the delivery vehicle on a platform scale. Asphaltic mixtures may be measured over platform scales, in silos on load cells, in hoppers, or by counting batches.

104.41 SCALE TICKETS

The contractor shall provide a scale ticket for each load showing the required mass information on the procedure being used, the project number or contract description, the truck number, the date, and the type of material.

The required data to be automatically printed on the scale tickets will vary according to the method of measurement (hopper, silos on load cells, batch scales, or platform scales) and type of system (automatic or semi-automatic).

Automatic or Semi-Automatic Measuring

- For hoppers, batch scales, or silos on load cells, all tickets printed automatically shall include the gross mass, empty mass of the hopper or mass not discharged, net mass of material for each drop, and the total net mass for the load. When measured under the semi-automatic procedure, the scalemaster may include on the ticket the calculated total net mass.

- For batch scales, the batch mass and batch count are to be automatically printed under both procedures. The total net mass may be printed with a system or calculated by a scalemaster with a semi-automatic system.

- For truck platform scales, all scale tickets printed automatically shall include gross mass, tare mass of the truck, and net mass of the load. For semi-automatic measuring, the printer shall print the gross mass, and the scalemaster shall conduct all measurements and may enter by hand or by printer the tare mass of the truck and calculate the true net mass.

Manual Measurement

- For manual measurement of loaded trucks (project quantities less than 10,000 Mg) (11,000 ton), scale equipment on truck platform scales may or may not include a mechanical ticket printer. A scalemaster shall include the gross and tare mass and calculate the net mass on the scale ticket. The Project Manager may arrange for the measurement to be witnessed.

The inspector will collect the accompanying load ticket for each load of material on its arrival at the work site and check to see that the ticket has been validated by the scale inspector when such scale inspection is required. The inspector will observe each load of delivered material to detect any obvious deficiencies in quality or in quantity and reject any loads which are unsatisfactory.

The inspector will sign or initial the scale ticket for each accepted load to verify the material was delivered and accumulate the tickets on a daily basis for determination of

pay quantities. Quantities for each day's operation shall be totaled and checked against the contract records and any discrepancy promptly resolved.

The requirement that an inspector personally receive all load tickets at the time of delivery may be relaxed only in cases of very small quantities or intermittent deliveries under conditions where the Project Manager or inspector can visually determine the approximate quantity delivered.

On asphalt projects, it is permissible for a contractor's employee to collect the tickets and place them on a clipboard. An inspector must be present at the laydown operations at all times and observe the collection of the tickets.

104.42 TRUCK PLATFORM SCALE APPROVAL

The *SSHC Subsection 503.03* explains requirements for scales. A platform scale used for measurement of items such as crushed stone, base and subbase material, and asphaltic mixtures, contracted for and measured by the Megagram, shall meet these criteria.

Truck Platform Scale Use

Each truck to be measured shall be tared twice a day. Taring of trucks should be on a random basis during the day's operation, using the previous day's tare mass until a new tare mass for that day is determined. No truck may be used for hauling material paid for on a mass basis until tared.

104.50 SMOOTHNESS

104.51 TESTING

SSHC Sections 502 and *602* contain the current asphalt and concrete pavement smoothness Specifications.

The special provisions provide the current smoothness Specification for bridge decks and bridge deck overlays. They discuss the requirements of smoothness criteria for bridge decks, new approaches, bridge deck overlays, and overlaid approaches. They will also indicate when evaluation is excluded.

Any pavement and bridge deck areas carrying traffic, but excluded from profilograph testing, must be checked with the 3 m (10 foot) straightedge or “bump buggy”. Deviations in these areas shall not exceed 3 mm (1/8”) in 3 m (10 feet).

If two or more lanes are placed in a single pass with a full width paver, smoothness results of adjoining lanes should be evaluated separately and independently so that each lane has its own profilograph trace.

104.52 EVALUATION

Bridge Approach Smoothness

The final 1.8 m (6 feet) at a section end may be excluded from testing and evaluation only when the contractor is not responsible for the adjacent section, but the entire header-to-header section should be included in computations for price reduction or incentive assessments.

The 1.8 m (6 feet) on either side of a 100 mm (4”) expansion joint may be excluded from testing by the Project Manager, since the small averaging wheels on the profilograph may fall into the joint and possibly damage the profilograph and affect the trace. Contractors should fill these joints or cover them to allow the profilograph to run through the joint area.

A composite header, where one side is ACC and one side is PCC, is excluded from profilograph testing only when this header is at the extreme end of the project (i.e., only where one half of the header joint is existing pavement). If the composite header is constructed as a single project, no exclusions for smoothness testing should occur since both types of pavement (ACC and PCC) are under the same contract. The smoothness index should be determined independently for each surface type, but the bump specification should apply across the header.

Bridge Deck Smoothness

Profilograph tests will be conducted in each traffic lane approximately 1.0 m (3 feet) from the outside lane line of each traffic lane segment of bridge decks and bridge deck overlays.

The final 1.8 m (6 feet) at the end of a bridge and at an expansion joint are not included in testing or evaluation, but should be included in computations for incentive or price adjustment assessments. These areas will be evaluated for deviations exceeding 3 mm (1/8") in 3 m (10 feet).

Profilograph tests for bridge approach sections or overlay of bridge approach sections are run 1.0 m (3 feet) from the outside lane line of each traffic lane. These areas shall be corrected for smoothness and will not be used in the computation for incentive or price reduction of bridge decks or bridge deck overlays.

104.53 BUMP CORRECTION

Exact location of 10 mm (3/8") bumps requiring correction has proven difficult particularly on resurfacing projects. Referencing by station location, string line, and rolling straightedge often lacks the precision necessary for identification of exact bump locations. Locate bumps on the pavement surface during initial profilograph testing with spray paint or have a profilograph available during correction to locate bumps and monitor correction results.

104.60 LIQUIDATED DAMAGES & EXTENSION OF CONTRACT TIME

Liquidated Damages (*SSHC Subsection 108.08*)

The Construction Division will assess liquidated damages based on the District's recommendation.

The Construction Division will be responsible for settling liquidated damage disputes.

If project level good faith efforts fail to resolve differences, the Project Manager shall request negotiation assistance from the District Construction Engineer. In addition, factual information relative to the issue(s) shall be forwarded to the Construction Engineer.

Should combined efforts described above fail to resolve dispute(s), the issue will be considered to have reached an impasse. At this point, a meeting with all affected parties shall be scheduled with representatives from the Construction Division.

Contract Time Extensions (*SSHC Subsection 108.02*)

In SiteManager, all time extensions are change orders and the "Contract Time Allowance Extension Document" (DR Form 16) is obsolete. The value of a time extension is the liquidated damage amount times the number of days extended. The "Approved Limits" chart in Subsection 104.08 applies to time extension change orders.

A good example would be when a contractor was held up due to a delay in delivery of material and it was necessary to charge working days until the contractor provided proper documentation. After proper documentation, the contract time allowance is extended by the District for the amount of working days assessed during the delay.

It is intended to use this means to correct mischarged days rather than going back and revising the working day report. An example of this would be when a contractor

contests the working day charges shown on the working day report and he/she is considered to be correct.

The "Head to Head", "Detour" and "Earth Shouldering" time allowances are specific time allowances within the time frame of the overall contract allowance. They usually are not, but can be, affected by contract time extensions.

SSHC Subsection 108.02, Paragraph 6 says the Project Manager will grant an extension in the working day time allowance consistent with delays resulting from conditions beyond the contractor's control.

The Project Manager should be careful to keep complete and accurate records and information on any conditions or circumstances which delay the work. The Project Manager should keep good records, particularly on circumstances in connection with acts by the State and delays (to the work) caused by other contractors. If such delays are involved and the time allowance is exceeded, the contractor will surely request and be entitled to an extension in the time allowance. In the fair handling of such requests, the Construction Division review relies principally on the records kept by the Project Manager, and accurate, complete records on any such delays are of prime importance.

If the working day time allowance has been exceeded, the Project Manager should prepare a resume of the working days charged to accompany the final records. The resume should be based on a review of the working days charged, considering any requests for extensions in time made by the contractor.

104.70 ACCIDENTS

Whenever a traffic accident occurs in a construction zone, the Attorney General suggests that the Project Manager immediately video tape, photograph, and/or document the area to verify the position of signage, obstructions, traffic control devices, and other pertinent features.

Use the publication *Collecting of Accident Data* as an aid when reporting accidents.

105.00 -- MEASUREMENT AND PAYMENT

105.01 GENERAL

The Project Manager may elect to pay the plan quantity for items like pavement when the item is built to plan geometrics. Measurements are not always required when the item is constructed to plan and specification requirements.

If the item of work does not conform to the specification requirements, a new item of work must be added as extra work. Example: On guard rail, if it is necessary to leave out a post because of a drainage structure and use a double safety beam section, this section of guard rail must be paid for as extra work as it does not conform to the specification requirements for guard rail.

105.02 MEASUREMENT OF QUANTITIES AND COMPENSATION FOR ALTERED QUANTITIES

All standard items of work listed in the contract are to be measured for payment using
@ English (metric) System of measurement. A list of standard contract items and their units of measurement is available at each field headquarters and on Lotus Notes or the NDR Web Page. Inspectors or survey parties concerned with measuring and/or recording contract items will need to be informed of proper procedures to be followed.

The contractor may request that materials hauled to the project and paid for by the cubic meter (cubic yard) be measured and a mass conversion factor be used for determining the cubic meters (cubic yards) of material delivered. When the Project Manager approves this procedure, the mass of the material must be obtained on approved scales, the material must be hauled approximately the average haul to the point of delivery, and then the volume of the material must be determined. The mass of the material in kilograms (tons) divided by the volume of the material in cubic meters (cubic yards) will be the mass conversion factor. The cubic meters (cubic yards) of material used may be determined by dividing the total mass delivered by the mass conversion factor.

The Project Manager will determine the frequency for establishing mass conversion factors. The frequency will be dependent on the quantity of material delivered, on variations in the material's characteristics (moisture content, gradation, etc.), and on variations in the length of haul.

The final record for the contracted work must include all records and computations used in determining the mass conversion factors.

If provision is made that payment of any contract item is to be made as an "established quantity", payment will be made on the established quantity listed unless authorized alterations are made. Established quantities are often listed with prescribed tolerances set forth to allow for minor construction changes without requiring that final measurement be made. Authorized alterations are considered to be substantial changes in construction items which would usually be authorized by revised plans or

specifications, and may be listed in two categories. (See *SSHC Subsections 104.02, 109.01* and *109.04*.)

- The first type would be an alteration of a minor item and does not involve supplemental agreements. In this case, payment will be made at the contract unit price for the actual total.

- The second type is an alteration of a major item involving an increase or decrease of more than 25 percent of the item. This situation may involve a supplemental agreement stipulating changes in the actual quantities of the work and establishing (if necessary) a new price per unit price for such work. If there is an overrun, the original contract quantity plus 25% is paid for at the bid price. The extra quantity above 125% is paid for at the new negotiated cost. If there is an underrun, the entire quantity is paid for at the new negotiated price per unit. Payment would then be made at the new unit price for the increased orders and quantity.

105.03 CANCELLED ITEMS (MATERIALS FURNISHED BY CONTRACTOR AND NOT USED DUE TO CHANGES IN PLANS)

The Department will, if the contractor desires, take over unused material at the cost delivered to the location at which it is accepted by the Department.

It will be necessary for the District Engineer or the Project Manager to initiate a change order providing for payment for such materials. The item included in this agreement shall include the phrase, "delivered but not incorporated in the work", in order to specifically identify such materials. The unit price established for items of material furnished by the contractor and not used because of a change in plans will usually be based on the actual cost of the materials, plus 10 percent to cover overhead, handling, other costs and profit. To substantiate the unit price established, the Project Manager should obtain a copy of the receipted invoice for the material and attach it to the supplemental agreement.

Change Order/Supplemental Agreement must be created to pay this. It will also be
@ necessary for the Project Manager to include an explanation of the transaction in the Change Order/Supplemental Agreement. Complete information regarding the disposal made of the material, such as the supply base to which it is delivered or the project on which it is used, is essential. The party to whom it is delivered should prepare a DR Form 329, “Imprest Inventory”, providing for the proper transfer of the charges for the material.

Payment for such materials must be included in the final estimate as a nonparticipating contingency.

105.04 PARTIAL PAYMENT

The contractor is to be paid once a month for satisfactory progress on the basis of work completed during that month. The Project Manager prepares a contractor's estimate in the computer stating the estimated quantities for items of completed work to date. This

document is forwarded to Lincoln through the District Engineer's office for processing and payment via E-mail.

When the value of the work completed during the first half of the contractor's pay month exceeds the amount stipulated in the specifications (usually $10,000.00), a semi-monthly contractor's estimate is prepared. All partial payments are made on satisfactory work and materials only, as evidenced by complete certifications or test results as required. Defective work or material shall not be included for payment until the defect has been remedied.

105.05 FIELD MEASUREMENT AND PAYMENT

Photographs and Video Tapes - Documentation on film can save many questions and provide critical answers. Take a picture any time it may be helpful.

Field Records - General - Payment for most contract items is based on the plan quantities. Final measurements should be avoided as long as the specifications permit and the contractor does not dispute the quantities. Their construction should, however, be documented as described under "Inspection Notebooks" with the statement (if applicable) "Constructed as per plans" and substantiating data or measurements, if necessary, also entered in the record.

Field records must be properly kept to substantiate that the contractor has conformed to the requirements of the plans, specifications, and Special Provisions both as to quantity, usually involving measurements, and quality, usually involving tests, of the work or material items used on the project.

Instructions and examples of preparation of specific records may be found in this manual in *Appendix 3*.

@ **Field SiteManager Entries or SiteManager Item Documentation** - Field measurements made for pay items of work and records of placement of materials shall be entered directly in SiteManager.

@ Field and lab test results on quality of materials will be entered into SiteManager. Record and document tests using approved Material Sampling Guide and SiteManager procedures.

@ The item documentation records should indicate the stationing used, date placed or constructed, and sketches with dimensions if necessary to give clear understanding of the placement and material used. The names of the party or engineer making the measurements and dates performed must be entered in SiteManager or included with the supporting documentation. Materials used in the construction of the project for which no direct payment is made but are considered subsidiary to other pay items should also be documented in SiteManager, Materials Management Section.

@ SiteManager should contain a detailed summary of all shipments received for the project, including the kind of material, the identification number, net mass, date received, delivery point and, if possible, the point of origin. Include distribution to the proper group of the contract and information on material received but not used on the project.

The laydown inspector shall enter in SiteManager the activities required in the performance of his/her job. This would normally include such items as types of
@ equipment being used, equipment checks, tonnage checks, thickness checks, temperature checks of mixture, etc. **All entries are to be dated**. Also, we would like to bring to your attention that the inspectors are to sign the scale ticket on receipt and acceptance of the material. Base all entries on facts, not opinions.

Final computations shall be entered directly into SiteManager or other approved recording
@ and documentation methods used in conjunction with SiteManager. Operations of performing computations and checking computations shall be identified on each page of computations by operation, date, and the name or initials of the individual.

Plans, tables, and sketches provide supplementary details necessary to clarify
@ SiteManager entries for pay items. Any such plan or sketch shall be saved electronically in the project files. Supplementary plans and sketches are sometimes necessary to define the extent of a pay item sufficiently enough to remove any doubt as to its limits.

@ • A good technique is to build the sketch or table in the computer and then save it electronically.

Supplementary sketches are sometimes necessary to show measurements of irregular areas for both pavement removal and the construction of new pavement.

Computation spreadsheets should be used where detailed computations are necessary
@ to determine pay quantities. These computations are made from SiteManager, cross section, or sketch information and should be fully referenced in SiteManager. It is necessary that all computations be referenced in SiteManager or saved electronically in a project folder (Read Only Access) so that the computations can be checked for correctness of method and accuracy.

Scale Tickets - Scale tickets are used to substantiate quantities of materials which are paid for by mass. The original copies (white) should be submitted with the final records of the project to the District Final Reviewer. Preparation of scale tickets and distribution is discussed in the section pertaining to asphaltic concrete inspection (Subsection 507.12 in this manual).

105.06 CONTRACTOR'S ESTIMATES

SSHC Subsection 109.07 allows payments to the contractor if satisfactory progress is being made. These contractor's estimates will include quantities and amounts for items of work completed to the date of the estimate.

@ Progress estimates are completed in SiteManager by the Project Manager and signed electronically. It is the District Engineer’s responsibility to review and approve the estimate in a timely manner, sign it electronically, and forward it electronically to the Controller.

Upon receipt by the Controller, the estimate is processed further by the Construction and Controller Divisions before it is released for payment.

On all Federal-Aid projects, it is necessary to separate participating and nonparticipating items of work on the progress estimate form by dividing them into separate summaries for each project in a contract. Each line is properly divided by the Controller Division
@ when the item is loaded in SiteManager. This procedure is done to comply with our agreement with the Federal Highway Administration regarding procedures for current billing and current audits. Items which are added to the contract should be included in the proper group in the participating or nonparticipating summary as applicable. Items added by change order-supplemental agreement should be considered as participating unless the agreement form is marked "nonparticipating" when returned from the Lincoln Office. The District Office should be consulted for further information on any item for which there is some uncertainty regarding its status.

For contracts which include wage rates, progress estimates shall not be released by the Project Manager until the contractor and subcontractor have submitted all delinquent payrolls and Forms WH-348. These reports shall be considered delinquent when they are not in the Project Manager's hands by the seventh day after the date on which the employees are paid. Notify the contractor by letter, with a copy to the Construction Division, of any delinquent payrolls and WH-348's in advance of the estimate date. The estimate should be prepared at the regular time and forwarded immediately upon the receipt of the payrolls.

Estimate Preparation

Please remember to update Line 2 (current quantity) on the estimate for all items added by plan revision or supplemental agreement. This adjustment should be made as soon as you receive the plan revision or supplemental agreement.

The Controller Division depends on Line 2 being accurate so they can allocate sufficient funding to each project.

DISTRICT ESTIMATE SCHEDULE		
District No.	Regular Estimate Date (Only if money due contractor)	Alternate Estimate Date ($10,000 or more must be paid)
*1	1st Saturday of Month	3rd Saturday of Month
2	2nd Saturday of Month	4th Saturday of Month
*3	1st Saturday of Month	3rd Saturday of Month
4	2nd Saturday of Month	4th Saturday of Month
5	4th Saturday of Month	2nd Saturday of Month
6	3rd Saturday of Month	1st Saturday of Month
7	4th Saturday of Month	2nd Saturday of Month
8	4th Saturday of Month	2nd Saturday of Month
* Districts 1 and 3 use the 5th Saturday of the month instead of the 1st Saturday of the future month as Primary Cutoff day when there are 5 Saturdays in a month.		

Stockpiling:

SSHC Subsection 109.07, Paragraph 4. provides that estimates may also be allowed for acceptable nonperishable materials meeting the requirements of the plans and specifications and delivered in the vicinity of the project or stored in acceptable storage places. This will generally apply to aggregates, structural and reinforcing steel, metal specialty items delivered but not incorporated in the work, and other materials which cannot be used for extended periods of time because of delays beyond the contractor's control. The amount included in the estimate will be determined by the PM, but in no case shall it exceed 100-percent of the value of the materials as shown by copies of receipted invoices or costs. Partial payments shall be listed under the stockpiling category with an "800" series number.

As the material is used, the payment for this material should be reduced accordingly in the stockpile item on the estimate.

Payment for stockpiled material is "permissive", and it should not be interpreted to be a requirement in cases where the material will remain in storage a comparatively short time (less than one month). When there is a question as to the inclusion of a material for payment, the District Construction Engineer should be consulted for instructions.

SSHC Subsection 106.02 states that:

All materials are subject to and will be inspected, tested, and accepted by the Project Manager before incorporation in the work.

SSHC Subsection 1001.02 requires:

Materials which must be documented by a certificate of compliance, certified test, or test reports shall not be incorporated into the work until such certificates have been delivered to the Department and verified for compliance.

It follows from the above that material items which have not been tested and accepted, or for which appropriate certification, as defined in the Materials and Research Manual, has not been delivered to the State, should not be included on an estimate for payment. Likewise, no material item which has been stored in accordance with Paragraph 4. of Subsection 109.07 of the Specifications should be included on an estimate for payment unless the appropriate test data or certifications for compliance with the specified requirements are in the files of the Project Manager and documented in SiteManager.

@

The Project Manager shall maintain documentation of progress estimate quantities.

Types of Contractor Estimates – SiteManager has only three types of estimates:

- **Progress –** all estimates prior to the "Final Estimate."
- **Final –** generated once District has completed its review and is ready to forward the project to Lincoln for "Finaling."
- **Supplemental –** all estimates generated to change the "Final Estimate." Additional estimates are obsolete in SiteManager. However, the PM must notify the Construction Division when a project is complete – which used to be the purpose of the additional estimate. In SiteManager, the PM must send a Lotus note to "DOR-CONST-COMPLETION NOTIFICATION." The Finaling Manual explains what must be included in the "note."

Processing Estimates – Each District should direct a copy of signed estimates to the Construction Division printer (CON1) as soon as possible after affixing the electronic signature.

Each District is encouraged to sign and print estimates as often as possible. The uniform and steady arrival of estimates in Lincoln is encouraged and appreciated by both the Construction Office and the Controller Division.

Contractor's Statement of Compliance (Form WH-348) - Form WH-348 shall be submitted for each weekly payroll period by each contractor and subcontractor on all projects financed by Federal Funds. (Form WH-348 is not required on other than Federal-Aid projects.) The WH-348 form should be attached to and submitted to the

Project Manager with the contractor's payrolls and kept in the District. The Project Manager should maintain a record of WH-348s and payrolls received. The WH-348 for the last week of work shall clearly indicate that it is the final report.

The contractor and subcontractor are required to submit the payrolls with Form WH-348 weekly. Payrolls shall be considered delinquent when they are not in the Project Manager's hands by the seventh day after the date on which the employees are paid. The Project Manager shall defer the release of progress estimates until contractors comply with this rule. The Project Manager shall notify the contractor by letter of any delinquent payrolls or Forms WH-348 in advance of the estimate date.

Contractor's Statement of Materials and Labor - (Form FHWA-47). Form FHWA-47, "Statement of Materials and Labor", shall be submitted by the contractor as required and explained in Section VI, Record of Materials, Supplies and Labor, Form FHWA-1273 (Rev. 4-93). The FHWA-1273 is included in every Federal Aid project. The contractor shall submit one copy of this report to the Lincoln Construction Division. If this report has not been received when the final records are sent to the Lincoln Office, the Construction Division shall withhold release of the final estimate until the Form FHWA-47 is received.

105.07 FIELD COMPUTATIONS FOR FINAL PAYMENT

General - The quantity of each item of work on the project shall be computed and checked by the Project Manager and his/her assistants. Computations must be complete so that each step may be easily followed without completely checking the mathematics. The date and initials of persons performing computations and verifications should be shown on each sheet of the field notes, cross sections, and computations. Unless this information is shown, it will be necessary for the work to be duplicated in the District Office.

All computations will then be reviewed in the District Office to determine the correctness of the method used in computing the quantities of the various items. Sufficient checks of the mathematics should be made to determine the care and accuracy used in preparing the computations. A check should be made to determine if all necessary, supplemental and force account agreements have been executed. Considerable discretion must be exercised during the District review in order to ascertain the accuracy of final computations and yet eliminate needless rechecking.

The Construction Division will not check all projects. Only random audits will be performed.

Roadway Excavation - Final earthwork quantities may be computed by either of two methods or a combination of the two methods.

A. **Data Collector -** When the preliminary survey was entered in a Data Collector, then all survey data during and after construction can be modeled with GeoPak. Final cross sections are computed by GeoPak once the final surface shots are input in the Data Collector. Cross sections can be taken at any location by GeoPak.

B. **Planimeter Method** - After the final cross sections have been plotted and checked, the areas of excavation which are enclosed by the original and final cross sections are measured by the planimeter. In using the planimeter, for areas plotted 60 mm (5 feet) to 1 mm (1") horizontally and vertically, each area should be circumscribed twice. The reading at the end of the second circuit should be twice the reading at the end of the first circuit. The planimeter shall be set so that the reading at the end of the second circuit is in square meters (square yards) of end area. Without changing the planimeter setting, areas may also be determined for cross sections plotted vertically 60 mm (5 feet) to 1 mm (1") and horizontally 120 mm (10 feet) to 1 mm (1"). The reading at the end of the second circuit should be twice the reading at the end of the first circuit. The reading at the end of the second circuit should then be divided by 2 for the area in square meters (square yards).

Planimeters shall be checked frequently by running around 4 squares of the cross section paper. Different individuals and different cross section sheets often require different settings of the planimeter arm, and the machine should be checked when changing operators or cross section sheets. Each area should be checked by another person. In checking areas, the following shall be the allowable error:

ALLOWABLE AREA ERROR
(metric)

Areas of 3 to 38 m²		1 m²
Areas of 39 to 50 m²	not over	2 m²
Areas of 51 to 99 m²	not over	3 m²
Areas of 100 to 250 m²	not over	4 m²
Areas of 251 to 500 m²	not over	5 m²
Areas over 500 m²		1 percent

ALLOWABLE AREA ERROR
(English)

Areas of 32 to 400 ft^2		10 ft^2
Areas of 400 to 550 ft^2	not over	20 ft^2
Areas of 550 to 1075 ft^2	not over	30 ft²
Areas of 1075 to 2700 ft²	not over	40 ft²
Areas of 2700 to 5400 ft²	not over	50 ft²
Areas over 5400 ft²		1 percent

All excavation cross sections shall be inspected for closure and, if necessary, a "field check" made. Sections must close in order that the end area may be accurately determined.

If any excavation area occurs on a horizontal curve, it must be corrected for curvature. This correction will be a reduction in area size on the inside of the curve and an addition to the area size on the outside of the curve. If the entire area is a cut section, the correction may be either a subtraction or an addition to the original area size depending on the location of the center of gravity of the cross section. The formula and an example of end area curvature correction for both simple and spiral curves is shown here:

INSTRUCTIONS FOR CORRECTING EARTHWORK AREAS FOR CURVATURE

Excavation areas of cross sections on horizontal curves shall be corrected for curvature using the formula $C = \frac{Ae}{R}$ where:

A = the area of the cross section
e = the eccentricity
R = the centerline radius of the curve

The area A is the area of the section determined with a planimeter. The eccentricity is the distance between the centerline or base line of the cross section and the center of gravity of the cross section, and is a positive number when the center of gravity falls outside the centerline, and a negative number when the center of gravity falls inside the centerline. The correction is positive or negative depending upon the sign of the eccentricity.

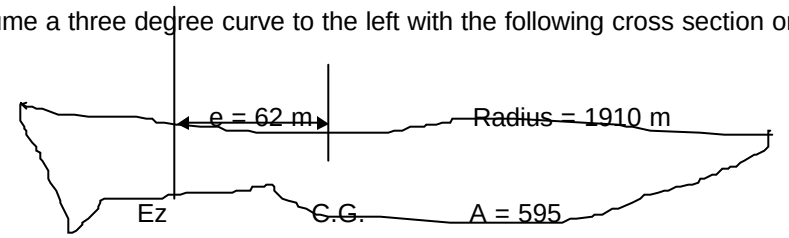
The center of gravity of the cross section in most cases can be determined by inspection. If the area and the eccentricity are large and the radius small, it may be necessary to determine the center of gravity of the section by the moment arm method, after determining the center of gravity of the smaller portions of the section by inspection.

In determining the center of gravity, it must be remembered that the center of area falls at the center of gravity only when the area is rectangular in shape.

All computations for the correction for curvature may be made with a slide rule.

EXAMPLE

Assume a three degree curve to the left with the following cross section on the curve at Station 100+00.



StaM 100+00

C = 595 + 19 = 614
F = 0

Then, $C = \frac{595 \times 62}{1910} = 19$

RADIUS COMPUTATION FOR AREAS IN SPIRAL CURVE

When the above area falls in a spiral curve, the radius must be computed for each station and plus using the formula $r = \frac{RL}{1}$ where:

r = Radius at Required Station on the Spiral
R = Radius of Main Curve
L = Length of Spiral
1 = Distance from T.S. to Required Station

If the above Station 100+00 is 150 m from the T.S. and given a 300 m spiral, then
$r = \frac{(1910)\ (300)}{150} = 3820$ m, the radius at Station 100+00.

After the excavation areas have been carefully checked, they are transferred to earthwork computation sheets (DR Form 99) and the volumes of cut areas computed. These need be computed only as far as the fifth column (Sum End Areas Corrected for Distance). The total of this column may be converted to cubic meters (square yards) by multiplying it by the factor 50 (in English units use factor 1.8518519.) Earthwork computations shall be computed to one decimal place (0.1 m^3) (0.1 cy). Sheet totals to the nearest cubic meter (cubic yard) should be summarized on DR Form 205.

Overhaul - Overhaul will be computed in the Lincoln Office using the mass diagram. When overhaul is involved, the following procedures should be followed by field personnel (See *SSHC Section 209)*:

1. Recheck balance to determine that all plan excavation has been incorporated.

2. Recheck embankment to insure that undue swelling or slope flattening has not occurred.

3. Locate additional excavation within the balance if possible.

4. Inform the District Office of the existing conditions and shortages.

5. Take embankment sub final cross sections over the entire area where embankment is deficient. Correlate this area to the project centerline.

6. Take preconstruction cross sections of the new borrow area and correlate it to the project centerline. Should the borrow originate in an adjoining balance, subfinal cross sections should be taken to complete the separation of the two balances. Upon completion of the excavation and placement in embankment, final cross sections over both areas (excavation and embankment) are necessary to measure the quantity of excavation moved and in order to compute the overhaul, if any. A diagram of the source and final deposit area with "measured distances" will be very helpful in making the final computations.

7. Transmit all notes, plotted cross sections and computations (DR Form 99), diagrams, and pertinent information to the Lincoln Office for analysis and overhaul computations.

8. The Project Manager will be advised of the quantity for payment and all notes, diagrams, computations, and pertinent information will be returned.

Foundation Course - Foundation course may be of several types. It will be noted that *SSHC Subsection 307.04* provides that Foundation Course will be measured for payment by the square meter (square yard) or Megagram (ton) as defined in the Bid Item Schedule. When Foundation Course is measured by determining the mass, it is important that the moisture content be maintained within the limits shown in the

specifications in order to avoid payment for extra water in the material. Frequent moisture tests should be made at the time of measurement.

SSHC Subsection 307.04 says moisture content at time of measurement shall be between optimum and 3 percent below optimum.

Gravel Surfacing - Gravel surfacing computations should be submitted on DR Form 264.

Since the payment the contractor receives for gravel depends on test results and computations shown on this form, it is extremely important that both the testing and the arithmetic be accurate. Placing information shall be shown in the field books.

"Truck Capacity Computations", Form DR-101, are necessary when trucks are hauling such items as gravel, sand, filler, etc. and payment is to be on a cubic meter (cubic yard) basis. This form shall be prepared promptly at the beginning of the work and submitted to the District Office. The type of material being hauled shall be noted on the form.

If trucks are transferred to another project under the inspection of the same Project Manager or inspector during the construction season, it is not necessary to remeasure the trucks or submit DR Form 101. However, always inform the District Office of the transfer.

This information should include the name of the owner and license number, capacity of the truck, original project number on which the truck was measured, and the new project number.

Prime Coat and Tack Coat - (See *SSHC Sections 504* and *517*) - Asphaltic materials for prime coat and tack coat shall be measured in liters, corrected to 15°C (60°F). If the material is delivered in tank cars, the quantity is usually determined by measuring the mass or metering at the source. If this is not done at the source, the mass of the material must be measured at the point of delivery.

When material is transported directly to the work in trucks, the mass shall be measured on scales.

If the material has been metered, the volume at 15°C (60°F) shall be determined. (Contact Materials & Tests Division for proper conversion factors.) Any material that is lost, wasted, used on private work, or transferred to other projects shall be deducted. Tank cars and trucks shall be checked to verify that they have been entirely emptied before returning to the refinery.

When asphaltic material is transferred from the project, the Project Manager shall measure the material before it leaves the project and immediately notify the Materials and Research Division that the material is being transferred. The Construction Division and the District Engineer(s) should also be notified. The notice shall be by the DR Form 193, Transfer of Asphaltic Material. If possible, it is advantageous for a copy of this report to accompany the transferred asphaltic material.

Asphaltic Concrete Surface Course and Base Course - Tickets may be furnished by the Department or by the contractor. The contractor may furnish the tickets if he/she wishes to use automatic printing equipment. If the contractor desires a copy of the scale tickets, they should be prepared in triplicate. The original should be received by the laydown inspector. The first copy is the contractor's copy, and the second copy is for the project records.

The liters of asphaltic cement shall be measured as shown in *SSHC Subsection 503.05)*. (HINT: A common final computation error is the failure to deduct asphalt cement used in wasted asphaltic concrete from the final pay quantity.)

Concrete Pavement - The number of square meters (square yards) of concrete pavement to be paid for will be the plan quantity. Widths and lengths of irregular areas built other than as shown in the plans shall be measured and recorded in a data collector and the areas computed, or computations made from staking data providing no changes occurred during the actual construction. Quite often the plans indicate the quantity (square meters) (square yards) involved in intersections, driveways, and the more complex sections of the projects. In these instances, the quantity indicated on the plans for a given area may be used as the final pay quantity, provided that no geometric changes have been made from those shown on the plans and that a rough check of the quantity shown has been made to determine if any apparent errors exist.

In determining the final quantities for concrete pavement or base course on an area basis, deductions will be made for fixtures in the roadway having an area greater than 1.0 m^2 in accordance with *SSHC Subsection 109.01, Paragraph 1.b*.

When municipal paving projects involve several items of work for which payment is made on an area or length basis, such as sidewalk, curb, curb and gutter, driveways, pavement, etc., it is suggested that complete sketches be prepared in Microstation or on cross section paper to show the actual work performed as well as the computations for the pay quantities. As a general rule, two complete sets of sketches should be prepared. One set should show the removal items and the other set should show the new work. The measurements and dimensions included with these sketches should be clearly identified as to whether they are actual field measurements or computed dimensions. The computations should always be shown on, or accompany, such sketches.

When municipal paving projects contain various radii curves at street intersections, concrete paving area measurements and computations may be based on the chord and rise method. Dimensions used for final payment will be as staked dimensions. (This assumes any difference is a contractor error.) The only exception would be if the area was constructed smaller than it was staked.

Combination curb and gutter is measured for payment by the meter (linear foot). (*SSHC Section 606*)

Removal of Existing Structures and Preparation of Existing Structures (*SSHC Section 203*)

A. **Removal of Existing Structures** - Unless the contract contains a unit bid for the removal of an old structure, the excavation necessary for such removal is paid

for by the cubic meter (cubic yard). Preconstruction cross sections shall be taken for all removals.

Pipe removal excavation limits are shown in the *SSHC* in *Figure 701.01*. Headwalls and box culverts may be removed on a unit basis and any removal excavation will be subsidiary. The volume occupied by them within the limits of the new work shall be included for payment as culvert excavation. However, deductions will be made for openings in structures, other than pipe and pipe-arch culverts, if the openings have an average cross sectional area over 2.0 m² (21.5 square feet). This means the nominal opening of the old concrete box regardless of the accumulated silt and debris. On old structures without paved floors, the PM shall measure and compute the average cross sectional area of the opening. (See *SSHC Subsection 702.04.)*

In the case of removal of old pipe and headwalls, where the headwall is removed on a unit price basis, the excavation limits for the old pipe removal will extend 500 mm (18 inches) beyond the end of the pipe the same as would be applicable if no headwalls were involved. Any necessary excavation for removing the old headwalls outside the pipe excavation limits would still be subsidiary. (See *SSHC Subsections 702.04* and *702.05*)

B. **Preparation of Existing Box Culverts** - When the contractor has the option of breaking the box culvert back 600 mm (2 feet) or drilling dowel holes to insure a structural tie, the concrete and excavation pay item quantities shall be only the volume from the vertical plane that would be necessary for the doweling procedure. When the plans stipulate or the Project Manager orders removal of 600 mm (2 feet) of the box culvert barrel then the pay quantities shall be computed from the vertical plane 600 mm (2 feet) into the existing structure.

The excavation limits are to be computed as shown in *SSHC* in *Figure 701.01*.

Excavation for Structures

A. **Excavation for Bridges** - Excavation for bridges is computed in the Bridge Division at the time the plans are prepared. Payment is a lump sum for all abutments, piers and/or bents. No further computations need be made on this item unless the station location of the bridge or the depth of the footings is changed. The Project Manager should not change the location of any bridge without first consulting with the District Engineer, and the Bridge Division.

If it is decided that a change in location is necessary, any required information should be forwarded to the Bridge Division, via the Construction Division, for use in redetermining the excavation quantity.

B. **Concrete Seal Course** - The construction of concrete seal course or removal of unsuitable material is extra work (see *SSHC Subsection 702.05)*. These amounts shall be listed in the field book. The concrete seal course quantities shall be negotiated before the contractor begins the work.

The cubic meters (cubic yards) of concrete in the seal course shall be paid for as indicated in *SSHC Subsection 704.*05.

C. **Excavation for Culverts**

1. **General** - The Project Manager should be thoroughly familiar with *SSHC Section 702*, "Excavation for Structures", before measuring or computing the contractor's culvert quantities.

   Following are listed some of the various classes of culvert excavation listed for payment in State contracts: "Excavation for Pipe Culverts and Headwalls", "Excavation for Box Culverts", "Excavation for Inlets and Junction Boxes", "Excavation for Sewers", etc. Since these are separate items in the contract, they should be kept separated in the field notebooks and computations. Include sufficient information in the field notebook so this separation may be checked during final review. If the plan data calls for removing a pipe culvert and building a box culvert at the same location, the excavation for removing the pipe culvert and headwalls would be determined as if no box culvert were to be built at the removal location. Any duplicated or overlapping excavation would be deducted from the volume of excavation for the new box culvert.

2. **Typical Channel Section** - When the plans show a typical channel section through a culvert site, the separation of grading and culvert excavation should be handled as follows:

   Slope stake the typical channel section through the culvert site.

   Take final cross sections after the channel dirt is removed.

   Do not pay for any of the excavation twice.

3. Excavation for New Structures.

   Field Measured Culvert Excavation - In general, the Project Manager shall bear in mind that:

   There shall be no duplication of excavation when headwalls are constructed.

   No additional excavation will be allowed for concrete elbows. This is a minor amount and since the kind of pipe is usually optional with the contractor, the excavation quantity will be based on the use of corrugated metal pipe.

   The contractor is entitled to payment to the excavation limits specified even though he/she may not actually remove the soil to those limits. However, in all cases, the contractor should be held to a width adequate for proper compaction of the backfill beneath the lowest 90 degrees of pipe culverts and adjacent to all pipe-arch culverts at the widest

dimension. If slope is not properly laid back, other safety precautions must be taken to protect people from a cave-in.

Following are the excavation limits to be used in computing the contractor's culvert excavation. Since these limits are fixed by the specifications, final computations may be completed at any time after taking the preconstruction cross sections.

Box Culverts - 450 mm (18 inches) outside of the neat lines of the concrete to the bottom of the box floor or footings. On box curtain walls below the bottom of the floor and the footing beneath the lower break of broken back boxes, the excavation shall be the same as the neat lines of the concrete curtain wall or footing.

Pipe Culverts - the nominal inside diameter of the pipe plus 1 meter (3 feet), and 450 mm (18 inches) beyond the end of the pipe and to the flowline of the pipe.

Pipe Arches - the maximum nominal inside clear span dimension on the arch plus 900 mm (3 feet), and 450 mm (18 inches) beyond the end of the pipe and to the flowline of the pipe.

Concrete Headwalls - 450 mm (18 inches) outside the neat lines of the concrete and to the bottom of the headwall. If it is necessary to construct compacted embankment to the flowline elevation before laying the pipe, headwall excavation shall be allowed from the flowline of the pipe to the bottom of the headwall.

Concrete Elbows, Collars, and Collars with Bend - the excavation limits for elbows and collars is the same as for pipe culverts without elbows, collars or collars with bend.

All the above limits are increased when flowline is more than 1.25 m (4 feet) below natural ground. There is an additional allowance for safe excavation. See *SSHC Specification Figure 701.01*.

Piles and Pile Driving

The Project Manager shall measure all piling to ±30 mm (0.10 foot) before they are placed in the leads by the contractor. Cutoffs shall also be measured to ±30 mm (0.10 foot).

Sheet Piling - The quantity to be paid the contractor for this item is the number of square meters (square yards) of piling remaining in the completed structure, except that no payment shall be made for lengths in excess of those ordered by the Project Manager.

For steel sheet piling, the computation width shall be the manufacturer's nominal driving width of each sheet, in accordance with *SSHC Subsection 703.04*. This has been interpreted to mean in the case of bent sections for corners, the nominal width of the

sheet before bending regardless of angle of bend. The quantity of steel sheet piling cutoff to be paid for shall be in accordance with *SSHC Subsection 703.05* and shall be verified by the inspector in the bridge book.

The computation width for concrete and timber sheet piling shall be the nominal width shown on the plans. For timber sheet piling in sloping wingwalls, the contractor shall be allowed payment for the square meters (square yards) of piling remaining in the completed wingwall, plus payment as cutoff for the square meters (square yards) cutoff to make the slope. The combined length of pile and cutoff shall not be in excess of the plan order length or revised length ordered by the Project Manager.

In order to determine the final pay quantity for these items, it is essential that the total length, the length of cutoff and the net length remaining in place be shown in the field notebook for each sheet pile. All measurements shall be ±30 mm (0.10 foot) and in the case of wing piling cutoff on the slope, the length of cutoff should be the average of the long and short sides.

The field notebook for the bridges shall include definite information as to the final quantities for all contract items even though a number of the items may have the same final quantity as listed in the contract. Final quantities shall be summarized in the field notebook. This eliminates questions on the part of the reviewer as to the correct final quantity.

Concrete Construction and Reinforcement - Pay quantities for these two items are computed from tables found on the standard plans. Plans for special structures also contain this information.

The Project Manager shall not make a deduction from the concrete quantity shown on the standard headwall plan when the pipe enters the headwall on a vertical (broken back pipe) skew.

In computations for concrete quantities for junction boxes and inlets, the deductions for pipe openings shall be computed on the basis of right angle openings even though the actual opening may be on a skew. No correction shall be made for shell thickness of concrete pipe culverts.

Culverts

A. **Concrete Pipe Culverts** - The contractor's payment for concrete pipe is based on a measurement of the actual length of pipe in place, but in no case will a length greater than order length be submitted for payment.

When elbows are required, the measurement shall be continuous through the elbow. The additional allowance for elbows is provided in *SSHC Subsection 718.04*.

When either prefabricated or field constructed elbows connect two sections of new pipe, the pay length of the elbow will be the measured length on the longitudinal axis of the pipe (average of the long and short sides), plus the allowance (depending on the diameter) listed in the specifications or as amended

by the Special Provisions. No payment is allowed for the concrete and reinforcing steel used to construct the elbow.

If the elbow, poured in place, connects old and new pipe, it will be considered as a collar with a bend and no payment will be included for the elbow as such. In lieu thereof the concrete and steel required for the elbow will be included for payment under the items of concrete and reinforcing steel for collars.

The measurement for payment of all the types of culvert pipe is based on the number of linear meters (linear feet) in place and accepted. This is interpreted to mean that culverts are to be measured after material has been cut off for skewed ends. Thus payment is not made for waste resulting from skew angle cuts on either one or both ends of a culvert.

B. **Corrugated Metal Pipe and Pipe Arch Culverts** (*SSHC Subsection 718.04*)

Corrugated Metal Pipe - The contractor's payment for corrugated metal pipe is based on a measurement along the longitudinal axis of the pipe and payment will not be made for lengths greater than order length.

When elbows are required, the measurement shall be continuous through the elbow. To the measured length of each elbow shall be added the additional allowance provided in *SSHC Subsection 718.04*. The pay length of the elbow will be based on the centerline distance.

If field connections are required for the extension of existing corrugated metal pipe, the contractor shall receive payment for the necessary connecting band. When the Project Manager makes changes in his/her original pipe order after it has been fabricated, the contractor shall receive payment for any connecting bands made necessary by such changes. (See *SSHC Subsection 718.04*)

Corrugated Metal Pipe Arches - Corrugated Metal Pipe Arches shall be measured for payment in the same manner as corrugated metal pipe culverts along the flowline of the pipe-arch. Include elbow and skewed end dimension sketches in the notebook.

Pipe Ordered But Not Used - The quantity of various pipe items is shown on the Project Manager's field checked culvert list, the testing laboratory's delivery records and in the final summary. These three records should be in agreement or any differences fully explained before submitting the final estimate.

If any pipe is delivered but not installed, due to a change in plans, this should be recorded in the notebook and the project records shall show the final disposition of the pipe. If the pipe is transferred to the maintenance department, it shall be included for payment on the final estimate under "Contingencies" nonparticipating.

For roadway pipe and driveway culvert pipe, payment shall be made to the contractor on the basis of his/her actual delivered cost to the project plus a handling charge of 10 percent. A supplemental agreement shall be executed to

establish this price which must be substantiated by a copy of the contractor's invoice attached to the agreement.

Notify the District Office or the Maintenance Superintendent who will arrange to pick up the pipe and issue a requisition crediting the project and charging the supply base. Advise the person issuing the credit requisition of the name of the contractor and unit price to be used in making the credit and charge.

C. **Culvert Pipe** - Some pipe items are "required" in the sense that the contractor must furnish definite types and sizes of pipe if stipulated in the plan and in the bidding proposal. A required pipe is one that the plan definitely states the type and size of pipe to be furnished. This may be an extension of an existing pipe so that the contractor must furnish the same type and diameter. The plans may definitely require a corrugated metal pipe - arch at some location due to low head clearance under the project road, or any type or size necessary due to some special construction feature of the project.

All other pipes are listed in the bidding proposal as "Culvert Pipe". The contractor may furnish any of the types of pipe listed in *SSHC Subsection 718.02*.

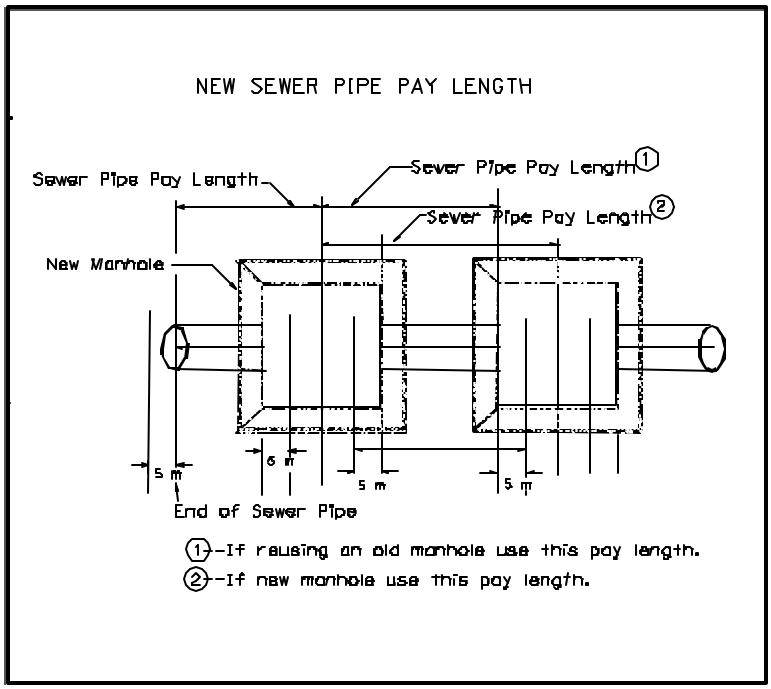
Quantities of pipe that are "required" by the plans or are "culvert pipe" shall be separated in the notebook and computations. "Required" and "culvert pipe" prices may be interchanged to some extent. For example, if the contract contains a bid price for 600 mm (2 feet) culvert pipe and it develops that an existing 600 mm (2 feet) pipe must be extended, it will be permissible to include the extension for payment under the contract item for 600 mm (2 feet) culvert pipe, provided the extension is the same type of pipe the contractor has chosen to furnish. This interchange of prices is not permissible between roadway and driveway pipe items.

Flared end sections which are called for in the plans on either concrete or metal pipe shall be furnished, installed, measured and paid for in accordance with *SSHC Section 723*.

Sewers (*SSHC Section 722*)

A. **Excavation** - Sewer excavation is subsidiary to the sewer pipe pay item.

B. **Pipe Computations** - Sewer pipe is measured for payment as described in *SSHC Subsection 722.04*.



Guardrail - The contractor shall be allowed payment for linear meters (linear feet) of guardrail complete in place measured from center to center of end posts (*SSHC Section 902)*.

Seeding and Slope Protection - Example field book records for Cover Crop Seeding, Seeding, and Slope Protection are in *Appendix 3*.

105.08 BORROW AND LOCAL PIT MATERIALS OBTAINED BY THE CONTRACTOR

Under State Option - All amounts to be paid by the contractor for royalty and borrow costs, to comply with the terms listed in the option block shown in the plans, will be deducted from the payment due on the final estimate. Such amounts will also be included in the retention in the additional estimate. This Department will make payment directly to the owner. Before such payment can be made, it will be necessary to obtain concurrence from the contractor as to the quantities and amounts in order to eliminate the possibility of overpayment to the owner. For this purpose, the Project Manager shall

prepare and forward a letter to the contractor, substantially in accordance with the example included in *Appendix 2*.

The receipt of such letters from the Project Manager and contractor, plus the required releases from the pit owners, will complete the records required by the Right of Way Division to enable them to make payment to the owners of local pits. In the case of borrow, taken on an acreage basis, sketches are to be prepared showing the dimensions of the individual pits, the name of the owner, the description of the land subdivision, ties with the project centerline and computations for the acreage included in the letter to the contractor. Such sketches shall be forwarded to the Right of Way Division together with their copy of the letter to the contractor.

When the option block in the plans for the local pit includes payment for incidental items such as temporary fencing, reseeding, crop damage, payment for haul road, etc., the consideration for such incidental items will normally be on a lump sum basis and the lump sum payment for such items shall be included in the letter to the contractor. If payment is stipulated in the option block, for such incidental items, on other than a lump sum basis, the Project Manager shall request the Right of Way Division to advise the proper method of handling the item.

When work is to be suspended for the winter season, or for any other reason, for a considerable length of time and it is desirable to make partial payment to the landowners, the necessary information to authorize partial payment shall be forwarded to the Right of Way Division and, in such cases, it is not necessary to advise the contractor. In the event that a section of the project, involving optional borrow pits, is completed or the work is completed on some of the local pits, the normal letter to the contractor should be prepared in which it shall be noted that information will be forwarded at a later date for the remaining borrow or material pits.

In order to complete the records and eliminate any questions, the Project Manager's letter to the contractor must cover all optional borrow and local pits shown in the plans, regardless of whether they are actually used.

There have been some cases where a pit under state option does not appear on the plans for a particular project but does on an adjacent project. The contractor, if he/she uses this pit, must still be responsible for royalty payments.

Royalty payments for local pit material will normally be made on a cubic meter (cubic yard) basis and such quantities may be determined by preconstruction and final cross sections. In cases where payment to the contractor is based on truck measurement the royalty payment may be based on the same measurement, or by using weight conversion factors where payment to the contractor is based on units of mass.

Borrow and Local Pit Materials Furnished by the State or County and Not Involving the Contractor - When borrow or local pit materials are purchased from the owner directly by the Department or County, and no option requirements involving the contractor are included in the plans, substantially the same information must be forwarded to the Right of Way Division. However, no letter need be written to the contractor. The PM must obtain a site release from the landowner on these Department obtained borrow sites.

105.09 SUMMARY OF FINAL QUANTITIES

Project Managers are required to use only black lead pencils in the original preparation and checking of all field records and final computations in the field offices. The District Office review should be indicated by red check marks, initials and dates. Corrections shall be made with red pencil. If any further changes or corrections are found necessary in the Lincoln Office, they will be made in blue or green pencil. This method will eliminate any question at some future date as to where changes or corrections in the records originated.

@ **Each pay item in the contract must be summarized in SiteManager or other approved documentation.**

105.10 MOBILIZATION (*SSHC Section 112*)

Method of Measurement and Basis of Payment

The percent of payment for mobilization under a group of work is based on the percent of work completed on the original contract group amount. Accordingly, when two or more projects are included in the contract and work has been performed on only one project the quantity for mobilization should be paid to all projects based on the percent of work completed on the original contract group amount. In this case mobilization may be paid on a project when no work has been performed on the project.

105.11 SALVAGED PROJECT MATERIALS REPORTING

Many project plans indicate that some removal items shall be stockpiled or salvaged to a nearby maintenance facility. To accomplish documentation of these times, a DR 147a, "Stock Returned for Credit" form has been developed.

The form shall be completely filled out any time project materials are salvaged to a maintenance facility. The form needs the signature and initials of the project inspector and the maintenance employee who received the material.

Distribute a copy of the completed form to the Project Manager, District Maintenance
@ Superintendent, Logistics Division, project file, and the contractor. Purchasing & Supply will add the salvaged items to the appropriate stock inventory for the maintenance facility that received these materials. Include a copy of the completed form in the final payment packet for the project.

106.00 -- PROJECT FINALIZATION

106.01 FINAL PAYMENT TO CONTRACTOR

NDR policy is to retain one percent. This retainage is specifically withheld to cover:

- The amount of any possible overpayments or adjustments to contract items and change orders discovered during an audit (State and/or FHWA).
- Any assessed liquidated damages.

Nebraska Code also requires payment of interest on retained contract funds. The interest shall begin to accrue on retained funds on the 61st day after the project is complete provided all of the contractor's documents are on file with the Department.

On projects involving different fundings such as Federal, Interstate, County, State and City, the Project manager must review the project funding agreement and make sure costs are properly recorded on the DR Form 44, "Summary and Distribution of Cost".

106.02 PRICE ADJUSTMENT CHANGE ORDERS

Price adjustment deductions are processed by change orders. If additional price adjustments come up later, a second change order must be prepared; but such increases or decreases are processed as separate change numbers.

106.03 EQUIPMENT PURCHASED BY CONSTRUCTION CONTRACTS

Occasionally, items of equipment are shown as contract items and then taken into the Department's inventory when their use on the project is no longer required (variable message boards, for example). It is required that the contractor be given written confirmation when such equipment is ultimately received and title transferred to the Department.

In order to provide an adequate audit trail, it is required that the letter of confirmation should include detailed information regarding brand, model, serial number, date of transfer, current location and a statement indicating the condition of the equipment when title was transferred.

A copy of the letter of confirmation should be forwarded to the Logistics Division (in addition to your normal distribution of project correspondence) so that it may initiate the appropriate paperwork reflecting addition of the equipment to the Department's inventory.

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106.04 PROJECT ACCEPTANCE AND AUTHORIZATION FOR FINAL PAYMENT

The Final Estimate when signed by the Construction Engineer is authorization to the Controller's Office to release the final payment to the contractor.

Notification of Project Completion (DR Form 91) - All Projects

The Project Manager will prepare an acceptance letter and forward it to the DCE to notify the contractor of tentative acceptance.

The DR Form 91 (Notification of Project Completion) should not be prepared and distributed until the work is really done --- such as when a 180-day observation period is required on paint. Wait until the 180 days have past, then determine if all work is acceptable, and then complete the form.

The Controller Division uses the form to trigger final payments, so they want work which the county or city promised to do included in the definition of “complete.” They explain that although the local government may have performed the work, the value of that work is included in their bookwork and subsequent notification to the FHWA.

Immediately after completion and acceptance of a contract, the DCE/DE will prepare and sign a DR Form 91.

The DR Form 91 shall be completed promptly and forwarded to the District Engineer. In essence, this means construction work is complete and the contractor does not need to come back. However, processing DR Form 91 should **NOT** be held up waiting for finalization of paperwork, including material certifications and/or "Change Orders."

- Preparing a "Notification of Project Completion" (DR Form 91) is self-explanatory. All applicable blanks are to be completed.
- The DCE/DE, after signing DR Form 91, shall forward it to the FHWA, as applicable. Distribution within NDR is shown on the form.

106.05 FINAL PACKAGE

Refer to the *Final Review Process Manual* to finalize a project and determine documents to forward to the Construction Division.

106.06 FINAL COMPUTATIONS

When submitting final computations for any project, there shall be a statement by the District Engineer to the effect that any and all trucks which hauled materials, incorporated into the work on a volume basis, have been measured, computed and checked for volume specified.

106.07 ACCEPTANCE AND FINAL PAYMENT

Final Inspection and Acceptance - The District Engineer shall make the final inspection of the project. Generally, the contractor will be required to complete all items of work included in the contract before the final inspection and total acceptance of all contract work is made. However, it is the Department's policy to make a tentative acceptance of completed groups of a contract which have a separate time allowance. This tentative acceptance relieves the contractor of maintenance responsibilities for such groups. It does not relieve the contractor of the liability for any damage to the completed work caused by his/her operations in completing the remaining groups of work, or the liability for any defective work discovered in any item of groups of work prior to final acceptance and payment.

Before advising the District Engineer that final inspection of the project is desired, the Project Manager shall make a careful inspection of the work with the contractor's superintendent. He/she shall direct the superintendent's attention to any additional work which he/she considers necessary before the final inspection is made. He/she shall also

make certain that the contractor has complied with *SSHC Subsection 105.12* regarding the contractor's use of land obtained by the Department.

After the work has been completed, the District Engineer shall within one week advise the contractor in writing that the work is tentatively accepted by the Department. **The Project Manager shall include in the acceptance letter a list of documents that are missing.**

In the event the Federal Government is participating in the work, the District Engineer shall notify the Division Administrator of the Federal Highway Administration immediately upon completion of the total contract or direct labor project agreement items on any project. This report shall give the actual date that all contract work was completed. If any direct labor work, such as a reflectorized railroad crossing signs, etc., which are a part of the detail estimate, are constructed later, the date of their completion becomes the completion date for the project.

The PM must notify the Construction Division when a project is complete. In SiteManager, the PM must send a Lotus note to “DOR-CONST-COMPLETION NOTIFICATION.” The Finaling Manual explains what must be included in the “note.”

Interest Payments on Delayed Estimates - State law provides that, "if the contractor has furnished the Department all required records and reports, the Department shall pay the contractor interest on the amount retained and on final payment due the contractor beginning the sixty first day after the work under the contract has been completed, as evidenced by the completion date established in the department's letter of tentative acceptance, and running until the date when payment is tendered to the contractor.

The contractor is allowed fourteen calendar days from the date of notice as evidenced by the date of the letter of notification to:

(1) Reply to the project manager’s written notification of optioned pit material quantities and costs involved in a project (such reply shall be directed to the Department’s Right-of-Way Division).
(2) Provide signed records or documents, such as Change Order – Supplemental Agreements, requested in writing by the Department.
(3) Provide all required records and reports, such as payrolls, material certifications, etc., requested in writing by the Department.

In the event the time interval stated above is exceeded, deductions to the interest time period will be made for the actual number of days to complete the action which occur beyond the original sixty calendar days.

It is essential that the acceptance letter include the correct completion date which shall be in agreement with the completion date as shown in the Project Manager's weekly working day and progress reports. This date will be the last day on which any work is performed on the project, and may be several days after the last working day charged. This condition will occur when minor finishing or cleanup work is required prior to tentative acceptance.

In order to eliminate or minimize interest payments and provide adequate time for processing through the various NDR Headquarters, it is essential that the final records be completed and reviewed in the District Office as soon as possible after the actual completion date. This will require that the final measurements and computations be completed to the greatest extent possible during the time that construction is in progress and will require the taking of final cross sections for grading work (only when plan quantities are disputed) as early as possible. In some Districts, the volume of grading work will undoubtedly require the organization of "floating" parties to take final cross sections, which will require adequate District planning in advance of the need for such parties.

106.08 FINAL RECORDS

Introduction - The Project Manager shall prepare and submit, at the earliest possible date, all necessary records to expedite payment to the landowners along the project for right-of-way, channel changes, borrow and local pit materials, as provided in the various contracts and options as applicable to the project. Prompt payment to landowners will create good will and help in future right-of-way negotiations. DR Form 232, "Final Status Material and Site Releases" is to be prepared and submitted with the final records for each contract.

Right-of-Way - No measurements or computations need to be submitted for right-of-way as payment will normally be made for right-of-way prior to the actual construction, in accordance with the terms of the right-of-way contract. Any requirement for additional right-of-way shall be submitted to the Right of Way Division, through the District Office, for their further handling.

Crop Damage - The acquisition of right-of-way and subsequent construction often results in crop damage claims being made by the landowner. In order that information is available to settle these claims, the following should be recorded for all growing crops within the right-of-way, borrow, local pit and channel change areas.

1. A sketch showing the boundaries of each tract within station locations, angles, and distances as necessary to locate the tract accurately with reference to project centerline and to compute the area. The tract should be identified by the owner's name and tenant (if any).
2. If the tract is subdivided with more than one type of crop, show the subdivision of tract into fields as necessary to locate the limits of each crop. Information shown should be similar to that required for the tract. Indicate the type of crop growing in each tract or subdivision.
3. Show date of measurement and the name of the person making the measurement.
4. As construction progresses, record for each tract whether the crops are harvested by their owners or are destroyed by the contractor's operations. If harvested, the date of harvest should be recorded or if this date is not known, the date that the contractor began work in the area and a notation indicating that harvesting was complete should be recorded. If the crop in an area is only partially destroyed, the damage should be noted or sketched in a manner such that the area of damage can be determined.
5. The right-of-way contracts and condemnation descriptions should be reviewed carefully with respect to the provisions pertaining to crop damage. Crops planted after contract has been signed will not be eligible for reimbursement.
6. Crop damage for each tract is to be reported by letter to the Right of Way Division with a copy to the District Engineer as soon as the disposition of the growing crops on that tract is complete. The report should contain the information listed above along with computation of the area in acres, and the legal description of the property (section or part, township and range).
7. A DR Form 44 must be submitted with the final records for each project included in a contract. See *Appendix 1* for examples of this form.
8. On projects in which the Federal government participates in the cost of the work, each project is subdivided to conform with accounting practices established by the Federal Highway Administration. These subdivisions are shown in the "detail estimate", copies which are forwarded to the Project Manager by the Contracts

Section. The costs of each group of work performed in each subdivision shall also be shown on the summary and distribution sheet, DR Form 44, Summary and Distribution of Cost, prepared for the project. If DR Form 44 has insufficient columns to accommodate all the Municipal and Rural Sections required by the Federal Highway Administration, it shall be extended to the right by securely attaching sufficient columns from another DR Form 44.

9. Accounting records require that construction costs be prorated to individual counties. Therefore, county splits must be shown on DR Form 44.

10. Many times, the District Office files do not contain copies of the Certified Analysis of Asphalt Material received on the projects and it is requested the Project Managers include their copies with final computation when transmitted to the District Review Section. When they have served their purpose they will be returned.

Alternate Crop Damage Procedure

The Right-of-Way Division is leaving the way to present the crop damage payment up to the Project Manager. If the acreage is between 1/4-acre increments, go to the higher increment. 1/4 acre will be the minimum.

If the farmers accept the affidavit price, payment will be made within a few weeks. If they do not accept the affidavit price, payment will not be made until the crop is harvested and sold.

If the Project Manager runs into a crop that is not covered or the amount is not agreeable, make the measurements of the field and forward them to the Right-of-Way Division. They will in turn send them an affidavit asking for the average yield for the rest of the field, and the price they were paid when the crop was sold, minus harvesting and marketing costs.

The sources of information used in determining the average yield, average price, and the average cost were obtained from the Cooperative Extension, Institute of Agricultural and Natural Resources, and the Farm Custom Rates, University of Nebraska.

CROP	1/4 Acre	1/2 Acre	3/4 Acre	1 Acre
Irrigated corn	$75.00	$150.00	$225.00	$300.00
Dry corn	$40.00	$ 80.00	$120.00	$160.00
Irrigated soybeans	$62.00	$124.00	$186.00	$248.00
Dry soybeans	$48.00	$ 96.00	$144.00	$192.00
Wheat	$31.00	$ 62.00	$ 93.00	$124.00
Oats	$21.00	$ 42.00	$ 63.00	$ 84.00
Milo	$32.00	$ 64.00	$ 96.00	$128.00

Alfalfa was not included because the variables of age and cuttings affect the averages greatly. Other crops (beets, edible beans, potatoes, etc.) were not included because of insufficient information.

The schedule will be revised periodically. Any questions or comments should be referred to the Property Management Section, (402) 479-4770.

Conversion of Existing Direct Measurement Earthwork Pay Items to Established Quantity Pay Items

Certain earthwork items may be converted from being direct-measured for final payment to being paid as established quantities. This policy is to expedite the release of final payment to the contractor, reduce possible interest payments to the contractor, and relieve a portion of the workload performed by field personnel.

The following items of work will be eligible for conversion:

1. Excavation

2. Excavation, Borrow

3. Other earthwork-related items when approved by the Construction Engineer

Direct-measurement items may be converted to established quantities when the following requirements are met:

1. The project has been staked and built according to plan, or the plan quantity has been adjusted to account for field changes.

2. The plan quantity has been adjusted for any obvious errors, and the contractor has been notified of the adjustment.

3. The Project Manager has made written notification to the contractor of the proposed change in the method of measurement, and the contractor has agreed to the proposal in writing.

@ 4. If the contractor has agreed in writing to accept plan quantity including field adjustments and revisions, it is not necessary to create a new “established quantity” pay item. Payment will be made under the original contract item.

Sample Letter

1997

CROP DAMAGE PAYMENT AFFIDAVIT

Project:
Tract:

This is to certify that I, the undersigned, agree on the amount of $_____ which is being paid for _____ (acres) of _____ damaged during construction, based on the schedule prepared by the State of Nebraska, Department of Roads.

_____ _____
Owner/Tenant Social Security #
Federal Identification #

THE CROP PRICES HAVE BEEN COMPILED USING DEPARTMENT OF AGRICULTURE AND UNIVERSITY OF NEBRASKA STATISTICS. THE PRICE REFLECTS AVERAGE YIELDS AND MARKET PRICES LESS THE COST OF HARVESTING AND MARKETING.

CROP	1/4 Acre	1/2 Acre	3/4 Acre	1 Acre
Irrigated corn	$75.00	$150.00	$225.00	$300.00
Dry corn	$40.00	$ 80.00	$120.00	$160.00
Irrigated soybeans	$62.00	$124.00	$186.00	$248.00
Dry soybeans	$48.00	$ 96.00	$144.00	$192.00
Wheat	$31.00	$ 62.00	$ 93.00	$124.00
Oats	$21.00	$ 42.00	$ 63.00	$ 84.00
Milo	$32.00	$ 64.00	$ 96.00	$128.00

_____ _____
Project Manager Date

106.09 STATEMENT OF MATERIALS AND LABOR

A "Statement of Materials and Labor" (Form FHWA-47) is required for federal-aid projects that have contract cost (including change order adjustments) of $1,000,000 or more. Detailed instructions for completing Form FHWA-47 are on the back of the form. Blank forms are available from the Construction Division. A blank copy is provided in *Appendix 2*.

Upon contract completion, each subcontractor must submit a completed Form FHWA-47 (Part "B") to the prime contractor. Subcontractors shall include their name and the word "sub" in the blank space at the top of the form.

The prime contractor shall combine the data from each subcontractor with their own data on one form. Prime contractors shall include their name in the top margin of the "combined" form, note the form is "combined", and attach a listing of all subcontractors involved.

When completing Part "B," contractors shall:

- Report only use of material items that are listed on the form.
- Pay attention to the "units" being requested. "Quantity" entries must correspond to the form's "units."
- Enter required information in the correct column(s).

Prime contractors are responsible to furnish the Construction Division Headquarters (Lincoln) three completed FHWA-47 "packets" before a final pay voucher can be processed. (One packet shall be the original and two packets may be photocopies of the original.) Each FHWA-47 "packet" shall include:

- The prime contractor's combined contract information
- All FHWA-47 forms and any relevant supporting documents furnished by subcontractors.
- Composite of all subcontractors listed on subcontractor request form(s)

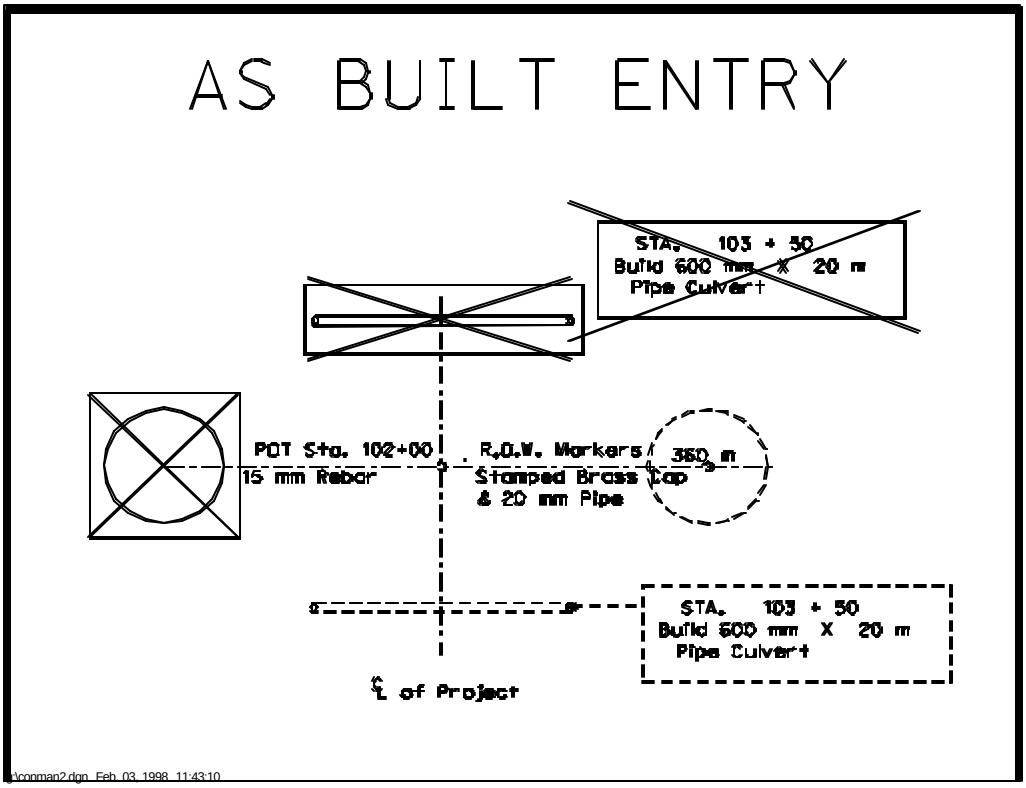
Upon receipt of FHWA-47 forms, the Construction Division shall complete Part "A" and verify that:

- An item of material used by a contractor has not been omitted.
- All "starred" line items have received a response or entry.
- Costs reported are reasonable and do not have obvious errors.
- The prime contractor has included required information from all subcontractors on the "combined" form.

106.10 AS BUILT PLANS

An extra set of full size plans will be furnished the Project Manager for use as as-built plans. The Project Manager may request an additional set of plans from the Construction Division for as-builts if needed. The as-built plans shall be an exact representation of the completed work. Any revised plan sheets must be included and the sheets they replace should be discarded. All special plan sheets must be included. The S1 sheets need to be corrected to
@ show the Final Quantities including additional items of work.

In preparation of these plans, only black pen shall be used. Lines, dimensions and notations shown in the original plans which have been eliminated or corrected shall be "X ed" (crossed out) and boxed with solid lines. Dashed lines shall be used to indicate any as-built lines, dimensions, or tie points which do not conform to the original plans. For example, a 2' x 65' 8" (600 mm x 20.0 m) pipe culvert is constructed at Station 103+50, whereas the plans called for a 2' x 63' 3 " (600 mm x 19.25 m) pipe culvert at Station 101+50. The outline of the culvert at Station 101+50 shall be boxed and the notations describing the work "X ed" within the box with solid lines. The outline of the as-built culvert, in dashed lines, and corrected description notation should be shown at Station 103+50. In striking out figures and notations, care should be used to avoid obliterating the original figures.



In the event appreciable errors are noted in the locations of side roads, section lines, property fences, buildings, roadway structures, or other important landmarks, the corrected locations shall be shown.

1

The front sheet shall bear the following label in some convenient blank space:

AS BUILT PLANS

Work performed by.....(Name of Contractor)

(If more than one contract has been let to complete the work, list all prime contractors)

Prepared by.....(Name).....(Title).....(Date)

Approved by.....(Project Manager).....(Title).....(Date)

The following information shall be shown for the various types of work:

Grading:

1. All changes in alignment.
2. All equations in stationing used during construction.

3. All permanent references for control points. Also, all control points required to establish centerline shall be perpetuated. Brass caps and pipe are available for this.

4. All changes in grade lines and elevations.

5. Locations and elevations of all benchmarks used during construction or permanently established in taking final cross sections. Permanent benchmarks should be identified by the word "Permanent". Benchmarks shall be established at box culverts, bridges and other locations where they may be considered permanent.

6. Location and number stamped on brass disc of all Government Survey benchmarks. The elevation based on the project level datum, if available.

7. Location of all right-of-way markers installed.

8. Location of all land corner witnesses, existing, or installed by the Project Manager.

9. Location of all farm entrances constructed showing lengths, diameters and type of culverts laid or relaid.

10. Locations of limits of construction of all borrow pits, channel changes, dikes, intercepting ditches, etc., outside the right-of-way not covered by extended roadway cross sections. The stationing and location of the base line with respect to the project centerline shall also be shown.

Culverts:

1. All changes in location.

2. All changes in lengths or dimensions.

3. The type of pipe installed (CMP, RCP, etc.).

Bridges and Special Culverts:

1. All changes in stationing.
2. All changes in design.
3. All revised dimensions.
4. Floor and bridge seat elevation of bridges.
5. Maximum and minimum length of piling in each footing.
6. The description, location and elevation of all permanent benchmarks.

Surfacing:

1. Beginning and ending stationing of each type and width of surfacing constructed.

2. Location of all option pits used in connection with the construction of the project. If any plan pits are not used," designate by the words "Not Used".

Processing As Built Plans

1. Project personnel will prepare one (1) full-size set of As Builts.

2. Cities, counties, etc. that have money involved or a special interest in the project will be asked by the Project Manager if they need/want a complete copy of the As Builts or only specified sheets.

3. The As Builts will be submitted to the Construction Division with the final records for finaling with notification of the number of complete copies or specified sheets desired.

4. The final review will be performed.

5. After the final review is completed, the specified sheets or complete copies, as requested by the District, will be copied in half-size sets. The copies will be returned to the District within three (3) to four (4) weeks after submittal to the Construction Division.

6. The full-size set of As Builts will be submitted to the Communication Division for microfilming after the final review is complete and the half-size copies of the As Builts are made.

7. After the As Builts have been microfilmed, the Communication Division will submit the As Builts to the Transportation Planning Division for their use.

8. Upon completion of their work, the Transportation Planning Division will periodically return the full-size As Builts to the District, via truck.

Lighting and Signals - On all roadway lighting and signal projects, a set of "as-builts" will be prepared, pertinent to the wiring alignment, showing the exact location of conduit or cable runs, pull boxes, and any other information which would be beneficial in case of maintenance problems or construction activities in the area. When "as-builts" are submitted to the agency at the time the agency is notified by letter of the acceptance of the installation and to assume the maintenance.

Clearance Letter

The Project Manager shall submit a letter to the Construction Division (with copies to Motor Carrier Permits & Facilities Maintenance) indicating clearance on bridges, sign trusses, and other structures that create a clearance limit.

106.11 OVERRUNS AND UNDERRUNS LETTER

The summary of overruns and underruns letter, which used to be submitted when a contract is finalled, is no longer required. However, a DR Form 74, Cost Overun/Underrun Notification is required whenever contract quantities overrun/underrun by $50,000.00 or more. This letter must go to the Construction Division and the Controller Division so that appropriate redistribution of funds is made as soon as possible. This letter is sent as soon as the change in contract quantities is known. The Controller Division will obtain appropriate approvals.

@ **106.12 CONTRACTOR EVALUATIONS**

The intent of the Contractor Evaluation is to report strengths and/or weaknesses of a contractor's project-related activities, including paperwork, material documentation, attitude, cooperation, and the actual contracted work. It is suggested that remarks be included to substantiate or help explain significantly high or low ratings or other unusual circumstances on the project. The Construction Division maintains a file of the completed forms, reacts to low evaluations, and seeks to improve the performance and project administration of contractors doing work for us.

The project manager should make note of significant events occurring throughout the life of the project to assist in the preparation of the evaluation when the work is complete. In so doing, perhaps problems can be discussed and resolved as they occur. At a minimum, significant problems reported on a contractor's evaluation should be discussed with him or her when the evaluation is presented.

Evaluations are used as a factor in determining the amount of work on which a contractor may bid. Therefore, it is extremely important that contractors are evaluated realistically, factually, and without bias. In this regard, it is equally important that evaluations are completed promptly. To be at all meaningful, data from the EOC's must be current - - and **ALL** of it must be in the system.

The EOC should be completed and submitted to the Construction Division within 30 days of completion of work. For subcontractors, the EOC should be submitted within 30 days of the time you are relatively certain that the subcontractor's work is complete. For a prime contractor, the EOC should be submitted within 30 days of the project completion date established in the District Engineer's letter of tentative acceptance to the contractor. (In other words, the prime contractor's EOC will always be the last EOC to be completed. The performance of all subcontractors reflects on the prime contractor's overall rating, so it is only proper that the prime contractor's overall rating, so it is only proper that the prime's EOC not be competed until the project is entirely complete.)

The Contractor Evaluation is to be completed on every contractor and subcontractor - - except "trucking" subcontracts. (Trucking subcontractors may receive an optional evaluation at the PM's discretion.) SiteManager identifies whether or not a subcontract is

@ for trucking. An evaluation should also be completed on all bridge painting jobs regardless of size.

Contractor evaluations are required for subcontractors at **any** level - - 2nd tier subcontract, for example.

Project Managers shall prepare and sign the evaluation and forward the original to the Construction Office in Lincoln. For projects inspected and managed by consultants, it is appropriate to have the evaluation signed by the local entity's project manager. (The document itself, however, must be prepared on the **RUG** so the results are posted to the database.)

A copy of the complete evaluation must also be furnished to the contractor or subcontractor being rated. Prime contractors deserve to see their ratings as well as those of their subcontractors, so make sure that both get a copy.

All contractor evaluations shall be prepared using the checklist system provided in **RUG**. The use of this system automatically enters the required data into the database.

For evaluations of subcontractors, report type of work done by that subcontractor.

Contractor evaluations are required for subcontractors at **any** level, including 2nd tier subcontractors.

The intent of an evaluation is to report strength and/or weakness of a contractor's project related activities including paperwork, material documentation, attitude, and cooperation. Special attention should be given to contractor ratings of "poor" and "unsatisfactory." Remarks should be included for any individual item(s) that is rated less than fair. Also good remarks should be included when a contractor is given a high rating or deserving recognition.

The Construction Division maintains a file of the completed form, reacts to low evaluations, and seeks to improve contractor project administration. Evaluations are also used as a factor to establish bidder qualifications. Therefore, it is very important that contractors are evaluated realistically, factually, and without bias. The rating system developed is intended to produce a rating of "good" when the minimum acceptable performance requirements are met.

A series of less than satisfactory evaluations may be grounds for disqualifying bidders from further contracts or reducing their bidding qualifications.

It is anticipated that lower than average ratings would have been discussed at a meeting between the Project Manager and contractor representatives prior to form submittal. A contractor should have an opportunity to discuss and understand why a low rating was given. Further, a contractor should be given (if requested) a critique of corrective actions which would prevent reoccurrence of low rating(s).

The RDP Form 344, Evaluation of Contractor, is available on the computer or you can use paper copies.

To provide a broader evaluation of the contractor's performance of his/her work with reference to his/her equipment, personnel and prosecution of work, RDP Form 344 "Evaluation of Contractor" has been devised. This report is to be completed by the Project Manager for the prime contractor and subcontractor(s) for each separate time allowance under a contract and submitted with the final computations.

The contract value for the prime contractor shall be the original contract value (not final value). The subcontract value used shall be that authorized by the subcontract approval letter. All subcontract approval letters will show the value of the work being subcontracted.

The working days allowed shall reflect all time extensions approved either by letter from the Construction Division during the progress of the work or by supplemental agreements. If a time extension is forthcoming due to "extra work" a correction in the field entry will be made by the Construction Division. However, extra work should be a consideration taken into account in evaluating the prosecution of the work. When this is the case, an explanation to this effect should be made on the reverse side of the form.

Intentionally left blank.

@

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106.13 LETTER OF TRANSMITTAL – FINALED PROJECTS

@ The Project Manager shall complete a letter of transmittal with project documents when they are forwarded to the District Reviewer. The District Reviewer will also create a letter of transmittal when he/she forwards the records to the Construction Division. The transmittal letter shall include an itemized list of all field notebooks, cross sections, computation sheets, forms, letters, statements, temperature charts, etc., which are being transmitted, so that the shipment can be checked to determine whether it is complete when received. When overhaul or additional haul computations were made in the Lincoln Office, attention should be directed to that fact. If there is any question regarding the accuracy of any of the computations, or there is any item which should be given special attention in the District Office, the items in question should be explained in the letter of transmittal. If the project was completed within the working day time allowance, a working day resume is not required. The transmittal letter should contain a statement indicating whether or not the work was completed within the contract time allowance and/or any internal time limits. A copy of the Project Manager's transmittal letter shall accompany the project records and final estimate when they are forwarded to the Lincoln Office.

When submitting final records, please label all computation and summary sheets with the item numbers for which documentation is being provided.

106.14 FINALING PROCEDURES

See Construction Division's Final Review Process Manual for detailed steps to finalize a project.

106.15 UNAUTHORIZED WORK

The contractor should not be permitted to perform work without line and grades established by the Project Manager.

The contractor should not be permitted to perform any work prior to the execution of the contract by the Construction Engineer. The Project Manager can request to be advised by telephone when the contract has been executed, if the contractor is "standing by" awaiting such execution to begin work.

106.16 USE OF ADJACENT LAND UNDER CONTRACT OR LEASE

We no longer require the contractor to provide a release letter. The contractor is responsible to the landowner and the Department will stay out of the agreement unless the Department acquires the access rights.

Option pits obtained by the Department will require a site release. The Project Manager shall contact the landowner and obtain the site release. The release should be obtained as soon as possible while the contractor is still on site with equipment to make corrections.

106.17 FINAL CLEANING UP

The importance of timely cleanup of cast-in-place concrete structures should be discussed at the pre-construction conference. It is the Department's policy to request the contractors to perform the necessary cleanup in flood plains at the earliest possible time to prevent scrap lumber, nails, form ties, etc., from being flushed out on adjacent landowners.

If this material is deposited on adjacent landowners, the contractor must satisfactorily gather and dispose of it before final acceptance of the work involved. It is in the contractor's and the Department's best interests to keep this cleanup work "current".

The District Engineer should be advised if the contractor refuses to perform this work in accordance with this policy and a field book entry made each time the contractor was contacted. Progress payments can be withheld until the area is cleaned.

The contractor shall make a final cleanup of the highway, borrow pits and all ground (off or on the project) occupied by him/her in connection with the work, leaving it in a neat and presentable condition.

106.18 CONSULTANT INSPECTION

In regard to projects utilizing consultant inspection services, some misunderstandings have arisen when our acceptance date preceded a date when the county board "accepted" the project.

Project Development has asked that consultants utilized for engineering and inspection services be given written notice regarding project completion dates. The consultant agreements usually specify the time allowed for the preparation and submittal of As-Built Plans and other final records, and the consultants need to be told when the clock has started. It is my understanding that the consultant agreements state *"The State will provide written notification of construction acceptance to the Consultant."* At least one consultant has reported he does not received the required notice.

Feel free to be somewhat flexible in "starting the clock", but do put it in writing --- and **send a copy of the letter to Lee Pavel in Project Development** so he may begin his end-of-project paperwork too. The consultant services agreements and payments are audited by the Department, and it is important to have the notification documented.

Protest of Final Quantities of Earthwork Items

If the contractor wants to protest any earthwork item, the contractor must notify the NDOR, in writing, of the disputed quantity, including the approximate quantity that the contractor feels is in error and the basis for the dispute.

The NDOR will review the appropriate data and determine if an error exists and notify the contractor of the decision.

Should the contractor dispute the NDOR decision, the contractor will be allowed to disprove the disputed final earthwork quantity provided the following requirements are met:

1. The work is done under the supervision of and the report is certified and stamped by a registered professional engineer licensed in the State of Nebraska.

2. The contractor furnishes the NDOR Construction Engineer with a cost estimate from the consultant for approval prior to commencement of the work.

3. The contractor furnishes the NDOR Construction Engineer with a copy of the contract with the consultant engaged to perform the work with a detailed description of the procedures and technology to be used in calculating the quantities prior to commencement of the work. The procedures and technology must be compatible with NDOR procedures and technology.

4. The report provided by the contractor to the NDOR Construction Engineer must show all calculations used to determine the quantity, list all data used in the review and its origin, identify the technology used and identify any differences between the contractor calculations and NDOR calculations.

5. If, after reviewing the report, the NDOR agrees that the final pay quantity or the aggregate correction of all items directly related (i.e.: Excavation and Excavation, Borrow) are in error by more than five percent (5%), the NDOR will compensate the contractor for the quantity in excess of the final pay quantity shown in the final records and for the contractor-incurred expenses to perform the post-construction calculations previously approved by the NDOR Construction Engineer.

   Payment will not be made for contractor-incurred expenses to perform the post-construction calculations if the contractor fails to prove that the NDOR final pay quantity is in error by more than five percent (5%).

   If the contractor's report indicates that an overpayment of more than five percent (5%) has occurred, the NDOR will pay for the contractor-incurred expenses to perform the post-construction calculations previously approved by the NDOR Construction Engineer and will make payment on the reduced quantity.

6. The issues of waste, shrinkage, compaction and settlement are not eligible for additional payment under this policy, and no allowance will be made for them.

Upon request and at no cost, the NDOR will furnish the contractor with the following information:

1. Preliminary Cross-Sections
2. Slope Stake Data
3. Blue Top Data
4. Design Cross-Sections
5. Current Revisions
6. Standard Plans
7. Design Calculations
8. Current Field Changes
9. Final Cross-Sections

The contractor's failure to fulfill any or all of the requirements stated above will be cause to deny the contractor's claim for additional compensation.

CHAPTER NOTES:

CHAPTER NOTES:

DIVISION 200

EARTHWORK

SECTION 201.00 -- EARTHWORK INSPECTION CHECKLIST

EMBANKMENTS/EXCAVATION

SSHC References:

Section 205 Excavation & Embankment
Section 1033 Aggregates

Other References:

NDR, Materials & Tests, Earthwork Engineering Guide
NDR Materials and Sampling Guide
NDR Standard Test Methods

Inspection Crew:

Grade Inspector

Inspection Equipment:
(AASHTO T 238)

Nuclear Density Gauge (With Manual)
Nuclear Density Gauge probe puller or auger.
Thermometer (Surface)
Scale (Dept. of Ag. Certified)
Metal Thickness Ruler
3 m (10 foot) straightedge
Gravel Sampling Bags

Equipment
(NDR T 205)

Spade.
Rubber Balloon (flexible membrane)
Sand.
Calibrated container with an air valve and a volume indicator.
Base plate.

Embankment/Excavation
Procedures:

General Comments:

1. The operations of excavating the roadway and borrow material (Roadway Excavation) and the placing, compacting and finishing of the excavation material in the embankments or fills (Embankment) are inspected and controlled as a single "Grading operation".
2. The value of grading may be considerable.
3. “No building is better than its foundation" and good quality embankments and subgrade are essential to the good performance and quality of the base course and pavement structure.
4. The grade inspector's work is of the utmost importance in producing a quality riding surface for the motorist.

5. The large and fast grading equipment employed by grading contractors means inspector should be on site to sample each lift.
6. The inspector should be thoroughly familiar with *SSHC Section 205 Excavation and Embankment*.
7. Check all contract documents for grading requirements.
8. The type of embankment compaction will be specified in the plans (generally on Sheet No. 3).
9. Construction notes in the plans should be noted and checked against physical features on the project. The right of way should be checked for physical features and obstructions which may not be shown in the plans. Typical items to be checked:
   a. Check the construction widths needed, and fences which must be moved, and compare them with the available right of way and contracts for additional right of way, borrow and construction easements.
   b. Utility pole lines - check against construction limits and utility agreement provisions.
   c. Survey or other type monuments or markers - mark or relocate.
   d. Selective placement notes.
   e. Trees or shrubs which are indicated in the plans to be preserved -mark as necessary.
   f. The Design file contains all of the preliminary and design information of the soils, pit sketches and contracts, preliminary soil compaction curves and soil tests.
10. Rights of adjacent property owners will be protected.
    a. Tile lines and intakes should be located, replaced, and repaired to maintain the integrity of the subsurface drainage. (Preventing unintended drainage from reaching adjacent property.)
    b. Right-of-way contracts should be checked for possible special negotiated items which should be included in the work being done.
11. Any contractor operation that causes damage to partially completed or completed work shall be reported to the Project Manager and noted in the Daily Diary.
12. Make sure the contractor installs silt fences prior to commencing soil disturbing work.

See Subsection 1300.03

Preconstruction Conf:	13.	Preconstruction Conference (See Subsection 102.01) a. The Project Manager should go over the unusual, difficult, or special items with the grading inspector, and with the contractor.
1-800-331-5666		b. Remind the Contractor to call "1 CALL - Diggers Hotline of Nebraska", for buried utilities, pipe lines, sewers, communication cables, etc. - check for possibility of such not being shown and be sure provisions are made to mark or protect as necessary to prevent damage. c. Inspection and Control of Grading Operations d. The contractor's Pre-Watering Plan should be presented and discussed. e. Discuss selective placement requirements. f. Determine what contractor will do to keep stockpiles free from contamination. g. Removal and storage of topsoil materials, shall be discussed. h. Project schedule. *(SSHC Subsection 108.07)* i. Partnering procedures. j. Traffic control. k. Archeological & palentological discoveries. l. Environmental issues(Erosion Control, Wet Lands, Migratory Bird Nesting) m. Detours and Shooflies. n. Railroad Special Provisions. o. Safety issues (Guardrail removal, etc.) p. Material submittals.
	14.	Site preparation such as clearing and grubbing, wetlands preparation, removals, and vegetation disposal on cuts, fills, and borrows are accomplished according to contract documents.
Stockpiling:	15.	If stockpiling of selective placement material is necessary, <u>no payment</u> is made for re-excavation. (Topsoil, sand, or any soil identified as select materials.)
Clearing & Grubbing: A large tree has 1 m (3 foot) circumference at 1 m (3 foot) above ground line or if only the stump remains, a stump of 1 m (3 foot) circumference at ground level.	16.	If contract has "Large Tree Removal" count and record trees before work starts.
	17.	*SSHC Subsection 204.02* limits the surface area that the contractor may disturb to 75,000 m² (90,000 square yards) plus an equal amount of clearing and grubbing area.
	18.	The Project Manager may increase these limits but only by written notice to the contractor.
	19.	The written notice should include justification

for the increase and special procedures the contractor must use to safeguard the environment.

20. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer.
21. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average project.

Soil Moisture:

22. Check the moisture content of the excavation and borrow material 1-5 days before the contractor starts work.
23. Discuss the drying or moistening of the excavated material.
24. Check to see if contractor knows the condition of the soil.
25. Verify how the contractor will control moisture in Class "III" embankments
26. Contractor should mix clay/non-granular material to uniformly distribute the moisture and various soil types before compaction.
27. Pre-Watering can be wasteful. Ponding or sprinkling may require more water and more work than wetting the soil as it is placed.
    a. But the moisture content will be more uniform and dust will be eliminated.
    b. The contractor is responsible to obtain the soil samples both before and during the water application.
    c. The Project Manager will run moisture tests to determine water application rates and to check the progress of the penetration. Use nuclear density gauge to determine the moisture content at different elevations below the surface up to depth of cut. Compare the amount of prewater to the expected amount that would be required if added at time soil is placed.
    d. The following example does not allow for water lost by evaporation, run off, etc., and will need to be supplemented by information derived from subsequent testing.
    e. As a precautionary measure against overwatering, leave some dry material for mixing with soil which was over watered. (Required water per cubic meter) (cubic yard) - (Natural in place water in the soil per cubic meter) (cubic yard) = Amount of water to add or if negative result, the amount of water to remove per cubic meter (cubic yard).
    f. Preserve the natural vegetation on the area until the watering is complete.

g. If the vegetation is removed before watering, or the soil type, slope, or condition warrants, the ground should be ripped 650 mm (2 feet) deep on its contours approximately 1.2 m (4 feet) centers to allow penetration of water and minimize runoff.
h. Adjust the application rate to control runoff and erosion.
i. Construct dikes to control runoff and erosion.
j. Document any wasted water in field book.

28. Excavation areas should be disced immediately after pre-watering to reduce evaporation.
    a. A two to three week curing period is necessary to permit the water to move downward and become uniformly distributed in the soil.
    b. The importance and length of this curing period will vary with the soil type and conditions of the soil. (Clay very important--sand not important.)

Compaction:
(See *SSHC Subsection 206.03 para 9*)

29. Compacting equipment which produces a glossy surface shall not be allowed. This may cause lamination.
30. PM should approve all haul routes over structures.
31. Know the moisture/density requirements for each section of the project.
    a. Review *SSHC Subsection 205.03* for construction methods and procedures which give moisture, density, and lift thickness requirements.
32. a. A good practice is for the contractor to spread the soil as thinly and smoothly as practicable, to distribute the hauling equipment over the embankment to minimize the rolling.
    b. Discing is required to get uniform density.
    c. Layers must be compacted before the next layer is placed.
33. Require rolling over entire area--completely to the outside edges.
34. Require that hauling and leveling equipment is routed over the full width of the embankment.
35. Visually check the subgrade and the embankment under compacting equipment.
    a. When a sheepsfoot walks out of soil you have good compaction.
    b. Peorian clays may show movement/instability and yet be at specified density. (When this occurs, additional work is necessary to stabilize the fill.)
36. a. Compare earthwork to the stakes--tell the Project Manager and the contractor if something does not look right.

b. Make sure stakes are uniform and easily read.

37. Run one-point curves for soils that do not have corresponding compaction curves.

Subsurface Concerns:

38. Insist that all objectionable material such as logs, vegetation, trash, or unsuitable soils are removed before fill is started.

39. a. Require old pavements to be removed if embankment will not be greater than 1 m (3 feet). If more than 1 m (3 feet) of embankment the pavement must be broken-up.

b. *SSHC Subsection 104.06* defines "minor obstruction" and lists examples of when the contractor should be paid extra for removal of unforeseen obstructions.

Drainage:

40. The roadbed will be adequately drained and protected at all times. (Poor drainage during construction often results in an inferior construction.)

a. The roadbed should be tight (shaped, bladed smooth, and rolled, so as to shed water) at the end of each day.

b. Flowable fill, granular fill, drain pipes, or other requirements may be necessary to permanently correct the problem.

Settlement:

41. Things to check:

a. Settlement or side slip may result in slopes or sidehills if not properly stepped or plowed.

42. Settlement may result at Grade points (0-0 sections) due to fill taper, improper or insufficient compaction and different soil type (Subsoil - topsoil - parent soil) meeting. Particular attention should be given to the compaction of the new embankment at 0-0 points. Usually blending to 1 m (3 feet) depth is required.

43. Settlement of areas adjacent to or over structures frequently occurs. Take additional density readings in these areas.

a. Proper placement and compaction of material in the areas inaccessible to rollers and the earth moving equipment will eliminate this problem.

b. This involves close contact inspection of compaction performed by small mechanical tampers, which is tiresome, manual work.

c. The inspectors' must confirm that this work is properly performed.

d. When the slope is greater than 1-vertical to 4-horizontal, step the ground to prevent wedging action against the structure.
e. Use selected soil which will compact readily, if available.
f. Silty soil should not be used.
g. During backfill operations, displacement of wing or abutment walls may be checked by erecting a "telltale" before backfilling is started and checking the wall for movement as the backfill progresses. If movement is detected, backfill operations should be suspended and the Project Manager advised of the problem.

44. Watch for and report unstable and unanticipated settlement to the Project Manager and Materials & Tests Engineer.
a. Bulging at the toe of the slope.
b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
d. Pumping action.

Foundation Engineer (479-4678)

45. Where surcharges are included in the plans as work to be accomplished during construction, the Soil Mechanics Section of the Materials and Research Division wishes to be informed before the beginning of the construction of the surcharge.
a. Construction progress and anticipated paving date may allow a change in the height of the surcharge necessary to complete the anticipated settlement.

Backfill:

46a. Confirm culvert backfill material meets specification requirements.

46b. Backfills on box and pipe culverts should be brought up evenly on both sides at the same time to avoid displacement of the structure.

47. When tamping under the lowest 90° of a culvert place elevation check stakes at the ends of the pipe to detect any rise.

48. The grade inspector should be alert to possible damage to any drainage structures which the contractor's heavy equipment may cause by crossing or working over such structures, and particularly to possible damage to pipe culverts covered with minimum fill.

a. The contractor shall be informed immediately of any observed damage and the information recorded in the field book.

Grades, Lines & Profile:

49. Large shortages or overages of excavation material may be encountered.
    a. Revising the grade lines, rebalancing, or obtaining additional material outside construction limits or balance points require prior District approval.
    b. The Project Manager should be contacted on all overage or shortage conditions.
50. The grade inspector should inspect and advise the Contractor of deviations from the lines and grades as staked by the Project Manager.
51. The inspector should note any actual construction balance points in the grading notebook.

See Survey Blue Tops

52. Finish grading
    a. The roadbed surface should be finished within 15 mm (5/8 inch) of the finish grade stakes.
    b. The shoulder lines and slopes should be <u>reasonably</u> true.
    c. Side ditches and borrow areas should be finished <u>reasonably</u> true to grade and should drain.
    d. Finish grade stakes should be set for finishing flow line grades in borrow pits if the width and grade are such that stakes are essential to finishing the pit to provide proper drainage without ponding.
    e. Finish grading must be completed on a timely basis so that erosion control measures may progress <u>satisfactorily</u>.

Covercrop Seeding:
(Agronomist Dick Gray
479-4537)

53. All finished work and any other areas that need erosion control should be kept current with covercrop seeding performed as the work progresses.

54. Any repair required on a section that has been tentatively accepted will be paid as extra work (unless considered to be the fault of the contractor). (*SSHC Subsections 105.13, 107.14* and 1*09.08* define tentative acceptance.)

Soil Tests:
(Form DR 86)

55. The inspector should require the contractor to move the field lab as necessary to facilitate the field testing.

56. The grade inspector will test soil samples for two primary purposes.
    a. To monitor the effectiveness of the contractor's operations and use of forces and equipment in controlling the moisture and the compaction of the soil. These are called "job control tests".
    b. To verify that the completed work (compacted embankment) meets the requirements for moisture (if specified) and density. These are called "acceptance tests".

    The minimum number of tests necessary to verify that the compacted embankment meets the specified requirements for moisture and density will be shown in the *Materials Sampling Guide*.

57. The number of moisture-density tests will vary but the minimum is spelled out in the *Materials Sampling Guide*. However, the inspector is encouraged to take additional tests as are necessary because with the nuclear density gauge, moisture and density are easily monitored. "Job control tests" which indicate the need for additional work to meet moisture-density requirements shall not be counted in the "acceptance tests" since a check test would be required in the area represented by the original sample.

Grading Diary:

58. Grading diary, shall include:
    a. Date, weather, soil conditions.
    b. Information on contractor's forces -include numbers of personnel, numbers, types, and sizes of equipment, hours worked each day.
    c. Data on work in progress -section of the project, balance limit, channels, dikes, rough grading or finish grading, etc. This should include a record of known construction balance points, particularly balance points between "off-site" borrow pits.
    d. Weather conditions or other conditions affecting the progress of or delaying prosecution of the work, equipment break downs, etc.
    e. Sufficient records of the progress of the work, to enable the Project Manager to prepare progress reports, working day reports and progress estimates accurately.
    f. Estimates of wasted water, and cause.
    g. Disputes.

h. Contractor's progress should be monitored to check that the work is being completed according to the construction schedule. Report major deviations.

Field Book

59. Field Book Entries

a. Any supporting information or records necessary to facilitate the preparation of the required reports on sampling and testing (see Materials and Research "Earthwork Engineering Guide").
b. Calibration of distributor water tanks and of meter accuracy if the water is metered.
c. Daily record of water hauled (on large projects the water applied may be kept in a separate "water application notebook"). Include location (i.e., station of the excavation, borrow pit, embankment or surface) where water was applied and obtained.
d. Select placement, confirming information, etc.
e. Identify all work performed on the project by the contractor and subcontractor actually completing each pay item.
f. Make entries supporting extra work quantities.
g. Get the contractor representative signature agreeing to pay quantities in the entry.

Measurement:

60. Method of Measurement

a. See CM Subsection 1300.04 for instructions to take cross sections. (Use Geopak when possible.)
b. Measure and pay authorized excavation of material below grade and overbreakage or slides.
c. Unsuitable material which is removed below grade in excavation areas, or below existing ground in embankment areas, is considered to be "authorized excavation of material below grade".
d. If the existing ground in an embankment area must be dried to such a depth as to be impractical to dry in place, the contractor may be ordered to undercut (excavate below grade) and haul this material to higher areas, drying and using it in the construction of embankment.
e. The volume of the undercut would also be considered to be authorized excavation below grade, and the volume measured and paid.
f. Larger quantity under cuts should be authorized by the District Construction Engineer and the volume should be measured by cross sections.

Tell the Contractor what is "larger" at the preconstruction conference.

61. Water, Applied
    a. Distributor truck tanks may be calibrated by determining the mass of both the empty and filled truck. The net mass (kg) (lb) is the tank capacity, in liters (gallons).
    b. Each truck tank should be numbered and the numbers and capacities recorded in the water haul notebook.
    c. Calibration of meters for the pre-watering methods may be accomplished by pumping through the meter into a water truck and checking the mass of water against the liters on the meter.
    d. Meters may be calibrated by registered pump and meter service companies and their calibrations may be used if they are current. Calibrations are good for one year.
    e. Inspector must convert meter readings in English units to S.I. units (metric).
    f. Trucks that are too large to measure their mass on available commercial scales may be calibrated from capacity if model numbers, serial numbers, etc., are the same as shown on the specifications literature.
    g. If the water is measured by tank count, the grade inspector will record each day, the number and size of loads delivered to the project by each truck.
    h. If the quantity of water is measured by a meter, the grade inspector will record the meter readings at the beginning or ending of each day or shift.
62. Calibration
    a. Water meter calibration sheets usually show a correction factor to be used to convert meter volume to actual volume for differing rates of delivery.
    b. The rate of delivery for the application can be determined by timing the meter and computing the liters (gallons) per minute being delivered.
    c. The liters (gallons) per minute delivered will vary with the length of pipe and number of sprinkler heads being used.
    d. Therefore, the delivery rate should be determined and documented for each pipe setup so the correction factor can be determined and used.

63. Wasted Water
    a. The quantities of water wasted or not eligible for payment should be entered in the records each day with substantiating or estimating information to support the quantity deducted or ineligible for payment.
    b. The contractor should be furnished the documented quantities of water wasted each day, to facilitate resolving of any discrepancies in quantities.
    c. The grade inspector is responsible for the proper determination of the quantities of water measured for payment, and each day's entry in the notebook should be validated by his/her signature and agreed to by the contractor and signed.
64. Metering is more practical and economical than a tank measurement.
    a. Encourage the contractor to provide an acceptable meter at the point of loading the trucks to measure the water for payment.
    b. If the water is being applied by the truck sprinkler method, the "Water Applied Haul Sheet" (DR Form 8) may be prepared by the truck driver, and used by the grade inspector to determine the distribution of water applied on various sections of the project, finishing, etc., and for cross-checking quantities.
    c. These sheets are to be used for this purpose only and not for payment, and should not be submitted with the final records.

Critical Construction Requirements:

1. Preconstruction Conference
2. Verify how the contractor will control moisture in Class III" embankments.
3. Visually check subgrade and embankment under compacting equipment.
4. Stability and Settlement Indications. Watch for and report to the Project Manager and Materials & Tests Engineer indications of instability.
    a. Bulging at the toe of the slope.
    b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
    c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
    d. Pumping action.
5. The roadbed will be adequately drained and protected at all times. Roadbed should be bladed smooth and rolled tight at the end of each day.

6. All contract pay items will be properly documented.

Safety Areas:

1. Maintained Traffic
   a. Contractor's cars and trucks must adhere to project traffic control procedures.
   b. Flaggers must be certified and use proper procedures.
2. The contractor should be told to stop all unsafe activities such as:
   a. Speeding trucks and other equipment.
   b. Inoperable back-up alarms.
   c. Inoperable or nonfunctional strobe lights.
3. Contractor vehicles shall be parked beyond the lateral obstacle clearance.
4. Worker protection barriers should be placed as shown in the plans.
5. Traffic markings should clearly indicate traffic flow.

NDR Tests:

1. Nuclear Density NDR T 238
2. NDR T 99 Soil Density (See Earthwork)
3. Soil Type NDR T 87
4. NDR T 2 Sampling Aggregate from Stockpiles
5. Moisture: NDR T 217, T 205, or Nuclear Density Gauge AASHTO T 238/ASTM D 2922.

Sampling Requirement/ Freq.:

1. See Materials Sampling Guide

Inspector's Records & Forms

1. Grading diary
2. Water application notebook
3. Field book
4. DR Form 8, Water Applied Haul Sheet
5. DR Form 86, Weekly Report of Moisture-Density Tests or Nuclear Density Machine Output

NDR Point of Contact

1. Materials & Tests Soil Mechanics Engineer 479-4678

202.00 GENERAL GRADING INSTRUCTIONS

Grading Inspection

A grading inspector should devote the majority of his/her time to observing and checking the contractor's excavating, drying, moistening, spreading and compacting operations, and securing samples, vary the balance of his/her time in testing samples and making neat and accurate records. The grade inspector will need to check moisture (if control is required) and density at the rate shown in the Materials Sampling Guide (usually check moisture and
@ density once for each 2,500 cubic yards (2000 m^3) placed and once for each 1000 feet (300 m) of shoulder or subgrade).

Blue Tops

After the roadway excavation and roadway embankment has been constructed substantially to grade elevations, the construction survey party will set finish grade stakes for finishing the grade or subgrade to the lines and grades shown in the plans. The blue top book elevations must be checked to insure they conform to the information shown on the plan cross-sections.

Rounding of Hinge Points

The Department has determined that the rounding of “hinge points” in the cross-sectional elements can significantly reduce their potential as hazards. Rounded slopes reduce the chances of an errant vehicle becoming airborne, reduce the hazards of encroachment, and afford drivers more control over their vehicles.

The Construction Division suggests that finish grading and ground preparation activities that result in the rounding of hinge points be permitted, if not encouraged. For example, an 8’ disc that “hangs over” a 6’ shoulder will provide the desired effect and should not be ruled unacceptable. However, this suggestion is not meant to imply that the cuts and embankments may be built to other than the cross-sections shown in the plans.

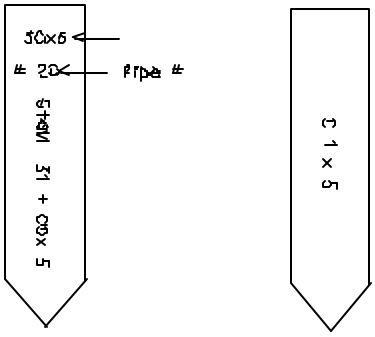
Erosion Control

@

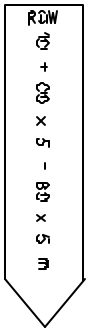
The contractor must have as a minimum silt fence or other erosion control measures as shown in the plans installed to keep silt on our ROW before any grading is allowed.

CULVERT STAKES

Offset



ROW STAKES



Green-yellow flag for easements

Orange flag ROW

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203.00 CLEARING AND GRUBBING *(SSHC Section 202)*

203.01 CONSTRUCTION METHODS

There may be considerable elapsed time between an estimate of clearing and grubbing and the actual work. If actual site conditions are different than those shown in the contract documents, the following suggested resolutions are provided:

- If the pay item is "General Clearing and Grubbing" then no action is necessary
@ because tree removal is subsidiary for trees with circumference of 80 inches or less at 40 inches above ground level.

- If the pay item is "Large Tree Removal" then a new tree count should be taken and recorded before the contractor starts work.

@ - If a tree has been cut, leaving branches and the stump, payment is covered under "Clearing and Grubbing" or "Large Tree Removal." If the stumps is the only item remaining and payment method is large tree removal, you would count just the stump as a tree.

- If a fence is partially removed or in poor condition but requires an identifiable removal operation, full price for fence removal may be made.

@ - Where brush and/or junk has recently (After the letting was announced) been deposited within the right-of-way, a price agreeable to both the contractor and the Project Manager may be negotiated or a force account extra work order may be used.

Disposal of Waste

Disposal of the clearing and grubbing waste is restricted according to applicable federal, state, and local laws. Disposal options include:

- Open Burning

@ Contractor must obtain necessary permits. In locations where burning is allowed, the burning of the waste must be located at least 1/4 mile (400 m) from any inhabited building.

- Chipping

  Chipping of the down timber for mulching material.

- Firewood

  Salvage of the logs for firewood.

- Landfill

  Disposal at a "yard waste" landfill.

204.00 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

204.01 CONSTRUCTION METHODS

Removal and Disposal of Old Pavement

@ Pavement is removed from all cuts and fills with less than 3 feet (1 m) of cover. The removed concrete is to be broken into pieces with an area of 2 square feet (0.2 m²) or less if placed in fills. *(SSHC Section 203)*

@ Where existing PCC pavement would be located more than 3 feet (1 m) under the proposed profile grade, the PCC pavement will be required to be broken into surface areas that will not exceed 4 square feet (0.4 m²) when left in place. If the existing pavement has been resurfaced, the asphalt resurfacing will be removed if the PCC pavement is to be used as slope protection or in a waterway. *(SSHC Subsection 205.03)*

Disposal of Asphaltic Concrete Pavement

The contractor shall manage the material in accordance with all current federal and state rules and regulations. *(SSHC Subsection 107.01)*

@ Salvaged asphaltic cement concrete pavement may be used as special backfill material. When intended for special backfill material, the ACC pavement is normally removed by scarification. Removed bituminous materials may be placed in the outer slopes of embankments, 12 inches (300 mm) below the finished shoulders and foreslopes. *(See SSHC Subsection 205.03)*

Hazardous Material (Wells, Asbestos Fibers in ACC, Building Removal, Underground Storage Tanks, Archeological Remains)

Appropriate federal, state and local regulations must be followed. (See *Construction Manual Division 1100* for further guidance).

205.00 EXCAVATION *(SSHC Section 205)*

205.01 DESCRIPTION

The importance of being able to identify soil types cannot be overemphasized. Some soil types have to be placed in the proper location. The inspector must be sure that the work is performed according to the plans.

The balance factor is the change in quantity from cut to fill and includes subsidence, change from borrow density to the final compacted density, incidental loss, and all other factors changing density.

205.02 MATERIAL REQUIREMENTS

Embankment and Excavation Soils Criteria *(SSHC Section 206)*

There are four basic categories of earthwork.

- Excavation
  - ♦ Usually final cross sections determine pay quantity.
  - ♦ No off-site borrow is required.
- Excavation (Established Quantity)
  - ♦ Payment is based on the plan quantities.
  - ♦ No off-site borrow is required.
- Excavation Borrow
  - ♦ Usually final cross sections determine pay quantities.
  - ♦ Borrow will be needed from off-site source(s).
- Earthwork-Measured-in-Embankment *(SSHC Subsections 205.04/205.05)*
  - ♦ Plan quantities of the proposed embankment are used to determine the payment quantity.
  - ♦ Contractor must forecast shrinkage. (A change from borrow density to compacted density.)
  - ♦ Borrow from off-site sources.

"Excavation" and "Excavation Borrow" are paid based on final cross sections. The Project Manager may forego the final cross sections when the contractor agrees, in writing, that the plan quantities, including field adjustments and revisions, accurately reflect the work done. Payment will be made under the original contract items. It is not necessary to eliminate the original contract item and establish a new “E. Q.” item. Refer to Page 129.

@

The Project Manager and the contractor may elect to measure areas in question and accept the remaining areas as "Established Quantities."

Unsuitably Wet Material

In low-lying areas and in wet soil contact zones, it may be necessary to declare most of the material as unsuitably wet at the direction of the Project Manager. A granular material that will drain can be used to replace the wet soil. An effort should be made to provide an outlet for water which may occur in the embankment or subgrade. Most wet soils that are removed can be dried and reused in some other area.

Soft shale, in some cases, can be moved in a manner similar to soil excavation. Shale cuts are usually benched and covered with topsoil in accordance with the plans. If unexpected shale is found, contact the Materials and Research Soil Mechanics Engineer. Slides can occur in backslopes of shale cuts, and flatter slopes may be required.

Rock Material (See *SSHC Subsection 107.08 and Section 206*)

If material to be excavated is too tough to be ripped, the Project Manager, contractor and a geotechnical specialist experienced in blasting should discuss the aspects of the work to be done.

Contractor Furnished Borrow Areas *(SSHC Subsection 205.03)*

On some projects, the contract documents will require a "contractor borrow." In these cases, the contractor is responsible for submitting a site approval request to the Construction Division (allow 60 calendar days for the Construction Division to obtain site approval from Nebraska agencies).

Construction Engineer
Nebraska Department of Roads
1500 Highway 2
P.O. Box 94759
Lincoln, Nebraska 68509-4759
Fax No. (402) 479-4854

The approval request shall include:

- A Borrow Pit/Materials Pit Identification and Evaluation Form for each site.
- An aerial photo or topographical map showing the location of the pit site (one photo or map for each site).

No material will be removed from the site prior to the Project Manager's written approval of the sites.

The contractor shall also obtain a Corps of Engineers approval letter for the site and submit this to the Project Manager. The contractor shall submit a topographical map or a photocopy of an ASCS aerial photograph showing the exact location of the proposed pit sites to the Corps of Engineers. A legal description of the location should also be included.

Corps of Engineers
Regulatory Branch
P.O. Box 5
Omaha, NE 68101-0005

ASCS aerial photos are available at county ASCS offices at a nominal cost. ASCS aerial photos cover agricultural ground only. In some instances, aerial photos or urban areas are not available from the ASCS.

Topographic maps may be obtained from the following source:

University of Nebraska
Conservation & Survey Division
113 Nebraska Hall
Lincoln, NE 68588-0517
Attn: Judy Otteman
(402) 472-7523

Approval For Soil Type (Contractor furnished borrow)

- The Contractor will obtain soil samples to verify material is acceptable. The Project Manager will forward the samples to the Materials & Tests Office for evaluation. (See *SSHC Subsection 205.02.*)

Preservation of Cultural Resources *(SSHC Subsections 205.03 and 107.10)*

Cultural resources are the composite of archaeological and historic/architectural resources in an area. A common cultural resource site is a burial ground or remains of a Native American village.

Nebraska law requires action be taken to insure that cultural resources are not damaged or destroyed.

If a cultural site is discovered during construction, the contractor is required to temporarily discontinue work at the site. Upon discovering such a site, the Project Manager shall notify the Construction Office of the finding.

Nebraska Game and Parks Commission Approval of Borrow Sites

- All Contractor borrow sites must be submitted to the Nebraska Game and Parks Commission (NGPC) for approval. The NGPC will examine the proposed site for endangered plant and wildlife species and for potential Platte River drainage system depletion. This process can take 60 days or more.

Borrow Pit/Materials Pit Identification and Evaluation

Date:	
Project No.:	Control No.:
Project Location:	County(s):
Requesting Contractor:	Phone:

Pit Size and Location

1. Pit Identification No.: _____
2. Identify the precise location of the pit *(to 2.5 acres)*:

   ____ ¼, of ____ ¼, of ____ ¼, of ____ ¼, of Section ____ , T- ____ -N, R- ____ - ____

3. Attach a copy of an ASCS aerial photo and/or a copy of an USGS 1:24,000 scale topographic map precisely depicting the pit location.
4. Give pit dimensions *(in feet)* and orientation *(NE-SW, etc.)* for long axis *(length)*, short axis *(width)* and depth.

   Length: Feet: _____ Orientation: _____
   Width: Feet: _____ Orientation: _____
   Depth: Feet: _____

5. This is a: ☐ Dry Pit ☐ Wet Pit
6. Will this pit pond water when completed? ☐ Yes ☐ No
7. Pit location is owned by: ☐ Private Owner ☐ Commercial/Business ☐ State/County/City Government ☐ Federal Government
8. Name of Owner: _____

Pit Characteristics

1. Pit location is for: ☐ Borrow ☐ Material ☐ Both ☐ Other *(Explain)*
2. To your knowledge, has this pit location been used previously for borrow and/or materials? ☐ Yes ☐ No ☐ Unknown
3. The pit location is presently used for: ☐ Commercial Borrow/Materials ☐ Pasture ☐ Row-Crop Agriculture ☐ Stock Pond ☐ Irrigation Recharge Pit ☐ Urban/Suburban Residential ☐ Stockpiled Borrow/Material ☐ Other *(Explain)*
4. Vegetation cover is: ☐ Grass ☐ Trees ☐ Weeds ☐ Crops ☐ Other *(Explain)*
5. Name, address, phone number of contact person, if additional information is required:

Contractors requesting use of borrow or materials pits for Nebraska Department of Roads' construction projects need to identify their location and character on this form. Please fill in the blanks with the correct information or select appropriate answers to questions. ***Send the completed form to the Construction Division, Nebraska Department of Roads, PO Box 94759, Lincoln NE 68509-4759 or FAX to (402) 479-4854.***

Approval Block – For State Use Only	
Nebraska State Historical Society	**Nebraska Game and Parks Commission**
Date received from the contractor: _____	Date received from the contractor: _____
Date submitted to NSHS: _____	Date submitted to NGPC: _____
Return due date: _____	Return due date: _____
Approval date: _____	Approval date: _____
Non-approval date: _____	Non-approval date: _____
Signature: _____	Signature: _____

DR Form 119, Feb 01/

Figure 204.01

205.03 EQUIPMENT *(SSHC Subsection 206.03, Paragraph 9.a.)*

- Equipment should be sufficient to meet compaction requirements and the type of equipment used should be recorded in the field book.

Overweight Axle Loads *(SSHC Subsection 105.11)*

All oversize hauling units delivering equipment or materials to the project shall be legal loads and/or have appropriate hauling permits issued by the Motor Carrier Permit Office. The State Patrol Carrier Enforcement Division has enforcement authority outside of the project limits and on those portions of the construction project maintained to through traffic.

Hauling On or Over Surfaced Roads

The contractor must protect from damage all public roads that will be used by the contractor. Usually berms (greater than 300 mm (12 inches) thick) are constructed over the road surface for the earth moving equipment to use.

Certified flaggers are required when the berm is on an active road.

The berm must be removed from the road and shoulders at the end of each day when the road is active and the surface area cleaned.

The berm must be maintained constantly by the contractor. This will allow safe traffic flow over the berm.

205.04 CONSTRUCTION METHODS

Embankment Construction *(SSHC Section 205)*

The construction of embankments is covered in *SSHC Section 205*. This Subsection provides a more detailed picture of certain procedures mentioned in the *Specifications*. These comments should be regarded as explanatory but in no way supersede or invalidate Specification requirements.

Site Preparation

All trees, shrubs, cornstalks, sod, and other vegetation are to be removed and disposed of according to *SSHC Section 202*. After cornstalks and tall grass are cut and removed, the area within the limits of construction is to be thoroughly disced and scarified.

Deposition of Embankment Material *(SSHC Subsection 205.03)*

On projects where a slope is being widened, "benching" will be required.

Hauling units should be directed over a fill so that uniform compaction will result.

The self-propelled tamping type roller may be used on the embankment area for leveling as long as the unit follows the prescribed rolling pattern, does not spin the power drums, and accomplishes both rolling and leveling to the satisfaction of the Project Manager.

Decisions and unusual situations should be recorded in the field book.

Compaction

Embankments shall be compacted as prescribed in *SSHC Subsection 206.03*.

Class I embankments are to be rolled when specified by special provisions or plans; no moisture-density tests required.

Class II embankments require rolling; no moisture-density tests required.

Class III embankments require moisture-density control. The moisture content of soils being handled for these embankments is very important because the objective is to stabilize soils and improve their engineering behavior by compaction. Maintaining a soil to near "optimum moisture" during grading operations will reduce the time and compaction effort necessary to obtain the required density.

Note:
- Class I and II embankments require only enough moisture in the soil to attain a compaction acceptable to the Project Manager.
- Class I - no moisture requirement by *Specifications*.
- Class II - drying only required if necessary to obtain compaction.

Moisture control; water acts as a lubricant and helps the soil particles move relative to each other into a denser condition when compaction effort is applied. Dry soils must have water added and be thoroughly mixed before compacting. A general guide would be to add water to silt-clay soils when lab or field tests indicate moisture content is five percent or more below the optimum.

When wet and dry soils are placed in the same lift, they should be disc blended to a uniform condition prior to compaction.

Soft Ground; embankments that cross low wet areas may require an initial stabilization layer which is granular material. Usually the Project Manager will permit a working platform, up to 1.0 m (3 feet) thick, to be placed in one lift when bridging a soft area. Sand, gravel, or well graded crushed rock may be used for this initial lift. Compaction should proceed with caution. In general, the use of vibratory rollers should be discouraged since the vibrations may cause underlying soil to pump into the granular fill. In some areas, capillary action will move moisture into the upper grade by equipment moving on it. Contact Materials & Tests when you encounter this situation and it is not covered in the Plans.

◆ HELPFUL HINTS

Sand embankment directly deposited by dredge pipe will obtain about 95% of NDR T 99 proctor density by the transporting water flowing through the fill. For this method of placing sand, other methods of compaction may be required. Testing should be done at regular intervals and recorded in the field book. The time for this test is just after the free water leaves the top 200 mm (8 inches) of fill and can be done very quickly with a nuclear density gauge.

Sand lifts should be placed the full width of the embankment. If this cannot be done, a sand trench drain should be placed to eliminate ponding water.

If soils are too wet, compactive effort increases the pore water pressure and holds the particles apart. The upper limits on moisture has been set above optimum and recommendations are based on the type of surfacing or embankment designed. (Requirements are shown on the plans and/or in design files).

Wet soils can become elastic and result in heaving or pumping of the embankment when loads are applied. This is caused by water pore pressure and the strength of the soil is substantially reduced. If the embankment has not been damaged, equipment should stay off of the area long enough to allow excess pore pressures to dissipate naturally. If loading were to continue on wet soil, it may have shear failure or rutting. The Project Manager should explain to the contractor that continued operations can only worsen the situation and require removal. Take a moisture measurement to show the contractor that the soils moisture content is rising and to document that the contractor is damaging the soil.

The contractor should be encouraged to route hauling equipment as evenly as possible over the entire surface area of the embankment during soil placement. This will reduce possible rutting or damage caused by heavy equipment following one path.

The nuclear gauge for moisture and density determination may be used. Only properly trained and qualified nuclear gauge operators can use a nuclear gauge.

Nuclear gauges are to be operated according to NDR T 238, AASHTO T 238 and ASTM D 2922. Test results are distributed according to the instructions on the test form. This form may be used without field book entries.

Use the nuclear gauges printout as the official project record.

Moisture Density Curves

When a grading inspector is not sure which moisture density curve to use, he/she should review the available soils information at the location in question. If it is determined that there is not a moisture density curve to represent the soil in question, then a 1-point moisture density curve may be run in the field according to NDR T 505. Only use the 1-point curve method until Materials & Tests can determine the complete curve data for the soil.

During compaction, the mold shall rest on a firm surface such as concrete box culverts, bridges, and pavements.

Construction of Embankment Toe Berms

If the plans require a berm, it should be constructed at the same time as the embankment.

Toe berms are built in areas where the roadway is used as a dam for a pond. In these areas the berm is used to protect the embankment from saturation by the standing water. Also to help construct fills on unstable ground. Proper compaction and soil types are needed to reduce permeability of the fill.

Construction of Bridge Approach Fills

Toe stakes should be set and the slopes and the centerline checked during the construction of the embankment. The slopes should be finished to the lines and grade called for in the plans.

In the construction of these berms, particular attention should be given to prevent the incorporation of rocks over 100 mm (4 inches) in diameter as the lifts are placed. Rocks cause extreme difficulty when driving piling or preboring for piling.

The removal of boulders greater than 1 m (3 feet) in diameter in bridge berms should be covered as "extra work".

Bridge approach fills should be constructed to grade with adequate length along the centerline for the bridge contractor to work. This length should be adequate for the bridge contractor's storage of material. Usually 30 to 45 m (100 to 150 feet) are adequate. This can be shortened by mutual agreement between the contractors.

On some projects settlement plates are required along with delay periods for abutment construction. The settlement plate readings are sent to Materials & Tests for comparison with the design settlement predictions. In cases where the settlement differential is minimal (near the end of the delay period), the delay period may be reduced with Materials & Tests approval.

Earthwork-Measured-in-Embankment

Payment for embankment in place will be based on the plan quantity.

Sections of deep fills may have the quantities adjusted, based on settlement plates. These settlement plates should be well protected to insure that they are not damaged or destroyed.

A graph may be plotted with fill height vs. settlement to determine settlement at intermediate heights of fill. Using this chart, the settlement below the original ground line can be determined and plotted. The volume between the plotted settlement line and original ground can then be calculated using the average end cross section method. This volume is added to the plan quantity for final payment.

Prewatering Plan

The contractor shall present a prewatering plan at the pre-construction conference when prewatering is required. The plan should be approved by the Project Manager.

Payment for Water for Embankment Construction

When water is required for compaction of embankments other than Class III, it should be paid for as extra work if no contract item has been provided.

When water is required for moisture and density control, the cost of adding and incorporating water is a part of the item.

Finishing

Finish grading must be completed on a timely basis so that erosion control measures may progress satisfactorily. Special provisions on many projects limit the surface area that the contractor may disturb. Generally, this area is 75,000 m² (90,000 square yards), excluding areas to be paved, plus an equal amount of clearing and grubbing area may be opened up. The Project Manager may increase these limits but only by written notice to the contractor. If used, this written notice should include justification for the increase and special procedures the contractor must use to safeguard the environment. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average two-lane, full grading project. Any repair required on sections that have been tentatively accepted will be considered extra work (unless considered to be the fault of the contractor) and if performed by the contractor they are entitled to additional pay as provided for in *SSHC Subsection 109.05*. Therefore, final cross sections may be taken on a section of grading after it is tentatively accepted per *SSHC Subsection 105.13*.

If the finishing work is not performed on a timely schedule, the Project Manager is advised to follow these progressive steps:

- Project Manager should notify the contractor of the concerns in writing.
- If this does not obtain results, suspend estimate payments.

Tentative Acceptance

Areas that have been final graded may be accepted by the Department. However, do <u>not</u> accept an area until silt fence, cover crop, erosion checks, and other erosion control measures are in-place. Do not tentatively accept areas where the contractor must operate equipment to do other requirements. For example, shoulders and foreslopes should not be accepted until pavement and shoulders are finished. Ditch bottoms are a questionable area for tentative acceptance. Often, the Contractor plans to use material in the roadside ditch bottom to build the shoulder. In these cases, do not tentatively accept the ditch bottom until the shoulder work is also complete.

206.00 TOPSOIL *(SSHC Section 207)*

206.01 CONSTRUCTION METHODS

Stripping, Salvaging, and Spreading

The areas of stripping, salvaging, and spreading of topsoil should be identified on the plans or Special Provisions.

Topsoil on Roadway Cuts and Embankments

Where sand pockets are encountered on backslopes and where sand is used for embankment, every effort is made by Roadway Design to place topsoil on these areas. Where these situations are missed, every effort should be made by the Project Manager to obtain topsoil for use as cover for the sand areas. If no topsoil is available, see plans for proper erosion control.

206.02 BASIS OF PAYMENT

- As topsoil is removed and stockpiled, the contractor may be paid at one half the item unit price on the progress estimate. At the time the topsoil is spread and finish graded, the remaining one half may be paid on a progress estimate.

- Topsoil quantity is based on the area where the topsoil is placed. The excavation volume is not adjusted when the project has topsoil as a pay item.

207.00 OVERHAUL

SSHC Section 209 outlines the method used to determine the quantity for overhaul.

CHAPTER NOTES:

DIVISION 200

EARTHWORK

SECTION 201.00 -- EARTHWORK INSPECTION CHECKLIST

EMBANKMENTS/EXCAVATION

SSHC References:

Section 205 Excavation & Embankment
Section 1033 Aggregates

Other References:

NDR, Materials & Tests, Earthwork Engineering Guide
NDR Materials and Sampling Guide
NDR Standard Test Methods

Inspection Crew:

Grade Inspector

Inspection Equipment:
(AASHTO T 238)

Nuclear Density Gauge (With Manual)
Nuclear Density Gauge probe puller or auger.
Thermometer (Surface)
Scale (Dept. of Ag. Certified)
Metal Thickness Ruler
3 m (10 foot) straightedge
Gravel Sampling Bags

Equipment
(NDR T 205)

Spade.
Rubber Balloon (flexible membrane)
Sand.
Calibrated container with an air valve and a volume indicator.
Base plate.

Embankment/Excavation
Procedures:

General Comments:

1. The operations of excavating the roadway and borrow material (Roadway Excavation) and the placing, compacting and finishing of the excavation material in the embankments or fills (Embankment) are inspected and controlled as a single "Grading operation".
2. The value of grading may be considerable.
3. “No building is better than its foundation" and good quality embankments and subgrade are essential to the good performance and quality of the base course and pavement structure.
4. The grade inspector's work is of the utmost importance in producing a quality riding surface for the motorist.

5. The large and fast grading equipment employed by grading contractors means inspector should be on site to sample each lift.
6. The inspector should be thoroughly familiar with *SSHC Section 205 Excavation and Embankment*.
7. Check all contract documents for grading requirements.
8. The type of embankment compaction will be specified in the plans (generally on Sheet No. 3).
9. Construction notes in the plans should be noted and checked against physical features on the project. The right of way should be checked for physical features and obstructions which may not be shown in the plans. Typical items to be checked:
   a. Check the construction widths needed, and fences which must be moved, and compare them with the available right of way and contracts for additional right of way, borrow and construction easements.
   b. Utility pole lines - check against construction limits and utility agreement provisions.
   c. Survey or other type monuments or markers - mark or relocate.
   d. Selective placement notes.
   e. Trees or shrubs which are indicated in the plans to be preserved -mark as necessary.
   f. The Design file contains all of the preliminary and design information of the soils, pit sketches and contracts, preliminary soil compaction curves and soil tests.
10. Rights of adjacent property owners will be protected.
    a. Tile lines and intakes should be located, replaced, and repaired to maintain the integrity of the subsurface drainage. (Preventing unintended drainage from reaching adjacent property.)
    b. Right-of-way contracts should be checked for possible special negotiated items which should be included in the work being done.
11. Any contractor operation that causes damage to partially completed or completed work shall be reported to the Project Manager and noted in the Daily Diary.
12. Make sure the contractor installs silt fences prior to commencing soil disturbing work.

See Subsection 1300.03

Preconstruction Conf:	13.	Preconstruction Conference (See Subsection 102.01) a. The Project Manager should go over the unusual, difficult, or special items with the grading inspector, and with the contractor.
1-800-331-5666		b. Remind the Contractor to call "1 CALL - Diggers Hotline of Nebraska", for buried utilities, pipe lines, sewers, communication cables, etc. - check for possibility of such not being shown and be sure provisions are made to mark or protect as necessary to prevent damage. c. Inspection and Control of Grading Operations d. The contractor's Pre-Watering Plan should be presented and discussed. e. Discuss selective placement requirements. f. Determine what contractor will do to keep stockpiles free from contamination. g. Removal and storage of topsoil materials, shall be discussed. h. Project schedule. *(SSHC Subsection 108.07)* i. Partnering procedures. j. Traffic control. k. Archeological & palentological discoveries. l. Environmental issues(Erosion Control, Wet Lands, Migratory Bird Nesting) m. Detours and Shooflies. n. Railroad Special Provisions. o. Safety issues (Guardrail removal, etc.) p. Material submittals.
	14.	Site preparation such as clearing and grubbing, wetlands preparation, removals, and vegetation disposal on cuts, fills, and borrows are accomplished according to contract documents.
Stockpiling:	15.	If stockpiling of selective placement material is necessary, <u>no payment</u> is made for re-excavation. (Topsoil, sand, or any soil identified as select materials.)
Clearing & Grubbing: A large tree has 1 m (3 foot) circumference at 1 m (3 foot) above ground line or if only the stump remains, a stump of 1 m (3 foot) circumference at ground level.	16.	If contract has "Large Tree Removal" count and record trees before work starts.
	17.	*SSHC Subsection 204.02* limits the surface area that the contractor may disturb to 75,000 m² (90,000 square yards) plus an equal amount of clearing and grubbing area.
	18.	The Project Manager may increase these limits but only by written notice to the contractor.
	19.	The written notice should include justification

for the increase and special procedures the contractor must use to safeguard the environment.

20. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer.
21. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average project.

Soil Moisture:

22. Check the moisture content of the excavation and borrow material 1-5 days before the contractor starts work.
23. Discuss the drying or moistening of the excavated material.
24. Check to see if contractor knows the condition of the soil.
25. Verify how the contractor will control moisture in Class "III" embankments
26. Contractor should mix clay/non-granular material to uniformly distribute the moisture and various soil types before compaction.
27. Pre-Watering can be wasteful. Ponding or sprinkling may require more water and more work than wetting the soil as it is placed.
    a. But the moisture content will be more uniform and dust will be eliminated.
    b. The contractor is responsible to obtain the soil samples both before and during the water application.
    c. The Project Manager will run moisture tests to determine water application rates and to check the progress of the penetration. Use nuclear density gauge to determine the moisture content at different elevations below the surface up to depth of cut. Compare the amount of prewater to the expected amount that would be required if added at time soil is placed.
    d. The following example does not allow for water lost by evaporation, run off, etc., and will need to be supplemented by information derived from subsequent testing.
    e. As a precautionary measure against overwatering, leave some dry material for mixing with soil which was over watered. (Required water per cubic meter) (cubic yard) - (Natural in place water in the soil per cubic meter) (cubic yard) = Amount of water to add or if negative result, the amount of water to remove per cubic meter (cubic yard).
    f. Preserve the natural vegetation on the area until the watering is complete.

g. If the vegetation is removed before watering, or the soil type, slope, or condition warrants, the ground should be ripped 650 mm (2 feet) deep on its contours approximately 1.2 m (4 feet) centers to allow penetration of water and minimize runoff.
h. Adjust the application rate to control runoff and erosion.
i. Construct dikes to control runoff and erosion.
j. Document any wasted water in field book.

28. Excavation areas should be disced immediately after pre-watering to reduce evaporation.
    a. A two to three week curing period is necessary to permit the water to move downward and become uniformly distributed in the soil.
    b. The importance and length of this curing period will vary with the soil type and conditions of the soil. (Clay very important--sand not important.)

Compaction:
(See *SSHC Subsection 206.03 para 9*)

29. Compacting equipment which produces a glossy surface shall not be allowed. This may cause lamination.
30. PM should approve all haul routes over structures.
31. Know the moisture/density requirements for each section of the project.
    a. Review *SSHC Subsection 205.03* for construction methods and procedures which give moisture, density, and lift thickness requirements.
32. a. A good practice is for the contractor to spread the soil as thinly and smoothly as practicable, to distribute the hauling equipment over the embankment to minimize the rolling.
    b. Discing is required to get uniform density.
    c. Layers must be compacted before the next layer is placed.
33. Require rolling over entire area--completely to the outside edges.
34. Require that hauling and leveling equipment is routed over the full width of the embankment.
35. Visually check the subgrade and the embankment under compacting equipment.
    a. When a sheepsfoot walks out of soil you have good compaction.
    b. Peorian clays may show movement/instability and yet be at specified density. (When this occurs, additional work is necessary to stabilize the fill.)
36. a. Compare earthwork to the stakes--tell the Project Manager and the contractor if something does not look right.

b. Make sure stakes are uniform and easily read.

37. Run one-point curves for soils that do not have corresponding compaction curves.

Subsurface Concerns:

38. Insist that all objectionable material such as logs, vegetation, trash, or unsuitable soils are removed before fill is started.

39. a. Require old pavements to be removed if embankment will not be greater than 1 m (3 feet). If more than 1 m (3 feet) of embankment the pavement must be broken-up.

b. *SSHC Subsection 104.06* defines "minor obstruction" and lists examples of when the contractor should be paid extra for removal of unforeseen obstructions.

Drainage:

40. The roadbed will be adequately drained and protected at all times. (Poor drainage during construction often results in an inferior construction.)

a. The roadbed should be tight (shaped, bladed smooth, and rolled, so as to shed water) at the end of each day.

b. Flowable fill, granular fill, drain pipes, or other requirements may be necessary to permanently correct the problem.

Settlement:

41. Things to check:

a. Settlement or side slip may result in slopes or sidehills if not properly stepped or plowed.

42. Settlement may result at Grade points (0-0 sections) due to fill taper, improper or insufficient compaction and different soil type (Subsoil - topsoil - parent soil) meeting. Particular attention should be given to the compaction of the new embankment at 0-0 points. Usually blending to 1 m (3 feet) depth is required.

43. Settlement of areas adjacent to or over structures frequently occurs. Take additional density readings in these areas.

a. Proper placement and compaction of material in the areas inaccessible to rollers and the earth moving equipment will eliminate this problem.

b. This involves close contact inspection of compaction performed by small mechanical tampers, which is tiresome, manual work.

c. The inspectors' must confirm that this work is properly performed.

d. When the slope is greater than 1-vertical to 4-horizontal, step the ground to prevent wedging action against the structure.
e. Use selected soil which will compact readily, if available.
f. Silty soil should not be used.
g. During backfill operations, displacement of wing or abutment walls may be checked by erecting a "telltale" before backfilling is started and checking the wall for movement as the backfill progresses. If movement is detected, backfill operations should be suspended and the Project Manager advised of the problem.

44. Watch for and report unstable and unanticipated settlement to the Project Manager and Materials & Tests Engineer.
a. Bulging at the toe of the slope.
b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
d. Pumping action.

Foundation Engineer (479-4678)

45. Where surcharges are included in the plans as work to be accomplished during construction, the Soil Mechanics Section of the Materials and Research Division wishes to be informed before the beginning of the construction of the surcharge.
a. Construction progress and anticipated paving date may allow a change in the height of the surcharge necessary to complete the anticipated settlement.

Backfill:

46a. Confirm culvert backfill material meets specification requirements.

46b. Backfills on box and pipe culverts should be brought up evenly on both sides at the same time to avoid displacement of the structure.

47. When tamping under the lowest 90° of a culvert place elevation check stakes at the ends of the pipe to detect any rise.

48. The grade inspector should be alert to possible damage to any drainage structures which the contractor's heavy equipment may cause by crossing or working over such structures, and particularly to possible damage to pipe culverts covered with minimum fill.

a. The contractor shall be informed immediately of any observed damage and the information recorded in the field book.

Grades, Lines & Profile:

49. Large shortages or overages of excavation material may be encountered.
    a. Revising the grade lines, rebalancing, or obtaining additional material outside construction limits or balance points require prior District approval.
    b. The Project Manager should be contacted on all overage or shortage conditions.
50. The grade inspector should inspect and advise the Contractor of deviations from the lines and grades as staked by the Project Manager.
51. The inspector should note any actual construction balance points in the grading notebook.

See Survey Blue Tops

52. Finish grading
    a. The roadbed surface should be finished within 15 mm (5/8 inch) of the finish grade stakes.
    b. The shoulder lines and slopes should be <u>reasonably</u> true.
    c. Side ditches and borrow areas should be finished <u>reasonably</u> true to grade and should drain.
    d. Finish grade stakes should be set for finishing flow line grades in borrow pits if the width and grade are such that stakes are essential to finishing the pit to provide proper drainage without ponding.
    e. Finish grading must be completed on a timely basis so that erosion control measures may progress <u>satisfactorily</u>.

Covercrop Seeding:
(Agronomist Dick Gray
479-4537)

53. All finished work and any other areas that need erosion control should be kept current with covercrop seeding performed as the work progresses.

54. Any repair required on a section that has been tentatively accepted will be paid as extra work (unless considered to be the fault of the contractor). (*SSHC Subsections 105.13, 107.14* and 1*09.08* define tentative acceptance.)

Soil Tests:
(Form DR 86)

55. The inspector should require the contractor to move the field lab as necessary to facilitate the field testing.

56. The grade inspector will test soil samples for two primary purposes.
    a. To monitor the effectiveness of the contractor's operations and use of forces and equipment in controlling the moisture and the compaction of the soil. These are called "job control tests".
    b. To verify that the completed work (compacted embankment) meets the requirements for moisture (if specified) and density. These are called "acceptance tests".

    The minimum number of tests necessary to verify that the compacted embankment meets the specified requirements for moisture and density will be shown in the *Materials Sampling Guide*.

57. The number of moisture-density tests will vary but the minimum is spelled out in the *Materials Sampling Guide*. However, the inspector is encouraged to take additional tests as are necessary because with the nuclear density gauge, moisture and density are easily monitored. "Job control tests" which indicate the need for additional work to meet moisture-density requirements shall not be counted in the "acceptance tests" since a check test would be required in the area represented by the original sample.

Grading Diary:

58. Grading diary, shall include:
    a. Date, weather, soil conditions.
    b. Information on contractor's forces -include numbers of personnel, numbers, types, and sizes of equipment, hours worked each day.
    c. Data on work in progress -section of the project, balance limit, channels, dikes, rough grading or finish grading, etc. This should include a record of known construction balance points, particularly balance points between "off-site" borrow pits.
    d. Weather conditions or other conditions affecting the progress of or delaying prosecution of the work, equipment break downs, etc.
    e. Sufficient records of the progress of the work, to enable the Project Manager to prepare progress reports, working day reports and progress estimates accurately.
    f. Estimates of wasted water, and cause.
    g. Disputes.

h. Contractor's progress should be monitored to check that the work is being completed according to the construction schedule. Report major deviations.

Field Book

59. Field Book Entries

a. Any supporting information or records necessary to facilitate the preparation of the required reports on sampling and testing (see Materials and Research "Earthwork Engineering Guide").
b. Calibration of distributor water tanks and of meter accuracy if the water is metered.
c. Daily record of water hauled (on large projects the water applied may be kept in a separate "water application notebook"). Include location (i.e., station of the excavation, borrow pit, embankment or surface) where water was applied and obtained.
d. Select placement, confirming information, etc.
e. Identify all work performed on the project by the contractor and subcontractor actually completing each pay item.
f. Make entries supporting extra work quantities.
g. Get the contractor representative signature agreeing to pay quantities in the entry.

Measurement:

60. Method of Measurement

a. See CM Subsection 1300.04 for instructions to take cross sections. (Use Geopak when possible.)
b. Measure and pay authorized excavation of material below grade and overbreakage or slides.
c. Unsuitable material which is removed below grade in excavation areas, or below existing ground in embankment areas, is considered to be "authorized excavation of material below grade".
d. If the existing ground in an embankment area must be dried to such a depth as to be impractical to dry in place, the contractor may be ordered to undercut (excavate below grade) and haul this material to higher areas, drying and using it in the construction of embankment.
e. The volume of the undercut would also be considered to be authorized excavation below grade, and the volume measured and paid.
f. Larger quantity under cuts should be authorized by the District Construction Engineer and the volume should be measured by cross sections.

Tell the Contractor what is "larger" at the preconstruction conference.

61. Water, Applied
    a. Distributor truck tanks may be calibrated by determining the mass of both the empty and filled truck. The net mass (kg) (lb) is the tank capacity, in liters (gallons).
    b. Each truck tank should be numbered and the numbers and capacities recorded in the water haul notebook.
    c. Calibration of meters for the pre-watering methods may be accomplished by pumping through the meter into a water truck and checking the mass of water against the liters on the meter.
    d. Meters may be calibrated by registered pump and meter service companies and their calibrations may be used if they are current. Calibrations are good for one year.
    e. Inspector must convert meter readings in English units to S.I. units (metric).
    f. Trucks that are too large to measure their mass on available commercial scales may be calibrated from capacity if model numbers, serial numbers, etc., are the same as shown on the specifications literature.
    g. If the water is measured by tank count, the grade inspector will record each day, the number and size of loads delivered to the project by each truck.
    h. If the quantity of water is measured by a meter, the grade inspector will record the meter readings at the beginning or ending of each day or shift.
62. Calibration
    a. Water meter calibration sheets usually show a correction factor to be used to convert meter volume to actual volume for differing rates of delivery.
    b. The rate of delivery for the application can be determined by timing the meter and computing the liters (gallons) per minute being delivered.
    c. The liters (gallons) per minute delivered will vary with the length of pipe and number of sprinkler heads being used.
    d. Therefore, the delivery rate should be determined and documented for each pipe setup so the correction factor can be determined and used.

63. Wasted Water
    a. The quantities of water wasted or not eligible for payment should be entered in the records each day with substantiating or estimating information to support the quantity deducted or ineligible for payment.
    b. The contractor should be furnished the documented quantities of water wasted each day, to facilitate resolving of any discrepancies in quantities.
    c. The grade inspector is responsible for the proper determination of the quantities of water measured for payment, and each day's entry in the notebook should be validated by his/her signature and agreed to by the contractor and signed.
64. Metering is more practical and economical than a tank measurement.
    a. Encourage the contractor to provide an acceptable meter at the point of loading the trucks to measure the water for payment.
    b. If the water is being applied by the truck sprinkler method, the "Water Applied Haul Sheet" (DR Form 8) may be prepared by the truck driver, and used by the grade inspector to determine the distribution of water applied on various sections of the project, finishing, etc., and for cross-checking quantities.
    c. These sheets are to be used for this purpose only and not for payment, and should not be submitted with the final records.

Critical Construction Requirements:

1. Preconstruction Conference
2. Verify how the contractor will control moisture in Class III" embankments.
3. Visually check subgrade and embankment under compacting equipment.
4. Stability and Settlement Indications. Watch for and report to the Project Manager and Materials & Tests Engineer indications of instability.
    a. Bulging at the toe of the slope.
    b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
    c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
    d. Pumping action.
5. The roadbed will be adequately drained and protected at all times. Roadbed should be bladed smooth and rolled tight at the end of each day.

6. All contract pay items will be properly documented.

Safety Areas:

1. Maintained Traffic
   a. Contractor's cars and trucks must adhere to project traffic control procedures.
   b. Flaggers must be certified and use proper procedures.
2. The contractor should be told to stop all unsafe activities such as:
   a. Speeding trucks and other equipment.
   b. Inoperable back-up alarms.
   c. Inoperable or nonfunctional strobe lights.
3. Contractor vehicles shall be parked beyond the lateral obstacle clearance.
4. Worker protection barriers should be placed as shown in the plans.
5. Traffic markings should clearly indicate traffic flow.

NDR Tests:

1. Nuclear Density NDR T 238
2. NDR T 99 Soil Density (See Earthwork)
3. Soil Type NDR T 87
4. NDR T 2 Sampling Aggregate from Stockpiles
5. Moisture: NDR T 217, T 205, or Nuclear Density Gauge AASHTO T 238/ASTM D 2922.

Sampling Requirement/ Freq.:

1. See Materials Sampling Guide

Inspector's Records & Forms

1. Grading diary
2. Water application notebook
3. Field book
4. DR Form 8, Water Applied Haul Sheet
5. DR Form 86, Weekly Report of Moisture-Density Tests or Nuclear Density Machine Output

NDR Point of Contact

1. Materials & Tests Soil Mechanics Engineer 479-4678

202.00 GENERAL GRADING INSTRUCTIONS

Grading Inspection

A grading inspector should devote the majority of his/her time to observing and checking the contractor's excavating, drying, moistening, spreading and compacting operations, and securing samples, vary the balance of his/her time in testing samples and making neat and accurate records. The grade inspector will need to check moisture (if control is required) and density at the rate shown in the Materials Sampling Guide (usually check moisture and
@ density once for each 2,500 cubic yards (2000 m^3) placed and once for each 1000 feet (300 m) of shoulder or subgrade).

Blue Tops

After the roadway excavation and roadway embankment has been constructed substantially to grade elevations, the construction survey party will set finish grade stakes for finishing the grade or subgrade to the lines and grades shown in the plans. The blue top book elevations must be checked to insure they conform to the information shown on the plan cross-sections.

Rounding of Hinge Points

The Department has determined that the rounding of “hinge points” in the cross-sectional elements can significantly reduce their potential as hazards. Rounded slopes reduce the chances of an errant vehicle becoming airborne, reduce the hazards of encroachment, and afford drivers more control over their vehicles.

The Construction Division suggests that finish grading and ground preparation activities that result in the rounding of hinge points be permitted, if not encouraged. For example, an 8’ disc that “hangs over” a 6’ shoulder will provide the desired effect and should not be ruled unacceptable. However, this suggestion is not meant to imply that the cuts and embankments may be built to other than the cross-sections shown in the plans.

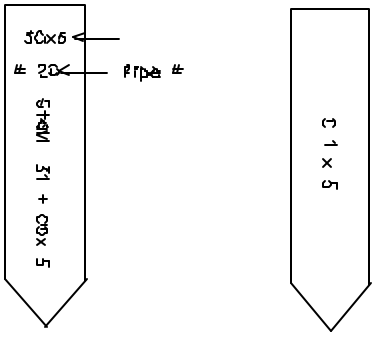
Erosion Control

@

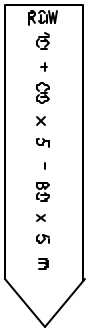
The contractor must have as a minimum silt fence or other erosion control measures as shown in the plans installed to keep silt on our ROW before any grading is allowed.

CULVERT STAKES

Offset



ROW STAKES



Green-yellow flag for easements

Orange flag ROW

c:\users\default\bolts.dgn Jan. 28, 1998 15:41:31

203.00 CLEARING AND GRUBBING *(SSHC Section 202)*

203.01 CONSTRUCTION METHODS

There may be considerable elapsed time between an estimate of clearing and grubbing and the actual work. If actual site conditions are different than those shown in the contract documents, the following suggested resolutions are provided:

- If the pay item is "General Clearing and Grubbing" then no action is necessary
@ because tree removal is subsidiary for trees with circumference of 80 inches or less at 40 inches above ground level.

- If the pay item is "Large Tree Removal" then a new tree count should be taken and recorded before the contractor starts work.

@ - If a tree has been cut, leaving branches and the stump, payment is covered under "Clearing and Grubbing" or "Large Tree Removal." If the stumps is the only item remaining and payment method is large tree removal, you would count just the stump as a tree.

- If a fence is partially removed or in poor condition but requires an identifiable removal operation, full price for fence removal may be made.

@ - Where brush and/or junk has recently (After the letting was announced) been deposited within the right-of-way, a price agreeable to both the contractor and the Project Manager may be negotiated or a force account extra work order may be used.

Disposal of Waste

Disposal of the clearing and grubbing waste is restricted according to applicable federal, state, and local laws. Disposal options include:

- Open Burning

@ Contractor must obtain necessary permits. In locations where burning is allowed, the burning of the waste must be located at least 1/4 mile (400 m) from any inhabited building.

- Chipping

  Chipping of the down timber for mulching material.

- Firewood

  Salvage of the logs for firewood.

- Landfill

  Disposal at a "yard waste" landfill.

204.00 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

204.01 CONSTRUCTION METHODS

Removal and Disposal of Old Pavement

@ Pavement is removed from all cuts and fills with less than 3 feet (1 m) of cover. The removed concrete is to be broken into pieces with an area of 2 square feet (0.2 m²) or less if placed in fills. *(SSHC Section 203)*

@ Where existing PCC pavement would be located more than 3 feet (1 m) under the proposed profile grade, the PCC pavement will be required to be broken into surface areas that will not exceed 4 square feet (0.4 m²) when left in place. If the existing pavement has been resurfaced, the asphalt resurfacing will be removed if the PCC pavement is to be used as slope protection or in a waterway. *(SSHC Subsection 205.03)*

Disposal of Asphaltic Concrete Pavement

The contractor shall manage the material in accordance with all current federal and state rules and regulations. *(SSHC Subsection 107.01)*

@ Salvaged asphaltic cement concrete pavement may be used as special backfill material. When intended for special backfill material, the ACC pavement is normally removed by scarification. Removed bituminous materials may be placed in the outer slopes of embankments, 12 inches (300 mm) below the finished shoulders and foreslopes. *(See SSHC Subsection 205.03)*

Hazardous Material (Wells, Asbestos Fibers in ACC, Building Removal, Underground Storage Tanks, Archeological Remains)

Appropriate federal, state and local regulations must be followed. (See *Construction Manual Division 1100* for further guidance).

205.00 EXCAVATION *(SSHC Section 205)*

205.01 DESCRIPTION

The importance of being able to identify soil types cannot be overemphasized. Some soil types have to be placed in the proper location. The inspector must be sure that the work is performed according to the plans.

The balance factor is the change in quantity from cut to fill and includes subsidence, change from borrow density to the final compacted density, incidental loss, and all other factors changing density.

205.02 MATERIAL REQUIREMENTS

Embankment and Excavation Soils Criteria *(SSHC Section 206)*

There are four basic categories of earthwork.

- Excavation
  - ♦ Usually final cross sections determine pay quantity.
  - ♦ No off-site borrow is required.
- Excavation (Established Quantity)
  - ♦ Payment is based on the plan quantities.
  - ♦ No off-site borrow is required.
- Excavation Borrow
  - ♦ Usually final cross sections determine pay quantities.
  - ♦ Borrow will be needed from off-site source(s).
- Earthwork-Measured-in-Embankment *(SSHC Subsections 205.04/205.05)*
  - ♦ Plan quantities of the proposed embankment are used to determine the payment quantity.
  - ♦ Contractor must forecast shrinkage. (A change from borrow density to compacted density.)
  - ♦ Borrow from off-site sources.

"Excavation" and "Excavation Borrow" are paid based on final cross sections. The Project Manager may forego the final cross sections when the contractor agrees, in writing, that the plan quantities, including field adjustments and revisions, accurately reflect the work done. Payment will be made under the original contract items. It is not necessary to eliminate the original contract item and establish a new “E. Q.” item. Refer to Page 129.

@

The Project Manager and the contractor may elect to measure areas in question and accept the remaining areas as "Established Quantities."

Unsuitably Wet Material

In low-lying areas and in wet soil contact zones, it may be necessary to declare most of the material as unsuitably wet at the direction of the Project Manager. A granular material that will drain can be used to replace the wet soil. An effort should be made to provide an outlet for water which may occur in the embankment or subgrade. Most wet soils that are removed can be dried and reused in some other area.

Soft shale, in some cases, can be moved in a manner similar to soil excavation. Shale cuts are usually benched and covered with topsoil in accordance with the plans. If unexpected shale is found, contact the Materials and Research Soil Mechanics Engineer. Slides can occur in backslopes of shale cuts, and flatter slopes may be required.

Rock Material (See *SSHC Subsection 107.08 and Section 206*)

If material to be excavated is too tough to be ripped, the Project Manager, contractor and a geotechnical specialist experienced in blasting should discuss the aspects of the work to be done.

Contractor Furnished Borrow Areas *(SSHC Subsection 205.03)*

On some projects, the contract documents will require a "contractor borrow." In these cases, the contractor is responsible for submitting a site approval request to the Construction Division (allow 60 calendar days for the Construction Division to obtain site approval from Nebraska agencies).

Construction Engineer
Nebraska Department of Roads
1500 Highway 2
P.O. Box 94759
Lincoln, Nebraska 68509-4759
Fax No. (402) 479-4854

The approval request shall include:

- A Borrow Pit/Materials Pit Identification and Evaluation Form for each site.
- An aerial photo or topographical map showing the location of the pit site (one photo or map for each site).

No material will be removed from the site prior to the Project Manager's written approval of the sites.

The contractor shall also obtain a Corps of Engineers approval letter for the site and submit this to the Project Manager. The contractor shall submit a topographical map or a photocopy of an ASCS aerial photograph showing the exact location of the proposed pit sites to the Corps of Engineers. A legal description of the location should also be included.

Corps of Engineers
Regulatory Branch
P.O. Box 5
Omaha, NE 68101-0005

ASCS aerial photos are available at county ASCS offices at a nominal cost. ASCS aerial photos cover agricultural ground only. In some instances, aerial photos or urban areas are not available from the ASCS.

Topographic maps may be obtained from the following source:

University of Nebraska
Conservation & Survey Division
113 Nebraska Hall
Lincoln, NE 68588-0517
Attn: Judy Otteman
(402) 472-7523

Approval For Soil Type (Contractor furnished borrow)

- The Contractor will obtain soil samples to verify material is acceptable. The Project Manager will forward the samples to the Materials & Tests Office for evaluation. (See *SSHC Subsection 205.02.*)

Preservation of Cultural Resources *(SSHC Subsections 205.03 and 107.10)*

Cultural resources are the composite of archaeological and historic/architectural resources in an area. A common cultural resource site is a burial ground or remains of a Native American village.

Nebraska law requires action be taken to insure that cultural resources are not damaged or destroyed.

If a cultural site is discovered during construction, the contractor is required to temporarily discontinue work at the site. Upon discovering such a site, the Project Manager shall notify the Construction Office of the finding.

Nebraska Game and Parks Commission Approval of Borrow Sites

- All Contractor borrow sites must be submitted to the Nebraska Game and Parks Commission (NGPC) for approval. The NGPC will examine the proposed site for endangered plant and wildlife species and for potential Platte River drainage system depletion. This process can take 60 days or more.

Borrow Pit/Materials Pit Identification and Evaluation

Date:	
Project No.:	Control No.:
Project Location:	County(s):
Requesting Contractor:	Phone:

Pit Size and Location

1. Pit Identification No.: _____
2. Identify the precise location of the pit *(to 2.5 acres)*:

   ____ ¼, of ____ ¼, of ____ ¼, of ____ ¼, of Section ____ , T- ____ -N, R- ____ - ____

3. Attach a copy of an ASCS aerial photo and/or a copy of an USGS 1:24,000 scale topographic map precisely depicting the pit location.
4. Give pit dimensions *(in feet)* and orientation *(NE-SW, etc.)* for long axis *(length)*, short axis *(width)* and depth.

   Length: Feet: _____ Orientation: _____
   Width: Feet: _____ Orientation: _____
   Depth: Feet: _____

5. This is a: ☐ Dry Pit ☐ Wet Pit
6. Will this pit pond water when completed? ☐ Yes ☐ No
7. Pit location is owned by: ☐ Private Owner ☐ Commercial/Business ☐ State/County/City Government ☐ Federal Government
8. Name of Owner: _____

Pit Characteristics

1. Pit location is for: ☐ Borrow ☐ Material ☐ Both ☐ Other *(Explain)*
2. To your knowledge, has this pit location been used previously for borrow and/or materials? ☐ Yes ☐ No ☐ Unknown
3. The pit location is presently used for: ☐ Commercial Borrow/Materials ☐ Pasture ☐ Row-Crop Agriculture ☐ Stock Pond ☐ Irrigation Recharge Pit ☐ Urban/Suburban Residential ☐ Stockpiled Borrow/Material ☐ Other *(Explain)*
4. Vegetation cover is: ☐ Grass ☐ Trees ☐ Weeds ☐ Crops ☐ Other *(Explain)*
5. Name, address, phone number of contact person, if additional information is required:

Contractors requesting use of borrow or materials pits for Nebraska Department of Roads' construction projects need to identify their location and character on this form. Please fill in the blanks with the correct information or select appropriate answers to questions. ***Send the completed form to the Construction Division, Nebraska Department of Roads, PO Box 94759, Lincoln NE 68509-4759 or FAX to (402) 479-4854.***

Approval Block – For State Use Only	
Nebraska State Historical Society	**Nebraska Game and Parks Commission**
Date received from the contractor: _____	Date received from the contractor: _____
Date submitted to NSHS: _____	Date submitted to NGPC: _____
Return due date: _____	Return due date: _____
Approval date: _____	Approval date: _____
Non-approval date: _____	Non-approval date: _____
Signature: _____	Signature: _____

DR Form 119, Feb 01/

Figure 204.01

205.03 EQUIPMENT *(SSHC Subsection 206.03, Paragraph 9.a.)*

- Equipment should be sufficient to meet compaction requirements and the type of equipment used should be recorded in the field book.

Overweight Axle Loads *(SSHC Subsection 105.11)*

All oversize hauling units delivering equipment or materials to the project shall be legal loads and/or have appropriate hauling permits issued by the Motor Carrier Permit Office. The State Patrol Carrier Enforcement Division has enforcement authority outside of the project limits and on those portions of the construction project maintained to through traffic.

Hauling On or Over Surfaced Roads

The contractor must protect from damage all public roads that will be used by the contractor. Usually berms (greater than 300 mm (12 inches) thick) are constructed over the road surface for the earth moving equipment to use.

Certified flaggers are required when the berm is on an active road.

The berm must be removed from the road and shoulders at the end of each day when the road is active and the surface area cleaned.

The berm must be maintained constantly by the contractor. This will allow safe traffic flow over the berm.

205.04 CONSTRUCTION METHODS

Embankment Construction *(SSHC Section 205)*

The construction of embankments is covered in *SSHC Section 205*. This Subsection provides a more detailed picture of certain procedures mentioned in the *Specifications*. These comments should be regarded as explanatory but in no way supersede or invalidate Specification requirements.

Site Preparation

All trees, shrubs, cornstalks, sod, and other vegetation are to be removed and disposed of according to *SSHC Section 202*. After cornstalks and tall grass are cut and removed, the area within the limits of construction is to be thoroughly disced and scarified.

Deposition of Embankment Material *(SSHC Subsection 205.03)*

On projects where a slope is being widened, "benching" will be required.

Hauling units should be directed over a fill so that uniform compaction will result.

The self-propelled tamping type roller may be used on the embankment area for leveling as long as the unit follows the prescribed rolling pattern, does not spin the power drums, and accomplishes both rolling and leveling to the satisfaction of the Project Manager.

Decisions and unusual situations should be recorded in the field book.

Compaction

Embankments shall be compacted as prescribed in *SSHC Subsection 206.03*.

Class I embankments are to be rolled when specified by special provisions or plans; no moisture-density tests required.

Class II embankments require rolling; no moisture-density tests required.

Class III embankments require moisture-density control. The moisture content of soils being handled for these embankments is very important because the objective is to stabilize soils and improve their engineering behavior by compaction. Maintaining a soil to near "optimum moisture" during grading operations will reduce the time and compaction effort necessary to obtain the required density.

Note:
- Class I and II embankments require only enough moisture in the soil to attain a compaction acceptable to the Project Manager.
- Class I - no moisture requirement by *Specifications*.
- Class II - drying only required if necessary to obtain compaction.

Moisture control; water acts as a lubricant and helps the soil particles move relative to each other into a denser condition when compaction effort is applied. Dry soils must have water added and be thoroughly mixed before compacting. A general guide would be to add water to silt-clay soils when lab or field tests indicate moisture content is five percent or more below the optimum.

When wet and dry soils are placed in the same lift, they should be disc blended to a uniform condition prior to compaction.

Soft Ground; embankments that cross low wet areas may require an initial stabilization layer which is granular material. Usually the Project Manager will permit a working platform, up to 1.0 m (3 feet) thick, to be placed in one lift when bridging a soft area. Sand, gravel, or well graded crushed rock may be used for this initial lift. Compaction should proceed with caution. In general, the use of vibratory rollers should be discouraged since the vibrations may cause underlying soil to pump into the granular fill. In some areas, capillary action will move moisture into the upper grade by equipment moving on it. Contact Materials & Tests when you encounter this situation and it is not covered in the Plans.

◆ HELPFUL HINTS

Sand embankment directly deposited by dredge pipe will obtain about 95% of NDR T 99 proctor density by the transporting water flowing through the fill. For this method of placing sand, other methods of compaction may be required. Testing should be done at regular intervals and recorded in the field book. The time for this test is just after the free water leaves the top 200 mm (8 inches) of fill and can be done very quickly with a nuclear density gauge.

Sand lifts should be placed the full width of the embankment. If this cannot be done, a sand trench drain should be placed to eliminate ponding water.

If soils are too wet, compactive effort increases the pore water pressure and holds the particles apart. The upper limits on moisture has been set above optimum and recommendations are based on the type of surfacing or embankment designed. (Requirements are shown on the plans and/or in design files).

Wet soils can become elastic and result in heaving or pumping of the embankment when loads are applied. This is caused by water pore pressure and the strength of the soil is substantially reduced. If the embankment has not been damaged, equipment should stay off of the area long enough to allow excess pore pressures to dissipate naturally. If loading were to continue on wet soil, it may have shear failure or rutting. The Project Manager should explain to the contractor that continued operations can only worsen the situation and require removal. Take a moisture measurement to show the contractor that the soils moisture content is rising and to document that the contractor is damaging the soil.

The contractor should be encouraged to route hauling equipment as evenly as possible over the entire surface area of the embankment during soil placement. This will reduce possible rutting or damage caused by heavy equipment following one path.

The nuclear gauge for moisture and density determination may be used. Only properly trained and qualified nuclear gauge operators can use a nuclear gauge.

Nuclear gauges are to be operated according to NDR T 238, AASHTO T 238 and ASTM D 2922. Test results are distributed according to the instructions on the test form. This form may be used without field book entries.

Use the nuclear gauges printout as the official project record.

Moisture Density Curves

When a grading inspector is not sure which moisture density curve to use, he/she should review the available soils information at the location in question. If it is determined that there is not a moisture density curve to represent the soil in question, then a 1-point moisture density curve may be run in the field according to NDR T 505. Only use the 1-point curve method until Materials & Tests can determine the complete curve data for the soil.

During compaction, the mold shall rest on a firm surface such as concrete box culverts, bridges, and pavements.

Construction of Embankment Toe Berms

If the plans require a berm, it should be constructed at the same time as the embankment.

Toe berms are built in areas where the roadway is used as a dam for a pond. In these areas the berm is used to protect the embankment from saturation by the standing water. Also to help construct fills on unstable ground. Proper compaction and soil types are needed to reduce permeability of the fill.

Construction of Bridge Approach Fills

Toe stakes should be set and the slopes and the centerline checked during the construction of the embankment. The slopes should be finished to the lines and grade called for in the plans.

In the construction of these berms, particular attention should be given to prevent the incorporation of rocks over 100 mm (4 inches) in diameter as the lifts are placed. Rocks cause extreme difficulty when driving piling or preboring for piling.

The removal of boulders greater than 1 m (3 feet) in diameter in bridge berms should be covered as "extra work".

Bridge approach fills should be constructed to grade with adequate length along the centerline for the bridge contractor to work. This length should be adequate for the bridge contractor's storage of material. Usually 30 to 45 m (100 to 150 feet) are adequate. This can be shortened by mutual agreement between the contractors.

On some projects settlement plates are required along with delay periods for abutment construction. The settlement plate readings are sent to Materials & Tests for comparison with the design settlement predictions. In cases where the settlement differential is minimal (near the end of the delay period), the delay period may be reduced with Materials & Tests approval.

Earthwork-Measured-in-Embankment

Payment for embankment in place will be based on the plan quantity.

Sections of deep fills may have the quantities adjusted, based on settlement plates. These settlement plates should be well protected to insure that they are not damaged or destroyed.

A graph may be plotted with fill height vs. settlement to determine settlement at intermediate heights of fill. Using this chart, the settlement below the original ground line can be determined and plotted. The volume between the plotted settlement line and original ground can then be calculated using the average end cross section method. This volume is added to the plan quantity for final payment.

Prewatering Plan

The contractor shall present a prewatering plan at the pre-construction conference when prewatering is required. The plan should be approved by the Project Manager.

Payment for Water for Embankment Construction

When water is required for compaction of embankments other than Class III, it should be paid for as extra work if no contract item has been provided.

When water is required for moisture and density control, the cost of adding and incorporating water is a part of the item.

Finishing

Finish grading must be completed on a timely basis so that erosion control measures may progress satisfactorily. Special provisions on many projects limit the surface area that the contractor may disturb. Generally, this area is 75,000 m² (90,000 square yards), excluding areas to be paved, plus an equal amount of clearing and grubbing area may be opened up. The Project Manager may increase these limits but only by written notice to the contractor. If used, this written notice should include justification for the increase and special procedures the contractor must use to safeguard the environment. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average two-lane, full grading project. Any repair required on sections that have been tentatively accepted will be considered extra work (unless considered to be the fault of the contractor) and if performed by the contractor they are entitled to additional pay as provided for in *SSHC Subsection 109.05*. Therefore, final cross sections may be taken on a section of grading after it is tentatively accepted per *SSHC Subsection 105.13*.

If the finishing work is not performed on a timely schedule, the Project Manager is advised to follow these progressive steps:

- Project Manager should notify the contractor of the concerns in writing.
- If this does not obtain results, suspend estimate payments.

Tentative Acceptance

Areas that have been final graded may be accepted by the Department. However, do <u>not</u> accept an area until silt fence, cover crop, erosion checks, and other erosion control measures are in-place. Do not tentatively accept areas where the contractor must operate equipment to do other requirements. For example, shoulders and foreslopes should not be accepted until pavement and shoulders are finished. Ditch bottoms are a questionable area for tentative acceptance. Often, the Contractor plans to use material in the roadside ditch bottom to build the shoulder. In these cases, do not tentatively accept the ditch bottom until the shoulder work is also complete.

206.00 TOPSOIL *(SSHC Section 207)*

206.01 CONSTRUCTION METHODS

Stripping, Salvaging, and Spreading

The areas of stripping, salvaging, and spreading of topsoil should be identified on the plans or Special Provisions.

Topsoil on Roadway Cuts and Embankments

Where sand pockets are encountered on backslopes and where sand is used for embankment, every effort is made by Roadway Design to place topsoil on these areas. Where these situations are missed, every effort should be made by the Project Manager to obtain topsoil for use as cover for the sand areas. If no topsoil is available, see plans for proper erosion control.

206.02 BASIS OF PAYMENT

- As topsoil is removed and stockpiled, the contractor may be paid at one half the item unit price on the progress estimate. At the time the topsoil is spread and finish graded, the remaining one half may be paid on a progress estimate.

- Topsoil quantity is based on the area where the topsoil is placed. The excavation volume is not adjusted when the project has topsoil as a pay item.

207.00 OVERHAUL

SSHC Section 209 outlines the method used to determine the quantity for overhaul.

CHAPTER NOTES:

CHAPTER NOTES:

DIVISION 200

EARTHWORK

SECTION 201.00 -- EARTHWORK INSPECTION CHECKLIST

EMBANKMENTS/EXCAVATION

SSHC References:

Section 205 Excavation & Embankment
Section 1033 Aggregates

Other References:

NDR, Materials & Tests, Earthwork Engineering Guide
NDR Materials and Sampling Guide
NDR Standard Test Methods

Inspection Crew:

Grade Inspector

Inspection Equipment:
(AASHTO T 238)

Nuclear Density Gauge (With Manual)
Nuclear Density Gauge probe puller or auger.
Thermometer (Surface)
Scale (Dept. of Ag. Certified)
Metal Thickness Ruler
3 m (10 foot) straightedge
Gravel Sampling Bags

Equipment
(NDR T 205)

Spade.
Rubber Balloon (flexible membrane)
Sand.
Calibrated container with an air valve and a volume indicator.
Base plate.

Embankment/Excavation
Procedures:

General Comments:

1. The operations of excavating the roadway and borrow material (Roadway Excavation) and the placing, compacting and finishing of the excavation material in the embankments or fills (Embankment) are inspected and controlled as a single "Grading operation".
2. The value of grading may be considerable.
3. “No building is better than its foundation" and good quality embankments and subgrade are essential to the good performance and quality of the base course and pavement structure.
4. The grade inspector's work is of the utmost importance in producing a quality riding surface for the motorist.

5. The large and fast grading equipment employed by grading contractors means inspector should be on site to sample each lift.
6. The inspector should be thoroughly familiar with *SSHC Section 205 Excavation and Embankment*.
7. Check all contract documents for grading requirements.
8. The type of embankment compaction will be specified in the plans (generally on Sheet No. 3).
9. Construction notes in the plans should be noted and checked against physical features on the project. The right of way should be checked for physical features and obstructions which may not be shown in the plans. Typical items to be checked:
   a. Check the construction widths needed, and fences which must be moved, and compare them with the available right of way and contracts for additional right of way, borrow and construction easements.
   b. Utility pole lines - check against construction limits and utility agreement provisions.
   c. Survey or other type monuments or markers - mark or relocate.
   d. Selective placement notes.
   e. Trees or shrubs which are indicated in the plans to be preserved -mark as necessary.
   f. The Design file contains all of the preliminary and design information of the soils, pit sketches and contracts, preliminary soil compaction curves and soil tests.
10. Rights of adjacent property owners will be protected.
    a. Tile lines and intakes should be located, replaced, and repaired to maintain the integrity of the subsurface drainage. (Preventing unintended drainage from reaching adjacent property.)
    b. Right-of-way contracts should be checked for possible special negotiated items which should be included in the work being done.
11. Any contractor operation that causes damage to partially completed or completed work shall be reported to the Project Manager and noted in the Daily Diary.
12. Make sure the contractor installs silt fences prior to commencing soil disturbing work.

See Subsection 1300.03

Preconstruction Conf:	13.	Preconstruction Conference (See Subsection 102.01) a. The Project Manager should go over the unusual, difficult, or special items with the grading inspector, and with the contractor.
1-800-331-5666		b. Remind the Contractor to call "1 CALL - Diggers Hotline of Nebraska", for buried utilities, pipe lines, sewers, communication cables, etc. - check for possibility of such not being shown and be sure provisions are made to mark or protect as necessary to prevent damage. c. Inspection and Control of Grading Operations d. The contractor's Pre-Watering Plan should be presented and discussed. e. Discuss selective placement requirements. f. Determine what contractor will do to keep stockpiles free from contamination. g. Removal and storage of topsoil materials, shall be discussed. h. Project schedule. *(SSHC Subsection 108.07)* i. Partnering procedures. j. Traffic control. k. Archeological & palentological discoveries. l. Environmental issues(Erosion Control, Wet Lands, Migratory Bird Nesting) m. Detours and Shooflies. n. Railroad Special Provisions. o. Safety issues (Guardrail removal, etc.) p. Material submittals.
	14.	Site preparation such as clearing and grubbing, wetlands preparation, removals, and vegetation disposal on cuts, fills, and borrows are accomplished according to contract documents.
Stockpiling:	15.	If stockpiling of selective placement material is necessary, <u>no payment</u> is made for re-excavation. (Topsoil, sand, or any soil identified as select materials.)
Clearing & Grubbing: A large tree has 1 m (3 foot) circumference at 1 m (3 foot) above ground line or if only the stump remains, a stump of 1 m (3 foot) circumference at ground level.	16.	If contract has "Large Tree Removal" count and record trees before work starts.
	17.	*SSHC Subsection 204.02* limits the surface area that the contractor may disturb to 75,000 m² (90,000 square yards) plus an equal amount of clearing and grubbing area.
	18.	The Project Manager may increase these limits but only by written notice to the contractor.
	19.	The written notice should include justification

for the increase and special procedures the contractor must use to safeguard the environment.

20. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer.
21. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average project.

Soil Moisture:

22. Check the moisture content of the excavation and borrow material 1-5 days before the contractor starts work.
23. Discuss the drying or moistening of the excavated material.
24. Check to see if contractor knows the condition of the soil.
25. Verify how the contractor will control moisture in Class "III" embankments
26. Contractor should mix clay/non-granular material to uniformly distribute the moisture and various soil types before compaction.
27. Pre-Watering can be wasteful. Ponding or sprinkling may require more water and more work than wetting the soil as it is placed.
    a. But the moisture content will be more uniform and dust will be eliminated.
    b. The contractor is responsible to obtain the soil samples both before and during the water application.
    c. The Project Manager will run moisture tests to determine water application rates and to check the progress of the penetration. Use nuclear density gauge to determine the moisture content at different elevations below the surface up to depth of cut. Compare the amount of prewater to the expected amount that would be required if added at time soil is placed.
    d. The following example does not allow for water lost by evaporation, run off, etc., and will need to be supplemented by information derived from subsequent testing.
    e. As a precautionary measure against overwatering, leave some dry material for mixing with soil which was over watered. (Required water per cubic meter) (cubic yard) - (Natural in place water in the soil per cubic meter) (cubic yard) = Amount of water to add or if negative result, the amount of water to remove per cubic meter (cubic yard).
    f. Preserve the natural vegetation on the area until the watering is complete.

g. If the vegetation is removed before watering, or the soil type, slope, or condition warrants, the ground should be ripped 650 mm (2 feet) deep on its contours approximately 1.2 m (4 feet) centers to allow penetration of water and minimize runoff.
h. Adjust the application rate to control runoff and erosion.
i. Construct dikes to control runoff and erosion.
j. Document any wasted water in field book.

28. Excavation areas should be disced immediately after pre-watering to reduce evaporation.
    a. A two to three week curing period is necessary to permit the water to move downward and become uniformly distributed in the soil.
    b. The importance and length of this curing period will vary with the soil type and conditions of the soil. (Clay very important--sand not important.)

Compaction:
(See *SSHC Subsection 206.03 para 9*)

29. Compacting equipment which produces a glossy surface shall not be allowed. This may cause lamination.
30. PM should approve all haul routes over structures.
31. Know the moisture/density requirements for each section of the project.
    a. Review *SSHC Subsection 205.03* for construction methods and procedures which give moisture, density, and lift thickness requirements.
32. a. A good practice is for the contractor to spread the soil as thinly and smoothly as practicable, to distribute the hauling equipment over the embankment to minimize the rolling.
    b. Discing is required to get uniform density.
    c. Layers must be compacted before the next layer is placed.
33. Require rolling over entire area--completely to the outside edges.
34. Require that hauling and leveling equipment is routed over the full width of the embankment.
35. Visually check the subgrade and the embankment under compacting equipment.
    a. When a sheepsfoot walks out of soil you have good compaction.
    b. Peorian clays may show movement/instability and yet be at specified density. (When this occurs, additional work is necessary to stabilize the fill.)
36. a. Compare earthwork to the stakes--tell the Project Manager and the contractor if something does not look right.

b. Make sure stakes are uniform and easily read.

37. Run one-point curves for soils that do not have corresponding compaction curves.

Subsurface Concerns:

38. Insist that all objectionable material such as logs, vegetation, trash, or unsuitable soils are removed before fill is started.

39. a. Require old pavements to be removed if embankment will not be greater than 1 m (3 feet). If more than 1 m (3 feet) of embankment the pavement must be broken-up.

b. *SSHC Subsection 104.06* defines "minor obstruction" and lists examples of when the contractor should be paid extra for removal of unforeseen obstructions.

Drainage:

40. The roadbed will be adequately drained and protected at all times. (Poor drainage during construction often results in an inferior construction.)

a. The roadbed should be tight (shaped, bladed smooth, and rolled, so as to shed water) at the end of each day.

b. Flowable fill, granular fill, drain pipes, or other requirements may be necessary to permanently correct the problem.

Settlement:

41. Things to check:

a. Settlement or side slip may result in slopes or sidehills if not properly stepped or plowed.

42. Settlement may result at Grade points (0-0 sections) due to fill taper, improper or insufficient compaction and different soil type (Subsoil - topsoil - parent soil) meeting. Particular attention should be given to the compaction of the new embankment at 0-0 points. Usually blending to 1 m (3 feet) depth is required.

43. Settlement of areas adjacent to or over structures frequently occurs. Take additional density readings in these areas.

a. Proper placement and compaction of material in the areas inaccessible to rollers and the earth moving equipment will eliminate this problem.

b. This involves close contact inspection of compaction performed by small mechanical tampers, which is tiresome, manual work.

c. The inspectors' must confirm that this work is properly performed.

d. When the slope is greater than 1-vertical to 4-horizontal, step the ground to prevent wedging action against the structure.
e. Use selected soil which will compact readily, if available.
f. Silty soil should not be used.
g. During backfill operations, displacement of wing or abutment walls may be checked by erecting a "telltale" before backfilling is started and checking the wall for movement as the backfill progresses. If movement is detected, backfill operations should be suspended and the Project Manager advised of the problem.

44. Watch for and report unstable and unanticipated settlement to the Project Manager and Materials & Tests Engineer.
a. Bulging at the toe of the slope.
b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
d. Pumping action.

Foundation Engineer (479-4678)

45. Where surcharges are included in the plans as work to be accomplished during construction, the Soil Mechanics Section of the Materials and Research Division wishes to be informed before the beginning of the construction of the surcharge.
a. Construction progress and anticipated paving date may allow a change in the height of the surcharge necessary to complete the anticipated settlement.

Backfill:

46a. Confirm culvert backfill material meets specification requirements.

46b. Backfills on box and pipe culverts should be brought up evenly on both sides at the same time to avoid displacement of the structure.

47. When tamping under the lowest 90° of a culvert place elevation check stakes at the ends of the pipe to detect any rise.

48. The grade inspector should be alert to possible damage to any drainage structures which the contractor's heavy equipment may cause by crossing or working over such structures, and particularly to possible damage to pipe culverts covered with minimum fill.

a. The contractor shall be informed immediately of any observed damage and the information recorded in the field book.

Grades, Lines & Profile:

49. Large shortages or overages of excavation material may be encountered.
    a. Revising the grade lines, rebalancing, or obtaining additional material outside construction limits or balance points require prior District approval.
    b. The Project Manager should be contacted on all overage or shortage conditions.
50. The grade inspector should inspect and advise the Contractor of deviations from the lines and grades as staked by the Project Manager.
51. The inspector should note any actual construction balance points in the grading notebook.

See Survey Blue Tops

52. Finish grading
    a. The roadbed surface should be finished within 15 mm (5/8 inch) of the finish grade stakes.
    b. The shoulder lines and slopes should be <u>reasonably</u> true.
    c. Side ditches and borrow areas should be finished <u>reasonably</u> true to grade and should drain.
    d. Finish grade stakes should be set for finishing flow line grades in borrow pits if the width and grade are such that stakes are essential to finishing the pit to provide proper drainage without ponding.
    e. Finish grading must be completed on a timely basis so that erosion control measures may progress <u>satisfactorily</u>.

Covercrop Seeding:
(Agronomist Dick Gray
479-4537)

53. All finished work and any other areas that need erosion control should be kept current with covercrop seeding performed as the work progresses.

54. Any repair required on a section that has been tentatively accepted will be paid as extra work (unless considered to be the fault of the contractor). (*SSHC Subsections 105.13, 107.14* and 1*09.08* define tentative acceptance.)

Soil Tests:
(Form DR 86)

55. The inspector should require the contractor to move the field lab as necessary to facilitate the field testing.

56. The grade inspector will test soil samples for two primary purposes.
    a. To monitor the effectiveness of the contractor's operations and use of forces and equipment in controlling the moisture and the compaction of the soil. These are called "job control tests".
    b. To verify that the completed work (compacted embankment) meets the requirements for moisture (if specified) and density. These are called "acceptance tests".

    The minimum number of tests necessary to verify that the compacted embankment meets the specified requirements for moisture and density will be shown in the *Materials Sampling Guide*.

57. The number of moisture-density tests will vary but the minimum is spelled out in the *Materials Sampling Guide*. However, the inspector is encouraged to take additional tests as are necessary because with the nuclear density gauge, moisture and density are easily monitored. "Job control tests" which indicate the need for additional work to meet moisture-density requirements shall not be counted in the "acceptance tests" since a check test would be required in the area represented by the original sample.

Grading Diary:

58. Grading diary, shall include:
    a. Date, weather, soil conditions.
    b. Information on contractor's forces -include numbers of personnel, numbers, types, and sizes of equipment, hours worked each day.
    c. Data on work in progress -section of the project, balance limit, channels, dikes, rough grading or finish grading, etc. This should include a record of known construction balance points, particularly balance points between "off-site" borrow pits.
    d. Weather conditions or other conditions affecting the progress of or delaying prosecution of the work, equipment break downs, etc.
    e. Sufficient records of the progress of the work, to enable the Project Manager to prepare progress reports, working day reports and progress estimates accurately.
    f. Estimates of wasted water, and cause.
    g. Disputes.

h. Contractor's progress should be monitored to check that the work is being completed according to the construction schedule. Report major deviations.

Field Book

59. Field Book Entries

a. Any supporting information or records necessary to facilitate the preparation of the required reports on sampling and testing (see Materials and Research "Earthwork Engineering Guide").
b. Calibration of distributor water tanks and of meter accuracy if the water is metered.
c. Daily record of water hauled (on large projects the water applied may be kept in a separate "water application notebook"). Include location (i.e., station of the excavation, borrow pit, embankment or surface) where water was applied and obtained.
d. Select placement, confirming information, etc.
e. Identify all work performed on the project by the contractor and subcontractor actually completing each pay item.
f. Make entries supporting extra work quantities.
g. Get the contractor representative signature agreeing to pay quantities in the entry.

Measurement:

60. Method of Measurement

a. See CM Subsection 1300.04 for instructions to take cross sections. (Use Geopak when possible.)
b. Measure and pay authorized excavation of material below grade and overbreakage or slides.
c. Unsuitable material which is removed below grade in excavation areas, or below existing ground in embankment areas, is considered to be "authorized excavation of material below grade".
d. If the existing ground in an embankment area must be dried to such a depth as to be impractical to dry in place, the contractor may be ordered to undercut (excavate below grade) and haul this material to higher areas, drying and using it in the construction of embankment.
e. The volume of the undercut would also be considered to be authorized excavation below grade, and the volume measured and paid.
f. Larger quantity under cuts should be authorized by the District Construction Engineer and the volume should be measured by cross sections.

Tell the Contractor what is "larger" at the preconstruction conference.

61. Water, Applied
    a. Distributor truck tanks may be calibrated by determining the mass of both the empty and filled truck. The net mass (kg) (lb) is the tank capacity, in liters (gallons).
    b. Each truck tank should be numbered and the numbers and capacities recorded in the water haul notebook.
    c. Calibration of meters for the pre-watering methods may be accomplished by pumping through the meter into a water truck and checking the mass of water against the liters on the meter.
    d. Meters may be calibrated by registered pump and meter service companies and their calibrations may be used if they are current. Calibrations are good for one year.
    e. Inspector must convert meter readings in English units to S.I. units (metric).
    f. Trucks that are too large to measure their mass on available commercial scales may be calibrated from capacity if model numbers, serial numbers, etc., are the same as shown on the specifications literature.
    g. If the water is measured by tank count, the grade inspector will record each day, the number and size of loads delivered to the project by each truck.
    h. If the quantity of water is measured by a meter, the grade inspector will record the meter readings at the beginning or ending of each day or shift.
62. Calibration
    a. Water meter calibration sheets usually show a correction factor to be used to convert meter volume to actual volume for differing rates of delivery.
    b. The rate of delivery for the application can be determined by timing the meter and computing the liters (gallons) per minute being delivered.
    c. The liters (gallons) per minute delivered will vary with the length of pipe and number of sprinkler heads being used.
    d. Therefore, the delivery rate should be determined and documented for each pipe setup so the correction factor can be determined and used.

63. Wasted Water
    a. The quantities of water wasted or not eligible for payment should be entered in the records each day with substantiating or estimating information to support the quantity deducted or ineligible for payment.
    b. The contractor should be furnished the documented quantities of water wasted each day, to facilitate resolving of any discrepancies in quantities.
    c. The grade inspector is responsible for the proper determination of the quantities of water measured for payment, and each day's entry in the notebook should be validated by his/her signature and agreed to by the contractor and signed.
64. Metering is more practical and economical than a tank measurement.
    a. Encourage the contractor to provide an acceptable meter at the point of loading the trucks to measure the water for payment.
    b. If the water is being applied by the truck sprinkler method, the "Water Applied Haul Sheet" (DR Form 8) may be prepared by the truck driver, and used by the grade inspector to determine the distribution of water applied on various sections of the project, finishing, etc., and for cross-checking quantities.
    c. These sheets are to be used for this purpose only and not for payment, and should not be submitted with the final records.

Critical Construction Requirements:

1. Preconstruction Conference
2. Verify how the contractor will control moisture in Class III" embankments.
3. Visually check subgrade and embankment under compacting equipment.
4. Stability and Settlement Indications. Watch for and report to the Project Manager and Materials & Tests Engineer indications of instability.
    a. Bulging at the toe of the slope.
    b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
    c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
    d. Pumping action.
5. The roadbed will be adequately drained and protected at all times. Roadbed should be bladed smooth and rolled tight at the end of each day.

6. All contract pay items will be properly documented.

Safety Areas:

1. Maintained Traffic
   a. Contractor's cars and trucks must adhere to project traffic control procedures.
   b. Flaggers must be certified and use proper procedures.
2. The contractor should be told to stop all unsafe activities such as:
   a. Speeding trucks and other equipment.
   b. Inoperable back-up alarms.
   c. Inoperable or nonfunctional strobe lights.
3. Contractor vehicles shall be parked beyond the lateral obstacle clearance.
4. Worker protection barriers should be placed as shown in the plans.
5. Traffic markings should clearly indicate traffic flow.

NDR Tests:

1. Nuclear Density NDR T 238
2. NDR T 99 Soil Density (See Earthwork)
3. Soil Type NDR T 87
4. NDR T 2 Sampling Aggregate from Stockpiles
5. Moisture: NDR T 217, T 205, or Nuclear Density Gauge AASHTO T 238/ASTM D 2922.

Sampling Requirement/ Freq.:

1. See Materials Sampling Guide

Inspector's Records & Forms

1. Grading diary
2. Water application notebook
3. Field book
4. DR Form 8, Water Applied Haul Sheet
5. DR Form 86, Weekly Report of Moisture-Density Tests or Nuclear Density Machine Output

NDR Point of Contact

1. Materials & Tests Soil Mechanics Engineer 479-4678

202.00 GENERAL GRADING INSTRUCTIONS

Grading Inspection

A grading inspector should devote the majority of his/her time to observing and checking the contractor's excavating, drying, moistening, spreading and compacting operations, and securing samples, vary the balance of his/her time in testing samples and making neat and accurate records. The grade inspector will need to check moisture (if control is required) and density at the rate shown in the Materials Sampling Guide (usually check moisture and
@ density once for each 2,500 cubic yards (2000 m^3) placed and once for each 1000 feet (300 m) of shoulder or subgrade).

Blue Tops

After the roadway excavation and roadway embankment has been constructed substantially to grade elevations, the construction survey party will set finish grade stakes for finishing the grade or subgrade to the lines and grades shown in the plans. The blue top book elevations must be checked to insure they conform to the information shown on the plan cross-sections.

Rounding of Hinge Points

The Department has determined that the rounding of “hinge points” in the cross-sectional elements can significantly reduce their potential as hazards. Rounded slopes reduce the chances of an errant vehicle becoming airborne, reduce the hazards of encroachment, and afford drivers more control over their vehicles.

The Construction Division suggests that finish grading and ground preparation activities that result in the rounding of hinge points be permitted, if not encouraged. For example, an 8’ disc that “hangs over” a 6’ shoulder will provide the desired effect and should not be ruled unacceptable. However, this suggestion is not meant to imply that the cuts and embankments may be built to other than the cross-sections shown in the plans.

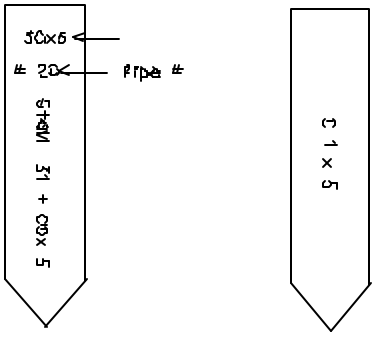
Erosion Control

@

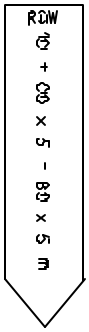
The contractor must have as a minimum silt fence or other erosion control measures as shown in the plans installed to keep silt on our ROW before any grading is allowed.

CULVERT STAKES

Offset



ROW STAKES



Green-yellow flag for easements

Orange flag ROW

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203.00 CLEARING AND GRUBBING *(SSHC Section 202)*

203.01 CONSTRUCTION METHODS

There may be considerable elapsed time between an estimate of clearing and grubbing and the actual work. If actual site conditions are different than those shown in the contract documents, the following suggested resolutions are provided:

- If the pay item is "General Clearing and Grubbing" then no action is necessary
@ because tree removal is subsidiary for trees with circumference of 80 inches or less at 40 inches above ground level.

- If the pay item is "Large Tree Removal" then a new tree count should be taken and recorded before the contractor starts work.

@ - If a tree has been cut, leaving branches and the stump, payment is covered under "Clearing and Grubbing" or "Large Tree Removal." If the stumps is the only item remaining and payment method is large tree removal, you would count just the stump as a tree.

- If a fence is partially removed or in poor condition but requires an identifiable removal operation, full price for fence removal may be made.

@ - Where brush and/or junk has recently (After the letting was announced) been deposited within the right-of-way, a price agreeable to both the contractor and the Project Manager may be negotiated or a force account extra work order may be used.

Disposal of Waste

Disposal of the clearing and grubbing waste is restricted according to applicable federal, state, and local laws. Disposal options include:

- Open Burning

@ Contractor must obtain necessary permits. In locations where burning is allowed, the burning of the waste must be located at least 1/4 mile (400 m) from any inhabited building.

- Chipping

  Chipping of the down timber for mulching material.

- Firewood

  Salvage of the logs for firewood.

- Landfill

  Disposal at a "yard waste" landfill.

204.00 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

204.01 CONSTRUCTION METHODS

Removal and Disposal of Old Pavement

@ Pavement is removed from all cuts and fills with less than 3 feet (1 m) of cover. The removed concrete is to be broken into pieces with an area of 2 square feet (0.2 m²) or less if placed in fills. *(SSHC Section 203)*

@ Where existing PCC pavement would be located more than 3 feet (1 m) under the proposed profile grade, the PCC pavement will be required to be broken into surface areas that will not exceed 4 square feet (0.4 m²) when left in place. If the existing pavement has been resurfaced, the asphalt resurfacing will be removed if the PCC pavement is to be used as slope protection or in a waterway. *(SSHC Subsection 205.03)*

Disposal of Asphaltic Concrete Pavement

The contractor shall manage the material in accordance with all current federal and state rules and regulations. *(SSHC Subsection 107.01)*

@ Salvaged asphaltic cement concrete pavement may be used as special backfill material. When intended for special backfill material, the ACC pavement is normally removed by scarification. Removed bituminous materials may be placed in the outer slopes of embankments, 12 inches (300 mm) below the finished shoulders and foreslopes. *(See SSHC Subsection 205.03)*

Hazardous Material (Wells, Asbestos Fibers in ACC, Building Removal, Underground Storage Tanks, Archeological Remains)

Appropriate federal, state and local regulations must be followed. (See *Construction Manual Division 1100* for further guidance).

205.00 EXCAVATION *(SSHC Section 205)*

205.01 DESCRIPTION

The importance of being able to identify soil types cannot be overemphasized. Some soil types have to be placed in the proper location. The inspector must be sure that the work is performed according to the plans.

The balance factor is the change in quantity from cut to fill and includes subsidence, change from borrow density to the final compacted density, incidental loss, and all other factors changing density.

205.02 MATERIAL REQUIREMENTS

Embankment and Excavation Soils Criteria *(SSHC Section 206)*

There are four basic categories of earthwork.

- Excavation
  - ♦ Usually final cross sections determine pay quantity.
  - ♦ No off-site borrow is required.
- Excavation (Established Quantity)
  - ♦ Payment is based on the plan quantities.
  - ♦ No off-site borrow is required.
- Excavation Borrow
  - ♦ Usually final cross sections determine pay quantities.
  - ♦ Borrow will be needed from off-site source(s).
- Earthwork-Measured-in-Embankment *(SSHC Subsections 205.04/205.05)*
  - ♦ Plan quantities of the proposed embankment are used to determine the payment quantity.
  - ♦ Contractor must forecast shrinkage. (A change from borrow density to compacted density.)
  - ♦ Borrow from off-site sources.

"Excavation" and "Excavation Borrow" are paid based on final cross sections. The Project Manager may forego the final cross sections when the contractor agrees, in writing, that the plan quantities, including field adjustments and revisions, accurately reflect the work done. Payment will be made under the original contract items. It is not necessary to eliminate the original contract item and establish a new “E. Q.” item. Refer to Page 129.

@

The Project Manager and the contractor may elect to measure areas in question and accept the remaining areas as "Established Quantities."

Unsuitably Wet Material

In low-lying areas and in wet soil contact zones, it may be necessary to declare most of the material as unsuitably wet at the direction of the Project Manager. A granular material that will drain can be used to replace the wet soil. An effort should be made to provide an outlet for water which may occur in the embankment or subgrade. Most wet soils that are removed can be dried and reused in some other area.

Soft shale, in some cases, can be moved in a manner similar to soil excavation. Shale cuts are usually benched and covered with topsoil in accordance with the plans. If unexpected shale is found, contact the Materials and Research Soil Mechanics Engineer. Slides can occur in backslopes of shale cuts, and flatter slopes may be required.

Rock Material (See *SSHC Subsection 107.08 and Section 206*)

If material to be excavated is too tough to be ripped, the Project Manager, contractor and a geotechnical specialist experienced in blasting should discuss the aspects of the work to be done.

Contractor Furnished Borrow Areas *(SSHC Subsection 205.03)*

On some projects, the contract documents will require a "contractor borrow." In these cases, the contractor is responsible for submitting a site approval request to the Construction Division (allow 60 calendar days for the Construction Division to obtain site approval from Nebraska agencies).

Construction Engineer
Nebraska Department of Roads
1500 Highway 2
P.O. Box 94759
Lincoln, Nebraska 68509-4759
Fax No. (402) 479-4854

The approval request shall include:

- A Borrow Pit/Materials Pit Identification and Evaluation Form for each site.
- An aerial photo or topographical map showing the location of the pit site (one photo or map for each site).

No material will be removed from the site prior to the Project Manager's written approval of the sites.

The contractor shall also obtain a Corps of Engineers approval letter for the site and submit this to the Project Manager. The contractor shall submit a topographical map or a photocopy of an ASCS aerial photograph showing the exact location of the proposed pit sites to the Corps of Engineers. A legal description of the location should also be included.

Corps of Engineers
Regulatory Branch
P.O. Box 5
Omaha, NE 68101-0005

ASCS aerial photos are available at county ASCS offices at a nominal cost. ASCS aerial photos cover agricultural ground only. In some instances, aerial photos or urban areas are not available from the ASCS.

Topographic maps may be obtained from the following source:

University of Nebraska
Conservation & Survey Division
113 Nebraska Hall
Lincoln, NE 68588-0517
Attn: Judy Otteman
(402) 472-7523

Approval For Soil Type (Contractor furnished borrow)

- The Contractor will obtain soil samples to verify material is acceptable. The Project Manager will forward the samples to the Materials & Tests Office for evaluation. (See *SSHC Subsection 205.02.*)

Preservation of Cultural Resources *(SSHC Subsections 205.03 and 107.10)*

Cultural resources are the composite of archaeological and historic/architectural resources in an area. A common cultural resource site is a burial ground or remains of a Native American village.

Nebraska law requires action be taken to insure that cultural resources are not damaged or destroyed.

If a cultural site is discovered during construction, the contractor is required to temporarily discontinue work at the site. Upon discovering such a site, the Project Manager shall notify the Construction Office of the finding.

Nebraska Game and Parks Commission Approval of Borrow Sites

- All Contractor borrow sites must be submitted to the Nebraska Game and Parks Commission (NGPC) for approval. The NGPC will examine the proposed site for endangered plant and wildlife species and for potential Platte River drainage system depletion. This process can take 60 days or more.

Borrow Pit/Materials Pit Identification and Evaluation

Date:	
Project No.:	Control No.:
Project Location:	County(s):
Requesting Contractor:	Phone:

Pit Size and Location

1. Pit Identification No.: _____
2. Identify the precise location of the pit *(to 2.5 acres)*:

   ____ ¼, of ____ ¼, of ____ ¼, of ____ ¼, of Section ____ , T- ____ -N, R- ____ - ____

3. Attach a copy of an ASCS aerial photo and/or a copy of an USGS 1:24,000 scale topographic map precisely depicting the pit location.
4. Give pit dimensions *(in feet)* and orientation *(NE-SW, etc.)* for long axis *(length)*, short axis *(width)* and depth.

   Length: Feet: _____ Orientation: _____
   Width: Feet: _____ Orientation: _____
   Depth: Feet: _____

5. This is a: ☐ Dry Pit ☐ Wet Pit
6. Will this pit pond water when completed? ☐ Yes ☐ No
7. Pit location is owned by: ☐ Private Owner ☐ Commercial/Business ☐ State/County/City Government ☐ Federal Government
8. Name of Owner: _____

Pit Characteristics

1. Pit location is for: ☐ Borrow ☐ Material ☐ Both ☐ Other *(Explain)*
2. To your knowledge, has this pit location been used previously for borrow and/or materials? ☐ Yes ☐ No ☐ Unknown
3. The pit location is presently used for: ☐ Commercial Borrow/Materials ☐ Pasture ☐ Row-Crop Agriculture ☐ Stock Pond ☐ Irrigation Recharge Pit ☐ Urban/Suburban Residential ☐ Stockpiled Borrow/Material ☐ Other *(Explain)*
4. Vegetation cover is: ☐ Grass ☐ Trees ☐ Weeds ☐ Crops ☐ Other *(Explain)*
5. Name, address, phone number of contact person, if additional information is required:

Contractors requesting use of borrow or materials pits for Nebraska Department of Roads' construction projects need to identify their location and character on this form. Please fill in the blanks with the correct information or select appropriate answers to questions. ***Send the completed form to the Construction Division, Nebraska Department of Roads, PO Box 94759, Lincoln NE 68509-4759 or FAX to (402) 479-4854.***

Approval Block – For State Use Only	
Nebraska State Historical Society	**Nebraska Game and Parks Commission**
Date received from the contractor: _____	Date received from the contractor: _____
Date submitted to NSHS: _____	Date submitted to NGPC: _____
Return due date: _____	Return due date: _____
Approval date: _____	Approval date: _____
Non-approval date: _____	Non-approval date: _____
Signature: _____	Signature: _____

DR Form 119, Feb 01/

Figure 204.01

205.03 EQUIPMENT *(SSHC Subsection 206.03, Paragraph 9.a.)*

- Equipment should be sufficient to meet compaction requirements and the type of equipment used should be recorded in the field book.

Overweight Axle Loads *(SSHC Subsection 105.11)*

All oversize hauling units delivering equipment or materials to the project shall be legal loads and/or have appropriate hauling permits issued by the Motor Carrier Permit Office. The State Patrol Carrier Enforcement Division has enforcement authority outside of the project limits and on those portions of the construction project maintained to through traffic.

Hauling On or Over Surfaced Roads

The contractor must protect from damage all public roads that will be used by the contractor. Usually berms (greater than 300 mm (12 inches) thick) are constructed over the road surface for the earth moving equipment to use.

Certified flaggers are required when the berm is on an active road.

The berm must be removed from the road and shoulders at the end of each day when the road is active and the surface area cleaned.

The berm must be maintained constantly by the contractor. This will allow safe traffic flow over the berm.

205.04 CONSTRUCTION METHODS

Embankment Construction *(SSHC Section 205)*

The construction of embankments is covered in *SSHC Section 205*. This Subsection provides a more detailed picture of certain procedures mentioned in the *Specifications*. These comments should be regarded as explanatory but in no way supersede or invalidate Specification requirements.

Site Preparation

All trees, shrubs, cornstalks, sod, and other vegetation are to be removed and disposed of according to *SSHC Section 202*. After cornstalks and tall grass are cut and removed, the area within the limits of construction is to be thoroughly disced and scarified.

Deposition of Embankment Material *(SSHC Subsection 205.03)*

On projects where a slope is being widened, "benching" will be required.

Hauling units should be directed over a fill so that uniform compaction will result.

The self-propelled tamping type roller may be used on the embankment area for leveling as long as the unit follows the prescribed rolling pattern, does not spin the power drums, and accomplishes both rolling and leveling to the satisfaction of the Project Manager.

Decisions and unusual situations should be recorded in the field book.

Compaction

Embankments shall be compacted as prescribed in *SSHC Subsection 206.03*.

Class I embankments are to be rolled when specified by special provisions or plans; no moisture-density tests required.

Class II embankments require rolling; no moisture-density tests required.

Class III embankments require moisture-density control. The moisture content of soils being handled for these embankments is very important because the objective is to stabilize soils and improve their engineering behavior by compaction. Maintaining a soil to near "optimum moisture" during grading operations will reduce the time and compaction effort necessary to obtain the required density.

Note:
- Class I and II embankments require only enough moisture in the soil to attain a compaction acceptable to the Project Manager.
- Class I - no moisture requirement by *Specifications*.
- Class II - drying only required if necessary to obtain compaction.

Moisture control; water acts as a lubricant and helps the soil particles move relative to each other into a denser condition when compaction effort is applied. Dry soils must have water added and be thoroughly mixed before compacting. A general guide would be to add water to silt-clay soils when lab or field tests indicate moisture content is five percent or more below the optimum.

When wet and dry soils are placed in the same lift, they should be disc blended to a uniform condition prior to compaction.

Soft Ground; embankments that cross low wet areas may require an initial stabilization layer which is granular material. Usually the Project Manager will permit a working platform, up to 1.0 m (3 feet) thick, to be placed in one lift when bridging a soft area. Sand, gravel, or well graded crushed rock may be used for this initial lift. Compaction should proceed with caution. In general, the use of vibratory rollers should be discouraged since the vibrations may cause underlying soil to pump into the granular fill. In some areas, capillary action will move moisture into the upper grade by equipment moving on it. Contact Materials & Tests when you encounter this situation and it is not covered in the Plans.

◆ HELPFUL HINTS

Sand embankment directly deposited by dredge pipe will obtain about 95% of NDR T 99 proctor density by the transporting water flowing through the fill. For this method of placing sand, other methods of compaction may be required. Testing should be done at regular intervals and recorded in the field book. The time for this test is just after the free water leaves the top 200 mm (8 inches) of fill and can be done very quickly with a nuclear density gauge.

Sand lifts should be placed the full width of the embankment. If this cannot be done, a sand trench drain should be placed to eliminate ponding water.

If soils are too wet, compactive effort increases the pore water pressure and holds the particles apart. The upper limits on moisture has been set above optimum and recommendations are based on the type of surfacing or embankment designed. (Requirements are shown on the plans and/or in design files).

Wet soils can become elastic and result in heaving or pumping of the embankment when loads are applied. This is caused by water pore pressure and the strength of the soil is substantially reduced. If the embankment has not been damaged, equipment should stay off of the area long enough to allow excess pore pressures to dissipate naturally. If loading were to continue on wet soil, it may have shear failure or rutting. The Project Manager should explain to the contractor that continued operations can only worsen the situation and require removal. Take a moisture measurement to show the contractor that the soils moisture content is rising and to document that the contractor is damaging the soil.

The contractor should be encouraged to route hauling equipment as evenly as possible over the entire surface area of the embankment during soil placement. This will reduce possible rutting or damage caused by heavy equipment following one path.

The nuclear gauge for moisture and density determination may be used. Only properly trained and qualified nuclear gauge operators can use a nuclear gauge.

Nuclear gauges are to be operated according to NDR T 238, AASHTO T 238 and ASTM D 2922. Test results are distributed according to the instructions on the test form. This form may be used without field book entries.

Use the nuclear gauges printout as the official project record.

Moisture Density Curves

When a grading inspector is not sure which moisture density curve to use, he/she should review the available soils information at the location in question. If it is determined that there is not a moisture density curve to represent the soil in question, then a 1-point moisture density curve may be run in the field according to NDR T 505. Only use the 1-point curve method until Materials & Tests can determine the complete curve data for the soil.

During compaction, the mold shall rest on a firm surface such as concrete box culverts, bridges, and pavements.

Construction of Embankment Toe Berms

If the plans require a berm, it should be constructed at the same time as the embankment.

Toe berms are built in areas where the roadway is used as a dam for a pond. In these areas the berm is used to protect the embankment from saturation by the standing water. Also to help construct fills on unstable ground. Proper compaction and soil types are needed to reduce permeability of the fill.

Construction of Bridge Approach Fills

Toe stakes should be set and the slopes and the centerline checked during the construction of the embankment. The slopes should be finished to the lines and grade called for in the plans.

In the construction of these berms, particular attention should be given to prevent the incorporation of rocks over 100 mm (4 inches) in diameter as the lifts are placed. Rocks cause extreme difficulty when driving piling or preboring for piling.

The removal of boulders greater than 1 m (3 feet) in diameter in bridge berms should be covered as "extra work".

Bridge approach fills should be constructed to grade with adequate length along the centerline for the bridge contractor to work. This length should be adequate for the bridge contractor's storage of material. Usually 30 to 45 m (100 to 150 feet) are adequate. This can be shortened by mutual agreement between the contractors.

On some projects settlement plates are required along with delay periods for abutment construction. The settlement plate readings are sent to Materials & Tests for comparison with the design settlement predictions. In cases where the settlement differential is minimal (near the end of the delay period), the delay period may be reduced with Materials & Tests approval.

Earthwork-Measured-in-Embankment

Payment for embankment in place will be based on the plan quantity.

Sections of deep fills may have the quantities adjusted, based on settlement plates. These settlement plates should be well protected to insure that they are not damaged or destroyed.

A graph may be plotted with fill height vs. settlement to determine settlement at intermediate heights of fill. Using this chart, the settlement below the original ground line can be determined and plotted. The volume between the plotted settlement line and original ground can then be calculated using the average end cross section method. This volume is added to the plan quantity for final payment.

Prewatering Plan

The contractor shall present a prewatering plan at the pre-construction conference when prewatering is required. The plan should be approved by the Project Manager.

Payment for Water for Embankment Construction

When water is required for compaction of embankments other than Class III, it should be paid for as extra work if no contract item has been provided.

When water is required for moisture and density control, the cost of adding and incorporating water is a part of the item.

Finishing

Finish grading must be completed on a timely basis so that erosion control measures may progress satisfactorily. Special provisions on many projects limit the surface area that the contractor may disturb. Generally, this area is 75,000 m² (90,000 square yards), excluding areas to be paved, plus an equal amount of clearing and grubbing area may be opened up. The Project Manager may increase these limits but only by written notice to the contractor. If used, this written notice should include justification for the increase and special procedures the contractor must use to safeguard the environment. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average two-lane, full grading project. Any repair required on sections that have been tentatively accepted will be considered extra work (unless considered to be the fault of the contractor) and if performed by the contractor they are entitled to additional pay as provided for in *SSHC Subsection 109.05*. Therefore, final cross sections may be taken on a section of grading after it is tentatively accepted per *SSHC Subsection 105.13*.

If the finishing work is not performed on a timely schedule, the Project Manager is advised to follow these progressive steps:

- Project Manager should notify the contractor of the concerns in writing.
- If this does not obtain results, suspend estimate payments.

Tentative Acceptance

Areas that have been final graded may be accepted by the Department. However, do <u>not</u> accept an area until silt fence, cover crop, erosion checks, and other erosion control measures are in-place. Do not tentatively accept areas where the contractor must operate equipment to do other requirements. For example, shoulders and foreslopes should not be accepted until pavement and shoulders are finished. Ditch bottoms are a questionable area for tentative acceptance. Often, the Contractor plans to use material in the roadside ditch bottom to build the shoulder. In these cases, do not tentatively accept the ditch bottom until the shoulder work is also complete.

206.00 TOPSOIL *(SSHC Section 207)*

206.01 CONSTRUCTION METHODS

Stripping, Salvaging, and Spreading

The areas of stripping, salvaging, and spreading of topsoil should be identified on the plans or Special Provisions.

Topsoil on Roadway Cuts and Embankments

Where sand pockets are encountered on backslopes and where sand is used for embankment, every effort is made by Roadway Design to place topsoil on these areas. Where these situations are missed, every effort should be made by the Project Manager to obtain topsoil for use as cover for the sand areas. If no topsoil is available, see plans for proper erosion control.

206.02 BASIS OF PAYMENT

- As topsoil is removed and stockpiled, the contractor may be paid at one half the item unit price on the progress estimate. At the time the topsoil is spread and finish graded, the remaining one half may be paid on a progress estimate.

- Topsoil quantity is based on the area where the topsoil is placed. The excavation volume is not adjusted when the project has topsoil as a pay item.

207.00 OVERHAUL

SSHC Section 209 outlines the method used to determine the quantity for overhaul.

SECTION 201.00 -- EARTHWORK INSPECTION CHECKLIST

EMBANKMENTS/EXCAVATION

SSHC References:

Section 205 Excavation & Embankment
Section 1033 Aggregates

Other References:

NDR, Materials & Tests, Earthwork Engineering Guide
NDR Materials and Sampling Guide
NDR Standard Test Methods

Inspection Crew:

Grade Inspector

Inspection Equipment:
(AASHTO T 238)

Nuclear Density Gauge (With Manual)
Nuclear Density Gauge probe puller or auger.
Thermometer (Surface)
Scale (Dept. of Ag. Certified)
Metal Thickness Ruler
3 m (10 foot) straightedge
Gravel Sampling Bags

Equipment
(NDR T 205)

Spade.
Rubber Balloon (flexible membrane)
Sand.
Calibrated container with an air valve and a volume indicator.
Base plate.

Embankment/Excavation
Procedures:

General Comments:

1. The operations of excavating the roadway and borrow material (Roadway Excavation) and the placing, compacting and finishing of the excavation material in the embankments or fills (Embankment) are inspected and controlled as a single "Grading operation".
2. The value of grading may be considerable.
3. “No building is better than its foundation" and good quality embankments and subgrade are essential to the good performance and quality of the base course and pavement structure.
4. The grade inspector's work is of the utmost importance in producing a quality riding surface for the motorist.

5. The large and fast grading equipment employed by grading contractors means inspector should be on site to sample each lift.
6. The inspector should be thoroughly familiar with *SSHC Section 205 Excavation and Embankment*.
7. Check all contract documents for grading requirements.
8. The type of embankment compaction will be specified in the plans (generally on Sheet No. 3).
9. Construction notes in the plans should be noted and checked against physical features on the project. The right of way should be checked for physical features and obstructions which may not be shown in the plans. Typical items to be checked:
   a. Check the construction widths needed, and fences which must be moved, and compare them with the available right of way and contracts for additional right of way, borrow and construction easements.
   b. Utility pole lines - check against construction limits and utility agreement provisions.
   c. Survey or other type monuments or markers - mark or relocate.
   d. Selective placement notes.
   e. Trees or shrubs which are indicated in the plans to be preserved -mark as necessary.
   f. The Design file contains all of the preliminary and design information of the soils, pit sketches and contracts, preliminary soil compaction curves and soil tests.
10. Rights of adjacent property owners will be protected.
    a. Tile lines and intakes should be located, replaced, and repaired to maintain the integrity of the subsurface drainage. (Preventing unintended drainage from reaching adjacent property.)
    b. Right-of-way contracts should be checked for possible special negotiated items which should be included in the work being done.
11. Any contractor operation that causes damage to partially completed or completed work shall be reported to the Project Manager and noted in the Daily Diary.
12. Make sure the contractor installs silt fences prior to commencing soil disturbing work.

See Subsection 1300.03

Preconstruction Conf:	13.	Preconstruction Conference (See Subsection 102.01) a. The Project Manager should go over the unusual, difficult, or special items with the grading inspector, and with the contractor.
1-800-331-5666		b. Remind the Contractor to call "1 CALL - Diggers Hotline of Nebraska", for buried utilities, pipe lines, sewers, communication cables, etc. - check for possibility of such not being shown and be sure provisions are made to mark or protect as necessary to prevent damage. c. Inspection and Control of Grading Operations d. The contractor's Pre-Watering Plan should be presented and discussed. e. Discuss selective placement requirements. f. Determine what contractor will do to keep stockpiles free from contamination. g. Removal and storage of topsoil materials, shall be discussed. h. Project schedule. *(SSHC Subsection 108.07)* i. Partnering procedures. j. Traffic control. k. Archeological & palentological discoveries. l. Environmental issues(Erosion Control, Wet Lands, Migratory Bird Nesting) m. Detours and Shooflies. n. Railroad Special Provisions. o. Safety issues (Guardrail removal, etc.) p. Material submittals.
	14.	Site preparation such as clearing and grubbing, wetlands preparation, removals, and vegetation disposal on cuts, fills, and borrows are accomplished according to contract documents.
Stockpiling:	15.	If stockpiling of selective placement material is necessary, <u>no payment</u> is made for re-excavation. (Topsoil, sand, or any soil identified as select materials.)
Clearing & Grubbing: A large tree has 1 m (3 foot) circumference at 1 m (3 foot) above ground line or if only the stump remains, a stump of 1 m (3 foot) circumference at ground level.	16.	If contract has "Large Tree Removal" count and record trees before work starts.
	17.	*SSHC Subsection 204.02* limits the surface area that the contractor may disturb to 75,000 m² (90,000 square yards) plus an equal amount of clearing and grubbing area.
	18.	The Project Manager may increase these limits but only by written notice to the contractor.
	19.	The written notice should include justification

for the increase and special procedures the contractor must use to safeguard the environment.

20. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer.
21. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average project.

Soil Moisture:

22. Check the moisture content of the excavation and borrow material 1-5 days before the contractor starts work.
23. Discuss the drying or moistening of the excavated material.
24. Check to see if contractor knows the condition of the soil.
25. Verify how the contractor will control moisture in Class "III" embankments
26. Contractor should mix clay/non-granular material to uniformly distribute the moisture and various soil types before compaction.
27. Pre-Watering can be wasteful. Ponding or sprinkling may require more water and more work than wetting the soil as it is placed.
    a. But the moisture content will be more uniform and dust will be eliminated.
    b. The contractor is responsible to obtain the soil samples both before and during the water application.
    c. The Project Manager will run moisture tests to determine water application rates and to check the progress of the penetration. Use nuclear density gauge to determine the moisture content at different elevations below the surface up to depth of cut. Compare the amount of prewater to the expected amount that would be required if added at time soil is placed.
    d. The following example does not allow for water lost by evaporation, run off, etc., and will need to be supplemented by information derived from subsequent testing.
    e. As a precautionary measure against overwatering, leave some dry material for mixing with soil which was over watered. (Required water per cubic meter) (cubic yard) - (Natural in place water in the soil per cubic meter) (cubic yard) = Amount of water to add or if negative result, the amount of water to remove per cubic meter (cubic yard).
    f. Preserve the natural vegetation on the area until the watering is complete.

g. If the vegetation is removed before watering, or the soil type, slope, or condition warrants, the ground should be ripped 650 mm (2 feet) deep on its contours approximately 1.2 m (4 feet) centers to allow penetration of water and minimize runoff.
h. Adjust the application rate to control runoff and erosion.
i. Construct dikes to control runoff and erosion.
j. Document any wasted water in field book.

28. Excavation areas should be disced immediately after pre-watering to reduce evaporation.
    a. A two to three week curing period is necessary to permit the water to move downward and become uniformly distributed in the soil.
    b. The importance and length of this curing period will vary with the soil type and conditions of the soil. (Clay very important--sand not important.)

Compaction:
(See *SSHC Subsection 206.03 para 9*)

29. Compacting equipment which produces a glossy surface shall not be allowed. This may cause lamination.
30. PM should approve all haul routes over structures.
31. Know the moisture/density requirements for each section of the project.
    a. Review *SSHC Subsection 205.03* for construction methods and procedures which give moisture, density, and lift thickness requirements.
32. a. A good practice is for the contractor to spread the soil as thinly and smoothly as practicable, to distribute the hauling equipment over the embankment to minimize the rolling.
    b. Discing is required to get uniform density.
    c. Layers must be compacted before the next layer is placed.
33. Require rolling over entire area--completely to the outside edges.
34. Require that hauling and leveling equipment is routed over the full width of the embankment.
35. Visually check the subgrade and the embankment under compacting equipment.
    a. When a sheepsfoot walks out of soil you have good compaction.
    b. Peorian clays may show movement/instability and yet be at specified density. (When this occurs, additional work is necessary to stabilize the fill.)
36. a. Compare earthwork to the stakes--tell the Project Manager and the contractor if something does not look right.

b. Make sure stakes are uniform and easily read.

37. Run one-point curves for soils that do not have corresponding compaction curves.

Subsurface Concerns:

38. Insist that all objectionable material such as logs, vegetation, trash, or unsuitable soils are removed before fill is started.

39. a. Require old pavements to be removed if embankment will not be greater than 1 m (3 feet). If more than 1 m (3 feet) of embankment the pavement must be broken-up.

b. *SSHC Subsection 104.06* defines "minor obstruction" and lists examples of when the contractor should be paid extra for removal of unforeseen obstructions.

Drainage:

40. The roadbed will be adequately drained and protected at all times. (Poor drainage during construction often results in an inferior construction.)

a. The roadbed should be tight (shaped, bladed smooth, and rolled, so as to shed water) at the end of each day.

b. Flowable fill, granular fill, drain pipes, or other requirements may be necessary to permanently correct the problem.

Settlement:

41. Things to check:

a. Settlement or side slip may result in slopes or sidehills if not properly stepped or plowed.

42. Settlement may result at Grade points (0-0 sections) due to fill taper, improper or insufficient compaction and different soil type (Subsoil - topsoil - parent soil) meeting. Particular attention should be given to the compaction of the new embankment at 0-0 points. Usually blending to 1 m (3 feet) depth is required.

43. Settlement of areas adjacent to or over structures frequently occurs. Take additional density readings in these areas.

a. Proper placement and compaction of material in the areas inaccessible to rollers and the earth moving equipment will eliminate this problem.

b. This involves close contact inspection of compaction performed by small mechanical tampers, which is tiresome, manual work.

c. The inspectors' must confirm that this work is properly performed.

d. When the slope is greater than 1-vertical to 4-horizontal, step the ground to prevent wedging action against the structure.
e. Use selected soil which will compact readily, if available.
f. Silty soil should not be used.
g. During backfill operations, displacement of wing or abutment walls may be checked by erecting a "telltale" before backfilling is started and checking the wall for movement as the backfill progresses. If movement is detected, backfill operations should be suspended and the Project Manager advised of the problem.

44. Watch for and report unstable and unanticipated settlement to the Project Manager and Materials & Tests Engineer.
a. Bulging at the toe of the slope.
b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
d. Pumping action.

Foundation Engineer (479-4678)

45. Where surcharges are included in the plans as work to be accomplished during construction, the Soil Mechanics Section of the Materials and Research Division wishes to be informed before the beginning of the construction of the surcharge.
a. Construction progress and anticipated paving date may allow a change in the height of the surcharge necessary to complete the anticipated settlement.

Backfill:

46a. Confirm culvert backfill material meets specification requirements.

46b. Backfills on box and pipe culverts should be brought up evenly on both sides at the same time to avoid displacement of the structure.

47. When tamping under the lowest 90° of a culvert place elevation check stakes at the ends of the pipe to detect any rise.

48. The grade inspector should be alert to possible damage to any drainage structures which the contractor's heavy equipment may cause by crossing or working over such structures, and particularly to possible damage to pipe culverts covered with minimum fill.

a. The contractor shall be informed immediately of any observed damage and the information recorded in the field book.

Grades, Lines & Profile:

49. Large shortages or overages of excavation material may be encountered.
    a. Revising the grade lines, rebalancing, or obtaining additional material outside construction limits or balance points require prior District approval.
    b. The Project Manager should be contacted on all overage or shortage conditions.
50. The grade inspector should inspect and advise the Contractor of deviations from the lines and grades as staked by the Project Manager.
51. The inspector should note any actual construction balance points in the grading notebook.

See Survey Blue Tops

52. Finish grading
    a. The roadbed surface should be finished within 15 mm (5/8 inch) of the finish grade stakes.
    b. The shoulder lines and slopes should be <u>reasonably</u> true.
    c. Side ditches and borrow areas should be finished <u>reasonably</u> true to grade and should drain.
    d. Finish grade stakes should be set for finishing flow line grades in borrow pits if the width and grade are such that stakes are essential to finishing the pit to provide proper drainage without ponding.
    e. Finish grading must be completed on a timely basis so that erosion control measures may progress <u>satisfactorily</u>.

Covercrop Seeding:
(Agronomist Dick Gray
479-4537)

53. All finished work and any other areas that need erosion control should be kept current with covercrop seeding performed as the work progresses.

54. Any repair required on a section that has been tentatively accepted will be paid as extra work (unless considered to be the fault of the contractor). (*SSHC Subsections 105.13, 107.14* and 1*09.08* define tentative acceptance.)

Soil Tests:
(Form DR 86)

55. The inspector should require the contractor to move the field lab as necessary to facilitate the field testing.

56. The grade inspector will test soil samples for two primary purposes.
    a. To monitor the effectiveness of the contractor's operations and use of forces and equipment in controlling the moisture and the compaction of the soil. These are called "job control tests".
    b. To verify that the completed work (compacted embankment) meets the requirements for moisture (if specified) and density. These are called "acceptance tests".

    The minimum number of tests necessary to verify that the compacted embankment meets the specified requirements for moisture and density will be shown in the *Materials Sampling Guide*.

57. The number of moisture-density tests will vary but the minimum is spelled out in the *Materials Sampling Guide*. However, the inspector is encouraged to take additional tests as are necessary because with the nuclear density gauge, moisture and density are easily monitored. "Job control tests" which indicate the need for additional work to meet moisture-density requirements shall not be counted in the "acceptance tests" since a check test would be required in the area represented by the original sample.

Grading Diary:

58. Grading diary, shall include:
    a. Date, weather, soil conditions.
    b. Information on contractor's forces -include numbers of personnel, numbers, types, and sizes of equipment, hours worked each day.
    c. Data on work in progress -section of the project, balance limit, channels, dikes, rough grading or finish grading, etc. This should include a record of known construction balance points, particularly balance points between "off-site" borrow pits.
    d. Weather conditions or other conditions affecting the progress of or delaying prosecution of the work, equipment break downs, etc.
    e. Sufficient records of the progress of the work, to enable the Project Manager to prepare progress reports, working day reports and progress estimates accurately.
    f. Estimates of wasted water, and cause.
    g. Disputes.

h. Contractor's progress should be monitored to check that the work is being completed according to the construction schedule. Report major deviations.

Field Book

59. Field Book Entries

a. Any supporting information or records necessary to facilitate the preparation of the required reports on sampling and testing (see Materials and Research "Earthwork Engineering Guide").
b. Calibration of distributor water tanks and of meter accuracy if the water is metered.
c. Daily record of water hauled (on large projects the water applied may be kept in a separate "water application notebook"). Include location (i.e., station of the excavation, borrow pit, embankment or surface) where water was applied and obtained.
d. Select placement, confirming information, etc.
e. Identify all work performed on the project by the contractor and subcontractor actually completing each pay item.
f. Make entries supporting extra work quantities.
g. Get the contractor representative signature agreeing to pay quantities in the entry.

Measurement:

60. Method of Measurement

a. See CM Subsection 1300.04 for instructions to take cross sections. (Use Geopak when possible.)
b. Measure and pay authorized excavation of material below grade and overbreakage or slides.
c. Unsuitable material which is removed below grade in excavation areas, or below existing ground in embankment areas, is considered to be "authorized excavation of material below grade".
d. If the existing ground in an embankment area must be dried to such a depth as to be impractical to dry in place, the contractor may be ordered to undercut (excavate below grade) and haul this material to higher areas, drying and using it in the construction of embankment.
e. The volume of the undercut would also be considered to be authorized excavation below grade, and the volume measured and paid.
f. Larger quantity under cuts should be authorized by the District Construction Engineer and the volume should be measured by cross sections.

Tell the Contractor what is "larger" at the preconstruction conference.

61. Water, Applied
    a. Distributor truck tanks may be calibrated by determining the mass of both the empty and filled truck. The net mass (kg) (lb) is the tank capacity, in liters (gallons).
    b. Each truck tank should be numbered and the numbers and capacities recorded in the water haul notebook.
    c. Calibration of meters for the pre-watering methods may be accomplished by pumping through the meter into a water truck and checking the mass of water against the liters on the meter.
    d. Meters may be calibrated by registered pump and meter service companies and their calibrations may be used if they are current. Calibrations are good for one year.
    e. Inspector must convert meter readings in English units to S.I. units (metric).
    f. Trucks that are too large to measure their mass on available commercial scales may be calibrated from capacity if model numbers, serial numbers, etc., are the same as shown on the specifications literature.
    g. If the water is measured by tank count, the grade inspector will record each day, the number and size of loads delivered to the project by each truck.
    h. If the quantity of water is measured by a meter, the grade inspector will record the meter readings at the beginning or ending of each day or shift.
62. Calibration
    a. Water meter calibration sheets usually show a correction factor to be used to convert meter volume to actual volume for differing rates of delivery.
    b. The rate of delivery for the application can be determined by timing the meter and computing the liters (gallons) per minute being delivered.
    c. The liters (gallons) per minute delivered will vary with the length of pipe and number of sprinkler heads being used.
    d. Therefore, the delivery rate should be determined and documented for each pipe setup so the correction factor can be determined and used.

63. Wasted Water
    a. The quantities of water wasted or not eligible for payment should be entered in the records each day with substantiating or estimating information to support the quantity deducted or ineligible for payment.
    b. The contractor should be furnished the documented quantities of water wasted each day, to facilitate resolving of any discrepancies in quantities.
    c. The grade inspector is responsible for the proper determination of the quantities of water measured for payment, and each day's entry in the notebook should be validated by his/her signature and agreed to by the contractor and signed.
64. Metering is more practical and economical than a tank measurement.
    a. Encourage the contractor to provide an acceptable meter at the point of loading the trucks to measure the water for payment.
    b. If the water is being applied by the truck sprinkler method, the "Water Applied Haul Sheet" (DR Form 8) may be prepared by the truck driver, and used by the grade inspector to determine the distribution of water applied on various sections of the project, finishing, etc., and for cross-checking quantities.
    c. These sheets are to be used for this purpose only and not for payment, and should not be submitted with the final records.

Critical Construction Requirements:

1. Preconstruction Conference
2. Verify how the contractor will control moisture in Class III" embankments.
3. Visually check subgrade and embankment under compacting equipment.
4. Stability and Settlement Indications. Watch for and report to the Project Manager and Materials & Tests Engineer indications of instability.
    a. Bulging at the toe of the slope.
    b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
    c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
    d. Pumping action.
5. The roadbed will be adequately drained and protected at all times. Roadbed should be bladed smooth and rolled tight at the end of each day.

6. All contract pay items will be properly documented.

Safety Areas:

1. Maintained Traffic
   a. Contractor's cars and trucks must adhere to project traffic control procedures.
   b. Flaggers must be certified and use proper procedures.
2. The contractor should be told to stop all unsafe activities such as:
   a. Speeding trucks and other equipment.
   b. Inoperable back-up alarms.
   c. Inoperable or nonfunctional strobe lights.
3. Contractor vehicles shall be parked beyond the lateral obstacle clearance.
4. Worker protection barriers should be placed as shown in the plans.
5. Traffic markings should clearly indicate traffic flow.

NDR Tests:

1. Nuclear Density NDR T 238
2. NDR T 99 Soil Density (See Earthwork)
3. Soil Type NDR T 87
4. NDR T 2 Sampling Aggregate from Stockpiles
5. Moisture: NDR T 217, T 205, or Nuclear Density Gauge AASHTO T 238/ASTM D 2922.

Sampling Requirement/ Freq.:

1. See Materials Sampling Guide

Inspector's Records & Forms

1. Grading diary
2. Water application notebook
3. Field book
4. DR Form 8, Water Applied Haul Sheet
5. DR Form 86, Weekly Report of Moisture-Density Tests or Nuclear Density Machine Output

NDR Point of Contact

1. Materials & Tests Soil Mechanics Engineer 479-4678

202.00 GENERAL GRADING INSTRUCTIONS

Grading Inspection

A grading inspector should devote the majority of his/her time to observing and checking the contractor's excavating, drying, moistening, spreading and compacting operations, and securing samples, vary the balance of his/her time in testing samples and making neat and accurate records. The grade inspector will need to check moisture (if control is required) and density at the rate shown in the Materials Sampling Guide (usually check moisture and
@ density once for each 2,500 cubic yards (2000 m^3) placed and once for each 1000 feet (300 m) of shoulder or subgrade).

Blue Tops

After the roadway excavation and roadway embankment has been constructed substantially to grade elevations, the construction survey party will set finish grade stakes for finishing the grade or subgrade to the lines and grades shown in the plans. The blue top book elevations must be checked to insure they conform to the information shown on the plan cross-sections.

Rounding of Hinge Points

The Department has determined that the rounding of “hinge points” in the cross-sectional elements can significantly reduce their potential as hazards. Rounded slopes reduce the chances of an errant vehicle becoming airborne, reduce the hazards of encroachment, and afford drivers more control over their vehicles.

The Construction Division suggests that finish grading and ground preparation activities that result in the rounding of hinge points be permitted, if not encouraged. For example, an 8’ disc that “hangs over” a 6’ shoulder will provide the desired effect and should not be ruled unacceptable. However, this suggestion is not meant to imply that the cuts and embankments may be built to other than the cross-sections shown in the plans.

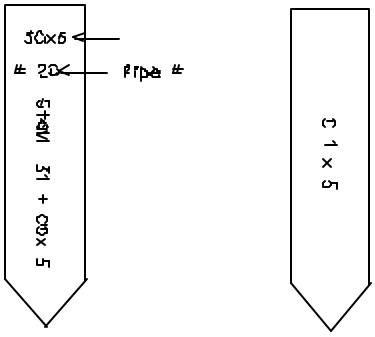
Erosion Control

@

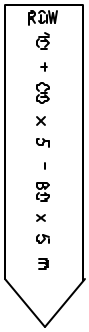
The contractor must have as a minimum silt fence or other erosion control measures as shown in the plans installed to keep silt on our ROW before any grading is allowed.

CULVERT STAKES

Offset



ROW STAKES



Green-yellow flag for easements

Orange flag ROW

c:\users\default\bolts.dgn Jan. 28, 1998 15:41:31

203.00 CLEARING AND GRUBBING *(SSHC Section 202)*

203.01 CONSTRUCTION METHODS

There may be considerable elapsed time between an estimate of clearing and grubbing and the actual work. If actual site conditions are different than those shown in the contract documents, the following suggested resolutions are provided:

- If the pay item is "General Clearing and Grubbing" then no action is necessary
@ because tree removal is subsidiary for trees with circumference of 80 inches or less at 40 inches above ground level.

- If the pay item is "Large Tree Removal" then a new tree count should be taken and recorded before the contractor starts work.

@ - If a tree has been cut, leaving branches and the stump, payment is covered under "Clearing and Grubbing" or "Large Tree Removal." If the stumps is the only item remaining and payment method is large tree removal, you would count just the stump as a tree.

- If a fence is partially removed or in poor condition but requires an identifiable removal operation, full price for fence removal may be made.

@ - Where brush and/or junk has recently (After the letting was announced) been deposited within the right-of-way, a price agreeable to both the contractor and the Project Manager may be negotiated or a force account extra work order may be used.

Disposal of Waste

Disposal of the clearing and grubbing waste is restricted according to applicable federal, state, and local laws. Disposal options include:

- Open Burning

@ Contractor must obtain necessary permits. In locations where burning is allowed, the burning of the waste must be located at least 1/4 mile (400 m) from any inhabited building.

- Chipping

  Chipping of the down timber for mulching material.

- Firewood

  Salvage of the logs for firewood.

- Landfill

  Disposal at a "yard waste" landfill.

204.00 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

204.01 CONSTRUCTION METHODS

Removal and Disposal of Old Pavement

@ Pavement is removed from all cuts and fills with less than 3 feet (1 m) of cover. The removed concrete is to be broken into pieces with an area of 2 square feet (0.2 m²) or less if placed in fills. *(SSHC Section 203)*

@ Where existing PCC pavement would be located more than 3 feet (1 m) under the proposed profile grade, the PCC pavement will be required to be broken into surface areas that will not exceed 4 square feet (0.4 m²) when left in place. If the existing pavement has been resurfaced, the asphalt resurfacing will be removed if the PCC pavement is to be used as slope protection or in a waterway. *(SSHC Subsection 205.03)*

Disposal of Asphaltic Concrete Pavement

The contractor shall manage the material in accordance with all current federal and state rules and regulations. *(SSHC Subsection 107.01)*

@ Salvaged asphaltic cement concrete pavement may be used as special backfill material. When intended for special backfill material, the ACC pavement is normally removed by scarification. Removed bituminous materials may be placed in the outer slopes of embankments, 12 inches (300 mm) below the finished shoulders and foreslopes. *(See SSHC Subsection 205.03)*

Hazardous Material (Wells, Asbestos Fibers in ACC, Building Removal, Underground Storage Tanks, Archeological Remains)

Appropriate federal, state and local regulations must be followed. (See *Construction Manual Division 1100* for further guidance).

205.00 EXCAVATION *(SSHC Section 205)*

205.01 DESCRIPTION

The importance of being able to identify soil types cannot be overemphasized. Some soil types have to be placed in the proper location. The inspector must be sure that the work is performed according to the plans.

The balance factor is the change in quantity from cut to fill and includes subsidence, change from borrow density to the final compacted density, incidental loss, and all other factors changing density.

205.02 MATERIAL REQUIREMENTS

Embankment and Excavation Soils Criteria *(SSHC Section 206)*

There are four basic categories of earthwork.

- Excavation
  - ♦ Usually final cross sections determine pay quantity.
  - ♦ No off-site borrow is required.
- Excavation (Established Quantity)
  - ♦ Payment is based on the plan quantities.
  - ♦ No off-site borrow is required.
- Excavation Borrow
  - ♦ Usually final cross sections determine pay quantities.
  - ♦ Borrow will be needed from off-site source(s).
- Earthwork-Measured-in-Embankment *(SSHC Subsections 205.04/205.05)*
  - ♦ Plan quantities of the proposed embankment are used to determine the payment quantity.
  - ♦ Contractor must forecast shrinkage. (A change from borrow density to compacted density.)
  - ♦ Borrow from off-site sources.

"Excavation" and "Excavation Borrow" are paid based on final cross sections. The Project Manager may forego the final cross sections when the contractor agrees, in writing, that the plan quantities, including field adjustments and revisions, accurately reflect the work done. Payment will be made under the original contract items. It is not necessary to eliminate the original contract item and establish a new “E. Q.” item. Refer to Page 129.

@

The Project Manager and the contractor may elect to measure areas in question and accept the remaining areas as "Established Quantities."

Unsuitably Wet Material

In low-lying areas and in wet soil contact zones, it may be necessary to declare most of the material as unsuitably wet at the direction of the Project Manager. A granular material that will drain can be used to replace the wet soil. An effort should be made to provide an outlet for water which may occur in the embankment or subgrade. Most wet soils that are removed can be dried and reused in some other area.

Soft shale, in some cases, can be moved in a manner similar to soil excavation. Shale cuts are usually benched and covered with topsoil in accordance with the plans. If unexpected shale is found, contact the Materials and Research Soil Mechanics Engineer. Slides can occur in backslopes of shale cuts, and flatter slopes may be required.

Rock Material (See *SSHC Subsection 107.08 and Section 206*)

If material to be excavated is too tough to be ripped, the Project Manager, contractor and a geotechnical specialist experienced in blasting should discuss the aspects of the work to be done.

Contractor Furnished Borrow Areas *(SSHC Subsection 205.03)*

On some projects, the contract documents will require a "contractor borrow." In these cases, the contractor is responsible for submitting a site approval request to the Construction Division (allow 60 calendar days for the Construction Division to obtain site approval from Nebraska agencies).

Construction Engineer
Nebraska Department of Roads
1500 Highway 2
P.O. Box 94759
Lincoln, Nebraska 68509-4759
Fax No. (402) 479-4854

The approval request shall include:

- A Borrow Pit/Materials Pit Identification and Evaluation Form for each site.
- An aerial photo or topographical map showing the location of the pit site (one photo or map for each site).

No material will be removed from the site prior to the Project Manager's written approval of the sites.

The contractor shall also obtain a Corps of Engineers approval letter for the site and submit this to the Project Manager. The contractor shall submit a topographical map or a photocopy of an ASCS aerial photograph showing the exact location of the proposed pit sites to the Corps of Engineers. A legal description of the location should also be included.

Corps of Engineers
Regulatory Branch
P.O. Box 5
Omaha, NE 68101-0005

ASCS aerial photos are available at county ASCS offices at a nominal cost. ASCS aerial photos cover agricultural ground only. In some instances, aerial photos or urban areas are not available from the ASCS.

Topographic maps may be obtained from the following source:

University of Nebraska
Conservation & Survey Division
113 Nebraska Hall
Lincoln, NE 68588-0517
Attn: Judy Otteman
(402) 472-7523

Approval For Soil Type (Contractor furnished borrow)

- The Contractor will obtain soil samples to verify material is acceptable. The Project Manager will forward the samples to the Materials & Tests Office for evaluation. (See *SSHC Subsection 205.02.*)

Preservation of Cultural Resources *(SSHC Subsections 205.03 and 107.10)*

Cultural resources are the composite of archaeological and historic/architectural resources in an area. A common cultural resource site is a burial ground or remains of a Native American village.

Nebraska law requires action be taken to insure that cultural resources are not damaged or destroyed.

If a cultural site is discovered during construction, the contractor is required to temporarily discontinue work at the site. Upon discovering such a site, the Project Manager shall notify the Construction Office of the finding.

Nebraska Game and Parks Commission Approval of Borrow Sites

- All Contractor borrow sites must be submitted to the Nebraska Game and Parks Commission (NGPC) for approval. The NGPC will examine the proposed site for endangered plant and wildlife species and for potential Platte River drainage system depletion. This process can take 60 days or more.

Borrow Pit/Materials Pit Identification and Evaluation

Date:	
Project No.:	Control No.:
Project Location:	County(s):
Requesting Contractor:	Phone:

Pit Size and Location

1. Pit Identification No.: _____
2. Identify the precise location of the pit *(to 2.5 acres)*:

   ____ ¼, of ____ ¼, of ____ ¼, of ____ ¼, of Section ____ , T- ____ -N, R- ____ - ____

3. Attach a copy of an ASCS aerial photo and/or a copy of an USGS 1:24,000 scale topographic map precisely depicting the pit location.
4. Give pit dimensions *(in feet)* and orientation *(NE-SW, etc.)* for long axis *(length)*, short axis *(width)* and depth.

   Length: Feet: _____ Orientation: _____
   Width: Feet: _____ Orientation: _____
   Depth: Feet: _____

5. This is a: ☐ Dry Pit ☐ Wet Pit
6. Will this pit pond water when completed? ☐ Yes ☐ No
7. Pit location is owned by: ☐ Private Owner ☐ Commercial/Business ☐ State/County/City Government ☐ Federal Government
8. Name of Owner: _____

Pit Characteristics

1. Pit location is for: ☐ Borrow ☐ Material ☐ Both ☐ Other *(Explain)*
2. To your knowledge, has this pit location been used previously for borrow and/or materials? ☐ Yes ☐ No ☐ Unknown
3. The pit location is presently used for: ☐ Commercial Borrow/Materials ☐ Pasture ☐ Row-Crop Agriculture ☐ Stock Pond ☐ Irrigation Recharge Pit ☐ Urban/Suburban Residential ☐ Stockpiled Borrow/Material ☐ Other *(Explain)*
4. Vegetation cover is: ☐ Grass ☐ Trees ☐ Weeds ☐ Crops ☐ Other *(Explain)*
5. Name, address, phone number of contact person, if additional information is required:

Contractors requesting use of borrow or materials pits for Nebraska Department of Roads' construction projects need to identify their location and character on this form. Please fill in the blanks with the correct information or select appropriate answers to questions. ***Send the completed form to the Construction Division, Nebraska Department of Roads, PO Box 94759, Lincoln NE 68509-4759 or FAX to (402) 479-4854.***

Approval Block – For State Use Only	
Nebraska State Historical Society	**Nebraska Game and Parks Commission**
Date received from the contractor: _____	Date received from the contractor: _____
Date submitted to NSHS: _____	Date submitted to NGPC: _____
Return due date: _____	Return due date: _____
Approval date: _____	Approval date: _____
Non-approval date: _____	Non-approval date: _____
Signature: _____	Signature: _____

DR Form 119, Feb 01/

Figure 204.01

205.03 EQUIPMENT *(SSHC Subsection 206.03, Paragraph 9.a.)*

- Equipment should be sufficient to meet compaction requirements and the type of equipment used should be recorded in the field book.

Overweight Axle Loads *(SSHC Subsection 105.11)*

All oversize hauling units delivering equipment or materials to the project shall be legal loads and/or have appropriate hauling permits issued by the Motor Carrier Permit Office. The State Patrol Carrier Enforcement Division has enforcement authority outside of the project limits and on those portions of the construction project maintained to through traffic.

Hauling On or Over Surfaced Roads

The contractor must protect from damage all public roads that will be used by the contractor. Usually berms (greater than 300 mm (12 inches) thick) are constructed over the road surface for the earth moving equipment to use.

Certified flaggers are required when the berm is on an active road.

The berm must be removed from the road and shoulders at the end of each day when the road is active and the surface area cleaned.

The berm must be maintained constantly by the contractor. This will allow safe traffic flow over the berm.

205.04 CONSTRUCTION METHODS

Embankment Construction *(SSHC Section 205)*

The construction of embankments is covered in *SSHC Section 205*. This Subsection provides a more detailed picture of certain procedures mentioned in the *Specifications*. These comments should be regarded as explanatory but in no way supersede or invalidate Specification requirements.

Site Preparation

All trees, shrubs, cornstalks, sod, and other vegetation are to be removed and disposed of according to *SSHC Section 202*. After cornstalks and tall grass are cut and removed, the area within the limits of construction is to be thoroughly disced and scarified.

Deposition of Embankment Material *(SSHC Subsection 205.03)*

On projects where a slope is being widened, "benching" will be required.

Hauling units should be directed over a fill so that uniform compaction will result.

The self-propelled tamping type roller may be used on the embankment area for leveling as long as the unit follows the prescribed rolling pattern, does not spin the power drums, and accomplishes both rolling and leveling to the satisfaction of the Project Manager.

Decisions and unusual situations should be recorded in the field book.

Compaction

Embankments shall be compacted as prescribed in *SSHC Subsection 206.03*.

Class I embankments are to be rolled when specified by special provisions or plans; no moisture-density tests required.

Class II embankments require rolling; no moisture-density tests required.

Class III embankments require moisture-density control. The moisture content of soils being handled for these embankments is very important because the objective is to stabilize soils and improve their engineering behavior by compaction. Maintaining a soil to near "optimum moisture" during grading operations will reduce the time and compaction effort necessary to obtain the required density.

Note:
- Class I and II embankments require only enough moisture in the soil to attain a compaction acceptable to the Project Manager.
- Class I - no moisture requirement by *Specifications*.
- Class II - drying only required if necessary to obtain compaction.

Moisture control; water acts as a lubricant and helps the soil particles move relative to each other into a denser condition when compaction effort is applied. Dry soils must have water added and be thoroughly mixed before compacting. A general guide would be to add water to silt-clay soils when lab or field tests indicate moisture content is five percent or more below the optimum.

When wet and dry soils are placed in the same lift, they should be disc blended to a uniform condition prior to compaction.

Soft Ground; embankments that cross low wet areas may require an initial stabilization layer which is granular material. Usually the Project Manager will permit a working platform, up to 1.0 m (3 feet) thick, to be placed in one lift when bridging a soft area. Sand, gravel, or well graded crushed rock may be used for this initial lift. Compaction should proceed with caution. In general, the use of vibratory rollers should be discouraged since the vibrations may cause underlying soil to pump into the granular fill. In some areas, capillary action will move moisture into the upper grade by equipment moving on it. Contact Materials & Tests when you encounter this situation and it is not covered in the Plans.

◆ HELPFUL HINTS

Sand embankment directly deposited by dredge pipe will obtain about 95% of NDR T 99 proctor density by the transporting water flowing through the fill. For this method of placing sand, other methods of compaction may be required. Testing should be done at regular intervals and recorded in the field book. The time for this test is just after the free water leaves the top 200 mm (8 inches) of fill and can be done very quickly with a nuclear density gauge.

Sand lifts should be placed the full width of the embankment. If this cannot be done, a sand trench drain should be placed to eliminate ponding water.

If soils are too wet, compactive effort increases the pore water pressure and holds the particles apart. The upper limits on moisture has been set above optimum and recommendations are based on the type of surfacing or embankment designed. (Requirements are shown on the plans and/or in design files).

Wet soils can become elastic and result in heaving or pumping of the embankment when loads are applied. This is caused by water pore pressure and the strength of the soil is substantially reduced. If the embankment has not been damaged, equipment should stay off of the area long enough to allow excess pore pressures to dissipate naturally. If loading were to continue on wet soil, it may have shear failure or rutting. The Project Manager should explain to the contractor that continued operations can only worsen the situation and require removal. Take a moisture measurement to show the contractor that the soils moisture content is rising and to document that the contractor is damaging the soil.

The contractor should be encouraged to route hauling equipment as evenly as possible over the entire surface area of the embankment during soil placement. This will reduce possible rutting or damage caused by heavy equipment following one path.

The nuclear gauge for moisture and density determination may be used. Only properly trained and qualified nuclear gauge operators can use a nuclear gauge.

Nuclear gauges are to be operated according to NDR T 238, AASHTO T 238 and ASTM D 2922. Test results are distributed according to the instructions on the test form. This form may be used without field book entries.

Use the nuclear gauges printout as the official project record.

Moisture Density Curves

When a grading inspector is not sure which moisture density curve to use, he/she should review the available soils information at the location in question. If it is determined that there is not a moisture density curve to represent the soil in question, then a 1-point moisture density curve may be run in the field according to NDR T 505. Only use the 1-point curve method until Materials & Tests can determine the complete curve data for the soil.

During compaction, the mold shall rest on a firm surface such as concrete box culverts, bridges, and pavements.

Construction of Embankment Toe Berms

If the plans require a berm, it should be constructed at the same time as the embankment.

Toe berms are built in areas where the roadway is used as a dam for a pond. In these areas the berm is used to protect the embankment from saturation by the standing water. Also to help construct fills on unstable ground. Proper compaction and soil types are needed to reduce permeability of the fill.

Construction of Bridge Approach Fills

Toe stakes should be set and the slopes and the centerline checked during the construction of the embankment. The slopes should be finished to the lines and grade called for in the plans.

In the construction of these berms, particular attention should be given to prevent the incorporation of rocks over 100 mm (4 inches) in diameter as the lifts are placed. Rocks cause extreme difficulty when driving piling or preboring for piling.

The removal of boulders greater than 1 m (3 feet) in diameter in bridge berms should be covered as "extra work".

Bridge approach fills should be constructed to grade with adequate length along the centerline for the bridge contractor to work. This length should be adequate for the bridge contractor's storage of material. Usually 30 to 45 m (100 to 150 feet) are adequate. This can be shortened by mutual agreement between the contractors.

On some projects settlement plates are required along with delay periods for abutment construction. The settlement plate readings are sent to Materials & Tests for comparison with the design settlement predictions. In cases where the settlement differential is minimal (near the end of the delay period), the delay period may be reduced with Materials & Tests approval.

Earthwork-Measured-in-Embankment

Payment for embankment in place will be based on the plan quantity.

Sections of deep fills may have the quantities adjusted, based on settlement plates. These settlement plates should be well protected to insure that they are not damaged or destroyed.

A graph may be plotted with fill height vs. settlement to determine settlement at intermediate heights of fill. Using this chart, the settlement below the original ground line can be determined and plotted. The volume between the plotted settlement line and original ground can then be calculated using the average end cross section method. This volume is added to the plan quantity for final payment.

Prewatering Plan

The contractor shall present a prewatering plan at the pre-construction conference when prewatering is required. The plan should be approved by the Project Manager.

Payment for Water for Embankment Construction

When water is required for compaction of embankments other than Class III, it should be paid for as extra work if no contract item has been provided.

When water is required for moisture and density control, the cost of adding and incorporating water is a part of the item.

Finishing

Finish grading must be completed on a timely basis so that erosion control measures may progress satisfactorily. Special provisions on many projects limit the surface area that the contractor may disturb. Generally, this area is 75,000 m² (90,000 square yards), excluding areas to be paved, plus an equal amount of clearing and grubbing area may be opened up. The Project Manager may increase these limits but only by written notice to the contractor. If used, this written notice should include justification for the increase and special procedures the contractor must use to safeguard the environment. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average two-lane, full grading project. Any repair required on sections that have been tentatively accepted will be considered extra work (unless considered to be the fault of the contractor) and if performed by the contractor they are entitled to additional pay as provided for in *SSHC Subsection 109.05*. Therefore, final cross sections may be taken on a section of grading after it is tentatively accepted per *SSHC Subsection 105.13*.

If the finishing work is not performed on a timely schedule, the Project Manager is advised to follow these progressive steps:

- Project Manager should notify the contractor of the concerns in writing.
- If this does not obtain results, suspend estimate payments.

Tentative Acceptance

Areas that have been final graded may be accepted by the Department. However, do <u>not</u> accept an area until silt fence, cover crop, erosion checks, and other erosion control measures are in-place. Do not tentatively accept areas where the contractor must operate equipment to do other requirements. For example, shoulders and foreslopes should not be accepted until pavement and shoulders are finished. Ditch bottoms are a questionable area for tentative acceptance. Often, the Contractor plans to use material in the roadside ditch bottom to build the shoulder. In these cases, do not tentatively accept the ditch bottom until the shoulder work is also complete.

206.00 TOPSOIL *(SSHC Section 207)*

206.01 CONSTRUCTION METHODS

Stripping, Salvaging, and Spreading

The areas of stripping, salvaging, and spreading of topsoil should be identified on the plans or Special Provisions.

Topsoil on Roadway Cuts and Embankments

Where sand pockets are encountered on backslopes and where sand is used for embankment, every effort is made by Roadway Design to place topsoil on these areas. Where these situations are missed, every effort should be made by the Project Manager to obtain topsoil for use as cover for the sand areas. If no topsoil is available, see plans for proper erosion control.

206.02 BASIS OF PAYMENT

- As topsoil is removed and stockpiled, the contractor may be paid at one half the item unit price on the progress estimate. At the time the topsoil is spread and finish graded, the remaining one half may be paid on a progress estimate.

- Topsoil quantity is based on the area where the topsoil is placed. The excavation volume is not adjusted when the project has topsoil as a pay item.

207.00 OVERHAUL

SSHC Section 209 outlines the method used to determine the quantity for overhaul.

CHAPTER NOTES:

CHAPTER NOTES:

DIVISION 300

SUBGRADE PREPARATION

DIVISION 300 - SUBGRADE PREPARATION

301.00 **CHECKLISTS** (See Division 200)

302.00 BASE COURSE AND SUBGRADE INSPECTION

The Construction Technician will inspect and control fine grading and subgrade preparation as required by the plans and contract provisions. Grade stakes for trimming, if required, will usually be set by a construction survey party. The Project Manager and/or the construction technician will check the design gradation and proportions. The construction technician will stake and inspect the quality, quantity, and placement of aggregates and binder materials. If gravel aggregates are produced at a screening plant, inspection may be required at the plant and a scale inspection may be required.

The Construction Technician should be able to determine all project transitions and the complete roadway layout. He/she should anticipate that the prime contractor will need “paving hubs” once the grading contractor has the grade within 75-90 mm (3 – 3 ½ inches) of the final grade. The “paving hubs” once placed should clearly define the roadway. If any points do not fit as anticipated, the Construction Technician should check the point(s) with the survey crew and, if necessary, the Project Manager.

Fly Ash

Liberal use of fly ash is recommended to dry and stabilize unsuitable soil on critical projects.

When purchasing fly ash, the price to be paid for the fly ash should be from the invoice the contractor receives from the source of the fly ash. It is not our intent that the contractor purchases and stockpiles fly ash, marks up the price, and then invoices it to us.

303.00 SUBGRADE PREPARATION AND SHOULDER SUBGRADE PREPARATION

(See SSHC Section 302)

303.01 CONSTRUCTION METHODS

Since the performance of these items is accomplished to prepare the subgrade to support rigid or flexible pavement, and since the performance of either type of pavement is strongly affected by the moisture and density conditions of the subgrade at the time of placement of the pavement, the inspection of work under this subsection is of the highest importance. While staying within the Specification moisture and density limits, the following points should be kept in mind:

- In order to achieve high subgrade strength for flexible pavements, soils should have high densities and low moisture contents.
- In order to avoid differential swell in subgrade below rigid pavements, soils should have lower densities and higher moisture contents.
- In order to avoid roughness due to differential heave, subgrade soils should have uniform moisture and densities.

Studies have shown that a wide range of moistures and densities may be found in subgrades thought to be uniformly compacted to the satisfaction of the construction inspectors. It is believed that this lack of uniformity may to some extent be due to the tendency to take samples in locations thought to be representative (thus actually being a median condition) rather than taking samples at random locations. *See Materials Sampling Guide* for directions on how to sample the subgrade.

Another problem which may result in improper moisture and density control is the erroneous
@ identification of the soil type. A review of the Materials and Research "Earthwork Engineering Guide" is recommended.

Settlement of shoulder pavement relative to the driving lanes and a resulting maintenance operation to eliminate a drop-off condition is quite common. Extra care in compaction of subgrade adjacent to the pavement edge is necessary to alleviate this problem area.

The item of work "Subgrade Preparation" is designated as the procedure to be followed in preparing the grade on projects where the surfacing will be constructed.

It is particularly important to test the portion of the roadbed which will underlie the outer edges of the surfacing. Frequently, this portion of the roadbed will be found to be high in moisture content and have less than satisfactory density due to freezing and thawing or lack of traffic compaction. If the moisture or density of this outer portion is less than satisfactory, difficulty may be experienced in properly constructing and compacting the overlying pavement.

This work provides for adjusting grade lines, scarifying, drying, shaping and compacting of the upper 150 mm (6 inches) of the roadbed ahead of surface or base construction. The moisture and density requirements will be shown in the plans.

The Specifications require that the correction of failures below the upper 150 mm (6 inches) of the subgrade will be performed on an "Extra Work" basis.

After the operations of Subgrade Preparation, Shoulder Subgrade Preparation and Subgrade Trimming are completed, the Project Manager should arrange to measure the cross sections of the trimmed subgrade surfaces. The measurements should be taken at 600 mm (2 feet) intervals across the subgrade from side to side and the results recorded in the inspector's notebook. The sections should be taken with a tight string line stretched across the top of the forms or across the reference lines and measurements made to the nearest 3 mm (1/8 inch) from the cord to the subgrade. In some cases it may be advantageous to perform this checking by instrument which is an acceptable method.

At the beginning of the operation checks should be made to assure that the equipment is in proper adjustment and the operating ability is such as to produce the desired template. As a minimum, after having checked the beginning operation, the template should be checked each 300 m (1000 feet) and the results recorded in a field book. In the case of urban work, or when the performance of the work is such that it is questionable, the frequency of checks should be substantially increased to assure the correctness of the grade. The contractor should be informed of any areas that will need correction before subsequent operations proceed.

The Specifications provide a maximum trimming tolerance from the staked elevation when preparing the subgrade for placement of asphaltic concrete or a combination of base and asphaltic concrete or armor coat. There are no specified trimming tolerances when preparing the subgrade for placement of foundation courses or concrete pavement. However, there are "contractor self-imposed tolerances" due to thickness tolerances of the subsequent surface structure. Thus, due to the nature of the specifications, the tolerances imposed by the contractor should in reality be even more rigid than those specified for flexible pavement.

Subgrade preparation is not accepted until the overlying pavement has been placed. Any damage to the subgrade prior to placement of the overlying pavement shall be corrected by the contractor at no additional cost to the Department.

Prime Coat (*SSHC Section 517*)

The special provisions or plans may require the application of a prime coat after the trimming operation has been completed. The Project Manager may desire a prime coat due to actual job conditions when one has not been provided for. The District Engineer may be consulted for advice and for procedure when a prime coat is needed and has not been provided for in the project documents.

Subgrade Preparation After Removal of Existing Approach Slabs

SSHC Subsection 603.05, Paragraph 8 states that "the work of preparation of the subgrade under the pavement approaches shall not be measured and paid for directly but shall be considered subsidiary to the concrete pavement." This is intended to apply to approach slabs placed on new subgrade and not to the existing subgrade found after the removal of existing approach slabs.

When existing approach slabs are removed and the existing subgrade must be corrected, corrective work at depths greater than 150 mm (6 inches) shall be paid for as "extra work" (as per *SSHC Subsection 302.05*, Paragraph 5).

303.02 METHOD OF MEASUREMENT

Note in the *SSHC Subsection 302.04* that when measured by the square meter, the area is the plan quantity for the overlying paved surface. When measured by the station, each shoulder is measured separately without regard to width (100 m or 100 foot stations).

304.00 SUBGRADE STABILIZATION (*SSHC Section 303*)

304.01 DESCRIPTION

The principal function of subgrade stabilization is to provide a stable grade for subsequent construction.

304.02 MATERIAL REQUIREMENTS

@ See the Materials and Research Sampling Guide for sampling and testing requirements.

Obtaining Materials From Local Pits

In general, the contractor must obtain all off site pits and close them with the landowner. The Department no longer tracks site releases for contractor provided pits.

304.03 EQUIPMENT

The inspector should carefully check the contractor's equipment and calibrations. Pay quantities and other important measurements may be based on some of the equipment and we need to make certain that they conform to the requirements of the Specifications and the special provisions.

304.04 CONSTRUCTION METHODS

This item consists of the stabilization of non-cohesive sand by the addition of a natural soil binder material. In order to insure satisfactory performance of the overlying pavement, especially if it is of the flexible type, the following points should be kept in mind:

1. Silt clay soils exhibit poorer support for pavement if they exist as thin layers over pervious sands than if they comprise the full depth of the subgrade. For this reason, the placement of a thin soil binder layer over the sand should be prohibited.

2. The minimum amount of soil binder required to support construction operations should be used. An excessive amount of binder causes the mixture layer to act as a silt-clay layer as in 1 above.

3. Thorough mixing of sand and soil binder is conducive to good performance.

4. A stabilized subgrade will allow paving equipment to travel over sandy areas.

305.00 EARTH SHOULDER CONSTRUCTION (*SSHC Section 304*)

305.01 DESCRIPTION

Shoulder construction when included in the plans and contract shall be constructed in accordance with *SSHC Section 304*. Very often there are also special provisions included in the contract that pertain to specific problems anticipated in the shoulder construction of the project. The inspector and Project Manager should be certain that the special provision requirements are followed.

305.02 CONSTRUCTION METHODS

I. Signs, delineators, mailboxes and guardrail will usually need to be removed from the areas where the contractor is required to perform this item of work. Department maintenance forces may be required to move the signs, delineators, and guardrail. There generally will be instructions in the contract stating the disposition of the delineators and guardrail and who is responsible for the relocation. The mailboxes should be moved by the owner. It is a good policy to discuss the anticipated conflicts affecting mail deliveries with the postmaster for the area before actual construction begins. The Project Manager or inspector will have to contact the mailbox owners and coordinate the relocation of these mailboxes so that inconveniences will be held to a minimum for all parties involved. The Department's or contractor's employees should not move these mailboxes except with the permission of the owners. If the owners will not cooperate, the postmaster for the area should be contacted.

II. Safety and protection of the highway user is a prime concern. The Standard Plans require plastic barrels if the drop-off at the edge of the traveled way is more than 50 mm (2 inches).

Certified flaggers are required when the normal flow of traffic must be interrupted. All slow equipment as defined in the Nebraska Rules of the Road shall display the slow moving vehicle emblem and have strobe or flashing yellow beacons. The contractor must erect and maintain all the required signs and barricades in the correct positions to protect and warn the motorists. The Project Manager should take photographs and video tape the construction zone to document conditions.

III. The inspector shall take sufficient measurements and make sufficient observations to confirm that the shoulders have been constructed in reasonably close conformity with the typical section and the material requirements specified. These conforming checks shall be recorded in a bound field notebook. One check per 1.0 km (1/2 mile) highway centerline distance shall be the minimum number of checks required.

IV. The time limitations imposed by the Specifications in Table 304 and
@ Subsection 304.03 on placing the shoulders should be enforced. The tally of days (internal) charged against the shouldering must be shown on the weekly working day report.

305.03 METHOD OF MEASUREMENT

Plan stationing may be used for computing shoulder construction except in cases where apparent errors in stationing are discovered and the correct stationing is to be used.

Calibration of water measuring equipment is discussed in the *SSHC Section 205*.

Note in the *SSHC Subsection 304.04* that shoulders are measured by the station and each shoulder is measured separately without regard to width and depth.

306.00 FOUNDATION COURSE

306.01 DESCRIPTION

The principal functions of a foundation course are:

1. To provide a means of distributing water, which leaks through cracks and joints, in a uniform manner throughout the subgrade, thus avoiding differential swell and frost heave.

2. To prevent pumping at joints, cracks, and edges.

3. To strengthen support under joints, thus avoiding faulting.

4. To provide uniform support for the entire slab, thus reducing cracking.

For these reasons, the construction of foundation course deserves close inspection.

SSHC Section 307 describes foundation courses. All types require the use of mineral aggregate for foundation course, fine sand and water and all must be mixed in a twin pugmill mixer.

306.02 MATERIAL REQUIREMENTS

Generally all borrow pits are the contractor's responsibility to obtain and close.

306.03 CONSTRUCTION METHODS

Preparation of Subgrade

See plans and specifications for material requirements. Sampling procedures in the *Materials Sampling Guide* shall be followed.

Subgrade preparation will normally be accomplished under a contract item in *SSHC Section 302*. However, it is important that the moisture and density conditions specified under the subgrade preparation item be maintained until the foundation course is laid. Obtaining the moisture and density conditions is required by *SSHC Subsection 302.01*.

Mixing, Laying and Compacting

SSHC Subsection 307.03 require that the mineral aggregates and the pulverized soil binder be mixed in an approved pugmill. The purpose of this requirement is to produce a uniform and intimate mixture of the binder, water and aggregates and to make it possible to place this mixture, spread it and compact it to a firm foundation, without incorporating additional material from the subgrade. Accordingly, hauling should not be permitted when moisture conditions in the subgrade are such as to cause ruts and the resulting contamination of the base course material.

Uniformity of thickness of the compacted layer is very important. Since the Specifications require trimming of the subgrade and the base course by the use of automated electronically controlled equipment, accurate thickness control must be demanded.

Proper control of moisture content is significant for two reasons:

1. Uniformity of moisture content at the proper level aids in obtaining uniform density, meeting requirements.

2. Uniform moisture content, thoroughly distributed throughout the binder and aggregate mass, aids in the development of the necessary cohesion.

In the laydown of foundation course, it is best to lay the full thickness in one layer, when feasible. If there is only one layer, slippage between layers, a common problem in granular base courses, will be avoided.

After completion of the trimming operation, cross sections should be taken on the surface of the soil aggregate base course at 600 mm (2 feet) transverse intervals and at 300 m (1000 ft) longitudinal intervals matching the locations of the cross sections taken on the subgrade and recorded in the field book.

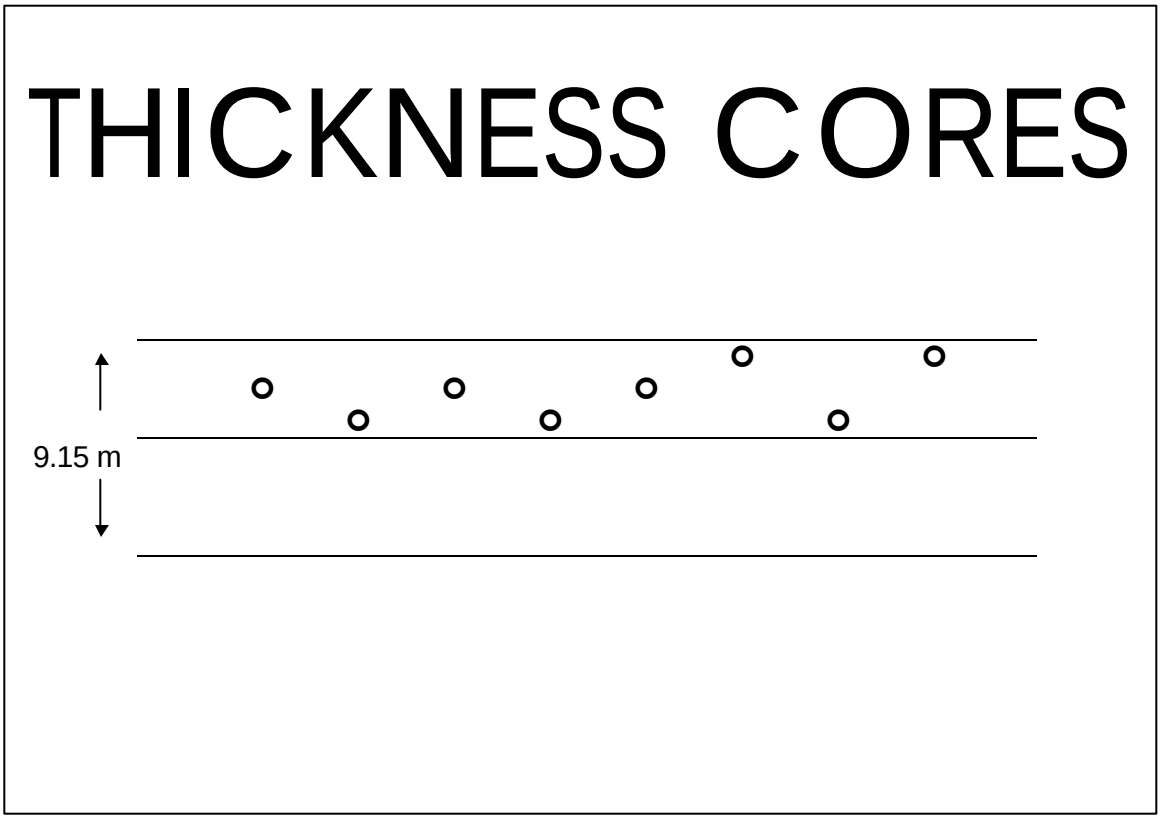
The Materials and Tests "*Materials Sampling Guide*" requires that density tests be made a 300 m (1000 foot) intervals or closer. At the time the density tests are made, following the trimming operation, the thickness of the soil aggregate base shall be carefully measured and recorded as documentation that the thickness requirements have been met. The thickness measurements shall be considered to represent only that width constructed and trimmed in a single operation. If any of these measurements show a deficiency from planned thickness of 12.5 mm (1/2 inch) or more and if payment is to be made by the square meter, additional measurements shall be made to define the extent of the soil aggregate base course shortage.

If a measurement shows a deficiency in thickness, a check measurement shall be taken 3 m (10 foot) either side of this location parallel to the centerline of roadway. If both check measurements fall within the 12.5 mm (1/2 inch) tolerance permitted, no deficiency is to be considered. If one or both are deficient in thickness, further checking shall be made at 15 m (50 foot) intervals from the original measurement and parallel to the centerline of roadway until a thickness within the tolerance is found in one or both directions as the case may be. Between this point and the location 15 m (50 foot) back, determine the point within 3 m (10 foot) at which the soil aggregate base course is within the tolerance permitted. If both categories of deficiency occur, the same procedure shall be used to determine the beginning and ending points of the two categories. The width of the deficiency shall be considered to be the full width constructed and trimmed in that particular operation.

Measurements for determining the thickness should be made at a maximum spacing of 150 m (500 feet) directly behind the trimming operation. This will prevent the priming of any deficient section that the contractor has the option to remove or that must be removed and replaced in accordance with the specifications.

The Project Manager shall enter all measurements and locations where made in a field notebook. In some cases a sketch may be necessary to clarify a nonpay area. Deductions in the pay quantity of the soil aggregate base course are to be computed and made by the field Project Manager.

The following examples shows measurements taken in a 150 m (500 foot) section where a thickness deficiency has occurred.



Measurement No.	Location	Actual Thickness	Specified Thickness
1	1 m Lt. cl Sta. 1001+50	81 mm	100 mm
2	1001+40	93 mm	100 mm
3	1001+60	79 mm	100 mm
4	1002+00	75 mm	100 mm
5	1002+50	79 mm	100 mm
6	1003+00	100 mm	100 mm
7	1002+90	91 mm	100 mm
8	1002+80	84 mm	100 mm

Limits of deficient area in the category of 12 mm to 25 mm deficient equal Station 1001+40 to Station 1002+90.

Non Pay Square Meters Soil Aggregate Base Course (Contractor's Option)

$150\ m \times 9.15\ m = 1350\ m^2$

Portland Cement Treated Foundation Course Requirements:

The time schedules given in the specifications should be strictly enforced. Once hydration of the cement is started, the process continues and cementing characteristics of the cement will be lost if aggregate and cement are not quickly compacted to their final orientation within the foundation course.

Compaction operations should be completed as quickly as possible. If rolling continues for too long a period, the bonds which the portland cement is trying to establish are broken in the upper part of the layer.

Prime coat application, which serves to some extent as protection against the infiltration of moisture, should not be delayed. If moisture penetrates the portland cement treated foundation course and enters the subgrade, a very serious problem can result.

Maintenance of the Compacted Base Course and Prime Coat

Prime coats should be applied as soon as possible after laydown and compaction procedures are completed, to protect against soaking of the base course by rainfall. The second laydown of a base course almost always is inferior to the first, especially if drying operations on the subgrade have been made necessary as a result of rainfall percolating through an unprotected base course.

The specifications provide that after the base course has been compacted to the required density and shaped to the typical cross section, the base course and prime coat shall be maintained by the contractor until subsequent construction has been completed.

306.04 BASIS OF PAYMENT

If the foundation course is to be paid for by the megagram (ton), deductions should be made for excess water.

Foundation course measured by the m^2 (square yard) is not directly measured but is the quantity of overlying pavement. (See *SSHC Subsection 307.04*)

307.00 ROCK OR AGGREGATE SURFACING (*SSHC Section 310*)

307.01 DESCRIPTION

This work consists of placing aggregate for a wearing course on an approved roadbed or on a newly built earth grade or on detours temporarily in use during construction. The aggregate surfacing shall be spread to meet the requirements shown in the plans or as directed by the Project Manager.

307.02 MATERIAL REQUIREMENTS

I. Setting Up the Field Testing Laboratory - Usually aggregate tests on construction projects are carried on in conjunction with other phases of the contract work and in that case the inspector may use the testing facilities provided for that work. The following equipment should be available to the aggregate inspector:

1 - 15 m (50 foot) tape
1 - Handaxe
1 - Grain Scale and pan or equivalent
1 - Set of sieves, 4.75 mm (No. 4) and 2.00 mm (No. 10) (including pan and lid)
1 - Shaker
1 - Splitter
2 - Aggregate drying pans
1 - Gasoline stove or hotplate
1 - Shovel or aggregate probe

II. Sampling and Testing - Aggregates shall be sampled, tested or submitted for testing in accordance with the Materials and Tests "*Materials Sampling Guide*". The inspector should read and become familiar with *SSHC Sections 310 and 1033*, and the special provisions of the contract.

The inspector will be responsible for sampling and testing of aggregate on the project. In some cases, when aggregate is supplied by a large producer, the District Engineer will have an inspector available at the pit site to test the material before it is shipped. However, even though some testing is done at the source, testing will be required on the project in order to calculate the payment to the contractor (*SSHC Subsection 310.05*).

307.03 EQUIPMENT

The inspector should inspect the contractor's equipment before starting. Each truck should be carefully measured and the capacity computed by the inspector. These capacities, truck numbers, etc., should be recorded in a field notebook. The measurement and capacities are reported to the District Engineer on a DR Form 101. (A sample of DR Form 101 is included on *Appendix 1*). For additional information in regard to the measurement of trucks, (see Subsection 103.04 in this manual.)

The specifications provide that the contractor shall secure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful

prosecution of the work. District Offices have current copies of the laws and load limits and questions concerning legal loads should be directed to the District Offices.

The Project Manager and inspector shall also be familiar with and see that the contractor adheres to the provisions of *SSHC Subsection 105.11*, Restrictions on Moving and Use of Heavy Equipment.

The load capacity for which the truck is licensed is indicated on a sticker pasted on the license plate and should be checked against the license certificate carried in the cab. Mass capacity will vary according to the number of single or tandem axles and will be specified for the truck's gross mass.

All trucks used on the project in connection with the performance of the work are required to be licensed in Nebraska regardless of the fact that they may be properly licensed in some other state. Trucks used only in hauling equipment or materials from outside the state to the project are covered by reciprocity and may not be required to be licensed in Nebraska.

Violations should be called to the contractor's attention. In the event that the contractor does not take steps to comply, the Project Manager shall immediately advise the District Engineer by letter with a copy to the contractor. Letters reporting violations shall include the name and address of the owner, make, type and license numbers of the vehicles and an explanation of the violation involved. This information will be referred to the proper authorities for investigation.

307.04 CONSTRUCTION METHODS

Hauling and Distributing Materials

I. Hauling Materials. No more than two different truck box capacities will be permitted unless approved by the Project Manager. No hauling shall be permitted when weather or roads are such that hauling causes excessive rutting. When aggregate for detours is required, it is advisable to go over the detour road with the District Construction Engineer to see what road defects need correction before the aggregate is placed.

II. Staking for the Distribution of Materials - In order that the contractor may know where on the road to place aggregate, stakes should be set along the shoulder which is to receive the aggregate at the load distance spacing. If it should occur that it is not desirable to place aggregate continuously, two stakes driven vertical should be set at the beginning and ending of each series of loads, two stakes driven to form a "X" may be used to mark each tenth load. One load should be spread between each pair of stakes, and instructions should be issued to the contractor to leave a small gap between loads so that you may be sure that all loads are placed as staked. When trucks of more than one capacity are used, stakes shall be set for each size in sections rather than intermingling the different sizes. One size usually takes the long haul and the other the short. Consult the plan for the width and depth of the aggregate to be placed.

When placing aggregate on a newly graded project, the number of loads staked in any given distance shall be checked against the project station reference stakes. When placing aggregate on an unreferenced detour, the number of loads per kilometer (mile) staked should be checked against the number of cubic meters (cubic yards) required per kilometer (mile).

III. Inspection Costs - In order to avoid excessive inspection costs, particularly on other than high production operations, it may be necessary to control the placement and inspection operations as follows:

1. When a single aggregate, or separate aggregate materials are being deposited on both long and short haul sections, or on separate sections of the project, one inspector located at the short haul placement point may observe and inspect the loads destined for the other, or longer haul sections.

2. The inspector staking and inspecting the delivery of the aggregates may also take necessary material samples and check the gradation of the aggregate.

3. If the material placement rate is so low as to create uneconomical and wasteful inspection costs, the headquarters or District Office should be contacted for special instructions.

307.05 METHOD OF MEASUREMENT

Rock or aggregate for surfacing will be measured by the cubic meter (cubic yard) in trucks with "struck loads". This measurement will be made at the point of delivery. Refer to Section 105 of this manual for a more complete discussion.

307.06 BASIS OF PAYMENT (*SSHC Subsection 310.05*)

This material is now paid for according to *SSHC* Table 310.01. If there is a deduction it will be computed and deducted from the contract unit price and that lot must be shown as a contingency item on the estimate with the computed unit price.

Maintenance of temporary surfacing is paid for with equipment rental pay items.

CONVERSION FACTORS	
To Convert Tons of Material to Cubic Yards	Divide By
Crushed Sand Gravel	1.20 Tn/CY
Fine Aggregate for Concrete	1.30 Tn/CY
Coarse Aggregate (Limestone) for Concrete	1.25 Tn/CY
Sand-Gravel for Concrete; Surfacing Gravel or Crushed Rock	1.35 Tn/CY
Crushed Rock for Base Course	1.25 Tn/CY
Crushed Rock for Base Course Screenings	1.25 Tn/CY
Mineral Filler and Soil Binder	0.85 Tn/CY
To Convert Megagrams of Material to Cubic Meters	Divide By
Crushed Sand Gravel	1.30 Mg/m^3
Fine Aggregate for Concrete	1.54 Mg/m^3
Coarse Aggregate (Limestone) for Concrete	1.48 Mg/m^3
Sand-Gravel for Concrete; Surfacing Gravel or Crushed Rock	1.60 Mg/m^3
Crushed Rock for Base Course	1.48 Mg/m^3
Crushed Rock for Base Course Screenings	1.48 Mg/m^3
Mineral Filler and Soil Binder	1.06 Mg/m^3

Road Gravel Requirements

English Version

Width	Sq,	1/2" Depth			3/4" Depth			1" Depth			1 1/2" Depth			2" Depth			2 1/2" Depth			3" Depth		
of	Yds.	1 cu.yd.	Cu. Yds.		1 cu.yd.	Cu. Yds.		1 cu.yd.	Cu. Yds.		1 cu.yd.	Cu. Yds.		1 cu.yd.	Cu. Yds.		1 cu.yd.	Cu. Yds.		1 cu.yd.	Cu. Yds.	
Road-	Per	Covers	Per	Per	Covers	Per	Per	Covers	Per	Per	Covers	Per	Per	Covers	Per	Per	Covers	Per	Per	Covers	Per	Per
way	Mile	Lin. Ft.	Sta.	Mile	Lin. Ft.	Sta.	Mile	Lin. Ft.	Sta.	Mile	Lin. Ft.	Sta.	Mile	Lin. Ft.	Sta.	Mile	Lin. Ft.	Sta.	Mile	Lin. Ft.	Sta.	Mile
9'	5280.0	72.00	1.39	73.33	48.00	2.08	110.00	36.00	2.78	146.67	24.00	4.17	220.00	18.00	5.56	293.33	14.40	6.94	366.67	12.00	8.33	440.00
10'	5866.7	64.80	1.54	81.48	43.20	2.31	122.22	32.40	3.09	162.96	21.60	4.63	244.44	16.20	6.17	325.93	12.96	7.72	407.41	10.80	9.26	488.89
11'	6453.3	58.91	1.70	89.63	39.27	2.55	134.44	29.45	3.40	179.26	19.64	5.09	268.89	14.73	6.79	358.52	11.78	8.49	448.15	9.82	10.19	537.78
12'	7040.0	54.00	1.85	97.78	36.00	2.78	146.67	27.00	3.70	195.56	18.00	5.56	293.33	13.50	7.41	391.11	10.80	9.26	488.89	9.00	11.11	586.67
13'	7626.7	49.85	2.01	105.93	33.23	3.01	158.89	24.92	4.01	211.85	16.62	6.02	317.78	12.46	8.02	423.70	9.97	10.03	529.63	8.31	12.04	635.56
14'	8213.3	46.29	2.16	114.07	30.86	3.24	171.11	23.14	4.32	228.15	15.43	6.48	342.22	11.57	8.64	456.30	9.26	10.80	570.37	7.72	12.96	684.44
15'	8800.0	43.20	2.31	122.22	28.80	3.47	183.33	21.60	4.63	244.44	14.40	6.94	366.67	10.80	9.26	488.89	8.64	11.57	611.11	7.20	13.89	733.33
16'	9386.7	40.50	2.47	130.37	27.00	3.70	195.56	20.25	4.94	260.74	13.50	7.41	391.11	10.13	9.88	521.48	8.10	12.35	651.85	6.75	14.81	782.22
17'	9973.3	38.12	2.62	138.52	25.41	3.94	207.78	19.06	5.25	277.04	12.71	7.87	415.56	9.53	10.49	554.07	7.62	13.12	692.59	6.35	15.74	831.11
18'	10560.0	36.00	2.78	146.67	24.00	4.17	220.00	18.00	5.56	293.33	12.00	8.33	440.00	9.00	11.11	586.67	7.20	13.89	733.33	6.00	16.67	880.00
19'	11146.7	34.11	2.93	154.81	22.74	4.40	232.22	17.05	5.86	309.63	11.37	8.80	464.44	8.53	11.73	619.26	6.82	14.66	774.07	5.69	17.59	928.89
20'	11733.3	32.40	3.09	162.96	21.60	4.63	244.44	16.20	6.17	325.93	10.80	9.26	488.89	8.10	12.35	651.85	6.48	15.43	814.81	5.40	18.52	977.78
21'	12320.0	30.86	3.24	171.11	20.57	4.86	256.67	15.43	6.48	342.22	10.29	9.72	513.33	7.72	12.96	684.44	6.17	16.20	855.56	5.14	19.44	1026.67
22'	12906.7	29.45	3.40	179.26	19.63	5.09	268.89	14.73	6.79	358.52	9.82	10.19	537.78	7.36	13.58	717.04	5.89	16.98	896.30	4.91	20.37	1075.56
23'	13493.3	28.17	3.55	187.41	18.78	5.32	281.11	14.09	7.10	374.81	9.39	10.65	562.22	7.04	14.20	749.63	5.63	17.75	937.04	4.70	21.30	1124.44
24'	14080.0	27.00	3.70	195.56	18.00	5.56	293.33	13.50	7.41	391.11	9.00	11.11	586.67	6.75	14.81	782.22	5.40	18.52	977.78	4.50	22.22	1173.33
25'	14666.7	25.92	3.86	203.70	17.28	5.79	305.56	12.96	7.72	407.41	8.64	11.57	611.11	6.48	15.43	814.81	5.18	19.29	1018.52	4.32	23.15	1222.22
26'	15253.3	24.92	4.01	211.85	16.61	6.02	317.78	12.46	8.02	423.70	8.31	12.04	635.56	6.23	16.05	847.41	4.98	20.06	1059.26	4.15	24.07	1271.11
27'	15840.0	24.00	4.17	220.00	16.00	6.25	330.00	12.00	8.33	440.00	8.00	12.50	660.00	6.00	16.67	880.00	4.80	20.83	1100.00	4.00	25.00	1320.00
28'	16426.7	23.14	4.32	228.15	15.43	6.48	342.22	11.57	8.64	456.30	7.71	12.96	684.44	5.79	17.28	912.59	4.63	21.60	1140.74	3.86	25.93	1368.89
29'	17013.3	22.34	4.48	236.30	14.89	6.71	354.44	11.17	8.95	472.59	7.45	13.43	708.89	5.59	17.90	945.19	4.47	22.38	1181.48	3.73	26.85	1417.78
30'	17600.0	21.60	4.63	244.44	14.40	6.94	366.67	10.80	9.26	488.89	7.20	13.89	733.33	5.40	18.52	977.78	4.32	23.15	1222.22	3.60	27.78	1466.67

CHAPTER NOTES:

CHAPTER NOTES:

DIVISION 400

LIGHTING, SIGNS, TRAFFIC SIGNALS AND TRAFFIC CONTROL

DIVISION 400

LIGHTING, SIGNS, TRAFFIC SIGNALS & TRAFFIC CONTROL

401.00 LIGHTING CHECKLIST

SSHC References:

Section 400 - Lighting, Signs, Traffic Signals & Traffic Control
Section 203 - Removal of Structures and Obstructions

Other References:

NDR Materials Sampling Guide
National Electric Code
National Electric Safety Code

Inspection Equipment:

Volt Meter
Light Meter (Photometer)
Flashlight
Hex Wrenches
Adjustable Wrenches

Construction Requirements:

CONDUITS:

1. Conduit sizes and types installed must agree with those detailed in the plans.

2. All conduit ends must have bell ends or bushings.

3. Conduit must be minimum of 750 mm (30 inches) below grade.

4. Spare conduit bend must be capped or plugged with standard fittings.

CONDUCTORS:

1. Conductors must be of the size, type, and number as detailed in the Plans. Conductors which have properties exceeding the minimum requirements, may be furnished at the contractor's option with the Project Manager's approval. No adjustment in contract price will be allowed.

2. Conductors shall be individually tagged when the conduit in which they are housed is inaccessible and cannot itself be tagged. (*SSHC Subsection 402.03*)

3. Conductors shall be color coded for safety and to facilitate maintenance of the lighting system. (SSHC Subsection 402.02)

PULL BOXES:

1. All pull boxes with a cast iron ring and cover must be grounded with all grounding connections securely made. (*SSHC Subsection 406.01*)
2. Check all wire sizes in pull box.
3. All conduit entrance bends must be tagged with a permanent tag indicating direction of the conduit run.
4. All cable connections in pull boxes must be made using approved URD submersible connectors. Check for proper cable insertion into connector; that all connections are tight and that all openings are covered or plugged.

POLES:

1. New light poles should <u>not</u> be placed directly under other overhead distribution systems.
2. All poles must have handhole covers securely fastened.
3. Power foundations are to be flush with grade. Concrete foundations are allowed a 25 mm (1 inch) chamfer.
4. All settlement of soil around pole base and along conduit runs must be backfilled and compacted to 95 percent of maximum density as determined by NDR T 99 (*SSHC Subsection 407.03*).
5. Check for minimum of 300 mm (1 foot) cover over the grounding rod and for proper connection to the grounding rod. Contractor must use connectors detailed in the plans.
6. Check for proper grounding to pole (anchor type) or to transformer base (breakaway type). Contractor must use connectors detailed in the plans.

7. Check for spare bend on last pole of each run.

8. Check for proper mechanical cable connections in base of each pole. (Taps and taping not allowed).

9. Check for heavy flat washer between top of pole base and anchor bolt nut.

10. Check for correct "hold-down" and "connecting-washers" on pole installations using breakaway transformer bases. It is very important that the washers supplied with the base be used as instructed by the manufacturer.

11. On installations where three or more conduit bends enter the pole or transformer base, each conduit bend should be tagged. Tags to be embossed or stamped with the direction of the conduit run. On anchor base installations where the conduit entrance bends are inaccessible, each run of feeder cable should be tagged.

LIGHTING CONTROL CENTER:

1. Installation of conduit, controls, and grounding to be as detailed in plans. Verify that disconnect or relay installed is of the size and type that has been approved for use on the project.

2. Conduit or conductors should be properly tagged indicating direction of run. Conductors should be color coded.

JUNCTION BOX IN BRIDGE CURB:

1. Bushings are required on all conduits entering the junction box.

2. Junction box should be grounded.

3. Lid of junction box should be gasketed.

4. Junction boxes with more than two conduits entering the box shall have the conduits tagged to indicate the direction of the conduit run.

5. Conductors should be color coded.

TESTS ON THE COMPLETED SYSTEM:	Circuit Continuity Voltage Drop Ground Resistance
INSPECTOR'S RECORDS & FORMS:	Field Book Material Certifications
POINT OF CONTACT:	Lighting Engineer, 479-4695

402.00 LIGHTING

402.01 GENERAL INFORMATION

SSHC References:

Section 203 - Removal of Structures and Obstructions
Section 401 - Lighting and Traffic Signal Requirements
Section 402 - Cable Installation
Section 403 - Direct Burial Cable
Section 404 - Aerial Cable
Section 405 - Conduit
Section 406 - Pull Boxes
Section 407 - Pole and Tower Foundations
Section 408 - Poles and Towers
Section 412 - Luminaires
Section 413 - Lighting Control Center
Section 414 - High Mast Lowering System
Section 415 - Lighting System Maintenance
Section 416 - Temporary Lighting System
Section 1073 - Material Requirements

Other References:

NDR Materials Sampling Guide
National Electric Code
National Electric Safety Code

General Comment

Because roadway lighting usually makes up only a small portion of a projects total cost, it is many times thought of as insignificant and not requiring much attention. Many benefits in the form of public safety, security, convenience and drivers comfort, however, are derived from a quality lighting job. This makes the lighting inspector's job of checking out and inspecting all aspects of the lighting construction, one of utmost importance.

Special Construction Items

Unusual, difficult or special items of work are usually discussed at the preconstruction conference. The inspector should confer with the Project Manager regarding all items of work he/she does not understand. Further clarification may be had by contacting the Lighting Engineer.

402.02 PRECONSTRUCTON CONFERENCE

In addition to discussing special items of work, the preconstruction conference is also an excellent time to remind the contractor that many problems and delays can be avoided by the early submittal of his/her material list, shop drawings, and samples of all materials that require testing. No materials can be incorporated into the work before first being approved.

If utility support is necessary, confirm the date that any utility work will be started and, if possible, the date completed.

402.03 SHOP DRAWINGS AND MATERIALS LIST

SSHC Subsection 401.02 provides information on shop drawings and a materials list that is required of the contractor before he/she may incorporate any items into the project.

To assure uniform and effective operation of this requirement, the following procedures will be followed:

After receiving the required seven copies of the materials list and shop drawings from the contractor, the Construction Division will send the submittals to the Lighting Section for their review and comments.

All items will be checked for compliance with the plans and specifications. Two copies of the reviewed list and shop drawings, showing approval or disapproval of each item, will be returned to the contractor with a copy to the Project Manager. If the contractor desires additional copies, they must be submitted with the seven required copies.

All equipment and materials to be used on a project must be approved before installation. Once approved, there shall be no substitutions for any of the items without prior written request to, and written approval from, the Lighting Engineer. The inspector must make sure that only materials that have been approved are used on the project.

The contractor shall inform his/her supplier that all items supplied to the project must be suitably stamped, stenciled, tagged or otherwise marked to allow for easy identification with the descriptive markings, brand names and catalog numbers shown on the materials list and shop drawings.

402.04 CONSTRUCTION REQUIREMENTS

Staking of Light Pole and Tower Foundations

SSHC Subsection 407.03 states that the contractor is responsible for field verifying the foundation location and elevation of each lighting unit to determine that no conflicting or hazardous situation will exist when the pole or tower is erected. Any location or elevation that appears unreasonable or out of specifications as to projection above grade, will be brought to the Project Manager's attention. The Project Manager will decide any changes in location and/or elevation.

Wood Poles Used on Lighting Projects

Specifications covering wood poles used on lighting projects will be shown on the project plans.

Testing of Lighting Systems

SSHC Subsection 401.03 requires the contractor to perform operating circuit and resistance test on the lighting system. The Project Manager will send written results of these tests to the Lighting Engineer.

Poles and Towers (*SSHC Section 408)*

Conventional light poles are usually furnished by the Contractor complete with pole shaft, mast arm, luminaire, anchor bolts, foundation, and breakaway device (if required).

High mast towers are usually furnished by the Contractor complete with tower shaft, base plate, anchor bolts, lowering system with motor and foundation.

All poles and towers shall be plumb. Poles will be shimmed to stand plumb. Only regular “U” shaped shim stock is allowed. Towers will be supported solely by anchor bolts and nuts. The nuts will be adjusted to plumb the tower.

All poles and towers will be grounded to a grounding rod(s) as shown in the plans.

All poles must have a handhole with cover attached.

Unless indicated otherwise, all poles required to breakaway on impact will have a frangible transformer base ("T base") as its breakaway device.

Poles and towers shall conform to the requirements of Section 1073.

Poles and Tower Foundations (*SSHC Section 407)*

Pole foundation details will be shown in the plans. Tower foundations will usually be designed by the contractor.

Towers are installed using concrete foundations only. Poles are installed using either concrete or power foundations. Power foundations are allowed only when so indicated in the plans.

All excavations for concrete foundations shall be dry and free of loose dirt before the concrete is placed.

Foundations shall be installed before trenching for conduit and cable.

Backfill around foundations shall be compacted to 95 percent of maximum density as determined by NDR T 99.

Luminaires (*SSHC Section 412)*

All luminaires must be on the NDR Approved Products List or have been specifically approved for use on the project in question by the contractor's submittal of shop drawings or catalog cuts.

Most luminaires are factory set to meet photometric requirements. Occasionally, in order to meet specifications, the position of the lamp socket in each luminaire must be adjusted by following a set of manufacturer's instructions accompanying each luminaire.

Unless indicated otherwise, all luminaires will be installed level in both horizontal axes.

Luminaires shall be installed to proper alignment and orientation with respect to the roadway.

Night inspection by the Project Manager may determine the need for adjustments to the luminaires.

Lighting Control Centers (*SSHC Section 413)*

The location of the lighting control center as shown on the plans is approximate. Actual location will be as determined by the electric utility and the Project Manager.

Components comprising the various types of lighting control centers will be listed on the NDR Approved Products List or will be specifically approved for use on the project in question by the contractor's submittal of shop drawings or catalog cuts.

High Mast Lowering System (*SSHC Section 414)*

Unless indicated otherwise, all new lowering systems will be furnished with an internal power unit (each tower will have its own motor to raise or lower the light ring).

High mast lowering systems will be on the NDR Approved Products List or specifically approved for the project in question by the contractor's submittal of shop drawings or catalog cuts.

A new lowering system will accompany each new tower.

Installation of a new high mast lowering system on an existing tower may require some modification to the tower. Modifications shall be made as detailed in the plans.

Temporary Lighting System (*SSHC Section 416)*

There are a number of different types of temporary lighting systems.

All temporary lighting systems require the contractor to properly operate and maintain the lights daily from dusk to dawn through the construction period.

Materials for a temporary lighting system may be state or contractor furnished as indicated in the plans.

Usually, the contractor will be responsible for providing the electrical energy required to energize the crossover type temporary lighting system.

An equipment grounding conductor is usually not required in a temporary lighting system. In some service areas, however, the utility may require that an equipment ground be used.

When the temporary lighting units are no longer required, the contractor will, in strict conformance with the project requirements, remove, prepare and deliver the units to the designated storage area. Any deviation from the project requirements must be cleared with the Lighting Engineer.

402.05 PAYMENT FOR ELECTRIC POWER USED BY THE LIGHTING SYSTEM

SSHC Subsection 401.05 states that the contractor will not be required to pay for any electrical energy consumed by a permanent lighting system.

The plans should indicate whether the Contractor or the Department arranges and pays for the electrical power for a temporary lighting system.

402.06 COMPLETION AND ACCEPTANCE OF THE PROJECT

Upon completion and acceptance of a lighting project, the Project Manager shall furnish the District Maintenance Superintendent with an accurate set of half-size "as built" plans together with a complete set of shop drawings to facilitate maintenance of the lighting system.

403.00 TRAFFIC SIGNALS (*SSHC Sections 409, 410, 411 and 1073)*

403.01 GENERAL

The following items should be emphasized during the construction of a typical traffic signal. Although most of these items are covered in the Plans, Special Plans, Special Provisions, and in Division 400 and Section 1073 of the Standard Specifications, they are sometimes overlooked, causing problems for the contractor and the Project Manager.

403.02 PRE-CONSTRUCTION CONFERENCE

Remind Contractors

Preformed loops MUST be under the pavement, sawed loops are not an alternative (per Detector Plan).

Submit wire samples to Materials & Tests early, get approval before installation.

Order the poles early, lead time is 11-15 weeks.

403.03 PRELIMINARY STAKING

Stake poles according to plan but avoid utilities. If poles are relocated, make sure mast arms are long enough to center signal heads in their appropriate lanes.

In urban areas there should be a minimum of 1.0 m (3 foot) clearance between the curb and the pole. In rural areas there should be a minimum of 2.0 m (6 foot) clearance between the edge of pavement and the pole.

Call Traffic Engineering (402-479-4594) if the poles must be moved more than 600 mm (2 feet).

403.04 SAW CUT LOOP LOCATION

Avoid crossing cracks and joints when locating loops. The exact size and shape of the loop is not critical. Keep the loops in the vehicle path and keep the spacing between the loops in a lane under 3.0 m (10 feet).

Call Traffic Engineering (402-479-4594) for locating the loops if there are any questions.

403.05 TEMPORARY SIGNAL

It is the contractor's duty to construct, maintain, and remove the signal.

If the project involves construction phasing which requires shifting traffic and moving heads and poles etc., the contractor shall do this at no additional cost. (per Special Provisions).

403.06 ELECTRICAL POWER

Arrange for electrical service early in the project, especially in larger cities like Lincoln and Omaha.

403.07 STATE SUPPLIED MATERIAL

Project Manager should check to make sure state supplied material has been shipped to the designated yard 4 weeks before construction. Check stock requisition for back ordered items. Call Traffic Engineering if anything is missing.

403.08 SAFETY

Make sure the contractor's vehicles and equipment are not blocking the view of motorists using the intersection during construction.

403.09 ITEMS TO CHECK WHEN INSTALLING

POLE FOUNDATIONS

The foundation must include a ground rod, a spare conduit and a conduit for lighting. (per Standard Plan 910)

PULL BOXES (per Standard Plan 914)

Conduit ends must have bell ends.

Gravel must be 300 mm (1 foot) deep in the bottom of the pull box.

Specified pull box lids must be grounded.

Splices in the pull box must be raised off the bottom of the pull box. (per Wiring Diagram)

LOOPS, PREFORMED

Remind the contractor to install preformed loops BEFORE paving. Sawing in the loops after paving will not be accepted. We will require the contractor to remove the pavement to a joint, place the loops in the subgrade and replace the pavement if they forget, NO EXCEPTIONS. (per Detector Plan)

Remind the contractor to protect and mark the leads to the preformed loops so they are not damaged during adjacent paving.

LOOPS, SAWED

The saw slot must be 9 mm (3/8 inch) wide, 19 mm (3/4 inch) wide at cracks and joints to allow for the joint tube. (per Detector Plan)

MAGNETIC DETECTORS

Handle magnetic detector leads gently where they join the detector.

If the magnetic detector serves one lane, place the detector under the right wheel track. If the detector serves 2 lanes, center the detector between the two lanes.

The conduit housing the detector should slope to drain into the pull box. (per Detector Plan)

POLES (per Standard Plan 912)

The pole bases must be double nutted so the pole can be plumbed.

The pole bases for towers should not be grouted. The pole bases for galvanized steel poles may be grouted at the Project Manager's discretion to prevent rodent damage to wires.

The ground wire must be attached to the nut in the pole behind the handhole and to the ground rod in the pole foundation.

MAST ARMS (per Standard Plan 912)

Wait until the signal is turned on to install the set screw in the clamp of the mast arm, to allow for adjustment of the arm at the time of turn on. The minimum clear height under the signal head must be 5.33 m (17' 6") to the crown of the roadway.

WIRING

Span wire signal installations shall be wired with stranded wire.

All splices must be made with the specified splice kit. (per Wiring Diagram)

Be sure wires are not damaged when they are stripped for splicing. Check several of the splices by bending the entire splice back and forth to see if the wire breaks, especially where the stripping of the wire starts. Check to make sure the wire insulation has not been cut where the cable sheathing has been removed. This can also be done by bending the wires.

Splices are not allowed in a cable from the controller to the cables final destination. Wire the loop detectors for an approach in series, not in parallel.

Holes in poles and mast arms must be protected with rubber grommets prior to pulling wire. Be sure wires are not skinned or damaged while being pulled. (per Standard Plan 912)

Do not use spade lugs on solid wire, use spade lugs on stranded wire.

CONTROLLER

Wires must be labeled as shown on the wiring diagram using the specified method. Examples: Loop 20, NE Pole. (per Wiring Diagram)

All conductors pulled into the cabinet must extend 1.5 m (5 feet) beyond the end of the conduit housing them. (per Wiring Diagram)

Pole mounted cabinets should be mounted 1.83 m (6 feet) to 2.0 m (6.5 feet) to the top of the cabinet. (per Standard Plan 912)

The conduit LB fitting under a pole mounted cabinet must be 62 mm (2.5 inches) or larger.

A ground rod must be installed in the concrete pad of all pad mounted controllers.

Pad mounted controllers must contain one spare conduit.

Make sure the cabinet doors swing as shown on the installation plans.

TRAFFIC SIGNAL HEADS

The minimum spacing between heads (center to center) must be at least 3.0 m (10 feet). (per Installation Details)

The backplates and heads must be mounted PLUMB, not aiming downward. Be sure the lenses are installed right side up.

The backplates must be one piece and vacuum formed.

Cover the signal heads with an opaque material prior to turn on so motorists are not confused.

The minimum clear height under the signal head must be 5.33 m (17’ 6”) to the crown of the roadway.

The bulbs must be of the specified wattage and type. The contractor should have spare bulbs on the job.

PEDESTRIAN HEADS

Mount the pedestrian heads as shown on the plans, not on the street side of the pole.

The bulbs must be of the specified wattage and type. The contractor should have spare bulbs on the job.

Pedestrian heads must be mounted 3.0 m (10 feet) to the bottom of the head.

PED PUSHBUTTONS

Pushbuttons must be mounted on the correct side of the pole as shown on the plans.

The pushbutton signs must be worded as shown on the shop drawings with the arrow pointing in the proper direction.

403.10 FINAL SIGNAL TURN ON

Call Traffic Engineering (402-479-4594) at least 2 days before turn on, try to avoid turning the signal on Fridays, signal failures usually occur in the first few days.

Prior to requesting a turn on:

The power service must be installed and energized.

Each signal head and ped head must be "flashed out" by the contractor to check for short circuits and to assure that each wire really does service the assigned signal head.

Check each loop wire in the cabinet for continuity.

Arrange with the District or local jurisdiction for STOP sign removal when the signal is turned on.

"Signal Ahead" signs must be installed.

Arrange for flagging by the police/State Patrol at turn on, if required.

404.00 CONSTRUCTION WORK ZONE TRAFFIC CONTROL

404.01 TRAFFIC CONTROL SPECIFICATION REFERENCES

The Project Manager shall prepare Traffic Control Plan and present it at the Preconstruction Conference. The Traffic Control Plan must be approved by the Traffic Engineering Division.

Contract documents include references to traffic control requirements in many locations. Project plans contain references to traffic control requirements in the traffic control plan tabulation usually found on estimate of quantities sheet. Plans may also contain project specific traffic control and/or staging details.

Traffic control specification references are found in:

- *SSHC Section 422* - Temporary Traffic Control Devices
- *SSHC Section 1069* - Temporary Centerline Stripe for Pavements
- *SSHC Section 423* - Traffic Provisions

Traffic control requirements may also be found in the Specification Sections for specific construction activities.

DR Form 502, "Construction Signs and Posts", or a similar computer file shall be used to record transfer of signs to a contractor.

404.02 TRAFFIC CONTROL SIGNING CHANGES

Plan notes indicate signing changes cannot be made without concurrence of the District Construction Engineer and Traffic Engineering [(402) 479-4594]. Field flexibility is required by situations that will not fit standard traffic control layouts such as hilly terrain, permanent signs, guardrail location, or side roads and entrances impacting the location of temporary traffic control signs. Presence of unusual traffic generators that affect volume or high turning movements might also require sign location adjustments.

Evaluate construction work zones prior to installation of traffic control signing, and again when operational, to look for any problem areas that may affect operational quality. Traffic control evaluations shall be held during work hours, on weekends, and during nighttime hours. **Presence of skid marks are a good indication of a problem area.** Early review of proposed traffic control signing situations prior to the preconstruction conference will allow traffic control detail changes to be made prior to impacting public traffic.

Make **immediate** changes when obvious operational problems exist, then call the District Construction Engineer and Traffic Engineering Division as soon as possible to discuss needed changes. For other than obvious operational problems that could be dangerous to motorists or workers, contact the District Construction Engineer and Traffic Engineering Division **first** for concurrence of any proposed changes.

The following modifications to traffic control details **shall not** be made:

- Do **not** change taper lengths
- Do **not** change the sign word message or symbol

- Do **not** change the sign color combination
- Do **not** reduce sign size or alter sign shape

Field adjustments can be made, if necessary, in the following areas **without** Traffic Engineering Division notification and concurrence:

- Individual sign locations may be adjusted up to a maximum of 60 m (200 feet) as long as no two signs, either permanent or temporary, become closer than 60 m (200 feet) apart. Removal, covering, or adjusting of permanent signs in the vicinity of construction work zones should be coordinated with maintenance. Adjustment greater than 60 m (200 feet) must be approved by the District Construction Engineer.
- Paired signs may be adjusted a maximum of 60 m (200 feet).
- Taper location, sequencing arrow location, and corresponding lane merge signs may be adjusted up to 150 m (500 feet) away from construction work area. This is appropriate with poor advance sight distance due to hills or curves, or when earlier detection of a sequencing arrow is needed.

404.03 CONSTRUCTION ZONE ACCIDENT REPORTING

Prior to the start of construction, the District Construction Engineer (DCE) will notify in writing the appropriate Nebraska State Patrol office of the project location and scope. This correspondence should identify location, construction dates, and other pertinent construction project data including names and phone numbers of responsible contact persons from contractor and District Office in case of accident or other construction work zone problems.

If the Nebraska State Patrol determines the NDR needs to make immediate repairs at a construction work zone accident site, the investigating officer will contact the appropriate District office. The DCE will evaluate the request and advise the PM as to what action to take. The Project Manager will then inform the contractor's representative of needed corrective action. When construction work zone accident site does not require immediate corrective action by NDR or contractor representatives, the investigating officer is to report accident to the Project Manager within 12 hours.

Investigation Procedure

When an accident occurs within a construction work zone, the Project Manager will complete DR Form 100 "Construction Zone Accident Report". The report should include pictures, diagrams, traffic control, weather conditions, and other pertinent information as appropriate. Attach a copy of any accident report by other agencies (highway patrol, county sheriff, or city police). Also, attach photographs and a video tape (whenever possible) of the accident site showing location of traffic control devices and other pertinent items.

For accidents resulting in property damage to NDR facilities, the Project Manager shall identify repair costs on DR Form 11, State Property Damage Report. This form is initiated by the Traffic Engineering Division. An example is damage to new guardrail on a staged bridge construction. The District should identify work status when completing the report. Repair costs and supporting documentation should be submitted on the form. An

approved extra work order can be attached to the form to document costs in lieu of completing that part of the form.

The ORM form, Vehicle Accident Report, and the DR form 41, Driver's Motor Vehicle Accident Report shall be completed within 10 days and should be forwarded to the Traffic Engineering Division, State Property Damage Coordinator, 479-4645.

Accident Notification Procedure

The NDOR or contractor staff should report construction work zone accidents to appropriate enforcement authorities (usually Nebraska State Patrol for NDR administered projects) and notify appropriate medical responders if needed. Both the inspection supervisory staff and contractor supervisory staff should be notified promptly. Note additional reporting procedures for severe personal injury or fatality accidents.

Reporting of Severe Personal Injury and Fatal Accidents

If an accident results in a severe personal injury or fatality within a NDR administered construction work zone, immediately notify the Construction Division, District Construction Engineer, and Traffic Engineering Division.

Additional information to be gathered and forwarded by FAX within one working day to the Construction Office, and Traffic Engineering Division includes:

Project Number
County
Route Number
Direction
Milepost
Date of Accident
Time of Accident
Contractor
Traffic Control Required in the Contract Documents
Approved Traffic Control Modifications
Brief Description of Facts Surrounding Accident
(Do not include hearsay, assumptions, or unsubstantiated facts.)

404.04 STOP SIGNS ON CONSTRUCTION PROJECTS

Particularly during grading activities, the need arises to frequently move stop signs as intersections are staged to allow access into project corridor. Instructions regarding the placement of stop signs during grading activity are as follows:

- Existing stop signs should be left in place until work in that area necessitates removal. If an intersection does not have an existing stop sign, the appropriate maintenance area supervisor should be notified to install a stop sign immediately. All side roads to primary highways must have a stop sign unless the side road is physically closed.

- At the time work progresses to the point that existing stop sign is no longer in the proper location or in the way of construction activities, the stop sign should be removed by NDR Maintenance. A temporary stop sign with a minimum size of

750 mm x 750 mm (30 inches x 30 inches) should be furnished by NDR Maintenance and placed by the contractor. Temporary stop sign should be mounted approximately 1.5 m (5 feet) high on a 1.5 m (5 feet) Type III barricade or other suitable support furnished by the contractor. See Standard Plan 920. This sign may be moved as needed to allow construction to proceed, but must be maintained in an effective position at all times traffic is staged through the intersection.

- When work at the intersection is completed to the point where the permanent stop sign can be installed, Maintenance should be notified to install the permanent stop sign. This notification should be given on an intersection by intersection basis and not delayed until entire project is completed.

404.05 "ROAD WORK AHEAD" AND "END ROAD WORK" SIGNS

When Traffic Control plans require contractors to place "Road Construction Ahead" (W20-1) and "End Construction" (G20-2) signs at appropriate ends of highway construction projects. On any mainline roadway where a "Road Work Ahead" sign is placed, the opposite end of the work zone shall have an "End Road Work" sign placed.

These signs are required to be in place during and after the milling operation until existing pavement has had a lift of resurfacing placed due to the roughened pavement surface.

404.06 NO PASSING ZONES ON CONSTRUCTION PROJECTS

Often it is necessary to place temporary no-passing zones through a traffic control zone. Guidelines to aid in proper use of no-passing zones follow:

- Never shorten an existing no-passing zone for temporary traffic control.
- If existing no-passing zone is lengthened, a black on orange "No Passing Zone" (W14-3) (pennant) sign should be erected at beginning of no-passing zone and existing black on yellow "No Passing Zone" (W14-3) sign should be removed or covered.
- If temporary no-passing zone falls within existing no-passing zone, no additional signs should be added. Either existing black on yellow "No Passing Zone" sign can remain or be replaced with black on orange "No Passing Zone" sign.
- If no-passing zone ends within 90 m (300 feet) of beginning of existing no-passing zone, then both no-passing zones should be connected to make one continuous no-passing zone. Only one "No Passing Zone" sign should be placed at the beginning of continuous no-passing zone.

404.07 EQUIPMENT AND MATERIAL STORAGE

When maintaining through traffic on construction projects, equipment and materials stored within the right-of-way during nonworking hours should normally be stockpiled as far as possible from the traveled way. Avoid storage areas in the following locations unless protected by temporary concrete barrier, rail or metal beam guardrail:

- Within 9 m (30 feet) of traveled way on primary highways

- Within 15 m (50 feet) of traveled way on interstate highways
- On foreslopes
- On outside of sharp horizontal curves

Other storage locations may be approved by Project Manager when it is not practical to satisfy the above criteria.

Storage behind guardrail must provide for partial collapse of rail upon impact. For beam
@ guardrail this is normally a minimum of 12 feet (3.6 m) on bull noses and a minimum of 5 feet (1.4 m) on parallel sections of rail. A minimum of 3.6 m (12 feet) should be allowed behind cable guardrail.

404.08 CONSTRUCTION WORK ZONE SIGNING DURING WINTER SHUTDOWN

Responsibilities of the District Construction Engineer (DCE), District Maintenance Superintendent, and the contractor for highway projects not fully completed by winter shutdown are reviewed below.

Unless contract documents identify signing responsibilities different than stated herein, the following guidelines will apply. Unusual circumstances will be handled on a project specific basis with approval of the Construction Division.

Uncompleted Projects

This category of projects includes contracts having some carry-over work into the next year or intended by plan to be multi-year contracts.

- Prior to winter shutdown, the DCE, PM and Maintenance should field review the project to identify access, signing, and safety features needed to be completed before the contractor suspends work. The DCE and Maintenance will decide which items are contractors responsibilities and what is best accomplished by NDR Maintenance forces. Cost of traffic control devices furnished by NDR Maintenance can be charged against the project.
- During the winter shutdown period, traffic operation services become the responsibility of the NDR Maintenance. This includes routine surveillance and sign maintenance.
- Snow removal for through traffic and local accesses, if needed, is the responsibility of Maintenance.

Multi-Contract Projects

Some projects are phased so a series of contracts are awarded over several years. The most common examples are separate grading and paving projects. Unless contract documents identify responsibility for traffic signing between completion of one project and start of the next project, the Project Manager should evaluate and resolve each specific situation.

Special Concerns

When temporary traffic signals are involved, the contractor shall arrange for emergency maintenance services. No payment will be made to contractor.

On urban projects, DCE will need to coordinate with the city to determine who is responsible for access, signing, and safety features.

404.09 FLAGGERS & PILOT CARS (*SSHC Section 422)*

The Department, in conjunction with the AGC, has made the Flagger Certificate quiz, the Flagger Training video, and a Flagger Training audio cassette available in Spanish.

The availability of this material in Spanish in no way is meant to void the specification that requires that flaggers read and speak English clearly. However, in recent years the number of Hispanic workers on our construction projects has increased. The intent is to provide better education to those whose native language is Spanish, realizing that while they may be able to speak English clearly they may have difficulty learning and taking a test in English. You could relate it to learning metrics. While we know and talk metric, few of us really think in metric.

The flagger on a construction project is the first line player in communicating with the driving public. It is imperative that the flagger be able to speak English clearly with the drivers in a work zone. The contractor is responsible for insuring that anyone performing flagging can meet these requirements.

Flaggers may wear the company's hard hat no matter what color it is.

Flagger Bid Item

@ If the contractor's flagging crew works four hours or less, then ½ flagger day is charged. If the crew works more than four hours, then one flagger day is charged.

Slow/Slow Paddles

@ The Flagger Handbook indicates that when a flagger is used near the lane-line to warn public traffic of workers and equipment close to the open lane, then these flaggers are only allowed to use a "slow/slow" paddle. This paddle shall be 24 inches (0.6 m) diamond shaped with the word "slow" in black letters on orange background on both sign faces. The standard stop/slow paddle shall never be used on a multi-lane highway, since through traffic should never be forced to stop on these roadways.

Permanent & Temporary Pavement Marking

Pavement moisture can be measured by placing and holding a two square foot piece of clear plastic on the existing pavement for a period of 15 to 20 minutes. Remove and hold the plastic in a vertical position. If water drips from the underside of the plastic sheet, the pavement has excess moisture.

The slow/slow paddle shall not be used on two-lane primary highways, since the purpose of the stop/slow paddle on these roadways is to actually stop traffic and then allow them to proceed through the traffic control zone under pilot car or flagger control.

Method of Measurement

If an item for flaggers and pilot cars is included in the bid proposal, days are estimated to determine the low bidder. These bid items often overrun due to contractors using multiple work crews at different locations within the same project.

The inspector will count the number of days each flagger (or pilot car) was used. Every flagger and pilot car used and approved by the PM as part of a preplanned work operation is to be paid if their usage is required as a part of required traffic control. Flaggers used solely as a benefit to contractor to help control their own equipment are not to be counted for payment.

404.10 INTERSTATE TRAFFIC CONTROL REQUIREMENTS

Median Crossings

The contractor is prohibited from using any established or other type median crossover on most four-lane divided highway projects unless a crossover is required and drawn in the Plans.

Traffic Control Removal for Head-to-Head Projects

The procedure to remove traffic control devices from head-to-head sections of interstate repair projects has been accomplished differently across the state. To achieve uniform removal practices across the state, the following steps will be used to remove traffic control devices from head-to-head projects:

- Move diverted traffic stream back to its normal side of median.
- Place plastic drums in closed (passing) lane at intervals as prescribed in *Manual on Uniform Traffic Control Devices*.
- Remove all "Two Way Traffic" (W6-3) signs, leaving "Do Not Pass" (R4-1) signs in place.
- Remove double yellow lines with simultaneous removal of tubular markers, "Do Not Pass" signs, and plastic drums. At the same time yellow lines are removed, new white lane lines shall be placed. If lane line painting cannot be accomplished the same day as the double yellow lines are removed, plastic drums shall remain in place effectively closing the passing lane.
- Remove impact attenuator and all temporary barrier rail at upstream end.
- Remove any advance construction work zone signing in the direction towards oncoming traffic.

The entire removal operation shall proceed upstream towards traffic. This will ensure that motorists will have two clear open lanes once they pass traffic control removal operations. Tubular markers shall not be removed in any area until the double yellow lines are removed, unless they are replaced with vertical panels or Type II barricades.

Raised Pavement Markers (*SSHC Section 422)*

Many interstate or other complex project traffic control plans include the use of raised pavement markers to supplement the temporary pavement markings for the project. Raised pavement markers are used in lane shifts or at crossover location to enhance visibility of correct travel path through these areas. Raised pavement markers are very effective if they stay in the correct location on pavement surface.

Off-tracking rear wheels on semi-trailers often dislodge raised pavement markers from the pavement surface. It is permissible to offset the location of the raised pavement markers up to 300 mm (1 foot) laterally away from the temporary pavement marking line to avoid the off-tracking rear trailer wheels.

404.11 CHANGEABLE MESSAGE SIGN GUIDELINES (*SSHC Section 422)*

The Department owns changeable message signs (CMS) stored at various locations statewide. These CMS units are intended to be used for incident management traffic control for major interstate reconstruction, emergency response, temporary road closures for bridge beam replacement, temporary utility crossing requiring road closure, and for other emergency related road closings.

CMS units used for incident management traffic control for major interstate reconstruction projects should have the word message approved by the Traffic Engineering Division, since the appropriate message will vary from project to project. CMS units used for all other situations should also have the word messages approved by the state traffic engineer.

Proposed word messages should be limited to a maximum of 2 panels and usually eight words or less per panel.

CMS units used for project purposes will be under control of the appropriate maintenance office. Repair costs for CMS units used for project related incident management can be charged against project funds using the appropriate documentation.

404.12 FLASHING ARROW PANELS

A listing of currently approved flashing arrow panels is found in the NDR Approved Products List. Manufacturers of flashing arrow panels not currently approved for project use may contact the Materials and Research and Traffic Engineering Divisions to schedule a field review for inclusion in the NDR Approved Products List.

Any flashing arrow panels approved prior to January 1, 1996 must be resubmitted for approval under the new MUTCD requirements.

If any solar arrow panel fails to perform adequately in a field situation, it shall immediately be removed and replaced with a diesel powered arrow panel. The Materials and Research Division and Traffic Engineering Division should be informed if any approved solar arrow panel fails to perform adequately so that the deficient arrow panel model can be dropped from the NDR Approved Products List.

404.13 SIGN MOUNTING DEVICES

SSHC Section 422 states that signs for traffic control zones that are used 24 hours a day are permanent signs that shall be post mounted. Temporary signs may either be post mounted or temporarily mounted.

In urban areas, signs that require post mounting may be skid mounted at the post mounting heights required in the MUTCD provided that skid mounting devices are either a breakaway design or a design that would not become a hazard if hit by vehicles.

404.14 REMOVAL OF TEMPORARY PAVEMENT MARKINGS (*SSHC Section 422)*

Temporary pavement markings are necessary for most construction projects. Typical locations include shooflys, shifts, stage construction, etc. When temporary pavement markings are placed, they will eventually be removed as part of the project.

Removal depends on the type of pavement marking material placed and type of surface to which it is attached (new, old, ACC, or PCC).

Each temporary pavement marking material has its own removal characteristics.

All residue and/or debris shall be removed from the pavement surface when removing temporary pavement marking materials. Any removal process shall not cause damage to the final pavement surface.

It has been brought to our attention that some of the contractors have been using raised pavement markers in place of temporary pavement marking Type I or Type II.

When the project includes the pay item(s) "Temporary Pavement Marking, Type I," "Temporary pavement Marking, Type II," or "Temporary Pavement Marking, Type RPM," only that specific tape or raised pavement marker may be used and paid for at that contract unit price. The contractor is not allowed to use RPMs when the contract bid item is Temporary Pavement Marking, Type II. Only temporary removable preformed tape may be used for Temporary Pavement Marking, Type II.

When the project bid item is "Temporary Pavement Marking" without any type specified, the contractor is allowed to choose between the three different types of markings, provided that the type of material used complies with the plans and specifications. Therefore, if the plans call for TPM Type II at a crossover, for instances, and the other locations do not specify the type of marking, the contractor is required to use Type II markings at the crossover, and may choose to use another material for the rest of the project, providing it complies with the specifications.

Upon completion of the project, any temporary pavement marking which is not intended to remain in place must be removed. This includes stop bars, lane shifts, and any temporary markings left on travel lanes or shoulders.

404.15 WORK AREA SPEED ZONE

Speed Limits in Maintenance Work Areas

For the purpose of establishing speed limits through a maintenance work area, an urban area is defined as the portion of the State Highway System within the corporate limits of a city or village, and a rural area is defined as the portion of the State Highway System outside the corporate limits of a city or village.

Never drop speed more than 20 mph at one point. If 20 mph or greater reduction is needed, phase the drop so that no phase exceeds 20 mph.

When it is deemed necessary to implement a speed limit through a maintenance work area, the following guidelines should be used in determining the value of the speed limit:

Rural Areas

Work activity is being performed in the driving lanes.

Freeways - Normally 50	40 mph
Other State Highways -	35 mph

Work activity is being performed on the shoulder and the work does not encroach onto the driving lane.

Freeways - Normally 50	45 mph
Other State Highways -	40 mph

Work activity is being performed off the shoulder.

No change from statutory limit.

Urban Areas

Freeways

The guideline for determining the value of the speed limit in a rural area for freeways should be used.

Other State Highways

35 mph if the posted speed limit is 50 mph or higher.
25 mph if the posted speed limit is 45 mph or lower.

Special conditions or work activities may occur where speed limits higher or lower than those described above may be appropriate; however, in no situation can a speed limit of less than 35 mph in a rural area, or 25 mph in an urban area, be implemented.

Many maintenance work activities are of short duration (approximately 1/2 day) take place off the roadway or shoulder, or are fast-moving operations. In many cases, the additional exposure to traffic while setting up signing to mark the work area creates a greater hazard than the actual work activity. Work activities of this type may not require work area speed

limit signing and are exempted from the provisions of the guideline regarding speed limits and double fines. In all instances, however, the safety of the worker and the traveling public must be the determining factor. If, in the opinion of the supervisor, a work area speed zone is appropriate, the provisions of the guideline should be followed.

The following activities may not require speed zone signing:

- Survey crew (See existing policy)
- Litter pickup (Adopt-a-Highway)
- Bridge deck inspection (non-snooper) if under 1 hour (snooper)
- Pavement condition and inspection survey
- Deflection testing
- Coring operations
- Traffic counting
- Minor milling (Activity Code 2003)
- Hauling and mixing materials for cold mix (Activity Code 2020)
- Spot patching (Activity Code 2026)
- Grade shoulders (Activity Code 2031)
- Blading unpaved roads (Activity Code 2035)
- Major restoration unpaved roads (Activity Code 2036)
- Maintenance of access and frontage roads (Activity Code 2040)
- Unspecified roadway and shoulder maintenance (Activity Code 2050)
- Drainage structure maintenance (Activity Code 2101)
- Maintaining miscellaneous structures (Activity Code 2102)
- Reshaping ditches and filling washouts (Activity Code 2111)
- Channel cleaning and reshaping (Activity Code 2114)
- Machine mowing (Activity Code 2301)
- Hand mowing (Activity Code 2302)
- Chemical control of insects and roadside trees and shrubs (Activity Code 2303)
- Care and replacement of desirable roadside trees and shrubs (Activity Code 2304)
- Litter pickup (Activity Code 2311)
- Rest area and wayside area operations (Activity Code 2313)
- Seeding and sodding (Activity Code 2315)
- Survey and investigation of junkyard sites (Activity Code 2321)
- Outdoor Advertising Control (Activity Code 2323)
- Fence repair (Activity Code 2332)
- Other roadside maintenance (Activity Code 2350)
- Sign repair or replacement (Activity Code 2401)
- Centerline and edgeline striping (Activity Code 2408)
- Contract striping (Activity Code 2409)
- Signal Repair (Activity Code 2415)
- Highway lighting maintenance (Activity Code 2416)
- Erecting and removing snow fence (Activity Code 2501)
- Brush cutting (Activity Code 2505)
- Snow plowing and spreading of winter chemicals and sand (Activity Code 2511)
- Loading and hauling of snow (Activity Code 2514)
- Stockpiling chemical and sand (Activity Code 2521)
- Correct vandalism or roadside features (Activity Code 2603)

Speed Limits in Construction Work Areas

The maximum speed limit through any construction and maintenance work area shall be 35 mph in rural areas and 25 mph in urban areas, provided signs are in place to give notice of the speed limit.

The Director may raise the 35-mph speed limit in rural areas and the 25-mph speed limit in urban areas, or may delegate the authority to raise the speed limits to Department of Roads' employees in a supervisory capacity. The speed limits shall be raised in 5-mph increments, and cannot exceed the statutory speed limits.

Speed limits above 35 mph in a rural area and 25 mph in an urban area will be effective when the Director, or any officer to whom authority has been delegated, gives a written order for the increase and signs identifying the speed limit are displayed.

Speed limit signs may be mounted on a fixed or movable stand. For a moving-type operation, speed limit signs may be mounted upon moving Department of Roads' vehicles.

Authorization

In order to raise the work area speed limit from 35 mph in rural areas and 25 mph in urban areas, the authorized supervisory employee shall complete a Speed Zone Authorization form identifying the speed limit, highway number, location, and starting and ending times that the speed limit will be in effect. The original Speed Zone Authorization form should be kept in the file of the individual signing the authorization. A copy of the Speed Zone Authorization should be forwarded to the individual in charge of the work crew.

The establishment of speed limits through construction work areas will be determined in the Lincoln office, and will be included in the contract provisions so that a contractor will be aware of a construction speed limit while preparing his/her bid.

If a situation arises where a construction speed limit is needed during the course of a construction project and no provision was made for the speed limit in the contract provisions, or if a speed zone established through the contract provisions needs to be raised or lowered, individuals designated by the Director may establish or alter speed limits in accordance with these guidelines.

Signing (*SSHC Section 422)*

All signing shall conform to the requirements of the *Manual on Uniform Traffic Control Devices*.

Speed limit signs are intended to supplement normal work area signing. They are not intended to replace any of the signs that are now being used, except under certain situations where advisory speed plates are used.

In order to make the "Double Fines" enforceable, the "FINES FOR SPEEDING DOUBLED IN WORK ZONES" sign must be posted at the beginning of each work zone. On all speed limit signs, the "FINES DOUBLED" sign needs to be installed, except for 35 mph in rural areas and 25 mph in urban areas, must be set by utilizing the authorization form. If, for example, within the limits of an interstate construction project, there are two sections under

work which require a reduced speed of 55 mph and the balance of the project maintains a 75 mph speed limit, an authorization form must be completed raising the speed limit on the two sections from 35 mph to 55 mph and the balance to 75 mph.

All existing speed limit signs that conflict with the work area speed limit should be removed or covered during the period of time that the work area speed limit is in effect, except that advisory speed limits that are lower than the work area speed limit being implemented should be left in place. The minimum length of a work area speed zone should be 1/2 mile.

A "Work Area - Speed Zone Ahead" sign should be placed approximately 250 m (800 feet) in advance of the first work area speed limit sign. If the work area is on a steep downhill grade, the 250 m (800 foot) distance should be extended to allow a motorist sufficient distance to decelerate from the statutory speed limit to the work area speed limit. In urban areas where lower speed limits exist, the 250 m (800 foot) distance should be decreased to from 100 m (300 foot) to 200 m (450 foot), depending on the reduction in speed limit that is being implemented through a work area.

The first speed limit sign should be placed approximately 200 m (450 m) in advance of the start of the work area. In urban areas where lower speed limits exist, the 200 m (450 m) distance should be decreased to from 30 m (100 feet) to 100 m (300 feet), depending on the reduction in the speed limit that is being implemented.

The maximum length of a work area speed zone should be one-half mile, with the exception of work operations that are being performed simultaneously at the beginning, through, and at the end of a work area that is longer than one-half mile in length.

A “FINES FOR SPEEDING DOUBLED IN WORK ZONES” signs should be placed 500 to 1000 feet following the first work zone signs with the appropriate speed limit sign with the “FINES DOUBLE” plate 500 to 1000 feet beyond that.

For reduced speed areas, a “REDUCED SPEED AHEAD” sign should be placed approximately 800 feet in advance of the first work area speed limit signs. If the work area is on a steep downhill grade, the 800-foot distance should be extended to allow a motorist sufficient distance to decelerate from the statutory speed limit to the work area speed limit. In urban areas where lower speed limits exist, the 800-foot distance should be decreased to from 200 to 500 feet, depending on the reduction in speed limit that is being implemented through a work area.

The first speed limit sign with the “FINES DOUBLE” plate should be placed in advance of the start of the actual work area.

In reduced speed areas, a speed limit sign with the R2-1wz “FINES DOUBLE” plate shall be repeated at no greater than one mile intervals.

The appropriate standard R2-1 speed limit sign shall be installed immediately following the End Road Work, Thank You Drive Safety sign.

Recordkeeping

It is necessary to keep a daily log of work area speed limits, in the event a court case results from a driver being given a citation for exceeding the speed limit.

The daily log should identify the date, hours the speed limit is in effect, value of the speed limit being implemented, highway number, starting and ending reference posts of the work area speed zone, and in the event a speed limit is implemented on one side of a divided highway, the direction of travel.

404.16 BRIDGE APPROACH GUARD RAILS

On construction projects that require the removal of guardrail at the approaches to bridges, or if the rail has not yet been installed, the following minimum traffic controls should be in place at all unprotected bridge ends whenever traffic is permitted to use the highway:

Two-lane, two-way condition

Three Type III barricades should be in place to the right of the lane approaching the bridge. The barricades should be placed at 15 m (50 foot) centers, with the last barricade placed at the unprotected bridge end.

One Type III barricade should be in place to the right of the lane leaving the bridge (facing traffic approaching from the opposite direction). The barricade should be placed at the unprotected bridge end.

Divided highway condition

Three Type III barricades should be in place both to the right and to the left of the lanes approaching the bridge. The barricades should be placed at 15 m (50 foot) intervals, with the last barricade placed at the unprotected bridge end.

Barricades are not required on the lanes leaving the bridge.

In addition to the barricades at bridge ends, normal signing warning traffic that they are approaching a construction area should be in place.

These traffic controls are applicable to both active construction projects and projects that are held over the winter for completion in the next construction season.

The above traffic controls are intended for use only during the period of time when construction activities require that a bridge end remain unprotected. The replacement of guardrail should be accomplished at the earliest possible date, to eliminate the unprotected bridge end condition.

404.17 INERTIAL BARRIER SYSTEMS

There seems to be some misunderstanding among the contractors about the proper installation of the Type I object marker on the inertial barrier systems. The object marker
@ must be placed directly on the front of the first 440 lb (200 kg) module, either by adhesive or rivet, etc. The marker is not to be placed on a separate post in front of the module. The presence of a post in front of the system could effect the crash characteristics of the inertial barrier system.

404.18 BARRICADES/PLASTIC DRUMS

Due to increased usage of plastic drums and Type II barricades on resurfacing projects, and the considerable amount of time involved in testing one of every five devices, we are making the following changes in the minimum tests required:

- When less than 50 are furnished, test one of every five furnished, or a minimum of two each, whichever is greater.

- When 50 or more of any one device are furnished, test one of every ten furnished of that device.

@ **405.00 SIGNS**

405.01 DEDUCTION FOR SIGNS

Use DR Form 502 "Construction Signs and Posts" to document signs supplied and returned by the contractor.

@ Itemize those signs not returned or damaged by the contractor in the Sign Deduction Computation Letter to the Construction Division, Finals Section. The itemized list, as prescribed in the Finaling Manual should show the number of signs, sign number, message, sign size, cost per sign and total deduction. The list should also indicate which signs were damaged and which were not returned.

The Project Manager shall determine if the value of damaged or missing signs are to be deducted from the Contractor's payments. Assessment for broken, damaged or unreturned signing materials is to be made for losses or damages which is due to the contractor's actions. The contractor will be assessed the total value of a sign and a salvage value will no longer be allowed for damaged signs.

The Project Manager will compute the assessment and enter it on a project estimate.

405.02 SIGN MAINTENANCE

When a permanent sign has been destroyed or damaged due to the actions of the public, either by accident or by vandalism, the work of repairing or replacing the sign shall be considered to be part of the item, "Maintenance of Permanent Signs". The Department will furnish a new sign and post, if required, at the permanent maintenance headquarters from which the signs were originally obtained.

Log of Work Area Speed Zones

			Reference Post			Time		Divided Highways
Date	Highway No.	Speed Limit	From	To	Location	Start	End	Direction of Travel

Notes: If special remarks or comments are necessary for a particular speed zone, use an extra line.
The direction of travel is needed only if work is being performed on one side of a divided highway.

_____
Signature

Speed Zone Authorization

Pursuant to the authority contained in Section 60-6,188 Reissue Revised Statutes of Nebraska, and in accordance with Authorization No. ____ issued on July 19, 1996 by the Director, the maximum speed limit of 35 miles per hour in rural area, or 25 miles per hour in an urban area through highway maintenance, repair or construction zones on the portion of the state highway system, has been increased as set forth below.

Highway No.: ..... Location: .....

Ref. Post: ..... To Ref. Post: .....

Project No. *(if applicable)*.....

The **prima facie** speed limit shall be increased from ____ miles per hour to _____ miles per hour, this increase maintains the same posted speed limit as the speed limit prior to work for the entire length of the work zone, and will be in effect 24 hours a day, except as changed below.

The following **prima facie** speed limit for sections of the work zone shall be increased from _____ miles per hour to the speed shown below, and shall be in effect only when standard signs giving notice thereof are installed as provided by law, for the lengths and time periods as set forth below.

Work Zone Section One: _____ **Miles Per Hour** Activity: _____

Transition Speed Zone Required (y/n) _____ if Yes, Transition Zone - _____ Miles Per Hour

Stationary _____ Sta. or To: _____
(Longer than 3 Days) Ref. Post: _____ Ending Date: _____

Starting Date: _____ Ending Date: _____

24 Hours (y/n)_____ or Daily, Start Time: _____ End Time: _____

Non-Stationary _____ Actual Starting and Ending Locations, Dates, and Times will be documented
(Less than 3 Days) in a daily log.

Work Zone Section Two: _____ **Miles Per Hour** Activity: _____

Transition Speed Zone Required (y/n) _____ if Yes, Transition Zone - _____ Miles Per Hour

Stationary _____ Sta. or To: _____
(Longer than 3 Days) Ref. Post: _____ Ending Date: _____

Starting Date: _____ Ending Date: _____

24 Hours (y/n)_____ or Daily, Start Time: _____ End Time: _____

Non-Stationary _____ Actual Starting and Ending Locations, Dates, and Times will be documented
(Less than 3 Days) in a daily log.

Authorizing Authority (Signature)	*Title*	*Date*

cc: District Office
Nebraska State Patrol
County Sheriff

CHAPTER NOTES:

CHAPTER NOTES:

DIVISION 500

BITUMINOUS PAVEMENT

DIVISION 500

BITUMINOUS PAVEMENT

501.00 ASPHALT PAVEMENT CHECKLIST

SSHC References:	*Section*	*503*	*Asphalt Concrete Pavement*
		1028	*Asphalt Concrete*
		1033	*Aggregates*

Inspection Crew:

Plant Inspector
Laydown Inspector
Lab Inspector

Inspection Equipment:

Nuclear Density Gauge
Thermometer (Surface)
Thickness Ruler
3 m (10 foot) Straightedge
Cleaning Solvent
Insulated Container
Gravel Sampling Bags
Paper Sacks
1.3 m (4 ft.) Carpenter Level
Performance Graded Binder Sample Cans

Inspection Procedures:

1. Review all Plans, Specifications, Road Standards, Materials & Research Manuals/guidance and the *Construction Manual*. Prepare field books.
2. Check traffic control, work zone length, flaggers, signing, pilot car operations.
3. Check project quantities to insure accuracy.
4. Are asphalt concrete mix designs approved?
5. Obtain necessary inspection equipment and review sampling and testing procedures and frequencies.
6. Locate and reference fixtures to be adjusted prior to placing final layer.
7. Does equipment meet requirement of *SSHC*:
   - Trucks
   - Tampers
   - Rollers
   - Material Bins
   - Weighing Equipment
   - Distributors

Spreaders
Brooms
Trenchers
Pavers

8. Check paver screed for proper crown and excessive wear. Are automatic grade and slope controls operational (*SSHC Subsection 503.03*)?
9. Check frequency of vibratory rollers to assure 30-40 impacts/m (100-130 impacts/ft.) with a tachometer.
10. Where a rubber-tired roller is used, verify the manufacturer's recommended contact pressure.
11. Are there enough rollers to obtain required density (*SSHC Subsection 503.04*) and smooth out bumps, ridges, and marks in surface? (*SSHC Subsection 503.03*)
12. Are tarps or insulated truck boxes required? Check for improper use of cleaning solvents. (*SSHC Subsections 501.02 and 503.03*)
13. Check hand equipment. Lutes, rakes, and shovels should be heavy enough to do the job. (*SSHC Subsection 501.02*)
14. Check distributor spray bar height and nozzle angle against manufacturer's recommendations to achieve uniform tack coat. Is the distributor tank calibrated? (*SSHC Subsection 501.02*)
15. Were all vertical faces tack coated?
16. Determine if correct type and rate of tack coat material is being applied. (*SSHC Section 504*)
17. Check each truck load of mix for proper scale ticket. (*SSHC Section 503*)
18. Are trucks properly loaded and within legal weight limits?
19. Is mix being placed at proper temperature range? (*SSHC Subsection 503.04*) Check surface temperature. (*SSHC Subsection 501.01*)
20. Don't expose conveyor. Make sure material is on the hopper conveyor at all times.
21. Is paver hopper near full at all times? (*SSHC Subsection 503.04*) Check flow gates and augers. Paver wings should not be dumped as large aggregate accumulates in the wings. Waste it at the end of each day.

22. Are proper number of trucks available for continuous paving?
23. Compare paver speed to plant output to reduce amount of stopping. (*SSHC Subsection 503.04*)
    Consistent speed results in more consistent pavement properties.
24. Check width, depth, and cross-slope, and compare to spread width typical and typical section as per plan.
25. Check and record yield based on megagrams (tons) of mix required compared to megagrams (tons) of mix used. (Recommend 2-hour intervals)
26. Is gradeline string accurately set and maintained? (*SSHC Subsection 503.04*)
27. Are transverse and longitudinal joints constructed properly? (*SSHC Subsection 503.04 and Construction Manual 502.40.3*)
28. Is surface texture uniform, dense, and free from irregularities, tearing, steel roller marks, check cracks, solvent spots, and segregation? (*SSHC Subsection 503.04*)
29. Check smoothness (*SSHC Section 502*) with 3 m (10 foot) straightedge when profilometer smoothness (*SSHC Section 502*) is not required.
30. Are temporary runouts and fillets in compliance with applicable standards?
31. Obtain required performance graded binder samples. Obtain tack samples if required.
32. Mark original and any recut core locations and observe core sampling. Be sure core holes are properly filled. May use nuclear density gauge to check density.
33. Think safety! Use proper equipment, wear protective clothing, and be aware of contractor's operations.
34. Is the established rolling pattern being maintained and documented? (*SSHC Subsection 503.04*) Are asphalt concrete properties in the test strip determined to be acceptable prior to proceeding?
35. Do shoulder rumble strips conform to the Plan details? Check indentation depth and alignment of strip.
36. Do drop-offs comply with plan details?

37. Has grade and alignment staking been completed and checked?
38. Is subgrade according to plan, stable, and corrected tolerance (*SSHC Section 302*)? Check subgrade according to *Construction Manual 540.1*.
39. Are any string line offsets referenced to permanent stakes?
40. Review "Manufacturer's Operations Manual"
41. Make sure loader operator does not contaminate aggregates.

Laydown Procedures:

1. Keep records on temperature at plant and at laydown site.
2. Asphalt spilled while loading finishing machine must be picked-up.
3. Have Contractor demonstrate how they will maintain level & smooth finishing operation.
4. Keep scale records.
   a. Know what is on the records.
   b. Save records in project files.
5. Note: "Daily Report of Asphaltic Concrete Mass".
6. Do not allow any longitudinal joints in the driving lanes wheel path. Paver must be able to cover the entire lane in one pass.
7. Continuously monitor thickness & notify the Contractor as soon as he/she is out of limits.
8. Take all densities including recuts by random schedule.
9. Traffic will not be allowed over bumps greater than 50 mm (2 inches). Wedges must not exceed 25 mm (1 inch) in 1 m (3 feet) (40 to 1).
10. Before laydown, the surface shall be clean.
11. Verify breakdown rolling has been accomplished before minimum temperature is reached.
12. If thickness is 12.5 mm (½ inch) less than required, then investigate to determine the extent and why.
13. If thickness is 12.5 mm (½ inch) greater than required, investigate to determine the extent and why.

Construction Critical Areas:	1.	Asphalt should not be heated to more than 175°C (350°F) in the plant.
	2.	Asphalt at laydown should be 115 to 160°C (240 to 320°F).
	3.	Watch joints to make sure they close tightly and attain proper density. Tack vertical face of joints.
Safety Areas:	1.	Maintained Traffic: a. Keep Contractor vehicles behind pilot car. b. Flaggers should use proper procedures.
	2.	Watch for trucks and loaders traveling at an unsafe speed.
	3.	Electrical cords near plant must be safely used.
	4.	All work must comply with OSHA and other applicable safety requirements.
NDR Tests:	1.	Nuclear Density Gauge Procedures NDR T 238 & T 587
	2.	NDR T 99 Soil Density
Sampling Requirement/Freq.: *SSHC Subsection 1028.02*	1.	Performance Graded Binder a. 1 L/Day and 1 L/3400 Mg of mix (1 qt/day & 1 qt/3750 tons).
	2.	Asphalt Concrete a. Density Cores: 1/680 Mg; 5 cores/3400 Mg Lot (1/750 tons; 5 cores/2750 ton lot) b. Thickness Cores: (See contract Special Provisions.) c. Mix Properties: 1/1000 Mg (1/1100 tons)
Inspector's Records & Forms:	1.	Profilogram
	2.	DR Form 143 - Pavement Marking Report
	3.	DR Form 261 - Daily Report of Cores Drilled
	4.	DR Form 295 - Summary of Quantities and Location of Surfaced Intersections and Driveways
	5.	Density Pay Factor Summary (DR Form 173 or equal)

502.00 ASPHALT PAVEMENT

502.10 ASPHALT PAVEMENT DESCRIPTION

This Subsection explains how to inspect and monitor quality controlled asphalt paving operations. It includes monitoring plant preparation of the asphalt mix and laydown procedures.

502.20 ASPHALT PAVEMENT MATERIAL REQUIREMENTS

502.20.1 ASPHALT ACCEPTANCE AND TESTING

Field Tests and Certification of Materials

Sampling and testing are required to determine whether the quality of materials and construction are in reasonably close conformance with the plans and Specifications.

Project inspectors shall monitor all materials received on a project before they are incorporated into work. Inspectors shall determine that proper inspection reports or certifications are on hand, and that no unusual alterations in characteristics of materials due to handling or other causes occurred.

Schedules in the *Materials Sampling Guide* contain various field tests and sampling frequencies for asphalt materials and mixtures.

The QA/QC program was started in 1993 with the goal of improving the overall quality of asphalt produced and giving the contractor the responsibility for mix design, sampling, testing, and making mix adjustments. In other words, contractors were given responsibility for the product they produce. If needed, most administrative questions involving QA/QC projects can be answered by referring to the Flexible Pavement Engineer [(402) 479-4675].

Asphalt Materials

Acceptance of asphalt materials will be on the basis of test results or certification from an approved source. Formal approval of a source is to be issued by the Materials and Research Engineer.

Each shipment invoice covering asphalt materials delivered to a project shall have a signed certification statement as to type and grade, specific gravity or mass per liter, load quantity, batch number or other identification, and project number. A copy of this invoice shall be furnished to Project Manager or project inspector for review and filing.

The Project Manager must have documentation of the following:

1. Performance Graded Binder
2. Aggregates
3. Asphaltic mix taken behind the paving machine but in front of the rolling operation.
4. Asphalt in-place density.

Performance graded binder suppliers are grouped into two categories (levels).

1. Level-1 suppliers are certified suppliers who have submitted documentation to the Department and as part of the certification process, the Department has inspected the supplier's plant.

2. Level-2 suppliers are approved suppliers that are not certified.

The difference between being level-1 and 2 is that level-1 suppliers are only verified every other day while level-2 suppliers must be verified each day. This verification is between the lab and the supplier and the PM is not involved.

Hot-In-Place asphalt work may require support from the lab. Make sure you notify the lab at least 2-3 days in advance so they can plan to be on-site when the work begins.

Density of the in-place mix can be tested with the nuclear density gauge or by taking cores and measuring the density of the cores. Do not use the contractor's random sampling tables. Use the Department's tables and keep location secret.

@

Aggregates

Aggregate gradation and characteristics are covered in detail by *SSHC Section 1033*. Acceptance for quality will be based on source monitoring and test results on assurance or project samples.

502.20.2 RESPONSIBILITY AND DOCUMENTING ASPHALT MIXTURE PROPORTIONING CHANGES

SSHC Section 1028 explains how asphalt mixtures will be controlled. It establishes job mix criteria and corrective procedures to be followed when mixture characteristics are changed from the job mix formula during mix production.

On QA/QC projects, the contractor has sole responsibility for making mix changes; however, the Materials & Research Engineer and Project Manager must be kept informed and involved in these changes. Mix change decisions must be an interactive process between the contractor and the Department.

The Project Manager must also insure that required changes are implemented by the contractor as soon as possible when mixture characteristics fall outside *SSHC* Section 1028 limits. **On each working day, the Project Manager shall determine if work for previous working day was within *SSHC* guidelines.** If not, immediately consult with the contractor and ask what corrective actions have been or will be made. Contact Flexible Pavement Engineer if additional guidance is needed.

Adjusting Performance Graded Binder Contents

On QA/QC projects, job mix control is the contractor's responsibility. The contractor is responsible for sampling, testing, reporting results, and making appropriate mix changes. Also, testing is done up to four times per day at each asphalt plant site so immediate results are available.

When test results for air voids of plant produced mix are outside the limits given in *SSHC Section 1028*, the contractor needs to contact the Project Manager and initiate changes in the asphalt mixture. The contractor’s first efforts at corrective action should be to adjust the aggregate percentages as needed. The adjusting of the performance graded binder content should not be the first step because when performance graded binder content changes are considered to adjust air voids, caution must be used to assure that adequate film thickness is maintained. Reductions in performance graded binder content must not go below the minimum allowable performance graded binder content as calculated in *SSHC Section 1028*. Documentation of changes should be on the contractor's "Daily Plant Report."

Documenting Corrective Action for Noncomplying Air Voids Test on Specimens Taken from Constructed Pavement

Materials Sampling Guide also requires the contractor to report tests for field air voids on mix samples from behind the paver on the contractor's "Daily Plant Report."

If conflicts develop between the contractor's and the NDR'S field voids, then together the contractor and the Department should concentrate on achieving proper voids and resolve the conflicts.

When noncomplying tests for air voids in specimens taken from constructed pavement occur, the Project Manager will notify the Materials and Research Asphalt Lab [(402) 479-4757] if it cannot be corrected. The contractor and the NDR plant inspector will document noncompliance on the contractor's "Daily Plant Report" containing the noncomplying test results.

In response, the contractor will inform the Project Manager as to what changes in mix proportions, if any, should be made. The contractor will furnish project personnel written documentation for the decision or action taken.

Adjusting Aggregate Proportions

Contractor must occasionally adjust aggregate proportions to consistently comply with the contract provisions and to correct calibration errors.

Contractors shall initiate and make changes necessary to insure compliance to *SSHC Sections 1028 and 1033*. The contractor shall document all changes being made.

Proportion changes which exceed provisions of the contract may require a new mix design unless waived by Project Manager.

Project Managers and inspectors need to be familiar with the contractor's QC program because it should provide many of the guidelines needed for making mix change decisions. Project Managers are expected to reference *SSHC Section 1028* and communicate with Materials & Research if needed prior to, during, and after the contractor makes decisions concerning mix proportion changes.

Proportion changes shall be documented by the contractor on their "Daily Plant Report."

Filler-Bitumen Ratio

SSHC Section 1028 defines the filler-bitumen ratio. Filler-bitumen is the ratio of material passing the 75 µm (#200) sieve divided by percent of performance graded binder in the mix (i.e., tank sticks, etc.).

The Plant inspector should determine if and by how much a contractor proportion change will affect the filler-bitumen ratio. If it is necessary, contact Materials & Research Asphalt Lab [(402) 479-4757] for guidance.

502.20.3 ASPHALT REPORT FORMS

Construction inspection personnel are responsible for monitoring/assisting in field sampling and testing in accordance with requirements of *SSHC* and those outlined in the *Materials Sampling Guide*. Forms are supplied for reporting test results, submitting samples, and as inspector work sheets.

Under the certified plant inspector program and Quality Assurance/Quality Control (QA/QC) program, specific sampling and testing will be done by the contractor's representative per *SSHC Section 1028* and the *Materials Sampling Guide*. Plant

inspectors and the contractor's QC technicians must also be familiar with all applicable specification requirements including the sampling and testing procedures.

Form Identification and Use

- Daily plant operation, job control testing, and material placement for asphalt production are recorded in the field book or project records. Copies of the contractor's reports shall be sent to Materials & Research Engineer and the Project Manager.

- DR Form 12, "Sample Identification Form" must accompany all samples submitted to central materials laboratory and District materials laboratories.

- A mix design letter from the contractor and approved by the Flexible Pavement Engineer is used to define aggregate components of asphalt, to identify material sources, gradation, production limits, and proportions for the asphalt mix designs.

- “Summary Form of Tests of Asphalt Mixtures” is to be used by District materials laboratories to report extraction, sieve analysis, density, voids, maximum specific gravity, etc.

The contractor will use NDR forms for plotting all moving average data, various temperatures and other graphed data.

Although submission of a daily report is not required, it is necessary that each day's production information be recorded in the field notebook. It is very important that the daily placement be identified by station location, side, lift, lift thickness, and material characteristics. This type of information becomes necessary in case of deductions or answering inquiries regarding any traffic accident occurring on the project.

502.30 ASPHALT PAVEMENT EQUIPMENT

502.30.1 INSPECTION AT ASPHALT PLANTS

Project Managers are responsible for verification, inspection and/or monitoring at asphalt plants. They should assure themselves that the contractor's QC inspectors are qualified and have been informed about their specific duties. This should include, but not be limited to, frequency of tests, information to be recorded, and samples to be obtained and held for use by Materials & Research and District laboratories.

The contractor is responsible for all plant inspections. Their duties include constant checks of stockpile handling, equipment settings, mixture appearance, and supervision of scale inspectors and assistant plant inspectors. Plant inspectors should spend part of their time in the laboratory trailer, and assist as needed.

The contractor shall furnish and be responsible for certified plant inspection in accord with *SSHC Section 1028*. All asphalt production, including patching, will be covered by certified plant inspection unless otherwise excluded by contract documents or when 450 Mg (500 tons) or less of asphalt are used on project. Plant monitor requirements are identified in *SSHC Section 1028*.

On QA/QC projects, the contractor's QC lab technician is responsible for meeting all sampling, testing, and documentation requirements as set forth by the current contract. For some contractors, this person may also be responsible for certified plant QC inspector duties as well. It should be possible for two people to handle both QC and Plant Inspection responsibilities on a typical asphalt resurfacing or paving project. The QC technician should maintain good communication with the NDR inspector and Materials & Research personnel especially on test results and mix changes.

502.30.2 INSPECTING THE MIXING TIME OF ASPHALT PLANTS

Project Managers should insure that mixing time is inspected on continuous plants and on batch plants.

Necessary action shall be taken to insure compliance with the mixing time in *SSHC Subsection 503.03*. Inspectors shall check mixing time when work begins on the project and thereafter as they consider necessary to insure compliance. The QC inspector's diary must show when it is done and calculations used.

If mixing time is found to be deficient, the contractor shall increase it to a specified amount. For continuous plants, this is done by decreasing the megagrams of output or by increasing pugmill contents.

Materials & Research personnel will give assistance in determining the mixing time as a component of the plant calibration process.

502.30.3 USE OF SPECIAL EQUIPMENT

Material Transfer Vehicle

The Material Transfer Vehicle provides mix surge capacity to allow more constant paver speed and efficient paving operations. It operates in front of or beside the paver and accepts loads of hot asphalt from delivery trucks. It provides a large surge storage bin that can continually feed the paver hopper.

This vehicles mass is 34,500 kg (75,000 lb.) empty with a maximum additional 31,500 kg (70,000 lb.) mix storage capacity. It has four axles with large flotation tires. Front two axles have 17.5R x 25 flotation tires and rear two axles have 20.5R x 25 flotation tires. Tire pressure is 345 - 450 kPa (50 – 65 psi).

The Bridge Division will verify each bridge capability on a case-by-case basis with the following limitations.

An empty MTV-3500 usually can safety cross all bridges that are not load-restricted, subject to the following conditions:

- Vehicle must be centered on bridge with no other vehicles on bridge.
- Gross mass cannot exceed listed empty mass of 34,500 kg (75,000 lb.).
- Speed of vehicle on bridge cannot exceed 8 km/h (5 mph).

A partially loaded MTV-3500 usually can safely cross all bridges that are not load-restricted, subject to the following conditions:

- Vehicle must be centered on bridge with no other vehicles on bridge.
- Gross weight cannot exceed 45,000 kg (50 ton) (approximately one-third hopper). Note: This situation should be avoided. We prefer the contractor anticipate the need to cross a bridge and have the MTV empty by the time they reach bridge.
- Speed of vehicle on bridge cannot exceed 8 km/h (5 mph).

An MTV-3500 shall not cross any load-restricted bridge without prior approval of the Bridge Division.

Pavement on which MTV-3500 operates must be at least 200 mm (8 inches) in thickness. It shall not be operated on shoulders, subbases, or lower lifts of asphalt pavement. Any damage caused to existing surfacing shall be repaired at the contractor's expense.

These limitations apply for use of vehicle in a construction work zone. Contractors must obtain any necessary permits for moving this vehicle to and from project on an open highway. Do not allow contractor to operate this equipment unless the lane in which the MTV operates is closed to traffic or is controlled by flaggers.

Mat Smoothness Machine

This is an asphalt material receiving hopper and elevator that deposits hot asphalt into paver hopper. Use of this equipment allows for a more consistent paver operation by providing some surge capacity for paver, only on a much smaller scale than the MTV.

Its mass is approximately 8,500 kg (10 tons) empty and has a hopper capacity of 1.7 m^3 (60 ft^3). Mass restrictions are not a concern with this piece of equipment.

Advantages for use of MTV and CR MS-3 include:

- Smoother pavements due to elimination of trucks backing into paver and ability to provide a more uniform operation speed.
- Reduction in potential for truckload interval segregation due to amount of mixing the material receives going through this equipment.

Even with the MTV or CR MS-3, paver hopper should be kept relatively full at all times. If hopper is allowed to drawn down too far, coarse aggregate collected in sides of paver hopper might be drawn down and create streaks of segregation in mat surface.

Windrow Pick-up Equipment

With this process, hot asphalt is deposited in a windrow onto pavement surface using bottom dump trailers. A windrow pick-up elevator deposits the material into paver hopper. Again, primary advantages are contractor efficiency and uniform speed of operation.

Segregation has occurred on several projects on which this equipment was used. Truckload and longitudinal strip type segregation are potential problems with this equipment.

All material deposited onto roadway must be picked up and put through the paver. Material left on roadway will cause surface problems following completion of project.

502.40 ASPHALT PAVEMENT CONSTRUCTION METHODS

502.40.1 UNSTABLE SUBGRADES AND SUBBASES

See *SSHC Sections 302, 303, and 305* for subgrade requirements.

Whenever trucks or other paving equipment cause rutting of the subbase or subgrade in asphalt placement areas, inspectors shall immediately stop construction. Construction shall not be allowed to resume until distorted subgrade or subbase is repaired (*SSHC Subsections 105.03 and 105.10*).

Locating Unstable Areas

Contractors and inspectors should locate by proof rolling, any questionable unstable areas in advance to avoid distortion under equipment. Wet, unstable areas must be dried out or replaced before starting placement of asphalt to avoid unanticipated and costly work shutdowns.

Locating wet or soft areas in advance can be accomplished by testing finished subgrade or subbase with a loaded truck. When the proof truck causes subgrade distortions, the subbase and subgrade must be dried out and reworked.

Construction of asphalt pavement should not proceed unless testing gives a reasonable indication that distortions will not occur during construction of overlying pavement.

Determining Cause

During spring and early summer, unstable subgrades caused by high moisture contents are encountered statewide. This condition is usually seasonal and tends to improve as warmer, dryer summer weather stabilizes subgrade. Additional pavement thickness is not justified to bridge over these particular soft subgrades because of their seasonal nature.

When evaluating individual cases of instability, experienced judgment is advisable because of the similarity in outward appearances between moisture in subgrade due to seasonal conditions and more serious causes such as frost boil, unsuitable material, etc.

If excess moisture is encountered, dry subgrade and recompact.

Drying and Recompaction

This treatment may be paid for as extra work provided the Project Manager authorizes it, and the work is closely monitored by the inspector and the contractor did not cause the wet condition.

SSHC Subsection 205.03 or special provisions require the contractor to disc or take other action to remove moisture and then recompact the soil at their expense. For a natural subgrade, contractors are required, if necessary, to repair distorted areas by scarifying to a depth up to 150 mm (6 inches), aerating, and recompacting at their

expense. Overdepth aeration and recompaction below the top 150 mm (6 inches) shall be paid for as extra work (*SSHC Subsections 302.03 and 503.04*).

When repair, drying, and recompaction are required to correct damage from contractor's operation, all necessary repair will normally be done at the contractor's expense. However, if the Project Manager determines that additional depth of aeration and recompaction are needed, that should be paid as extra work (*SSHC Subsection 302.03*).

Special Treatments

When unusual problems are encountered with unstable subgrades or subbases, the District Engineer should contact Materials & Research for assistance.

502.40.2 GRADELINE STRINGS AND EDGE ALIGNMENT

New Construction

The inspector should make frequent measurements to insure the guideline string has been correctly set and maintained. Support arms used to secure the guideline string shall be at intervals close enough to minimize chords on curves and other irregularities. Make the curve look like a curve.

Guideline strings placed on two-lane asphalt pavement should be located by measuring from redhead nails placed on centerline. Placement of a lower asphalt layer will cover redheads. For succeeding lifts, guideline string should be located by measuring from exposed nails used to hold string for each previous lift.

Resurfacing

When resurfacing two-lane PCC pavement, contractors may locate guideline strings on shoulders along outer edges. To insure that parallel alignment is used for an adjacent lane, the gradeline string for that lane shall be located by measuring across pavement from the first string.

True edge alignment controls the correct lap at each longitudinal joint. If insufficient lap, the joint will lack density resulting in raveling and joint deterioration. Excessive lap produces an objectionable wide scab of mixture on the surface next to the centerline joint, resulting in an unacceptable appearance.

An intended lap of 25 mm (1 inch) with a variance of 12.5 mm (½ inch) will normally be the optimum overlap for longitudinal joint construction. To maintain these close variances, adjacent lane must be constructed with true edge alignment.

The finishing machine operator shall follow the guideline string exactly. If the machine goes off line for any reason, it shall be adjusted back onto the line immediately. It is incorrect to smooth out the edge alignment by coming back onto the line gradually. This results in long stretches where incorrect lap at longitudinal joint will occur. When batch trucks bump finishing machines off line on curves, movement is usually down the slope of the curve. If the machine is brought back on line gradually, an objectionable, long, straight chord will result in what is supposed to be curved edge alignment.

Irregular edge alignment due to any cause, including adjustments of finishing machine, shall be corrected at once by hand tools. When corrections in edge alignment are

unable to be made promptly after they occur, the inspector shall require the finishing machine to be stopped until workers catch up with making corrections.

When constructing handworked areas such as driveway returns and bridge approach tapers, edge alignment may become irregular during rolling because small, high, and low spots in handworked surface tend to extend in width unevenly. Edge alignment of handworked areas can be made true by first rolling the surface with a steel roller, then immediately trimming the edge with hand tools while the mixture is still hot and workable.

502.40.3 LONGITUDINAL JOINTS

To obtain adequate compaction at longitudinal joints, the contractor shall place sufficient thickness of mix to compensate for 20 to 25 percent reduction in thickness that normally occurs from rolling. If thickness is insufficient prior to rolling, joint will usually be smooth in appearance but lack density because of inadequate compaction. **Make sure density is checked along the joints.**

The vertical face of exposed, longitudinal joints must be tacked before the adjacent lane is placed. This treatment is very important to insure a seal at the joint. No tack coat shall be sprayed on the surface of lane being matched. Shields on distributor spray bar will help protect adjacent lanes (*SSHC Subsection 503.04*).

@ If overlap is maintained at approximately 1 inch (25 mm) and thickness of joint is correct, brooming or raking may not be necessary to obtain a good joint. However, occasional corrections with hand tools may be necessary. When hand work is completed, excess material should be wasted as opposed to scattered on lane being constructed.

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502.40.5 DENSITY CONTROLS FOR ASPHALTIC CONCRETE CONSTRUCTION (*SSHC Subsection 503.06*)

Specifications for asphaltic construction require each layer to be compacted to a density not less than a given percentage of the Rice voidless density.

Density of pavement is determined from cores cut by the contractor or by nuclear density gauges, normally on the working day following construction. The method of mix density determinations will be determined by the contractor, and any disputes will be resolved with cores.

@ One hot box sample per sublot [750 tons (680 Mg)] will be obtained from the roadway surface by the contractor and transported to the field lab for testing. The lab will determine the voidless density. The location of the sample shall be a secret and it must be random.

An average of the voidless densities for a day's production will be used to determine the degree of field density.

@ Five samples shall be cut from each 3750 tons (3400 Mg) or use Nuclear Density Gauge to determine density.

@ The 1,000 ton test strip (and smaller test strips in earlier contracts) is independent of the tonnage listed in the random sampling schedule provided to the PM. The random sampling schedule becomes active following the placement of the 1,000th ton of an approved test strip.

The Specifications also describe a procedure for field density evaluation together with a schedule for payment adjustments when noncompliance occurs. Project inspection personnel shall observe the following:

- The contractor is required to take *a* prescribed number of samples at locations selected and marked out by the project inspector. The project inspector will witness the core sampling. A circle approximately 16 inches (400 mm) in diameter is adequate for identification of sampling location. The core should be taken from within the area identified. It is not appropriate for the contractor to use a nuclear device to "hunt" for a particular spot to sample; coring locations are no longer random when a nuclear device is used in this fashion.

@

- Sample locations are identified in the random sampling schedule which will be provided by Materials & Research. Keep the location a secret. A core will not be taken less than 12 inches (300 mm) from the edge of a given pass of the finishing machine. Procedure for identifying random locations should provide for the potential to obtain a core sample at any distance 12 inches (300 mm) or greater from the edge.

@

- If the layer being sampled adheres to a lower layer, it may be necessary to sample through two or more layers or full depth. The contractor will need to remove the extra depth by sawing the sample with a masonry saw. It may be necessary to cool the sample by refrigeration or ice to prevent damage during sawing. It is important that core drill bits be kept sharp.

- Each sample shall be inspected carefully by the contractor and inspector prior to testing. Be sure each core sample is representative of the density of the mixture placed and not damaged. If damage is noticeable, discard without testing and take another to replace it.

- If tests indicate that density is less than the specified percentage, the sample shall be retested to insure accuracy. The contractor can request another random sample be taken. (See *SSHC Subsection 1024.02*.)

- Tests on density samples give lower results if samples are damaged during handling. Contractors and project inspectors are advised to use extreme care when taking, transporting, and preparing cores for testing.

- Samples should be transported on hard flat surfaces to avoid loss of density by distortion. If necessary, samples should be stored in a cool place and on a hard flat surface.

- Specifications also require the contractor to take density samples as promptly as practical as prescribed by NDR T 168. Samples should be taken no later than the working day following placement. If the contractor is unable to comply with this timing, the project inspector shall stop construction until the contractor is able to do so.

- NDR personnel shall be responsible for performing density tests as prescribed by NDR T 166 using the contractor provided samples.

- Any failures should be reported to the Project Manager and to the contractor on the day tests are performed.

- When rerolling is performed, insure the area that is rerolled is the complete area of low density, not just the area of the sample.

Asphalt Compaction

@ Many Superpave mixes exhibit what is called a "Tender Zone" during compaction. You will have to confirm the contractor has determined the "Tender Zone" for the mix. Normally the "Tender Zone" is between 230° and 160°F. **When the asphalt is between 230° and 160°F stop compaction rolling.** Do the finish rolling below 160°F and make sure heavy and intense compaction rolling is done above 230°F.

Procedures for Construction of Test Strips (*SSHC Subsection 503.04*)

SSHC Subsection 503.04 requires the contractor to construct a control (test) strip for all mixture types except S.P.S. Test strips are used to evaluate properties of asphalt mixture and identify an effective roller pattern.

Proper construction and documentation of the test strip is the responsibility of the contractor and shall be provided by the contractor to the NDR inspector.

Document the procedure that was followed to construct the test strip.

Resolving Density - Void Conflicts

The project inspector should be aware that the field laboratory and compacted voids are to be tightly controlled. This may require more compactive effort for compliance. Become familiar with other controls by reading the *Materials Sampling Guide* and asking questions of Materials & Research personnel.

For the case where specified density is met, but field laboratory voids are outside designated limits for two moving average points, the production will cease. The Project Manager may allow production to start following agreement on corrective action to be taken. The contractor will select the combination of rollers to be used and preliminary rolling pattern. Nuclear gauge readings would normally be taken after each pass or series of passes.

The inspector shall only observe and document this process. Documentation of type and amount of compactive effort shall be recorded. Inspector will then select and mark out five random core sites within the test site. Density cores taken by contractor will be tested and results reported as soon as possible.

Cooperation between the project inspector, Materials & Research, and the contractor is essential to reach a timely solution. If all anticipated results are not met, further experimenting with a different combination of rollers and operation should be performed. Changes in gradation may be one of the first items looked at by Materials & Research. Changes in performance graded binder content would be one of the last items. Relief from minimum laboratory voids specified may only be approved by Materials & Research.

502.40.6 LAYING WIDTHS FOR ASPHALT

Plans for asphalt projects will show the overall dimensions of finished pavement.

When spreading layers of asphalt 1 ½ inches to 2 inches (38 to 50 mm) in thickness, a typical 24 foot (7.2 m) pavement may broaden 2 to 4 inches (50 to 100 mm) in width
@ during rolling. Therefore, laydown width before rolling might require) 3 inches (75 mm) less than final design width. An intended lap of 1 inch (25 mm) at the longitudinal joint is best for proper joint construction but seldom seen these days because the contractor has to have someone "set up" the inch overlap. Use of a cutoff shoe when matching a longitudinal joint is not acceptable.

When using finishing machines that spread the pavement full width, the inspectors shall insure that contractors adjust the spreading width so the final dimensions conform to the dimensions specified in the project documents.

The finishing machine screed extensions are usually available in 6 inches (150 mm)
@ increments. Where standard screed extensions are utilized to increase the paver width by more than 12 inches (300 mm), the paver auger must also be extended. Many new pavers are equipped with automatic screed extensions which can be adjusted to conform to the required width for most resurfacing situations. Some paver models have automatic auger extensions as well.

502.40.6a POLICY FOR PLACEMENT OF TEMPLATE CORRECTION ON OVERLAY PROJECTS

Effective immediately, the following shall be Department of Roads policy for placement
@ of asphaltic concrete template correction quantities. **This policy shall be applicable to all new and existing contracts.**

(1) When constructed under traffic maintained conditions and the **design thickness is greater than 2 inches (50 mm)** for the asphaltic concrete type and nominal aggregate size to be used on the surface layer, the asphaltic concrete shall be placed in **more than one layer. The proposed compacted placement thickness of the top layer shall not exceed 2 inches (50 mm).** Asphaltic concrete provided for template correction shall be placed with the lower layer or with the leveling course, if shown in the plans.

(2) When constructed under traffic maintained conditions and the plans indicate that template correction is provided with a **designed** asphaltic concrete **thickness if 2 inches (50 mm) or less,** the total asphaltic concrete thickness, including template correction, shall be placed as a **single layer.**

@

502.40.7 PLACEMENT RATES FOR HOT MIX ASPHALT BASES, BINDER, AND SURFACE COURSES

The inspector shall check contract quantities for accuracy.

In general, placement rates for hot mix asphalt shall be determined using the contract asphalt mass. The estimated unit mass from design standards used to calculate contract quantities will provide sufficient material for construction of design thickness for most mixtures used.

If the contract quantity is not sufficient to construct the required thickness, notify the Construction Division.

For lower layers on resurfacing projects, automatic controls should not be adjusted repeatedly based on megagram yields taken at short intervals. Automatic controls should be allowed to correct for irregularities in underlying base without frequent adjustments. Accordingly, the placement rate for individual truckloads will sometimes vary substantially from contract rate because of irregularities in old base. However, over
@ longer distances, 1650 feet (500 m) or more, taking both sides of the pavement into account, inspectors should select a general spread rate that compares as closely as possible with contract quantities.

For paved shoulders or other construction where dimensions are controlled by specified elevations, existing structures, or other unusual requirements, spread rates shall be adjusted as necessary.

@

502.40.8 COLD WEATHER ASPHALT CONSTRUCTION (*SSHC Section 501*)

SSHC Subsection 501.01 contains limitations for placement of asphalt and liquid bitumen under cold weather conditions. These restrictions apply to pavement surface temperature and time of year, and vary according to whether layer is surface course, lower binder, or base course, and nominal lift thickness.

Cold weather construction problems may show up in the form of increased roughness on profilograph, mat raveling, low density, high voids, segregation, slippage, or failure of tack coat to break. The Project Manager and inspector should be aware of other weather related conditions which may further limit placement.

After September 15, it is appropriate to require tarping and insulation of truck bodies, especially if hauls exceed 3 miles (5 km) (*SSHC Subsection 503.04*). However, if the contractor can demonstrate that the asphalt temperature is not adversely affected by hauling, the tarp and insulation requirements should be waived.

Base temperature is the single greatest factor in the rate of cool down for freshly placed asphalt mat. Consequently, base temperature has direct affect on recommended minimum laydown temperature and rolling time available to obtain specified density.

Wind velocity, air temperature, and cloud cover are additional factors that affect the cooling rate of hot mix asphalt.

For fall work, a cutback asphalt may be used at the Project Manager's option. Cold surface temperatures cause emulsions to lose tackiness and increase breakage time resulting in higher risk of mat slippage.

502.40.9 RUMBLE STRIPS IN ASPHALT SHOULDERS

(The paragraph below moved from Page 247)

Rumble strips will be milled into shoulder on future projects. Department will no longer accept rolled-in rumble strips.

502.40.10 QUALITY CONTROL MONITORING

Requirements for monitoring a contractor's quality controlled plant operation are shown in Table 502.40.1.

Table 502.40.1

NDR Monitoring Program for Asphalt Paving Plants -- Quality Control Methods	
Before production begins, the contractor's plant inspector and the NDR plant monitor should discuss these duties, documentation, sampling and testing plans to ensure compliance with the contract. Any noncompliance or work quality deficiency shall be immediately reported to the contractor's superintendent and the Project Manager. The contractor shall be required to take corrective action. The monitoring requirements are minimum and should be increased if deficiencies occur until the problems are resolved.	
Contractor's Plant Inspection/QC	**NDR Minimum Monitoring Requirement**
Stockpiles Observe construction of stockpiles to prevent segregation, contamination, and intermingling.	Inspect before construction begins and once a week thereafter.
Plant Erection	
Inspect material bin foundations. Assure sampling locations are safe and convenient.	Inspect for evidence of settlement. Inspect prior to calibration and after heavy rain.
Plant Equipment	
Check interlocks on aggregate feeders and performance graded binder delivery systems, screens for removal of oversize material, performance graded binder storage tank, tank stick, and general condition of all plant equipment.	Inspect all plant and testing equipment prior to calibration (including lab trailer).
Check scales for sensitivity and accuracy daily.	Check first day and once a week thereafter.
Plant Sampling & Testing	
The contract allows the contractor to test for gradations by either "cold feed" or "ignition burn-off of field sample." Determine moisture content of all aggregates including RAP. (When daily plant output is less than 750 tons); only one sample is required for every 750 tons of asphalt produced.)	Witness at least 1 of 4 process samples of each mix type.
Observe performance graded binder sampling.	Using proper sampling techniques, obtain 1 sample per 7500 tons for Level 1 suppliers and per 3750 tons for Level 2 suppliers and submit sample to Materials and Research Lab.
Obtain density cores and core thickness.	Identify random core locations, observe core cutting, transport to field lab, determine and record core densities, and core thickness.
	1 of 4

NDR Monitoring Program for Asphalt Paving Plants -- Quality Control Methods	
Contractor's Plant Inspection/QC	**NDR Minimum Monitoring Requirement**
Documentation	
Prepare daily plant report.	Audit entries daily.
Document all checks, tests, and quantities in field books.	Audit entries daily.
Complete tank stick sheet.	Audit daily.
Check for approved sources and certifications for all materials (including material transferred from other projects) and document deliveries.	Audit once per week.
Assure total certified quantities are sufficient for tons produced.	Audit once per week.
Maintain file of all certified material tickets, worksheets, and forms submitted.	Obtain file at end of project.
QC	
Maintain control charts and data sheets. Document all mix control changes. Document correlation results.	Monitor daily.
	2 of 4

NDR Monitoring Program for Asphalt Paving Plants -- Quality Control Methods	
Contractor's Plant Inspection/QC	**NDR Minimum Monitoring Requirement**
Plant Calibration Observe calibration and obtain copy of all calibration data.	Observe calibration and review calibration data.
Obtain copy of job mix formula.	
Check cold feed bins for method of adjustment.	Participate in check.
Discuss mix designs and plant controls with Project Manager.	Participate in discussion.
Mix Control Monitor coating of aggregates and mixing time.	Observe each day of production.
Monitor and record air, performance graded binder, and mix temperatures on 2-hour intervals.	Check once each day of production.
Monitor truck loading procedures, amount of mix maintained in silo, and operation of hopper/silo gates to avoid segregation.	Observe each day.
Check aggregate proportions, interlocks, and cold feed bin gate settings daily.	Check first day and weekly thereafter.
Inspect trucks for proper/improper use of cleaning fluids.	Monitor daily.
Prepare containers and send to road for hot samples.	
	3 of 4

NDR Monitoring Program for Asphalt Paving Plants -- Quality Control Methods	
Contractor's Plant Inspection/QC	**NDR Minimum Monitoring Requirement**
Asphalt Delivery Determine quantities on hand and calculate performance graded binder added by tank stick or weighing. Compare with brodie meter daily.	Monitor once per day.
Responsible for proper and random sampling of hot asphalt mixture behind paver. Sampling frequency is one sample for each sublot 680 Mg (750 tons) produced.	Monitor daily.
	4 of 4

502.50 ASPHALT PAVEMENT METHOD OF MEASUREMENT AND PAYMENT

502.50.1 TESTING FOR SMOOTHNESS (*SSHC Section 502*)

Equipment for smoothness testing includes the 7.6 m (25 foot) California profilograph and a 3 m (10 foot) straightedge. Pavement surfaces to be tested for smoothness with the 7.6 m (25 foot) profilograph are identified in Plans or Special Provisions. The Contractor is responsible for providing the profilograph. The Department should provide the rolling straight edge. For all projects, the 10-foot straightedge method may be used to identify 1/8" and greater bumps.

Make sure that the tire pressure on the profilograph is maintained at the proper level (210 kPa) (30 psi).

The contractor is not permitted to tight-blade the surface with a grader blade in hopes of minimizing any bumps, and no bonus will be allowed for any section -- regardless of the trace obtained -- if there is any evidence of such scrape marks in that section.

Contractor should be encouraged to test directly behind the finish roller to allow correction of an identified 10 mm (3/8 inch) bump by re-rolling while the mixture is still hot enough to be affected.

Make sure that the profilograph operator maintains a true course while advancing the machine down the road. Weaving, even if not done in an attempt to avoid a rough area, should not be permitted.

Since so much money can be involved, it is very important that you make an effort to have an inspector present while the smoothness testing is being performed. Make it very clear to the contractors that they are to provide adequate notice of any smoothness testing so that inspection can be arranged. DO NOT accept a profilogram if you were not notified about a test and did not have an opportunity to provide inspection.

Incentive/Disincentive Payments for Asphaltic Concrete Smoothness

The following standard items and standard item numbers have been established to provide payment for bumps and smoothness incentives/disincentives:

9300.70	Deduction for Asphalt Concrete Bumps	Each
9300.60	Smoothness Incentive - Asphaltic Concrete	Mg
9300.62	Smoothness Disincentive - Asphaltic Concrete	Mg
9300.64	Smoothness Incentive – Performance Graded Binder	Mg
9300.66	Smoothness Disincentive – Performance Graded Binder	Mg

The mass of asphaltic concrete to which the incentive/disincentive payment is to be applied shall be determined by calculating the asphalt placed in the top layer within those areas defined by the width of the driving lane (or lanes) shown on the plans and the length (or lengths) of the project subject to profiling, except that:

1. When a narrow shoulder is required to be laid with the adjacent lane (inside shoulder on Interstate, for example), the full lane and shoulder width shall be used.

2. When it is impractical to lay additional width except while laying the top lift through the laydown machine (8.5 m (28 foot) roadway, for example), the full width shall be used.

The thickness of the top layer used to determine the mass shall be either:

1. The nominal thickness shown on the plans (if shown), or

2. The lesser of the actual, average thickness laid or the maximum thickness allowed by the Specifications.

The mass per unit volume used to determine the total mass shall be as follows:

Mass Per Unit Volume	Mix Type
143 lb/ft^3 (2291 kg/m^3)	SP3, SP4, SP5
144 lb/ft^3 (2307 kg/m^3)	SP0, SP1, SP2
145 lb/ft^3 (2323 kg/m^3)	SPL
146 lb/ft^3 (2339 kg/m^3)	SPS

The mass of performance graded binder to which the incentive/disincentive payment is to be applied shall be determined by the formula:

[Concrete mix (mass)] (Percent of Performance Graded Binder) = Mass Performance Graded Binder

Unless revised by the Materials and Research Division, the percentage of performance graded binder to be added as shown on the EBM shall be used to compute the smoothness incentive/disincentive for performance graded binder.

When calculating the pay factor for smoothness (PF), round to the nearest hundredth.

The unit price for the incentives shall be calculated by the formula:

$$\frac{\text{(Pay Factor - 100.00)}}{100} \times \text{Contract Unit Price}$$

and entered as a "positive" dollar amount.

The unit price for the disincentives shall be calculated by the formula:

$$\frac{\text{(100.00 - Pay Factor)}}{100} \times \text{Contract Unit Price}$$

and entered as a "negative" dollar amount.

Be reminded that the incentive/disincentives calculations are based on the bid price for the asphaltic concrete. Penalties or deductions determined on the Density Pay Factor summary do not enter into these calculations.

When making the contract modifications to place these items into the system, show "Spec. Prov." as the authority for the modification. It is also requested that you show pay factor on the same line; e.g., "Spec. Prov. 101.26%".

Use of Straightedge

Pavement smoothness specification does not relieve contractor of responsibility for proper rolling and workmanship. Each pavement layer is to be inspected visually to insure that surface is free of roller marks and distortion. Transverse joints are to be checked with a 3 m (10 foot) straightedge. The tolerance is 3 mm (1/8 inch).

Corrections for surface irregularities shall be made, if possible, before mixture has cooled to 65.6°C (150°F). A large percentage of irregularities can be corrected by finish rollers above this temperature.

The inspector operating the surface checking straightedge should also observe the surface to insure that all roller marks or roller wheel depressions are smoothed out during the finish rolling. The inspector should observe the longitudinal joints carefully to insure that they have been smoothly rolled as the Specifications require. If surface is not being finished as Specifications require, the inspector shall stop construction until contractor takes corrective action.

STOPPING A BAD OPERATION IS A VALUABLE INSPECTION PROCEDURE.

502.50.2 CHECKING TRANSVERSE JOINTS FOR SMOOTHNESS

SSHC Subsection 503.04 requires the use of a 3 m (10 foot) straightedge for checking transverse joints for smoothness. The contractor should use a straightedge according to the following procedure:

1. The first check with the straightedge shall be made before any saw cuts. The straightedge is used to determine where full thickness of each layer ends and tapered portion begins. The inspector shall require that saw cut be located in full thickness of layer. All of the layer extending beyond the saw cut, including tapered portion, is then removed.

   While the joint is being constructed and checked, the contractor should require the finishing machine to be stopped approximately 10 to 15 m (30 to 50 feet) from the joint. Construction shall not be permitted to continue until the checking has been completed. This permits repaving of the joint, with the finishing machine, if the straightedge indicates a poor riding surface was constructed.

2. The second check with the straightedge is made after the finishing machine has constructed the new layer, but before rolling. The straightedge is used to locate irregularities in the newly constructed layer and any irregularities found that must

be corrected by hand tools. When the straightedge indicates no high or low spots, compaction should be permitted with the initial roller.

3. The third check with the straightedge is across the joint between cold pavement and hot mixture after compacted with initial roller. This third check indicates whether the correct amount of material has been placed. For instance, if freshly rolled layer is too high, it indicates too much material has been placed. If freshly rolled layer is too low, it indicates not enough hot mixture has been placed.

   For that reason, high or low transverse joints are not usually corrected by additional rolling. Instead, corrections should be made by cutting or filling the rolled surface while the mixture is still warm and can be manipulated. If there are unusually high or low areas after rolling, paths must be shoveled through the pavement for finishing machine tracks. Finishing machine is then backed up to the joint and paving operation is started again.

   The above procedure shall be repeated as necessary until the straightedge indicates that a good riding joint has been constructed. If repeated repaving operations cause the mixture to cool to the extent that reuse becomes impractical, it should be removed and wasted.

4. The final procedure for insuring proper construction at transverse joints is checking for true edge alignment. Edge of the freshly rolled layer should be carefully trimmed by hand tools until it matches the alignment of adjoining cold pavement.

502.50.3 PERFORMANCE GRADED BINDER

When payment for an asphaltic concrete mixture is based on megagrams, payment will also be made for performance graded binder as a separate item. Compensation will be made for all megagrams of asphalt binder incorporated into the construction within Specification tolerances. (*SSHC Subsection 503.05*)

Megagrams of performance graded binder paid is not deducted from megagrams of asphaltic concrete mixture measured for payment.

When small quantities of asphalt binder are involved, the design plan may state that performance graded binder is considered subsidiary to asphaltic concrete. Check the special provisions for this reference.

For specific mixes used as patching materials, or in an alternate bid situation, payment may not be made for performance graded binder.

Tank Measurement and Performance Graded Binder Content Determination

At batch plants, automatic or semi-automatic printouts record the actual mass of performance graded binder in each separate batch. This quantity may be used for payment.

Volume measurements will be converted to mass by computation. The amount in storage at beginning of project will be measured or estimated by inspector and added to

amount measured for payment. Asphalt binder remaining in storage at end of project and amount otherwise not used in the work will be measured or estimated by inspector and deducted from amount measured for payment.

Measuring Asphalt Binder for Small Quantities

SSHC Section 109 provides that by mutual agreement, the method of measuring asphalt binder for payment may be modified when small quantities or intermittent operations are involved.

If a recorded mass is not available, quantity may be calculated from intended asphalt binder percent with asphalt plant meter results providing further verification. For small quantities on a given day, the previous day's tank stick may be used as a check.

The project inspector should document procedure selected and reasons for doing so.

Asphalt Binder Quantities and Pay Adjustments

Asphalt binder contract quantities for a project are estimated based on a basic asphalt binder content identified in the contractor's mix design.

When noncomplying viscosity or penetration tests occur, payment for asphalt binder incorporated into affected asphalt mixture is subject to price adjustment as prescribed in the *SSHC Subsection 503.06*.

PG Binder/RAP – Pay Adjustments

The contractor’s initiative to substitute RAP and correspondingly reduce the amount of performance graded binder should not be reason to negotiate a higher price for the binder because it is a major item of work. The Specifications will be modified to add this safeguard.

Binders from different suppliers should not be mixed.

502.50.4 TARGET VALUES FOR ASPHALTIC CONCRETE PRODUCED

The tolerances specified for asphaltic concrete are provided for reasonable variances only. Whenever regular and repeated variances from target values occur, the Project Manager shall insist on quick and corrective action by contractor to secure target values, not simply within tolerance.

The above comments are addressed to asphalt binder content, aggregate tolerance and specifically to air voids and VMA values.

502.50.5 MEASURING ASPHALT MATERIALS

SSHC Subsection 503.03 covers equipment and procedures for measuring the mass of the asphalt materials. When automatic or semi-automatic measurement is used, continuous direct observation of the measuring process by a scale inspector is not required. For manual measuring of loaded trucks, Project Manager may assign a scale inspector. This normally occurs only when accuracy in the measuring procedures is in question.

When witnessing is required, scale inspector should be positioned near contractor's scale operator so measuring can be closely observed. Contractor's representative shall write

the scale tickets and present them individually to scale inspectors for their signatures or initials before each truck leaves the plant.

503.00 ASPHALT CURBS

The Roadway Design Engineer has indicated that asphaltic concrete curb with a steeper than 45-degree face seemed to be a major consideration in a court's ruling. Since a 45-degree face is the design used on present plans, we should not be granting exceptions for any of our present or future contracts.

A number of contractors have requested permission to construct asphaltic concrete curbs to a template and/or dimensions which did not conform to that shown in the plans. You do not have authority to grant such permission on projects.

504.00 STATE MAINTENANCE PATCHING

Asphaltic Concrete for State Maintenance Patching and Performance Graded Binder for State Maintenance Patching are always nonparticipating items and should be paid for with State funds only.

The Construction Division, Final Reviewers Office, has seen estimates that were incorrectly prepared. The estimates do not split these items out from the participating items. Thus, they are not split out on the progress estimates, either.

Please check your projects to assure that these items are in a "State Funds Only" Section. If they are not, create a new section and move them using CICS3, Function 21, Subfunction 4.

Contact Highway Coordinator Finals Supervisor Bill Hitzeman, (402) 479-4456, if you have any questions.

505.00 P.E.P. GUIDELINES

1. NSI must be between 60 and 70 and surfacing doesn't require extensive patching or base work.

2. Existing pavement must be asphalt, not composite or concrete, because of reflective cracking.

3. Current truck ADT must be less than 500.

4. P.E.P. candidate location can't already be in the five-year program.

5. P.E.P. is for 7.3 m (24 feet) width only. Any shoulder work, other than fog seal or armor coat will be charged to the district's regular budget. Existing 7.3 m (24 feet) top will remain 7.3 m (24 feet) even if standard calls for 8.5 m (28 feet).

6. P.E.P. projects are allowed on segments that have no deficiencies other than surfacing. If highway segment has other deficiencies, a future project will also be programmed to correct the deficiencies.

7. A 12.5 mm (1/2 inch) grade raise is acceptable with no shoulder work or guardrail adjustment.

8. P.E.P. projects with a grade raise of more than 12.5 mm (½ inch) will be the exception and will require approval of the Deputy Director-Engineering. The cost of any shoulder work or guardrail adjustment will be charged to the district's regular budget, if the work is done by the contractor. The district's construction budget won't be charged if the work is done by maintenance forces.

9. If grade is raised and contractor does the shoulder work, the District Engineer will determine if dirt is available within the right-of-way.

10. Anything out of the ordinary for a P.E.P. project will be charged to the district's regular budget and may require more than one year to develop the project.

11. Other considerations for P.E.P. projects:

    A. No new mailbox turnouts.

    B. No superelevaton corrections.

    C. Surfacing will be feathered out at intersections and driveways.

    D. P.E.P. projects are considered to be maintenance projects and as such no ADA work will be done.

506.00 MILLINGS

Millings that are to be used as a base or foundation course shall pass a 38 mm (1 ½ inch) screen opening.

Each District remains responsible for specifying the disposition of millings.

Specifications and special provisions need to be crystal-clear as to exactly which millings are available and at what cost.

Pre-letting information should only be released through Frank Brill's (479-4568) office so that no relevant bidding information is withheld from any possible bidder.

507.00 TACK COATS USING EMULSIONS

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For Dilution

SS-1, SS-1H, CSS-1, and CSS-1H grades are specified. Dilution of emulsion is required if nonuniform tack applications are experienced. Dilute at 1:1 ratio, i.e., 1 gallon emulsion to 1 gallon water.

Application Rate for Diluted Emulsion

For diluted material, double the rates of undiluted material application. Example: .03 to .06 gal/yd^2 (0.14 to 0.28 L/m^2) undiluted increased to .06 to .12 gal/yd^2 (.28 to .56 L/m^2) dilute emulsion.

Sample for Compliance

Sample emulsion at spray bar of distributor with bar valve in a circulating position, prior to dilution.

Measurement for Pay

Net liters of diluted emulsion.

Keep in mind, diluted emulsion as supplied normally contains 60% asphalt residue, therefore, a 1:1 field diluted emulsion will contain the minimum of 30% residue (*SSHC Subsection 504.03*).

Settlement of Diluted Emulsions

Varying residue rates of diluted emulsion may be related to blending of original emulsion or settlement while in storage. To minimize this problem, the following steps are recommended:

- Contractor emulsion delivered to storage should be gently circulated prior to pumping into distributor truck.
- If contractor obtains emulsion directly from terminal, the emulsion should be gently circulated prior to use each day.

Material in a storage tank can be circulated with a large diameter, slow turning propeller, or by pumping from top to bottom. Only a small amount of agitation is necessary. **Forced air should not be used for agitation since it may cause the emulsion to break.**

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CHAPTER NOTES:

DIVISION 600

PORTLAND CEMENT CONCRETE PAVEMENT

DIVISION 600

601.00 CONCRETE PAVEMENT CHECKLISTS

601.01 CONCRETE PAVEMENT CHECKLIST

SSHC References:

Section 600 Portland Cement Concrete Pavements
Section 603 Concrete Pavement
Section 1002 Portland Cement Concrete
Section 1010 White Opaque Polyethylene Film and White Burlap--Polyethylene Sheeting For Curing Concrete
Section 1011 Burlap For Curing Concrete
Section 1012 Liquid Membrane-Forming Compound For Curing Concrete
Section 1014 Joint Sealing Filler
Section 1015 Preformed Joint Filler
Section 1033 Aggregates

Inspection Crew:

Placement Inspector
Certified Plant Inspector

Inspection Equipment:

Slump Cone
Air Meter (pressure)
Cylinder Molds and Lids
Rod
Mallet
Strike Off Bar
Ruler
3 m (10 foot) straightedge
Subgrade Templet

Placement Procedures:

1. Preplacement check of equipment. Verify vibratory, paver and all other equipment are operational.
2. Check subgrade. Use nuclear density gauge to check density.
3. Check base or foundation course. Use nuclear density gauge to check density.
4. Check placement of steel if present.
5. Check Form setting and alignment, if used.
6. Slab thickness and crown should be checked 3 times a day.
7. Have contractor wet grade before concrete placement.
8. Keep track of time from placement on grade to machine finishing.
9. Test concrete for air content and make cylinders when the consistency of the concrete appears different and as a minimum according to the Sampling Guide.

10. Watch concrete placement for compliance with specifications.
11. Check machine installation of steel.
12. Should not use water as a finishing aid; approved chemical finishing aid/evaporation retardants are also authorized.
13. Check surface with straightedge. Remove depressions and irregularities.
14. Check tining for conformance to specification.
15. Stamp station numbers in the plastic concrete.
16. Check application of spray curing compound.
17. Inspect prepared joints prior to sealing.
18. Inspect sealed joints.
19. Observe contractor's performance of pavement smoothness testing.
20. Notify coring crew of placement.
21. Each day prepare DR Form 85, Pavement Laid Report.
22. Reset section corner markers. (See Subsection 104.03)

Construction Critical Area:

1. Maintain a uniform roll, of about 100 mm, of concrete ahead of the front screed and a minimum of a 50 mm roll ahead of the rear screed.
2. Placement of tie bars and key ways.
3. Verify string line is tight and in correct position.
4. Verify layout will place longitudinal joints at correct locations. (Usually should coincide with lane lines.)
5. Use 3 m (10 foot) straightedge behind paver to check smoothness.
6. The time the concrete is in the truck and the time it sits on the grade should not exceed the specifications limits.
7. Trucks that segregate concrete or have cement balls must not be used.
8. The timing of cure application and even coverage.
9. Timing of joint sawing.

Safety Areas:

NDR Tests:

1. NDR T 23 Making and Curing concrete test specimens.
2. NDR T 119 Slump of Portland Cement Concrete.
3. NDR T 141 Sampling of Fresh Concrete.
4. NDR T 152 Air Content of Freshly Mixed Concrete by the Pressure Method.

601.02 CONCRETE PLANT CHECKLIST

SSHC References:

Section 603 Concrete Pavement
Section 1002 Portland Cement Concrete
Section 1004 Portland Cement
Section 1005 Water for Concrete
Section 1006 Calcium Chloride
Section 1007 Concrete Admixtures
Section 1008 Fly Ash
Section 1009 Silica Fume
Section 1033 Aggregates

Inspection Crew: Certified Plant Inspector

Inspection Equipment:

Large balance or Dunagan buoyancy apparatus (5 kg)
Small balance (2 kg)
Set of gram weights, 2 kilogram weights
Set of coarse aggregate sieves and a set of fine aggregate sieves
Mechanical shaker
2 burner gas or electric stove
Sampling bags and containers
Slump Cone
Air Meter (pressure)
Cylinder Molds and Lids
Rod
Mallet
Strike Off Bar
Ruler
Water Bottle

Plant Procedures:

1. Check Plant Certification Checklist before production begins. This may be accompanied with a check of the equipment.
2. Check cement, fly ash, and admixture certifications and if approved; before production begins and when new materials arrive.
3. Check aggregate piles for segregation and contamination. (*SSHC Subsection 1033.03)*
4. Take materials samples as required by the Sampling Guide and specifications.
5. Test materials as required by the Sampling Guide and specifications.
6. Each day check the batching operation as needed.
7. Collect Proportioning Reports daily.
8. Check truck ticket for correct volume as necessary.
9. Send copies of Proportioning Report to Concrete Materials Section of the Materials and Research Division daily. Keep truck tickets in project file.

Construction Critical Areas:

1. Cementitious material bins must be watertight and prevent contamination.
2. Coarse aggregate stockpiles must be watered.
3. Admixtures need to be protected from freezing.
4. Delivery trucks need to be checked for wash water before batching each load of concrete.

Safety Areas:

NDR Tests:

1. NDR T 23 Making and Curing concrete test specimens.
2. NDR T 119 Slump of Portland Cement Concrete.
3. NDR T 141 Sampling of Fresh Concrete.
4. NDR T 152 Air Content of Freshly Mixed Concrete by the Pressure Method.
5. NDR T 27 sieve Analysis of Fine and Coarse Aggregates
6. NDR T 248 Reducing Field Samples of Aggregate to Testing Size
7. NDR T 506 Determination of the Free Moisture Content of Aggregates
8. NDR T 504 Determination of Clay Lumps, Shale, and Soft Particles in Coarse Aggregate and of Clay Lumps in Fine Aggregate and Sand and Gravel Aggregates
9. NDR T 255 Total Moisture Content of Aggregates by Drying

601.03 CONCRETE PAVEMENT REPAIR CHECKLIST

SSHC References:

Section 600 Portland Cement Concrete Pavements
Section 605 Concrete Pavement Repair
Section 1002 Portland Cement Concrete
Section 1012 Liquid Membrane-forming Compound For Curing Concrete
Section 1013 Bituminous Liquid Compound For Curing Concrete
Section 1014 Joint Sealing Filler

Inspection Crew:

Pavement inspector
Certified Plant Inspector

Inspection Equipment:

Slump Cone
Air Meter (pressure)
Cylinder Molds and Lids
Rod
Mallet
Strike Off Bar
Ruler
3 m (10 foot) straightedge
Subgrade Templet
Water Bottle

Patching Procedures:

1. Mark areas of pavement removal.
2. Preplacement check of the equipment.
3. Check subgrade.
4. Check base or foundation course.
5. Check placement of steel.
6. Check Form setting and alignment, if used.
7. Have contractor wet grade before concrete placement.
8. Test concrete for air content and make cylinders when the consistency of the concrete appears different and as a minimum according to the Sampling Guide.
9. Watch concrete placement for compliance with specifications.
10. Should not use water as a finishing aid; an approved chemical finishing aid/evaporation retardants are also authorized.
11. Check tining for conformance to specification.
12. Watch curing operation for conformance to specifications.
13. Keep track of ambient temperature during curing period.

Construction Critical Area:

1. Specified mixing is required to insure uniform dispersion of admixtures.

2. Proper cure procedures are critical to insure the early strength is achieved.

Safety Areas:

NDR Tests:

1. NDR T 23 Making and Curing concrete test specimens.
2. NDR T 119 Slump of Portland Cement Concrete.
3. NDR T 141 Sampling of Fresh Concrete.
4. NDR T 152 Air Content of Freshly Mixed Concrete by the Pressure Method.

602.00 PORTLAND CEMENT CONCRETE (PCC) PAVEMENT (*SSHC Section 603)*

602.10 DESCRIPTION

Concrete pavement is a surface course composed of portland cement concrete. It may be constructed on a prepared subgrade, a stabilized fill or a granular foundation course.

The production of high quality concrete pavement requires a very close control of all phases of the work. The Project Manager and inspectors assigned to concrete pavement projects should become thoroughly familiar with the construction details outlined in *SSHC Subsection 105.13, Division 600,* and the material details given in *Sections 1002 to 1027*.

The essentials to observe in this type of pavement construction are:

1. Accurate proportioning of aggregate and cement.
2. Absolute control of the water and admixture content of the mix.
3. Prevention of segregation in the concrete.
4. Adequate amount and proper spacing of finishing equipment to handle the production of the mixer or mixers.
5. Properly trained equipment operators and finishers.
6. Proper curing.
7. Timely sawing of joints.

602.20 PCC PAVEMENT MATERIAL REQUIREMENTS

602.201 Composition of Concrete (*SSHC Section 1002)*

The plans or special provisions may offer the contractor a choice of various classes of concrete. *SSHC Section 1002* lists the classes of concrete used in Nebraska road construction. If a choice is allowed, the contractor is required to advise the Project Manager of the class of concrete to be used. This notification must be given prior to construction. The Materials and Research Division should be consulted in regard to problems of concrete composition. Table 1002.02 shows authorized mix proportions for the classes of concrete.

Material Inspection - The production of a high quality concrete requires careful control over concrete materials at the batch plant. The inspector must be prompt and accurate to insure quality concrete.

SSHC Sections 601, 602, and *603* contains requirements for concrete pavement construction. The Project Manager and inspectors must familiarize themselves with these requirements and insist that materials be tested and approved before being incorporated in the work. The frequency of sampling, testing or submitting of material samples to the Central Laboratory and the procedures to be followed are covered by the Materials & Research *Materials Sampling Guide*.

Field Testing Laboratory - *SSHC Subsection 105.03* requires the contractor to furnish a field laboratory building meeting certain specific requirements for the type required in the contract. The project manager should document compliance for the laboratory's condition in the Field Book and notify contractor of any problems.

Admixtures - *SSHC Section 1002* states that "only admixtures authorized by the contract documents will be permitted for use in portland cement concrete". Since the various materials constituting admixtures can have a profound effect on the characteristics of the hardened concrete, extreme caution is justified. (See *SSHC Section 1007* for more information on admixtures.*)*

602.202 Concrete Strength

Currently, four test cylinders are to be fabricated for each placement (generally four cylinders are required for each lot of concrete). These test cylinders are then tested at ages of 7, 10, 14, and 28 days.

@ If the 7-day cylinder tests 3500 psi (25 MPa) or above, the 10 and 14-day cylinders need not be tested and can be discarded. If the 7-day cylinder should test less than 3500 psi (25 Mpa), the 10 and 14-day cylinders must be retained and the above policy applied to the 10-day cylinder. In any case, the 28-day cylinder must be retained and tested.

@ A 5th cylinder is required if the contractor wants an early break.

602.203 Concrete Sampling Locations

Concrete samples shall be collected from at least three different portions of a batch after it is discharged, whether mixed on site or central mixed. Sample location point shall be after plastic concrete has been placed on the grade, either by direct depositing from a batch truck or by use of a placer/spreader machine. On slipform paving projects, optimum sample location is between placer/spreader and slipform paver machines. Care should be taken to avoid sampling concrete that has been vibrated manually or mechanically. Samples should be taken at locations within the batch that appear to be representative.

602.204 Testing Procedures

When making test specimens, sample should consist of about 0.03 cubic meters (1 ft^3) and should be remixed a minimum amount by use of a shovel to ensure uniformity. For routine air and slump tests, smaller samples may be used.

602.205 Air Entrainment in Plastic Concrete

SSHC Table 1002.02 shows the required percent of entrained air needed in concrete paving mixes.

Newer, heavier slipform paving equipment can sometimes cause an entrained air loss greater than 1.5% due to their higher consolidation capabilities. If a contractor is consistently running near the usual minimum specified 5% entrained air content, the contractor should be advised to increase amount of air entraining agent that is supplied to the mix at the paving plant. The increased amount of entrained air added at plant should provide 6% air in the finished, consolidated concrete.

602.206 Ready Mix Concrete (See National Ready Mixed Concrete, Quality Control Manual)

Each truck load of concrete for a paving project must be identified by plant ticket.

Required Information:

- The ticket must show plant name, contractor, project number, date, quantity, class, and time batched. Complete information regarding water in materials, water added, and total allowable water need only be shown at beginning of each run, and each time thereafter when moisture content changes or plant adjustments in mixing water are made.

Any water added to the mix must be documented. Moisture tests must be made frequently to insure uniformity in concrete consistency.

602.207 Concrete Discharge Times

To insure that quality concrete is incorporated into pavement maximum discharge times have been included in *SSHC Subsection 1002.03* for both continuous agitation (agitator trucks) and non-agitated trucks (dump trucks).

These discharge times should be verified at least once during each day of normal paving. These verifications should be recorded in project field books. During hot, dry, windy weather, maximum time limitations listed in specifications are critical limits set to insure that quality concrete is being placed and incorporated into project.

The nomograph in *SSHC Figure 710.01* can be used as a guide to determine what is the current evaporation rate.

602.208 Miscellaneous Material Requirements

Concrete with a low air content shall not be incorporated into work. **Only one addition of air entraining admixture is allowed at the site.** (See *SSHC Subsection 1007.03*)

Concrete with a high air content should not be incorporated into work except under extreme circumstances. If low compressive strengths result, the concrete may be required to be removed and replaced.

The *Materials Sampling Guide* requires that the pink copy of the DR Form 22, Certificate of Compliance, or a copy of the mills own certification form be mailed to the Materials & Research Division. These are required in order for us to determine the quantity of cement which was used when additional estimates are processed.

The certificate of compliance is needed both for mills that require sampling and those that do not. When a sample is required, normal procedure has been to submit the pink copy with the sample. This is acceptable. For those mills which do not require sampling, please collect and submit the certifications on a routine basis but at a minimum of once each week.

602.30 PCC PAVEMENT EQUIPMENT (*SSHC Subsection 601.02*)

602.031 General

All equipment to be used on the project should be thoroughly inspected and measuring equipment should be carefully calibrated before the start of production. All calibration data should be recorded in plant notebooks. These notes should include a description of each piece of equipment such as make, model number, etc.

Repeated breakdown of a piece of paving equipment is sufficient reason to suspend paving operations until the machine is repaired and brought into proper operating condition or replaced. (*SSHC Subsection 105.01*)

602.032 Batching Equipment

Batching equipment should be in compliance with the National Ready Mixed Concrete Association (NRMCA) Quality Control Manual - Section 3 - Plant Certification. (See *SSHC Subsection 1002.03*)

602.303 Cement Bulk Handling Equipment

The principal concern with regard to handling cement is moisture. Contact between cement and water prior to entering the mixer must be positively prevented.

602.304 Scales

Scales shall be in compliance with National Ready Mixed Concrete Association, Quality Control Manual, Section 3, Plant Certification.

602.305 Concrete Mixers

General - Equipment for handling and mixing concrete shall conform to the requirements of *SSHC Sections 601, 603,* and *1002*.

The inspector should be familiar with the mixing drum, water meter, timing device, and AEA dispenser. Check the inside of the drums for worn pick-up or throw-over blades. The contractor is required to provide information making it possible to check the wear accurately. The blades should not be worn more than 10 percent of the original height. Check the capacity plate for size of batch and manufacturer's recommendation for speed of rotation of the mixing drum.

The mixer must be equipped with a timing device which locks the discharge lever in the closed position until the end of the full mixing time. Set the timing device for the specified mixing time after all materials are in the drum. After paving operations begin, the mixing time should be checked with the mixer operating under load. The door of the timing box shall be kept closed and locked except during repair or adjustment.

Water Measuring Devices - The water tank should be inspected and the accuracy of the gauge checked. Using a 200 L (50 gallon) drum and a platform scale furnished by the contractor, the tank should be calibrated for each gauge setting through the operating range. The measuring device shall have an accuracy of 1.0 percent of the metered volume.

Make at least two trials for each setting of the dial to insure consistency in the measuring device. Record the calibration in the inspector's notebook. Check the valves to see that no water dribbles into the mixer drum when the tank is shut off.

Admixture Dispensers - When an admixture is to be added to the mix it should be arranged to enter the drum with the mixing water. The volume graduations on the AEA dispenser should be checked by measuring the amount released at each setting and the results recorded. The amount dispensed should be accurate within 3 percent of the quantity specified for each batch.

Mixer Performance Tests - A decrease in mixing time can be made under certain conditions, including the use of interlocked automatic batching. The basis for permissible reduction of mixing time is the contractor's mixer performance test.

Specific sampling and testing procedures, equipment list and method of reporting are included under the Materials & Research *Materials Sampling Guide.*

602.306 Hauling Equipment (*SSHC Subsection 603.03)*

May be one of two different types, depending on the setup at the plant:

1. Trucks which have drums or containers (dump trucks) in which central mixed concrete is delivered to the project. (30 minute limit till discharged.)

2. Trucks which have a concrete mixer mounted on the truck bed to provide complete mixing of concrete ingredients after they have been batched or blended at the central mixing plant. (90-minute limit till discharged.)

Trucks and Mixers - Each vehicle shall have a metal plate attached and listing:

1. Designed use.

2. Concrete capacity

3. Rotation (RPMs) of the mixing drum or blades.

Mixers and agitators shall be operated within the limits of capacity and speed of rotation designed by the manufacturer of the equipment. When used as a mixer, it is important for the inspector to make sure that the equipment is not loaded beyond its capacity. Blade wear should be checked against the manufacturer’s design. Blade height should be at least 90 percent of original height. There should be no appreciable accumulation of hardened concrete. Control and measurement of water added should be clearly inspected. Revolution counters should be checked.

602.307 Subgrade Trimmer (*SSHC Subsection 302.03)*

Check the setting of the cutting blades to secure the exact subgrade crown and elevation. The subgrade trimmer, if used, should operate at least 90 m to 150 m (300 to 500 feet) ahead of the concrete placement operation. Usually, the segment that is to be paved will be trimmed at least one day prior to concrete being placed on the job.

602.308 Concrete Spreader (*SSHC Subsection 601.02)*

The spreader or mechanical strike-off must be self-propelled and equipped with:

1. A power-driven spreading device.
2. An adjustable strike-off blade capable of striking off the concrete at any required elevation within the forms. This requirement anticipates the construction of reinforced concrete pavement in two courses. The strike-off should be adjusted so that some concrete will be carried in front of the blade.
3. Vibrators, either internal or surface type, capable of consolidating the pavement to its full width and depth. These should be checked for frequency of vibration with a contractor supplied tachometer.

602.309 Finishing Equipment

SSHC Subsection 601.02 provides for use of various types of concrete pavement finishing machines. Mainline paving is intended to be placed with a finishing machine designed for concrete paving. Approval may be given for alternate types of finishing equipment based on satisfactory field performance. Should a new machine be brought on the job and contractor's staff are not experienced with its operation, a qualified manufacturer's representative should be present until equipment is in proper adjustment and functioning as intended.

Equipment normally associated and approved for hand methods shall not be substituted for a finishing machine on mainline paving. Bridge deck finishing machines are not approved for placement of standard paving when a finishing machine is required, due to their lack of adequate consolidation equipment.

The finishing machine must be self-propelled and equipped with:

1. Two independently operating screeds constructed with end wings to prevent concrete spillage over the forms.
2. A pan-type finisher-float for each paving train.

If the screeds are the conventional reciprocating type which ride on the forms, check the end shoes for a worn surface. A poor slab surface with a valley along the form will result from worn end shoes.

A crown check of the screeds and pan-type finisher-float should be made by the contractor and in the presence of the inspector or project manager before the start of paving operation. To check the crown, raise the screed or float and stretch a 20-gauge piano wire or strong fish line across the bottom about 25 mm (1 inch) from the front face. Place a similar wire about 25 mm (1 inch) from the back face. Lower the screed or float down to the forms or to

hardwood blocks and check the distance from the wire to the screed or float surface at every 300 mm (12 inches) across the roadway. The crown elevation at centerline on the back screed and float should be set about 3 mm (1/8 inch) high to allow for subsidence and shrinkage during setting of the concrete. This 3 mm (1/8 inch) may then be worked out to a normal crown in the 1.5 m (5 feet) each side of centerline. The front screed should be set slightly higher than the back so that concrete will be available for manipulation by the back screed.

SSHC Subsection 601.02 provides that all spreading and finishing equipment in the paving train shall be equipped with scrapers or be constructed in such a manner as to keep the top of the paving form free of concrete.

602.3010 Slip Form Paving Equipment

Requirements are given in *SSHC Subsections 601.02* and *603.03*. The principal requirements is that the equipment be "capable of spreading, consolidating, striking off, shaping and float finishing the freshly placed concrete to the desired line, grade, and thickness in one continuous passage in such a manner that a minimum of finishing by hand methods will be required". This is a performance specification and the approval of the equipment depends on the end result on the current project or an earlier project. Appropriate equipment to provide internal vibration is very important. Automated electronically controlled subgrade machines are also required. The subgrade equipment must perform "in conjunction" with a taut reference line erected and maintained by the contractor.

602.3011 Saws Used on New Pavement & Unbonded PCC Overlays

SSHC Subsection 603.03, Paragraph 7 says sawing may begin when the contractor can accomplish the sawing without causing the concrete to ravel.

Sawing equipment heavier than 905 kg (2000 lb) will not be allowed on pavement with less than 18 hours age regardless of pavement thickness. Span saws with a mass of 3620 kg (8000 lb) or greater are not to be used on pavements of 175 mm or less design thickness without approval of the Project Manager and Construction Division. Span saws can be utilized on pavements greater than 175 mm (7 inches) design thickness after pavement has a minimum age of 18 hours.

The contractor shall provide sufficient sawing equipment to produce the sawing schedule required in the specifications or special provisions. Standby saws should be provided. If the sawing schedule is not maintained, uncontrolled cracking of the slab will occur.

602.3012 Miscellaneous Equipment

Master Straightedge - The contractor is required to furnish and keep in a convenient place a master straightedge, made of 150 mm (6 inches) steel channel at least 3 m (10 feet) in length for the purpose of checking the straightedges at any time during the progress of the work. A sufficient number of straightedges shall be kept in readiness so as not to delay the paving operations.

Water Supply Equipment - Check over the water supply equipment with the contractor's superintendent. Be sure that it is adequate. After the pavement is placed curing takes precedence over all other uses of water.

Forms - Forms shall be of metal and of a depth equal to the edge thickness of the pavement. Visually inspect the forms. Forms which are bent enough to produce uneven alignment or a poor riding surface should not be used until straightened. Flexible metal or wood forms should be used on curves having a radii of less than 30.0 m (100 feet). See *SSHC Subsection 603.03*.

602.3013 Accumulation of Materials in Transporting Vehicles

The contractor should periodically clean and flush all transporting equipment such as transit mixers, agitators, and wet batch trucks, to prevent accumulation of hardened concrete in compartment. This also includes central plant mixing equipment. Frequent inspection of transporting vehicles and hoppers should help assure prevention of accumulation and build-up of hardened concrete.

602.40 PCC PAVEMENT PRECONCRETING CONFERENCE (*SSHC Subsection 1002.03*)

On all projects involving PCC pavement, the Project Manager and inspectors should meet with appropriate contractor and supplier personnel to discuss concrete production and pavement placement quality issues before any materials are placed. When ready mix concrete is used, the ready mix producer should also attend.

For the various types of work, the following items should be covered:

- Approvals and required quantities of aggregate and cement, class of mix, time and rate of delivery, percent of air, slump, batch weights, volume per truck, total quantity required, preparation of delivery tickets, testing arrangements, procedures in case of load rejection (air can be increased), responsibility for setting batch weights and amount of admixtures, placing, finishing and curing arrangements, and personnel work assignments.

- Adverse (cold or hot) weather plan of action.

- Settings and condition of paving equipment, dust control, subgrade treatment, procedure for checking steel placement, utility and street return box outs, heading-up equipment, joint sawing and cleaning, joint sealing, rain damage prevention, and cold weather protection.

Only one preconcreting conference is considered necessary for thoroughly discussing the work and responsibilities and duties of all involved in the project. On small projects it may be possible to include a preconcreting conference with preconstruction conference.

602.401 PCC Daily Report of Pavement Laid (DR Form 85)

The daily inspection report on paving work is a record of the construction progress, working conditions, weather, etc. during paving and plant operations which may affect pavement quality. This report keeps the central offices advised on job status and serves as a detailed permanent record of the paving project. At the end of each day on which any pavement was placed, this report is to be completed by field inspection staff for appropriate distribution.

The Daily Pavement Laid Report must accurately reflect the type of cement used.

602.50 PCC PAVEMENT CONSTRUCTION METHODS

602.501 Subgrade General

Make sure that the grade is always drained. There should be no areas where water can pool.

602.502 Preparation of Subgrade

Compaction Requirements - The subgrade compaction requirements will be shown in the plans. When a granular foundation course is not to be constructed, the upper 150 mm (6 inches) of subgrade shall be compacted to at least 900 mm (3 feet) beyond the edge of the proposed pavement and this should be shown in the Plans. The crown and elevation of the subgrade will be established by means of trimming, as described in *SSHC Subsection 302.03*.

Subgrade Cross Sections - After completion of the Subgrade preparation items, cross-sections should be taken and recorded on a data collector.

602.503 Foundation Course

Construction Requirements - Foundation course, when required in the plans, is to be constructed according to *SSHC Section 307*.

Protection of Foundation Course - The contractor should be advised that the protection of the foundation course from rainwater is one of the most important features connected with concrete pavement. Ahead of the placing operation, holes should be opened beneath the pavement forms to drain the water off the subgrade. Trenches should also be cut through any shoulder dirt outside the form line to carry the water away. In case of rain, such precautions will protect the foundation course and earth subgrade from standing water and may prevent saturation of the material.

Behind the finisher, protection of the foundation course beneath the previously laid slab is even more critical. During rains, water running off the pavement works under the bottom edge of the slab and washes out the foundation course. Even on very slight grades the force of the water soon becomes strong enough to wash out the entire depth of the foundation course from beneath the edge of the pavement. This may be in a strip of variable width, and may amount to as much as 1 m (3 feet).

To prevent this damage to the foundation course, the contractor may push an earth windrow against the edge of the slab sometime after the curing compound has been applied. Washing away of the foundation course is not usually a problem on slab which still have the side forms in place. However, it will occur on steeper grades unless the water is diverted over the shoulder by dikes at frequent intervals.

Immediately after any rain, inspect the foundation course along the slab edges.

Cross Sections and Thickness Measurements - Cross Sections should be taken on the completed subgrade and later, on the completed foundation course.

Thickness measurements should be made at the time of testing for density.

602.504 Grades on Drives in Cities

An attempt is made to standardize grades for residential drives constructed in conjunction with urban paving projects. Standardization reduces property owner complaints about their cars dragging when using their drives. A special design will be shown on plans for commercial drives such as filling station drives. The Design Office uses a standard design detail for driveways as well as a typical automobile template to check driveway cross sections.

If field conditions necessitate a change in driveway grades, vehicle clearances should be checked using typical automobile template dimensions. This can be accomplished by using a scale model template to check plotted grades for new driveways. Keep in mind that there are exceptions to all rules and there may be cases when more clearance may be required than indicated by template. In critical locations it may be necessary to contact the Roadway Design Division for help in determining a revised driveway design.

602.505 Protection of Pavement (*SSHC Subsection 601.02)*

Wheels of finishing equipment operating on previously placed pavement shall be rubber faced. Track propelled equipment should be equipped with rubber protective pads on crawler tracks or tracks shall travel on cushions of wood or belting. The near edge of wheels or tracks shall not be closer than 75 mm (3 inches) from edge of pavement. Provisions must also be made to prevent the screed from damaging the edge of existing pavement surface.

602.506 Operating Finishing Equipment on Previously Placed Concrete in Multiple-Lane Construction *(SSHC Subsection 603.03)*

Concrete pavement finishing equipment may be permitted to travel on an adjacent lane 7 days after finishing when concrete has attained cylinder break compression strength of 25 MPa (3500 psi) or after 14 days.

602.507 Surface Cleaning

When placing a lane adjacent to completed pavement any spillage or flow of concrete slurry on the surface of existing pavement must be broomed off prior to hardening. This helps prevent the transverse groove from being filled with concrete which would reduce the effectiveness of the texture.

602.508 Material Inspections

SSHC Subsection 603.04 explains how materials for concrete pavement shall be measured. National Ready Mixed Concrete Association (NRMCA), Quality Control Manual, explains how batching shall be conducted so as to result in the mass of each material required within a tolerance of one percent for cement and two percent for aggregates. The following is a discussion of measuring and handling concrete materials as set forth in *SSHC Section 1002* and the NRMCA Quality Control Manual.

Stockpiles - It is the contractor's responsibility to avoid harmful contamination, segregation or excessive degradation in placing or removing aggregates from the stockpile. Although the specifications do not specify the methods to be used by the contractor in stockpiling aggregates, the Project Manager should be aware of the method to be used and should

alert the contractor when chosen methods may produce unsatisfactory results. All aggregates are to be stockpiled separately. (*SSHC Section 1033)*

If a bulkhead is used in separating the individual aggregates it should be high enough to prevent intermingling of the aggregates. Aggregates which become intermixed shall not be used. Building a stockpile properly in horizontal layers tends to reduce the tendency to segregate. If the material is being dropped form a considerable height, the stacker should be equipped with a rock ladder or tremie to reduce the falling impact and prevent segregation. A brisk wind blowing through the falling aggregates will deposit the fines on the lee side of the pile while the larger particles remain on the opposite side. It is the contractor's responsibility to provide the specified gradation of the aggregate entering the mix. When crawler tractors are used on gravel stockpiles, the contractor must clean all caked dirt and mud from the track ways and from beneath the machine before running it on the pile. Crawler equipped dozers or end loaders must not be allowed to damage aggregates in the stockpiling areas.

If the aggregates are hauled to the project in railroad cars, burlap and boards used to chink cracks in these cars become mixed with the material. A grizzly with a maximum of 150 mm (6 inches) square openings should be placed on top of the aggregate bins to catch foreign material previously missed. They should be cleaned at least twice daily to prevent forcing the foreign material through the grizzly openings and into the batch.

602.509 Batching Inspections

General - The importance of proper batching inspection cannot be over-emphasized since proper proportioning of materials is one of the major steps in obtaining a satisfactory pavement. The plant inspector and his/her assistant carry out the inspection at the batching plant. The following items should be closely inspected during the progress of the work:

1. Be familiar with the physical characteristics of aggregates, design mix proportions, the method of determining batch quantities, scales operation, yield, effective water, cement factor and the procedure for adjusting proportions and yield when using air entrainment.

2. Calibration of scales and measuring devices, and the systematic and regular checking of scale settings for batches to assure proper quantities are being dispensed. (Scale settings are not to be made by the inspector since this is the contractor's responsibility.) The NRMCA, Quality Control Manual, Section 3, Plant Certification, outlines the steps required of the contractor in calibrating the scales and checking their sensitivities.

3. Sampling and testing is as indicated by the Materials & Research *Materials Sampling Guide*.

4. Water of doubtful quality must be tested and accepted prior to incorporating in the mix. The intake end of the pipe or hose used in pumping mixing water from a stream or standing body of water should be covered with wire mesh and located so that no foreign matter will enter. Hauling of mixing water should be done in clean, covered containers. Assurance of using acceptable water is the responsibility of the plant inspector for central or ready mixing and the responsibility of the slab inspector for on-the-job mixing.

5. Some scale bins do not always empty themselves after each batching cycle. The inspector should check the cement and aggregate bins for cleaning frequently at the beginning of the job. If the cement becomes packed in the corners of the scale bin, the correct mass will be shown on the scale but something less than the full mass will actually reach the batch. This condition can be corrected by rounding out such dead areas in the bin design or by means of vibrators attached to the bin sides.

6. When changing scale weights for batch correction in the aggregates, be sure that the set screws, holding the counterweights in position on the beam arms, are firmly tightened with pliers by the operators. Constant vibration around the plant tends to move these weights, causing an incorrect amount of aggregate to enter the batch.

7. If rain comes at any time while the aggregate bins are loaded, the water will collect in the material at the bottom of the bins. Two or three truckloads of each size aggregate should be taken from the bins and hauled back into the stockpiles before batching begins. When this is not done, the moisture content of the first few batches will be excessive and sloppy concrete will result at the mixer. Many contractors allow the bins to empty at the end of the day for the above reason.

8. All working parts, particularly the knife edges, should be in good condition, free from friction, readily accessible for inspection and cleaning, and protected from falling or adhering material. Dash pots should be clean, regularly inspected and filled, and free from friction. Elements of the lever system must not rub against other elements or framework of the plant. All nuts that might work loose in operation should be protected by locking devices. The scale container and closing devices should be tight against leakage and the plant should be carefully leveled and on a firm foundation.

9. At least once each shift the scale should be checked by halting the measuring cycle with a normally measured batch in the scale hopper and noting the precise scale reading. The addition of four standard 25 kg (50 lb) weights to the hopper should result in an exact indication of an additional 100 kg (200 lb) on the scale dial or beam balance. Erratic measurement due to binding scales can be detected in this manner.

10. Require that central-mixed concrete be hauled in vehicles meeting specification requirements and in a manner to avoid segregation and be delivered at the site with proper consistency and workability before the concrete starts to take its initial set. Require agitating type trucks if batch is to be held in trucks more than 30 minutes.

11. When the yield is found to vary considerably for no apparent reason, check accuracy of the scale. In addition to the methods of checking described above a quick method is to measure a loaded and tared batch truck on platform scales. Erratic measurement due to binding scales can also be detected in this manner.

602.5010 Cement Hauling Inspections

The inspector will observe the measurement of all batches and see that the beams balance after the discharge of each batch. If a springless, dial-type scale is used, the pointer must return to zero.

The inspector must also keep a complete, accurate record of all cement received, used and wasted. This record will be used to determine the cement factor being obtained and to verify the correct proportions of cement to aggregates. The record is kept in the "cement notebook" and should consist of:

A complete index
Scale calibration record
Daily cement record
Cement car record

The cement car record consists of statistical information concerning every car of cement used on the project. The railroad net mass of each car may be obtained from the freight office or from the contractor's freight bills. The remainder of the information is a record of the use of the cement on the project.

The cement used at the plant shall be checked against the cement required by the total number of batches or cubic meters mixed. These checks are to be made during the progress of the work in accordance with the procedures outlined herein. The first or initial check of cement used against the cement required should be made at or near the close of the first or second full day's paving operation, and at least before unloading the 11th carload of cement. The initial and successive cement checks should be made between carloads and with cement silo and storage or service bins completely empty.

If the initial check shows that less than 99 percent of required cement was used, the calibration and operation of all measurement and proportioning equipment, and the proportioning of aggregates and cement should be immediately and thoroughly checked. A second "empty bin" check of cement used should then be made at or near the close of the first or second full day's paving operation following and before unloading the 11th carload of cement used after the initial check.

If the initial check or succeeding checks of cement used show more than 99 percent but less than 100 percent of required cement used, a succeeding "empty bin" check shall be made at or near the close of a day's paving operations or not later than the 50th carload of cement used after the previous check, whichever involves the greater quantity of cement. The contractor can make "empty bin" cement checks at more frequent intervals if he/she so desires and our Project Managers should lend their full cooperation in making such checks.

It is realized that in the case of paving projects obtaining concrete proportioned at commercial ready-mixed plants, it is usually impossible to make accurate, "empty bin" checks of the cement used. Accordingly, it is extremely important that the project manager and the paving plant inspector make certain that the inspection of the measuring and proportioning is full time and fully adequate; that the scales measuring the aggregates and cement are accurate; and that the procedures are conducted in a careful and precise manner so as to insure the correct proportioning of aggregates and cement.

In the inspection of the cement measuring operations at either commercial ready-mixed concrete plants or proportioning plants, the Project Manager and the plant inspector should make certain that air pressure in the cement delivery and storage system is not affecting the cement scale and cement measuring operation. It has been found that in certain proportioning plants, if the service bin and the scale hopper for cement are not adequately vented, air pressure buildup in the scale hopper will cause some under measurement of the cement. This can be positively checked by introducing cement into the hopper until the scale indicates the correct amount for a batch and then hold up the operation with the scale fully loaded for a short period of time -- sufficient to void any air pressure in the cement weighing hopper. If the cement scale is functioning properly, the scale beam and dial indicator will remain stable. If air pressure is affecting the measuring operation, the cement scale beam and dial indicator will indicate a decreased mass of cement as the air pressure dissipates. It is important that this item be checked periodically on all proportioning plants using air pressure to transfer or move cement within the plant.

Checking the Interlocked Automatic Batching Controls

1. During regular batching operations, compare the dial reading at cut off with the cut off settings.

2. During a measuring cycle with the plant in automatic operation ask the operator to move the control lever from charge position to discharge position. If the discharge gates open before the weighing cycle is complete, the system is not functioning in a proper manner.

3. During the discharge cycle, before the discharge gate is closed, place or suspend 25 kg (50 lb) on the hopper. If the discharge gate can be closed and the bin gates opened automatically at the end of the discharge cycle, with the 25 kg (50 lb) mass still in place, the interlock system is not functioning properly.

4. During a normal batching cycle, ask the operator to set one bin gate for manual control, closing it early so that less than normal mass is drawn from that bin. Then ask the operator to return to operation by automatic control, with the light mass batch in the hopper. If the discharge gate opens, the controls are not functioning properly. Repeat this operation with the bin gates for each of the ingredients of the batch.

602.5011 Mixing and Hauling

Methods - Several combinations of methods for mixing and hauling of concrete for pavement construction can be used:

Since the procedures to be used by the contractor may vary, the Project Manager on each project should assign definite division of responsibility to the plant inspector and the slab inspector before paving operations are started.

Inspection - The following paragraphs include important mixing and hauling inspections:

1. Check the time on the mixer at least twice daily.

2. Check for uniformity of batch consistency. Non-uniformity may be caused by any of the following:

a. Leaky mixer valves. Indications of this condition are wet batches when mixed for periods longer than the normal interval.

b. Double pulling of water valve. Watch the mixer man for correction of this condition.

c. Moisture change in the aggregate. Loader operator may be dipping into aggregate stockpile which has not drained sufficiently.

d. Empty AEA supply container or partially clogged supply tube to mixer drum. Another indication of the failure of the AEA supply is free water on the finished slab. The plant foreman should be made responsible for delegating a reliable man to fill the AEA supply tank each day or as often as necessary. A leaking valve on the AEA dispenser will also cause trouble, producing a batch with too much slump and too high an air content.

3. Wash water in transit-mix trucks, if being used, should be completely discharged. Quality concrete work is dependent on the uniform consistency of the concrete mixture being used and will only result when good control of the water-cement ratio is maintained. Our specifications do permit the use of wash water as a portion of the mixing water when accurately measured and taken into account in determining the quantity of water to be added. However, it is very difficult, if not impossible, to accurately measure wash water remaining in the drum, and this procedure should always be discouraged.

4. Mixing is controlled either by a specified time, or number of revolutions at a specified revolutions per minute. Regardless of the method used for controlling proper mixing, it shall begin after all ingredients are in the mixer, including water. Close cooperation is required between plant and road inspectors to assure proper mixing time or number of revolution is being observed and that concrete is placed within the designated time limit.

5. Truck mixers should be checked to assure that there is no leakage from the water tank into the mixer.

6. Concrete, when it leaves the chute of a truck mixer or truck agitator, tends to segregate. Segregation can be corrected by providing a baffle at the end of the chute to cause the concrete to drop vertically.

7. A satisfactory method of extending the actual haul in transit-mix operations is to add the cement, not at the batching plant, but a point closer to the work. During the haul between the batching plant and the point at which the cement is added the mixer should not be revolving as otherwise the aggregate would be subjected to unnecessary grinding action.

8. The specifications provide that the truck mixer or agitator shall be capable of delivering and discharging the concrete in a thoroughly mixed and uniform condition. According to ASTM, concrete that has not been thoroughly mixed will have a slump test value that differs by more than 50 mm (2 inches) when taken at approximately the 1/4 and 3/4 discharge points.

9. *SSHC Subsection 1002.03* requires the contractor to have a procedure to issue a ticket to the driver of each load of concrete delivered to the project. In addition to the requirements shown in the specifications, the concrete ticket handling procedure shall include the following:

    a. The concrete ticket for the first load of concrete each day will indicate the number of liters of water that can be added without exceeding the maximum specified. The maximum number of liters will be indicated on subsequent tickets as changes occur.

    b. Any additional water added to the mixer, at the site of work, will be recorded in liters on the ticket by the driver. If additional mixing water is required, a minimum of 20 revolutions of the truck mixer drum at mixing speed shall be required before discharge of any concrete.

10. Truck mixers shall be randomly checked against ASTM C 94. The concrete shall be mixed for not less than 50 nor more than 100 revolutions at mixing speed. It is further required that additional mixing in excess of 100 revolutions be at agitating speed and the change from mixing to agitating speed shall be done by the truck mixer operator at an intermediate station established at a point along the route by the Project Manager. Random checks are to be made often enough to assure compliance, and in general should consist of from one to four checks daily based on the quantity of concrete produced. These random checks shall include the following:

    a. Plant inspection personnel shall check the zero setting of the revolution counter after charging of batch and the proper drum mixing speed.

    b. Placement inspection personnel shall check the number of revolutions recorded on the counter for compliance with the specifications.

    c. The random checks shall be recorded in the field notebooks.

11. The temperature controls in SSHC Section 1002 should be strictly enforced.

12. Regardless of whether concrete is mixed in site mixers, stationary mixers, or truck mixers it is the responsibility of the slab inspector to assure that it is properly mixed and meets the requirements in regard to slump, air content, uniformity, and desired workability when delivered to the subgrade. Wet and dry batches should be avoided and the slump held to within very narrow limits, normally not exceeding 12.5 mm (1/2 inch) variation.

13. The schedule of delivery of ready-mixed concrete is sometimes a problem due to the long haul and the interference of other commercial traffic. The Project Manager should check this matter carefully with the contractor's superintendent. Sufficient hauling units should be provided to assure a minimum time lag between the arrival of batches at the site of the work. In no case should this be longer than 30 minutes.

14. The two main faults with truck mixers and agitators is their inability to discharge low slump concrete and their tendency to hold back too much of the coarse aggregate until the last few cubic feet of the batch are discharged. Nothing can be done about the first of these faults, the second can be partially corrected by depositing the last increment of the batch at a point where it can be mixed into other concrete.

15. Haul time and stand-by time frequently has an adverse effect on the consistency of truck-mixed or truck-agitated concrete. The batch becomes progressively stiffer as the time increases. The rate of stiffening is affected by the characteristics of the cement and aggregates, and by temperature. The 1 1/2 hours maximum mixing and agitating time allowed in *SSHC Subsection 1002.04* shall be reduced if undue stiffening is apparent. The stiffening process may be reversed by adding extra water either at the start or at the point of delivery. In either case the end result is the same, a higher water-cement ratio and lower quality concrete. Caution should be used in employing this method of retarding stiffening, and in no case should the total amount of the water per batch exceed the total allowed by the specifications.

16. In transit-mixed concrete, the inspector should examine the batch for cement balls. These usually are the result of the method of charging the water. If sufficient water, about 40 percent, enters the drum ahead of the aggregates and cement, cement balls will not usually occur. Most of the remainder of the water should enter with the cement and aggregates and the mixer should be rotating during the charging period.

17. When discharging transit mixers at the site of the work, the rate of discharge should be regulated by the speed of rotation of the drum and not by the size of the discharge opening.

18. Truck mixers shall be examined periodically for accumulation of hardened concrete. Any truck mixers showing such accretions or excessively worn pickup and mixing blade shall not be used.

602.5012 **Forms** (Usually small paved areas.) *(SSHC Subsection 603.03)*

Form Setting - After the foundation course has been properly compacted, the forms may be set. If the foundation course is low along the form line, additional material shall be placed and compacted before setting the forms in place. Forms shall be tamped mechanically. Form pins shall be long enough to penetrate the earth grade below the foundation course a sufficient depth to hold the form rigidly in place. If the project is in town, or in curb sections where drainage is a factor, form elevations should be checked with an instrument after the forms are set and tamped.

Form Alignment Ahead of Paver - All forms should be inspected for alignment, elevation and adequacy of tamping immediately ahead of the paver. This should be done far enough in advance to allow for correction of high and low joints or additional tamping if necessary. A smooth form line is an important factor in the riding quality of the finished pavement and should always be checked before placing concrete between the forms. Forms should be oiled to prevent sticking to the concrete.

Check forms as necessary to verify they have not settled.

Form Removal - Forms should not be removed sooner than **12 hours** after concrete has been placed. Care is to be exercised in this operation to see that the edges of the slab are not broken or otherwise damaged. The sides of the pavement slab should be covered with the curing compound within 30 minutes after removal of the forms.

602.5013 Placing Reinforcing Steel *(SSHC Subsection 603.03)*

Steel reinforcing bars and dowel bars are required to be supported by metal chairs or units of approved design. It is the contractor's responsibility to get approval prior to construction of dowel baskets of a type not shown in the plans or described in the special provisions.

The specifications allow machine placement of the longitudinal deformed tie bars in lieu of being supported by metal chairs. The machine must be self-loading with a reasonable tie bar storage space and be capable of placing the tie bars at the spacing shown in the plans. It must be located in the paving train so as to place tie bars prior to the placement of the wire mesh on reinforced concrete pavement, or prior to the passage of the first finishing machine on non-reinforced concrete pavement.

602.5014 Tie-Bar Steel Inspection (*SSHC Subsection 603.03*)

All paving contractors should place joint tie steel according to details in the plans. The following tie-bar steel inspection procedures will be required on all portland cement concrete paving projects where centerline or lane line tie-bar steel is either manually or mechanically placed in plastic concrete:

- Manually check location and depth of tie-bar steel in the plastic concrete behind slipform paver each day.
- Using a magnetic locator (pin finder), verify location of tie-bar steel in hardened concrete every day.

To insure compliance with proper joint design parameters, use the following minimum frequencies when checking rebar location:

- Once in morning and once in afternoon for tangent roadway sections check the location.
- In at least three locations within all horizontal curve sections. These locations generally would be at the beginning transition, in the middle of the curve, and at the ending transition.
- For each inspection, at least two tie-bar steel locations within a panel should be checked.
- Checks of any area with out-of-tolerance tie-bar steel should be expanded so that extent of problem area is identified for retrofit correction. These areas should be determined on hardened concrete.

The checked areas of hardened concrete should not overlap previously checked plastic concrete areas.

Project inspector should document tie-bar steel inspection results in field book.

Minimum placement tolerances are as follows:

- Depth: D/2+25 mm, -37 mm (D/2 + 1 inch, - 1.5 inch).

- Angle: Minor variations to 1.6 radians not critical as long as at least an effective length of 300 mm (12 inches) of tie-bar steel extends across joint.

- Lateral position, number of bars shall be as shown in the plans.

- Joint deficiencies in lateral position and number should be evaluated by the Construction Division.

If previously mentioned inspection procedures discover out-of-tolerance tie-bar steel, the contractor has the following options to remedy the problem:

- Contractor may substitute a longer bar to better ensure an adequate length across joint.

- Contractor may place additional uniformly spaced bars across joint.

- Contractor may move the bar inserter uphill on the paver.

602.5015 Inlet and Utility Accesses

Inlet standards show a portion of slab, or a portion of curb and gutter unit blocked out at the time of construction which is to be filled in later when the inlets are built. Since the inlets are usually sublet by paving contractor, the question of including this insert section as a part of the inlet has been brought up frequently.

When computing the quantity of pavement, designers consider all concrete work between the curb edges of pavement.

No deduction is made for insert sections which are blocked out and then formed when the inlet is built. These insert sections are blocked out to facilitate construction of inlet. Other areas of pavement or curb and gutter may be blocked out to prevent slowdowns of the paving crew because of special shaping requirements. Insert sections and areas requiring special shaping will be paid for as part of the pavement or curb and gutter quantities.

602.5016 Box-Outs for Utility Accesses

Standard Road Plans provide for boxing out utility accesses in pavement. Clearance of the manhole ring below pavement grade shall generally be 6 mm (1/4 inch). Care must be taken during paving process to avoid disturbance of the ring. The concrete roll in front of the screed as it passes over the ring should be removed and used to pack around the ring. This should prevent movement.

Box-out for utility accesses occurring in the form line should be three-sided with the end sections at 60 degrees with form and center section parallel with form. All three sides should be about 300 mm (12 inches) from the upper edge of the ring.

The ring should be set to the required grade and concreted-in when an adjacent slab is being placed. Special procedures may be necessary when incorporating some old utility accesses into new pavement as to whether a box-out is used or not. Particular attention should be paid if bearing support of the old structure is questionable.

602.5017 Box-Outs on Slip-Form Paving

Contractors when slip-forming urban projects sometimes fill the inside area of box-outs for utility accesses and intakes with soil. This is to help keep the forms from moving and reduce the volume of concrete mix that is wasted during passage of paver over box-outs.

In some cases, the box-out is filled to a greater height than forms and soil becomes intermixed with concrete as paver passes over these areas. This results in contaminated mix being incorporated in pavement. To insure that the concrete mix will not be contaminated, the height of the fill inside box-out area should be 75 mm (3 inches) or more below top of the forms or a sheet of plywood may be placed over opening of box-out areas.

602.5018 Placing and Spreading *(SSHC Subsection 603.03)*

General - The slab inspector normally has the responsibility for inspecting the placement and spreading of the plastic concrete in such a manner as to provide a structurally sound pavement with smooth riding qualities and to see that this work and the finishing is accomplished as required by the contract documents.

The paver, truck mixer or truck agitator should distribute the concrete evenly on the subgrade without displacement of reinforcing steel or joint material. Concrete dumped in piles can cause roughness. Do not overload one side of the spreader as the extra weight on one side of the machine may cause it to displace the forms. Centerline tie bars shall be placed carefully so that the centerline splits the bar. When expansion joints are encountered, concrete should be banked around both sides of all joint material by hand prior to spreading near the joint with the machine. The slab inspector shall see that none of the dowel assemblies or joint material is displaced during the placing and vibrating of the concrete.

The quantity of concrete used should be checked by comparing the number of batches used with the number of cubic meters required. These checks should be made at shutdown, mid-shift breaks and at other points providing a distinct check on batches used and such checks should be entered in the DR Form 85 "slab report". If measurements (such as subgrade, form settlement, slab thickness, and crown measurements) indicate the possibility of thin pavement, checks on the concrete quantities used should be made more often. When the pavement is placed in two layers, concrete quantity checks are difficult to make. However, using a little forethought and exercising good judgment, a fairly accurate check can be made without "evening up".

Batch volume underruns may be due to any of the following reasons and should be investigated immediately:

1. High subgrade
2. Form settlement
3. Low crown
4. Excess mass from aggregate scale operator
5. Wrong scale setting or slipping of counter weight at aggregate scale

Slab thickness and crown checks should be performed a minimum of three times each day. The slab thickness check shall be made by placing a thin piece of plywood or other suitable material of approximately 200 x 200 mm (8” x 8”) size at existing subgrade or foundation course level at three points along the transverse section, such as at the two one-quarter points and at centerline. After the finishing machine has passed over the selected location the thickness of the slab shall be measured at the three predetermined points. Crown checks shall be made directly back of finishing machine by the use of a taut line over blocks placed on the edge of the slab. The blocks should be of the same thickness as the height of the crown. The line should be drawn taut and lowered to the blocks and then moved back and forth in a sawing action. If the crown is correct, the taut line will leave a mark of approximately 0.5 to 1 m (18 to 36 inches) in length at the center of the slab. Generally, the contractor makes similar checks and these checks can be made in conjunction with his/her checking. All checks are to be made a matter of record in a field notebook.

602.5019 Slip-Form Construction *(SSHC Subsection 603.03)*

The pavement may be constructed by means of slip-form equipment conforming to the requirements of the *Standard Specifications*. Conventional methods of construction shall be used on irregular or variable width sections which are not adaptable to slip-form construction.

Any provisions of the specifications requiring the use of equipment riding on forms will not be applicable when slip-form construction is used.

The adequacy of the finished pavement constructed by the slip-form method is highly dependent upon a sequence of correct methods, equipment and inspection procedures. In order that the essential events occur in their proper order, the inspectors shall carry out their assignments with diligence. The paver is equipped with side forms to support the concrete laterally for a sufficient length of time during placement to produce pavement of the required cross section.

Smooth pavement begins with a uniformly stable subgrade and foundation course which have been constructed, trimmed and maintained at true line and grade during the time prior to the passage of the slip-form paver. These courses shall be constructed to conform to the typical cross sections shown on the plans and of sufficient width to include the trackways for the subgrade machine or machines and the slip-form paver.

Vigilant inspection is required of all construction operations to insure that they are in accordance with the requirements of the specifications. Various factors essential to production of sound, smooth and durable slip-form pavement are listed below:

1. Use of aggregates meeting specified requirements for quality and gradation.
2. Accurate determination of batch proportions with adjustments for determined moisture content of aggregate.
3. Use of minimum quantity of mixing water required to produce a plastic, workable concrete mix of uniform consistency and specified slump.
4. Introduction of air into mix within the prescribed limits.
5. Thorough mixing for required length of time.

6. Proper placing and consolidation of the concrete.

7. Correct placement of steel reinforcement and dowel joint assemblies.

8. Strict compliance with required curing methods.

9. Timely sawing of transverse contraction joints.

10. Restriction of loads on pavement until it has gained the required strength.

Control of line and grade for both the subgrade and foundation course work is accomplished by using a reference line set from the offset hub line. It is supported and tensioned to prevent any measurable sag or transverse movement. The machines have sensors which use the reference line for alignment and automatic grade control. The use of these automatic controls is analogous to the form line in the conventional method. The maintenance of the cross-section of the subgrade or foundation course to the plan elevation, controls the thickness of the finished pavement. Once the subgrade or foundation course has been completed to plan requirements of line, grade and density, it is extremely important that it be protected, particularly the tracking path area, until the passage of the slip-form paver.

The concrete is delivered to the paver in any conventional manner. When possible, keep concrete trucks off the subgrade. The fresh concrete is deposited on the subgrade, by uniform distribution of batches, just ahead of the paver. The uniform distribution of the batches is very important in slip-form paving. For the purpose of metering the correct amount of concrete for the full paving width to the main screed, pavers of this type are normally equipped with an initial strike-off blade provided with power travel fore and aft independent of the forward travel of the paver. Some pavers are equipped with augers which effectively meter the fresh concrete to the main screed. The forward speed of the paver shall be adjusted to the average progress of the concrete production and delivery in order that operations shall be as continuous and uninterrupted as possible.

Because of physical limitations as to the mass of the machine and of the relatively large screed area, the importance of using concrete of proper consistency and uniform distribution is extremely critical. Large piles of concrete or dry batches will cause the paver to "float" or lift above the true grade and result in a high area or bump. Wet batches cause low spots and edge slump and irregularity.

The concrete, for the full paving width, shall be effectively consolidated by internal vibration with transverse vibrating units of a series of longitudinal vibrating units. The paver extrusion plate or screed shall extrude the concrete under load, properly shaping and compacting the concrete into a dense, stable mass to assure that the concrete remains stable, with a minimum amount of slumping after the passage of the paver. Some pavers may have more than one device for the screeding operation.

When the pavement is being constructed by slip-form method, all reinforcing steel shall be placed in accordance with *SSHC Subsection 603.03*, Paragraph 4. In some instances two slip-form pavers may be required in tandem in order to comply with the requirements.

The finishing and curing shall be in accordance with *SSHC Subsection 603.03*, Paragraphs 5 and 6. The requirements for surface texturing and curing may be accomplished by accessories mounted on the self-propelled float finisher.

602.5020 Surface Finishing

General - The traveling public judges your pavement job by its riding qualities. Careful inspection of the finishing operation will assure a surface which will receive public approval.

The intention of the specifications is that manipulation of the concrete during finishing should be held to a minimum. Overworking tends to bring water to the top. This is detrimental to the wearing surface and to the strength of the concrete. Hand finishing, unless allowed by the special provisions, can be used only in cases of emergency on normal width pavement or on narrow or variable width sections where mechanical methods are impractical.

Machine Finishing (*SSHC Subsection 601.02)* - The minimum requirement of mechanical finishing equipment prescribed by the specifications is:

1. Self-propelled concrete spreader
2. Self-propelled finishing machine equipped with a pan-type finisher-float

On high production pavement projects [over 45 m (150 feet)] of pavement per hour or when more than one concrete mixer is used), an additional finishing-machine without the pan-type finisher-float is recommended. The goal of this paving train is to adjust the forward speed of the final finishing machine (equipped with the pan-type finisher-float) to the concrete production, so as to provide an uninterrupted strike-off operation. The combination float-finisher is designed for a one-pass operation. Concrete should be accurately metered to this machine. The spreader of the auxiliary finisher (if required) should leave enough concrete for a uniform roll of approximately 100 mm (4 inches) for the front screed. This screed in-turn should be tilted enough to allow 50 to 75 mm (2 to 3 inches) roll for the rear screed. The pavement surface is then trimmed to the desired grade and crown by the rear screed. The pan float will normally be set almost flat longitudinally with the roadway and should just make contact with the pavement surface.

Transitions - Some pavements are designed with a tangent crown, which shall be removed gradually for superelevated curves. The distance in which the crown is to be removed will be shown on the standard or special plans. This will require adjustments on both the spreader and the finish machine or machines. The operation of this equipment should be synchronized so that the same amount of crown is being removed, or replaced, by each machine at any given point in the transition.

The transverse finishers in use usually have a single adjustment point at one end of the screeds and pan float which permits running the crown in and out on superelevated curve transitions.

The distance in which the crown is removed is not critical and may be increased or decreased over the distance given on the standard plan, if the Project Manager determines a change is beneficial. The crown is removed in the transition distance in equal increments. The number of increments to be used should be divided into the transition distance to obtain the length between each crown change. Set a stake in the shoulder along the form line at

each of these points, where it will be visible to the machine operators. The pavement foreman should delegate experienced personnel to "crank out" the crown on the screeds and float.

Straightedging *(SSHC Subsection 603.03)* - After completion of the mechanical finishing and while the concrete is still plastic, laitance and surplus water shall be removed and the surface shall be made true and smooth with approved 3 m (10 foot) straightedges supplemented by such floating as is necessary to eliminate all depressions and irregularities. Straightedges shall be set parallel to centerline and shall be lapped 1/2 their length in each successive position. High areas shall be removed and depressions shall be filled with fresh concrete and consolidated by floating with approved hand floats. Straightedge testing shall be continued as necessary until all irregularities have been found to be satisfactorily corrected. Straightedges should be checked against the master straightedge at least twice daily. When using slip form construction, straightedging will generally only be required at the beginning and ending of the daily placement. (Also see *SSHC Section 602*.)

At longitudinal contraction joints along old pavement or companion lanes, care must be taken to prevent the newly finished surface overhanging the top of the adjacent slab. This can be accomplished by the flat finishers "dragging off" the excess concrete with a straightedge pulled longitudinally along the joint after the initial subsidence of the fresh concrete. This "pushing up" of the fresh concrete against the previously laid slab is especially noticeable when the crown elevation of the fresh concrete is higher than that of the lane already in place. (This also channels water into the joint and shall be avoided.) If this is not corrected, it will be very annoying to traffic when changing lanes and may even become a traffic hazard. Edgers must not depress this joint. Competent workmen shall be detailed to the finishing and edging of this part of the work.

Drag Finish - The surface of the pavement shall be given a final finish by means of a wet burlap, carpet or canvas drawn in the longitudinal direction. The drag should be of sufficient width so that the entire slab can be textured in one operation. It is required to be supported from a mandrel which is often attached to the rear of the belting machine or the self-propelled float finisher when slip forming.

Expansion joints, if any, should be edged at this time taking care to remove all concrete from the top of the joint leaving a full 25 mm (1 inch) wide opening. Workmen should be cautioned not to bear down on edgers as this will depress the concrete and leave a rough joint. Edger marks at the joints and the edge of the slab should be removed with a small piece of wet burlap, leaving the surface with a uniform texture and appearance. Straightedge all joints after edging.

602.5021 Use of Water in Finishing Concrete

SSHC Subsection 603.03 does not allow concrete finishers to apply water to surface of pavement to aid in finishing of concrete except limited amounts with an orchard sprayer. Any additional water added to surface of fresh concrete increases water/cement ratio of mortar and adversely affects air content. This results in a less durable matrix and concrete surface is more prone to early scaling and general surface deterioration.

Chemical finishing aids and evaporation retarders may be approved by the Project Manager.

Should a voided surface occur during finishing and finishers experience difficulty in closing an open pavement surface, fresh mix or mortar should be obtained from in front of paving train and added to surface to facilitate finishing and produce a tight, closed pavement surface.

602.5022 Tining *(SSHC Subsection 603.03)*

The plans indicate those pavements that shall receive tining.

Tining impressions are made in plastic concrete while grooves are made once concrete has hardened.

@ The Department has changed tining requirements. Mainline pavement will now be longitudinally tined instead of transversely tined. Transverse tining shall be done with a rake, not a bull float. Ramps and other irregular areas that cannot be properly tined longitudinally shall be transverse tined.

@ Mainline pavement tined surface longitudinally is the primary goal to reduce noise levels.

@ Proper timing is critical. Longitudinal or transverse tining of the surface too early may result in grooves filling up with mortar or surface tearing. Tining too late results in a reduced groove depth.

To obtain a uniform transversely grooved pavement inspector should check the following items:

- Texture machine operating properly and all control devices functioning correctly.
- Pad line maintained in smooth and stable condition.
- @ Tining rake carrier rails set to pavement crown, so uniform down pressure on tines maintained as comb sweeps down across the slab.
- Four springs attached to carrier frame and to broom channel with a tension adjusting chain are identical and adjusted to obtain proper groove depth.
- Tines of comb parallel. A bent tine, which narrows spacing at tips, undercuts adjoining groove.
- No build up of dry mortar near tips of tines. A build up of mortar widens groove at surface and may cause tearing or displacement of larger aggregate particles.
- Steel tines not worn and comb in good condition, to ensure sufficient groove depth.

@ Should an unsatisfactory tined surface result for any reason, stop the paving operation and do not allow resumption until the problem is corrected.

Tine Determination

Depth of the grooves may be determined by using a standard commercial tire tread depth gauge, but normally a visual inspection without measurements is adequate.

Guidelines for Tining Concrete Pavement

@ 1. Tine mainline pavement longitudinally.

2. Ramps and small irregular areas can be transverse tined with a tining rake.

3. Tine all concrete pavements where posted speed limit will be 40 mph or greater. When a mainline is tined, include tining in intersections, acceleration lanes, deceleration lanes, left-turn lanes and ramps.

4. Do not tine concrete shoulders.

5. On pavement built without curb, stop tining 6 inches (150 mm) from edge of pavement (for edge of pavement painted line.)

6. On pavement built with curb, stop tining 2 feet (600 mm) from back of curb.

602.5023 Pavement Depression

A pavement depression prevents proper drainage of slab during periods of rain and may cause maintenance problems during the winter. This may be due to one or more of the following reasons:

- Screed not set correctly
- Poor workmanship by finishers in manipulating straightedge
- Improper tension between ends of trailing forms
- Improper adjustment of edges attached to trailing forms

@ Check this deficiency by placing a 10 ft (3 m) straightedge or 4 ft (1.2 m) carpenters level transversely on pavement surface and noting trueness of surface with bottom of straightedge.

602.5024 Pavement Station Stamping

@ Station location of all PCC pavement shall be stamped in plastic concrete at every station (100 ft/100 m) by the NDR inspector.

@ Permanent Station Numbers - Each station number shall be marked permanently in the surface of the concrete slab by the use of metal dies furnished by the department. The numbers should be stamped neatly in the concrete just before it takes its initial set. They should be placed about 6 inches (150 mm) in from the right-hand edge of the slab so that they can be read from the right roadway shoulder.

On interstate concrete pavement, station numbers should be stamped on the outside edge of both roadways (sides: away from the median). These numbers will also be 150 mm (6 inches) in from the slab edge and facing so that they can be read from the outside asphalt shoulder. Placement of station numbers on all ramps, loops, "S" roads, etc., should be made in conformity with the first paragraph of this section.

On concrete slabs having integral curbs, the location of station numbers will vary between projects according to desires of parties most likely to use them in the future. The city engineer and/or District Engineer should be consulted on this matter prior to construction.

602.5025 Integral Curb Placement

Integral curb may be placed simultaneously with the pavement placement, directly behind the pavement finishing operation, or at some later date. When placed directly behind the finishing operation, the specifications require placement within 30 minutes from the time of placement of the pavement and that the curb be placed on a roughened surface. Both of these requirements are important to insure an adequate bond to the slab. If the integral curb is to be placed at a later date, reinforcing steel, as indicated in the plans, shall be placed during the construction of the slab.

Two important items to note during the inspection of constructing curb is proper consolidation of the concrete and configuration of the finished curb. Proper consolidation will eliminate voids on the backside. Should voids be present they are to be filled with a mortar, immediately if slip-form methods are being used or in the case of forms immediately upon removal of the forms. Configuration should be checked for conformance with dimensions shown in the plans. If hand methods are being used a "mule" type float of the proper configuration should be used in the construction of the curb.

602.5026 Protection and Curing

The slab inspector in charge of curing should study the requirements for the method proposed for use by the contractor. If the method of cure involves the use of "blanket-type" coverings, these should be inspected and sampled, if necessary, prior to pavement production. Impervious coating material proposed for use must be tested before use. Although its application rate will not be less than 0.3 L/m² (1.5 gal/22 yd^2) for tine/surfaces and 0.2 L/m² (1.0 gal/22 yd^2) for all other finishes, the rate of application may be increased depending on the moisture retention qualities of the impervious coating.

One method of curing is the use of "wet burlap and impervious coatings". When this method is used, the initial curing with wet burlap is very important as it prevents evaporation of the mixing water at the time when hydration is most rapid. The wet burlap should be applied as soon as the fingertips can be gently touched to the concrete without becoming sticky. If hair checking develops during hot weather, the wet burlap should be applied immediately behind the finishing operations. Hair checks are much more objectionable than burlap marks. If the burlap is applied with care, and with the seams up, burlap marks will be held to a minimum. Water for curing takes priority over all other pavement operations. Impervious coatings are then applied after the first 20 hours of initial curing. The testing laboratory will test each lot of impervious materials received and will designate the quantity per square yard to be applied. A daily record of the liters used and the amount applied per square meter shall be kept in the slab inspector's notebook. It will be the inspector's duty to see that the coating materials are applied uniformly and in an amount at least equal to the

amount designated by the laboratory. The vertical edges of the slab shall be coated with the same quantity per square meter as the surface. Keep the material from coating any joint areas to which joint-sealing filler is to be applied.

When curing with burlap, at times keeping the burlap in place and continuously in a dampened condition is an endless task. However, since proper curing is essential to good quality in the concrete, the curing requirements for the particular work should be reviewed and discussed with the contractor. It is the responsibility of the Project Manager to ensure that the contractor carries out the curing requirements as specified.

Prior to start of paving operations the inspector should be assured that the contractor has sufficient material on hand, such as burlap, polyethylene sheeting or other approved material, to properly protect the pavement surface in case of rain. Sudden showers which might occur during paving operations or immediately after finishing operations require the exposed surface of the fresh concrete to be covered to prevent washing cement from the surface. Mixing and placing of concrete should cease immediately in the event of rain.

When hot dry and windy conditions prevail, the application or placement of curing material becomes extremely important.

602.5027 Joints *(SSHC Subsection 603.03)*

Joints are sawed in PCC pavements to eliminate random cracking and to provide areas for pavement to expand and contract. These control joints are then cleaned and sealed with various types of sealants to keep out water and incompressibles such as soil, sand, and gravel.

Transverse Construction Joints - The header board used to form the construction joint at the end of the day's run should be cut from 50 mm (2 inch) material and approximately 37.5 mm (1 ½ inch) shorter than the width of the pavement. Holes bored in the board to receive the load transfer dowels should be at least 6 mm (1/4 inch) larger in diameter than the dowel bars.

When due to breakdowns, construction joints are necessary during the day, and work is resumed after a short delay, great care must be used in removing the header board from the green concrete. Any pressure or lift on the dowel bars will break the bond with concrete and cause the joint to spall at some future date.

Generally, header boards should be set 3 mm (1/8 inch) below normal crown at centerline. Observe the straightedging of the header joint the next morning and adjust the setting of the next header board, accordingly. When paving down steep grades (4 to 6 percent), set the header board 6 mm (1/4 inch) below crown elevation. When paving up steep grades, set the board exactly to crown elevation. Boards should be set at right angles to the pavement grade with dowel bars parallel to the subgrade.

Concrete pavement failures on the "morning" side of transverse construction joints have sometimes been noted. This is normally caused by unconsolidated concrete. Machine vibration should be observed at this point and if not considered adequate, hand vibrations for a few feet out from the header should be required.

Dowel bars on all joints shall be greased as shown in the plans.

Transverse Expansion Joints - The joint materials should be set at right angles to the pavement grade with dowel bars parallel to the subgrade and to the centerline of the

pavement. Tilted or skewed dowels will "blow up" the joint at some future date when the pavement expands. The joint material must touch the subgrade throughout its entire length and there should be no gaps between the mastic sections. Concrete plugs form in such gaps and defeat the purpose of the joint. Make certain that the expansion tubes are not driven on past the stop lugs or the joint will fail to function. The 25 mm (1 inch) temporary filler between the ends of the expansion material and the side form should be removed before placing the hot-poured joint material. If the temporary filler is composed of unyielding material, it should be removed the day after the pavement is poured to prevent spalling the corners of the concrete slab when the pavement expands.

The strike bar on the spreader and the screeds of the finishing machine should be raised slightly when making their trip over the joint. Machines pushing a heavy roll of concrete tend to tilt the mastic, and shovelers should be employed to transfer such rolls across the joint. The inspector shall check all joints for position behind the finishing machine by inserting a thin wood stake about 0.8 m (30 inches) long in the concrete alongside and in contact with the joint material. If the stake contacts the joint material all the way to the subgrade and appears to be plumb, the joint will function properly. Tilted joints should be dug out and reset.

Contraction Joints - The specifications provide that plane of weakness joints shall be sawed. Great care and attention should be given to the planning of sawing joints. Sawing at the wrong time or sawing along side of a crack already formed can be the cause of extensive maintenance work. The cutting of transverse-control joints to relieve early shrinkage stresses may be necessary depending on the type of slab, the atmosphere conditions and the amount of shrinkage inherent in the concrete. No exact time can be given as to when sawing of transverse-control joints should start, and it will be necessary to prepare a sawing sequence for each project.

The plans should be carefully checked to determine the location and depth of sawing required. Usually the specified depth of cut is different for transverse and longitudinal joints. The depth of cut should be checked as soon as possible so that the contractor may seal the joints.

On Reinforced Concrete Pavement, with transverse contraction joints at 14.17 m (46.5 ft), it probably won't be necessary to cut control joints except in very hot weather periods. It is recommended that on the first day of concrete paving, sawing of the transverse joints begin as soon as possible without excessive raveling or tearing. The time at which this sawing should start may vary from 6 hours on warm days to 20 hours in cold, cloudy weather. Sawing of these joints should continue progressively at the plan spacing until concrete is encountered that is so green that it cannot be sawed without tearing. Some slight raveling of the concrete must be expected. If a sharp edge joint is being obtained, it is quite likely that the concrete may have hardened sufficiently to result in uncontrolled cracking. This would indicate that sawing should be earlier or control joints should be made.

The first joint following the previous day's construction joint should always be sawed as a control joint. The older concrete will place sufficient stress on the newly placed concrete to produce an uncontrolled crack near the header if a plane of weakness is not provided at this point.

SSHC Subsection 603.03, Paragraph 7 should be thoroughly reviewed and understood by both the inspector and contractor. Transverse joints near cracks developing before sawing should be skipped, the crack routed and filled with joint material. Sawing shall be

discontinued when a crack develops ahead of the saw. If a joint is sawed where a crack exists or develops during sawing, the sawed joint or portion considered to not be the working joint shall be cleaned and epoxied.

In the multilane pavement, for the companion lanes, those joints that are open and working should be sawed as control joints. Volume change stresses from the initial lane are transmitted through the tie bars and edge friction to the second lane. A matching plane of weakness must be sawed in the second lane to prevent formation of an uncontrolled crack.

Uncontrolled cracks in the initial lane must be matched with a control joint in the companion lane. In laying out joints, blocks of concrete should always be 3 m (10 feet) or more in length.

Instances have been noted where the depth of the sawed joint through the curb section was insufficient on concrete pavement construction requiring integral curb. The depth through the curb section is variable and is to be sawed as shown on the plans. This should be brought to the attention of the contractor and your assigned inspector.

Longitudinal Joints - The time for sawing the longitudinal center joint is not critical. The concrete shall have hardened sufficiently to permit the sawing of a sharp-edged, clean cut joint.

Sealing Joints

As concrete cures, moisture moves to the surface. Therefore, concrete should be cured seven days or more before sealants are applied. Insure that sealant manufacturer's procedures are followed. Check for moisture in the joint before the sealant is applied.

Hot Poured Sealants

All joints required to be sealed shall be filled immediately after they have been cleaned and dried, and checked for proper depth. A hot poured joint sealer must be applied with the use of a pressure-type applicator equipped with a nozzle which will fit into the sawed groove. How full the joint is to be filled should be discussed with the District Construction Engineer. However, placement of joint sealer should be done in a neat, workmanlike manner striving to eliminate any smearing of sealer on the pavement.

The Project Manager should obtain the manufacturers recommendations for temperature control of the joint sealer, and frequent measurements of the actual temperatures should be made to insure compliance with those recommendations.

If curing compound is applied on a slab with open joints the contractor should lay a rope or belt along the length of the joint to exclude the cure from the opening. If curing compound has been permitted to enter a joint, the contractor should be required to resaw the joint.

All joints to be sealed shall be cleaned with a jet of compressed air, flushed out with water under high pressure and diked before pouring the joint sealing filler.

We have experienced some problems in the past regarding hot pour joint sealer and white pigmented curing compound. The problem stems from the fact that the manufacturer is supplying his/her distributor, or the contractor, with a certificate of compliance staring that the material meets Nebraska Department of Roads' specifications as well as the applicable

ASTM and AASHTO specifications. In one instance, the certification also stated the material to be pretested. However, this has since been corrected by the manufacturer.

We want to emphasize that if hot pour joint sealer is from tested and approved stock, this material can then be used upon delivery to the project. The lot number will appear on the NDR Approved Products List for approved stock. The Materials and Research Division should be notified as to the lot numbers and quantity delivered. If the lot number is not on the NDR Approved Products List, then the joint sealer must be tested and approved before it is used. We do not accept joint sealer by certificate of compliance or by a Project Manager's certification, unless this is the rubber modified asphalt compound consisting of an asphalt cement containing a minimum of 22 percent of new or reclaimed, synthetic or natural rubber. This material is accepted by a certificate of compliance furnished by the supplier per the Special Provisions.

The foregoing instructions concerning tested and approved stock also applies to cold poured joint sealer, preformed joint filler, and pressure relief joint filler.

White Pigmented Curing Compound

White pigmented curing compound that is approved for use is shown on the Approved Products List. The Materials and Research Division should be advised as to the quantity and lot numbers involved. Reports will then be issued to the project. Curing compound not from tested stock must be sampled and tested prior to being used. We do not accept curing compounds by certificate of compliance or Project Manager's certification.

Preformed Polychloroprene Elastomeric Type *(SSHC Section 1016)*

The construction procedures in *SSHC Subsection 603.03*, Paragraph 7 are quite detailed and close adherence to these instructions is important to insure the proper performance of the seals. Important points to emphasize in this type of construction follow:

1. Installation should result in less than 5 percent elongation of the performed seal.
2. Sawed joint dimensions should be of correct size - neither too large nor too small.
3. Sawed joints should be inspected closely for cleanliness at the time of installation.
4. Spalls should be repaired as indicated in the specifications.
5. Certification as indicated in Specification Subsection 1016 should be in the Project Manager's files before installation.
6. Excessive adhesive has been known to accumulate on the top of the seal, preventing proper expansion of the seal.
7. Hot dry weather can produce a condition of premature set to the adhesive and this can be the cause of seal popping.
8. The seals be placed at the specified depth. If placed too high, attrition will take its toll.

Silicone Sealants (*SSHC Section 1014)*

Silicone sealants shall meet requirements in *SSHC Section 1014* and shall be installed in accordance with the manufacturer's recommended procedures.

Mastic Sealants *(SSHC Section 1014)*

Mastic sealants are considered as temporary sealants and their composition is not tested. The contractor must submit a letter from the manufacturer certifying materials comply with AASHTO M 213 requirements for nonextruding and resilient bituminous, filter type, preformed joint filler or AASHTO M 33 for bituminous type (asphalt type) preformed joint filler.

Cleaning Joints

The Project Manager must ensure adequate inspection of joint cleaning operations prior to sealing. *SSHC Subsection 603.03* discusses proper method of cleaning joints.

In order for the joint sealant materials to adhere properly to joint edge, joint edges need to be properly cleaned. All recemented sawing residue from the initial saw cut operation must be removed immediately after cut is made. If these joint faces are not properly cleaned, sealer will prematurely fail. This will start deterioration of pavement and will eventually result in spalled or faulted pavement due to water intrusion into joint.

The sandblast wand should have a means to positively guide the nozzle along actual joint line. This is to insure that sandblast passage does not miss any of the joint face. This can be seen when sandblast nozzle passage shows as a wavy line on the pavement surface.

Air compressors shall have suitable traps to remove moisture and oil.

Sealing Sawed Joints

The plans identify the joint sealant material to be used. All joints are to be sealed before any traffic, including construction traffic, is permitted on the pavement.

Joint Filling *(SSHC Subsection 603.03)*

Due to pavement crown, hot poured asphaltic or any flowable joint material may flow out of the joint leaving an opening below the pavement surface which allows entrance of sand and dirt into the joint opening. This will cause spalling of joint edges when pavement expands. To insure a properly filled joint across the entire pavement width, the contractor is required to tape the joint opening at pavement edge. This helps to prevent sealant from flowing out of the joint opening. A ball of mud plastered on the pavement edge is not to be allowed in lieu of required tape.

All joint sealant materials should be placed so that the top edge is approximately 6 mm below pavement's surface. See paving details or manufacturer's instructions for exact elevation. Excessive filling of transverse and longitudinal joints can result in excessive sealant material being forced out of the joint and soiling the pavement surface. Excess sealant material should be removed from pavement surface prior to project acceptance.

Sealing Equipment

Hot poured asphaltic joint material may be overheated in hot pour kettles. An overheated sealant has lost its elasticity and will prematurely fail. Thermometers on hot pour kettles need to be checked and replaced if necessary. Calibrated thermometers are available from Quality Assurance Manager to use in checking contractor's thermometers.

Backer Rod

Backer rod is approved on a brand name basis. Approved backer rods are shown in the NDR Approved Products List.

Doweled Support Assemblies *(SSHC Subsection 603.03)*

To insure that a doweled contraction joint will function as designed, it is critical that assembly be properly installed. Dowel bars provide load transfer across the joint without prohibiting the opening and closing of the joint during pavement temperature changes.

Dowel Tolerances

To permit pavement slabs to move longitudinally on the subgrade during expansion and contraction, dowels must be parallel to both centerline and surface of pavement. The plans show the dowel placement tolerances. Dowel assemblies should not be permitted to remain in place if wire supports cannot hold dowels in correct alignment. Position of outside dowel bar to edge of pavement slab shall be within plus or minus 25 mm (1 inch).

Dowel Assembly Placement

When placing assemblies on subgrade, contractors use bottom support wires of assembly as a guide for bar alignment. This is not objectionable provided bars are fabricated at proper angle to wire supports. Assemblies should be inspected for proper fabrication when delivered to project.

Contractors shall not be permitted to block up or support the assemblies on bricks to obtain proper height of dowel bars. When paving project has two different slab thicknesses requiring load transfer devices, the contractor shall furnish correct height basket dowel assemblies specifically fabricated to position bars at mid-depth in slab for each slab thickness.

Temporary wire fasteners, which hold some assemblies together for shipping, are to be cut if they extend across a joint. Check for movement of assemblies during passage of slipform paver. If properly set, the side forms of the paver should not come in contact with the ends of wire bar supports. Check to insure vibrators on paver or finishing equipment are set to proper height so vibrators do not touch steel during passage over assemblies.

Workers who position steel and vibrate concrete must not step on joint assemblies. Assemblies must be firmly anchored to subgrade or subbase with a minimum of eight stakes per 3.6 m (12 feet) width to resist horizontal and vertical movement during concrete placement and subsequent finishing operations.

Marking Joint Locations

Prior to paving, dowel midpoint must be marked on the subgrade or granular foundation course so an accurate saw cut location can be made on cured pavement. A narrow band of paint can be applied to the subgrade at midpoint of dowels in same direction as proposed saw cut. This band of paint must be kept as narrow as possible to minimize chance of error in correctly locating saw cut. An alternate method would be to place a dowel basket staking pin on either side of pad line.

Dowel midpoint markings should then be transferred to PCC concrete surface. This may be accomplished with a string line marking plastic concrete or by use of a chalk line after concrete has hardened. This should insure that the transverse joint will be sawn over the center of the dowel bar basket assembly. Do not permit the saw operator to eyeball joint sawing from one edge of the slab to the other.

Blanking Bands

The plans may indicate a blanking band be used to blank out the transverse texture over the center of the dowel assemblies. Care needs to be taken to ensure that the blanking band is correctly located over the center of the dowel assemblies. Using a blanking band will ensure a smooth, nontextured pavement surface at the midpoint on the dowel assembly.

Longitudinal Joint Design

The standard plans show joint layout details. The joint layout designs for paving plans have specific requirements for certain type joints which consider traffic movements during and after construction and the effect of the joint type on these traffic movements.

Joints should be constructed as shown in the plans, unless the Standard Road Plans allow for alternates. Any requests by the contractor for joint substitution shall be submitted to the Construction Division for review.

Curing of Keyed and Doweled Joints

The vertical sides of pavement in areas where joints are constructed~~,~~ *can be cured with* the use of a liquid curing compound is an acceptable method of curing this portion of the slab.

Generally, little or no bond is obtained or expected between vertical faces of adjacent concrete. Deformation on tie bars provide adequate lateral support.

Tie bars should not be sprayed with curing compound. They must be protected from the spray. If a curing compound is sprayed on steel, this film should be removed before placing adjacent concrete.

602.5028 Prevention of Rain Damage to Plastic Concrete

SSHC Sections 603 and *1002* require contractors to produce a quality product and have materials for proper protection of edges and surface of concrete available near work site. Contractor must protect pavement from damage due to rain. Failure to properly protect concrete may constitute cause for removal and replacement of defective pavement.

At the preconstruction conference, it is important to emphasize that protective coverings and temporary forms must be available and that protection of fresh pavement from rain damage is the contractor's responsibility. The contractor should be advised to follow the weather forecasts closely to prevent being caught unprepared in case of rain. Plastic film is preferred for surface and edge protection, since burlap alone in a heavy rain is insufficient to prevent access of water and subsequent pavement surface erosion.

The District Engineer and the Construction Division should be notified when pavements are damaged by rain so an evaluation of the damage can be made. Acceptance or rejection of damaged portions of pavement will be based on the extent of damage incurred as determined by the Project Manager. Repair of damaged edges and surface may be considered, but extensively damaged pavement may require removal and replacement.

602.5029 Repair of Deficient Pavement

Pavements damaged by rain and deficiencies caused by poor workmanship may be repaired or restored to an acceptable condition without complete removal and replacement of damaged areas.

Rain damage varies considerably depending on rainfall intensity, duration, and protective measures taken by contractor. Covering and side forms placed by the contractor afford sufficient protection to unhardened concrete in some cases. In other cases, surface and edges may erode to such a degree that removal and replacement of slab is the only solution.

Guidelines follow for corrective measures that may be taken or used to restore damaged pavement to an acceptable condition. This instruction is not intended to cover the whole spectrum of correcting deficiencies that may occur on a paving project during construction. Other proposed procedures or methods suggested by the contractor may be considered.

Recommended Repair Method *(SSHC Subsection 108.05)*

A. Rain Damage and Excessive Edge Slump

1. On plastic concrete:

- Pavement surfaces which have slight surface damage due to placement of protective covering or sandy appearance may be retextured provided concrete is still plastic and in workable condition.

- Pavement surface which has texture removed and coarse aggregate exposed may be reworked by adding fresh concrete (same mix as pavement) to surface, rescreeding, texturing, and curing. Areas reworked must also meet specified smoothness requirements.

- Eroded edges may be repaired by setting side forms and replacing eroded concrete with fresh mix.

- Excessive edge slump may be corrected by setting side forms of proper height along slumped edge and refinishing to the correct elevation.

2. After concrete has cured and hardened:

- Pavement surfaces that have lost transverse groove texture without affecting surface profile shall have transverse or longitudinal grooves reestablished.

- Pavement surfaces which have been severely eroded require reprofiling by diamond grinding equipment and subsequent reestablishment of transverse grooving.

- Minor edge erosion and edge slump with a key and doweled joint and adjacent slab need to be butted to existing pavement. Establish a new edge, not to exceed 75 mm (3 inch) in from previous edge, by sawing to the top of the tie bar, remove concrete and replace when new adjacent pavement is poured. If necessary to go more than 75 mm (3 inch) from edge of pavement to correct eroded or slumped edge, the edge shall be repaired by using pavement patching methods prior to pouring adjacent slab.

- Excessive edge slump may be repaired by using pavement patching methods.

- Edges or panels that have been severely eroded may require all or a section of lane to be removed or replaced. If determined that a section of lane more than 600 mm (2 ft) in width should be removed, then entire lane or panel shall be removed and replaced with new concrete. Areas less than 600 mm (2 ft) in width shall require full depth repair with holes drilled and tie bars installed to anchor new concrete to remaining concrete.

- For areas with extreme severely eroded surface and edges, contractor should be required to place a bonded PCC overlay.

B. Vehicle Traffic on Plastic Concrete

Remove and replace sections where rutting is severe.

Minor wheel track rutting may be repaired by using pavement patching methods.

C. Shrinkage Cracks

Remove and replace affected areas with new pavement in severe cases.

Minor cracks may be filled with pressure injected epoxy or repaired using pavement patching methods.

D. Rough Pavement Sections

Surface variations which exceed specification smoothness requirements require correction by the contractor. Surface correction shall be accomplished with approved diamond grinding equipment. Use of milling machines, Roto Mill, Galion Scarifier, or other impact devices shall not be permitted.

Reestablishing transverse grooving of corrected areas is not required but longitudinal grooves must be established. Equipment for regrooving shall be specifically designed for grooving concrete with a cutting head fitted with diamond blades. Use of hand held equipment is not permitted.

E. Limitations

Necessary corrective measures on hardened concrete shall only be made after concrete attains age and strength requirements in *SSHC Section 603*.

All required corrective measures shall be completed prior to coring for pavement thickness measurements.

Approval of the Construction Division is required before placing a bonded PCC overlay.

602.5030 Mud Ball Repair

Occasionally mud balls appear in the surface on new concrete pavements. These usually are due to clay balls from a quarry or mud thrown into dump trucks from portable batch plant located at a wet site.

Correction of any discovered mud balls in pavement surface shall be as follows:

- Any thin concrete skin around perimeter of mud ball should be removed so that nearly vertical void walls remain.
- Each void shall be cleaned by a high pressure washer, followed by air blasting to dry void.
- Voids shall be filled with an approved grout. This material shall be used according to manufacturer's recommendations.
- Surface of filled voids shall be given the same texture as surrounding pavement.
- Void shall be given proper cure time recommended by manufacturer prior to opening roadway to normal traffic.

If a severe problem with mud balls is suspected and the suspicions have been document, then formal acceptance by Project Manager should be delayed until the following spring. This will allow the winter freeze-thaw cycles and snowplowing activities to expose additional mud balls located adjacent to pavement surface. These newly discovered mud ball areas will then also require corrective measures as stated above. The Project Manager may also elect to have the contractor use a high pressure sprayer (1200 psi) to locate mud balls and allow the project to be finalized immediately after any repairs are made.

602.5031 Cold Weather Paving and Plant Operations

Cold Weather Pavement Protection

During cold weather, *SSHC Subsections 601.01, 603.03* and *1002.02* requires that newly placed paving be protected against freezing temperatures. This protection is necessary to allow the hydration process of the curing concrete to continue in cold weather. Adequate protection of concrete allows for paving to be placed later in the cold seasons.

Materials that may produce acceptable insulation include:

- 3 layers of Burlene.
- 1 layer of Fast Track Blankets.
- 1 layer of 12 mm (1/2 inch) extruded polystyrene, must be weighted down.
- 2 layers of 6 mm (1/4 inch) air celled polyethylene.
- 1 layer of 12 mm (1/2 inch) air celled polyethylene.

Do not advise contractor regarding cold weather protection.

When cold weather protection is required, the contractor will not be reimbursed for whatever protection is used.

Cold Weather Plant Operation

SSHC Subsection 603.03 states that concrete mixing and placement may be started when air temperature is at least 5°C (40° F) and rising. In the late fall season before the subgrade begins to freeze and soil temperatures are still relatively warm, it is permissible to allow paving plant operations to begin below 5°C (40° F) providing a warming weather forecast is predicted. Paving plant operations basically self regulate during these conditions.

The intent is to maximize the remaining good paving weather still available in the fall. This provision is not intended to make a paving day out of one that is not but to allow for as much concrete pavement placement as possible during good weather.

After the subgrade begins to freeze, the above provisions should be halted and the Specifications strictly enforced.

602.60 PCC PAVEMENT METHOD OF MEASUREMENT

602.601 Smoothness Tests (Profilograph)

1. See *SSHC Section 602* for profilograph procedures.

2. When the contract Special Provisions require the smoothness of the concrete pavement to be tested by measurement with the profilograph, it is necessary and a requirement of the Provision that the thickness cores be taken after to any surface correction (grinding) by the contractor.

3. Since the thickness cores are taken by personnel from the Materials and Research Division (Lincoln), it is necessary they be kept posted as far in advance as possible when the coring must be done. It is generally preferable to do the coring prior to opening the pavement (segments in some cases) to traffic. Accordingly, prior planning is necessary and shall be accomplished by the Project Manager. Contact Rhonda DeButts at 479-4760 or Dave Hall at 479-4837 in the Materials & Research Quality Assurance Section.

602.602 Requirements for Thickness

SSHC Subsection 603.05 indicates the thickness requirements and includes a table of payments to be made for concrete of less than plan thickness. The table is based on the premise that a pay deduction should be proportioned to the reductions in service resulting from thin pavement. Thus the reductions in payment are quite severe.

602.603 Material Quantities

Concrete pavement is measured for payment in square meters in place and accepted, minus deductions. The reinforcing steel and dowel bars required by the Plans and Special Provisions will be considered subsidiary to the other pay items in concrete pavement construction.

SSHC Subsection 603.04 states that the quantity of concrete pavement will be measured by the square meter. This is interpreted by the Construction Division to mean that when the plans, stakes, etc., order a nominal width of pavement and the Project Manager determines that this nominal width requirement is met or exceeded, the nominal width will be used to compute the quantity for the concrete pavement item, i.e., the contractor should not be permitted to increase his/her compensation by purposely or inadvertently constructing the pavement to a width greater than the nominal width.

Base course, foundation course, and subgrade preparation are not measured quantities. They are established quantities that are based on the paved area.

602.604 Concrete Driveways

SSHC Subsection 609.04 states that concrete driveways will be measured by the square meter. This is interpreted by the Construction Division to mean that when the Project Survey Crew stakes the driveway for certain dimensions these are the dimensions that will be used to compute the area for payments.

602.605 Records and Reports

Daily Report of Concrete Pavement Laid (DR Form 85) should be prepared daily. The cylinder data for the day covered by the report should be written at the bottom of the form. Reports should be delivered to the plant inspector as early as possible so he/she may complete his/her records for the day reported.

When reporting multilane pavement, or when paving one lane on 2-lane pavement always report the lane being paved. Identification of the lane on multilane pavement should be positive - such as: 12' lane, 12'-24' Rt. of centerline. Lack of this information may result in confusion and delay in preparing the pattern of cores for the core drill. Sketches of irregular areas should be shown on the reverse side of the slab report DR Form 85, or prints of intersections and other unusual layouts may be ordered from the Lincoln Office for the purpose of logging daily pour information and should be turned in with the slab report which substantially completes the area involved. Sketches need not be elaborate but should clearly identify the area placed with any necessary dimensions. A diary record is also required.

Section corners falling within the area of the concrete pavement may be perpetuated by a registered land surveyor who will take a core as described in *CM Section 1300.03*, "Perpetuating Section Corner Markers". In many instances it may be possible to set the section corner while the concrete is plastic and cores need not be taken. If cores are needed to set the section corners, a list of the corners to be so perpetuated should be submitted to the Materials and Research Division as early as possible prior to the time that the pavement is to be cored. This list should include the station location and distance right or left of centerline of each section corner to be cored.

603.00 PCC PAVEMENT PATCHING

603.10 Full Depth PCC Patches

The plans show the details for full depth patches for PCC pavement or resurfaced PCC pavement. Each of these details identify the required depth of concrete for the patch. There are six pages of details that describe pavement repairs that will not receive an overlay and four pages of details that describe pavement repairs that will receive an overlay. However, only those details that are applicable are included in any set of plans. In general, if the length of the repair is 4' to 9', then it is considered "Joint Repair." If the repair is over 9', then it is called "Pavement (Panel) Repair."

The transverse and longitudinal faces of the pavement around the repair receive different treatments. The surface in the transverse (width of pavement) direction will either receive dowel bars or have the surface beveled to wedge the patch so it will not settle below the existing roadway surface. The longitudinal surface will be vertical and may have tie bars (see plans for details).

The details also show how to remove the pavement. The detail for beveling the transverse ledge includes both a full depth saw cut and a 2-inch + ¼ inch deep saw cut. The full depth saw cut is usually performed with a wheel saw. These saw cuts are intended to sever the pavement totally so the existing pavement can be completely removed. The breakout area between the full depth cut and the 2-inch depth cut should create a beveled ledge that will wedge the patch in place and prevent it from slipping below the roadway surface.

603.20 SAW CUTS IN FULL DEPTH PCC PATCHES

Some contractors have delayed saw cuts for joints in full depth PCC patches until after minimum 5-hour cure period (on two-lane roadways). Due to rapid setting concrete used for these patches, random cracks often appear when joints are not sawn quick enough. Any joints in full-depth patches shall be sawn as soon as possible as long as ravelling of saw cut edges does not happen. This early sawing will require temporary removal and replacement of required insulation boards in cold weather.

Any random cracks that appear due to a delay of the saw cut operation shall be repaired by the contractor. Repair will consist of routing random cracks with a crack saw and sealing with hot pour sealant. These repairs will be at the expense of the contractor.

Low Strength Deductions

Materials and Research will make deductions for concrete pavement because they establish the strength --- from cores which they have taken --- used to determine the basis of payment.

Payment for PR concrete, unlike pavement, is based upon cylinder strengths rather than from core strengths. Accordingly, the Project Manager should make the deduction when PR concrete for patching does not make the required strength. The deduction should be based on the 24-hour break strength of a cylinder using the deduction factors shown in Table 603.02.

Materials and Research will not make a deduction for PR concrete even if you submit a cylinder strength report indicating the low strength.

CHAPTER NOTES:

DIVISION 700

BRIDGES, CULVERTS, AND RELATED CONSTRUCTION

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DIVISION 700

701.00 CHECKLISTS

701.01 PILES AND PILE DRIVING CHECKLIST

SSHC References	*Section 703 -- Piles and Pile Driving* *705 -- Precast/Prestressed*
Concrete Structural Units	*1002 -- Portland Cement Concrete* *1004 -- Portland Cement* *1025 -- Steel Wire for Prestressed Concrete Units*
Inspection Crew	Project Manager (PM) Construction Technician
Equipment	Saximeter
Material Procedures	Check that all piling is acceptable for driving. Material certifications and/or reports should be given to Project Manager and evaluated before use.
Steel Piling	Steel bearing and sheet piling must be stored on suitable skids [6 inch (150 mm)] ground clearance recommended) and should be kept clean. Don't allow weeds and foreign material in storage sites.
Concrete Piling	Piling must be adequately supported when stored and handled to prevent excess deflection. The surface finish of concrete piling that will be exposed at the completion of driving (bent piles in concrete slab bridges) shall not be damaged or discolored.
Cast-in-Place Concrete Piles Procedures	Check shells immediately before placing any concrete (shape and accumulation of water). Use a drop cord.
Treated Timber	Notify Materials & Research if timber piling appears damaged. The Project Manager or inspector must obtain approval to reject timber piling. Piling certification procedures are found in the *Materials Sampling Guide*.
Pile Driving Procedures	The contractor should build a frame (sometimes called a checkerboard) to hold each pile in the exact position for driving.

Before driving any piles, the inspector should perform the following duties:

1. Verify that piles will be driven exactly as shown in the plan pile layout.

2. Check pile spacing, and record heat numbers (steel pile), code identification (concrete pile) and other pertinent information. Document points and splices.

3. Verify cut-off elevations against a permanent reference.

Confirm that the Project Manager, inspector and contractor understand:

1. How to check penetration depth at any point.

2. How to take and record bearing tests data with saximeter.

3. How to determine the cut-off elevation for individual piles.

SSHC Subsection 703.03, Paragraph 2. allows bearing piling to be driven with a gravity hammer for the first half of the penetration when bearing does not exceed one-third of the design bearing.

Concrete sheet piling shall be driven with a preapproved hammer.

Do not allow pilot holes or preliminary jetting to be greater than 10 ft (3 m).

Gravity hammers used to drive piling to final cut-off elevation shall be preapproved. The fall of gravity hammers shall be regulated so as to avoid damage to the piles. Hammer fall shall not exceed 15 ft (5 m) for wood and steel bearing piles, or 8 ft (2.4 m) for precast concrete piles and shells for cast-in-place piles.

Do not allow hammer fall to damage piles.

Leads are required on all driven piles. Leads shall be held in proper alignment.

Swinging leads are permitted with steam, air or diesel hammers.

Guyed, braced, or fixed leads are required with gravity hammers.

Bearing and Sheet Piles Procedures

1. Frequently check the pile for plumbness or for required batter. Do not allow a variation of more than 1-inch/50 inches (1 mm/50 mm) of pile during driving.

2. Tops shall not be out of line more than 3 inches (75 mm).

3. Adjacent sheets shall be in line within a ½ inch (12 mm) tolerance.

4. The inspector should observe the pile carefully while it is being driven. A sudden increase in the penetration may indicate a broken or collapsed pile.

5. Remove and replace all broken, split, or misplaced piles. If removal is impractical, contact the Construction Division for instructions on the procedure to be followed.

6. Lead with the tongue or ball end of sheet piles to keep the groove or socket clean.

7. The options when a pile is at cut-off elevation, and not at design bearing are:

    a. If less than 10% of the piles in any group fail to reach bearing, the average pile bearing may be adequate to support the structure.

    b. Additional piling may be added to the group.

    c. Extend the piling and drive to obtain design bearing.

    d. Determine a soil set up factor and then drive to cut-off elevation.

    e. Use pile-driving analyzer to determine bearing.

    f. Run a load test to check if bearing capacity is obtained.

Notify the Construction Division when two or three consecutive piling do not attain design bearing.

8. a. Record pile data on the M&R spreadsheet.

b. E-mail a copy of the spreadsheet to M&R (O. Qudus) and to Construction Division (B. Caples).

c. Do not use contractor provided charts for determining bearing.

Soil Setup Factor

1. Two representative piles shall be driven to 2 ft (600 mm) above cut-off elevation (see SSHC 703.07 para 4.f.).

2. The piling at cut-off+2 ft (600 mm), will be rested for 36 hours and then driven to cut-off elevation with a "warm" hammer.

3. The Project Manager will record the penetration for each ten blows of the hammer until cut-off is reached.

4. Record data and call it in to the Construction Division.

5. The factor and a decision on what action to take will be sent back to the Project Manager.

6. Construction Division recommendations shall be recorded under the Remarks Section of the pile driving record.

Bearing Capacity Procedure

1. Determine bearing at or just prior to the pile reaching final penetration.

2. When determining bearing, the inspector shall be certain that all of the following conditions exist:

   a. For single action, the hammer shall have a free fall.
   b. The head of the pile shall be free from crushed or broomed fibers.

   c. The penetration of the pile shall be at a reasonably quick and uniform rate.

   d. There is not excessive bounce of the hammer. Deduct twice the height of the bounce from "H" pile for gravity or stream hammers. No deduction is made for diesel hammers.

e. If the driving is stopped for more than 2 hours, the pile shall be driven at least 1 ft (300 mm) before the bearing capacity is determined.

f. For batter piles driven with gravity hammers, see *SSHC Subsection 703.03*, Paragraph 4 for bearing determination.

3. The energy values for common diesel hammers presently in use are listed in *SSHC Subsection 703.03*, Paragraph 4. If the contractor intends to use a hammer not listed, the Construction Office should be contacted to obtain the appropriate energy value.

4. For bearing capacity computations the mass of the driving cap may be taken from the manufacturer's freight bill or measured. The mass of the pile shall be determined as follows:

Steel "H"

a. Mass per foot (meter) times length at time bearing is determined.

Timber

b. Volume of pile times 44 lb/ft^3 (703 kg/m^3).

Concrete

c. Volume times 150 lb/ft^3 (2400 kg/m^3).

Reference Points

5. The reference point should be an object with a fixed elevation or horizontal distance from the pile. Mark the point where the reference intersects the pile. After the required number of blows, mark another line at reference intersection and the distance between the two lines is penetration. Average penetrations can be computed from several measurements.

Pile Driving Analyzer Procedures

1. Contact the Construction Division to schedule personnel and equipment.

Static Pile Load Test Procedures

1. The Department will furnish the equipment and personnel for conducting the test. The contractor shall unload, erect, dismantle and reload the testing equipment. Payment for this work shall be by the each for each test.

2. If a temporary anchor pile is required. It will be paid for as extra work.

Method of Measurement Procedures

1. If required bearing is obtained at minimum penetration and this is shorter than the order length, the contractor should be encouraged to continue driving until the order length has been driven. Usually he/she will want to drive this extra length to avoid payment deduction. Discontinue driving beyond minimum penetration when:

   a. Practical refusal is reached.

   b. Further driving may result in damage to the pile.

2. If practical refusal is reached before minimum penetration, discontinue driving and notify the District Construction Engineer or the Construction Division and do not cut off the pile without their approval.

3. No payment will be made for pile length driven beyond the order length without PM approval.

4. When steel "H" pile and steel pile shells are driven to the exact cut-off elevation without crimping or damage to the top of the pile, they need not be cut off. Length of pile cut-off (measured as provided in *SSHC Subsection 703.05*) shall be paid at 60% of the piles unit price.

5. It will be necessary to pay for pile cut-off only under the following conditions:

   a. When practical refusal is reached before minimum penetration and the pile cannot be driven or jetted further.

   b. The contractor elects to stop driving after reaching bearing and minimum penetration but before the order length is driven.

6. MASS FOR PRESTRESSED CONCRETE BEARING PILE

For computing bearing capacity required on M&R Pile Bearing spreadsheet.

Pile Type	Constant Section Mass Per Meter of Pile (Kilogram)	(lb)
I	220	(485)
II	298	(657)
IV	315	(694)

(See Appendix 1. DR97-Pile Driving Record)

Critical Construction Areas	1. Proper placement and length. 2. Permanent reference point. 3. Removal of broken/collapsed piles. 4. Achieving design bearing capacity.
NDR Tests	1. Test pile. 2. Bearing capacity. 3. Pile Driving Analyzer.
Inspector's Records and Forms	1. Pile Record M&R spreadsheet 2. Hammer Data Sheet

701.02 **CONCRETE CONSTRUCTION CHECKLIST**

SSHC References: *Section 704 Concrete Construction*
Section 1002 Portland Cement Concrete
Section 1010 White Opaque Polyethylene Film and Burlap--Polyethylene Sheeting For Curing Concrete
Section 1011 Burlap For Curing Concrete
Section 1014 Joint Sealing Filler
Section 1015 Preformed Joint Filler
Section 1016 Preformed Polychloroprene Elastomeric Joint Seals
Section 1033 Aggregates

Inspection Crew: Lead Inspector

Inspection Equipment:
Slump Cone
Air Meter (pressure)
Cylinder Molds and Lids
Rod
Mallet
Strike Off Bar
Ruler

Placement Procedures:

1. Preplacement check of equipment.
2. Check condition and placement of steel.
3. Check Form setting and alignment. Verify location coordinates and orientation.
4. Have contractor wet grade and forms before concrete placement.
5. Test concrete for air content, slump, and make cylinders when mix changes, as a minimum according to Sampling Guide.
6. Watch concrete placement for compliance with specifications. Do not allow free fall greater than 5 ft (1.5 m).
7. Do not use water as a finishing aid; use an approved chemical finishing aid/evaporation retardant.
8. Check curing operation.

Construction Critical Area:

1. Take pictures of any pavement under bridge before work begins.
2. Achievement of concrete consolidation without segregation.
3. The time between loads of concrete.
4. Trucks that segregate concrete or have cement balls must not be used.

NDR Tests:

1. NDR T 23 Making and Curing concrete test specimens.
2. NDR T 119 Slump of Portland Cement Concrete.
3. NDR T 141 Sampling of Fresh Concrete.
4. NDR T 152 Air Content of Freshly Mixed Concrete by the Pressure Method.

701.03 CONCRETE BRIDGE FLOORS CHECKLIST

SSHC References:

Section 706 Concrete Bridge Floors
Section 1002 Portland Cement Concrete
Section 1010 White Opaque Polyethylene Film and Burlap--Polyethylene Sheeting For Curing Concrete
Section 1011 Burlap For Curing Concrete
Section 1014 Joint Sealing Filler
Section 1015 Preformed Joint Filler
Section 1016 Preformed Polychloroprene Elastomeric Joint Seals
Section 1033 Aggregates

Inspection Crew:

Project Manager
Placement Inspector
Plant Inspector

Inspection Equipment:

Slump Cone
Air Meter (pressure)
Cylinder Molds and Lids
Rod
Mallet
Strike Off Bar
Ruler
10 ft (3 m) straightedge
Anemometer
Thermometer
Hygrometer

Placement Procedures:

1. Preplacement check of equipment.
2. Check condition and placement of steel. Enter in SiteManager the date steel was verified.
3. Check Form setting and alignment.
4. Check slab thickness.
5. Check deck for cleanliness
6. Have contractor wet deck forms and grade under approach slabs before concrete placement.

(Note: It's best to place deck and approach slabs at the same time.)

7. Test concrete for air content and make cylinders when mix changes, as a minimum according to Sampling Guide.
8. Watch concrete placement for compliance with specifications.
9. Do not use water as a finishing aid; use an approved chemical finishing aid/evaporation retardant.
10. Check surface with straightedge. Remove depressions and irregularities.
11. Check tining operation.
12. Check cure operation.
13. Make sure a water service and tanks are available to soak burlap.

Construction Critical Area:

1. Take pictures of any pavement under the deck before work begins.
2. Maintain a uniform roll, of about 4 inches (100 mm), of concrete ahead of the front screed and a minimum of a 2 inch (50 mm) roll ahead of the rear screed.
3. The time between loads of concrete.
4. Trucks that segregate concrete or have cement balls must not be used.
5. Avoiding placement when temperatures and wind velocities may cause plastic shrinkage cracking. (*SSHC Table 706.01*)
6. Vibrate concrete uniformly. Establish good pattern and adjust as necessary.
7. The timing of cure application.

Safety Areas:

NDR Tests:

1. NDR T 23 Making and Curing concrete test specimens.
2. NDR T 119 Slump of Portland Cement Concrete.
3. NDR T 141 Sampling of Fresh Concrete.
4. NDR T 152 Air Content of Freshly Mixed Concrete by the Pressure Method.

701.04 STEEL STRUCTURES CHECKLIST

SSHC References: *See SSHC Table 708.01*

Other References: AWS Standard Specifications. (ANSI/AASHTO/AWS D1.5 Bridge Welding Code)

Inspection Crew:
Fabrication Inspector
Project Manager (PM)
Lab Inspector

Inspection Equipment: Skidmore-Wilhem Calibrator

Shop Procedures:

1. Check Fabricators QC Plan.
2. Make sure QC Plan is followed.
3. The mill order list or the Certified Mill Test Reports must be furnished before fabrication begins.
4. Document all actions not in compliance with the QC Plan or Standard AWS procedures.
5. Welding symbols are shown in Section 708.

Field Construction Procedures:

1. Confirm steel was inspected on site and in shop. Enter date in SiteManager.
2. Sample bolts and send to M&R.
3. Heavy hexhead bolts require heavy hexhead nuts and a hardened washer under the element that is turned.
4. Check all bolts, washers, and nuts to make sure there is proper and correct marking on each. (See CM Subsection 704.03)
5. M&R personnel will calibrate the contractor's wrenches but they need at least 7-days advance notice.
6. Before the contractor begins steel erection, the Project Manager will make a final check of span lengths, skew angles, and bearing point elevations.
7. Also, take pictures of pavement under any structure where equipment will be lifting members.
8. Lead sheets [? inch (3 mm) thick] shall be placed between steel and concrete at all bearing points.
9. Rockers, rollers, expansion devices, etc., shall be set according to the temperature at time of installation. (See Plans.)
10. Check matchmarks on all girders, separators, angle braces, etc.
11. Verify that drift pins do not enlarge holes or distort the metal.
12. Stop the contractor from hammering if it appears the metal will be damaged or injured.
13. The Construction Division will be notified of all major misfits and determine what procedures will be allowed.

701.05 CONCRETE BRIDGE DECK REPAIR WITH SILICA FUME CONCRETE

SSHC References:

Section 710 -- Concrete Bridge Deck With Silica Fume Concrete
Section 1002 -- Portland Cement Concrete
Section 1010 -- White Opaque Polyethylene Film and White Burlap—Polyethylene Sheeting For Curing Concrete
Section 1011 -- Burlap For Curing Concrete
Section 1014 -- Joint Sealing Filler
Section 1015 -- Preformed Joint Filler
Section 1016 -- Preformed Polychloroprene Elastomeric Joint Seals
Section 1033 -- Aggregates

Inspection Crew:

Placement Inspector
Plant Inspector

Inspection Equipment:

Slump Cone
Air Meter (pressure)
Cylinder Molds and Lids
Rod
Mallet
Strike Off Bar
Ruler
10 ft (3 m) straightedge
Anemometer
Thermometer
Hygrometer

Placement Procedures:

1. Preplacement check of equipment.
2. Check condition and placement of steel.
3. Check Form setting and alignment.
4. Check slab thickness.
5. Check deck for cleanliness.
6. Have contractor wet deck and forms before concrete placement.
7. Test concrete for air content and make cylinders when mix changes, as a minimum according to Sampling Guide.
8. Watch concrete placement for compliance with specifications.
9. Do not use water as a finishing aid; use an approved chemical finishing aid/evaporation retardant.
10. Check surface with straightedge. Remove depressions and irregularities.
11. Check tining for conformance to specification.
12. Check cure operation.

Construction Critical Area:

1. Check finish machine (template & rails).
2. Check repair areas.
3. Deck shall be uniformly wet, without puddles prior to placement.
4. Bonding grout shall not be allowed to dry out.
5. Maintain a uniform roll, of about 4 inches (100 mm), of concrete ahead of the front screed and a minimum of a 2 inch (50 mm) roll ahead of the rear screed.
6. The time between loads of concrete.
7. Trucks that segregate concrete or have cement balls must not be used.
8. Avoiding placement when temperatures and wind velocities may cause plastic shrinkage cracking (see SSHC Figure 710.01).
9. Fogging system should be operating from time concrete is finished until wet burlap is in place.
10. Check tining operation.
11. The timing of wet burlap application.

Safety Areas:

NDR Tests:

1. NDR T 23 Making and Curing concrete test specimens.
2. NDR T 119 Slump of Portland Cement Concrete.
3. NDR T 141 Sampling of Fresh Concrete.
4. NDR T 152 Air Content of Freshly Mixed Concrete by the Pressure Method.

702.00 EXCAVATION FOR STRUCTURES (*SSHC Section 702*)

702.01 DESCRIPTION

A. All excavation should be done as shown in the plans. Excavation is very dangerous work and appropriate OSHA regulations must always be observed (see SSHC Figure 701.01).

B. Inspector should be present when an area is being backfilled. The inspector should check to see that the backfill materials are as specified. The materials shall be placed as prescribed in the *SSHC Subsection 205.03 or 702.03* as appropriate.

C. Structure excavation includes all excavation, removal of obstruction, bailing, draining, pumping, sheathing, construction and removal of cofferdams, backfilling, compacting and disposal of any excess material necessary to construct the structure in question.

702.02 MATERIAL REQUIREMENTS

A. Unsuitable Material Excavation (*SSHC Subsection 702.05*)

1. When unstable material is encountered it shall be removed and backfilled with approved material. The material shall be measured in cubic yds (meters) before it is placed. Payment for the extra work material and all work involved will be made at 10% of the contact unit price for box culvert concrete (when gravel or rock is used). The inspector should make an inspection of all structure footings as they are being excavated by the contractor.

2. Pier footings should not be constructed on unsuitable material. It is true that if the footing is supported by piles, the rock placed at the bottom of the footing serves a limited structural purpose. We should provide for a solid base to hold the concrete in the forms. However, the contractor is not entitled to a rock surface on which to work at the Department's expense.

702.03 CONSTRUCTION METHODS

A. Culvert Excavation (*SSHC Subsection 702.03*)

1. All culverts should be constructed with a minimum of approximately 12 inches (300 mm) of cover exclusive of surfacing. An accepted method for obtaining specified bedding for these culverts is to require the contractor to furnish a template conforming to the dimensions of the culvert pipe. This template is then used for shaping the trench to the specified depth.

2. The inspector must be knowledgeable of the Occupational Safety and Health Act (OSHA) requirements concerning excavation and trenching. Pipe culvert excavation by OSHA definition would normally be considered a trench.

3. Never allow any part of a pipe culvert to rest on rock or other unyielding materials. When rock is encountered in the bottom of the trench, it shall be removed to a depth of at least 6 inches (150 mm) below the subgrade and back filled with suitable earth or sand.

4. The Specifications provide that where unstable subgrades are encountered under pipes or pipe-arch culverts, the unsuitable material shall be removed and the excavated area refilled with gravel, crushed rock, or other suitable material. When crushed rock is used, care should be taken to place the fine rock immediately beneath all metal pipe to prevent abrasion of the spelter coating. When gravel or crushed rock is used in place of unsuitable material, it will be measured in cubic meters before it is placed. Payment for furnishing, hauling and placing this material will be made at 10% of the contract unit price for concrete for box culverts. When box culverts are not included in the contract, the average unit price for box culvert concrete shall be used. (*SSHC Subsection 702.05*)

B. General Structure Backfilling (*SSHC Subsection 702.03*)

1. This operation may involve *SSHC Sections 205, 702, and Table 702.01*. The inspector should insure that all applicable sections are followed. The compaction of backfill material close to structures must given special attention. Mechanical tampers should be operated carefully in such a manner as to obtain the required density without damaging the structure.

2. Before any material is placed, the area to be backfilled should be inspected for trash or perishable matter. The materials to be used for backfill should be given careful consideration. Only those that will produce a dense, well-compacted backfill should be used. Granular materials are desirable as much less effort is needed to compact them than clay.

3. When abutments are tied to an anchor or deadman by means of tie rods, care should be taken in the back filling operation. The backfill should be placed in layers, starting at the anchor or deadman and working toward the abutment. Hand tamping may be required around the tie rods, abutment and anchors.

4. Backfilling must not be started without the permission of the Project Manager and in the case of concrete structures not until test cylinders show a minimum strength of at least 80% of the design strength.

5. Backfill should be brought up evenly to the elevation shown in the plans. Granular material must be placed in not more than 8 inches (200 mm) layers (lifts) and should have sufficient moisture to facilitate compaction. Do not allow dumping of granular material directly from the truck into the excavation if this will result in lifts/layers greater than 8 inches.

6. Special attention should be given to culvert wingwalls and flumes to insure proper compaction to prevent erosion and possible washout. The soil should be brought up even with these walls so the surface water will flow over these walls and not along them. Heavy equipment should be kept 3 feet (1 m) or more away from these wingwalls. Compaction within 3 ft (1 m) of the wingwall shall be with pneumatic hand tampers or small hand operated vibratory plate compactors.

7. Backfill for Bridges - Moisture and density requirements for backfill which is to provide support for subsequent construction will be shown in the plans. Backfill which is not to support later construction shall be compacted to 95% of maximum density without definite moisture limits.

8. Backfill for Culverts - When backfilling pipe culverts, the lifts shall be deposited and compacted alternately on opposite sides of the pipe to avoid lateral displacement. The inspector should also watch for vertical displacement. This may occur when tamping adjacent to the lowest 90 degrees of the pipe and should be checked from the grade stakes as backfilling progresses. The pipe should be tied down if any uplift is noted.

9. Necessary precautions should be taken against washing under the pipe in case of rain. Compacted dikes or temporary earth headwalls at the inlet end will often save removing and relaying the pipe after a heavy rain. All drainage structures in the process of construction should be carefully inspected for washouts at the sides and beneath the structures after rains.

10. Flowable fill is sometimes included in the plans for backfilling culverts. The plans will identify the locations and show the details for using the flowable fill. *SSHC Section 1003* defines Flowable Fill requirements.

C. Concrete Seal Course (*SSHC Subsection 702.03*)

1. When it is impossible to dewater the foundation bed or box culvert footing or if live springs develop within the area, a seal course should be constructed below the elevation of the bottom of the footing. Concrete for seals constructed underwater shall contain 10% excess cement and be placed in accordance with *SSHC Subsection 704.03*. The concrete shall be allowed to harden a minimum of 72 hours after completing the final pour before dewatering and continuing work on the structure. Seepage through inadequate or poorly constructed cofferdams shall not be justification for placing a seal course.

D. Foundations

1. Staking and Checking Locations of Structures - -Check and Double Check

a. All measurements and skew angles must be independently checked. From past practice, "independently checked" meant having a second survey party come in, setup, and completely resurvey (verify) original staking. This method is still the most desirable; however, with our upgrading to total station equipment it is acceptable to either setup off to the side and recheck or "back into" the bridge starting up station after clearing the total station.

b. Stakes used should be substantial and protected from disturbance. Offset stakes for each pier and abutment must be placed outside the area of contemplated work.

c. Any checks suggested by the contractor should be considered, since the site superintendent usually has a good idea of the structure layout in relation to existing features such as trees, old structures, etc. Each stake must be clearly marked to denote its function. Pier numbers must correspond with plan designations.

2. Documentation

   a. A staking diagram for each structure must be recorded in a permanent survey field book. This sketch must show the exact location of each hub and the markings made on each guard stake. IT IS NOT COMPLETE UNLESS IT SHOWS THE MEASUREMENTS MADE AS CHECKS ON THE ACCURACY OF THE STAKING LAYOUT. Names of those in the staking party should be entered as well as the date, design and project numbers, location, type of structure, and any other pertinent information.

E. Common Survey Errors to Avoid

1. Turning the wrong skew angle.

2. Errors in measuring from piers to abutments (This should be detected by an overall check from abutment to abutment.)

3. The centerline of the bridge is not always on centerline of the road (This is quite common on interstate bridges.) A bridge with a sidewalk may not be centered on its pier(s).

F. Encountering Old Substructures (*SSHC Subsection 104.06*)

1. *SSHC Section 203* describes the removal requirements when structures interfere with the new work. Existing substructures are usually shown on the plans. If the designer intended to miss some of these old substructures and the contractor later encounters them, payment will be made to the contractor by change order to remove that portion in conflict. Payment will "NOT" be made if plans indicate the new substructure would hit the old structure. See *SSHC Subsection 104.06* for a list of approved unforeseen obstructions.

G. Bridge Deck Removal

1. Contractors generally can be expected to be able to remove the deck without damaging the girders. However, the contractor must use some caution. The contractor cannot use the same force directly over a girder as would be applied over the “free/open” space between girders.

2. Sometimes a contractor will start the removal work properly with heavy blows only in the “free” space. However, either from impatience, changes to the equipment operator or for some other reason, we have seen the contractor at some point begin to apply too much force directly over the girders. This is very bad because the girders are damaged.

3. Forewarn the contractor and monitor their operation to make sure girders are not damaged. This is covered in the contract but is still important to monitor in the field.

703.00 PILING AND PILE DRIVING (*SSHC Section 703*)

A. The Department's Geotechnical Section in the Materials and Research Division provides guidance and geotechnical designs for our projects. Some county bridge projects are completely designed by consultants including pile foundations. When a consultant design fails, i.e., bearing cannot be achieved, the consultant that designed the bridge should be the first point of contact to determine how to correct a failed design.

703.01 EQUIPMENT

A. Diesel Hammers

1. Generally, single acting diesel hammers are the mainstay of contractors for pile driving. Occasionally however, a contractor will request the use of an "air" or "hydraulic" operated hammer. In addition there are a few "double acting" hammers in use. A wave equation analysis will be required for approval of these hammers.

2. One manufacturer of hammers uses one size hammer barrel and places different sized rams inside. Therefore, the MKT "DE" series hammers need to be field verified for ram mass (weight). A check is accomplished by having the contractor stand the hammer upright (in the driving position) and measuring down from top of the barrel to top of the ram. Verify the ram mass (weight) shown on the Hammer Data sheet as follows:

Ram Mass (kg)	Ram Distance (meter)	Ram Mass (tons)	Ram Distance (ft)
907	1.9	1	6.25
1270	1.2	1.4	4.0
1497	0.7	1.65	2.3
1814	180 mm	2.0	0.6

B. Bearing and Penetration

1. Penetration Requirements

a. Design pile length is a calculated value based on design bearing and soil conditions. One factor which enters into the calculation is the potential for scour. Obviously, any soil which is eroded during a flood event represents a loss in bearing capacity and foundation stability. **For this reason "minimum penetration" is extremely important.**

b. A depth of expected scour is typically shown on the Bridge Geology sheet in the plans. In general, streams with large drainage areas and sand or gravel stream beds are quite susceptible to scour while streams with small drainage areas and heavy clay stream beds are less susceptible to scour.

c. When doubt exists concerning the amount of probable scour or minimum pile penetration required, the Construction Division should be consulted. If greater penetration is required, it will be achieved either by boring holes to receive the piles or by jetting. If penetration achieved is satisfactory, piles will be cut off.

C. Dynamic Pile Analyzer

1. The Materials & Research Division has a pile analyzer available for driving evaluations. The pile analyzer will evaluate the bearing, based on energy delivered to a pile as it is being driven.

2. There are two situations where the analyzer should be used:

Case 1. Contract documents require pile to be driven with the analyzer.

Case 2. Pile do not achieve bearing and there are unresolvable questions or conditions observed during driving.

703.02 CONSTRUCTION METHODS

A. Pile Driving Constraints

1. Piles shall not be driven within 50 ft (15 m) of freshly placed concrete. Normally piles may not be driven near new concrete until three days after the concrete was placed.

B. Splicing Pile--Welding Steel Pile

1. *SSHC Section 708* requires that all welds conform to the Structural Welding Code ANSI/AASHTO/AWS DI.5 of the American Welding Society.

2. Only Shielded Metal Arc Welding (SMAW) will be permitted for welding steel piles.

3. The welding electrode must be on the NDR Approved Products List.

C. Steel Pile Cutoffs

1. If the contractor feels the cutoff is long enough that they may use it on some future project, the Heat number should be placed on the cutoff and a number to indicate the project it came from.

D. Pile Groups/Categories

1. Selecting the type of pile to be used and estimating its necessary length are fairly difficult tasks that require good judgment.

2. Piles can be divided into two major groups, depending on their length and the mechanisms of load transfer to the soil:

a. Point Bearing Piles

(1) If bedrock is within a reasonable depth, then piles can be extended to the rock and achieve the ultimate bearing capacity.

b. Friction Piles

(1) The ultimate bearing capacity is achieved through the skin friction. The length of friction piles depends on the shear strength of the soil, the applied load and pile size. In clayey soils, the resistance to applied load is caused by adhesion.

(2) Piles are also divided into two different categories depending on their interaction with the soil:

c. Displacement Pile:

(1) The effect of displacement pile on the soil is, it increases the lateral ground stress. It displaces cohesion-less soils, remolds and weakens cohesive soils temporarily. If displacement piles are used for cohesive soil, setup time in sensitive clays may be up to six months.

(2) Typical types of displacement piles are closed end steel pipe pile and concrete pile.

d. Non-displacement Pile:

(1) Opposite of the displacement pile, it minimizes disturbance to the soil.

(2) Typical types of non-displacement piles are open-end steel pile and steel H pile. It should be mentioned open steel pipe is not suited for friction piles in coarse granular soils.

(3) It has low driving resistance and this makes field capacity verification difficult, which result in excessive pile length.

Weights of Prestressed Concrete Bearing Piling

For computing bearing capacity required on M&R Pile Record spreadsheet

Pile Type	Constant Section Wt. per Lin. Ft. (Pounds)	Tapered Section Total Weight (Pounds)
I	148	None
II	200	None
III	173	None
IV	212	None
V	124	1740
VI	169	2500
VII	221	2950

This table is based on and is for use only with Standard Plan 1720-C-R2.

Steel Pipe Pile Data

	ARMCO		Union Metal
Size O.D. (ins)	12	12¾	12 (Nominal)
Wall T. (ins.)	.188	.188	7 Ga.
Wt. per Lin. Ft. (lbs.)	23.72	25.16	25.3
Conc. per Lin. Ft. (C.Y.)	.0273	.0309	.0255

Union Metal 30' tapered Sec. Type F Total Wt. 589 Lbs. Conc. 0.55 Cu. Yd.

Size O.D. (ins)	14	14 (Nominal)
Wall T. (ins.)	.188	7 Ga.
Wt. per Lin. Ft. (lbs.)	27.66	29.5
Conc. per Lin. Ft. (C.Y.)	.0375	.0350

Union Metal 40' tapered Sec. Type F Total Wt. 895 Lbs. Conc. 0.95 Cu. Yd.

For Raymond step tapered pile, contact Geotechnical Section, Materials & Research.

Driving Sequence of Piles

The driving sequence of piles in a pier or bent can be important. The driving sequence can affect the way piles drive as well as the influence the new construction has on adjacent structures. This is especially true for displacement piles. For non-displacement piles, the driving sequence is generally not as critical.

The driving sequence of displacement pile groups should be from the center of the group outward or from one side to the other side. The preferred driving sequence of the displacement pile group shown in Figure 24.16 would be (a) by the pile number shown, (sequence 1), (b) by driving each row starting in the center and working outward (sequence 2), or (c) by driving each row starting on one side of the group and working to the other side (sequence 3).

Figure 703.01 Driving Sequence of Displacement Pile Groups (after Passe, 1994)

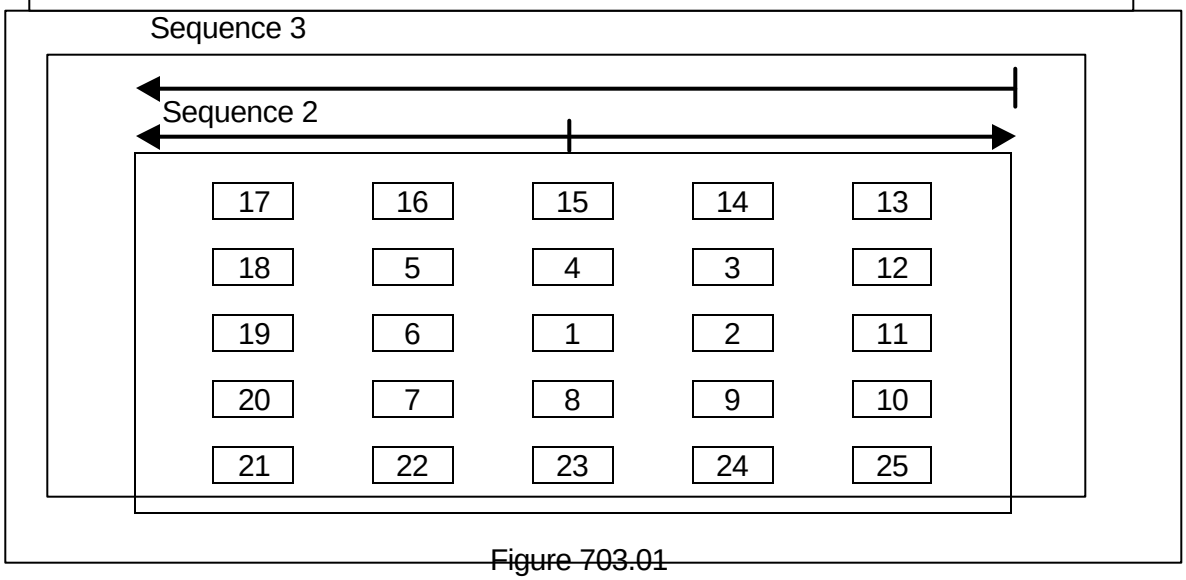


Figure 703.01

The following guidelines for Single Acting Diesel Hammer are provided to assist you. If there is a need for a different type of hammer inspection guideline, please contact the Geotechnical Section.

It is very important to field check the hammer systems provided by the contractor to the hammer data sheets after they are approved by the Geotechnical Section. Prior to pile driving, please verify cap weight and size and condition of the hammer cushion material as shown on the hammer data sheets.

E. Inspection of Piles Prior to and During Installation

1. The inspection will be different for each type of pile. Shop plans are required for sheet piles, but usually are not required for H-piles, concrete-piles or pipe-piles.

2. When MSE walls are being constructed, at times the soil conditions may require additional considerations. A note is sometimes included on our plans that states the MSE Wall Must Be Built Before Piles Are Driven. This note is usually applicable when the embankment behind the MSE wall is constructed as a fill. The note also usually specifies that the MSE wall cannot be constructed until the embankment has reached 95+% of its anticipated settlement. The concern here is that the granular backfill material will settle further and the embankment is also able to settle some additional amount due to the granular backfill load. The combined effect on the piling is to cause a downward load on the piling that will reduce the piling's capacity to resist the live and dead loads from the roadway.

3. Battered piles are driven at 1 ft. offset per 12 ft. of length or 3.33 ft. offset in 40 ft.

F. Precast Concrete Piles

1. The following is a list of items for prestressed concrete piles to be inspected at the construction site:

   a. The piles should be of the specified length and section. The inspector must be assured that a minimum concrete strength has been obtained. If the piles are to be spliced on the site, the splices should meet the specified requirements (type, alignment, etc.).

   b. Piles should be inspected for cracks or spalling. There should be no evidence that any pile has been damaged during shipping to the site, or during unloading of piles at the site. Lifting hooks are generally cast into the piling at pick-up points. Piles should be unloaded by properly sized and tensioned slings attached to each lifting hook.

   c. The piles should be stored properly. When piles are being placed in storage, they should be stored above ground on adequate blocking in a manner which keeps them straight and prevents undue bending stresses.

   d. The contractor should lift the piles into the leads properly and safely. Cables looped around the pile are satisfactory for lifting. Chain slings should never be permitted. Cables should be of sufficient strength and be in good condition. Frayed cables are unacceptable and should be replaced. For shorter piles, a

single pick-up point may be acceptable. The pick-up point locations should be as specified by the casting yard. For longer piles, two or more pick-up points at designated locations may be required.

e. The pile should be free to twist and move laterally in the helmet.

f. Piles should have no noticeable cracks when placed in leads or during installation. Spalling of the concrete at the top or near splices should not be evident.

g. Steel H-Piles

1. The following should be inspected at the construction site:

a. The piles being driven must be oriented with flanges in the correct direction as shown on the plans. Because the lateral resistance to bending of H-piles is considerably more in the direction perpendicular to flanges, the correct orientation of H-piles is very important.

b. The piles should be of the specified steel grade, length, or section/weight.

c. Pile points, if required for pile toe protection, should be as specified.

d. Splices should be either proprietary splices or full penetration groove welds as specified. The top and bottom pile sections should be in good alignment before splicing.

e. Pile point attachments and splices must be welded properly.

f. There should be no observable pile damage, including deformations at the pile head.

G. Steel Pipe Piles

1. The following should be inspected at the construction site:

a. The piles should be of specified steel grade, length, or minimum section/weight (wall thickness) and either seamless or spiral welded as specified.

b. Piles should be driven either open-ended or closed-ended. Closed-ended pipe piles should have bottom closure plates or conical points of the correct size (diameter and thickness) and be welded on properly, as specified. Open-end pipe piles should have cutting shoes that are welded on properly.

c. The top and bottom pile sections should be in good alignment before splicing. Splices or full penetration groove welds should be installed as specified.

d. There should be no observable pile damage, including deformations at the pile head. After installation, closed-end pipes should be visually inspected for damage or water prior to filling with concrete.

H. Steel Sheet Piles

1. The sheet piles must meet thickness, section models, steel grade, length and width requirements as shown in our plans.

2. Sheet pile length should be measured so that analysis of obstructions to driving can be properly accomplished.

3. Sheet piles should be driven plumb or at the angle shown in the plans.

I. Inspection of Driving Equipment

A typical driving system consists of crane, leads, hammer, hammer cushion, helmet, and in the case of concrete piles, a pile cushion. Each component of the drive system has a specific function and plays an important role in the pile installation. The project plans and specifications may specify or restrict certain items of driving equipment. The Geotechnical Section will approve the contractor's driving equipment and determine conformity with the plans and specifications. The inspector must be sure the equipment used is what was approved.

1. The following checklist will be useful in the inspection of driving equipment before driving:

   a. The pile driving hammer should be the specified type/size.

      (1) The inspector should make sure for single acting air/steam or hydraulic hammers that the contractor uses the proper size external power source and that, for adjustable stroke hammers, the stroke necessary for the required energy be obtained. For double acting or differential air/steam or hydraulic hammers, the contractor must again obtain the proper size external power source and the operating pressure and volume must meet the hammer manufacturer's specification.

   b. The hammer cushion being used should be checked to confirm it is of the approved material type, size and thickness.

      (1) The main function of the hammer cushion is to protect the hammer itself from fatigue and high frequency accelerations which would result from steel to steel impact with the helmet and/or pile. The hammer cushion should have the proper material and same shape/area to snugly fit inside the helmet (drive cap). If the cushion diameter is too small, the cushion will break or badly deform during hammer blows and become ineffective. The hammer cushion must not be excessively deformed or compressed. Some air/steam hammers rely upon a certain total thickness (of cushion plus striker plate) for proper valve timing. Hammers with incorrect hammer cushion thickness may not operate, or will have improper kinetic energy at impact. Since it is difficult to inspect this item once the driving operation begins, it should be checked before the contractor starts pile driving on a project as well as periodically during production driving on larger projects.

c. The helmet (drive cap) should properly fit the pile.

(1) The purpose of the helmet is to hold the pile head in alignment and transfer the impact concentrically from the hammer to the pile. The helmet also houses the hammer cushion, and must accommodate the pile cushion thickness for concrete piles. The helmet should fit loosely to avoid transmission of torsion or bending forces, but not so loosely as to prevent the proper alignment of hammer and pile. Helmets should ideally be of roughly similar size to the pile diameter. Although generally discouraged, spacers may be used to adapt an oversize helmet, provided the pile will still be held concentrically wit the hammer. A properly fitting helmet is important for all pile types, but is particularly critical for precast concrete piles. A poorly fitting helmet often results in pile head damage. Check and record the helmet weight for conformance to wave equation analysis or for future wave equation analysis. Larger weights will reduce the energy transfer to the pile.

d. The pile cushion should be of correct type material and thickness for concrete piles.

(1) The purpose of the pile cushion is to reduce high compression stresses, to evenly distribute the applied forces to protect the concrete pile head from damage, and to reduce the tension stresses in easy driving. Pile cushions for concrete piles should have the required thickness determined from a wave equation analysis but not less than 4 inches (100 mm). A new plywood, hardwood, or composite wood pile cushion, which is not water soaked, should be used for every pile. The cushion material should be checked periodically for damage and replaced before excessive compression (more than half the original thickness), burning or charring occurs. Wood cushions may take only about 1,000 to 2,000 blows before they deteriorate. During hard driving, more than one cushion may be necessary for a single pile. Longer piles or piles driven with larger hammers may require thicker pile cushions.

e. Predrilling, jetting or spudding equipment, if specified or permitted, should be available for use and meet the requirements. The depth of predrilling, jetting or spudding should be very carefully controlled so that it does not exceed the allowable limits, usually 10 feet (1 m). Predrilling, jetting, or spudding below the allowed depths will generally result in a reduced pile capacity, and the pile acceptance may become questionable.

f. A lead system must be used.

(1) The leads perform the very important function of holding the hammer and pile in good alignment with each other. Poor alignment reduces energy transfer as some energy is then imparted into horizontal motion. Poor alignment also generally results in higher bending stresses and higher local contact stresses which can cause pile damage. This is particularly important at end of driving when driving resistance is highest and driving stresses are generally increased.

J. Inspection of Driving Equipment During Installation

1. The main purpose of inspection is to assure that piles are installed so that they meet the driving criteria and the pile remains undamaged. The driving criteria is often defined as a minimum driving resistance as measured by the blow count in blows per inch. The driving criteria is to assure that piles have the desired capacity. However, the driving resistance is also dependent upon the performance of the pile driving hammer. The driving resistance will generally be lower when the hammer imparts higher energy and force to the pile, and the driving resistance will be higher if the hammer imparts lower energy and force to the pile. High driving resistances can be due either to soil resistance or to a poorly performing hammer. Thus, for the inspector to assure that the minimum driving criteria has been met and, therefore, the capacity is adequate, the inspector must evaluate if the hammer is performing properly.

2. Each hammer has its own operating characteristics; the inspector should not blindly assume that the hammer on the project is in good working condition. In fact, two different types of hammers with identical energy rating will not drive the same pile in the same soil with the same driving resistance. In fact, two supposedly identical hammers (same make and model) may not have similar driving capability due to several factors including differing friction losses, valve timing, air supply hose type-length-condition, duel type and intake amount, and other maintenance status items. The inspector should become familiar with the proper operation of the hammer(s) used on site. The inspector may wish to contact the hammer manufacturer or supplier who generally will welcome the opportunity to supply further information.

K. Single Acting Diesel Hammers

1. Determine/confirm that the hammer is the correct make and model. Check for and record any identifying labels as to hammer make, model and serial number.

2. Make sure all exhaust ports are open with all plugs removed.

3. Inspect the recoil dampener for condition and thickness. If excessively worn or improper thickness (consult manufacturer) it should be replaced. If the recoil dampener is too thin, the stroke will be reduced. If it is too thick, or if cylinder does not rest on dampener between blows, the ram could blow out the hammer top and become a safety hazard.

4. Check that lubrication of all grease nipples is regularly made. Most manufacturers recommend the impact block be greased every half-hour of operation.

5. As the ram is visible between blows, check the ram for signs of uniform lubrication and ram rotation. Poor lubrication will increase friction and reduce energy to the pile.

6. Determine the hammer stroke, especially at end of driving or beginning of restrike. A "jump stick" attached to the cylinder is a safety hazard and should not be used. The stroke can be determined by a saximeter which measures the time between blows and then calculates the stroke. The hammer stroke can also be calculated from this formula if the number of blows per minute (bpm) is manually recorded.

$$h\ [\text{meters}] = (4400/[\text{bpm}^2]) - 0.90$$

   a. The calculated stroke may require correction for batter or inclined piles. The inspector should always observe the ram rings and visually estimate the stroke using the manufacturer's chart.

7. As the driving resistance increases, the stroke should also increase. At the end of driving, if the ram fails to achieve the correct stroke (part of the driving criteria from a wave equation analysis), the cause could be lack of fuel. Most hammers have adjustable fuel pumps. Some have distinct fuel settings, others are continuously variable, and some use a pressure pump. Make sure the pump is on the correct fuel setting or pressure necessary to develop the required stroke. The fuel and fuel line should be free of dirt or other contaminants. A clogged or defective fuel injector will also reduce the stroke and should be replaced if needed.

8. Low strokes could be due to poor compression caused by worn or defective piston or anvil rings. Check compression by raising the ram, and with the fuel turned off, allowing the ram to fall. The ram should bounce several times if the piston and anvil rings are satisfactory.

9. Watch for signs of preignition. When a hammer preignites, the fuel burns before impact, requiring extra energy to compress gas and leaving less energy to transfer to the pile. In long sustained periods of driving, or if the wrong fuel with a low flash point is used, the hammer could overheat and preignite. When preignition occurs, less energy is transferred and the driving resistance rises, giving a false indication of high pile capacity. If piles driven with a cold hammer drive deeper or with less hammer blows, or if the driving resistances decrease after short breaks, preignition could be the cause and should be investigated. Dynamic testing is the preferable method to check for preignition.

10. For some diesel hammers, the total thickness of hammer cushion and striker plate must match the hammer manufacturer's recommendation and the hammer cushion cavity in the helmet for proper fuel injection and hammer operation. This total thickness must be maintained.

11. Make sure the helmet stays properly seated on the pile and that the hammer and pile maintain alignment during operation.

12. The hammer hoist line should always be slack, with the hammer's weight fully carried by the pile. Excessive tension in the hammer hoist line is a safety hazard and will reduce energy to the pile. Leads should always be used.

13. Some manufacturers void their warranty if the hammer is consistently operated above 100 blows per 250 mm of penetration beyond short periods, such as those required when toe bearing piles are driven to rock. Therefore, in prolonged hard driving situations, it may be more desirable to use a larger hammer or stiffer pile section.

14. Common problems and problem indicators for single acting diesel hammers are presented in the following table.

COMMON PROBLEMS AND PROBLEM INDICATORS FOR SINGLE ACTING DIESEL HAMMERS (from Williams Earth Sciences, 1995)	
Common Problems	**Indicators**
Water in fuel.	Hollow sound, white smoke.
Fuel lines clogged.	No smoke or little gray smoke.
Fuel pump malfunctioning.	Inconsistent ram strokes, little gray smoke or black smoke.
Fuel injectors malfunctioning.	Inconsistent ram strokes, little gray smoke or black smoke.
Oil low.	Blows per minute rate is lower than specified.
Oil pump malfunctioning.	Blows per minute rate is lower than specified.
Water in combustion chamber.	Hollow sound, white smoke.
Piston rings worn.	Low strokes.
Tripping device broken.	Pawl or pin used to lift piston does not engage piston. Pawl engages but does not lift piston.
Overheating.	Paint and oil on cooling fins start to burn/sound changes.

L. Field Driving Problem

In the following table, there is a list of common field problems and possible solutions.

COMMON PILE INSTALLATION PROBLEMS & POSSIBLE SOLUTIONS	
Problem	**Possible Solutions**
Piles encountering refusal driving resistance (blow count) above minimum pile penetration requirements.	Have wave equation analysis performed and check the pile has sufficient drivability and that the driving system is matched to the pile. If the pile and driving system are suitably matched, check driving system operation for compliance with manufacturer's guidelines. If no obvious problems are found, dynamic measurements should be made to determine if the problem is driving system or soil behavior related. Driving system problems could include preignition, preadmission, low hammer efficiency, or soft cushion. Soil problems could include greater soil strength than anticipated, temporarily increased soil resistance with later relaxation (required restrike to check), large soil quakes, or high soil damping.
Piles driving significantly deeper than estimated pile penetration depths.	Soil resistance at the time of driving probably is lower than anticipated or driving system performance is better than anticipated. Have wave equation analysis performed to assess ultimate pile capacity based on the blow count at the time of driving. Perform restrike tests after an appropriate waiting period to evaluate soil strength changes with time. If the ultimate capacity based on restrike blow count is still low, check drive system performance and restrike capacity with dynamic measurements. If drive system performance is as assumed and restrike capacity low, the soil conditions are weaker than anticipated. Foundation piles will probably need to be driven deeper than originally estimated or additional piles will be required to support the load. Contact the structural engineer/designer for recommended change.
Abrupt change or decrease in driving resistance (blow count) for bearing piles.	If borings do not indicate weathered profile above bedrock/bearing layer, then pile toe damage is likely. Have wave equation analysis performed and evaluate pile toe stress. If calculated toe stress is high and blow counts are low, a reduced hammer energy (stroke) and higher blow count could be used to achieve capacity with a lower toe stress. If calculated toe stress is high at high blow counts, a different hammer or pile section may be required. For piles that allow internal inspection, reflect light to the pile toe and tape the length inside the pile for indications of toe damage. For piles that cannot be internally inspected, dynamic measurements could be made to evaluate problem or pile extraction could be considered for confirmation of a damage problem.
Driving resistance (blow count) significantly lower than expected during driving.	Review soil borings. If soil borings do not indicate soft layers, pile may be damaged below grade. Have wave equation analysis performed and investigate both tensile stresses along pile and compressive stresses at tie. If calculated stresses are within allowable limits, investigate possibility of obstructions/uneven toe contact on hard layer or other reasons for pile toe damage. If pile was spliced, re-evaluate splice detail and field splicing procedures for possible splice failure.
Vertical (heave) or lateral movement of previously installed piles when driving new piles.	Pile movements likely due to soil displacement from adjacent pile driving. Contact geotechnical engineer for recommended action. Possible solutions include redriving of installed piles, change in sequence of pile installation, or predrilling of pile locations to reduce ground movements. Lateral pile movements could also result from adjacent slope failure in applicable conditions.

COMMON PILE INSTALLATION PROBLEMS & POSSIBLE SOLUTIONS	
Problem	**Possible Solutions**
Piles driving out of alignment tolerance.	Piles may be moving out of alignment tolerance due to hammer-pile alignment control or due to soil conditions. If due to poor hammer-pile alignment control, a pile gate, template or fixed lead system may improve the ability to maintain alignment tolerance. Soil conditions such as near surface obstructions (see subsequent section) or steeply sloping bedrock having minimal overburden material (pile point detail is important) may prevent tolerance from being met even with good alignment control. In these cases, survey the as-built condition and contact the Geotechnical engineer for recommended action.
Piles driving out of location tolerance.	Piles may be moving out of location tolerance due to hammer-pile alignment control or due to soil conditions. If due to poor hammer-pile alignment control, a pile gate, template or fixed lead system may improve the ability to maintain location tolerance. Soil conditions such as near surface obstructions (see subsequent section) or steeply sloping bedrock having minimal overburden material (pile point detail is important) may prevent tolerances from being met even with good alignment control. In these cases, survey the as-built condition and contact the Geotechnical engineer for recommended action.
Piles encountering shallow obstructions.	If obstructions are within 3 feet of working grade, obstruction excavation and removal is probably feasible. If obstructions are at deeper depth, are below the water table, or the soil is contaminated, excavation may not be feasible. Spudding or predrilling of pile locations may provide a solution with method selection based on the type of obstructions and soil conditions.
Pile encountering obstructions at depth.	If deep obstructions are encountered that prevent reaching the desired pile penetration depth, contact the structural engineer/designer for remedial design. Ultimate capacity of piles hitting obstructions should be reduced based upon pile damage potential and soil matrix support characteristics. Additional foundation piles may be necessary.
Concrete piles develop partial horizontal cracks in easy driving.	Check hammer-pile alignment since bending may be causing the problem. If the alignment appears to be normal, tension and bending combined may be too high. The possible solution is as above with complete cracks.
Concrete pile spalling or slabbing near pile head.	Have Geotechnical Section determine pile head stress for observed blow count and compare with allowable stresses. If high calculated stress, add pile cushioning. If low calculated stress, investigate pile quality, hammer performance, hammer-pile alignment.
Concrete piles develop complete horizontal cracks in easy driving.	Have Geotechnical Section determine tension stresses along pile for observed blow counts. If high calculated tension stresses, add cushioning or reduce stroke. If low calculated tension stresses, check hammer performance and/or perform measurements.
Concrete piles develop complete horizontal cracks in hard driving.	Have Geotechnical Section determine tension stresses along pile. If high calculated tension stresses, consider heavier ram. If low calculated tension stresses, take measurements and determine quakes which are probably higher than anticipated.
Concrete piles develop partial horizontal cracks in easy driving.	Check hammer-pile alignment since bending may be the problem. If alignment appears to be normal, tension and bending combined may be too high; solution will then be the same as for complete cracks above.
Steel pile head deforms, timber pile top mushrooms.	Check helmet size/shape; check steel strength; check evenness of pile head, banding of timber pile head. If okay, have Geotechnical Section determine pile head stress. If calculated stress is high, reduce hammer energy (stroke) for low blow counts; for high blow counts, different hammer or pile type may be required.
Unexpectedly low blow counts during pile driving.	Investigate soil borings; if soil borings do not indicate soft layers, pile may be damaged below grade. Have Geotechnical Section investigate both tensile stresses along pile and compressive stresses at toe. If calculated stresses are acceptable, investigate possibility of obstructions/uneven toe contact on hard layer or other reasons for pile toe damage.

COMMON PILE INSTALLATION PROBLEMS & POSSIBLE SOLUTIONS	
Problem	**Possible Solutions**
Higher blow count than expected.	Have the Geotechnical Section review the wave equation analysis and check that all parameters were reasonably considered. Check hammer and driving system. If no obvious defects are found in driving system, field measurements should be taken. Problem could be preignition, preadmission, low hammer efficiency, soft cushion, large quakes, high damping, greater soil strengths, or temporarily increased soil resistance with later relaxation.
Lower blow count than expected.	Probably soil resistance is lower than anticipated. Have the Geotechnical Section assess soil resistance. Perform restrike testing (soil resistance may have been lot during driving), establish setup factor and drive to lower capacity. Hammer performance may also be better than anticipated, check, by measurement.
Diesel hammer stroke (bounce chamber pressure) higher than calculated.	The field observed stroke exceeds the calculated stroke by more than 10%. Compare calculated and observed blow counts. If observed are higher, soil resistance is probably higher than anticipated. If blow counts are comparable, have the Geotechnical Section reanalyze with higher combustion pressure to match observed stroke and assure that preignition is not a problem, e.g., by measurements.
Diesel hammer stroke (bounce chamber pressure) lower than calculated.	The field observed stroke is less than 90% of the calculated stroke. Check that ram friction is not a problem (ram surface should have well lubricated appearance). Compare calculated and observed blow count. If observed one is lower, soil resistance is probably lower than anticipated. If blow counts are comparable, reanalyze with lower combustion pressure to match observed hammer stroke.
Cannot find hammer in data file.	See if there is a hammer of same type, similar ram weight and energy rating and modify its data.
Cannot find an acceptable hammer to drive pile within driving stress and driving resistance limits.	Both calculated stresses and blow counts are too high. Increase pile impedance or material strength or redesign for lower capacities. Alternatively, check whether soil has potential for setup. If soil is fine grained or known to exhibit setup gains after driving, then end of driving capacity may be chosen lower than required. Capacity should be confirmed by restrike testing or static load testing.

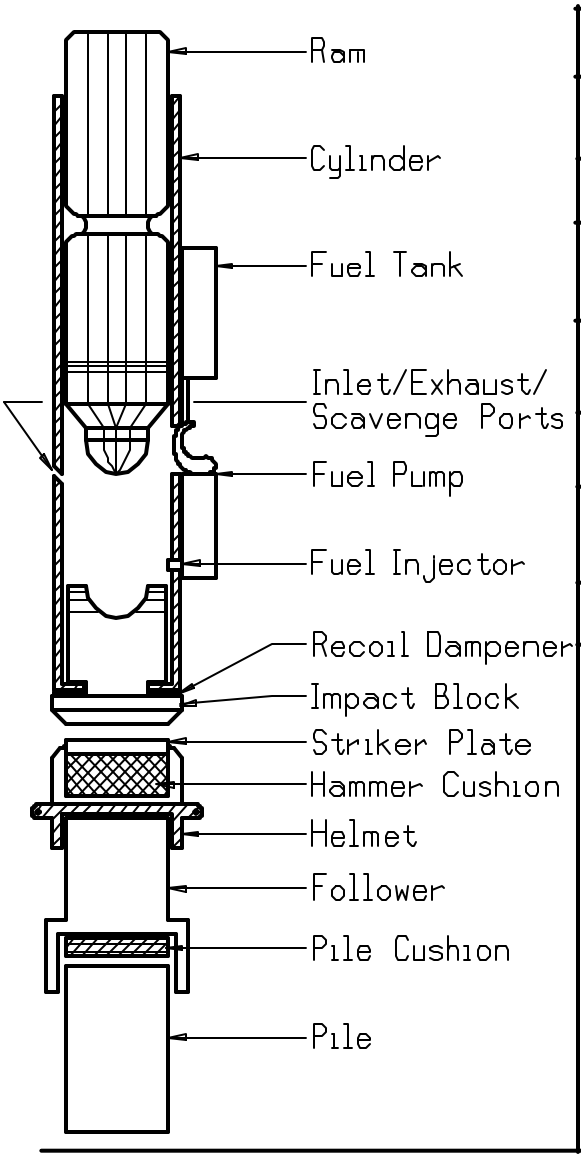
SINGLE ACTING HAMMER INSPECTION CHECKLIST

(For PM Use Only)

Project/Pile: _____ Hammer Name: _____

Date: _____ Serial No: _____

Conditions: _____



OBJECT	REQUIREMENTS	OBSERVATIONS
	Ram Lubricated?	Yes / No
	Exhaust Ports Open?	Yes / No
	Fuel Pump	Hammer Setting _____
	Recoil Dampener Undamaged?	Yes / No
	Impact Block Lubricated?	Yes / No
	Striker Plate	t= _____ D= _____
	Hammer Cushion	t= _____ D= _____ Material _____
		How long in use? _____
	Helmet	Type or Weight? _____
	Pile Cushion	Material _____ t= _____ Size _____ How long in use? _____

704.00 BRIDGES (STEEL STRUCTURES) (*SSHC Section 708*)

704.01 DESCRIPTION

A. This work includes the furnishing, preparing and erecting of all riveted, bolted or welded structures in which the main members spanning the supports are composed of steel.

704.02 MATERIAL REQUIREMENTS

A. Members of steel structures that are fabricated in the shop are inspected by NDR personnel before they are shipped to the job site. In some cases, when the fabrication is done outside of the state, the inspection will take place after delivery to the site of work. The Project Manager should have a copy of the shop inspection report and the mill test report before allowing the erection of any portion of the structure. Miscellaneous parts of the superstructure such as high tensile steel bolts will require field inspection and sampling according to the "*Materials Sampling Guide*".

B. Field welding may require the use of special welding electrodes as designated in the plans, specifications, or special provisions. Some of these welding electrodes may require special care and handling before their use will be permitted. (See *SSHC Section 708*.) Enter date steel is verified in SiteManager. Occasionally wrong size is delivered.

C. Concrete Industries rebar shipments will be documented to show bending details, heat numbers, quantity and project location by stationing.

704.03 CONSTRUCTION METHODS

A. Falsework (*SSHC Subsection 704.03*)

1. Girders should be blocked so that the weight of any deck overhang does not bend the girder, which will ripple the deck.

B. Temporary Fastenings

1. Contractors often request permission to use anchor supports for face forms, concrete curbs, Jersey barriers, raised medians on bridges. Any contractor desiring to use a temporary floor fastening may be allowed to use only some form of weakened section bolt or tie, cast in the floor. The weakened section must be so positioned that when broken off the break will be recessed below the surface. The resulting void must be patched with mortar.

2. NOTE:

   a. No bolt without a weakened section may be used.

   b. No holddown device shot into the floor will be allowed.

      (1) Concrete arch bridges.

      (2) Support of girders or other large structural elements when required.

(3) Unusual or complicated work indicated in the plans.

(4) Support of girders over or under active railroad tracks.

(5) Support of girders carrying traffic or extending over highways or streets carrying traffic.

C. Submitting Plans

NOTE: Submission of falsework plans does not imply that OSHA regulations are satisfied, that the NDR, or the Project Manager assumes any liability for the falsework. Inspectors should not give the contractors advice on how to construct the falsework.

D. Bridges-Steel Beam

1. On bridges using weathering steel (A 588) for steel structures, the contractor shall:

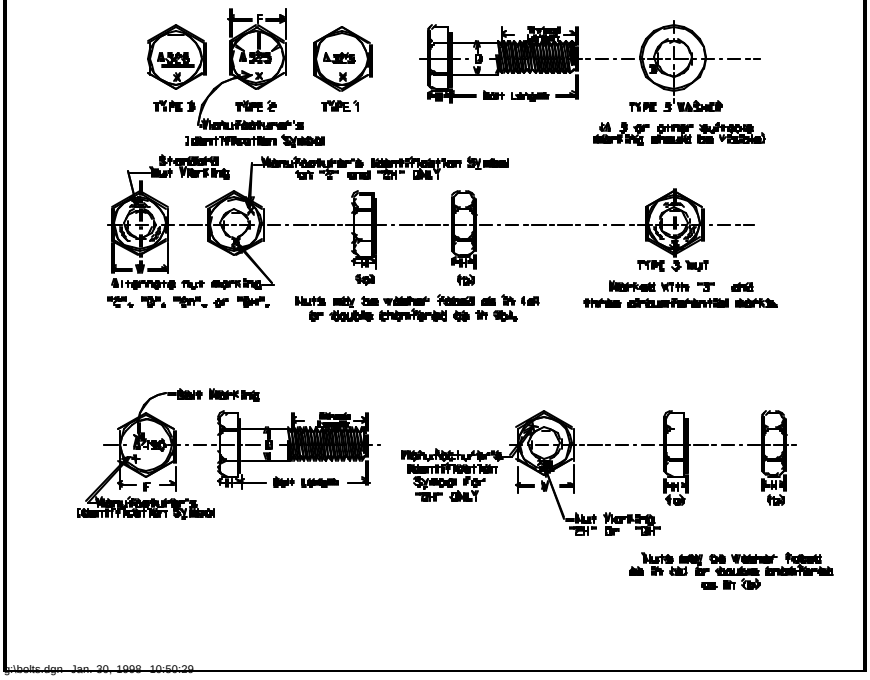
   a. Use "high strength," A325M Type III bolts, A563 Grade DH3 nuts, and F463 Type III washers.

   b. Limit shop painting to only areas under expansion joints and all bearings. Shop painting will be with a Zinc-rich primer and a colored topcoat. Field touch-up will be required for paint that is damaged and to fasteners in these areas and it will be done with same color and type of paint as the original painting.

   c. Require special care to assure concrete slobbers are eliminated (or at least removed) from steel surfaces before the concrete hardens. Washing with water is the preferred method of removing concrete slobbers.

E. Structural Joints Using High Tensile Steel

	HEAVY HEX STRUCTURAL BOLTS BOLT DIMENSIONS (INCHES)			HEAVY HEX NUTS NUT DIMENSIONS (INCHES)	
BOLT DIAMETER (INCHES) D	WIDTH ACROSS FLATS F	HEIGHT H	THREAD LENGTH	WIDTH ACROSS FLATS W	HEIGHT H
1/2	7/8	5/16	1	7/8	31/64
5/8	1 1/16	25/64	1 1/4	1 1/4	39/64
3/4	1 1/4	7/16	1 3/8	1 1/4	47/64
7/8	1 7/16	35/64	1 1/2	1 7/16	55/64
1	1 5/8	39/64	1 3/4	1 5/8	63/64
1 1/8	1 13/16	11/16	2	1 13/16	1 7/64
1 1/4	2	25/32	2	2	1 7/32
1 3/8	2 3/16	27/32	2 1/4	2 3/16	1 9/32
1 1/2	2 3/8	15/16	2 1/4	2 3/8	1 15/32



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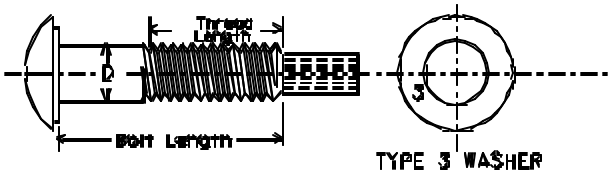
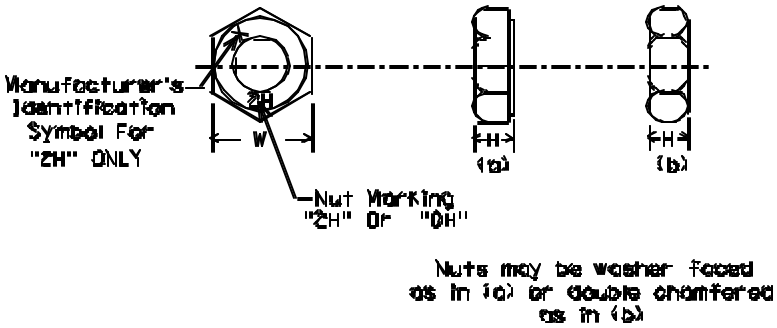
Bolts

DIRECT TENSION BOLTS





1. Must obtain Construction Division permission to use these bolts.
2. Special impact wrench that will hold bolt & tighten the nut must be used.
3. End of bolt will seperate at proper torque.

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1. *SSHC Section 1058* requires high tensile steel bolt, nut and washer material for structural steel joints to meet the requirements of ASTM Designation A 325/A 325M.

2. When heavy hexhead structural bolts and heavy hexagon nuts are used, a hardened washer is required only under the bolt head, or nut, whichever is the element being turned. Bolts and nuts may be washer faced, but these faces do not take the place of a hardened washer.

3. Heavy hexhead structural bolts manufactured to ASTM A 325/A 325M, Types 1, 2 and 3, the dimensions for which are shown in the ASTM tables, are identified on the top of the head by the legend "A 325", and the manufacturer's symbol.

4. Type 1 bolts, at the option of the manufacturer, may be marked with three radial lines 120 degrees apart.

5. Type 2 bolts shall be marked with three radial lines 60 degrees apart. Type3 bolts shall have the "A 325" underlined and the manufacturer may add other distinguishing marks indicating that the bolt is of a weathering type.

6. Heavy hex nuts for A 325 bolts are identified or at least one face by the manufacturer's mark and the number "2" or "2H", by three equally spaced circumferential lines, or by the legend "D" or "DH". Heavy hex nuts for A 325 Type 3 bolts shall be marked on one face with three circumferential marks and the numeral "3", in addition to any other distinguishing marks the manufacturer may elect to use.

7. Washers for A 325 Type 3 bolts shall be marked on one face near the outer edge with the numeral "3", or other distinguishing marks indicating that the washer is of a weathering type.

8. The marking on bearing surfaces of nuts and washers shall be depressed.

9. According to the specifications, high strength steel bolts may be installed by the turn of the nut method. It should be noted that the equivalent torque values given in SSHC Table 708.03 are experimental approximations and that the footnote to this table required that the torque-tension ratio be determined under actual conditions of the application. Wrenches will be calibrated and the torque-tension ratio will be determined at the site by Materials and Research Division personnel. The Construction Engineer should be notified as early as possible as to the time when the wrench and representative bolts will be present at the site in order that arrangements may be made to have appropriate personnel travel to the site and calibrate the wrench and establish the torque-tension ratio.

10. When Materials and Research Division personnel have calibrated the wrench and determined the torque-tension ratio, the bolt tension calibrator will be left with the project personnel so that the wrench calibration may be checked as the work goes on. Impact wrenches should be checked on a daily basis and manual torque wrenches at any time that, in the opinion of the Project Manager, conditions have varied form those present during the initial calibration.

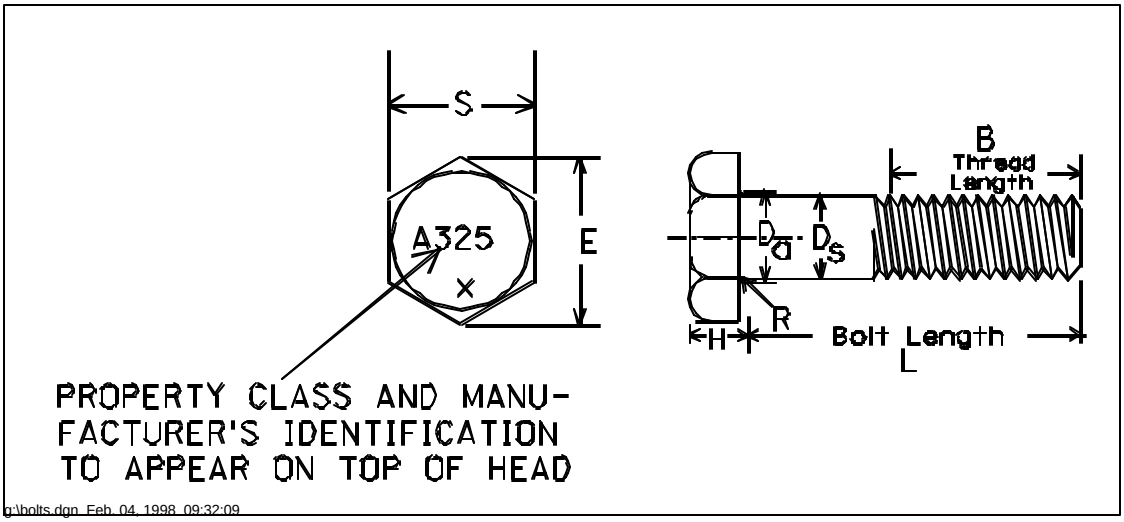
11. Impact wrenches should be calibrated under the same conditions, such as length of hose and power supply, that were present during actual installation of the bolts.

12. *SSHC Subsection 708.03* requires that the structure shall be adjusted to the requirements of blocking diagram before placing permanent bolts in field connections. This should be checked by the contractor and verified by the inspector prior to completing final phase of bolt tightening.

13. All splice plates and contact surfaces shall be clean.

F. High Strength Fasteners (*SSHC Section 1058*)

METRIC HEAVY HEX BOLTS



D	D_s		S		E		H		D_a	R	B (Ref.)		
											Thread Length (Basic)		
Nominal Bolt Size & Thread Pitch	Body Diameter		Width Across Flats		Width Across Corners		Head Height		Fillet Transition Dia.	Radius of Fillet	Bolt Lengths <125	Bolt Lengths >125 and <200	Bolt Lengths >200
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.			
M12x1.75	12.70	11.30	21.00	20.16	24.25	22.78	7.95	7.24	13.7	0.67	30	36	49
M14x2	14.70	13.30	24.00	23.16	27.71	26.17	9.25	8.51	15.7	0.6	34	40	53
M16x2	16.70	15.30	27.00	26.16	31.18	29.56	10.75	9.68	17.7	0.6	38	44	57
M20x2.5	20.84	19.16	34.00	33.00	39.26	37.29	13.40	12.12	22.4	0.8	46	52	65
M24x3	24.84	23.16	41.00	40.00	47.34	45.20	15.90	14.56	26.4	0.8	54	60	73
M30x3.5	30.84	29.16	50.00	49.00	57.74	55.37	19.75	17.92	33.4	1.0	66	72	85
M36x4	37.00	35.00	60.00	58.80	69.28	66.44	23.55	21.72	39.4	1.0	78	84	97

1. *SSHC Subsection 708.03, Paragraph 10.h*. Turn-of-Nut method shall be followed for tightening all high strength fasteners.

2. High Strength bolts and nuts, which have been torqued as outlined below, shall not be reused. This includes both black and galvanized bolts and nuts.

   a. Bolting

      (1) Receiving Shipments

         (a) Prior to installation, check shipping certifications and compare these to bolting kegs on site. Check for size, length, heat numbers, and general fastener condition i.e., rusted black bolts or non-lubricated galvanized nuts. Rotational-Capacity (RC) lots will need to checked.

   b. Installation Checklist

      (1) A pre-bolting meeting is strongly recommended/encouraged. Bolting procedures, Turn-of-Nut process described below, and the inspection process need to be discussed.

      (2) Site storage of fasteners is important. Storage should be in a sealed container within a sheltered storage shed.

      (3) Black bolts and nuts shall be oily to the touch when delivered and installed.

      (4) Galvanized nuts shall be checked to verify lubrication. A uniform dye color indicates lubricant has not been damaged. If there is no color, or color is not uniform, bolts and nuts shall be field lubricated with bees wax, stick wax, or other approved dry wax prior to installation.

      (5) Rusted or dirty bolts or nuts shall be cleaned and relubricated prior to installation.

      (6) Faying surfaces shall be free of burrs and foreign material; and bolted faying surfaces are to be painted with zinc rich paint.

      (7) All fasteners shall be free of dirt, moisture, rust, and be "well" lubricated.

      (8) Washers (when required) are to be placed under the **"turned element."**

      (9) Often contract documents will specify which way a bolt is to be installed. If there is no specific guidance, threaded ends of bolts will be turned inside and away from normal exposure to pedestrian and/or vehicular traffic for aesthetic reasons.

(10) During installation, particular care should be exercised so a snug-tight condition is achieved.

c. Rotational-Capacity

(1) The plans and specifications may eventually require a Rotational-Capacity (RC) test for all "high strength" fasteners. This test confirms component compatibility and the presence of adequate lubrication. Currently, it is only required when the Project Manager determines it is necessary.

(2) There are two separate Rotational-Capacity requirements:

(a). Fasteners (bolts, nuts, and washers) received at the project shall have been RC tested by the supplier or manufacturer prior to shipment. Therefore, each combination of production lots must have an unique RC lot number. This number must be readily identifiable on each container of fasteners.

(b). Prior to installation, the contractor shall field test all RC lots as supplied. Field tests are not intended to match the values provided by the supplier, but as a separate and added acceptance test.

(c) Field testing procedures are given in *SSHC Subsection 708.03, paragraph 10.h*.

d. Turn-of-Nut Method

(1) "Turn-of-Nut" method involves the following simple steps. Adherence to this procedure will assure a properly fitted and clamped connection. (*Refer to SSHC Subsection 708.03*.)

(a) Adequate number of bolts and pins shall be installed to bring a joint in tight contact and alignment. These bolts shall be brought to a snug-tight condition to insure that the joint is maintained in good contact during installation of remaining bolts. A washer shall be placed under the element to be turned.

(b) Remaining bolts in a connection shall be installed and brought to a snug-tight condition.

(c) Check initially installed bolts to assure they remained in a snug-tight condition.

(d) Tighten all bolts by the applicable Turn-of-Nut amount specified in *SSHC Subsection 708.03*. Additional rotation depends on the bolt length to diameter ratio and shape of connected pieces. For MOST installations (both faces normal to bolt Axis) the following table can be used to determine additional rotation for Turn-of-Nut.

NOTE: The following table is currently printed in English units only. When Standard diameter, lengths, and additional rotation values are developed for metric fasteners, another table will be prepared.

Turn of the Nut			
3/4" Dia. Bolts		**7/8" Dia. Bolts**	
Bolt Length	**Additional Rotation**	**Bolt Length**	**Additional Rotation**
0-3"	1/3 turn	0-3.5"	1/3 turn
>3"-6"	1/2 turn	>3.5-7"	1/2 turn
>6" -9"	2/3 turn	>7" - 10.5"	2/3 turn
NOTE: All additional rotations have a ± tolerance. Refer to *SSHC Section 708*.			
1" Dia. Bolts		**1 1/8" Dia. Bolts**	
Bolt Length	**Additional Rotation**	**Bolt Length**	**Additional Rotation**
0-4"	1/3 turn	0-4.5"	1/3 turn
>4"-8"	1/2 turn	>4.5"-9"	1/2 turn
>8" -12"	2/3 turn	>9" - 13.5"	2/3 turn
NOTE: All additional rotations have a ± tolerance. Refer to *SSHC Subsection 708.03*.			

e. Snug Tight

(1) Snug tight is defined as the tightness that exists when all plies of a joint are in "firm" contact with each other. There shall not be air gaps between metal to metal or metal to bolt surfaces. For properly fitting surfaces, snug tight can usually be accomplished by:

(a) The full effort of a person using an ordinary spud wrench.

(b) A "few impacts" of an impact wrench. To quantify "few impacts," tighten a few bolts using the full effort method on a spud wrench. Then apply the job impact wrench, and roughly check how many impacts it takes to develop at least the same effort.

(2) After **ALL** bolts in the connection are snug tight:

(a) **ALL** nuts shall be match-marked with bolt point nut and base steel using paint crayon, or other means to provide a straight reference line for determining final relative rotation of parts during tightening.

(b) All bolts in a connection shall then be tightened additionally by an applicable amount of nut rotation specified above. Tightening should progress from the most rigid part of the joint to its free edges. On our normal web and flange splices, this would mean beginning at the centerline of a splice and progressing away (in each direction) from the centerline of splice.

(3) Inspectors should observe this operation at intervals to make certain the match-marking is done correctly, and that the opposite bolt head or nut does not turn during the tightening process. Inspectors also should check to see if proper rotation has been made considering tolerances given at the bottom of the nut rotation chart.

f. Inspection Wrench Calibration

(1) Tension Measuring Calibrated Devices

(a) Tension measuring calibrated devices (typically Skidmore-Wilhelm Calibrator) are calibrated to a high degree of accuracy, but can lose some of this accuracy after an extended period of time. Contractors can have the devices calibrated by the Materials & Research Laboratory.

(b) When each device is calibrated, a calibration sheet will be issued indicating the date the test was performed. Contractors must keep the calibration sheet with the tension-measuring device.

(c) Attentiveness needs to be exercised when using this Calibration Sheet. The inspector needs to check the sheet and compare the "Indicated Load on Gauge" column to those values listed in the "AVG" column under "Actual Load on Testing Machine." These are usually **NOT** the same.

NOTE: Be sure to take any difference (INDICATED versus ACTUAL) into account when calibrating the Job Torque Wrench!

(2) Torque Wrench Calibration

(a) At least once a day, three bolts of the same grade, size, and condition as those used in the structure shall be placed individually in a calibration device capable of indicating bolt tension. A washer shall be used under the part to be turned.

NOTE: There must be 3-5 threads exposed behind the nut. Check and add washers if required. For longer bolts, steel shim plates should be used.

(i) Tension bolt to 100 percent of "Minimum Bolt Tension" listed for a particular bolt diameter. Tension is read directly from the tension measuring calibrated device as corrected by accounting for differences between INDICATED versus ACTUAL. (Refer to *SSHC Subsection 708.03* for "Minimum Bolt Tension.")

(ii) Apply inspection torque wrench, rotate nut or bolt and increase tension by an additional 5%. Remember, a dial type wrench must be set to zero before checking torque. Record the inspection wrench's "TORQUE" when 105% of the tension is achieved.

NOTE: The turned element must be moving to indicate the correct torque.

(iii) **EXAMPLE:** (English units)
Assume:
1. 7/8" Diameter bolt
2. Skidmore Calibration

Minimum Bolt Tension
39,250 lbs-force

Skidmore Calibration
Gauge Reading 40,000 lbs-force
Actual Ave. at 40,000 = **38,800 lbs-force**

Calculations

- For 100% tension, corrected Skidmore gauge should read:

39,250 + (40,000-38,800) = **40,450 lbs-force**

- For 105% tension, corrected Skidmore gauge should read:

40,450 x 1.05 = **42,473 lbs-force**

(vi) torque reading on Inspection Wrench at 42,47O± lbs-force is recorded.

(a) Repeat this process for a total of three fasteners.

(b) The inspector notes the torque for three fasteners, averages this torque, and that becomes the Job Inspection Torque Value until the wrench is recalibrated the next day, or another size or length of bolt is to be inspected.

The Inspector shall record:

- The job inspection torque.
- The Tension Measuring device's calibration "date reported," serial and model number, and calibration lab number.

g. Turn-of-Nut Inspection (*SSHC Subsection 708.03*)

(1) After all fasteners in a joint are properly tightened by the Turn-of-Nut method, they shall be inspected as indicated:

(a) Installed fasteners shall be inspected the same day as installed by the contractor with the inspector present.

(b) The contractor shall use a calibrated torque wrench for the inspection operation.

(c) Ten percent of the bolts which have been tightened in the structure shall be tested with the inspection wrench the same day as installed. At least two bolts, selected at random, in each connection shall be tested. If no rotation (nut or bolt head) is noted by job inspecting torque wrench and the faying surfaces are in tight contact the connection shall be accepted as properly tightened. If any nut or bolt head is turned, all bolts in the connection shall be checked, and all bolts whose nut or head is turned shall be tightened and reinspected.

(d) Bolts tightened by the Turn-of-Nut method may reach tensions substantially above minimum torque values specified, but this shall not be cause for rejection.

(e) Care should be taken, however, to not overstress the bolts. If most of the bolts exceed 20% of minimum bolt tension, the contractor's procedures should be reviewed to determine:

(i) Is the snug-tight procedure correct?

(ii) Are there nicks or burrs on the threads?

(iii) Are the nuts or bolts rusty or dirty?

(iv) Check for residual lubrication. All threaded fasteners (black and galvanized) are required to be lubricated. Black bolts and nuts need to have a water soluble oil, and galvanized nuts are to be lubricated as per ASTM A 563. Prelubricated galvanized nuts will be dyed typically to a blue color. If there is no indication of color OR if the color is faded, the bolts shall be field lubricated with bees wax, stick wax, or some other dry lubricant.

(v) Is calibrating device correct?

(4) Bolts and nuts must always be inspected prior to installation. Items of major concern are:

(a) Nicks or burrs in the threads

(b) Rust

(c) Presence of dirt or other foreign material

(d) Fastener lubrication

(e) All dirt, foreign material, and rust must be removed prior to use. Black bolts may require reoiling to remove rust etc. If reoiling is required, excess oil must be removed prior to installation. When rust cannot be removed by oiling, the bolt or nut must be rejected. Bolts or nuts with nicks or burrs on threads must be rejected. Relubrication will necessitate rechecking fasteners in the lot for Rotational-Capacity.

(5) Plan ahead before girder splices have been fully tightened. Make necessary adjustments prior to tightening the bolts in a connection. The best way to assure that beam lines are straight and true is to:

(a) Scribe a line at the center of each bearing on all masonry plates or concrete.

(b) Set beams and make snug tight connections proceeding to the forward pier. Then go back and straighten the beam line, checking to be sure bearings remain centered on their seats. Once the previous span is aligned and tightened, proceed to the next forward span.

(c) Check to be sure beam ends are aligned prior to tightening the splice.

(d) This will require coordination between survey and inspection crews and the contractor.

h. Galvanized Bolts

(1) *When using galvanized hardware, a lubricant approved by ASTM A 563 shall be applied to the nuts.* Galvanized nuts "typically" are delivered to the project pre-lubricated. Usually, pre-lubricated nuts are stained and have a distinguishing color. If a lubricant has been applied at the fabrication shop, a field reapplication is not necessary provided original lubrication has not been removed in some manner. For situations where fabrication shop lubricant is in question, field application of bees wax, stick wax, or some other dry lubrication shall be required. Rotational-Capacity requires the test to be conducted with fasteners in the same condition as they will be during installation.

(2) A WORD OF CAUTION:

(a) Lubrication is required to minimize galling during installation. Since nuts are lubricated (both threads and faces), it is important that nuts be rotated during tightening.

(b) Fasteners (bolts and nuts of any type) shall not be tightened, then removed, reinstalled, and retightened.

G. Welding (*SSHC Subsection 708.03*)

1. Contractors may be allowed to tack weld form hardware to the shear connectors on steel girders. (The intent is to eliminate the request procedure.)

2. This policy does not apply to the rebar stirrups which extend out of the top of prestressed girders.

H. Shear Connectors

1. OSHA has made a determination that shear connectors on steel girders are a tripping hazard. However, OSHA, after receiving petitions from FHWA, AASHTO, and other organizations, issued relief from the field welding requirements. The Department and other transportation agencies were concerned that field welded shear connectors created a bridge that would not be as safe as a bridge with shop welded shear connectors.

2. Girders may arrive on-site with all the shear connectors shop welded and this will not be a citable violation of the OSHA shear connector requirements. It will be considered a “de minimis” violation, or in other words, a minor concern that has a very low probability of occurrence and where expenditure of resources is not warranted to ensure compliance.

3. 100 percent conventional fall protection is required for all workers working overhead (6 feet or higher).

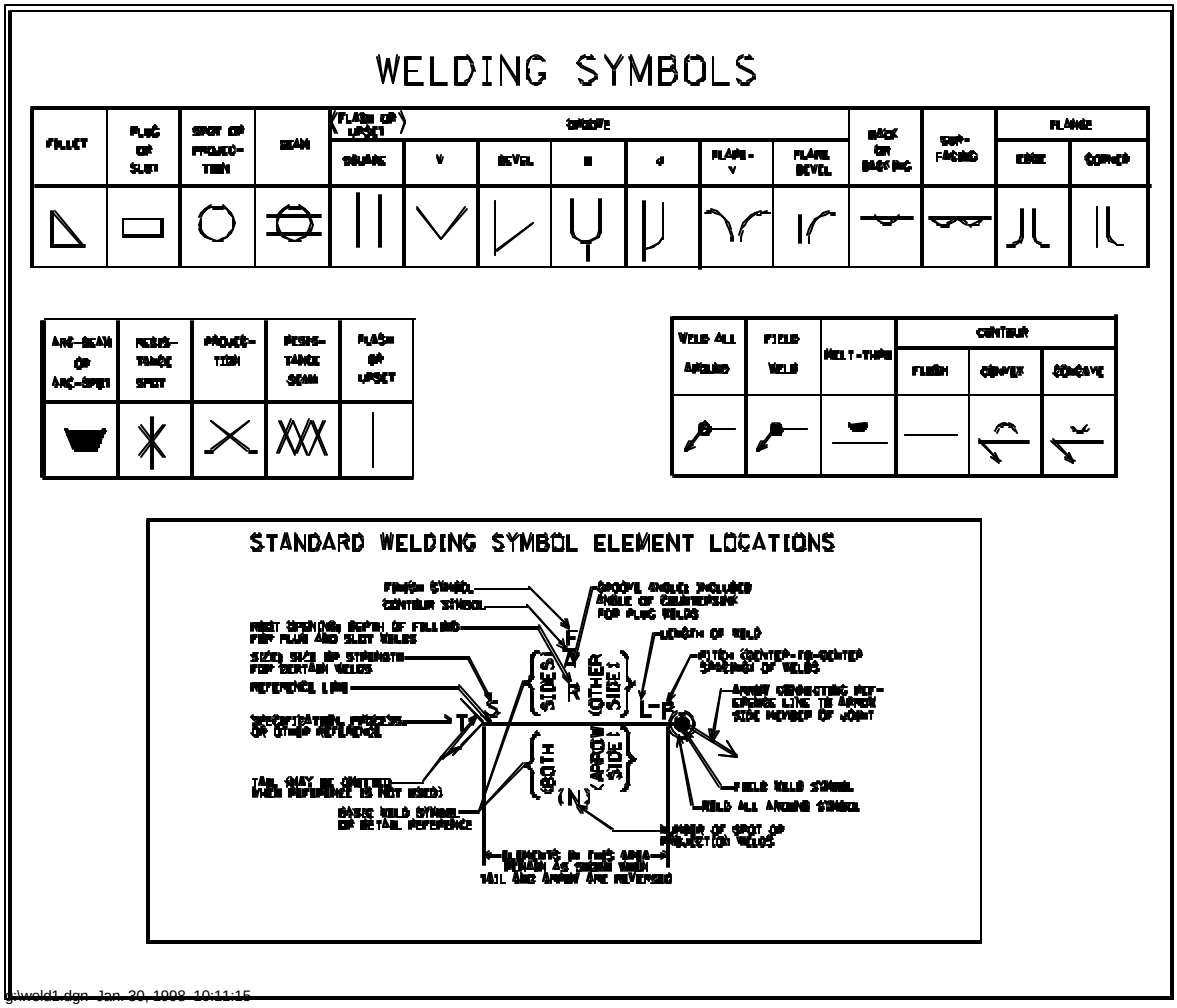
4. Shear connectors may either be shop welded or field welded.

- If they are field welded then the inspector needs to realize that welding shear connectors is a critical operation. The bridge may fail if the shear connectors are not welded properly.

- **Use a “big” hammer to check field welded shear connectors.**

Table 708.01 Shear Connector Checklist		
1.	An arc shield (ferrule) of heat-resistant ceramic or other suitable shall be furnished with each stud. The material shall not be detrimental to the welds or cause excessive slag and shall have sufficient strength so as not to crumble or break due to thermal or structural shock before the weld is completed.	
2.	Only approved studs shall be used. The arc shield used in production shall be the same as used in qualification tests.	
3.	Before installation of the studs, the contractor shall submit to the inspector for approval information on the studs to be furnished as follows:	
	a.	The name of the manufacturer.
	b.	A detailed description of the stud and arc shield.
	c.	A certification from the manufacturer that the stud is qualified as specified in the contract.
	d.	A copy of the qualification test report as certified by the testing laboratory.
4.	The studs, after welding, shall be free from any defect or substance which would interfere with their function.	
5.	Studs shall be end welded to steel with automatically timed stud welding equipment connected to a suitable power source.	
6.	If two or more stud welding guns are to be operated from the same power source, they shall be interlocked so that only one gun can operate at a time and so the power source has fully recovered from making one weld before another weld is started.	
7.	At the time of welding studs shall be free from any rust, rust pits, scale, oil or other deleterious matter which would effect the welding operation.	
8.	Welding shall not be done when the base metal temperature is below 0 degrees or when the surface is wet or exposed to rain or snow.	
9.	When necessary to obtain satisfactory welds, the areas on the beam or girder to which the studs are to be welded shall be brushed or ground free of mill scale or rust.	
10.	The arc shields or ferrules shall be kept dry. Any arc shield which shows signs of surface moisture from dew or rain shall be oven-dried at 250 degrees for two hours before use.	
11.	The first two studs welded on each beam or girder, after being allowed to cool to a temperature of 150 degrees or less, shall be bent 30 degrees by either striking the studs on the head with a hammer or placing a pipe or other suitable hollow device over the stud and manually or mechanically bending the stud.	
12.	When the temperature of the base metal is below 32 degrees, tow studs in each 100 studs welded, shall be bent in addition to the first two bent as specified in paragraph 11 above.	
13.	Studs on which a full 360 degree weld is not obtained shall be repaired by adding a 3/16 inch fillet weld in place of the lack of weld as ling as the repair weld extends 3/8 of an inch beyond the area on each end of where the lack of weld was. The shielded metal-arc process with 7018 or 8018 low hydrogen electrodes shall be used.	
14.	Longitudinal and lateral spacing of studs with respect to each other and to edges of the beam or girder flanges may vary a maximum of one inch from the location shown on the drawings. The clear distance between the studs shall not be less than one inch unless approved by the engineer. The minimum distance from the edge of the stud base to the edge of the flange shall be the diameter of the stud plus 1/8 inch, but preferably not less than 1-1/2 inch.	
15.	Prequalification. Studs which are field applied in the flat (down hand) position to a planar and horizontal surface are deemed prequalified by virtue of the manufacturer's stud-base qualification tests and no further application testing is required. The limit of flat position is defined as 0-15 degree slope on the surface to which the stud is applied.	

Table 708.02 Shear Connector Welder Qualifications	
1.	Before any production studs are welded by an operator, they must first shoot tow studs on a piece of material similar to the production member in thickness and properties. If the actual thickness is not available, the thickness may vary plus or minus 25%. All test studs shall be welded in the same general position as required on the production member.
2.	The test studs shall be visually examined. They shall exhibit a full 360-degree flash.
3.	In addition to the visual examination, the test shall consist of bending the studs after they are allowed to cool, to an angle of approximately 30 degrees from their original axes by either striking the studs on the head with a hammer or placing a pipe or other suitable hollow device over the stud and manually or mechanically bending the stud.
4.	If on visual examination the test studs do not exhibit 360 degree flash, or if on testing, failure occurs in the weld zone of either stud, the procedure shall be corrected, and two more studs shall be welded to separate material and tested again.
5.	If either of the second two studs fails, additional welding shall be continued on separate plates until two consecutive studs are tested and found to be satisfactory before any production welding begins.



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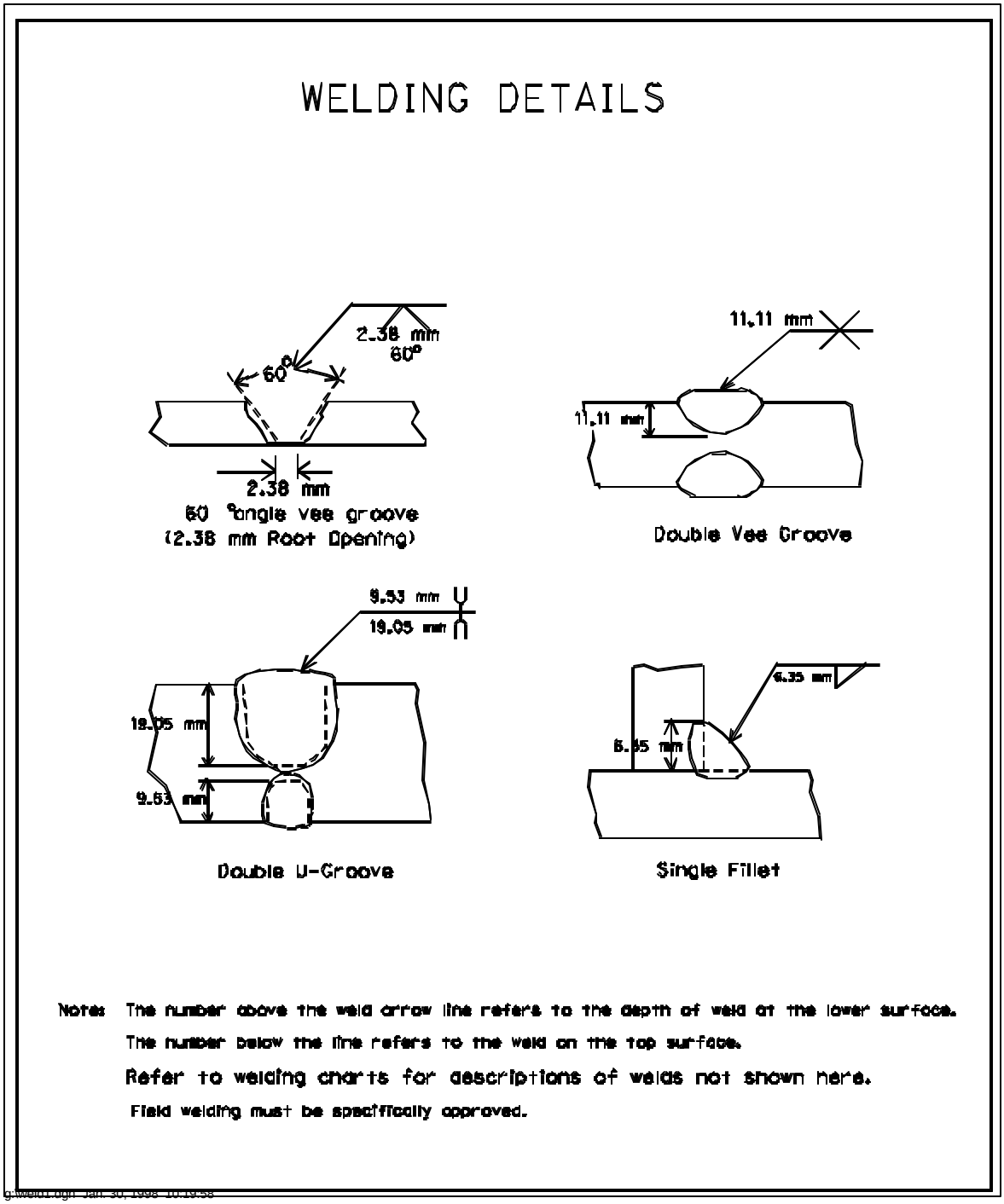


I. Trouble Shooting

1. Many operating variables can affect the quality and appearance of the weld. Methods for correcting undesirable characteristics are discussed in the following paragraphs.

J. Weld Spatter

1. Spatter does not affect weld strength but does produce a poor appearance and increases cleaning costs.

   (a) Be sure to control excessive splatter. Try lowering the current. Be sure the current is within the recommended range for the and size electrode (see attached Table).

   (b) Be sure the polarity is correct for the electrode type.

   (c) Try a shorter arc length.

   (d) If the molten metal is running in front of the arc, change the electrode angle.

   (e) Watch for arc blow.

   (f) The electrode is not too wet.

K. Undercut

1. Generally, the only harm from undercutting is impaired appearance. However, undercutting may also impair weld strength, particularly when the weld is loaded in tension or subjected to fatigue. To minimize undercut:

   (a) Reduce current, travel speed, or electrode size until the puddle is manageable.

   (b) Change electrode angle so the arc force holds the metal in the corners. Use a uniform travel speed and avoid excessive weaving.

L. Rough Welding

1. If polarity and current are within the electrode manufacturer's recommendations but the arc action is rough and erratic, the electrodes may be wet. Try electrodes from a fresh container. If the problem occurs frequently, store open containers of electrodes in a heated cabinet.

M. Porosity and Surface Holes

1. Most porosity is not visible. But severe porosity can weaken the weld. The following practices minimize porosity:

   (a) Remove scale, rust, paint, moisture, or dirt from the joint. Generally use an E6010 or E6011 electrode for dirty steel.

   (b) Keep the puddle molten for a long time, so that gases may boil out before the metal freezes.

(c) Steels very low in carbon or manganese or those high in sulfur or phosphorus should be welded with a low-hydrogen electrode. Minimize admixture of base metal with weld metal by using low currents and fast travel speeds for less penetration.

(d) Try using a short arc length; short arcs are required for low-hydrogen electrodes.

2. Surface holes can be avoided by many of the practices used to minimize porosity.

N. Poor Fusion

1. Proper fusion exists when the weld bonds to both walls of the joint and forms a solid bead across the joint. Lack of fusion is often visible and must be avoided for a sound weld. To correct poor fusion:

(a) Try a higher current and a stringer-bead technique.

(b) Be sure the edges of the joint are clean, or use an E6010 or E6011 electrode.

(c) If gap is excessive, provide better fitup or use a weave technique to fill the gap.

O. Shallow Penetration

1. Penetration refers to the depth the weld enters into the base metal. For full-strength welds, penetration to the bottom of the joint is required. To overcome shallow penetration:

(a) Try higher currents or slower travel.

(b) Use small electrodes to reach into deep, narrow grooves.

(c) Allow some gap (free space) at the bottom of the joint.

P. Cracking

1. Many different types of cracks may occur throughout a weld. Some are visible and some are not. However, all cracks are potentially serious, because they can lead to complete failure of the weld. The following suggestions may help control potential cracking.

2. Most cracking is attributed to high-carbon or alloy content or high-sulfur content in the base metal. To control this type of cracking:

(a) Use low-hydrogen electrodes.

(b) Preheat. Use high preheat for heavier plate and rigid joints.

(c) Reduce penetration by using low currents and small electrodes. This reduces the amount of alloy added to the weld from melted base metal.

(d) To control crater cracking, fill each crater before breaking the arc. Use a back-stepping technique so as to end each weld on the crater of the previous weld.

3. On multiple-pass or fillet welds, be sure the first bead is of sufficient size and of flat or convex shape to resist cracking until the later beads can be added for support. To increase bead size, use slower travel speed, a short arc, or weld 5° uphill. Always continue welding while the plate is hot.

4. Rigid parts are more prone to cracking. If possible, weld toward the unrestrained ends. Leave a 1/32 inch (0.8 mm) gap between plates for free shrinkage movement as the weld cools. Peen each bead while is still hot to relieve stresses.

Q. How to Reduce Arc Blow

1. All arc blow is not detrimental. In fact, a small amount of arc blow can sometimes be used beneficially to help form the bead shape, control molten slag, and control penetration.

2. When arc blow is causing or contributing to such defects as undercut, inconsistent penetration, crooked beads, beads of irregular width, porosity, wavy beads, and excessive spatter, it must be controlled. Possible corrective measures have already been suggested in the preceding text. In general, here are some methods that might be considered:

a. If DC current is being used with the shielded metal-arc process - especially at rates above 250 amperes - a change to AC current may eliminate problems.

b. Hold as short an arc as possible to help the arc force counteract the arc blow.

c. Reduce the welding current - which may require a reduction in arc speed.

d. Angle the electrode with the work opposite the direction of arc blow.

e. Make a heavy tack weld on both ends of the seam; apply frequent tack welds along the seam, especially if the fitup is not tight.

f. Weld toward a heavy tack or toward a weld already made.

g. Use a back-step welding technique.

h. Weld away from the ground to reduce back blow; weld toward the ground to reduce forward blow.

i. With processes where a heavy slag is involved, a small amount of back blow may be desirable; to get this, weld toward the ground.

j. Wrap ground cable around the work piece and pass ground current through it in such a direction that the magnetic field set up will tend to neutralize the magnetic field causing the arc blow.

3. The direction of the arc blow can be observed with an open-arc process, but with the submerged arc process must be determined by the type of weld defect.

4. Back blow is indicated by the following:

   a. Spatter.

   b. Undercut, either continuous or intermittent.

   c. Narrow, high bead, usually with undercut.

   d. An increase in penetration.

   e. Surface porosity at the finish end of weld on sheet metal.

5. Forward blow is indicated by:

   a. A wide bead, irregular in width.

   b. Wavy bead.

   c. Undercut, usually intermittent.

   d. A decrease in penetration.

R. The Effects of Fixturing on Arc Blow

1. Steel fixtures for holding the work pieces may have an effect on the magnetic field around the arc and, thus, on arc blow. Usually, the fixturing causes no problem with stick-electrode welding when the current does not exceed 250 amperes. Fixtures for use with higher currents and with mechanized welding should be designed with precautions taken so that an arc-blow-promoting situation is not built into the fixture.

2. Each fixturing device may require special study to ascertain the best way to prevent the fixture from interfering deleteriously with the magnetic fields. The following are some points to note:

   a. Fabricate the fixture from low-carbon steel. This is to prevent the buildup of permanent magnetism in the fixture.

   b. Welding toward the closed end of "horn type" fixtures reduces back blow.

   c. Design the fixture long enough so that end tabs can be used if necessary.

   d. Do not use a copper strip inserted in a steel bar for a backing. The steel part of the backup bar will increase arc blow.

   e. Provide for continuous or close clamping of parts to be seam-welded. Wide, intermittent clamping may cause seams to gap between clamping points, resulting in arc blow over the gaps.

f. Do not build into the fixture large masses of steel on one side of the seam only. Counterbalance with a similar mass on the other side.

704.04 METHOD OF MEASUREMENT

A. Structural steel is usually measured by the pound (kg). Structural steel for handrail is also measured by the pound. Ornamental handrails are measured by the lineal feet of rail between end posts. These values are listed on the plans and may be used in the final computation for payment.

704.05 BASIS OF PAYMENT

A. PMs are authorized to pay for steel plates and shapes as soon as the material arrives at the fabricator.

B. The Nebraska Department of Roads had determined that it may be possible to improve inspection procedures and to lower construction costs on bridges and other structures where significant quantities of steel are required if stockpiled materials are paid for upon receipt by the fabricator. Therefore, the Department will allow partial payments for stockpiled steel plates and shapes prior to fabrication. The procedure that must be followed before partial payment will be made is as follows:

1. The prime contractor must request partial payment from the Department's Project Manager for the specific project where payment is requested.

2. The Bridge Divisions, Fabrication Inspector [(402)-479-4763] will be responsible for verifying fabricators' invoices and forwarding them to the project managers; for verifying manufacturer's Certified Mill Test Report and forwarding copies to the PM and M&R Division; and for inspection of the steel.

3. The fabricator must provide the Department's Fabrication Inspector the steel manufacturer's paid invoice for the material. The Project Manager will make the payment for the amount shown on the invoice, which directly is attributed to the project for which payment is being considered. The invoice should be annotated to show:

   (a) the project number

   (b) steel quantity in pounds applicable to the project

   (c) material grade

   (d) material heat number

4. There must be identifying marks placed on each piece for which payment will be made.

5. Steel must be stored in orderly fashion to readily facilitate identification of specific materials to specific projects. Project materials cannot be commingled with other projects – each project's materials must have a separate location.

6. The Manufacturer's Certified Mill Test Reports must be provided to and approved by the Bridge Division before payment will be authorized. The Bridge Division will notify the Project Manager when payment is authorized.

7. The Department will verify that the material is properly stored before payment will be made.

8. The Prime Contractor will make payment to the fabricator within 20 days after the Department has paid for the material.

9. Payment is only authorized for materials that are stored within Nebraska as specified in Subsection 109.07 of the Nebraska *Standard Specifications for Highway Construction*.

705.00 REINFORCEMENT (*SSHC Section 707*)

705.01 DESCRIPTION

A. The reinforcement of concrete for structures consists of furnishing and placing deformed metal reinforcing bars or welded-wire fabric in the concrete as required by the plans and specifications.

705.02 MATERIAL REQUIREMENTS (*SSHC Subsection 707.02*)

A. Samples of reinforcing steel and welded-wire fabric are required by the Central Laboratory unless these materials are shipped from tested stock. Generally reinforcing steel has been sampled and tested before shipment to the project, and will arrive with acceptance tags attached. At the time this steel is placed in the work, the structure inspector should collect, record in field book, and submit the tags to the Project Manager. Steel arriving untagged should not be incorporated in the work until approved by the Materials Engineer. See the "*Materials Sampling Guide*".

B. The Materials and Research Division requires that two 6 ft (2.0 m) sample lengths of epoxy-coated reinforcing steel be submitted for testing purposes, and a special provision to that effect will be included in future contracts.

C. Similarly, the *Materials Sampling Guide* requires two 6 ft (2.0 m) sample lengths for uncoated reinforcement bars be provided (unless shipped from tested and approved stock). Enter the date resteel is verified on-site in SiteManager.

705.03 CONSTRUCTION METHODS (*SSHC Subsection 707.03*)

A. Placement and Checking (Bridge Deck)

1. Bridge plans specify nominal slab thickness and nominal clearance of reinforcing bars from face of the concrete. This section will establish acceptable deviations from nominal plan dimensions.

2. Four dimensions must be given special attention when checking placement of bridge slab reinforcing:

   (a) Slab thickness.

   (b) Clearance of bottom reinforcement from bottom of slab.

   (c) Distance from bottom of slab to top of top mat of reinforcement.

   (d) Cover over top mat of reinforcement

B. Slab Thickness

1. This shall be the nominal slab thickness shown on the plans with a tolerance of minus zero and plus ½ inch (13 mm).

C. Clearance of Slab Reinforcement

1. The reinforcing steel shall be placed to monitor the nominal clearances shown in the plans ± ¼ inch (5 mm). Contractors must provide an adequate number of bolsters and/or bar chairs of suitable height and strength to maintain clearance within this range.

2. Contractors must provide an adequate (sag shall be minimal, see *SSHC Figure 707.01*) number of bar chairs of suitable height and strength to maintain the distance within this range of tolerance.

D. Protection of Material (*SSHC Subsection 707.03*)

1. The Specifications provide that steel reinforcement shall be protected at all times from damage. When placed in the work, it shall be free of dirt, loose scale, detrimental rust, paint, oil or any foreign material. Detrimental rust is defined as heavy reddish coating formed on iron or steel when chemically attached by moist air. This must be removed by wire brushing. However, a light layer of rust or mill scale that is not readily removed with a wire brush is acceptable.

E. Placing and Fastening (*SSHC Subsection 707.03*)

1. Positioning - It is essential that inspectors give special attention to the placement of reinforcing steel in all structures. Reinforcement shall be placed in the exact position shown in the plans and held securely in that position to preclude movement or shifting during placement of the concrete. On a 7 inch (175 mm) thick bridge floor, designed with the top steel 1 ¾ inch (45 mm) below the surface, a sag or displacement in the top steel of only ½ inch (13 mm) will reduce the strength of the floor 19 percent. The reduction in strength of thinner sections such as culvert slabs and walls is even more critical.

2. Present policy is to tie all bar intersections except when the bar spacing is less than 12 inches (300 mm) in both directions in which case alternate intersections may be tied. This requirement is enforceable through *SSHC Subsection 707.03* in that it specifically defines the frequency of tieing. The Project Manager should thoroughly study the project documents in order to be aware of this requirement as well as any change which might occur in this revision.

3. Horizontal reinforcement in slabs shall be spaced vertically by means of approved metal chairs. The type and adequacy of bar support systems which includes the spacing of bar supports shall be in accordance with the Concrete Reinforcing Steel Institute's "Manual of Standard Practice", unless other stipulations are provided in the contract provisions. A copy of this manual may be obtained from the District Construction Engineer. Bar supports which are located at exposed concrete surfaces shall be galvanized, plastic coated or stainless steel to a depth of ½ inch (13 mm) minimum from the concrete surface. Chairs may also be used to keep vertical columns and wall steel from contacting the form.

4. Field welding will be permitted only when shown on the plans or with written permission of the Construction Engineer. Reinforcement can best be checked as the work progresses rather than waiting until the contractor has enclosed the reinforcement with forms. In the case of walls and columns it is virtually impossible to do the checking after the forms are in place. When bent bars are used, a check should be made that there are no cracks or splits at the bends. Stirrup hooks should be rotated to different positions in order that the hooks do not fall in the same location when a series of stirrups are used in beams or columns.

5. No welding will be allowed on the main vertical steel of high mast lighting tower foundations except at the very top and bottom where the end loops may be tack welded. If a more rigid cage is desired, additional vertical steel will be required to act as the frame and lifting points for the cage. The required loops may be tack welded to this additional vertical steel. The required vertical steel will then need to be wire tied to the tack welded loops.

6. Welding of all loops, other than the top and bottom loop, to the required vertical steel will not be allowed. Additional bracing may be tack welded to the added vertical bars, if required. The added vertical bars should be sized to support the required load.

7. *SSHC Subsection 704.03* requires the contractor to give the Project Manager sufficient advance notice before starting concrete operations in any unit of a structure, to permit the inspection of forms and reinforcing bars. The Project Manager shall require all reinforcing steel to be accurately placed and firmly held in position.

F. Special Attention Areas

1. Tie-Downs and Supports

   a. *SSHC Subsection 707.03* require that the top mat of reinforcing steel is to be tied down at not greater than 4 feet (1.2 m) spacing measured in each direction. This requirement can partially be met by wiring the top mat down to shear lugs at 4 feet (1.2 m) spacing along the beam. Regardless of beam spacing, the top mat must be tied to the forms or the bottom reinforcing mat at 4 feet (1.2 m) spacing. Likewise, the top reinforcing mat is to be tied to the bottom reinforcing mat on a 4 feet (1.2 m) grid in floors of concrete slab bridges. Tying should include bars near the ends of the bridge and bars near the curbs. **At least 50 percent of the bar contacts must be tied unless the spacing is more than 1 ft (300 mm) and then every bar contact must be tied.**

2. Epoxy Coated Bar

   a. Epoxy coated reinforcing steel requires the use of epoxy or plastic coated bar supports and tie wires (*SSHC Subsection 707.03*). Epoxy coated tie wires may tend to slide or break. If this occurs, they should be double tied or stronger ties used.

3. Clearance Check

   b. The specified clear distance from surface to reinforcing steel must be maintained. To check this, a clearance guide ¼ inch (5 mm) less in thickness than the specified clearance to top steel should be temporarily fastened to the bottom of the finishing machine screed. The finishing machine should then be operated along the bridge to insure that proper clearance is obtained. It will be necessary to bend all tie wire loops down to permit the clearance gauge to pass. Any steel not properly placed must be corrected.

4. Checks During Placement

   a. Checks of slab thickness and cover over top reinforcement must be made in the finished concrete directly behind the finish machine. A thickness and cover check should be made at the same location of an approximate grid of 10 ft (3 m) transverse and 20 ft (6 m) longitudinal. These checks must be documented in the field book. When the slab is of deficient thickness or cover checks indicate incorrect rebar placement corrections must be made immediately.

5. Cleaning Forms and Steel

   a. Mud and other foreign material must be removed from the steel and forms prior to placement. Remove any trapped/ponded water before placing the concrete.

G. Epoxy-Coated Reinforcement (*SSHC Section 1021*)

1. Epoxy coatings are applied to reinforcing bars by a fusion-bonded process. This means the coating achieves adhesion to the bar as a result of a heat-catalyzed reaction. Besides chemical adhesion, there is also physical adhesion of the coating to the bar.

H. Care and Handling

1. Epoxy coated bars are subjected to many quality control tests and inspections prior to leaving the supplier's facility. However, from that point forward, careless handling and construction practices can cause excessive coating damage. Contractors should be strongly encouraged to exercise care in handling, storage, and placing of epoxy coated bars. If problems are noted after delivery, the inspector is to contact the Materials and Research Division.

2. Handling

   a. During unloading epoxy coated bars from the truck, care must be exercised to minimize scraping of the bundles or bar-to-bar abrasion from sags in the bundles. Skidding bundles from the truck onto the ground should not be allowed. Use of power hoisting equipment for unloading and handling is strongly encouraged. Further, equipment for handling the bars should have

protective contact areas. Specifically, nylon slings or padded wire rope slings should be used and bundles should be lifted at multiple pick-points.

3. Storage

a. Epoxy coated bars should be stored on timbers or other suitable protective cribbing. All types of reinforcing bars should be stored off the ground as close as possible to the area where they will be used. The following storage practices are suggested to prevent damage:

b. Store bars above the ground on timbers, cribbing, or dunnage placed close enough together to prevent sags in the bundles.

c. If a large quantity of bars has to be stored in a small area, bundles can be stacked if adequate blocking is placed between the layers.

d. While fading of the coating's color is not specifically detrimental, it should be avoided to the fullest extent possible. One recommended method is to cover exposed bundles with burlap or dark plastic.

NOTE: If plastic or other nonporous material is used for covering, the ends must be left open to allow air movement. Without this, condensation under the cover could cause damage.

e. Long-term site storage (from one year to the next) of epoxy coated bars is not recommended.

4. Placing

a. Placing of epoxy coated bars is done similar to uncoated bars. The KEY exception is that coated bars require more careful handling and placing. Once bundles have been opened, dragging one bar over another or over any abrasive surface MUST be avoided.

b. After epoxy coated bars are placed, walking on the bars by construction personnel should be held to a minimum. Bars in high traffic areas or runways for concrete placement should be protected with plywood or other suitable material. Concrete placement equipment shall not be placed on, or supported by, any reinforcing steel.

c. Bar supports and tie wires for epoxy coated reinforcement shall be coated with epoxy, nylon, or plastic.

I. Field Inspection

1. Epoxy coated bars should be inspected for damaged coating:

a. when received at the job site, and

b. after they are placed in the structure.

2. Damage Evaluation and Repair

a. Damaged coating shall be evaluated as outlined below. The "holiday detector" should be used to determine coating flaws.

b. Bent Bars

(1) Examination of physical coating condition on the outside radii of hooks and other bends might reveal cracks in the coating. When cracking of the coating is evident, the contractor must remove loose coating, clean the area, and repair.

c. Fading of Color

(1) When epoxy coated bars are exposed to sunlight over a period of time, fading of the color may occur. Since discoloration does not harm the coating nor affect its corrosion protection properties, such fading will not be cause for rejection.

d. Damaged Ends

(1) Damage to ends because of field shearing, dragging or whatever must be repaired in the field.

J. Repair of Damaged Coating

1. When a damaged coating must be repaired, the patching or touch-up material should be applied in strict accordance with the instructions furnished by the manufacturer. Generally, surface preparation consists of a **THOROUGH** manual cleaning of damaged areas, including complete removal of: (1) unbonded epoxy and (2) all rust. Cleaning is usually accomplished with a power driven wire brush, hand steel brush, and/or emery paper. Care should be exercised during preparation so that excessive sound epoxy is not damaged. Acceptance criteria for epoxy repair and touchup materials is in accordance with the original epoxy resin manufacturer's recommendations.

2. Epoxy coated reinforcing steel is used in concrete bridge decks to prevent spalling of the concrete which is, in turn, caused by the corrosion of the reinforcing steel. The epoxy coating prevents the corrosion of the reinforcing steel. Two factors influence the capability of the coating to prevent corrosion. One of these factors is the thickness of the coating. The other factor is the integrity of the coating, i.e., the absence or presence of defects in the coating which would allow moisture and de-icing chemicals to reach the metal itself.

3. The epoxy coating on the rebars may have three types of defects when the bars arrive at the site. One of these is defined in the Specifications as a "holiday." A holiday is a small hole in the coating which is not visible to the naked eye. This type of defect is the result of some inadequacy in the application process. Holidays can be detected only with an electronic detector and the Specifications permit two holidays per 1 foot (300 mm).

4. The second type of defect, which may be present in the epoxy coating when the bar arrives at the site, is defined as handling damage. Handling damage may take the form of scuffs, scars, scratches or any other wound to the coating caused by rough handling. The Specifications permit a "reasonable" amount of handling damage. Handling damage is generally visible to the naked eye since rust will form over the damaged spot after a sufficient amount of time passes. A fresh cut or scar in the coating would probably be difficult to locate visually, but would be readily picked up with an electronic detector.

5. The third type of defect, which may be present in the epoxy coating when the bar arrives at the site, is due to what may be considered as an "uncoatable" bar. During the rolling process, some bars are formed with very sharp edges on the deformations and ribs.

6. These edges are very difficult to coat adequately, and coating applicators usually avoid coating bars so formed. The defect in coating on these edges may or may not be visible to the naked eye. This particular defect can be detected with an electronic detector. When this defect is present, the detector will indicate this flaw by a constant 'beeping' when run along a rib. In most instances, the thickness of the epoxy coating will be very low in these areas or there may be no coating at all where the sharp edges are present.

7. Materials and Research Division personnel will inspect epoxy coated rebars at the coating applicator's plant in some, but not, all cases. In cases where inspection is made at the applicator's plant, the bars will have a maximum of two holidays per meter, plus handling damage, is allowed, when they arrive at the site. In addition, the coating thickness, on bars inspected at the applicator's plant, must meet the specification requirements for thickness of coating. Bars not so inspected at the applicator's plant will have an unknown number of holidays and possibly uncoated sharp edges plus handling damage when they arrive at the site and, in addition, the coating thickness will not have been checked. Bars that contain rolling defects or have uncoated sharp edges that are found during the inspection shall be rejected.

8. The basis for acceptance will be the total of defects per 1 foot (300 mm) of bar, i.e., holidays plus handling defects as located with the electronic detector.

9. A total of six defects in any 1 foot (300 mm) of the bar will be permitted. As an example, in a bar of given length, if any 1 foot (300 mm) section of that bar has no more than the two allowable holidays and four handling defects, the bar is acceptable, providing none of the four handling defects has an area greater than 0.0025 $ft.^2$ (225 mm^2). [A square measuring 0.05 ft x 0.05 ft (15 mm x 15 mm) has an area of 0.0025 $ft.^2$ (225 mm^2)]. All handling defects having an area greater than 225 mm^2 must be repaired.

10. The following points may be helpful in the inspection and repair of epoxy coated rebars in the field.

    a. Inspect bars for coating defects, using the electronic detector, as they come out of the bundle.

b. It may not be necessary to check all bars in each bundle, but enough bars out of each bundle should be checked in order to determine the quality of coating on all bars in the bundle.

c. When the number of defects per 1 foot (300 mm) section exceeds six, only the number of defects necessary to bring the bar into compliance need be repaired. Only exception is that all defects greater than .00005 in^2 (.035 mm^2) must be repaired.

d. Repair of defects is accomplished with an approved two component epoxy compound supplied by the coating manufacturer.

e. Epoxy compounds used for repair have a minimum temperature at which they may be used and a limited pot life, as recommended by the manufacturer.

f. Any rust showing through the defect must be removed before applying the epoxy compound. A file or grinding wheel may be used provided no substantial reduction in the area of the bar occurs.

g. Coating thickness of the painted repair area must be as specified for the factory applied coating.

h. Coating on bars may be damaged during placement at the site. Such damage to the bars must be repaired when the bars are in place, if the six defects per 1 foot (300 mm) section limitation is exceeded.

i. Check coating thickness if bars were not inspected at the coating applicator's plant. This should be done as they come out of the bundle. Coating thickness is checked with a magnetic thickness gage.

j. To obtain a holiday detector, contact the nearest branch laboratory or the Construction Division. "Electometer" magnetic thickness gages may be obtained by requisition from the Engineering Equipment Section, "Inspector" or "Microtest" thickness gages which are used for checking paint film thickness cannot be used for checking epoxy coating thickness on reinforcing steel.

11. For situations where there is no information available as to what type of touch-up material should be used, 3M Corporation has two products available:

a. SCOTCHKOTE 213 is often used to repair minor nicks and gouges.

b. SCOTCHKOTE 312 is a two component epoxy that has been used to repair both small and large areas of damage.

NOTE: Repaired areas do not have as much corrosion or abrasion resistance as factory-applied coatings.

K. Bar Designation System

1. You must be very careful when you review a bar list. Currently, steel bar in the USA is usually measured in English units. Do not assume anything; measure to be sure you are getting the correct size. In general, the mark number for reinforcing bars as shown in the plans generally uses the following designation system. The first letter or letters identify the general location of the bar such as abutment, pier, or slab bar.

Location	Code
Abutment	A
Pier	P
Slab	S

2. The first number or numbers indicate the size of the bar and the last two numbers indicate whether the bar is bent or straight. (Even numbers are straight bars and odd numbers are bent bars.)

3. For example, P1002 would be a straight No. 10 bar located in the pier; A415 would be a bent No. 4 bar located in the abutment. The last two numbers also indicate the approximate length of the bar. The lower the number the longer the bar; for example, a S602 bar would indicate the longest, straight, No. 6 bar used in the slab, whereas a S612 bar would indicate that there are five groups of straight, No. 6 bars that are longer than the S612 in the slab. The reinforcing steel table in *Appendix 4* lists pertinent information concerning the standard bar designation system.

L. Splicing

1. All reinforcement shall be furnished in the full lengths indicated in the plans. Splices, not shown in the plan, shall not be allowed without approval of the Project Manager. Welding shall be allowed only if shown in the plans or authorized by the Construction Engineer in writing.

2. When splices are required, they should be staggered as far as possible in order that a plane of weakness is not caused in the member. The laps should be at least as long as is shown in the plans and if no lap is shown, the bars should be lapped as required in *SSHC Subsection 707.03*. Splices should preferably be made in areas of low stress concentration. The bars in the top of a slab or beam should be spliced in a positive moment section (bottom of slab or beam in tension) and the bars in the bottom of a slab or beam should be spliced in a negative moment section (top of slab or beam in tension). For example, the longitudinal bars in the top of a slab should be spliced near the center of the span rather than over a pier and the longitudinal bars in the bottom of the slab should be spliced near the pier rather than in the middle of a span. Following is a tabulation of 24 and 36 diameter lap requirements for the various sizes of rebars.

ASTM Standard Reinforcing Bars				
		Nominal Dimensions - Round Sections		
Bar Size Designation	Weight Pounds per Foot	Diameter Inches	Cross-Sectional Area - Sq. Inches	Perimeter Inches
#3	.376	.375	.11	1.178
#4	.668	.500	.20	1.571
#5	1.043	.625	.31	1.963
#6	1.502	.750	.44	2.356
#7	2.044	.875	.60	2.749
#8	2.670	1.000	.79	3.142
#9	3.400	1.128	1.00	3.544
#10	4.303	1.270	1.27	3.990
#11	5.313	1.410	1.56	4.430
#14	7.650	1.693	2.25	5.320
#18	13.600	2.257	4.00	7.090

LAP REQUIREMENTS			
Metric Bar Size	English Bar Size	24 Diameter Lap Grade 40 Steel	36 Diameter Lap Grade 60 Steel
10	2	6 in (150 mm)	9 in (225 mm)
10	3	9 in (225 mm)	14 in (350 mm)
10	4	12 in (300 mm)	18 in (450 mm)
15	5	15 in (375 mm)	23 in (575 mm)
15	6	18 in (450 mm)	27 in (675 mm)
25	7	21 in (525 mm)	32 in (800 mm)
25	8	24 in (600 mm)	36 in (900 mm)
30	9	27 in (675 mm)	41 in (1025 mm)
30	10	30 in (750 mm)	44 in (1100 mm)
35	11	33 in (825 mm)	49 in (1225 mm)

3. There are times when splicing of rebar in a manner other than lapping is necessary. Examples include:

   a. Complicated placement where the cage could be tied off site, in sections, and set in place.

   b. Reinforcement cages for drilled shafts.

   c. Situations where an existing rebar is not long enough to develop strengths by lapping.

4. Example: During removal of an existing curb on a bridge deck widening project existing rebar is either cut with the saw or broken during concrete demolition. In this case additional demolition is needed to provide a lap development length.

5. Mechanical splices are only authorized where shown in the plans and materials must be in the NDR Approved Products List. Currently, several couplers are manufactured which can be used to mechanically splice rebar. Mechanical splices, for field approval, shall develop 125% of the rebar's yield strength. Consideration for splice usage must be initiated by the contractor. The Project Manager is to forward that request to the Construction Division for review.

705.04 METHOD OF MEASUREMENT (*SSHC Subsection 707.04*)

A. Reinforcing steel for concrete structures is measured by the pound. Quantities to be paid for are computed from the theoretical mass of bars and wire mesh. The mass of steel reinforcement required for structures of varying sizes is usually given in tables on standard and special plans. The quantities contained therein may be used for computing final payment for structures except bridges. Plan quantity may be used for final quantity reinforcing steel for bridges.

706.00 CONCRETE CONSTRUCTION (*SSHC Section 704)*

706.01 DESCRIPTION

A. This section of the Specifications deals with the construction of structures composed of portland cement concrete. This work includes constructing, setting and supporting the forms, and handling, placing, finishing and curing the concrete for bridges, box culverts, arch culverts, headwalls, retaining walls and steps, and the miscellaneous structures listed in the incidental construction portion of the Specifications.

706.02 MATERIAL REQUIREMENTS

A. Composition of Concrete

1. The class of concrete to be used in the work is specified in the plans or special provisions and shall be one of those described in *SSHC Subsection 1002.02*. In the event that the contractor has a choice of several classes, he/she is required to advise the Project Manager by letter of the one to be used. This information should be obtained prior to any concrete construction to allow engineering personnel to make provisions for necessary inspection and testing. The contractor may not change classes of concrete during construction without the written permission of the Project Manager.

2. *SSHC Subsection 1002.03* prescribes requirements for concrete materials. The Contractor's responsibility for material requirements may be summarized as follows:

   a. Check with Materials & Research as to the approval of cement, coarse aggregate, fine aggregate, air-entraining agent and curing compound.

   b. Submit samples of non-approved materials to the Central Testing Laboratory in sufficient time before use to allow time to receive results. The size and frequency of samples are provided in the "*Materials Sampling Guide*".

   c. Materials for which approval has not been received must not be used in the work.

3. The inspector is concerned not only with the approval of materials but also with the storage of materials. Bag cement shall be stored in a dry location. If stacked more than 8 bags high for a period of time the lower layers take on a "warehouse set" and should not be used. Cement stored over 90 days must be retested before use.

B. Admixtures

1. Admixtures are those ingredients in concrete other than portland cement, water, and aggregates, that are added to the mixture immediately before or during mixing. Admixtures typically encountered on our jobs can be classified by function as follows:

   a. Air entraining admixtures (optional)

   b. Water reducing admixtures (optional)

c. Set retarding admixtures (required)

d. Set accelerating admixtures (optional)

e. Finely divided and permeability mineral admixtures (Fly Ash & Silica Fume) (optional)

f. Coloring agents (normally not used for NDR work) (optional)

2. The amount of any admixture used in a mix should be as recommended by the manufacturer. Effectiveness of an admixture depends upon such factors as type, brand, and amount of cement; water content; aggregate shape; gradation and proportions; mixing time; slump; and temperatures of concrete and air.

3. Concrete with a low air content shall not be incorporated into work. One addition of air entraining admixture is allowed at the site according to specification.

4. Concrete with a high air content should not be incorporated into work except under extreme circumstances. If low compressive strengths result, the concrete may be required to be removed and replaced. (*SSHC Subsection 106.05*)

C. Air Entraining Admixtures

1. Air entraining admixtures are used to purposely entrain microscopic air bubbles in concrete. Air entrainment will dramatically improve the durability of concrete exposed to moisture during cycles of freezing and thawing. Entrained air greatly improves concrete's resistance to surface scaling caused by chemical deicers.

2. Rules-of-Thumb

a. As cement content increases, air agent must increase to maintain equal entrained air.

b. As cement fineness increases, the amount of air agent must increase to maintain equal entrained air.

c. As coarse aggregate size decreases, the air content increases for a given amount of air agent.

d. As fine aggregate volume increases, the air content increases for a given amount of air agent.

e. As mixing water increases, the air content increases for a given amount of air agent.

f. Air entraining admixtures should be introduced into mix at the plant, but additional may be added at the site to adjust mix for correct air content.

g. Air entraining admixtures should (usually) be added to the front of the truck at the plant. If corrosion inhibiting admixture is used, air entraining agents should be added to the back of the truck.

D. Water Reducing Admixtures (Type A) (optional)

1. Water reducing admixtures are used to reduce the quantity of mixing water required to produce concrete of a certain slump or reduce the water/cement ratio. Regular water reducers reduce water content by about 5% to 10%.

2. Adding a water reducing admixture to a mix without reducing water content can produce a mixture with a much higher slump.

   a. Rules-of-Thumb

      (1) Typically, water reducing admixtures do not reduce the rate of slump loss; in most cases, it is increased. Rapid slump loss results in reduced workability and less time to place concrete at the higher slump.

      (2) Typically, water reducing admixtures decrease on bleed water because less water is available.

      (3) Certain types of sulfate starved portland cements may cause false set with certain brands of water reducers. Typically, water reducers contain lignosulfonates and these sulfates are easily attracted by sulfate starved cements. This action may cause early false set.

      (4) Despite reduction in water content, water reducing admixtures can cause a significant increase in drying shrinkage.

E. High Range Water Reducing Admixtures (Type F) (optional)

1. They are added to concrete with low-to-normal slump and water content to make high slump "flowable" concrete. Flowable concrete is a highly fluid, but workable concrete that can be placed with little or no vibration and can still be free of excessive bleeding or segregation. Flowable concrete has applications:

   a. In areas of closely spaced and congested reinforcing steel.

   b. In tremied concrete where "self consolidation" is desirable.

   c. In pumped concrete to reduce pump pressure.

   d. To produce low water/cement ratio - high strength concrete. High-range "super plasticizers" can reduce water content by about 12% to 30%.

2. Rules-of-Thumb

   a. The effect of most super plasticizers in increasing workability or flowable concrete is short lived. Typically, maximum is 30 to 60 minutes followed by a very rapid loss in workability.

b. Typically, super plasticizers are added as split treatments (part at the plant part at the site). Sometimes the addition is totally at the site.

c. Setting time may be affected depending on the brand used, dosage rate, and interaction with other admixtures.

d. Excessively high slumps of 10 inches (250 mm) or more may cause segregation.

e. High-slump, low water/cement super plasticized concrete has less dry-shrinkage than does high-slump high water/cement conventional concrete.

f. Effectiveness of super plasticizer is increased with an increased amount of cement and/or increased fineness of cement.

g. Effectiveness of water reducers on concrete is a function of their chemical composition, cement composition and fineness, cement content concrete temperature, and other admixtures being used.

h. Some water reducing admixtures, such as lignosulfonates, may also entrain some air in the mix.

F. Retarding Admixtures (required)

1. Retarding admixtures (retarders) are used to delay the initial set of concrete. High temperatures of fresh concrete 85°F (30°C) and up often cause an increased rate of hardening. Since retarders do not decrease the initial temperature of concrete, other methods of counteracting the effect of temperature must be used.

2. Rules-of-Thumb

a. Retarders are sometimes used to delay initial set of concrete when difficult, long placement times, or unusual placement conditions exist.

b. Retarders offset the set acceleration effect of hot weather.

c. Retarders can be added at the site.

d. In general, some reduction in strength at early ages (one to two days) accompanies the use of retarders.

e. Use of retarders must be closely monitored, because there is probably no single admixture which has caused more field problems.

f. If too much retarder has been used in a mix:

(1) Time will usually counter the effects.

(2) Be sure to maintain the cure during the added time.

G. Accelerating Admixtures (optional)

1. Accelerating admixtures (accelerators) are used to accelerate the setting time and strength development of concrete at an early age. Strength development can also be accelerated by using:

   a. Type III "high-early" cement

   b. Lowering water/cement ratio

   c. Curing at controlled higher temperatures

2. Calcium Chloride ($CaCl_2$) is the material most commonly used in accelerating admixtures. Besides accelerating strength gain, calcium chloride also causes an increase in drying shrinkage, potential reinforcement corrosion, discoloration, and potential scaling.

   a. Rules-of-Thumb

      (1) Always add calcium chloride in solution form as part of the mixing water.

      (2) Calcium chloride is not an antifreeze agent. When used in allowable amounts, it will only reduce the freezing point of concrete by a few degrees (may cause deck cracks).

H. Finely Divided Mineral Admixtures

1. These admixtures are powdered or pulverized materials added to concrete to improve or change the properties (plastic or hardened) of concrete. Based on the mineral's chemical or physical properties, they are classified as: (1) Cementitious, (2) Pozzolans, (3) Pozzolanic and Cementitious, and (4) Nominally inert. Typical PCC mix designs use pozzolanic and cementitious minerals.

2. Pozzolanic Materials

   a. A pozzolan is a siliceous or aluminosiliceous material that in itself possesses little or no cementitious value but will, in finely divided form and in the presence of water, chemically react with the calcium hydroxide released by the hydration of portland cement to form compounds possessing cementitious properties. Pozzolans include fly ash and silica fume.

3. Fly Ash (Class C & F)

   a. Fly ash is a finely divided residue that results from the combustion of pulverized coal in electric power plants.

4. Silica Fume

   a. Silica fume, also referred to as micro-silica or condensed silica fume, is another material that is used as a pozzolanic admixture. This light to dark gray powdery product is a result of the reduction of high-purity quartz with coal in an electric arc furnace.

b. Fly ash and silica fume have a spherical shape. Silica fume has an extremely small particle size (about 100 times smaller than the average cement particle). Although silica fume is normally in powder form, because of its small size and increased ease of handling the product is commonly available in liquid form.

c. Rules-of-Thumb

(1) Mixes containing fly ash will generally require less water (about 1% to 10%) for a given slump. Silica fume concrete requires more water for a given slump.

(2) The amount of air-entraining admixture required to obtain a specified air content is normally greater when fly ash or silica fume is used. The amount of air-entraining admixture for a certain air content is a function of the fineness, carbon content and alkali content.

(3) Fly ash will generally improve the workability of concretes of equal slump. However, fly ash in low slump concrete will tend to tear and have reduced workability. Silica fume tends to reduce workability, thus high-range water reducers are usually added to maintain workability.

(4) Concrete using fly ash or silica fume generally shows less segregation and bleeding than plain concrete.

(5) Use of fly ash will reduce the amount of heat buildup in concrete. Silica fume most likely will not reduce the heat of hydration, because typically high-range water reducers are used and they increase mass temperatures.

(6) Use of fly ash will tend to generally retard the setting time of concrete. Silica fume alone will accelerate the setting time, however, high-range water reducers tend to offset this.

(7) Use of fly ash generally aids the pumpability of concrete. With adequate and correct curing, fly ash generally reduces the permeability. Silica fume is especially effective in this regard.

(8) With adequate and correct curing, fly ash generally reduces for permeability. Silica fume is especially effective in this regard.

I. Concrete Temperatures

1. Recommended Concrete Temperatures

a. Concrete should be between 45°F and 80°F (7°C and 27°C) when placed. To ensure a concrete temperature of at least 50°F (10°C) for 72 hours after placement the concrete for thin sections such as culvert walls, end posts, piling encasements, etc. should be 65°F (18°C) or higher, since the only additional heat source is the heat of hydration. Concrete for massive sections such as abutments, heavy piers, and footings should be in the 55° to 65°F (13° to 18°C) range.

b. Since only dry insulation is effective, any insulation that has a propensity to absorb water or become saturated must be protected with a waterproof membrane. The insulation system must provide complete coverage and be secured to provide maximum protection during the full curing period.

c. For typical protection applications, insulated forms must be left undisturbed for 96 hours before being removed.

2. Checking Temperature of Concrete

a. For checking compliance with minimum temperature requirements during the 48-hour period after placement thermometer wells should be cast in the concrete during the pour. The following procedure for checking temperature is suggested:

(1) Drill a 5/16 inch (8 mm) hole through the form at one or more locations where temperature checks will be made.

(2) Grease the thermometer probe and insert it through the hole about 4 inches (100 mm) into the plastic concrete.

(3) Remove probe after the concrete is set and cover hole with insulating material.

(4) Further checks can be made by inserting the thermometer through the insulation into the well developed in step 2. Leave thermometer in place if desired, but protect from damage or theft.

NOTE: The thermometer stem should be inserted about 3 inches (75 mm) into the concrete because the sensitive portion of the stem is about 1¾ inch (44 mm) below the groove.

b. Record the temperature daily for 5 days following the pour. Temperature readings below 50ºF (10°C) during the first 48 hours should be entered in the Field Book and reported to the District Construction Engineer for evaluation of possible damage or price adjustment.

c. A thermocouple - - with recorder can also be used to document temperatures during curing.

3. Deck Concrete Temperature and Curing

   a. Subsection 706.03 identifies requirements for placing and curing concrete bridge floors. Of importance for this section are:

      (1) Plastic concrete, when placed, shall not exceed 86°F (30°C).

      (2) The curing method requires "wet" burlap cure for four (4) days.

      (3) If the forecast high outside air temperature for the day is predicted to be above 80°F (26°C) the contractor should cast the deck starting at 5:00pm.

   b. The placing of concrete will require close monitoring to comply with the specifications. Obtain a weather report to determine predicted air temperature, wind velocity, and relative humidity for the pour day.

   c. The above information should be discussed by the inspector, contractor, and ready mix plant operator before a deck pour. The pour should not be attempted if concrete temperature is predicted at 86°F (30°C) or higher and predicted air temperature is above 86°F (30°C).

4. Temperature Field Documentation

   a. The temperature of concrete should be taken as soon as concrete is placed. It should be taken when the first load is placed. Additional checking is warranted if the temperature is running at or near maximum. Air temperature should also be taken about the same time as the concrete temperature.

5. Maximum Air Temperature--No continuous placement is to be attempted when temperature forecast is above 86°F (30°C).

   a. Working time of concrete varies with the temperature of concrete, and concrete temperature varies with the temperature of different materials used in the mix. In order to determine the dosage rate of retarder, an estimate of the mix temperature must be made. The following are suggested estimating methods:

      (1) The temperature of concrete from previous placements could be taken.

      (2) If a ready mix producer is placing concrete the day before a deck placement, this concrete could be checked for concrete temperature.

   b. Regardless of the method used, make the best estimate of what the concrete temperature will be during the warmest part of the day. Remember, concrete shall not be placed in new decks if the concrete temperature is above 85°F (30°C).

706.03 CONSTRUCTION METHODS

A. Prepour Meeting

1. It is very important to use the prepour meeting to discuss the specifics of placement, establish communication, and resolve potential "sticky" issues prior to placement. Generally it is recommended to discuss:

   a. Chain-of-command. Who is in charge for the contractor? Who needs to be notified if material tests do not comply with specifications? Establish prior to placement how test results are reported (i.e., does the Contractor want to be notified verbally, or in writing each time?).

   b. More cement paste will cause more cracks and less paste means fewer cracks.

   c. Material requirements and admixtures needed for the placement (Examples: Single cement source, concrete temperature and methods used to cool the mix, source and amount of any admixtures, specific mixes required for bridge decks, etc.)

   d. Vibration can make a stiff mix workable with better results than adding water.

   e. Procedures for introducing admixtures during mixing operations need to be discussed and formalized. For example: How and where will the air entraining agent be introduced? There is a growing concern that placement location of admixtures is causing significant variability in mixes. The plant monitor must watch and document how admixtures are introduced during mixing.

   f. Method and frequency of acceptance testing during any placement. Inform the Contractor what is expected if non-acceptable material is found during placement.

   g. Scheduling, truck availability, placement method, and required placement rates.

   h. Establish an acceptable source of preplacement weather forecasting. Agree on weather parameters which will be used for "go" or "no-go" decisions both "prior to" and during the placement activity.

   i. Larger limestone aggregate will reduce deck cracks. The gradation tables all have tolerances. Make sure we get as large of limestone aggregate as is available.

2. Adequate Labor Force

   a. At preplacement meetings talk about and, before starting a placement be sure the contractor has:

      (1) Proper and adequate materials to protect the placement.

(2) Adequate numbers of sufficiently skilled laborers available.

(3) Proper tools on the job.

(4) Arranged for the rate of delivery of concrete to make the placement operation efficient.

b. 25 cy (20 cubic meters) per hour should be a minimum placement rate. Any method of delivery to the deck should be checked to see that rate of placement can be such that finishing operations can proceed at a steady pace, with final finishing completed before the concrete starts its initial set.

B. Concrete Plant Inspector's Checklist

1. Specifications regarding plant inspection, equipment approval, and batching operations should be reviewed for familiarity. **In addition to proper plant calibration, the inspector should verify that each truck mixer used on the job has a current certification as required by *SSHC Section 1002*.** It is good practice to inspect a random sample of ready mix trucks that will be used on the job, verifying that the certification accurately reflects the truck's condition. Truck certification numbers should be recorded in the inspector's diary and will need to be reverified at least every 30 days.

2. Batching and mixing should be limited to the lead truck until slump and air content have been tested for conformance with specifications. **Contractors may make preliminary tests at the plant but project acceptance is based on job site tests.** It is intended that the ready mix plant supply concrete to the construction site that conforms to all applicable specifications at the point where the acceptance sample is taken.

   a. *SSHC Table 1002.02*, Concrete Proportions, lists slump and air content requirements.

   b. If concrete is being delivered which deviates much from these target values, the contractor is responsible for taking corrective action to bring the mix to within target values. Even if the current mix is within specified limits. The intent of the tolerance is to provide latitude during placement for unforeseen changes in materials, mixes, and placement methods. Placing concrete "consistently" near a tolerance limit is not desirable and warrants additional sampling.

   c. What is important, is the contractor's response to test results approaching tolerance limits. Continually having to add water and/or air agent to each load at the site will not be permitted. If such practice is occurring, the inspector shall notify the contractor (or whomever was designated as "the" responsible individual in charge of the concrete at the site.) Ultimately, it is the contractor's responsibility to initiate immediate corrective action.

3. Non-responsiveness on the contractor's part is reason to initiate sampling and testing of each truck or halt placement. The purpose for additional testing is to ensure that no noncomplying materials are incorporated into the project.

4. In some cases admixtures, such as water reducers, are required to be added in split doses or sometimes totally at the site.

5. All Structural Concrete

   a. At the start of each day's placement, no concrete is to be placed in the forms or on the deck until the first truck has been sampled, tested, and approved. Incorporation of materials from this truck will not be permitted unless desired slump and air content are within specified limits. Continuous placement shall not begin until after test results indicate the material meets specified requirements.

   b. If the first load is close to a limit value, it is recommended to sample and test the second load unless site experience indicates it is not necessary.

   c. Initial start up test results (if taken from the truck chute) must account for method of placement. For example: If placement will be through a pump, air values should be on the high side of target to account for loss during pumping. Again, site/project experience should be factored in this decision.

   d. Routine acceptance testing will be at a minimum frequency of one sample per 100 yd^3 (100 m^3). This frequency may be changed for large, continuous placement where placement rates warrant a lesser frequency. Minimum quantity placed between routine acceptance tests is 100 yd^3 (100 m^3). This rate of testing may be increased (made more frequent) if the inspector has a concern that target values are not being met.

NOTE: Only the Materials and Research Division has authority to approve decreasing (less frequent) testing frequencies from those listed in *Materials Sampling Guide*. PLAN AHEAD and obtain approval for those cases where a variance would be reasonable.

(1) For routine acceptance testing, obtain a representative sample at the last practical point before incorporation, but prior to consolidation.

NOTE: When concrete is placed by means other than directly from the back of the truck the sample shall be taken after the concrete has passed through the conveyance method being used. (This includes placement by bucket, belt, pumps, power buggies, etc.)

(2) Routine acceptance sampling and testing does not require holding a truck until results are available. However, if there are obvious deficiencies, the inspector has the authority to hold that truck until test results are available.

(3) Inspectors should be alert to obvious visual changes in consistency, with routine acceptance air and slump tests being made as noted above. Any load having questionable consistency should be checked for slump, and air content.

(4) If noncomplying test results are found during routine acceptance sampling, no more material (from that truck or others) shall be incorporated until complying test results are obtained. When test results indicate noncomplying material:

(a) The rest of that load shall be rejected and not incorporated, unless adjustments can be made to bring it back into compliance.

(i) In an attempt to bring noncomplying concrete into compliance, the supplier may make field adjustments (i.e.. add air entraining agent, or rotate the drum). Such "field" adjustments shall be an EXCEPTION and not the general rule and the 90 minute time restriction shall not be waived for any situation.

(b) For all noncomplying test results the inspector shall immediately notify the contractor or their representative in charge of the concrete. This notification shall also inform the Contractor if noncomplying materials have been incorporated into the structure.

(c) If test results indicated noncomplying materials have been incorporated, the inspector shall make a note in the diary indicating the test results, approximate volume incorporated, location the material was placed, and to whom the notification was given. The inspector should also note a noncomplying event on that particular truck's delivery ticket.

(d) When noncomplying materials are found, the inspector will: a) hold each truck, and b) initiate sampling and testing of each truck until two consecutive loads meet specifications. At this point sampling and testing may return to normal project acceptance frequency.

6. Specifications spell out requirements that materials must meet to be acceptable. Further, the *Materials Sampling Guide* identifies a frequency for sampling/testing and whether the test is an acceptance or assurance test.

   a. Authority for initially rejecting noncomplying materials and poor quality work performance is given to the inspector in *SSHC Subsection 106.05*. This rejection authority is only superseded by the Project Manager. There is an old saying to the effect "*We shall not knowingly incorporate noncomplying material into a project*." This means exactly what it says and there is ample support in the specifications for this position.

7. During placements, the inspector should alternate sampling among the various trucks involved in the operation.

8. If there is a specific truck which is identified as causing a problem with consistency, that truck shall be rejected from further use.

9. Transit mixers shall be completely emptied of wash water before reloading. If the truck's top fill hopper is washed after loading, no wash water shall be allowed to enter the mixer.

10. The inspectors will need to satisfy themselves regarding compliance with the specifications for the number of drum revolutions at mixing speed.

11. If water, air entrainment or other admixtures are added at the project site, acceptance testing will not be performed until all additions have been made AND required mixing has been completed following the change.

C. Falsework

1. General: *SSHC Subsection 704.03*, paragraph 7.f. requires the contractor to submit 6 copies of falsework plans when required or when certain conditions apply. These plans shall be prepared by an Engineer registered in the State of Nebraska. The contractor shall prepare falsework plans, as called for in plans or in the special provisions, and for:

- Support of plastic concrete for concrete slab bridges with spans greater than 50 ft (15.25 m) in length.

- Cast-in-place concrete girders

- Slab bridge false work should allow for ? inch (3 mm) of deflection for each 10 feet (3 m) of span. This means that on an 80 foot simple span bridge the falsework should be I inch high at midpoint.

2. Falsework Inspection

a. Contract requirements governing falsework construction are contained in *SSHC Subsection 704.03, paragraph 7*.

b. The Project Manager should observe the falsework as it is erected to ensure that:

(1) Only sound materials are used.

(2) Quality work is used.

(3) During concrete pour, the falsework will carry the load. (More than ½" movement is bad.)

NOTE: Any inspection and/or acceptance by the Project Manager is not intended to relieve a contractor of responsibility under the contract for falsework design and construction.

c. By specification, a contractor is responsible for proper evaluation of the quality of their falsework materials. However, the Project Manager should not permit use of any material, when there is doubt as to the materials ability to safely

carry the load. If there is any question, the contractor should be required to perform a load test or furnish other evidence of structural adequacy.

d. Timely inspection is essential. Falsework deficiencies should be brought to the contractor's attention at once. Deficiencies include:

(1) Poor quality work.

(2) Use of unsound or poor quality materials.

(3) Construction which does not conform to the contractor's falsework drawings.

e. If the contractor fails to take corrective action, a noncompliance letter shall be issued. Corrective action will be required prior to placement of any additional dead or live load to the support structure.

3. Falsework Foundations

a. Falsework piling should be driven to adequate bearing unless mudsills or spread footings can be founded on rock, shale, compact gravel, coarse sand, firm clays in natural beds, or well compacted fill.

(1) Falsework Piles

(a) If requested, pile bearing values will be determined by the wave equation. Otherwise, the contractor is responsible for adequate foundation support.

(b) The pile bearing value required to support the design load must be shown on falsework drawings, and the pile driving operation must be inspected sufficiently to ensure that falsework piles attain required bearing.

b. Mudsills and Spread Footings

(1) Foundation material should be inspected before the footings are placed.

(2) To ensure uniform soil bearing, falsework pads must be set on material that provides a firm even surface, free of bumps or depressions within the pad bearing area. If necessary to obtain uniform bearing, a thin layer of sand may be used to fill in surface irregularities.

(3) Continuous pads must be analyzed differently than individual pads, and the two should not be considered equivalent. A change from one to the other requires resubmittal in the Construction Division for review by the Bridge Division.

(4) Falsework pads should be level. Benches in fill slopes should be cut into firm material, with the pad set well back from the edge of the bench.

(5) Many soils lose their supporting capacity when saturated. Adequate falsework construction must provide for drainage and protect pads from being undermined or ponded in water.

c. Soil Load Test

(1) Project Managers should require the contractor to perform a soil bearing test if there is any doubt as to the ability of foundation material to support the falsework load without appreciable settlement. One method to evaluate in-situ bearing capacity is to perform a plate bearing test as per ASTM D-1 194. (The above referenced method is not the only such test procedure, but is included to provide one method of determining in-situ capacity.)

4. Falsework Materials

a. One aspect of a falsework design and review is based on the use of undamaged, high-quality materials. Material strength values must be reduced if lower quality materials are to be used. Obviously, evaluation of the quality of materials actually furnished is an important, and essential, part of the falsework inspection procedure.

(1) Timber

(a) Inspecting falsework materials is necessary to prevent the use of materials which obviously do not meet the "undamaged high-quality" design criteria.

(b) Falsework materials delivered to the job site, should be equal to or greater than the grade, or type of material, assumed in the design review. Timber having large shakes, checks or knots, or which are warped or split should not be used at critical locations. Abused timber, although stress graded, may no longer be capable of withstanding the original allowable stress.

(c) Rough sawn timbers should be measured to determine their actual dimensions. Unlike surfaced/finished material, the dimensions of roughcut timber are not uniform from piece to piece. The variation may be appreciable, particularly in the larger sizes commonly used for falsework posts and stringers. If actual dimensions are smaller than the dimension assumed in design, the member may not be capable of carrying the imposed load without overstress. Therefore, undersized material should not be incorporated into the falsework, unless the design is reevaluated using smaller dimensions.

(2) Structural Steel

(a) Used beams, particularly beams salvaged from a previous commercial use, should be examined carefully for loss of section due to welding, rivet or bolt holes, or web openings which may adversely affect the ability of the beam to safely carry the load imposed by the falsework design.

(b) Welded splices should be inspected visually for obvious defects. Radiographic inspection or other methods of nondestructive testing will not be required as a means of determining the quality of the splices unless the Project Manager has reason to believe the welds are defective.

(3) Manufactured Products

(a) Manufacturer's ratings are based on the use of new material or used material in good condition. The determination as to whether a manufactured product is in good condition is highly subjective and requires experience and judgment.

(b) When manufactured assemblies are used in falsework, they shall be shown on the falsework plans along with their identification number. The actual assembly shall be clearly and permanently marked with the identification number.

b. Identification numbers will allow field inspectors to verify the capacity and proper application of various devices.

c. Identification by the contractor applies not only to jacks, beam hangers, overhang brackets, and similar devices, but to all vertical steel shoring systems as well.

d. Manufactured products such as tubular steel shoring and steel overhang brackets are particularly vulnerable to damage by continual reuse. Fabricated units in which individual members are bent, twisted, or broken will have a substantial reduction in load carrying capacity. Steel shoring materials should be examined carefully prior to use. Shoring components should not be used if they are heavily rusted, bent, dented, or have broken/damaged welds or other defects. Connections, in particular, should be examined for evidence of cracked or broken welds. Miscellaneous components such as screw jack extensions, clamps, and adjusting pins should be inspected as well.

e. Proprietary scaffolding must be used as intended and not subjected to additional stresses or conditions for which it was not originally designed and tested.

(1) Cable Bracing

(a) Cable bracing systems must be carefully inspected to ensure that field installation conforms to details shown on the falsework drawings. This is particularly important with respect to the location and method of cable attachment to any falsework.

(b) Prior to installation, each cable should be inspected to verify that the type, size, and condition (new or used) are consistent with design assumptions. Used cable should be inspected for strength-reducing flaws. Use of obviously worn, frayed, kinked, or corroded cable should not be permitted.

(c) Particular attention should be paid to cable clamp fasteners. Improperly installed clamps will reduce the safe working load by as much as 90 percent. Also, the omission of the thimble in a loop connection will reduce the safe working load by approximately 50 percent. After installation, clamps should be inspected periodically and tightened as necessary to ensure their effectiveness.

(d) A cable clamp has two parts - the "U-Bolt" and the "Saddle." Also a cable has two parts, the wrapped non-continuous end (dead end) and the continuous portion which supports the load (live side). Always put the cable clamp's "saddle" on the live side and the "U-bolt" over the "dead end."

5. Falsework Quality

a. High quality work, particularly in such details as wedges, fasteners, bracing, friction collars, jack extensions, etc., is critical to the proper performance of falsework. Accordingly, construction details should receive close attention from the project inspector.

(1) Timber Construction

(a) The following checklist is included as a guide to points which require special consideration:

(i) Diagonal bracing, including connections, must conform to details shown on the falsework drawings.

(ii) Diagonal bracing should be inspected after any falsework has been adjusted to grade. Connections must be securely fastened to ensure their effectiveness in resisting horizontal forces. Bolted connections may need retightening.

(iii) Timber posts may be wedged at either the top or bottom for grade adjustments, but not at both locations. Large posts may require two or more sets of wedges (side by side) to reduce compression stresses perpendicular to the grain.

(iv) Blocking and wedging should be kept to a minimum. It is poor workmanship to extend a short post by piling up blocks and wedges. This practice should not be permitted.

(v) Particular attention should be given to falsework bents where grade adjustment is provided at the bottom of the posts. Differential grade adjustment of posts within a particular bent may induce undesirable stresses in the diagonal bracing.

(vi) Splicing of wood posts will not be allowed unless shown on approved falsework plans.

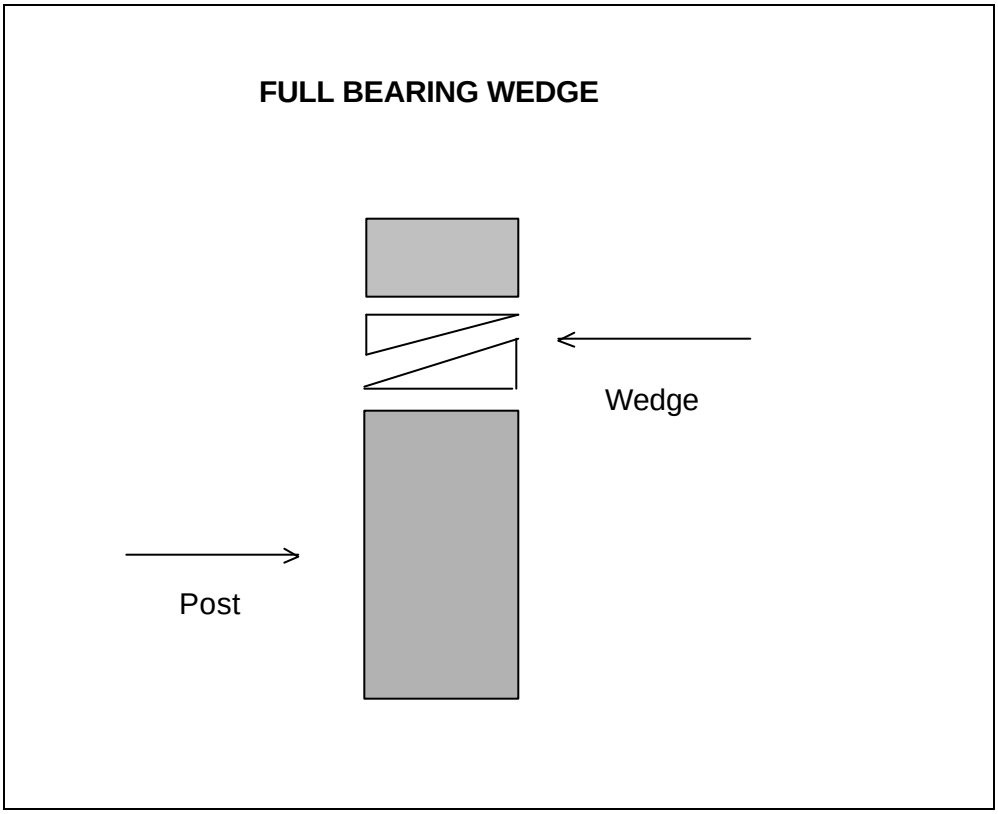
(vii) The ends of spliced posts must be cut square. The need for a post splice should have been anticipated by the contractor and the splice detail shown on falsework drawings. If this is not the case, the contractor must submit a detail for approval.

(viii) Posts must be plumb and centered over the falsework pad or corbel.

(ix) Abutting edges of soffit plywood should be set parallel to the joists and continuously supported on a common joist.

(x) A sufficient number of telltales must be installed to accurately determine the amount of joint take-up and settlement. Telltales should be attached to the joists as close as possible to the supporting post or bent.

(xi) Full bearing must be obtained between all members in contact. Deficiencies in this respect may be improved by feather wedging. If the joint requires more than a single shim or wedge, extra care should be taken to ensure that full bearing is obtained.



When using wedges, it is a good practice to use wedges inserted from both sides rather than deeply setting a single wedge. Using only one wedge increases the twisting effect on the member.

- When using wedges, it is good practice to install them parallel to and with the flat (nontapered) side against the main member. This improves contact with the main member and decreases the chance of a wedge "backing out" from vibration.

- Nail or clamp the wedge in place after installation.

(2) Steel Shoring (Scaffolding)

a. This checklist may be used as a guide by inspectors when inspecting falsework constructed of steel shoring.

(1) Shoring components should be inspected prior to erection. Any component that is heavily rusted, bent dented or rewelded, or which is otherwise defective, should be rejected. Fabricated units having individual members that are bent twisted, broken, or where welded connections are cracked or show evidence of rewelding should be rejected.

(2) A base plate, shore head, or screw jack extension device should be used at the top and bottom of all vertical components.

(3) All base plates, shore heads, and extension devices must be in firm contact with the footing at the bottom and the cap or stringer at the top.

(4) Shoring components should fit together evenly, without any gap between the upper end of one unit and the lower end of the other unit. Any component which cannot be brought into proper contact with the component it is intended to fit, should not be used.

(5) Shore heads, extension devices, and similar components must be axially loaded. Eccentric loads are not permitted on any shoring component.

(6) All locking devices on frames and braces must be in good working order, coupling pins must align the frame or panel legs, and pivoted cross-braces must have the center pivot in place.

(7) Shoring should be plumb in both directions. Maximum deviation from true vertical should not exceed 3 inches per 1000 inches (3 mm per meter).

6. Miscellaneous Falsework Items

a. This checklist covers items that may be used in either type of support system.

(1) New high strength bolts shall be used on any item that requires bolts to be torqued.

(2) Friction collar bolts and concrete anchors should be torqued initially and checked again just prior to concrete placement.

(3) Permanently deflected stringers should be placed with the crown turned upward.

(4) Jacks should be plumb and not overextended.

7. Falsework Adjacent to Traffic

a. This will be an unusual situation in Nebraska. If it occurs, the Construction Division should be notified.

8. Falsework Field Changes

a. If supplemental calculations are necessary to verify compliance with contract requirements, he change will be considered substantial. In this case, the proposed change must be submitted for review and approval in the same manner as the original drawings.

b. The following are examples of changes considered substantial and must be shown on revised falsework drawings, regardless of other considerations:

(1) A change in size or spacing of any primary load-carrying member.

(2) A change in method of providing lateral or longitudinal stability.

(3) Any change, however minor, which affects the falsework to be constructed over or adjacent to a traffic opening.

(4) A revised concrete placing sequence, if it significantly affects the stresses in load-carrying members.

(5) When revised drawings are required, they must be submitted for review in the same manner as the original falsework drawings. The Department does not approve falsework! Time shall be allowed for review of revised falsework drawings. Typically this is the same as required for the original submittal.

(6) The PM should be alert to and document any field changes to falsework plans.

9. Falsework Inspection During Concrete Placement

a. As concrete is being placed, the falsework should be inspected at frequent intervals. In particular, look for the following indications of potential failure:

(1) Excessive compression at the tops and bottoms of posts and under the ends of stringers.

(2) Pulling of nails in lateral bracing.

(3) Movement or deflection of braces.

(4) Excessive deflection of stringers.

(5) Tilting or rotating of joists or stringers.

(6) Excessive settlement of tell-tales.

(7) Posts or towers that are moving out of plumb.

(8) Sounds of falling concrete or breaking timbers.

(9) If any member deflects unduly or shows evidence of distress, such as splintering on the bottom of stringers, crushing of joints or wedges, etc., placement work in the affected area should be stopped immediately and the falsework strengthened by addition of members, installation of supplementary supports, or some other means.

(10) Settlement of the falsework should be limited to a maximum of ? inch (10 mm) deviation from the anticipated settlement. Should actual settlement exceed the anticipated settlement by more than the ? inch (10 mm) allowable, and if it appears that a serious problem is developing, concrete placing should be temporarily discontinued in affected areas until the contractor provides satisfactory corrective measures. Concrete placing should not be resumed until the Project Manager is satisfied that further settlement will not occur.

(11) If it is apparent that satisfactory corrective measures cannot be provided prior to initial setting of the concrete, the Project Manager shall stop placing of concrete and contact the Construction Division.

(12) One important and often overlooked point is the danger of curing water softening the falsework foundation. Some means should be provided to prevent curing water from reaching and soaking the foundation material beneath the falsework bearing pads.

(13) The contractor should provide the drainage for any water that accumulates in box-girder cells. Such accumulated water could easily overstress the falsework.

b. Falsework and Centering

(1) It is the contractor's responsibility to provide form work adequate to support the dead load of the fresh concrete. However, the inspector shall consult with the contractor and the Project Manager concerning any form work which he/she has reason to believe is inadequate to support the load capacity. In calculating the strength of centering, a mass of 150 lb/ft^3 (2400 kg/m^3) shall be assumed for fresh concrete.

(2) All falsework shall be rigidly braced and cross braced. Timber piling shall be free from defects with at least a 7 inch (175 mm) butt and a 5 inch (125 mm) tip, measured under the bark. The contractor shall provide jacks or suitable wedges to take up any settlement in the form work during the placing of the concrete. When setting grades for falsework or structure forms, allow 1/16 inch (1.5 mm) settlement or "take-up" for each lap in the falsework timbers.

(3) Build falsework for slab bridges with ? inch camber for each 10’ of span. Deflection after forms are removed should bring deck back to the proper elevation.

(4) Settlement caused by the concrete loads may be checked as placing of the concrete progresses by means of vertical “telltales” fastened to the bottom of the floor form. When this settlement has reached the amount allowed for “take-up” in the falsework timbers, any further settlement should be prevented by means of the wedges or jacks previously noted. Any adjustments that have to be made must be completed before the concrete has taken its initial set. If adjustments are made after the concrete has set, the concrete may be damaged

irreparably. (In general, if falsework settles more than ½ inch, the PM must investigate and determine the damage.)

10. Removal of Falsework (SSHC Table 704.02)

a. Specifications and applicable special provisions, contain specific criteria which must be met before falsework may be removed. Project Managers and inspectors should review these sections prior to falsework removal operations.

b. The Project Manager should discuss falsework removal methods and procedures at the preconstruction and/or prepour meeting. The need to provide for employee and public safety is of particular concern.

c. In general, all elements of the falsework bracing system must remain in place for the specified time period or until concrete attains the specific strength. In the case of cast-in-place, post tensioned construction, falsework elements must not be removed until stressing is completed.

D. Forms

a. The inspector shall check the lines, grades and dimensions on all structural form work before allowing the contractor to place concrete. On walls and columns this is best done as the form work progresses.

b. Forms shall be made of wood, metal or other approved materials. The forms shall be substantial, unyielding and mortar tight. All forms for exterior exposed surfaces, except those locations requiring a specific texture finish as listed in *SSHC Subsection 704.03* shall be lined with pressed wood, plywood or other approved materials used in the largest practicable panels. Forms shall be coated with a colorless oil to prevent sticking to the concrete. The forms should be oiled before placing the reinforcing steel to avoid splattering of oil on the steel. Forms for walls and columns, or wherever else required, may be constructed with the bottom board removable for cleaning out wood chips, dirt, etc., before placing the concrete. Metal tie rods or anchors within the forms shall be constructed so as to permit their removal to a depth of one inch below the surface of the finished concrete. All tie rod and tie-wire holes shall be filled with cement mortar as soon as possible to insure proper bond with the structure concrete.

c. Pier columns may be constructed using a laminated fiber form which is moisture resistant and seamless. These forms must be capable of withstanding the hydraulic pressure of fresh concrete. Any questions concerning the acceptability of a proposed fiber form should be referred to the Construction Engineer through the District Construction Engineer.

d. Removal of Forms and Falsework

(1) Specific requirements concerning the time limitations for form removal are listed in *SSHC Subsection 704.03*. Proper inspection includes both the monitoring of this time and the method of removing forms. Stresses in concrete due to its own weight must be introduced slowly and carefully during form removal operations to prevent concrete failures. For instance, the removing of falsework from under a cantilevered element, must begin at the point furthest from the support and proceed toward the support. In removing the falsework from under a structure that is continuous over its supports, removal should begin near the areas of maximum dead load positive moment and proceed in both directions towards the supports. In general, all

falsework should be removed before placing any surcharge, such as sidewalks and railings, on the superstructures.

(2) The requirements listed in the Specifications are based on sound engineering principals and the structures inspector should be thoroughly familiar with and rigidly enforce these requirements.

12. Use of Insulated Forms for Protection

a. Commercial insulation may be used for protecting concrete during cold weather, or when the contract documents require controlling the heat of hydration. This technique is the contractor's option and could be used in lieu of housing and heating. The contractor must furnish housing and heating and/or insulation of sufficient quality and thickness to maintain concrete at a temperature of not less than 50°F (10°C) for the first 72 hours after placing, and above 41°F (5ºC) for the next 48 hours.

E. Placing Concrete

1. Concrete shall be proportioned, mixed and handled in accordance with the requirements of *SSHC Section 1002*. The inspector should also refer to the Materials and Research Manual which outlines the method of proportioning, sampling and field testing the materials necessary for the production of concrete. The contractor shall organize his/her work so that the maximum interval between batches shall not exceed 30 minutes.

2. Concrete should not be placed in footings, columns, etc, until all pile driving within a radius of 50 feet has been completed. If concrete pours must be made within this area prior to the completion of pile driving, such concrete shall set at least three days before further driving is permitted within this radius. Concrete shall not be placed without special permission in steel pile shells for cast-in-place concrete piles for each bent, pier, or abutment until all the shells for that bent pier or abutment have been driven (*SSHC Section 703*).

3. When depositing concrete in the forms, segregation must be avoided. The mass of concrete should be generally free of surface cavities resulting from the trapping of air and water along the forms. Careful spading of concrete along vertical forms and tapping of the forms will usually release the air and water bubbles. Forms which are not mortar tight will leak cement paste and result in "sand streaking." Forms should be mortar tight to the maximum extent possible. Chutes shall be of metal or metal lined and of sufficient number to preclude the necessity of shifting the chutes. If necessary, the contractor shall leave holes in the forms for the entry of the chutes or pipes. Concrete must be deposited within 8 ft (2.5 m) horizontally of the place of its final location. Concrete shall not be dropped vertically more than 5 feet (1.5 m). Concrete in walls, footings, columns, etc, shall be placed in continuous horizontal layers not more than 18 inches (450 mm) thick and vibrated to a monolithic mass. Do not allow dried concrete to collect on forms or reinforcing bars where it will fall into the work.

4. See Section 1003.06 Concrete Cylinder Policy for cylinder requirement.

F. Placement Considerations

1. If there is any doubt about the concrete temperature exceeding 86°F (30°C), the contractor needs to identify measures which will be implemented to keep mix temperatures within specifications. If the contractor is not prepared to maintain a mix temperature below specifications, the pour should be postponed.

2. There are several ways concrete temperatures may be kept within specifications. They are:

   a. Scheduling placements during cooler times of the day.

   b. Wetting the aggregate stockpiles.

   c. Covering/shading the aggregate stockpiles.

   d. Maintaining a supply of portland cement on hand to preclude getting hot material from the supplier.

   e. Chilling the mixing water is one of the most effective ways to lower mix temperatures.

   f. Shaved ice can be used, however, the ready mix operator must submit a proposal for this to the Project Manager for review by the Construction Division.

NOTE:

- No payment will be made for methods taken to keep concrete temperatures within specifications.

- If pour has to be delayed because of temperature, and pouring is the controlling operation, no working days will be charged.

- Location of permissible headers should be discussed with the contractor during the pour, it appears the temperature may exceed 86°F (30°C).

- When casting deck on Phased Construction under traffic make sure potholes in the driving lanes are filled.

3. General - The wind velocity temperature relationships stated in the specifications should be enforced to avoid loss of water from the concrete surface faster than it can be replaced by normal bleeding and to avoid the resultant formation of plastic shrinkage cracks. Anemometers and thermometers must be available on site to measure wind velocity and temperature.

4. Concrete in bridge floors shall be placed uniformly on both sides of the centerline and shall be placed continuously between specified joints. The sequence of placing shall be in accordance with the pouring diagram shown in the plans. If no pouring diagram is shown in the plans, concrete shall be placed as directed by the Project Manager.

5. Wet the deck forms and approach slab grade before placing the concrete. Concrete shall be adequately vibrated to encase the lower bars of the reinforcing mat where these are near the deck form.

6. Special attention shall be given to finishing the riding surface on the bride floors. *SSHC* Subsections 706.03, 710.03, and 711.03 explain concrete bridge floor finish.

7. It has been the policy to permit the contractor to use mechanical finishing machines of an approved type whether or not they are required by the plans or special provisions.

8. Method of Finish - When the hand method is employed, the concrete surface shall be struck off with a strike board which conforms to the cross section shown in the plans. If this is pulled by hand, care shall be taken not to displace the reinforcing steel by the workmen doing the pulling. A small air winch anchored to a girder outside of the day's pour will pull the strike off at a slow, uniform rate, giving a truer surface with no displacement of the reinforcing steel. The strike board shall be operated with a combined longitudinal and transverse motion, always carrying a small roll of concrete in front of the cutting edge. The strike off shall be pulled a sufficient number of times to properly distribute the concrete. A longitudinal float generally is required and is described in *SSHC Section 704*. The longitudinal float shall be lapped 1/2 its length when moved to a new position and shall be operated across the surface a sufficient number of times to produce a uniform, smooth riding surface. Occasionally during the finishing operation, conditions may require the use of the long-handled transverse float, which require extreme care in its use to preserve the desired cross-section and a smooth riding surface.

9. Regardless of whether hand or machine finishing methods are used, the floor surface shall be tested for trueness with a straightedge 10 foot (3 m). The bridge contractor is required to furnish a 3 m master straightedge for use in trueing and checking the working straightedges.

10. A burlap drag is required and this operation should be performed as soon as the surface will support the drag. A tined surface is also required by the specifications.

11. Templates used to support the strike off should be in short sections [(10 to 14 ft) (3 m to 4 m)] so they may be removed as the finishing operation advances, allowing the final floating and surface testing to take place, and the wet burlap to be applied immediately. Decks should be cast after the afternoon high temperature is reached. (In summer, this can be as late as 7:00 p.m.) Protection of the aggregates from the sun is also helpful.

12. When mechanical self-propelled finishing machines are used, they shall be capable of obtaining a finish equal to or better than that obtained by the hand method. The screeds of the finishing machine should be set to the exact cross section shown in the plans. Elevation shots will be required for the setting of the riding rails. The usual procedure is to give a fill to grade at the locations where girder shots were taken. The contractor will then set the rail to the correct height to accommodate the machine. An "eyeball" check of the rail for smoothness should always be made. On girder bridges the rail will follow a line that should be smooth after the girders have deflected from the dead load. Correct elevations of the rail can be checked by measuring the distance from the screed to the formwork which should give the correct thickness of slab.

13. Careful attention should be given to the depth of cover over the top steel. With the extensive use of salt, the service life of the steel is reduced if the concrete cover is less than that shown in the plan. (The finishing machine must be dry run to check the minimum clearance of the reinforcing steel and to check the grade of the expansion devices.)

14. If the finishing machine is used when there is a transition between regular crown and full superelevation, a system should be worked out well in advance of pouring to insure that the screed can be changed rapidly and correctly at intermediate points of the transition. This is important in order that there are no long delays caused by screed adjustments while pouring the transition.

15. Retarders – Retarders shall be used to delay the setting time of the bridge floor concrete. If the temperature is 60°F (15°C) and rising, retarders must be used. A good goal is to be finishing at the next pier before the concrete is setting-up at the previous pier. Acceptable retarders are Pozzolith 300R and Doratard-17. Water reducing admixtures like WRDA-82, Procrete-N, and Masterpave-N are not acceptable retarders.

16. When a retarder is required the rate of placing concrete for any positive moment section will be within two-thirds of the initial setting up time of the retarded concrete after the previous negative moment section has been poured. For example, if the initial set takes place in 6 hours, the pouring of a positive moment section must be completed within 4 hours after the completion of the previous negative moment section. This same procedure should be required regardless of whether or not retarders are used.

17. Calibration of Concrete Proportioning Equipment - Calibration of this equipment should be as described in the National Ready Mixed Concrete Associations' Quality Control Manual.

G. Placement Methods (Pumping, Belting, And Crane Bucket) (*SSHC Subsection 704.03*)

1. Much concern has been expressed about the method of concrete placement because of lost entrained air. Rough handling of plastic concrete during placement has, at times, reduced entrained air to less than 2% not to mention potential segregation problems. While testing at the point of placement "should" identify such problems, varying placement conditions during the pour can affect concrete conditions significantly.

2. General conditions which must be avoided (Points to watch for), or at least severely minimized, are explained for each delivery system that follows: If one of the following cannot be avoided, at least be aware of the condition, and be sure to conduct additional testing should any of the conditions present themselves.

3. Crane and Bucket

   a. In the past it was felt the crane and bucket placement method did not adversely affect concrete. This is now in question when viewed from loss of air and potential segregation. Therefore, this method will now also require testing at the placement location, if practical.

b. Points-to-Watch For

(1) Free fall of unrestrained concrete shall not exceed 5 ft (1.5 m.) Avoid exceeding a 5-ft. free fall by removing a section of form work for intermediate placement or by use of a tremie.

(2) Discharge from the bucket must be controllable.

(3) Cross section of the drop chute should allow it to be inserted into the form work without interfering with reinforcing steel.

4. Belt Placement

a. Belt equipment is typically used to convey concrete to a: (1) lower, (2) horizontal, or (3) somewhat higher level.

b. Points-to-Watch For

(1) Keep the number and distance of drops between belts to an absolute minimum. Drops tend to encourage segregation and reduce entrained air.

(2) As belt conveyors are removed from the line (i.e., as on deck pours), recheck the "as placed" air content.

(3) Be sure all mortar is being removed at the discharge. (No mortar should be on the return belt.)

(4) Check discharge for potential segregation problems.

(5) In adverse weather (hot and/or windy conditions), long belt runs need to be covered.

H. Pump Placement

1. The modern mobile pump with hydraulic placing boom is economical to use in placing both large and small quantities of concrete. These units are used to convey concrete directly from a truck unloading point to the concrete placement area.

2. Points-to-Watch For

a. Typically, pumps are initially flushed with a thin water/cement paste mixture to coat the lines. This slurry must be wasted and the lines charged with the project mix before beginning. Observe, and be sure initial pump charge is thoroughly removed from the pipelines.

b. Always pump at a constant rate and keep pipelines full of concrete. High air loss can occur when concrete is allowed to free-fall inside pump lines.

c. Avoid, if at all possible, having steep angles in the pump pipelines. Steep angles and slow placement rates are probably the worst conditions for minimizing air loss and segregation. If this condition occurs:

(1) Attempt to relocate the pumper, thereby minimizing lift angle.

(2) If discharge is not maintaining a constant flow with the partial concrete head in the pipe, request the pump operator to place a reducer and short section of hose at the discharge end. The purpose is to avoid free falling concrete from impacting the deck or forms at high velocity.

(3) If the above condition is unavoidable, watch and test the discharge frequently for loss in air and potential segregation.

3. Rule-of-Thumb for Pumping

a. Pump concrete with pipelines as flat as possible (or at least with minimal down angle).

b. Minimize (or eliminate) free falling concrete in the pipelines. To do this, maintain some amount of concrete head in the pipelines.

c. Pump concrete through as few elbows and restrictions as possible.

d. Pump concrete at "some" constant rate.

e. Watch and test the air content frequently, when drop may exceed 5 feet.

I. Consolidation of Concrete

1. The contractor must establish a pattern for vibrating the concrete and ensure the pattern is followed across the entire deck.

2. Consolidation of concrete should be accomplished by the use of a sufficient number of vibrators of a type approved by the Project Manager. The vibrators must be of such an intensity as to visibly affect one-inch slump concrete over a radius of 18 inches (450 mm). The contractor is required to furnish a tachometer for the purpose of checking the speed of the vibrator elements.

3. Lateral movement of the concrete by means of a vibrators shall be avoided. Over vibration is harmful and is evidenced by grout appearing in the concrete around the vibrator head. Insert and withdraw the vibrator slowly. It should not come in contact with reinforcing steel which extends into previously placed concrete nor should the vibrator head be placed in concrete which is taking its initial set.

J. Reinforcement Bar Cover

1. Reinforcement bar cover has contributed to shadow effect. This occurs when reinforcing cage is not rigid or has only a minimum of cover and too much vibration was used. The remedy:

a. Increase bar cover to 2 ½ inches (65 mm) from minimum of 2 inches (50 mm).

b. Maintain uniformity of bar cover.

c. Build in rigidity to the reinforcing bar cage by placing diagonal braces as described above.

d. Reduce slump and do not over vibrate the concrete.

e. Require a dry run to check alignment and uniform spacing between the edge of the mule and rebar cage.

2. Shadowing occurs when slip forming a radius because of nonuniform form pressures inside the mule. The problem manifests as repetitious surface bumps, not depressions as one might think. This problem is inherent with slipforming a radius and is especially noticeable as the radius becomes smaller. In order to minimize shadowing effects, the contractor needs to have finishers work out the bumps by hand.

K. Use of Finishing Machine (*SSHC Subsections 710.03 and 711.03*)

1. The finishing machine shall be approved before use. Care must be taken to adjust the screeds to proper crown. Support rails must extend beyond the bridge at both ends at proper grade and sufficient distance to accommodate the machine. This permits finishing to begin promptly at the start of the run and also permits the required straightening to proceed on schedule at the end of the run.

L. Straightedging

1. Following the finishing machine, straightedging should be completed to check for longitudinal smoothness. Straightedges, 10 ft (3 m) in length, need to be operated parallel to centerline of roadway. Each pass should overlap the previous one by a half length. If bull-floating (mopping) is needed to close up the surface, it should always be followed by straightedging.

M. Tining (Transverse Grooving)

1. Tine bridge decks with a rake. No longer use a bull-float.

2. After straightedging, and as soon as practical following finishing, the entire traffic surface, except areas within approximately 2 ft (600 mm) from the curbs, shall be given a suitable tining with corrugated tining rake.

3. Tine all bridge decks where posted speed limit will be 40 mph or greater, except for county road bridges 100 feet (30 m) or less in length that have gravel approaches and no plans exist for future hard surfacing.

4. On bridge decks, stop the tining 2 ft (600 mm) from the face of the bridge curb.

5. **Do not overlap the grooving.**

N. Curing

1. The Bridge Deck Curing Special Provision defines how to cure the deck.

2. The surface must be covered with wet burlap as soon as possible. (Slight surface marring and removal of tining is acceptable.) Burlap must be wet before placing. In hot dry weather, it is better to be a little early than late with burlap cover.

3. Since shrinkage cracks are due to rapid loss of mix water before the concrete has attained adequate strength, it is imperative that curing protection be initiated before much evaporation can occur.

O. Ways to Avoid Deck Cracks

1. Verify falsework is stable.

   (a) Temporary piles need to have significant bearing – practical refusal is best.

   (b) Wood crush needs to be minimized. Avoid gaps between layers of timbers – be careful to shim the entire length of support timbers.

2. Avoid unnecessary vibrations.

   (a) Use shooflys where possible to keep traffic away from the bridge.

   (b) Do not rest falsework on active bridge during phased construction unless there is no other alternative.

   (c) However, when it comes to intentional consolidation – the contractor should be very careful to establish a fix pattern for vibration and make sure it is achieved along the entire length of the deck and approaches.

3. Check the temperature of the concrete as it arrives on site. It should not be greater than 86°F.

4. Check the slump and if the slump is less than 3.5 inches, confirm that the mix is not too dry – especially if retarders or water reducers are used. Low slump measurements are a good indicator that mix is too dry especially on hot days. Also, with a low slump, it will be hard to get the mix around and in between rebars and tining with the tining rake is much more difficult.

5. Verify camber on girders is correct.

6. Avoid skewed construction of approach sections. If there must be a skew, limit it to 20 degrees. If skew is above 20 degrees, then reinforce the area near the obtuse angles because the stress is significantly increased in this region.

7. Cover the concrete with saturated wet burlap 1 ½ hours after the concrete leaves the truck or pump chute.

8. If the outside air temperature is predicted to be above 80°F (26°C) then start casting the deck at 5:00 pm and finish before dawn.

9. Check the outside air temperature during casting. It should be less than 86°F.

10. If the evaporation rate during casting exceeds .15 lbs/sf/hr, then fogging as prescribed in the Nebraska Fogging Special Provision will replace the evaporating water, keep the deck cool, and slow the setting time.

P. Seal Bridge Deck Cracks

1. Bridge deck cracks should be sealed before de-icing salt is ever applied on or near the deck.

2. High molecular weight methacrylate is the best sealant and is squeegeed into cracks.

Q. Cold Weather Placement

1. On account of the high incidence of shrinkage cracks due to artificial heat during the protection period, no bridge floors will be constructed during cold weather except with the special written permission of the Construction Division.

R. Floor Drains

1. Check floor drain locations against floor grades to be sure deck surface will drain. Adjustments of drain height may be advantageous on every flat grade surface. Also, at this time, study the discharge area from the floor drain for potential damage to features under the structure such as shoulders, railroads, or berm slopes. Major problems foreseen should be brought to the attention of the Construction Division.

S. Flowable Fill (*SSHC Section 1003*)

1. The inspector shall make daily entries in the field book on all concrete placed for each project. Record concrete placement location, all results of sieve analysis tests, all data on test beams made and tested and all quantities placed.

2. Flowable fill can be used for the following purposes:

   a. Backfilling culverts.

   b. Backfilling culverts constructed under bridges.

   c. Filling void between culvert and culvert liner.

   d. Plugging culverts.

   e. Slope stabilization.

3. Free water in the sand pile must be considered as mix water because a mix design uses oven dried sand.

4. The plans may call for a sewer pipe to receive a gasket, otherwise, see *SSHC Section 722*.

5. If the contractor uses crushed limestone for granular backfill, it shall meet the requirements for Granular Backfill. (Refer to *SSHC Section 1033*.)

6. Remember flowable fill is a liquid until the water has dissipated. Bulkheads should be strong enough to withstand the hydraulic pressures.

7. Under normal conditions, flowable mortar should be set-up sufficiently within 24 to 48 hours for placement of the final lift of either earthfill or special backfill. If "set-up" does not occur or if it seems slow, typically the problem relates directly to drainage of the granular backfill. Often contamination or "dirty" granular backfill is the culprit. Check to be sure it is draining. If not, additional time will help.

8. Placement of 2 ft (0.6 m) of flowable mortar.

T. Installation of Joints (*SSHC Subsection 704.03*)

1. Reinforcement

a. Reinforcement must be accurately placed and rigidly fastened. If cages are not rigid and braced diagonally in both transverse and longitudinal directions, problems can occur. The remedy:

(1) Recommended Procedure:

(a) Epoxy coated smooth bar, about ¼ inch (6 mm) in diameter can be placed diagonally from the top of a leading cage to the bottom of the second trailing cage. (Description is referenced to direction of paver's travel.)

(2) Alternate Procedure:

(a) Welding of diagonal braces to provide longitudinal rigidity is possible, but material would need to be epoxy coated and repair of weld location is necessary.

2. Preformed Neoprene Joints

a. Preformed neoprene expansion joints are used on a large number of bridges.

(1) Inspection Checklist

(a) Neoprene cellular joints, if properly installed, provide a leak-proof joint capable of functioning within expansion limits of the bridge. To insure that a joint will function properly, there are a number of precautions that should be noted regarding the installation of this type of joint. Precautions:

(i) A neoprene seal can be placed in two positions, one correct and one incorrect. Make sure that the seal is not installed upside down or sideways.

(ii) Position of the ½ x ¼ inch (13 x 6 mm) keeper bars on vertical face of the expansion plate angles has to be consistent with the recommendations of the manufacturer of the neoprene seal. The depth that a seal is set varies greatly with the different manufacturers.

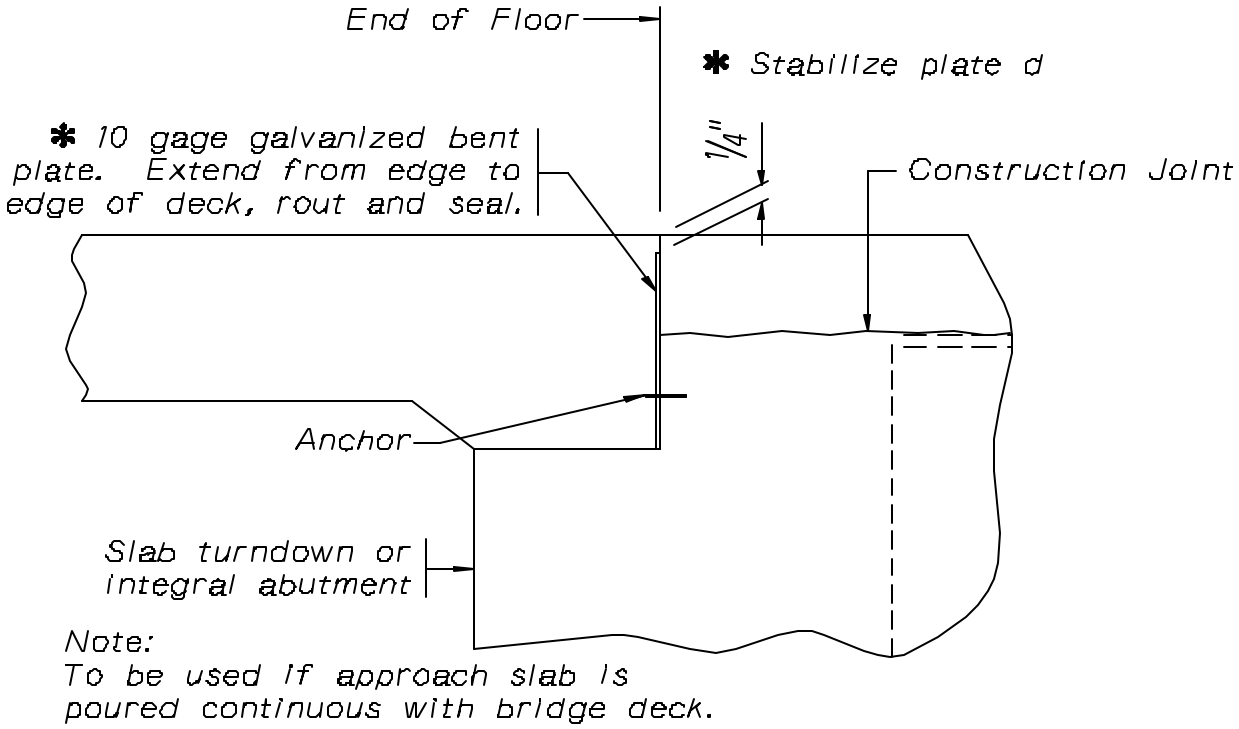
(iii) The neoprene seal has to be installed so bottom of the seal touches top of the ½ x ¼ inch (13 x 6 mm) keeper bars, but should not be forced past the keeper bars.

(iv) Make sure expansion opening between angles of the expansion device are consistent with the expansion setting shown on design plans and that the same expansion opening is maintained from gutter to gutter.

(v) The neoprene seal must project beyond the outside edge of slab as shown on the plans.

b. Summary

(1) When uncertain as to which side of the seal is top, or when the position of keeper bars is in question, the contractor must be required to submit drawings prepared by the manufacturer which indicate correct position of installation.



OPTIONAL JOINT DETAIL

U. Curing Concrete

1. The structure inspector should give careful attention to the curing, since proper curing is essential to good quality concrete.

2. When the evaporation rate exceeds 0.15 lb/sf/hr, the contractor must either fog the entire deck while placing the concrete; cover the concrete with wet burlap 1 ½ hours after the concrete leaves the truck; or take some action which will lower the evaporation rate on the entire deck below the 0.15 lb/sf/hr limit.

3. Applying wet burlap as soon as possible is essential – limited removal of tining is acceptable. The wet burlap should always be on the deck by 1½ hours after that portion is finished.

V. Concreting in Cold Weather (*SSHC Subsections 704.03 and 1002.02*)

1. As colder weather approaches each fall, the Department experiences a series of problems connected with concrete construction in cold weather. The first indication of the problem usually shows up as a low test result on a 7 day cylinder. At that stage, it is not known if the problem is an improperly fabricated cylinder.

2. A cylinder which has been exposed to colder conditions than the structure, or if the low strength actually represents the concrete in the structure. Sometimes the later cylinder tests show satisfactory results, but in other cases, low strengths are found in these tests also.

3. In some cases, definite information regarding the true condition of the concrete in the structure can only be obtained by coring the material and carrying out a series of special tests.

4. The best fogging system may be the simplest. Hand held fogging nozzles that mix compressed air and water to form a fog are some of the best fogging systems observed. (One nozzle that works very effectively is called a Hydro-Air Washer made by Power Systems Inc. of Lancaster, TX.)

W. Simultaneous Casting of Deck and Approach Slabs

1. Casting the approach slabs and the deck simultaneously creates a smoother transition and ride. However, to avoid maintenance and to preserve the integrity of the deck and the approach slabs, a metal bond breaker should be placed over the abutment across the entire width and depth of the deck. This will ensure that a random crack does not occur before the joint can be cut. At the grade beam, the joint is usually blocked out with styrofoam.

2. The rail that the finishing machine rides on must be uniformly rigid. Unfortunately, where the rail passes over the grade beam and abutment, the rail is frequently more rigid than either side of these substructures. This can cause a dip either side of the abutment and the grade beam, which can result in a “bump” over the abutment, and grade beam.

3. Another problem can result when the deck overhangs the outside girder. Typically, the deck forms are supported by outrigger jacks braced against the outside girder. The weight of the concrete and the finishing machine can momentarily bend the outside girder as the placing operation progresses. Temporary construction braces (usually wood blocks) between all girders can prevent girder movement.

X. Surface Checking (Not in Spec)

1. A 10 ft (3 m) straightedge surface check shall be conducted on all bridges and deck overlays not covered by the Smoothness Specification. Surface areas inaccessible to profilometer shall also be checked.

2. On some projects only one wheel path may be included in the placement width. For price adjustment or incentive pay, only the portion within the traveled lane shall apply. Variable width sections for on and off ramps, which are outside the through traveled lane, will be checked with the surface checker.

Y. Test Procedure for Smoothness

1. A Special Provision entitled “Bridge Deck and Approach Slab Smoothness” will usually be included in the contract proposal. This Provision deals with the method of testing for smoothness and the method for correcting surfaces outside of the smoothness limits. The contractor is responsible for scheduling the testing, which will be performed by Materials and Research Division personnel. The contractor must give the Project Manager seven days notice prior to the date he requests that testing be done. The Project Manager shall contact the Materials and Research Division and arrange for testing on the requested date. Evaluation

2. Materials and Research Division will furnish a profile index to the contractor within 72 hours of the completion of the tests.

Z. Smoothness of Bridge Decks

1. Checklist - The following items should be checked and procedures followed prior to, during, and after the overlay is placed to insure a smooth riding deck surface:

   a. Guide rails are used to support and guide the finishing machine. Check for rail deflection during passage of finish machine. Any vertical or horizontal movement could compromise smoothness and rideability. Request that the contractor readjust anchor legs and/or tie-downs.

   b. Check that all propulsion and control equipment are fully operational prior to placing concrete. The contractor shall traverse the finishing machine over the entire length of section to be placed. This not only serves to verify that equipment and control systems are functioning properly, but also provides a check to assure that screeds are adjusted for proper crown and height above existing surface.

   c. Sufficient materials (water, cement aggregate, and admixtures) are available on site to complete the intended placement in a continuous operation.

   d. The contractor may have to limit size of placement or provide additional mixers (HD-LS only).

      (1) If a mobile mixer is not large enough to provide adequate volume for the placement, or

      (2) If there is no provision for recharging.

   e. Ensure that adequate number of vehicles are available at the work site to transport mix from mixer to the placement area at a volume necessary to provide a uniform rate of forward progress. Any equipment working on the deck should be checked for oil and hydraulic fluid leaks.

   f. Contractor must provide sufficient, trained personnel to carry out the various phases of deck placement. Timeliness is of utmost importance during placement operations. Be sure specialized crafts, such as finishers, are

adequately represented and preferably have only one task during the placement.

g. Check concrete for smoothness with the 10 ft (3 m) straightedge. The straightedge should be placed on the surface from a vertical position, not pushed over the surface. Irregularities can be detected by comparing deck surface with a straightedge. Irregularities noted at this time should be corrected.

2. Surface Correction

a. Corrective work shall be done in the presence of the Engineer with a diamond bladed grinder at least one meter wide. Grinding residue must be controlled. After the deck is ground, a second test will be made to determine if the deck now meets the smoothness requirements. This second test will also be performed by Materials and Research personnel and it is anticipated they will be on-site at the time of grinding, in order that they may perform the retest while the grinding equipment is on-site.

3. Acceptance

a. Materials and Research personnel will notify the Project Manager whether or not the corrective work has resulted in an acceptable deck surface. If grinding cannot correct the surface profile, the Specification requires removal and an overlay with high-density low slump concrete.

b. Troubles and expense of this sort could virtually be eliminated by careful and detailed inspection by project personnel during construction and proper handling of test cylinders.

4. Missed Texturing

a. There will be times, due to various reasons, when texturing will have to be omitted from a pour. One such event could be when inclement weather catches a pour and covering prevents texturing. Obviously this condition is **NOT** desirable.

b. After full cure time has expired, grind in the required texture.

AA. Approach Sections--Bridge Approach Tapers

1. On deck overlay construction, normally some treatment of the approach is necessary and will be indicated on the plans. Watch the contract documents for bid items for ACC material. For projects where asphalt tapers are proposed and no quantity for ACC is given, an extra work order will be required.

a. Shoulder Maintenance - When temporary concrete barrier rails are used on deck repair and overlay jobs, traffic is constricted into a narrower lane. This in turn could cause a rapid deterioration of shoulders at bridge approaches and require the following corrective measures:

(1) Ruts developing in earth and granular shoulders should be repaired as necessary with a granular surfacing material. This is extra work order and a change order will be issued for this work.

(2) Ruts and loss of asphaltic cement concrete surfacing on Interstate shoulders should be repaired using an asphalt cement concrete pre-mix, hot mix, or some similar treatment to minimize the development of holes or ruts. A change order may be needed for this work unless there is an ACC contract item for shoulder maintenance and even then it may have to be extended.

(3) When shoulder strengthening was not included as a bid item, but is needed for the project, the change order must consider:

(a) Present shoulder construction and experience with shoulder stability in the immediate area.

(b) Traffic volumes, percent of trucks, and duration of potential problem.

BB. Setting Beams

1. The following should be used as a guide in conjunction with *SSHC Section 704*:

a. On diaphragm piers, beams may be set as soon as doing so will not mar or chip the concrete. It is recommended that 24 hours be considered a minimum cure time. (In cooler weather, ambient temperatures below 40°F (5°C), the minimum time indicated should be increased to 48 hours.)

b. No beams may be set on piers until the cap concrete is at least 7 days old and has its design compressive strength.

c. On stub abutments, steel beams and girders may be set as under A above. Concrete beams on stub abutments, same as A above. On full abutments (solid and continuous from spread footing), same as A above.

706.04 METHOD OF MEASUREMENT

A. The cubic yards of concrete for structures of varying sizes are computed from dimensions shown in the plans and placed in tables in the plans. All structures using the same type of concrete are lumped together.

707.00 BRIDGE DECKS AND OVERLAYS (*SSHC Sections 710 and 711*)

707.01 DESCRIPTION

A. The concrete bridge floor is the wearing surface of the bridge superstructure and is commonly referred to as the bridge "deck". This work consists of forming, reinforcing, and placing concrete to the lines, grades, and typical cross sections shown in the plans.

707.02 MATERIAL REQUIREMENTS

A. See Subsection 706.02

B. Density Testing

1. Durable, low maintenance bridge decks require impermeable (very dense) concrete. Therefore, checking density during placement is an essential part of deck surfacing and overlay inspection. Test frequencies for determining the density of bridge deck surfacing and overlays are listed in *SSHC Subsection 711.04*. A test should be taken at 5 ft (1.5 m), 10 ft (3 m), 15 ft (4.5 m), and every 50 ft (15 m) thereafter per placement width per bridge. Density tests will not be required for overlaying approach paving areas.

2. It is always desirable to take more than the minimum nuclear density tests per length of overlay placed. If densities are at or near the lower specification limits, additional testing will need to be performed.

3. Vibrating Mix at Test Well Location

   a. On some projects, contractors have been vibrating the concrete mix in the test well with a hand-held vibrator prior to passage of the finishing machine. This practice will not be permitted.

   b If the oscillating screed vibrators are functioning properly, complying density of the concrete mix in the test well will be obtained without any difficulty. Obtaining required density at test well locations, without supplemental vibration, assures us that the contractors' equipment and placement procedures are capable of producing the desired results throughout the overlay being placed.

4. Density Test Wells on Bridge Deck Repair Projects

   a. Follow guidelines in *SSHC Subsection 710.04, para. 7.b.*

707.03 CONSTRUCTION METHODS

A. General – The wind velocity-temperature relationships stated in the specifications should be enforced to avoid loss of water from the concrete surface faster than it can be replaced by normal bleeding and to avoid the resultant formation of plastic shrinkage cracks. Anemometers and thermometers must be available on site to measure wind velocity and temperature.

1. Concrete in bridge floors shall be placed uniformly on both sides of the centerline and shall be placed continuously between specified joints. The sequence of placing shall be in accordance with the pouring diagram shown in the plans. If no pouring diagram is shown in the plans, concrete shall be placed as directed by the Project Manager.

2. The deck forms shall be dry when using HD-LS but must be wet when using silica fume concrete before placing the concrete. Concrete shall be adequately vibrated to encase the lower bars of the reinforcing mat where these are near the deck form.

3. Special attention shall be given to finishing the riding surface on the bridge floors. *SSHC* Subsections 706.03, 710.03, and 711.03 explain concrete bridge floor finish.

4. It has been the policy to permit the contractor to use mechanical finishing machines of an approved type whether or not they are required by the plans or special provisions.

5. Method of Finish - When the hand method described in Section 704 is employed, the concrete surface shall be struck off with a strike board which conforms to the cross section shown in the plans. If this is pulled by hand, care shall be taken not to displace the reinforcing steel by the workmen doing the pulling. A small air winch anchored to a girder outside of the day's pour will pull the strike off at a slow, uniform rate, giving a truer surface with no displacement of the reinforcing steel. The strike board shall be operated with a combined longitudinal and transverse motion, always carrying a small roll of concrete in front of the cutting edge. The strike off shall be pulled a sufficient number of times to properly distribute the concrete. A longitudinal float generally is required and is described in

6. *SSHC Section 704.* The longitudinal float shall be lapped 1/2 its length when moved to a new position and shall be operated across the surface a sufficient number of times to produce a uniform, smooth riding surface. Occasionally during the finishing operation, conditions may require the use of the long-handled transverse float, which require extreme care in its use to preserve the desired cross-section and a smooth riding surface.

7. Regardless of whether hand or machine finishing methods are used, the floor surface shall be tested for trueness with a 10 ft (3 m) straightedge. The bridge contractor is required to furnish a 10 ft (3 m) master straightedge for use in trueing and checking the working straightedges.

8. Phased construction of a bridge deck usually requires a form longitudinally down the bridge deck near the center of the bridge. The location of the form is shown in the plans. Sometimes it is more efficient to move the location of the longitudinal phasing joint. On bridges with concrete girders it is nice if the joint can be lined up to use the notched lip in the girder flange. However, the resulting lane widths must be checked to confirm there is adequate clearance for vehicles.

B. Bridge Deck Curing

1. When the high temperature for the day that the deck will be cast is expected to exceed 80°F the deck should be cast at night. The Contractor should contact the concrete plant and schedule the concrete deliveries to the bridge deck to begin at 5:00 pm. The Contractor must also confirm that the concrete will have a 1-hour set delay when it arrives on the deck.

C. Bridge Deck Joints

1. If a joint compound is not specified the Contractor may use hot tar to seal bridge deck joints.

E. Deck Overlay Preparation

1. Securing an adequate bond at the interface of the existing prepared deck surface and proposed overlay course is essential in obtaining a durable and maintenance free bridge deck system. General surface preparation requires milling, shotblasting, and/or sandblasting depending on the surface condition or amount of existing surface material to be removed. Any reinforcing bar which is exposed must be sandblasted to remove all rust contaminants, and unsound concrete. Also, prior to placing the grout the surface must receive an air blast to remove dust and other foreign particles from the prepared surface.

2. The surface, once cleaned, must remain clean until the grout and concrete is placed. There have been cases where the prepared deck surface has become contaminated during the decking operations by concentrated traffic of vehicles transporting the concrete. This is especially true when the skid-steer type loaders are used to transport mix. The deck surface is contaminated by the abrasive action between the concrete surface and the rubber tires, and also from oil and other foreign material tracked in from off the bridge. Contamination can be recognized by discoloration or oil on the deck surface. Contamination is especially noticeable in the wheel paths used by the vehicles.

3. Core specimens taken and tested for bond strength from areas as mentioned above showed a marked decrease in bond strength between the interfaces.

4. To prevent the cleaned deck surface from being contaminated by traffic, the contractor shall cover any prepared surface with sheets of plywood, multiple layers of plastic, or other suitable material. To ensure a clean surface prior to placement of the overlay system, areas which become contaminated shall be resandblasted followed by an air blast.

F. Class I Floor Repair (*SSHC Sections 710 and 711*)

1. Follow guidance in SSHC Subsections 710.04, para. 1 and 711.04, para. 1.

G. Work on Adjacent Lanes

1. *SSHC Section 423* prescribes traffic provisions when traffic is present.

708.00 Bridge Diaphragms

A. Steel diaphragms, if allowed, are shown in the plans for prestressed beam structures. Shop drawings are required for steel diaphragms showing details of beam layouts, location of the diaphragms, and location of mounting holes.

1. High strength bolts for steel diaphragms shall be tightened by Turn-of-Nut method. (Refer to *SSHC Subsection 708.03* for information on proper bolt inspection and installation.) Inspection and field installation acceptance will be based on observing proper Turn-of-Nut procedures. (A tensioning device and inspection torque wrench is recommended, but will not be required.)

2. Concrete diaphragms at piers of prestressed concrete girder bridges should be cast to 2/3 of their intended depth. The final 1/3 and the deck are then placed at the same time. However, there are instances where allowance has been given for specific diaphragms to be placed prior to slab placement. If there is a construction option shown in the plans, the diaphragm can be poured separate from the deck. Note the construction joint detail will show how to strike-off the surface. Consult with the Construction Division in situations where the contractor requests to place concrete diaphragms other than as shown in the plans.

3. Phased bridge decks which have inverted “T” girders should not have the portion of the diaphragms cast between the two girders on each side of the longitudinal phasing construction joint until the second phase deck is cast. If the girder diaphragms for the gap between the two girders which are on each side of the phasing joint are cast before the second phase deck is cast, the diaphragms will lock the girders under the second phase deck at a position higher than the phase 1 girders. Cast the diaphragms between the two girders that are on each side of the phasing construction joint at the time the second phase deck is cast. The remaining girder diaphragms in the second phase should be cast before the deck is cast.

   a. Casting the intermediate (midspan) diaphragms before the deck is cast removes some of the girder camber and will make the structure more stable for the deck casting.

709.00 Girder Shims

A. Definition

1. A girder shim is defined as the distance measured from top of girder to top of finished slab. There are three different types of bridges which we build that have girder shims. The first type is a steel girder bridge, either a rolled beam section or a plate girder section. The second type is a prestressed girder (NU Girder Section). The third type is a prestressed twin tee girder. When taking shim shots on a prestressed twin tee girder, they should be taken at the edges of the twin tee. Take shim shot on steel girders or NU girders along the girder centerline.

2. For each type, the definition of the girder shim is the same; girder shim is the distance measured from the top of girder to top of finished slab.

3. Stages of the Girder Shim Process The Bridge Division, upon completion of the design, will prepare the shim input forms. After the project has been let, we send these forms to the Project Manager. After the girders are erected and prior to forming the deck for the slab, shim shots are required to be taken. These shim shots should be taken at the bearings, field splices, and at 3 m intervals along the length of the girder. The shim shots can be recorded on the input forms.

4. The H.I. Elevation needs to be recorded by the inspector at the time the shim shots are taken.

5. The rod readings at each location are recorded on RDP Form 50a. This information is normally sent by computer to the Bridge Division. The Bridge Division will run a computer program which uses the grade of the roadway, crown of roadway, the dead load deflection of the girder, and your rod readings to determine the amount of shim at each location.

6. The Bridge Division will look at the shims to see if they are too large or too small. The final shim information will be sent to the Project Manager along with solutions to any problems which may have occurred.

7. The proper girder shims are critical to ensure that construction of the bridge is in accordance with the intended design.

8. Composite Girders

   a. There are two methods of designing girders. One method is a non-composite design and the other method is a composite design. The non-composite design is basically the slab sitting on top of the girders. By providing shear connectors on the top of the top flange, we can tie the slab to the girders into what we call a composite section. On prestressed girders, the stirrups extending out of the girder into the slab provide the composite action. The composite section produces a more economical design. The Bridge Division designs the girders as a composite section.

   b. AASHTO Specifications

(1) In order for this composite action to actually take place, it is critical that these shear connectors extend into the slab the proper amount. For steel girders, AASHTO specifications require that the shear connectors penetrate at least 2 inches (50 mm) above the bottom of the slab.

(2) The AASHTO specifications also state that the clear depth of concrete over the tops of the shear connectors for steel girders shall not be less than 2 inches (50 mm). So this gives the Bridge Division a range for the location for the top of the shear connectors.

(3) Proper vs. Improper Shims

(4) When you are inspecting a job, a visual inspection of the relationship of the shear connectors to the slab reinforcement will help you determine if something is wrong. Based on the slab thicknesses that we normally use [7.5 inches (190 mm) or 8 inches (205 mm)] thick, the length of stud that we normally use [5 inches (125 mm long)] and if the slab is reinforced, the end of the sheer connector should be located somewhere between the top and bottom transverse slab reinforcing steel.

(5) We specify 1 inch (25 mm) of clearance between the bottom of the slab and the bottom transverse reinforcing steel. A ¾ inch (20 mm) bar is the largest bar specified. Therefore, knowing that we need 2 inches (50 mm) of penetration for the shear connectors, the top of the shear connector should always be above the transverse bar in the bottom of the slab.

3. Problems and Solutions

a. When we have the problem of too large of a shim, there are a couple of things we can do to solve this problem. One solution is to provide some reinforcing bars at each shear connector location that properly extend into the slab. Another solution is to weld a plate onto the top of the shear connectors to gain the proper penetration length.

b. Where we have the problem of too small of a shim (top flange extending into the slab) there is only basically one thing you can do. That is to raise the grade of the roadway.

4. Critical Item - Proper Girder Seat Elevations

a. The most important thing that our inspectors can do to insure proper shims is to make sure that the girder seats are poured to the proper elevations. If the girder seat elevations are wrong, you can almost be sure that you will have problems with your shims. If your girder seats are correct, more than likely your shims will also be correct.

5. Critical Item - To Ensure Proper Shim

   a. Steel girders must be set on substructure by following the blocking diagram shown on the plans.

Example Computer Print

IDENT	PROB. NO.	GIRD. NO.	DIST. CL PROJ. TO CL ROADWAY	E FROM BASELINE	H.I. ELEV.
7018	1	1	O.C.	10.0000 LT.	1719.24

Girder No.	Station	Centerline Grade	Crown Correction	Girder Elevation	Dead Load Deflection	Rod Reading	X Distance	Shim
1	22+10.77	1715.662	-0.150	1714.920	0.0	4.32	0.0	0.592
1	22+20.77	1715.753	-0.150	1715.020	0.015	4.22	10.00	0.598
1	22+30.77	1715.840	-0.150	1715.100	0.023	4.14	20.00	0.613
1	22+40.77	1715.925	-0.150	1715.180	0.021	4.06	30.00	0.616
1	22+50.77	1716.006	-0.150	1715.260	0.011	3.98	40.00	0.607
1	22+60.77	1716.084	-0.150	1715.320	0.001	3.92	50.00	0.616
1	22+65.77	1716.122	-0.150	1715.350	0.0	3.89	55.00	0.622
1	22+70.77	1716.189	-0.150	1715.370	0.004	3.87	60.00	0.644
1	22+80.77	1716.281	-0.150	1715.470	0.019	3.77	70.00	0.630
1	22+90.77	1716.300	-0.150	1715.490	0.033	3.75	80.00	0.693
1	23+ 0.77	1716.365	-0.150	1715.550	0.040	8.69	90.00	0.705
1	23+10.77	1716.427	-0.150	1715.610	0.033	3.63	100.00	0.701
1	23+20.77	1716.486	-0.150	1715.700	0.019	3.54	110.00	0.655
1	23+30.77	1716.342	-0.150	1715.730	0.004	3.51	120.00	0.666
1	23+35.77	1716.588	-0.150	1715.770	0.0	3.47	125.00	0.648
1	23+40.77	1716.594	-0.150	1715.810	0.001	3.43	130.00	0.636
1	23+50.77	1716.644	-0.150	1715.860	0.011	3.38	140.00	0.645
1	23+60.77	1716.690	-0.150	1715.900	0.021	3.34	150.00	0.661
1	23+70.77	1716.733	-0.150	1715.950	0.023	3.29	160.00	0.656
1	23+80.77	1716.773	-0.150	1715.980	0.015	3.26	170.00	0.658
1	23+90.77	1716.809	-0.150	1716.010	0.0	3.23	180.00	0.649

710.00 Pot Bearings

A. The Materials and Research Division inspects pot bearings at the site. In order to facilitate the work, we request that the Materials and Research Division be notified immediately when the pot bearings arrive at the site. This will permit Materials and Research personnel to inspect the bearings in a timely manner.

B. The person to notify is Mr. Mark Burham at Materials and Research. His phone number is (402) 479-4746.

711.00 Barrier Rails

711.01 Description

A. Fixed Form Jersey & Retrofit Rail

1. Before cast-in-place barrier rail is constructed on the existing bridge curb section, *SSHC Subsection 704.03*. requires that old concrete which is to be in contact with the new concrete be cleaned of all laitance (loose particles of concrete, dirt, or other foreign materials).

2. Structurally, the existing curb surface need not be roughened, but must be clean. To assure a clean surface and to obtain maximum bond at the interface, sandblasting the old curb surface shall be required. Other methods of cleaning may be approved by the Project Manager.

3. Surface preparation, such as sandblasting, should be completed prior to setting the epoxy coated dowels.

4. When retrofit is part of a deck overlay, the contractor may request permission to place the finish machine on the retrofit rail. Construction's policy will be:

   (a) A minimum cure time of at least 48 hours prior to placing the mass of a finish machine on the rail, AND

   (b) Finish machine rail support feet must be spaced less than 1’-9” (550 mm) apart.

      (1) If these conditions are unacceptable to the contractor, a minimum cure time of 72 hours will be required. After 72 hours there are no special conditions for placing a finishing machine on the barrier rail.

B. Cast-In-Place (Retrofit) Barrier Rail

1. This work is routinely combined with a deck repair project and includes an overlay. Often contractors will place the new rail prior to placing overlay. In these situations, the contractor intends to place the finish machine's rail on top of the new barrier rail. Question: How long must the new rail cure before allowing the deck finishing machine to be placed on it?

   a. 48 hours must expire prior to placing the weight of a finishing machine on the rail.

   b. Rail supports (legs) must be placed at a spacing of no greater than 18 inches (500 mm).

   c. Rail supports and rail cannot be placed until the surface has sufficiently cured to prevent scuffing and/or marring.

   d. Care must be taken to prevent damage to the face or back of the barrier rail.

C. Slip Form Barrier Rail

1. Slip form rails have at times displayed transverse cracks, longitudinal cracks, reinforcing steel shadows, and nonuniformity of top elevations. Consideration of the following construction problems and solutions will help to eliminate problems:

2 Longitudinal Cracks

(a) Longitudinal cracks and vertical cracks near posts can be prevented with proper construction techniques. (Consolidate uniformly, obtain proper rebar clearance and wet cure.)

711.02 Material Requirements (See Section 706)

711.03 Construction Methods

A. Concrete Surface Finish (Rail and Beams)

1. Ordinary surface finish is required for rails. Beams need only have "popcorns" filed.

B. Surface Finish

1. The type of surface finish required for concrete structures is governed by the special provisions, the plans and *SSHC Subsection 704.03*. A pre-construction study of these sources will bring to light any possible differences of opinion concerning requirements and allow time for their solution.

2. For either ordinary surface finish, rubbed finish, grout cleaned finish, or floated surface finishes, the contractor should be required to perform the work as promptly as practical after the removal of the forms. If this work is started promptly, and the surface finishing work performed before the concrete becomes excessively hardened, a much better surface finish will be obtained. Also, this better finish will be obtained with less work and consequently at lower cost.

3. If the required finish is a rubbed finish, then *SSHC Subsection 704.03* does not authorize plastering an excess of mortar on the surface of the concrete. The mortar is to be applied, as stated in the Specifications.

4. Note that proper rubbing is a sequence of three steps:

a. The surface is thoroughly saturated and then rubbed with the medium coarse stone faced with mortar. The paste (rubbed up from the surface of the concrete, and not applied as a plaster) is left on.

b. The surface is wetted and rubbed with a fine carborundum stone. The paste is left to dry on the surface.

c. The dried paste is rubbed off completely with burlap. Some laborers will not distinguish between coarse and fine stones, or the contractor may originally furnish only one grade. Check with the Project Manager as to the proper degree of fineness of the stones being used, on the basis of the finished results. Request the Project Manager's inspection of the first finishing work done in order that he/she can set standards for methods and results in subsequent work. Ordinary surface finish, rubbed finish, grout cleaned finish, and floated surface finishes include leaving all chamfer lines and all plane surfaces intersection lines cut clean and straight.

5. Special provisions currently allow the use of a special surface coating as an alternate to a rubbed surface finish.

6. Special attention and inspection should be given to the close tolerance required in finishing of the concrete at the bearing plate areas on abutment and pier caps. Promptly after the concrete has hardened sufficiently, remove the anchor-bolt templates and finish the bearing area to a true surface. A small carpenter's level is very helpful to level the area. Prompt and efficient performance of this work will save much grinding of the hardened concrete at the time the bearing plates are set, and will yield better, more uniform bearing areas.

NOTE: To enhance the ability to hand finish slipped rail, CONFILM is recommended. CONFILM is a Master Builders product and should be used per manufacturer's recommendations.

712.00 HAND RAILS (*SSHC Section 716*)

712.01 DESCRIPTION

A. This work shall consist of furnishing and erecting all steel or ornamental handrail and all miscellaneous hardware such as anchor bolts, capacity plates, and splices.

712.02 MATERIAL REQUIREMENTS

A. Handrails shall conform to the horizontal and vertical curves specified in the plans. Posts shall be set normal to the top of the curb, except when otherwise noted in the plans or special provisions.

712.03 CONSTRUCTION METHODS

A. Ornamental Handrail

1. Care must be taken in storing, handling, and erecting ornamental handrail so as not to permanently mar or injure the finish on the post and rail elements. Aluminum ornamental handrail which is to be stored in the open should be removed from the cardboard cartons since cartons may stain the handrail when they become wet and considerable effort is required to remove these stains.

2. Ornamental handrail inspection is not generally waived at the fabrication plant even if small quantities are involved. If the Project Manager does not have a copy of a shop inspection report on file indicating inspected material, the material should be inspected by Materials and Research Division. If there is a question of whether the material has been inspected or not, the Materials and Research Division should be contacted for clarification.

3. The Project Manager should make a visual check of the handrail before placing it in the structure. In the case of aluminum tubing, "carbon streaks" that develop in the manufacturing process are not cause for rejection. However, the carbon streaks should be limited to one 90-degree segment of the surface of any rail. Particular attention is necessary at the time of erection. Tubing should be placed in the bridge railing in such a manner that the carbon streaks are not visible to traffic.

713.00 **PAINTING** (*SSHC Section 709*)

713.01 **DESCRIPTION** - The painting of metal structures has a dual purpose. The primary function of paint application is to preserve the life of the metal. A second function, especially important in highway grade separations, is to produce and maintain an improved appearance. Painting includes the preparation of the surface and the application of the paint coatings.

A. Painting (*SSHC Section 709*)

1. New Non-Weathering Structural Steel

   a. Shop applied paint system shall be used for non-weathering steel bridges.

   b. A field applied "top coat" is usually required. A top coat will also be required when it is deemed necessary due to aesthetics.

   c. The contractor will be required to touch-up any damaged areas after erection. Touch-up with top coat paint system shall be the same paint as the shop coat.

2. New Weathering (ASTM A 588) Structural Steel

   a. The plans require shop applied prime paint to selected areas on the structure. They also require:

   b. The approved paint system.

   c. Only paint where shown in the plans with approved paint system.

   d. The contractor to touch-up any damage to primed areas after erection prior to top coating. This includes bolts in those areas. Touch-up paint shall be the same paint as the shop coat.

3. Field Painting

   a. Field painting of structural steel shall be done as shown in the plans and special provisions.

713.02 **MATERIAL REQUIREMENTS** - Paint sampling should be done according to the "*Materials Sampling Guide*" unless the paint to be used is from tested stock in which case it will be tagged to show acceptance.

A. Mixing Paint

1. Follow the manufacturers recommended mixing and thinning procedures.

713.03 CONSTRUCTION METHODS

A. Painting Structural Steel

1. Paint which has been applied on rust, or dirty surfaces will peel and crack. If rust blisters form under the paint film, they can, in time, seriously reduce the effective cross section of structural shapes. The specifications require that all erection work be completed before the cleaning process is started. The cleaning should be done in a systematic manner, with the painters cleaning a given area or member before painting it.

2. Paint shall be applied as prescribed by contract specifications or the manufacturer's recommendations, whichever is most demanding. The Project Manager shall determine the correct procedure if the contract specifications differ from the manufacturer’s recommendations.

3. The Project Manager or inspector should insist that the painting be done systematically, with painters working in groups on a given coat. The practice of having cleaners and painters spread out all over a bridge, with the inspector not knowing what men are working on each operation, nor which members have been cleaned and painted, should not be permitted. Painting should, in general, be started with the highest bridge members and progress downward, in order to cover areas where paint has dripped from the work above. Painting operations below deck level, should be permitted only after the deck slab concrete has been placed. Girders painted prior to the concrete placement are likely to be spattered by form leakage and may be badly scarred by form removal, necessitating considerable recleaning and repainting of all coats.

4. The plans and specifications require different paint film thickness depending on the type of paint specified. The Project Manager should check the plans and specifications to determine the types of paint required to verify that the correct system has been certified and should check for the required dry film thickness.

   a. County bridges usually only get one coat.

   b. New state structures usually get two coats.

   c. Repainting an existing structure usually means adding a third coat.

5. The Project Manager or inspector should check the dry film thickness of the shop and field coats of paint applied on structural steel in accordance with the following instructions:

6. Shop Coat - The shop coat of paint may or may not have been checked in the fabricator's shop; nevertheless the shop coat should always be checked in the field, and any deficiency in paint film thickness corrected, before the second coat is started. When the dry film thickness of the shop coat is found to be inadequate, the Materials and Research Engineer should be notified in order that the particular fabricator involved may be made aware of the situation.

7. Second and Third Coats - Checking the thickness of the second and third coat with the magnetic gauge is accomplished by measuring the cumulative thickness of the first (or shop coat) and the additional coats. The dry film thickness of the second coat should always be checked and any deficiency in paint film thickness corrected before the third coat is started. Any deficiency in paint film thickness must be corrected before the work can be considered complete and consideration of acceptance given.

8. The equipment used to check the dry film paint thickness is called a magnetic dry film thickness gauge. One or two of these gauges are being furnished to each District Office for use in the District in checking the painting of steel structures. These gauges are expensive, delicate instruments and must be carefully handled and always kept in the carrying case when not in use. The procedure for using the gauge is as follows:

    a. Turn dial to maximum reading.

    b. Place pole on the surface to be measured.

    c. Be sure the magnetic contact is touching the painted surface.

    d. Slowly and as continuously as possible, rotate the dial clockwise until magnetic contact breaks. A click will be heard when the pin breaks contact. At this point the coating thickness can be read on the dial indicator. The reading will remain on the dial when the gauge is removed from the surface being checked. The gauge can also be held in any position to take a reading. The magnetic gauge reads directly in mils. A reading of 2 on the dial indicates that the thickness of the paint film is 2 mils or .002 inch.

9. The frequency of testing for paint thickness should be as follows:

    a. Girders - Each line of girders should be checked at a maximum interval of 50 ft (15 m) and at each check point, 3 or 4 tests should be made. For example, on a 200 ft (60 m) bridge each line of girders should be checked at the abutments and at 3 intermediate points. At each one of these points three or four places should be checked such as a point on the web, a point on each flange, and a point on a stiffener.

    b. Separators, Cross-frames and Floor Beams - Alternate lines of separators, cross-frames and floor beams should be checked two times at one location. For example, the top and bottom angle should both be checked for every other line of cross-frames.

    c. Lateral Bracing - Lateral bracing should be checked at about 50 foot intervals.

    d. Miscellaneous Material - Material such as expansion devices, tie rods, bearing plates and drainage systems should be spot checked for required paint film thickness.

10. Additional tests should be made, as required, to determine the extent and location of any areas deficient in paint film thickness.

11. The bridge notebook or diary should verify that the paint film thickness on each structure meets the thickness requirement specified, and the entry should include the signature of the inspector and date of inspection.

714.00 CULVERTS (*SSHC Sections 717 to 726*)

714.01 GENERAL

A. The backfill near a pipe or box culvert is more expensive than excavation in the surrounding area. Therefore, in the *SSHC Subsection 702.03*, limits are placed on the quantities "Excavation for Box Culvert" and "Excavation for Pipe, Pipe-Arch Culverts, and Headwalls."

715.00 CONCRETE BOX CULVERTS (*SSHC Section 717*)

715.01 DESCRIPTION

A. A culvert may be defined as a structure to convey water under a roadway. Concrete box or arch culverts are used when drainage areas are too large for the conventional culvert pipe or when cattle passes under the roadway are desired. These structures are cast-in-place according to standard or special plans under *SSHC Sections 702, 704, 705 and 717.*

B. The contractor may request that culverts be built to the nearest whole English units. Any material savings will be deducted from the payments due the contractor.

715.02 MATERIAL REQUIREMENTS

A. See Section 706.02. Note in SiteManager the date the reinforcing steel is verified on-site.

715.03 CONSTRUCTION METHODS

A. General - The concrete placement for box and arch culverts is discussed in Section 706 of this manual. *SSHC Subsection 717.04* further provides that foundation excavations shall be "as dry as practicable before concrete is poured". This requirement recognizes the necessity of an adequate foundation for roadway structures. When the excavation for a footing is completed, the project manager or his/her representative should be contacted for his/her approval of the footing subgrade before any concrete is placed. In the event that unsuitable foundation subgrades are encountered, suitable ones composed of sand, gravel, concrete aggregates or a concrete seal course must be constructed (see *SSHC* Subsections 702 of this manual).

1. Construction of curtain walls on culvert footings usually is quite a problem because of the difficulty in maintaining the excavation in proper condition while placing concrete.

2. If material to be excavated is of such nature that neat lines for the curtain wall cannot be maintained, the Project Manager may allow forming and placing the curtain wall to the bottom of the footing. Mud must be prevented from working up into the concrete.

3. Currently, the plans for box culverts show the backside of the wing battered 3/8” in 12”, which results in a varying wall thickness. Contractors may be permitted to construct walls using the wall’s base thickness, thus eliminating the batter. A plan revision or change order will not be required to effect this change.

B. Placing Concrete and Form Removal

C. Placing Concrete

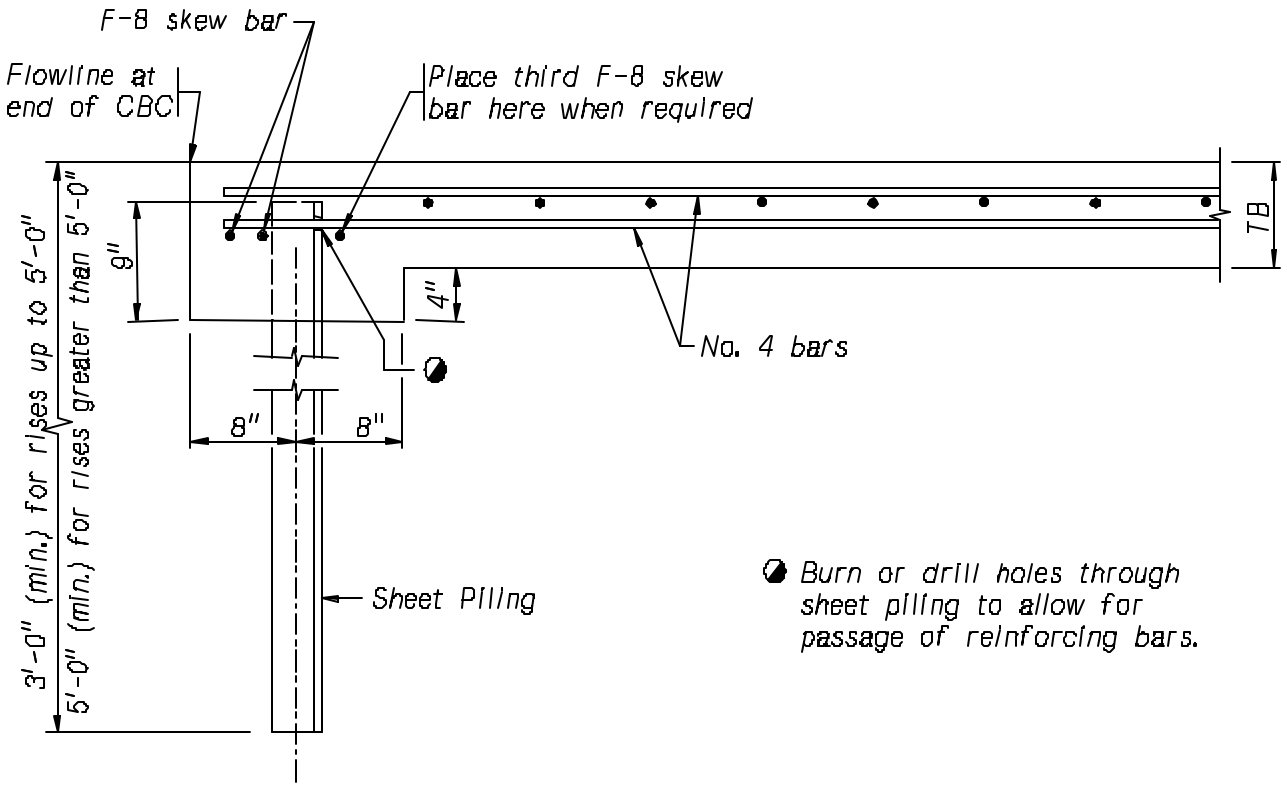
1. Placing Concrete in Walls and Top Slab. *SSHC Subsection 704.03* states that culvert, sidewalls, and top of slab may be constructed as:

   a. A monolith unit or,

   b. Concrete in sidewalls may be placed and allowed to harden before the top slab is placed.

2. If the contractor chooses to use the hardened concrete method, keyways will have to be installed to anchor the cover slab.

D. Sheet Pile Turndown. Option to Use Steel Sheet Piling in Lieu of the Planned Turndowns at Box Culvert Ends.



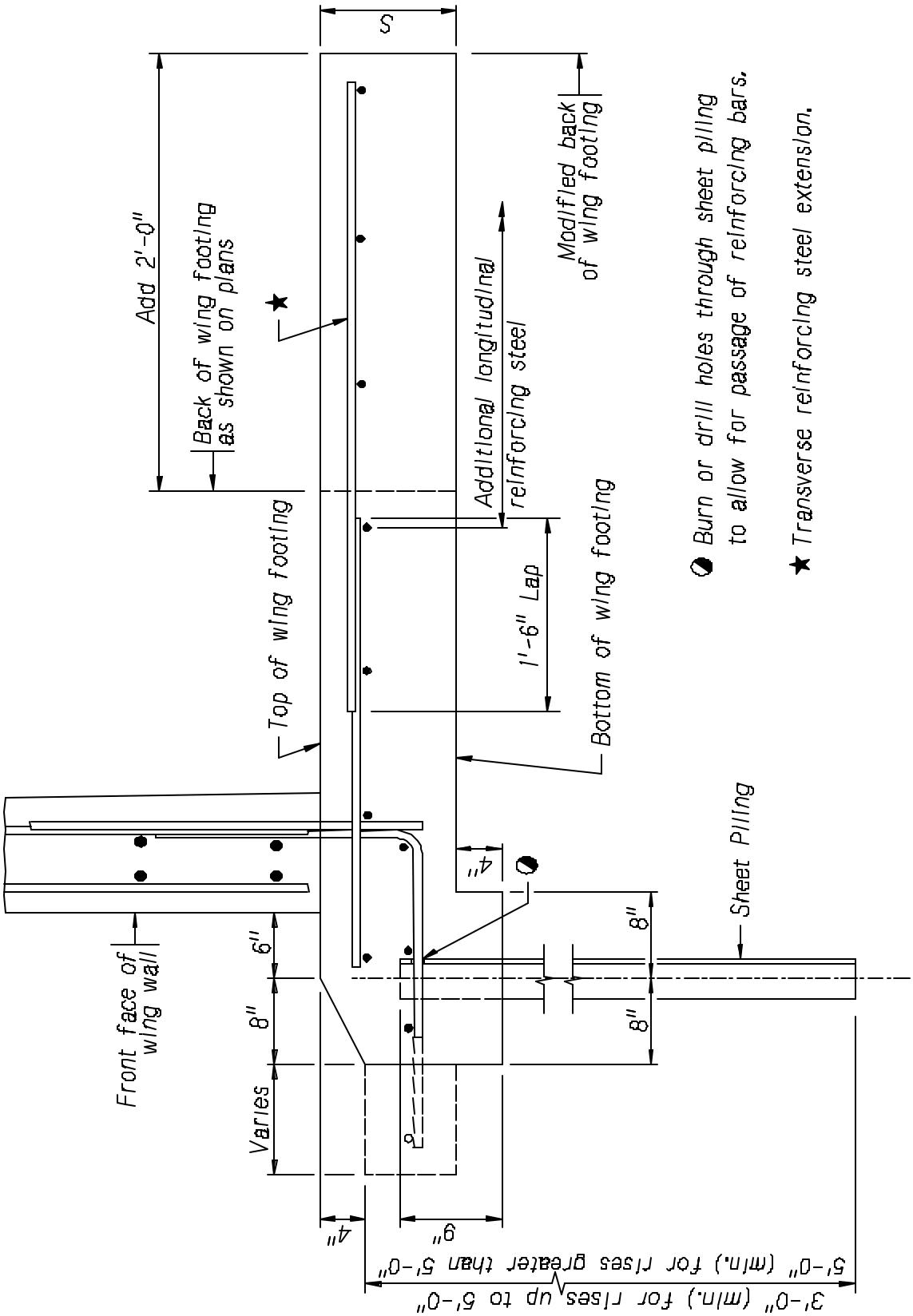
OPTIONAL SHEET PILING TURNDOWN AT END OF BARREL FLOOR

(Longitudinal section taken at midspan)

NOTES

The wing footing width, including the horizontal taper (dimension P to dimension Q), must be increased at the same footing thickness by an additional 2'-0". Additionally, the distance from the top of the wingwall footing to the bottom of the sheet piling turndown shall be 3'-0" for rises up to 5'-0", and, 5'-0" for rises greater than 5'-0". This option shall include the extension of the transverse reinforcing steel, placement of additional longitudinal reinforcing (same spacing as the No. 4 bars in the top of the footing), and the placement of additional concrete. The wing footing extension shall be poured monolithically with the rest of the wing footing. All sheet piling, additional concrete, reinforcing steel, preparation, equipment, tools, labor and incidentals necessary to complete the work shall be supplied at no additional cost to the Department.

All sheet piling shall be interlocking. Steel sheet piling shall have a 7 gage thickness (minimum). Plastic sheet piling may be used with permission from the Bridge Division.



OPTIONAL SHEET PILING TURNDOWN AT WING FOOTING

(For concrete box culvert wings)

E. Removal of Wall Forms

1. On large culvert jobs, it is a distinct advantage for the contractor to remove wall forms before the top slab has attained sufficient age to remove supporting forms. This will be permitted under the following conditions:

   a. Vertical forms may be removed as provided in *SSHC Subsection 704.03*.

   b. Slab forms must be supported independently of the wall forms.

   c. Vertical supports for the slab forms must be capped with timbers. Longitudinal spacing of supports with 4x6 inch (100 x 150 mm) caps on edge should not exceed 4.5 ft (1.4 m). With 4x8 inch (100 x 200 mm) caps, spacing should not exceed 6 ft (1.8 m). Rows of supports must not be over 4 ft (1.2 m) apart. There must be at least two rows of support, with the outside rows not more than 2 ft (0.6 m) from walls. Variance from the above suggested spacing should be reviewed by the Project Manager.

   d. Vertical posts shall not be smaller than 4x4 inches (100 x 100 mm), but may be built up of two 2x4 inches (50 x 100 mm) pieces of lumber. Lateral bracing will be required. A vertical clearance of ¼ inch (6 mm) must be provided between the wall form studs and the slab form joists.

NOTE: Lumber may be sized in metrics using actual, not the conventional nominal sizes.

   e. The slab form must remain in place as provided in *SSHC Subsection 704.03*.

   f. The interior walls of the culvert must be coated with white pigmented curing compound as provided in *SSHC Subsection 704.03*.

F. Flume Reinforcement

1. Regarding Type I, II, IV, and V Flumes, welded wire fabric reinforcing is now required on the Special Plan C (4341, 4342, 4344, 4345 – both E & M) for the flume and spillway areas. This wire can be awkward to place and keep in position. Contractors may place **intersecting No. 3 rebar at 12" centers** as an alternative to the welded wire fabric.

G. Backfilling Culverts – Typical Grading

1. The plans define the area used to calculate plan quantities for flowable mortar and granular backfill. (Flowable mortar plan quantities should include 30% additional for anticipated consolidation of the granular backfill and shrink due to loss of water.) If the Contractor opts to excavate a larger area than assumed for plan quantity, additional excavation, backfill, and flowable mortar will not be considered for pay. We will however, require additional excavation to be backfilled in a manner as identified by the plans or typicals.

2. Placement of flowable mortar shall always be computed from "top down." This means allow for:

a. Pavement thickness.

b. 1 foot (0.3 m) of special backfill, if required.

c. Variable thickness of earth fill where cover heights are over 8 ft (2.5 m).

H. Joints (*SSHC Subsection 704.03*)

1. The location and dimensions for construction joints will generally be shown on the plans.

2. In cases where the pour is larger than can be accomplished at one time, or for some other reason it is necessary to make a construction joint not shown on the plans, approval should come from the Construction Engineer.

3. When an emergency arises, construction joints shall be placed as directed by the Project Manager. If there is some doubt as to the proper location of the joint, the District Construction Engineer should be contacted.

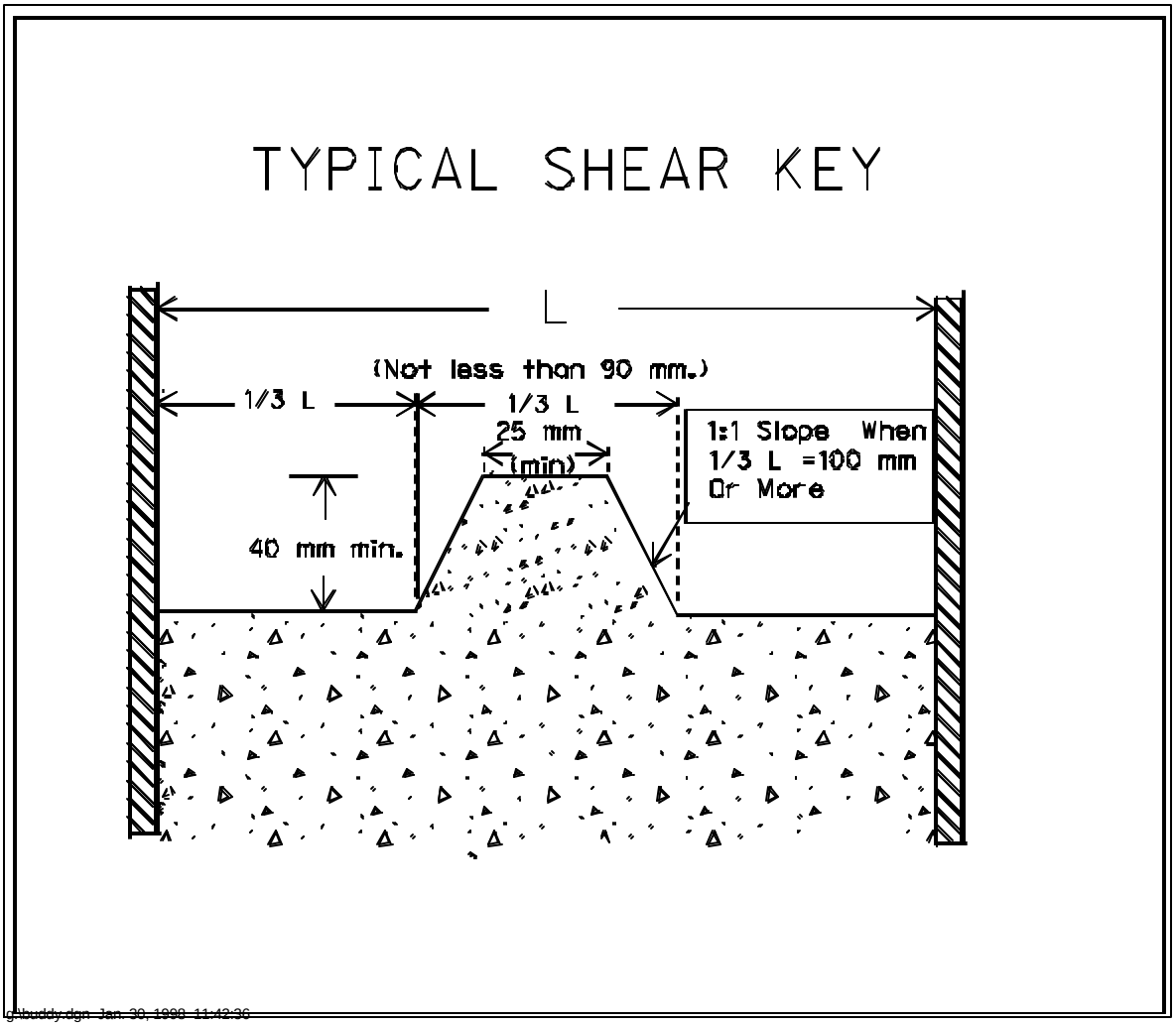
4. Construction joints shall be paid for as outlined in SSHC 704.04.

5. Where it is necessary to transfer shear, shear keys or inclined reinforcement shall be used. It should be pointed out that in practically all cases, shear transfer is essential and therefore shear keys or inclined reinforcement will usually be required. When inclined reinforcement is used as a means of shear transfer No. 5 bars at 1 foot (300 mm) centers should be considered a minimum. The angle of inclination should be approximately 15 degrees from the direction of shear and the length of bar should be at least 2'-3" (685 mm) in order that 20 bar diameters can be placed in both sections of the pour.

6. Shear keys should be formed with beveled strips or boards at right angles to the direction of shear. Typical dimensions for a shear key are shown in the following sketch.

7. If the volume of concrete culvert pour is greater than can be placed in a normal day's operation, or in case of emergency, construction joints located in accordance with the details shown in the drawing "Construction Joints for Box Culverts" may be constructed. Construction joints between roadway shoulder lines are not shown in this drawing since they are not to be so constructed unless authorized by the Construction Engineer.

8. Construction joints in box culverts should be located as follows: Vertical floor joints, wall joints and top slab joints should be constructed in accordance with the sketches in this article and should be staggered by approximately 3 ft (1.0 m). When the walls and top slab are placed simultaneously, the top slab should be stopped and jointed approximately 3 ft (1.0 m) before ending the wall. (Refer to sketch "Construction Joint for Box Culverts".)



[The side slopes of the key will be less than one to one until the widest dimension of the key reaches 4 inches (100 mm).]

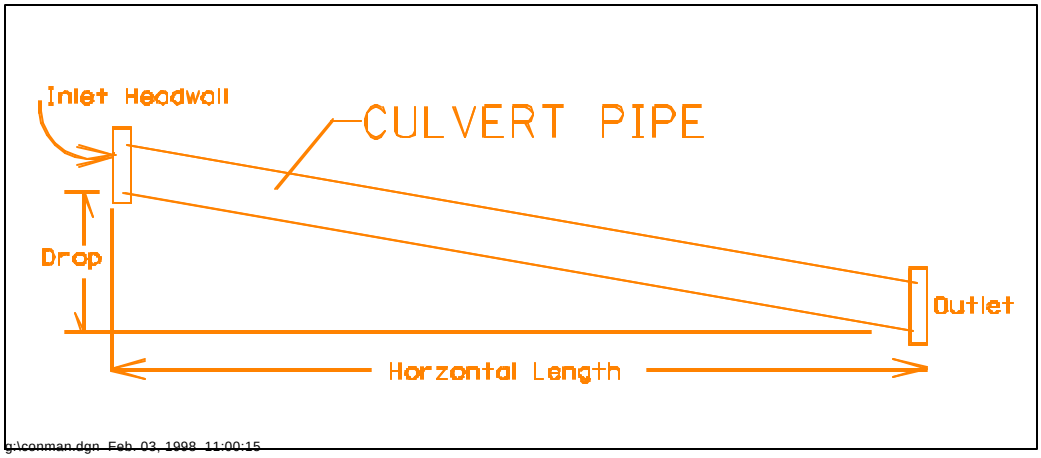
716.00 CULVERT PIPE (*SSHC Section 718*)

716.01 DESCRIPTION

A. This work shall consist of furnishing and installing culvert pipe. The contractor has the option to furnish any of the types of culvert pipe listed in the specifications.

716.02 CONSTRUCTION METHODS

A. Culvert List. The contractor is not permitted to order or deliver culvert pipe until a "culvert list" listing the correct sizes and lengths of pipe is furnished to him/her by the Project Manager.



B. Pipe Bedding

1. Pipe bedding is explained in the special plan for “Pipe Policy”.

2. The following soil classifications are necessary to use the pipe special plans to determine correct bedding materials.

ASTM D 2487 Description and Identification of Soils			
		SIEVE RANGE	
GRAVEL	COURSE	Passes 3-inch	Retained on ¾-inch
	FINE	passes ¾-inch	Retained on No. 4
SAND	COURSE	Passes No. 4	Retained on No. 10
	MEDIUM	Passes No. 10	Retained on No. 40
	FINE	Passes No. 40	Retained on No. 200

C. Temporary Culvert Pipe

1. The Districts will be responsible for making a determination (presumably during the plan-in-hand inspection) regarding whether or not to ask for new pipe.

2. Logistics Division maintains a list of pipe values which can be used to determine damages to the Department when pipe is not returned to us in usable condition.

D. Salvaged Culvert Pipe. The following listed examples and rules are given to help clarify removal and salvage of culvert pipe.

1. Rules

a. The decision to salvage or not to salvage the culvert pipe at each location must be made by the Inspector or Project Manager prior to beginning removal work on the culvert pipe, and the contractor must be advised of your decision prior to his/her commencing work on the removal.

b. Culvert pipe ordered salvaged and carefully removed by the contractor will be paid for as per the specifications even though after removal it is apparent that the removed pipe has no salvage value.

c. The contractor must carefully remove the culvert pipe to prevent damage to the culvert pipe.

2. Examples

a. The contractor is ordered to salvage the culvert pipe. The contractor carefully removes the culvert pipe. The culvert pipe has almost rusted through from the outside and really has no salvage value. The length of pipe removed will be included for payment.

b. The contractor is ordered to salvage the culvert pipe. After the pipe has been uncovered, it is apparent that it has very little salvage value. <u>If the contractor is agreeable</u>, the Inspector or Project Manager can rescind their salvage order and the contractor can complete the removal any way possible. The length of pipe removed under these conditions will not be included for payment.

c. The contractor is ordered to salvage the culvert pipe. The contractor is careless in removing the culvert pipe and damages it. The length of pipe removed less the damage length may be included for payment, or the Inspector or Project Manager may determine that there is no salvage value left in the culvert pipe and no payment will be made for salvaging the culvert pipe at this location.

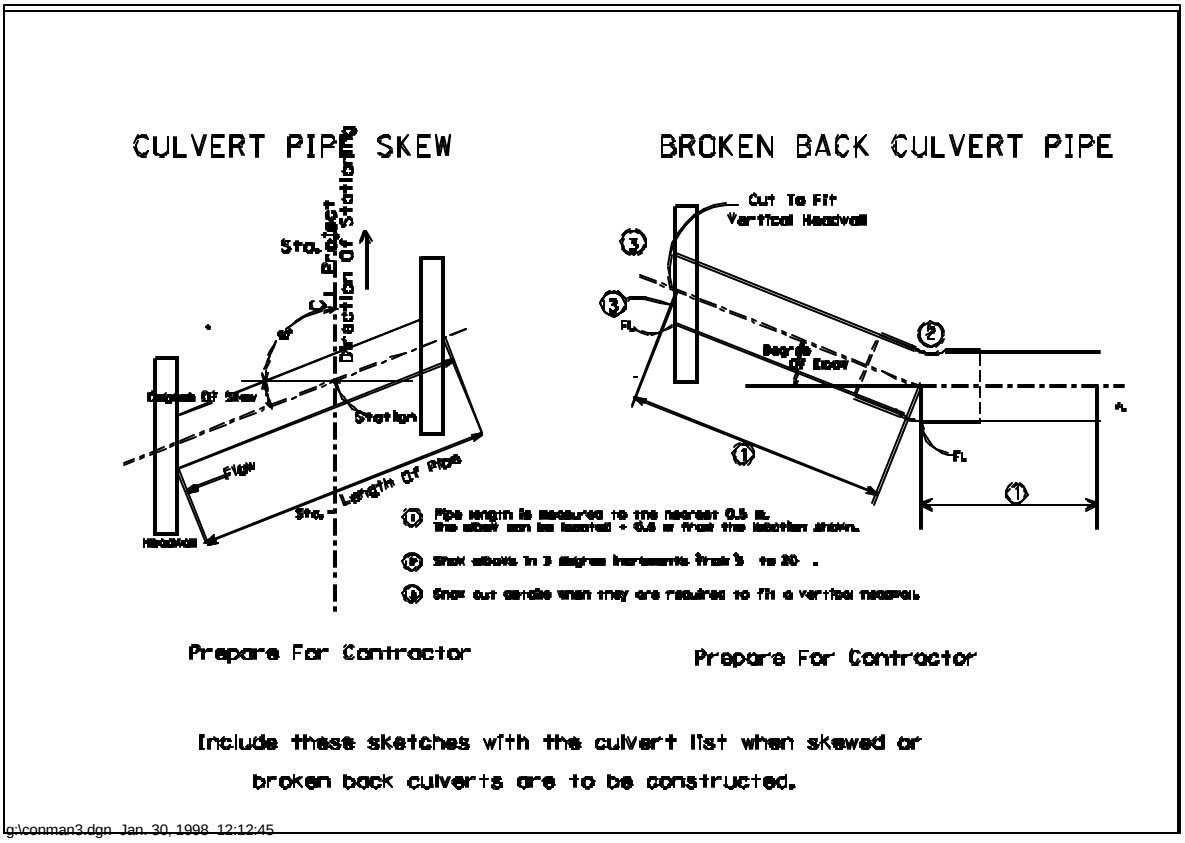
d. The contractor is ordered to not salvage the culvert pipe. The contractor removes the culvert pipe and disposes of part of it. The contractor advises that the remaining removed pipe may be picked up by the Department. The Department may refuse to pick it up, inasmuch as all such material is the property of the contractor and it is his/her responsibility to properly dispose of such material. If the Department picks it up the lengths may be included for payment as salvaging culvert pipe or they may be picked up without payment

being made. The Inspector or Project Manager shall determine what is fair and just.

3. Decisions and Documentation

   a. There will undoubtedly be conditions arising which are not entirely covered by these rules or examples but the Inspector or Project Manager should be able to make the proper decision within the spirit of these guidelines.

4. The project records must include pertinent notes explaining and detailing decisions made on salvaging culvert pipe.



ADDITIONAL EXCAVATION FOR EMBANKMENT OR BACKFILL
(Left in English Units for Your Convenience)

The following charts may be used for computing Additional Excavation for Embankment or Backfill for circular culvert pipe, arch culvert pipe or elliptical culvert pipe (pages 450C, D, E, F). “Y” is the distance from natural ground to the center of the pipe or in the case of arch pipe to the widest part of the pipe. The numbers in the columns under the different size pipe diameters are the end area in square feet of the backfill required by the specification.

Example: A 24" circular culvert pipe is laid at Station 17+30 with Flowline Lt. 2416.60 at 47' and Flowline Rt. 2415.00 at 51': The field design cross-section is 16.6 at 50' Lt., 16.3 at 35' Lt., 16.2 at

18' Lt., 16.2 at CL, 16.0 at 5' Rt., 16.0 at 10' Rt., 15.3 at 15' Rt., 15.0 at 27' Rt., 15.7 at 42' Rt. and 15.5 at 55' Rt.

16.6 at 50'		
16.5 at 47'	FL = 16.6 at 47'	Y = 1.1
16.3 at 35'	FL = 16.4 at 35'	Y = 1.1
16.2 at 18'	FL = 16.1 at 18'	Y = 0.9
16.2 at CL	FL = 15.8 at CL	Y = 0.6
16.0 at 5'	FL = 15.8 at 5'	Y = 0.8
16.0 at 10'	FL = 15.7 at 10'	Y = 0.7
15.3 at 15'	FL = 15.6 at 15'	Y = 1.3
15.0 at 27'	FL = 15.4 at 27'	Y = 1.4
15.7 at 42'	FL = 15.1 at 42'	Y = 0.4
15.6 at 51'		
15.5 at 55'	FL = 15.0 at 51'	Y = 0.4

24"×98' Culvert Pipe

Circular Culvert Pipe Embankment Areas

(Y=Height, TC = Center of Pipe)

Pipe Diagram

Y	12”	15”	18”	24”	30”	36”	42”	48”	54”	60”	72”
0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
0.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
0.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
0.4	2.0	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
0.5	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
0.6	3.3	3.3	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.1	3.1
0.7	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.8
0.8	4.9	4.9	4.8	4.7	4.6	4.6	4.6	4.6	4.6	4.5	4.5
0.9	5.7	5.7	5.7	5.5	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.0	6.6	6.6	6.6	6.4	6.3	6.2	6.2	6.2	6.2	6.1	6.1
1.1	7.5	7.6	7.6	7.4	7.2	7.1	7.1	7.1	7.0	7.0	7.0
1.2	8.5	8.6	8.6	8.5	8.2	8.1	8.0	8.0	7.9	7.9	7.9
1.3	9.5	9.6	9.6	9.4	9.4	9.1	9.0	9.0	8.9	8.9	8.8
1.4	10.5	10.7	10.7	10.7	10.6	10.3	10.1	10.0	10.0	9.9	9.8
1.5	11.6	11.8	11.9	11.9	11.8	11.5	11.2	11.1	11.0	11.0	10.9
1.6	12.7	12.9	13.0	13.1	13.1	12.8	12.5	12.3	12.2	12.1	12.0
1.7	13.9	14.1	14.2	14.4	14.4	14.1	13.7	13.5	13.4	13.3	13.2
1.8	15.1	15.3	15.5	15.7	15.7	15.5	15.2	14.8	14.7	14.5	14.4
1.9	16.3	16.6	16.8	17.0	17.1	17.0	16.7	16.2	16.0	15.8	15.6
2.0	17.6	17.9	18.1	18.4	18.5	18.5	18.2	17.7	17.4	17.2	17.0
2.1	18.9	19.2	19.5	19.8	20.0	20.0	19.8	19.3	18.9	18.6	18.3
2.2	20.3	20.6	20.9	21.3	21.5	21.5	21.4	21.0	20.5	20.1	19.8
2.3	21.7	22.0	22.3	22.8	23.1	23.1	23.0	22.7	22.2	21.7	21.3
2.4	23.1	23.5	23.8	24.3	24.7	24.8	24.7	24.4	24.0	23.4	22.9
2.5	24.6	25.0	25.4	25.9	26.3	26.5	26.4	26.2	25.8	25.2	24.5
2.6	26.1	26.6	26.9	27.5	28.0	28.2	28.2	28.0	27.7	27.1	26.2
2.7	27.7	28.1	28.5	29.2	29.7	29.9	30.0	29.9	29.6	29.1	28.0
2.8	29.3	29.8	30.2	30.9	31.4	31.7	31.9	31.8	31.5	31.1	29.8
2.9	30.9	31.4	31.9	32.6	33.2	33.6	33.8	33.7	33.5	33.1	31.8
3.0	32.6	33.1	33.6	34.4	35.0	35.5	35.7	35.7	35.5	35.2	33.9
3.1	34.3	34.9	35.4	36.2	36.9	37.4	37.7	37.7	37.6	37.3	36.1
3.2	36.1	36.7	37.2	38.1	38.8	39.3	39.7	39.8	39.7	39.5	38.3
3.3	37.9	38.5	39.0	40.0	40.8	41.3	41.7	41.9	41.9	41.7	40.6
3.4	39.7	40.4	40.9	41.9	42.8	43.4	43.8	44.0	44.1	43.9	43.0
3.5	41.6	42.3	42.9	43.9	44.8	45.5	45.9	46.2	46.3	46.2	45.4
3.6	43.5	44.2	44.8	45.9	46.9	47.6	48.1	48.4	48.6	48.5	47.8
3.7	45.5	46.2	46.8	48.0	49.0	49.7	50.3	50.7	50.9	50.9	50.2
3.8	47.5	48.2	48.9	50.1	51.1	51.9	52.6	53.0	53.2	53.3	52.7
3.9	49.5	50.3	51.0	52.2	53.3	54.2	54.9	55.3	55.6	55.7	55.3
4.0	51.6	52.4	53.1	54.4	55.5	56.5	57.2	57.7	58.0	58.2	57.9
4.1	53.7	54.5	55.3	56.6	57.8	58.8	59.6	60.1	60.5	60.7	60.5
4.2	55.9	56.7	57.5	58.9	60.1	61.1	62.0	62.6	63.0	63.3	63.1
4.3	58.1	58.9	59.7	61.2	62.5	63.5	64.4	65.1	65.6	65.9	65.8
4.4	60.3	61.2	62.0	63.5	64.9	66.0	66.9	67.6	68.2	68.5	68.6
4.5	62.6	63.5	64.4	65.9	67.3	68.5	69.4	70.2	70.8	71.2	71.4
4.6	64.9	65.9	66.7	68.3	69.8	71.0	72.0	72.8	73.	73.9	74.2
4.7	67.3	68.2	69.1	70.8	72.3	73.5	74.6	75.5	76.2	76.7	77.0
4.8	69.7	70.7	71.6	73.3	74.8	76.1	77.3	78.2	78.9	79.5	79.9
4.9	72.1	73.1	74.1	75.8	77.4	778.8	80.0	80.9	81.7	82.3	82.9
5.0	74.6	75.6	76.6	78.4	80.0	81.5	82.7	83.7	84.5	85.2	85.9

Culvert Pipe-Arch Embankment Areas

(Y=Height to Widest Section of Pipe)

Equivalent Round Size

Y	12”	30”	36”	42”	48”	54”	60”	66”	72”
0.1	0.6	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.3
0.2	1.1	1.1	1.1	1.2	1.3	1.4	1.5	1.7	1.8
0.3	1.6	1.6	1.6	1.7	1.8	1.9	2.1	2.2	2.4
0.4	2.0	2.2	2.2	2.2	2.24	2.5	2.6	2.8	2.9
0.5	2.8	2.7	2.7	2.7	2.9	3.1	3.2	3.4	3.5
0.6	3.7	3.6	3.5	3.4	3.4	3.7	3.8	4.0	4.2
0.7	4.6	4.6	4.5	4.4	4.2	4.1	4.5	4.7	4.9
0.8	5.5	5.6	5.6	5.5	5.3	5.0	4.9	5.4	5.6
0.9	6.5	6.6	6.7	6.7	6.5	6.2	5.9	5.8	5.7
1.0	7.5	7.7	7.8	7.9	7.8	7.5	7.1	6.8	6.7
1.1	8.6	8.8	9.0	9.1	9.1	8.9	8.6	8.1	7.8
1.2	9.7	10.0	10.2	10.4	10.4	10.3	10.0	9.6	9.2
1.3	10.8	11.2	11.5	11.7	11.8	11.7	11.5	11.2	10.8
1.4	12.0	12.4	12.8	13.1	13.2	13.2`	13.1	12.8	12.4
1.5	13.2	13.7	14.1	14.5	14.7	14.7	14.6	14.4	14.1
1.6	14.5	15.0	15.5	15.9	16.2	16.3	16.3	16.1	15.8
1.7	15.8	16.4	16.9	17.4	17.7	17.9	17.9	17.8	17.6
1.8	17.1	17.8	18.4	18.9	19.3	19.5	19.6	19.6	19.4
1.9	18.5	19.2	19.9	20.4	20.9	21.2	21.4	21.4	21.3
2.0	19.9	20.7	21.4	22.0	22.6	22.9	23.1	23.2	23.2
2.1	21.4	22.2	23.0	23.7	24.3	24.7	25.0	25.1	25.1
2.2	22.9	23.8	24.6	25.4	26.0	26.5	26.8	27.0	27.0
2.3	24.4	25.4	26.3	27.1	27.8	28.3	28.7	29.0	29.1
2.4	26.0	27.0	28.0	28.8	29.6	30.2	30.7	31.0	31.1
2.5	27.6	28.7	239.7	30.6	31.5	32.1	32.6	33.0	33.2
2.6	29.3	30.4	31.5	32.5	33.4	34.1	34.7	35.1	35.3
2.7	31.0	32.2	33.3	34.3	35.3	36.1	36.7	37.2	37.5
2.8	32.7	34.0	35.2	36.3	37.3	38.1	38.8	39.3	39.7
2.9	34.5	35.8	37.1	38.2	39.4	40.2	41.0	41.5	41.9
3.0	36.3	37.7	39.0	40.2	41.4	42.3	43.1	43.8	44.2
3.1	38.2	39.6	41.0	42.2	43.5	44.5	45.4	46.1	46.6
3.2	40.1	41.6	43.0	44.3	45.7	46.7	47.6	48.4	48.9

Culvert Pipe-Arch Embankment Areas

(Y=Height to Widest Section of Pipe)

Equivalent Round Size

Y	24”	30”	36”	42”	48”	54”	60”	66”	72”
3.3	42.0	43.6	45.1	46.4	47.8	48.9	49.9	50.7	51.3
3.4	44.0	45.6	47.2	48.6	50.1	51.2	52.3	53.1	53.8
3.5	46.0	47.7	49.3	50.8	52.3	53.5	54.6	55.6	56.3
3.6	48.1	49.8	51.5	53.0	54.6	55.9	57.1	58.1	58.8
3.7	50.2	52.0	53.7	55.3	57.0	58.3	59.5	60.6	61.4
3.8	52.3	54.2	56.0	57.6	59.4	60.7	62.0	63.1	64.0
3.9	54.5	56.4	58.3	60.0	61.8	63.2	64.6	65.7	66.6
4.0	56.8	58.7	60.6	62.4	64.3	65.7	67.1	68.4	69.3
4.1	59.0	61.0	63.0	64.8	66.8	68.3	69.8	71.0	72.0
4.2	61.3	63.4	65.4	67.3	69.3	70.9	72.4	73.8	74.8
4.3	63.7	65.8	67.8	69.8	71.9	73.6	75.1	76.5	77.6
4.4	66.0	68.2	70.3	72.4	74.5	76.2	77.9	79.3	80.5
4.5	68.5	70.7	72.9	75.0	77.2	79.0	80.6	82.2	83.4
4.6	70.9	73.2	75.5	77.6	79.9	81.7	83.5	85.0	86.3
4.7	73.4	75.8	78.1	80.3	82.6	84.5	86.3	88.0	89.3
4.8	76.0	78.4	80.7	83.0	85.4	87.4	89.2	90.9	92.3
4.9	78.5	81.0	83.4	95.1	88.2	90.2	92.2	93.9	95.3
5.0	81.2	83.7	86.2	88.5	91.1	93.2	95.1	97.0	98.4

Elliptical Culvert Pipe Embankment Areas
(Y = Height to Center of Pipe)
Equivalent Round Size

0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
0.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.0	0.9
0.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
0.4	2.0	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9
0.5	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5
0.6	3.3	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
0.7	4.0	4.0	3.9	3.9	3.9	3.9	3.9	3.9	3.9
0.8	4.9	4.8	4.7	4.7	4.7	4.6	4.6	4.6	4.6
0.9	5.9	5.7	5.6	5.5	5.5	5.4	5.4	5.4	5.4
1.0	6.9	8.7	6.5	6.4	6.4	6.3	6.3	6.2	6.2
1.1	8.0	7.8	7.5	7.4	7.3	7.2	7.2	7.1	7.1
1.2	9.1	9.0	8.6	8.4	8.3	8.2	8.2	8.1	8.1
1.3	10.3	10.2	5.9	9.5	9.4	9.3	9.2	9.1	9.1
1.4	11.5	11.5	11.2	10.8	10.6	10.4	10.3	10.2	10.1
1.5	12.7	12.8	12.6	12.2	11.9	11.6	11.5	11.4	11.3
1.6	14.0	14.1	14.0	13.7	13.3	12.9	12.7	12.6	12.5
1.7	15.3	15.5	15.4	15.2	14.9	14.3	14.1	13.9	13.7
1.8	16.6	16.9	16.9	16.7	16.3	15.9	15.5	15.2	15.1
1.9	18.0	18.3	18.4	18.3	18.1	17.6	17.0	18.7	16.5
2.0	19.4	19.8	19.9	19.9	19.8	19.4	18.7	18.2	18.0
2.1	20.9	21.4	21.5	21.6	21.5	21.1	20.6	19.9	19.6
2.2	22.4	23.0	23.2	23.3	23.3	23.0	22.5	21.7	21.2
2.3	24.0	24.6	24.8	25.0	25.1	24.8	24.4	23.7	23.0
2.4	25.6	26.2	26.0	26.8	26.9	26.7	26.4	25.7	24.9
2.5	27.2	27.9	28.3	28.6	28.8	28.7	28.4	27.9	27.1
2.6	28.9	29.7	30.1	30.5	30.7	30.7	30.4	29.9	29.2
2.7	30.6	31.4	31.9	32.4	32.7	32.7	32.5	32.1	31.5
2.8	32.3	33.3	33.8	34.3	34.7	34.8	34.7	34.3	33.7
2.9	34.1	35.1	35.7	36.3	36.7	36.9	36.8	36.5	36.0
3.0	35.9	37.0	37.7	38.3	38.8	39.0	39.1	38.8	38.4
3.1	37.8	38.9	39.7	40.4	40.9	41.2	41.3	41.1	40.7
3.2	39.7	40.9	41.7	42.5	43.1	43.6	43.6	43.4	43.2
3.3	41.7	42.9	43.8	44.6	45.3	45.7	45.9	45.8	45.6
3.4	43.7	45.0	45.9	46.8	47.5	38.0	48.3	48.2	48.1
3.5	45.7	47.1	48.1	49.0	49.8	50.4	50.7	50.7	50.6
3.6	47.8	49.2	50.3	51.3	52.1	52.7	53.2	53.2	53.2
3.7	49.9	51.4	52.5	53.6	54.5	55.2	55.7	55.8	55.8
3.8	52.0	53.6	54.8	55.9	56.9	57.6	58.2	58.4	58.5
3.9	54.2	55.9	57.1	58.3	59.3	60.1	60.8	61.0	61.2
4.0	56.4	58.2	59.4	60.8	61.8	62.7	63.4	63.7	63.9
4.1	58.7	60.5	61.8	63.2	64.3	65.3	66.0	66.4	66.7
4.2	61.0	62.9	64.3	65.7	66.9	67.9	68.7	69.1	69.5
4.3	63.4	65.3	66.7	68.3	69.5	70.6	71.8	71.9	72.4
4.4	65.8	67.8	69.3	70.8	72.1	73.3	74.2	74.8	75.3
4.5	68.2	70.3	71.8	73.5	74.8	76.0	77.1	77.6	76.2
4.6	70.7	72.8	74.4	76.1	77.5	78.8	79.9	80.5	81.2
4.7	73.2	75.4	77.0	78.8	80.3	81.6	82.8	83.5	84.2
4.8	75.7	78.0	79.7	81.6	83.1	84.5	85.7	86.5	87.3
4.9	78.3	80.6	82.4	86.3	85.9	87.4	89.7	89.5	90.4
5.0	80.9	83.3	85.2	87.2	88.8	90.4	91.7	92.6	93.5

Cu. Yds. of Concrete to be deducted from one Headwall because of skew.

Corrugated Pipe 8” Headwalls

Size/Skew	5”	10”	15”	20”	25”	30”	35”	40”	45”	50”	55”	60”
18” Pipe	.000	.001	.002	.003	.005	.007	.010	.013	.018	.024	.032	.044
24” Pipe	.000	.001	.003	.005	.008	.012	.017	.024	.032	.043	.058	.078
30” Pipe	.000	.002	.004	.008	.013	.019	.027	.037	.050	.067	.090	.121
30” Pipe	.001	.003	.006	.011	.018	.027	.039	.053	.072	.097	.130	.174
42” Pipe	.001	.004	.008	.015	.025	.037	.052	.073	.098	.132	.177	.238
48” Pipe	.001	.005	.011	.020	.032	`.048	.068	.095	.128	.172	.231	.310
54” Pipe	.001	.006	.014	.025	.041	.061	.087	.120	.163	.218	.292	.393
60” Pipe	.002	.007	.017	.031	.050	.075	.107	.148	.201	.269	.360	.485
72” Pipe	.003	.011	.025	.045	.072	.108	.154	.213	.289	.388	.519	.698
84” Pipe	.004	.015	.034	.061	..098	.147	.210	.290	.394	.528	.706	.950

Corrugated Pipe 6” Headwalls

Size/Skew	5”	10”	15”	20”	25”	30”	35”	40”	45”	50”	55”	60”
18” Pipe	.000	.001	.001	.002	.003	.005	.007	.010	.014	.018	.024	.033
24” Pipe	.000	.001	.002	.004	.006	.009	.013	.018	.024	.052	.043	.058
30” Pipe	.000	.001	.003	.006	.009	.014	.020	.028	.038	.051	.068	.091
36” Pipe	.001	.002	.005	.008	.014	.020	.029	.040	.054	.073	.097	.131
42” Pipe	.001	.003	.006	.011	.018	.028	.039	.054	.074	.99	.132	.178
48” Pipe	.001	.004	.008	.015	.024	.036	.051	.071	.096	.129	.173	.233
54” Pipe	.001	.005	.010	.019	.030	.046	.065	.090	.122	`.164	.219	.294
60” Pipe	.001	.006	.013	.023	.038	.056	.080	.111	.151	.202	.270	.364
72” Pipe	.002	.008	.018	.034	.054	.081	.116	.160	.217	.291	.389	.523
84” Pipe	.003	.011	.025	.046	.074	.110	.157	.218	.295	.398	.530	.713

Concrete Pipe 8” Headwalls

Size	T	5”	10”	15”	20”	25”	30”	35”	40”	45”	50”	55”	60”
18” Pipe	2½	.000	.001	.003	.005	.007	.011	.016	.022	.030	.040	.053	.071
24” Pipe	2¾	.000	.002	.004	.008	.012	.018	.026	.036	.049	.065	.087	.117
30” Pipe	3	.001	.003	.006	.011	.018	.027	.039	.053	.072	.097	.130	.174
36” Pipe	3½	.001	.004	.009	.016	.026	.039	.055	.076	.103	.138	.185	.249
42” Pipe	4¼	.001	.005	.012	.022	.035	.053	.076	.105	.142	.191	.255	.343
48” Pipe	5	.002	.007	.016	.029	.047	.070	.100	.138	.188	.252	.337	.453
54” Pipe	5”	.002	.009	.019	.035	.057	.085	.122	.168	.228	.306	.410	.551
54” Pipe	5½	.002	.009	.020	.037	.059	.088	.126	.14	.236	.316	.423	.569
60” Pipe	5½	.003	.010	.024	.044	.070	.105	.150	.207	.281	.377	.505	.579
60” Pipe	6”	.003	.011	.025	.045	.072	.108	.154	.213	.289	.388	.519	.698
72” Pipe	7”	.004	.015	.035	.064	.130	.154	.220	.304	.412	.553	.740	.996
84” Pipe	8”	.005	.021	.048	.086	.139	.208	.297	.411	.558	.748	1001	1346

Concrete Pipe 6” Headwalls

Size	T	5”	10”	15”	20”	25”	30”	35”	40”	45”	50”	55”	60”
18” Pipe	2½	.000	.001	.002	.003	.005	.008	.012	.016	.022	.030	.040	.053
24” Pipe	2¼	.000	.001	.003	.006	.009	.014	.019	.027	.036	.049	.065	.088
30” Pipe	3”	.001	.002	.005	.008	.014	.020	.029	.040	.054	.073	.097	.131
36” Pipe	3½	.001	.003	.007	.012	.019	.029	.041	.057	.077	.104	.139	.187
42” Pipe	4¼	.001	.004	.009	.017	.027	.040	.057	.079	.107	.143	.191	.258
48” Pipe	5”	.001	.005	.012	.022	.035	.053	.075	.104	.141	.189	.253	.340
54” Pipe	5”	.002	.006	.015	.027	.043	.064	.091	.126	.171	.230	.307	.414
54” Pipe	5½	.002	.007	.015	.027	.044	.055	.094	.130	.177	.237	.317	.427
60” Pipe	5½	.002	.008	.018	.033	.053	.079	.112	.155	.211	.283	.378	.509
60” Pipe	6”	.002	.008	.018	.034	.054	.081	.116	.160	.217	.291	.389	.523
72” Pipe	7”	.003	.012	.026	.048	.077	.116	.165	.228	.309	.415	.555	.747
84” Pipe	8”	.004	.016	.036	.065	.104	.156	.223	.308	.418	.561	.751	1.010

717.00 CONCRETE PIPE CULVERTS (*SSHC Section 720*)

717.01 DESCRIPTION

A. This work shall consist of furnishing and installing new reinforced concrete culvert pipe (round, pipe-arch and elliptical), reinforced concrete slotted pipe and the relaying of existing reinforced concrete pipe.

717.02 MATERIAL REQUIREMENTS

A. Pipe Marking. Each section of pipe used should be marked with the fabrication inspector's initial and the class of pipe, when it arrives at the site. The culvert inspector should not permit the laying of any section that does not have these markings. The project manager will receive a copy of the "Report of Shipment of Reinforced Concrete Pipe" (Form DR-420), listing the size, class, length, number of sections of pipe, the inspector's identification mark and stock report number. The inspector will use the information contained in this report to verify approval of reinforced concrete pipe received on the project. The diameter, class, length, number of sections and the pipe identification number shall be recorded in the culvert notebook. Each section of pipe should be examined for damaged ends, cracks and evidence of poor manufacture. All irregularities should be referred to the Project Manager before using of the pipe.

B. Ordering Material

1. The contractor is **not permitted to order or deliver** culvert pipe until a “culvert list” listing the correct sizes and lengths of pipe is furnished by the Project Manager.

2. The Project Manager shall funish a pipe list for driveway and sewer requirements.

3. The District Construction Engineer, and the Project Manager should go over the drainage situation and features in the field to confirm that the structures shown in the plans are adequate to handle the drainage. The cross sections taken at each culvert site should be plotted, the roadway cross section template and the structure plotted thereon at the proper flow line elevations, and the length of the structure thus determined. If the Project Manager includes either a larger drainage structure, or an additional drainage structure in the culvert list, he/she should, if possible, specify the same type of structure, or the same kind of pipe (culvert pipe, concrete pipe or corrugated metal pipe) as is shown in the approved plans for the project for the other structures.

4. In detailing and ordering the pipe culverts, the following rules should be followed for all kinds of culvert pipe (concrete pipe, corrugated metal pipe or culvert pipe):

   a. The overall length of culvert pipe should be given to the closest 2 ft (600 mm).

   b. The minimum distance from either end of the pipe to the break point of a broken back pipe culvert shall be 10 ft (3 m).

c. The dimensions from ends of the pipe to break points, or between break points of a broken-back pipe culvert should be given to the closest 2 ft (600 mm) along the centerline of the pipe. The fabricator will be permitted to locate the elbows 1 foot (300 mm) in either direction from the locations shown in the culvert sketch.

d. Generally, pipe culverts should not be designed or constructed with elbows of less than 5 degrees.

e. Prepare a sketch for each broken-back pipe culvert, designing and detailing the structure using the chart "Slope Data for Pipe Culvert" as a guide, and including dimensions, details and elevations as shown in the sample culvert sketch shown in this Subsection.

f. Pipe arch culverts are to be detailed and dimensioned the same as round pipe culverts. Broken-back pipe arch culverts should be avoided.

g. If flared end sections are to be installed, the pay length shall be the order length shown in the culvert list and sketch. A note should be made as part of the list indicating that order lengths do not indicate the "Y" distances shown in the applicable Standard Plan in the case of metal pipe.

h. The condition, kind of pipe, diameter and lengths right and left of centerline should be carefully checked before ordering extensions for an existing pipe culvert. Careful checking will eliminate ordering extensions which are improper as to length, diameter, kind of pipe, etc.

i. The maximum discharge of the average pipe culvert without head on the inlet will be provided when such pipe are given a slope of between one percent and two percent. Slopes steeper than this will not increase the water carrying capacity of the culvert. The Project Manager should make every effort to use such slopes when they are compatible with other drainage requirements at the individual culvert site. In choosing between a straight and a broken-back culvert pipe, the Project Manager should realize that little, if any, value is gained by installing elbows of less than 5 degrees.

j. If settlement or subsidence is anticipated under higher fills, pipe culverts and box culverts should be cambered. The plans will usually include a "Camber Note" which will state that the pipe culverts should be laid and box culverts constructed on parabolic camber grade as shown in the applicable standard plan, and will state the proportion of fill height which the foundation soil is expected to settle. Settlement of subsidence is generally zero at the toe of the slope, and at a maximum at the shoulder line.

717.03 CONSTRUCTION METHODS

A. Excavation and Backfilling

1. See Section 702 of this manual.

B. Installation

1. Begin laying concrete pipe at the downstream end of the culvert with the groove or bell portion of each section upstream.

2. Irrigation culverts shall be constructed of concrete pipe and must have approved gaskets at the joints. These gaskets shall be installed as per the manufacturer's recommendations and standards. Here is example of how to calculate payment for excavation.

EXAMPLE CALCULATION

Area for 1.25 m depth:
1a

Area for 2.75 m depth:

1b + 2b + 3b

Area for 4.25 m depth:
1c + 2c + 3c

Area for 5.75 m depth:

1d + 2d +3d

Area for greater than 5.75 m depth:
1e + 2e + 3e

718.00 CORRUGATED METAL PIPE CULVERTS (*SSHC Section 719*)

718.01 DESCRIPTION

A. This work shall consist of furnishing and installing new corrugated galvanized metal pipes and pipe arches and the relaying of existing corrugated metal pipe and pipe arches.

718.02 MATERIAL REQUIREMENTS

A. Pipe Marking. SSHC Tables 1035.01 & 1036.01 contain the required minimum gage or sheet thickness for the various pipe diameters. The "Materials and Sampling Guide" provides that the necessary tests for acceptance will be handled by the Materials and Research Division. Material samples need not be taken by project personnel unless a special request is made for samples. The diameter of the pipe and number of sections of pipe covered by each heat number and delivered to each culvert location should be recorded in the culvert notebook. The pipe shipment should be checked against the shipment report and any discrepancy should be reported to the Project Manager. The pipe shipment should also be checked for shipping damage and any damage noted should also be reported to the Project Manager.

B. Ordering Material

1. **The contractor is not permitted to order or deliver corrugated metal pipe or pipe arches until a "culvert list" listing the correct sizes and lengths of pipe is furnished to him/her by the Project Manager.**

718.03 CONSTRUCTION METHODS

A. Excavating and Backfilling

1. Refer to Section 702 of this manual.

B. Installation

1. The culvert inspector should insist on careful handling of the corrugated metal pipes or pipe arches. Corrugated metal pipes or pipe arches should be lifted and moved with a rope sling or similar device which will not damage the galvanized surfaces of the pipes or pipe arches. The contractor should not be allowed to drag the pipes or pipe arches over abrasive surfaces as this will also damage the galvanized surfaces.
2. Corrugated metal pipes and pipe arches shall be laid with the inside circumferential laps lapped downstream so that the water will flow over the lap. The pipe shall be rotated so that the longitudinal laps are horizontal. When joining sections of pipe, the connecting bands should be pulled up as tight as possible. The band should be tapped with a wooden mallet as the bolts are tightened. Excessive pressure on the bolts should be avoided to keep from pulling the steel angle loose from the band. A gap of about 1 inch (25mm) should be allowed between the pipe ends being joined,

CHAPTER NOTES:

DIVISION 800

ROADSIDE DEVELOPMENT AND EROSION CONTROL

DIVISION 800

ROADSIDE DEVELOPMENT & EROSION CONTROL

800.00 GENERAL COMMENTS

Introduction

The highway right-of-way is largely a disturbed environment, lacking a natural soil profile and subject to unusual runoff, strong winds and abnormal air turbulence, pollutants, wide temperature variations and other extremes. Seeding, sodding, erosion control and landscaping are used to deal with this disturbed environment and help to permanently stabilize it as soon as possible.

Plants and seeds are living things in contrast to concrete, steel, stone and asphalt which are the inanimate materials used in the major part of road construction. Plants change in shape, size, color and texture from season-to-season and year-to-year while the inanimate materials remain virtually constant.

Seeding and landscaping involve living materials used to stabilize the right-of-way, protect the concrete and steel construction and provide other functions to help safely direct the motorist. It is understandable that survival of these living materials is important to the entire roadway system.

These living materials need to be of the quality specified, properly installed and maintained so they produce the desired results of stabilizing the right-of-way to protect the construction and provide a complete roadway system.

General Inspection

Inspection personnel assigned to erosion control work should review project plans, specifications, special provisions, and road standards pertaining to erosion control. The right-of-way contracts should be reviewed for special treated areas not mentioned on the plans. For seeding, fertilizing, and mulching, a pre-measurement using slope distances of the project is needed before the contractor starts. Both the contractor and inspector need to know the quantities of seed, fertilizer, and mulch required on the project.

Attention should be given to the erosion control plan and proposal notes for the special items and conditions involved with each individual project.

Material delivered to the project and damaged due to improper storage or handling should be rejected, even though it may have been previously accepted.

The testing requirements for seed and fertilizer are outlined in the *Materials Sampling Guide*.

The inspector is to observe the following operations:

- Application of seed, fertilizer, and mulch.

Record the quantities of these materials used in the project records. Record the drill settings for each type of seed mix.

All revisions made to the seed mixtures, fertilizer, or rate of fertilizer application should be approved by the Construction Division or the Roadway Design Division (Roadside Development Section).

SSHC Subsection 802.02, Paragraph 1.a. tells the contractor to submit the plant purchase orders 90 days before the planting season. If a landscaping contract is awarded with less than 100 calendar days before the planting season begins, a minimum of 60 days will be allowed.

Equipment

Proper equipment in good working condition and operated at a reasonable speed must be used to get the best results. Where possible, the equipment should be operated on the contour or parallel to the slope.

Equipment for preparation of the seed bed includes a disc, field cultivator, spike tooth harrow, spring tooth harrow, and a slope harrow. Other equipment may be approved for use provided that it achieves the desired results.

A heavy disc, such as a Rome disc, may be required in areas of heavy vegetation. A slope harrow may be required in areas of light soil, where equipment tracks damage the seed bed.

Equipment for applying seed and fertilizer consists of a hydro-seeder, gravity seeder, end gate cyclone seeder, cyclone seeder, and a native grass seed drill. The cyclone seeder (hand seeder) is usually used to spread seed and fertilizer in small areas or areas inaccessible to field equipment.

The mulch crimper needs to be looked at. The blades, when new, are serrated. Some serration should be left. The serrations allow the mulch to be tucked into the soil rather than cut. When in doubt, just have an area crimped and see how it does.

The mulch blower should not chop the hay or straw so badly that all we have is very short pieces. Most machines are adjustable for the length of straw or hay.

Equipment should be checked for proper rate of application of seed and fertilizer by measuring a representative area and weighing the required amount of seed to be applied. All seeders must be cleaned when changing seed mixtures, particularly when changing from Type A to Type B.

Contract Administration

Both the Project Manager and the inspector should review the construction period shown on the proposal form.

From March 1 to June 30 and from August 1 to freeze-up, working days should be charged whenever it is possible to perform a seeding contract controlling operation.

Erosion Control

Normal grading operations require the following erosion control:

- Install “Silt Fence” before grading begins.
- “Temporary Silt Checks” must be installed as soon as rough grading establishes ditches. The Contractor should also construct earth-berm dikes, dams, sediment basins, temporary slope drains and other erosion control features as shown in the plans or as necessary to control erosion and siltation.
- When final grading begins “Temporary Silt Checks” need to be removed.
- When final grading is complete, the area should be cover crop seeded and TSC’s reinstalled.
- As soon as possible after final grading and pavement is complete, permanent ersosion checks should be installed and the area should be permanently seeded.

** If permanent erosion checks are available and installed immediately after final grading, the TSC do not need to be reinstalled.

801.00 REMOVING AND RESETTING TREES

801.01 REMOVING AND RESETTING TREES CHECKLIST

SSHC References: *Section 801*
Section 802

Other References: Equipment manufacturer recommendations
Special Provisions
Special Plan

Inspection Equipment: Tree Caliper

General Comments:

1. Make sure the location for resetting the trees is accessible by the mechanical tree spade.
2. Obtain from the contractor the equipment manufacturer's size rating for the tree spade and be sure the trees to be moved are within the allowable sizes for that machine. There may be size differences between evergreen trees and deciduous trees.
3. The size is usually called out as a caliper dimension - This should be the diameter of the tree trunk at 300 mm (12 inches) above the ground for trees over 100 mm (4 inches) in diameter.
4. After the trees have been properly set in their new location, make sure they are well watered. This watering and any required maintenance procedures in the Special Provisions are the most important part of keeping these plants alive.

802.00 FURNISHING AND PLANTING OF PLANT MATERIALS

802.01 FURNISHING AND PLANTING OF PLANT MATERIALS CHECKLIST

SSHC References: *Section 802*
Special Provisions

Other References: American Standard for Nursery Stock (current edition)
Approved Products list

Inspection Equipment: Tree calipers
Tape measure

General Comments:

1. The "American Standard for Nursery Stock" tells the characteristics each type of plant should have for its size and is used in determining if the plants are acceptable.
2. Preconstruction conference should be well in advance of the project starting date. Roadside Development Section personnel should be asked to attend.

MATERIAL REQUIREMENTS:

1. Contractor planting operation must occur within the specified planting seasons.
2. Confirm that the plant material sources have been approved by Roadside Development.
3. Be sure all plant material is healthy and in good growing condition before allowing it to be planted.
   a. no serious injuries
   b. no dry roots
   c. no broken root balls
   d. no insect pests or diseases
4. If plants must be stored, inspect the storage area to see if it meets the specifications.
5. Be sure products used meet the specifications.
   a. Approved planting fertilizer is pressure-formed pellets 20-10-5 @ 21 grams or 14-3-3 @ 16 grams.
   b. Establishment period fertilizer shall be liquid urea with 28 to 32 percent nitrogen.
   c. Wood mulch, approved by Roadside Development Section.
   d. Wood stakes or metal stakes are the appropriate sizes.
   e. Guying material - approved by Roadside Development.
   f. Absorbent polymer on approved product list.

g. Pre-emergent chemical is Dathal.
h. Post-emergent chemical is Roundup.

CONSTRUCTION METHODS:

1. Planting area tilled and drilled according to the plans, details and specifications.
2. Bare roots plants are the most delicate to handle. Their roots must be kept moist at all times, in storage; when delivered to the project site, they should be coated with the absorbent polymer slurry and protected from sun, wind and cold so they do not get dry before planting. If it is obvious the roots have been allowed to dry out before getting planted, these plants should be rejected.
3. Planting procedures are called out in the specifications. If you have specific questions, contact Roadside Development.
   a. B&B material-set ball into hole onto undisturbed soil at same depth it was grown.
   b. Plumb and partially backfill plants - no rocks or clods in backfill.
   c. Twine cut away from trunk and burlap pulled back on B&B plants.
   d. Properly placed fertilizer tablets in backfill, correct number for size of plant.
   e. Backfilling completed properly - check for exposed roots on bare root plants after first watering and initial soil settlement. Make sure these are covered with soil immediately.
   f. Plant material thoroughly watered at time of planting.
   g. Properly pruned branches.
   h. Trees staked and properly guyed.
   i. Water basin constructed to hold at least the minimum amount of water called for in Table 802.01.
   j. Applied proper pre-emergent chemical.
   k. Be sure mulch covers all tilled area to the specified depth.
4. During the establishment period, check the project regularly to see that all procedures are being accomplished. This is the most critical time in the project to keep plants from being stressed before going into winter. Establishment procedure items are:
   a. Pruning
   b. Protect against pests and diseases
   c. Regular watering
   d. Replacing mulch
   e. Adjust stakes and guys
   f. Control weeds
   g. Remove dead plant material

6. Make sure the contractor notifies you when he/she will be watering or doing other establishment work so you can check and document that it has been done properly. Be sure the contractor realizes this documentation is to his/her benefit also. If the project is not properly maintained, the contractor can be required to maintain the project for a second growing season.

BASIS OF PAYMENT:

1. Partial payment criteria and percentages are indicated in Table 802.02. (Check Special Provisions for possible changes.)
2. Inspection dates are approximately:
   July 15 - to check establishment procedures
   September 1 - count of plants in acceptable growing condition
   June 1 - to final out project
3. Check Special Provision for other inspections that may be required.

803.00 SEEDING

803.01 SEEDING CHECKLIST

SSHC Reference: *Section 803 -- Seeding Special Provisions*

Other References: Project seeding Record CDR-61, Section 804, Section 805

Inspection Crew:

Seeding Procedures:

1. Give the seeding quantities to the contractor and Roadside Development.

2. The seed will be mixed at the seed company and tagged with department furnished tags.

3. Fertilizer is usually furnished bulk and must have the bulk fertilizer form DR125 (Appendix 1). If it is delivered mixed and bagged it still needs the form. If it is delivered bagged in its separate components, the label on the bag will be enough.

4. Native grass drill must have either press wheels or drag chains (this is important -- the press wheels firm the seed bed and drag chains make sure the seed is covered)

4A. Other seeding equipment -- hydro-seeder - big squirt gun -- must have agitation. Brillion -- seed box that drops seed between two corrugated rollers

5. Mulching equipment like cultipacker, crimper, mulch stabilizer, and mulch spreader should be inspected to confirm proper operation.

6. Tillage equipment -- many shapes, sizes and descriptions, (common -- disc and field cultivator

7. Soil preparation -- the PM must release the area to be seeded -- no preparation is to begin until the finish grade has been approved!

8. Does maintenance have to fix and regrade areas? Notify the maintenance superintendent -- ahead of time! (*SSHC Subsection 803.03*)

9. Is there a heavy weed growth that needs to be mowed? (*SSHC Subsection 803.05*)

10. Mulch -- does the contractor have the proper mulch (some projects are specified prairie hay only)

11. Does the mulch have the noxious weed inspection certificate (*SSHC Subsection 805.02*)

12. Has the mulch been weighed in? (*SSHC Subsection 805.04*)

13. Seed bed preparation and seeding procedures:
for drilled seed:

    a. Fertilize
    b. Disc
    c. Or disc and then fertilize
    d. Harrow - several discings & harrowings may be necessary to produce a firm seed bed
    e. Seed
    f. Mulch
    g. Crimp mulch

    for hydro-seeding and broadcast seeding

    a. Fertilize
    b. Disc
    c. Or disc and then fertilize
    d. Harrow - several discings & harrowings may be necessary to produce a firm seed bed except if too steep to operate equipment on
    e. Seed
    f. Harrow seed into the soil unless too steep
    g. Mulch & crimp or hydro mulch

    for Brillion seeding --

    a. Same as for drilled seed (unless it is hydro-mulched)

    General

    b. Some hydro-seeding is done on very steep slopes that must be left in a roughened condition by the grader, or there is no way to make a seed bed.

    c. "Rule of Thumb" --

       Whatever is seeded in a day must also be mulched and crimped in that same day." Exceptions -- unexpected rain -- pay attention to the weather reports and conditions

d. Inspection tip for mulch

Establish a 1 hectare (2 ½ acre) or small 0.4 hectare (1 acre) plot for mulch. Mulch and crimp this area and use it for a reference

e. Send in the project seeding record to Roadside Development upon completion of seeding

f. Please remind the seeding contractors to do a good job of cleaning out the seeding drills when changing from Type “A” to Type “B”. Type ”A” has taller grasses than we want on our shoulder areas.

g. Changing from Type “B” to Type “A” does not require a clean out.

803.02 PERMANENT SEEDING DATES

The normal periods for permanent seeding are from March 1 to June 30 and from August 1 to December 31 or freeze up. These dates may be modified by the Special Provisions.

803.03 PREPARATION OF SEED BED

Before seeding operations commence, care should be taken to properly prepare the area to be seeded. Areas around culvert headwalls and wingwalls, shoulders, flumes, sign posts, guardrail, and other structures require special attention. The seed bed shall be worked to a depth of at least 50 mm (2 inches) deep.

803.04 SEED

The seed is mixed at the seed company and overseen by Roadside Development.

The following items should be noted when inspecting hydroseeding:

A fanning motion or horizontal motion of the seeding nozzle insures uniform application of the seed. Do not use an up and down motion; it results in seed application too heavy near the seeder and too thin at the far reach of the spray.

The seeder tank must be cleaned when changing seed mixtures.

@ The seed measurements should be discussed at the preconstruction conference and a date established as to when they would be provided to the contractor. The Department normally will buy any excess seed. Pay for what we want and get.

804.00 FERTILIZER

DR Form 125 is required for all bulk fertilizer and bulk blended and then bagged material.

"Fertilizer Grade" refers to the percentages of nitrogen (N), phosphoric acid (P_20_5) and potassium (K_2O) present. The contractor must furnish corresponding scale ticket from an approved scale for fertilizer used in the work.

804.01 FERTILIZER CHECKLIST (See Seeding Checklist)

804.02 EXAMPLE CALCULATIONS

Our fertilizers are specified in amounts of actual ingredients. A typical specification might read:

N_2 = 32 or 40 kg/ha (26 to 35 lb/acre)
P_2 = 103 or 108 kg/ha (90 to 95 lb/acre)

Typically, the contractors will furnish a 16-48-0 or an 18-46-0 material. These numbers are expressed as a percentage of the total mass. The first number represents the percentage of nitrogen relative to the total mass, the second number is the percent of phosphorous and the third is potassium.

In order for the contractor to furnish the 36 kg/ha of N_2 (nitrogen) he/she would apply 225 kg (bulk) material - this would also give us the 108 kg/ha of P_2 (phosphorus) when using 16-48-0 fertilizer.

Required: 36 kg/ha of N_2
Required Fertilizer: 16-48-0 (16% N_2)
36 kg/ha = (.16) x (Unknown Bulk Quantity)
225 kg/ha = Bulk Quantity
kg/ha of P_2 = (.48) x 225
= 108

NDR specified sulpher coated urea fertilizer is typically a 36-0-0 or a 37-0-0 material and is specified at 67 kg/ha (60 lb/acre):

Required: 67 kg/ha
Required Fertilizer: 36-0-0 36% N_2
67 kg/ha = (.36) x (Unknown Bulk Quantity)
186 kg/ha Bulk with 36-0-0
67 kg/ha = (.37) x (Unknown Bulk Quantity)
181 = kg/ha Bulk with 37-0-0

NDR specified urea formaldehyde fertilizer is a 38-0-0 material and is usually specified at 85 kg of N_2/ha (35 lb of N_2/Acre).

Required: 85 kg/ha of N_2
38% N_2 in the fertilizer
85 kg/ha = (.38) x (Unknown Bulk Quantity)
224 kg/ha = Bulk Quantity

Curve Ball

The contractor wants to use an 11-52-0 to satisfy the 36 or 40 kg N_2 and the 103 or 108 kg/ha requirement for P_2. How much 11-52-0 should be applied? (Our application rates state minimum = 36 or 40 & 103 or 108).

Required: 36 kg/ha N_2
103 kg/ha P_2
Contractor's fertilizer is 11% N_2 or 52% P_2.
36 kg/ha - (.11) x (Unknown Bulk Quantity)
327 kg/ha = Bulk Quantity to get N_2 and
(.52) x (327 kg/ha) = 170 kg/ha P_2

This would be an excess of P_2 (327 x 52% = 170 kg of P_2), but this is what must be applied to satisfy the minimum N_2 requirement.

Slider

The contractor wants to use the 11-52-0 to satisfy the P_2 requirement. How much 33-0-0 will have to be added to the mixture to satisfy the N_2 requirement.

Required: P_2 = 103 kg/ha
N_2 = 36 kg/ha
Fertilizers: 11-52-0
33-0-0
P_2: 103 kg/ha = (.52) x (Unknown Bulk Quantity)
198 kg/ha = Quantity of 11-52-0.
But now how much N_2 are we short?
(.11) x (198) = 21.78 kg/ha of N_2
Therefore,
(36 - 21.78) kg/ha N_2 missing

14.22 kg/ha = .33 (Unknown Quantity of Bulk 33-0-0 fertilizer)
43 kg/ha = Bulk Quantity of 33-0-0 that must also be added.

Required $\frac{14.22}{}$ = 43.09 kg of 33-0-0 to satisfy the N_2 when furnished N_2 = 33% of bulk.

Now what is the applicable rate per ha?

198.07 kg of 11-52-0
\+ 43.98 kg of 33-0-0
= 241.16 kg of the mixture per ha

Split-Ball

At 241.6 kg/ha - the bulk spreader has 3990 kg of mixture on the load. How many hectares will this do?

SO $\frac{3990 \text{ kg}}{241.6 \text{ kg/ha}} = 16.51$ hectares

Fast-Ball

The load (3990 kg total) is a blend of the 11-52-0 and 36-0-0 (Quick Release Nitrogen) and 37-0-0 (Slow Release Nitrogen) in the right proportions. Now how many hectares can the load do?

Add the per unit weights of the two components.
241.6 kg (the contractor's 11-52-0 plus the supplemental nitrogen in the 33-0-0) + 181 kg of sulpher coat quick release nitrogen requirement = 422.6 kg/ha

Then $\frac{3990}{422.6} = 9.44$ hectares of coverage

804.03 APPLICATION OF FERTILIZER

The fertilized area shall be disced prior to seeding. Harrowing may also be required.

805.00 MULCH

All permanent seeding with prepared seed beds are required to be mulched. The mulch shall be “blown" and "crimped in" as soon after seeding as possible. Machine printed weight tickets are required for all mulch used. The inspector should receive the weight ticket and obtain a count of the bales at the time the material is delivered to the job site. The average bale weight can then be calculated.

As soon as possible, the mulch should be applied to the specified areas at the required rate. A straw mulching machine capable of spreading mulch uniformly is used for applying mulch. Areas inaccessible to a straw mulching machine should be mulched by hand.

Immediately after mulch material has been applied, it should be anchored with a mulch stabilizer operated on the contour.

All areas seeded in a day are to be mulched in the same day. All mulch applied in a day is to be crimped in the same day.

805.01 MULCHING CHECKLIST (See Seeding Checklist)

805.02 EXAMPLE CALCULATION

Example of area to be mulched at the rate of 5 Mg/ha:

Measured area is 2.6 ha, the average mass per bale is 360 kg.
Compute as follows: 5 Mg/ha x 2.6 ha = 13 Mg of mulch required for the area.

Number of bales required: $\frac{13 \text{ Mg}}{360 \text{ kg/bale}}$ = 36.1 bales (say 36)

805.03 WEEDS

The mulch shall be free of noxious weeds and shall be certified as such by the County Weed Control Authority.

There is no form for this certification. This certification is done by letter.

805.04 ACCEPTABLE MULCH

Mulch shall either be dry cured native (prairie) hay or threshed grain straw.

There is a lot of go-down wheat that may be offered for mulch. If it has not been threshed, we do not want it. There are also many CRP acres that have been authorized for haying. Many of these CRP acres were planted in brome grass. Brome grass is not native (prairie) hay and cannot be used on our projects.

806.00 SODDING

806.01 SODDING CHECKLIST

SSHC Reference:		*Section 806 Sodding*
Other References:		Your New Sod Door Hanger - See Construction Engineer
Inspection Crew:		Construction Technician
Inspection Equipment:		NA
Sodding Procedures: (General Comments) Roadside Development (402) 479-4537	1.	Are the sodding dates in conformance with the Specifications? (*SSHC Subsection 806.01*, Para. 2.)
	2.	Has Roadside Development been notified where the sod is coming from?
	3.	Has the contractor obtained the proper fertilizer? (urea-formaldehyde fertilizer is BLUE.)
	4.	What preemergent is the contractor going to use and at what rate should it be applied? (*SSHC Subsection 806.02*, Para. 6.)
	5.	Where is the contractor's water source and what is the watering plan - (adequate watering is the key to sodding success.)
	6.	Is the finish grade approved for sod to be laid on? (Make sure the Project Manager has approved the finish grade.)
	7.	Has the soil next to the adjoining surfaces been properly lowered? (*SSHC Subsection 806.03*, Para. 5)
	8.	Distribute the "Your New Sod" door hanger.
	9.	Apply the pre-sodding fertilizer (*SSHC Subsection 806.02*, Para. 5.) to the prepared seed bed.
	10.	Enforce the watering requirement (*SSHC Subsection 806.03*, Para. 11.)
(402) 479-4537	11.	Sometimes rejected sod may be overseeded (contact Roadside Development for the mixture).

806.02 SOD PLACEMENT

The suggested sequence for placement of sod is:

SHAPE SOD BED

Ditch channels should be shaped in order to obtain a relatively level, flat-bottom ditch which will drain without water ponding. The depth should be a minimum of 150 mm (6 inches) below adjacent ground. Many ditch failures result because the ditch bottom is not level, causing a concentration of flow on one side of the ditch.

APPLY FERTILIZER

Presodding - Two kinds - Inorganic which is typically a 16-48-0 or a 18-46-0 and is available at most any fertilizer dealer and urea-formaldehyde - a 38-0-0 material that is blue in color.

These fertilizers are applied to the prepared sod bed prior to sodding.

Post Sodding - The 16-48-0 or the 18-46-0 applied at the completion of the watering period.

PLACE SOD

Note the quality of sod, making sure it is free of objectionable material (tree roots, brush, stones, etc.) also that it is free of noxious weeds and relatively free of all other weeds and grasses other than bluegrass.

Sod can be placed until the ground freezes at the construction site or at the sod farm.

FINISH SOD

Smooth disturbed areas along the edges of the sod. Be sure that no ridge of dirt remains along side the sod ditch, and that the disturbed area is properly shaped and sloped to allow water to run onto the sod.

WATER

Water the sod within one hour after laying, and sooner on hot days, and thereafter as specified. The amount of water required for sodding varies depending upon soil type, soil moisture, and local weather conditions at the time of sodding. Watering is to saturate the soil. Sod should be watered with a spray, and not much pressure. Too much pressure disturbs the sod and has a tendency to wash the dirt away from its edges.

TAMP

Tamp or roll sod as specified if necessary to secure bonding.

807.00 EROSION CONTROL

807.01 EROSION CONTROL CHECKLIST

SSHC Reference: *Section 807 -- Erosion Control & Special Provisions*

Other References: Approved Products List

Inspection Crew: Construction Technician

Inspection Equipment: NA

General Comments:

1. Has the finish grade been accepted for this area? (*SSHC Subsection 807.03*, Para. 1)
2. Is the material on the approved products list? (*SSHC Subsection 807.02*, Para. 1)
3. Does the contractor have the right pins? (*SSHC Subsection 807.02*, Para. 2)
4. Does the contractor have the right fertilizer? (Special Provisions)
5. Is the seed bed properly prepared? (*SSHC Subsection 807.03,* Para. 4)
6. Does the seed have the department tags for this project? (*SSHC Subsection 803.02,* Paragraphs 3 & 4)
7. Usual work sequence:
   a. Soil preparation including the slots for the erosion checks
   b. Fertilize
   c. Install filter fabric for check slots and soil fill
   d. Seed and rake the seed into the soil
   e. Install erosion control material
   f. Some erosion control materials come with the filter fabric attached. When this material is used, direct seed into the erosion control material and then soil is spread over the seed
8. Questions -- call 402-479-4537, Roadside Development.

807.02 FILTER FABRIC

@ Cut the fabric so that the excess material lies under the outlet so that the water falls on a double layer. this is shown on the plans.

The filter fabric detail should show the fabric covering the area above a box culvert opening and the boxes wings.

The bale check includes the necessary filter fabric so do not include this quantity when calculating the pay quantity for filter fabric. Pay limits will be added to the plan detail.

@

808.00 EROSION CHECKS

808.01 EROSION CHECKS CHECKLIST

SSHC Reference:		*Section 808 -- Erosion Checks & Special Provisions*
Other References:		Approved Products List
Inspection Crew:		Construction Technician
Inspection Equipment:		NA
General Comments:	1.	Work generally performed in conjunction with erosion control after an area is final graded.
	2.	Make sure that the center bale is lower than the outside bales
	3.	The erosion control material for the erosion checks must match the erosion control material used in the ditch. Is the material on the approved products list?
	4.	Work performed similar to erosion control
	5.	Seed is never to be placed under the filter fabric - only on top of the filter fabric
	6.	Some erosion control materials have the filter fabric attached. When this occurs, the seed is directly seeded onto the erosion control material and then soil is spread over the seed
	7. a.	"Temporary Silt Checks" (TSC) are to be installed as soon as rough grading begins. TSC should be placed as shown in the plans or as directed by the engineer.
	b.	Temporary Silt Checks (TSC) have to be removed in order for final grading to be completed. However, once final grading is complete, the TSC's need to be reinstalled.
	c.	The contractor does not have to reinstall TSC if instead the permanent erosion checks are available and will be installed immediately after finish grading.
Roadside Development (402) 479-4537	8.	Questions -- call 402-479-4537, Roadside Development

808.02 PLACEMENT

The suggested sequence of work for special ditch control is as follows:

Shape

@ Shape the ditch and prepare the seed bed approximately 3/4 inch (20 mm) deep. If ditches are unstable and equipment leaves them in a rough condition, the seed bed must be prepared by hand. The ditches should be shaped so that the ditch drains without water ponding and has a minimum depth of 6 inches (150 mm). Minor irregularities in ditch alignment must be corrected so the completed ditch will follow the ditch line constructed during the grading operation. This may not be possible in cases of severe washing of the ditch bottom. All rocks and clods more than 1½ inch (40 mm) in diameter, and all sticks and other materials, which prevent contact of the special ditch control materials with the seed bed, shall be removed.

@ The vegetation on new slopes may take more than one construction season to be effectively established and bale checks and silt fence should not be removed until they are no longer needed. It would be unacceptable to hold the contract open until the vegetation was established.

The only time that steel rebar should be used is when the stake must penetrate shale – then the PM needs to let Maintenance know this was allowed.

Check Slots

Install check slots as required. Take care that all check slots are carefully and properly installed. The success of the ditch may be dependent on proper installation of the check slots.

Finish

Smooth disturbed areas adjacent to ditch control. Make sure that no ridge of dirt remains along side the ditch, and that material excavated from the ditch channel is properly shaped and sloped to allow water to run onto the special ditch control material. This area should be raked.

Fertilize

Fertilizer should be applied at the proper rate with a mechanical spreader. A cyclone seeder may be used to secure a uniform rate of application.

Seed

Seed mixture and rate of application are specified. Seed may be applied in the same manner as fertilizer.

Special Ditch Control Material

Special ditch control materials must be applied without tension and in the direction of the flow of water since there may be some settling of low or filled portions of the ditch and some shrinkage of the material. Do not stretch the material. Install staples as specified.

809.00 SILT FENCING

The purpose of silt fence is to filter the soil from the runoff from our projects. Most of the time most of the silt will be left on our side of the fence. We may not catch all of the silt, but we can catch a large portion of it.

1. Q. - When do I have the silt fence installed?

   A. - Before any soil is disturbed on the project.

2. Q. - But the silt fence is in the way of construction.

   A. - Adjust the installation to fit the situation or adjust the location.

3. Q. - When do I have the silt fence installed around an area inlet?

   A. - As soon as there is something for the water to run into - even before the grate is set.

4. Q. - The silt fence is to be placed where no water will ever reach it.

   A. - Take the fence to the water.

5. Q. - I took the fence to the water, but have lots of it we cannot use.

   A. - Take it off the contractor's hands in the usual method. (Material furnished but not used on project -- CO/SA.)

6. Q. - There is no silt fence on this project and I can see the need for it.

   A. - Change Order.

7. Q. - The high porosity silt fence is allowing too many fine's to pass.

   A. - Install a low porosity fence on the downstream side of the high porosity silt fence.

8. Q. - There is no room on the downstream side of the silt fence.

   A. - Use a low profile, either low or high porosity silt fence, on the upstream side.

9. Q. - The contractor tore holes in the silt fence when he/she cleaned it out.

   A. - Repair work is on the contractor and is to be done immediately. Silt fence clean out is paid as equipment rental items. Make sure the equipment is capable of doing the work. A backhoe works usually but may require a CO/SA to add to the contract.

10. Q. - We did everything like we should and we still had some silt get away.

A. - Hari-kari is not required. The erosion process is a natural one. We are just trying to slow it down and keep our "dirt" at home. Take photographs of what did and did not work and send them in. We will pass on the good and redesign the bad.

809.01 SILT FENCING CHECKLIST

SSHC Reference:	*Section 809 -- Silt Fencing & Special Provisions*
Other References:	Silt Fence Guideline & Approved Products List
Inspection Crew:	Construction Technician
Inspection Equipment:	None
Silt Fencing Procedures:	

General Comments:

1. Silt fencing is a first item of business -- before any soil is disturbed.
2. Does the contractor have the right material? (*SSHC Subsection 809.02*, Para. 1.)
3. Is the material on the approved products list?
4. Does the silt fence location need to be adjusted to function better?
5. Silt fences only work when they are:
   a. installed correctly
   b. kept clean
   c. kept repaired

Roadside Development (402) 479-4537:

6. Questions -- call 402-479-4537, Roadside Development

809.02 SILT FENCE

@

At bridge approaches and on other steep slopes, the contractor should place extra rows of silt fence if necessary. The Plan requirements are only a guide and should be adjusted by the project manager to fit the actual field circumstances.

The bay portion of the silt fence is shown partially buried on some details and is not correct. The silt fence should be shown on top of the slope.

@ The objective is to place the silt fence so that silt will not leave our ROW. Design depends on site visits and preliminary survey data. However, erosion control has not been the focus in past surveys. Therefore placement of silt fence and other erosion control items may have not been optimal. If there is a better place – site the fence there; if more is needed, get it placed; the bottom line is do whatever is necessary to provide erosion control – in the long run it is really cheaper.

The District should remove silt fences and bail checks when the ground cover is established.

If the silt fence is properly installed and some subsequent construction activity damages the silt fence, is additional payment authorized?

It will depend on the circumstances. If the fence had to be installed at a location where subsequent activity was necessary and caused the fence to be removed and replaced, then additional payment is justified. However, if the contractor was negligent and did not use reasonable caution and his neglect resulted in damage to the silt fence, then no additional payment is authorized to replace the fence.

@

810.00 SLOPE PROTECTION

810.01 SLOPE PROTECTION CHECKLIST

SSHC Reference:	*Section 810 -- Slope Protection & the Special Provision*
Other References:	None
Inspection Crew:	Construction Technician
Inspection Equipment:	Yard stick, meter stick and small balance scale

Procedures and General Comments:

1. The mulch must be prairie hay and certified as noxious weed free (*SSHC Subsection 810.02*)

2. The seed will be mixed at the seed company and tagged with department supplied tags

3. All areas possible are to have the seed drilled. The drilled seed will establish much faster than broadcast seed. The percentage of the area to be drilled is given in the Special Provisions.

4. Hay buster machines have proven to be satisfactory for the mechanical application of the mulch

@ 5. Sampling for the proper weight of mulch per yd^2 or m^2. Use the meter stick or yard stick -- which ever applies -- and gather all the hay in a square <u>before</u> <u>crimping</u> -- and weigh this on the scale -- the results are <u>approximate</u>. Use them as a guide and not as an absolute

6. Best hay information -- Establish a test plot with the exact amount of hay per yd^2 or m^2 -- crimp -- and use this plot for a visual comparison

Roadside Development
(402) 479-4537

7. Questions -- call 402-479-4537, Roadside Development

811.00 SLOPE PROTECTION NETTING

811.01 SLOPE PROTECTION NETTING CHECKLIST

SSHC References:		*Section 811 Slope Protection Netting*
Other Reference:		Approved Products List & Plans
Inspection Crew:		Construction Technician
Inspection Equipment:		NA
Procedures & Comments:	1.	The slope protection must be complete before the netting is installed.
	2.	Is the netting on the approved products list? (*SSHC Subsection 811.02*)
	3.	Are the pins the right length and wire size? (*SSHC Subsection 811.02*)
	4.	Potential problem is inadequate pinning.
Roadside Development (402) 479-4537	5.	Questions - call Roadside Development (402) 479-4537.

812.00 COVERCROP SEEDING

812.01 COVERCROP SEEDING CHECKLIST

SSHC References:		*Section 812 Covercrop Seeding*
Other References:		None
Inspection Crew:		Construction Technician
Inspection Equipment:		None
Procedures & Comments:	1.	Covercrop seeding is intended to reduce erosion and siltation.
	2.	This cannot happen unless the covercrop seeding is done in a timely manner.
	3.	This does not mean to wait and have the permanent seeder put in the covercrop and then overseed with the permanent seed.
	4.	The covercrop seed should be done at least 45 days in advance of the permanent seeding to be of any use!
	5.	Covercrop will not be used as a matter of course on "overlay" project, but could be added by change order if the need ever arose.
	6.	Piper Sudan has been removed from the covercrop lists.
	7.	Questions - call Roadside Development (402) 479-4537.

812.02 WATER POLLUTION CONTROL (SOIL EROSION)

While this section addresses soil erosion on all projects, *Construction Manual Subsection 1100.30* addresses the additional requirements of a storm water discharge permit. Coverage under the Nebraska Department of Natural Resources permit is required for all projects which disturb more than 2 hectares (5 acres) and are administered by the NDR.

The primary objective is to control soil erosion during construction with reasonable and economical construction practices.

While the contract documents indicate locations of erosion control devices (silt fence, ditch checks, and silt basins), their actual location should be determined in the field in order to fit existing conditions.

The erosion control devices should not be limited to those which are included in the contract documents. The Project Manager should authorize adding any device that will be most effective in controlling erosion.

The primary method for temporary erosion control is cover crop seeding.

Cover crop seeding requires seed bed preparation covering, and compacting as described in *SSHC Section 803*.

The installation of the perimeter silt fence for ditch checks should be installed prior to any soil disturbing activities occurring on the project or as soon as any ditches are created.

Also install silt fence to protect wetlands.

812.03 TEMPORARY WATER POLLUTION CONTROL (SOIL EROSION)

Limitation of exposed surface area - 75,000 m² (90,000 sy) plus an equal amount for clearing and grubbing. These figures do include the roadbed until it is surfaced or the base course has been placed. (*SSHC Subsection 204.02,* Para. 2)

APPROXIMATE LENGTH OF AUTHORIZED OPEN GRADING AREAS

ROW Width x Length to Equal 69,700 m² - 750,000 sq. ft.

Row Width (Metric/English)	Project Length (Metric)	Project Length (English)	Station (English)	Station (Metric)
20m/66’	3,485 m (3.5 km)	11,364’	114 Stations	35
30m/100’	2,323 m (2.33 km)	7,500’	75 Stations	23.3
45 m/150’	1,515 m (1.5 km)	5,000’	50 Stations	15
60 m/200’	1,143 m (1.2 km)	3,750’	38 Stations	12
75 m/250’	917 m (0.90 km)	3,000’	30 Stations	9
90 m/300’	758 m (0.8 km)	2,500’	25 Stations	8

These figures are for level terrain. Large cuts and fills shorten the lengths given above.

These figures may be adjusted up or down to allow for soil conditions, season of the year, contractors operating performance or other considerations.

812.04 CONTRACTOR REQUIREMENTS

The contractor's responsibility is to insure that soil erosion is minimized and to prevent eroded soil from leaving the construction project onto adjacent property. Timely installation of silt control devices, such as silt fence and ditch checks, will help to prevent this damage from occurring. The most effective erosion control practice is cover crop seeding which shall be done as the grading progresses. This may require the erosion control contractor to mobilize and seed more than once.

The contractor's schedule (sequence of operation) and proposed method for accomplishing the required erosion control must be submitted to the Project Manager at the

preconstruction conference and be approved before clearing and grubbing or excavation begins.

The contractor's erosion control work plan should include the following:

- Materials to be used.
- Equipment to be used.
- Location and timing of silt fence and silt basins and other temporary erosion control measures outlined in the Plans.
- Schedule for placement of cover crop seeding and fertilizing.

If the temporary erosion control is to be performed by a subcontractor, the subcontractor should be involved in developing the work plan.

Damage due to siltation on private property shall be corrected by the contractor with no expense to the contracting authority.

813.00 PEAT MOSS

813.01 PEAT MOSS CHECKLIST

SSHC References:	*SSHC Section 813* -- PEAT MOSS
General Comments:	Although peat moss is not used often, it is a very important item when specified. The peat moss adds trace elements that some plants need and can help hold water in the planting soil and help loosen heavy clay in some cases. Make sure that the peat moss is well mixed with the backfill before it is placed in the planting hole so it gets distributed evenly throughout the planting hole.

CHAPTER NOTES:

CHAPTER NOTES:

CHAPTER NOTES:

DIVISION 900

INCIDENTAL CONSTRUCTION

DIVISION 900
INCIDENTAL CONSTRUCTION

901.00 FIELD LABORATORIES AND SCALE HOUSES

901.01 GENERAL REQUIREMENTS

The Project Manager shall determine if the field laboratories or scale houses furnished by the contractor conform to the requirements of the specifications, supplemental specifications and/or the special provisions. Inspection report forms for the laboratories are available at the district offices.

The Project Manager shall require the contractor to furnish, relocate when necessary and maintain the field laboratory or scale house as specified.

The personnel using the contractor furnished facility shall use due care in performing their required duties to prevent unnecessary wear and tear on the facility.

901.02 METHOD OF MEASUREMENT

Appendix 3 of this manual has an example of the field book records required for a field laboratory.

901.03 BASIS OF PAYMENT

Payment of 100 percent will be made for the field laboratory after it is inspected and approved by the Project Manager. When two or more projects are included in the same contract the cost for the field laboratories may be prorated to the projects on the contractor's estimate forms furnished the Project Manager. When preparing the form for submittal, the Project Manager will use the same decimal quantities, shown under contract quantities on the form, for each project on the first estimate that payment is made for this item even though work has started on only one of the projects involved. Payment for the field laboratory will not be related to the percent of work performed by the contractor.

902.00 GUARDRAIL CHECKLIST

			YES	NO
@	1.	Before construction of the guardrail, is the slope from the shoulder line 2 ft. (600 mm) past the guardrail post 10:1 or flatter?	_____	_____
	2.	Are offsets correct? [± 1" (25mm)].	_____	_____
	3.	Is rail height above ground, 27 to 27.5 inches (686 to 702 mm) is OK, but 27¾" to 30" (702 to 762 mm) preferred for W-beam; 32? inches (810 mm) for thrie-beam including the bull-nose; cable is at 30 inches.	_____	_____
	4.	Is rail alignment good?	_____	_____
	5.	Are laps to specified case in direction of traffic?	_____	_____
@	6.	Is post spacing correct?	_____	_____
	7.	Are plate washers on post bolts according to plans?	_____	_____
	8.	Is 8x8 inches (200 mm x 200 mm) plate washer installed correctly (nails)?	_____	_____
	9.	Are washers in correct location on all connections?	_____	_____
	10.	Is surfacing/pavement around timber guardrail posts removed and backfilled properly [7" (180 mm) behind post.]?	_____	_____
@	11.	Are high strength bolts used in bridge end connection? (See 903.03)	_____	_____
	12.	Are object markers and new hardware in correct location?	_____	_____
	13.	Are delineators in correct locations?	_____	_____
	14.	If 6x8 inch (150 mm x 200 mm) posts are used, are they installed properly?	_____	_____
	15.	Is end anchorage cable tightened? (Remove all slack)	_____	_____
	16.	Are the vertical steel tubes at the correct elevation [less than 4" (100 mm) above soil]?	_____	_____
	17.	Are the horizontal steel struts between the end post and the 2nd posts resting on the ground?	_____	_____
	18.	Is the horizontal steel strut below the hole in the wood post?	_____	_____

@

903.00 W-BEAM/THRIE-BEAM GUARDRAIL

@

903.01 DESCRIPTION

The construction inspection for this work includes:

1. Checking the plan information with actual field conditions to assure plan information is correct or to modify it as necessary to more closely fit field conditions.

2. Preparing a field checked order list for the contractor's use in ordering the necessary materials. This order list should be prepared in letter form to the contractor and include the following listed items.

   a. List stations of guardrail.

   b. Side of project.

   c. Build, remove, reset, etc.

   d. Linear feet (meters) of rail.

   @

   e. Type of rail.

   f. Type of end treatment.

   g. Number, type and dimensions for special posts.

   h. Special and/or standard plan numbers.

   This field checked order list should be prepared and submitted to the district office for their review. The district office will distribute the original and copies of the order list after they have reviewed it.

3. This field checked order list should be prepared and submitted as soon as possible to allow the contractor ample time to obtain the necessary materials prior to the date established for beginning the work.

4. All build items will be staked by the field personnel. Stakes will be set at the ends of guard rail locations. Nails (red heads with wire flags as guards) should be set at each post location. The location of end treatments, bridge approach sections, etc. should be marked with stakes.

   @

5. The field book record for this work should include:

   a. Plan data.

   b. Construction data.

   c. Staking information.

   d. Inspection information.

e. Quantities and summary of quantities.

@ f. End treatment.

6. Usually guardrail contract work cannot be started until other contract work on the project is completed. Therefore, the Project Manager must keep the district office, the contractor and the construction office informed as to the date the work site will become available.

@ 7. The Contractor must submit to the Construction Division shop plans on the type of "end treatment" that will be installed. Approved shop plans will be distributed to Maintenance so that future repair work has good reference documents. The PM must indicate on the "As-Built" Plans the types of "end treatments" that were installed.

GENERAL INSTRUCTIONS

@ Safety implications make it very important that the Project Manager, inspector, and contractor know the plans and specifications that apply to this work.

A guardrail inspection checklist is provided at the beginning of this Division. This checklist may be helpful in preparation and inspection for guardrail work. Inspection and material acceptance requirements are identified in the Plans and Specifications.

Guardrail installations are dependent on correct location of shoulder or bridge approach paving and 10:1 (or flatter) approach slope to guardrail. Prior to the start of guardrail installations, these need to be reviewed and verified.

@

Slope on finished surface between shoulder and a point at least 2 feet (600 mm) behind back of posts should be 10:1 or flatter. This provides a slope which will keep vehicle wheels in contact with the ground and adequate soil support for the posts.

If the inspector or the Project Manager observe a variance from plans or specifications, then the contractor should be advised immediately. When situations arise that are not covered by specifications, plans, standard plans, or this instruction, contact the Construction Division.

903.02 MATERIAL REQUIREMENTS

The plans, special provisions and specifications will include the material requirements. The Materials and Research Manual includes the inspection and test requirements for the materials. The field personnel must insure that all materials used in the work conform to these requirements.

903.03 CONSTRUCTION METHODS

@ Standard plan for Traffic Control Devices for Construction and Maintenance, is a part of all guardrail project plans. Field personnel shall insure that project traffic (whether local only or traffic maintained condition are in effect) is controlled and workmen protected so this work is performed under safe conditions for all involved. Generally, guardrail work would be considered to require traffic control procedures similar to the situation sketches for minor maintenance of short duration or road repair.

@ The specifications are very detailed on construction methods and the field personnel must insure that these methods are used. All connections must be tightened, etc. Cables that are anchored in concrete cannot be tightened until the concrete has attained 2000 psi (14 Mpa). The work is not complete until the contractor has tightened all turnbuckles, cables, nuts, etc.

W-BEAM AND THRIE-BEAM GUARDRAIL INSTALLATION

Rail Alignment

Rail shall be installed with reasonably smooth vertical and horizontal lines. Kinks in both straight and shop curved sections shall be avoided. Face of rail shall have no protrusions that could catch a vehicle sliding along the rail. The project plans will show how to install the guardrail. Minor adjustments may be made to meet plan requirements.

Guardrail Posts

@ Posts shall be installed at prepunched holes and at intervals shown on the correct plan. Post details on the plans show required backfill materials and correct hole sizes.

@ Where longitudinal obstructions (electric cables, curbs, etc.) are encountered, 2 or 3 posts may have a maximum of 2 blockouts to provide an offset. If this cannot be done, obstruction shall be removed or relocated. We could also use a 25 ft (7.62 m) section of nested guardrail over one or two posts and avoid using post in obstructed locations. Plans will show these details.

Rail Section Location

@ All prepunched rail sections should be in proper location within each guardrail assembly. This involves sections with 3 feet-1½ inch post spacing, sections with 6 feet- 3 inch (1.905 m) post spacing, and appropriate end treatments section as shown in the plans.

Rail Height

@ Guardrail installations are constructed with W beam and thrie-beam rail. The Standard Plans indicate the mounting height is measured from surface of ground at the face of rail to the top of rail. Target height is 27 ¾ (705 mm) for W-beam and 32? inch (829 mm) for thrie-beam.

On a project where all new guardrail is installed or existing guardrail is being removed and reinstalled, tolerance will be.

Lapping of Guardrail

Lapping of rail must be accomplished in a uniform manner. Details shown in the plans will achieve uniformity statewide. However, clarification may be helpful in obtaining this uniformity in specific instances.

@ Plans indicate guardrail shall normally be lapped in direction of traffic flow. Following this general rule, most installations will be lapped correctly. Plans provide a lapping procedure detail for each type of guardrail installation except:

- Where guardrail alignment is curved away from centerline (bridge ends or end sections), lap should protect approach vehicles.

Keep in mind that the basic principle of lapping has to do with favoring the traffic for which the guardrail is being installed.

@ All laps of rail shall take place at a post. The 5/8 inch (16 mm) x 1 ¼ inch (32 mm) splice bolts at these laps should not have washers.

BRIDGE CONNECTIONS

@ All end treatments including bridge approach sections shall be installed so that the end post sleeve is not more than 4 inches above ground level so that the undercarriage of a vehicle cannot be snagged. Exception to this is on trailing end of a one-way bridge where Type "J" terminal section shall be installed on outside of rail.

On guardrail attachments to concrete which require a bolt longer than 2 ft (600 mm), 7/8 inch (22 mm) bolt anchors may be grouted into concrete using threaded insert anchors with epoxy.

All bolts on bridge end connections shall be high strength, galvanized hex bolts. Surface of bolt head should be marked A-325, A449 or have three radial marks at 120° intervals.

GUARDRAIL POST

@ W-beam and thrie beam guardrail posts – wood **and** steel – must be able to rotate if the beam rail is to work properly. Care must be taken to insure compliance with the details shown on the plans regarding "space" and density of material behind the posts.

END TREATMENTS

@ There are two general types of end treatments (Type I & II). Future plans will no longer provide "end treatment" details. Contractors will be required to submit shop plans for the "end treatment" they want to use. The plans will indicate where the end treatment is to be installed and whether Type I or Type II end treatment is required and also the acceptable styles for each "Type" (such as Best, ET-2000, etc).

End treatment Type I is dimensioned as 50 feet (15.2 m) so that ET-2000, Best and SKT-350 can be bid competitively. The ET-2000 is only 37 feet- 6 inches (11.4 m) and the extra

@ 12 feet-6 inches (3.8 m) split will be standard W-beam, either placed parallel or 2511 as shown on the guardrail layout special plan.

End treatment Type I is generally used on expressways and interstates where the speed limit will be at or above 65 mph. "Type I" will be on a guardrail which is set on a 25:1 taper.

End treatment and Type II is used at locations where the posted speed is under 65 mph. Type II will be on guardrail which is on a 15:1 taper.

The PM must indicate the type of end treatment that was installed in the "As-Builts".

END ANCHORAGE

@ To insure that concrete does not become attached to bottom and sides of breakaway end anchorage post a small amount [1 or 2 inch (25 or 50 mm)] of soil may be tamped around post bottom or bottom 6 inches (150 mm) of post may be wrapped with expanded polystyrene foam sheets in place as shown on the plans. If steel tubes are used, grease the bottom 12 inches (300 mm) of the wood post and the inside of the sleeve generously. This is done so that it would be easy to remove the damaged ones.

Soil removed from all end anchorage holes should be disposed of away from the hole to insure proper installation height.

To remove post a small quantity of diesel fuel can be poured on expanded polystyrene foam. This will dissolve foam for easy removal.

903.04 METHOD OF MEASUREMENT

Final field measurement will not be required when the guardrail is constructed as ordered.

904.00 SUBDRAIN EARTHWORK

904.01 SUBDRAINS

Subdrains are constructed on grading, paving, and structures contracts. Refer to *SSHC Sections 914* and *915*.

Subdrains are used for tile relocations, backslope drains, longitudinal and cross drains under the roadway area.

Subdrains are also used with granular blankets to develop a drainage layer in areas where the soil has a high moisture content and poor stability.

904.02 BACKSLOPE DRAINS

Backslope drains are used in areas where seepage and/or a slide is possible. Where a water table is perched on a very dense layer, a subdrain is installed at or below the surface of the very dense layer. The flow line is very important in this case. A backslope drain may also be used to drain a sand pocket, again plan flow line is important.

904.03 LONGITUDINAL DRAINS

Longitudinal drains are usually installed at the pavement edge to remove any water that accumulates under the pavement.

Inspection considerations must include:

- **Trench Excavation**

  The trenching equipment must be adjusted and maintained so the trench is excavated to the specified depth. It is important that all of the loose excavated material is removed from the bottom of the trench to minimize settlement of the trench backfill. Trenchers have a metal device on the end of the trencher's boom called a "crumber." The "crumber" is to be adjusted so the loose material is scraped off of the bottom and removed.

- **Outlets**

  All outlets should be inspected prior to backfilling. The pipe coupling should be inspected to assure proper installation. The flow line of the outlet should be checked for uniform downward grade toward the ditch. All outlets are to be marked with an orange fence post.

  Some projects require that existing subdrain outlets be extended, for example, on a shoulder widening project. On these projects, the contractor must remove the existing rodent guard before extending the pipe.

Porous Backfill

Porous backfill material must be in contact with the base of the pavement for the subdrain system to operate correctly. This may require hand work by the contractor. No soil shall remain between the pavement edge and the subdrain trench.

CHAPTER NOTES:

DIVISION 1000

MATERIAL DETAILS

DIVISION 1000

MATERIAL DETAILS

1001.00 GENERAL

Specification Division 1000 provides detailed descriptions of the materials specified for highway construction. (Refer to the *Standard Specification for Highway Construction Manual Division 100* for further material information.)

1001.01 MATERIAL CERTIFICATIONS

Construction materials may required certificates of compliance, certified tests, or reports of inspection from an outside agency for their use and acceptance. These materials will not be incorporated into the work until such information has been received by State Personnel.

After the material information has been received, the following course of action will be taken:

A. The information will be reviewed by State Personnel to insure that it conforms with the material requirements.

B. The information will be dated when it is received from the contractor. This can either be initialed and dated or date stamped.

C. The original copy of the information will be forwarded to the Materials & Research Division immediately. A copy will be kept in the Project Manager's project file.

Material inadvertently incorporated in the work without the required material documentation should not be included for payment on the progress estimate. If an item is on the estimate, it should be removed until proper documentation is received.

1001.02 MATERIAL CERTIFICATION RECEIPT & INTEREST DATE DETERMINATION

The interest beginning date is normally the sixty first day following tentative acceptance.

If the certifications are not received in a timely manner, then the interest date will be adjusted to the date that the documentation is in NDR possession. This is why it is extremely important to date the information when it is received from the contractor.

1002.00 APPROVED PRODUCTS LIST

1002.01 DESCRIPTION

Many material items are not described in detail in the plans and specifications but are authorized for use as shown on the NDR Approved Products List. The NDR Approved Products List is on file on the NDOR web page and is updated when a new product is added to the list or when a product is dropped from the list.

1002.02 ACCESS COMMANDS

Moved following paragraph from page 479 and deleted text.

Contact Terry Masters in the NDR Materials and Research Division at (402) 479-4754 if there are any questions concerning the viewing or printing of the Approved Products List.

1002.03 ADDITIONS/DELETIONS TO THE APPROVED PRODUCTS LIST

The Approved Products List is normally updated on Friday. Materials that meet NDR's *Standard Specifications for Highway Construction* may be added to the list at any time. Materials may also be deleted from the list at any time.

Contact the Physical Testing Section in the NDR Materials and Research Division at (402) 479-4746 to obtain information on required certification and documentation that is necessary for a specific product.

SSHC Subsection 1001.03 identifies details relating to the use of the Approved Products List and the procedure for using a material that is not included on the Approved Products List.

1003.00 WHITE PIGMENTED CURING COMPOUND AND HOT-POUR JOINT SEALER

1003.01 DESCRIPTION

White pigmented curing compound and hot-pour joint sealer are sampled at the manufacturer's plant and tested in the Lincoln laboratory before being shipped to Nebraska. Test results for curing compound and joint sealer are on file on the computer. When either of these materials arrive at the construction site, it is necessary to identify the manufacturer and lot number of the material, then check the Approved Products List
@ on the Department's web-site to verify that the material has been tested and approved for use on the project. The possibility always exists that untested material may be shipped to the construction site.

1003.02 REPORTING MATERIAL USAGE

@ If you use white pigmented curing compound and/or hot-pour joint sealer, Materials and Research needs to know. Send Terry Masters an e-mail note with product name, manufacturer, lot number, approval date and the quantity used.

@

@

@ # 1004.00 PCC REQUIREMENTS

1004.01 CEMENT CERTIFICATIONS

Note 7 in the Materials Sampling Guide, Volume II, requires that the pink copy of the cement certificate of compliance, DR Form 228 or a copy of the mill's own certification form be mailed to the Materials & Research Division. However, Materials & Research does not need the pink copy of the certification mailed to them anymore. The copy at the concrete production facility is enough for Materials & Research records.

The certificate of compliance is needed both for mills that require sampling and those that do not. When a sample is required, normal procedure has been to submit the pink copy with the sample. This is acceptable. For those mills which do not require sampling, please collect and submit the certifications on a routine basis but at a minimum of once each week.

1004.02 CONCRETE STRENGTH

The following English and Metric unit "Concrete Strength Variation" table is provided to define the different strengths that may be specified. The specified strength has varied as the Department has converted from English to Metric units and then back to English units. In the following table, the standard strengths are given in pounds per square inch (psi) and the various equivalent units that have been used in the past 5 years to specify this strength are shown. **However, the strength that a contractor is held-to can only be what is contained in the contract. So if the contract calls for 2900-psi, we cannot reject or deduct if he does not provide 3000-psi.**

Concrete Strength Variation

Current Standard Strength (psi)	Actual Specified Strength (psi)	Actual Specified Strength (Mpa)
3000	3000, 2900	20, 20.7, 21
3500	3500, 3625	25, 24.3, 24
4000	4000, 4350	30, 27.6, 27

@ 1004.03 CONCRETE CYLINDER POLICY

Cylinders

All concrete cylinders applicable to this policy will be 6 inches by 12 inches. All cylinders shall be cast by currently certified technicians, or by new or temporary employees trained and approved by qualified Materials and Research personnel in accordance with the NDR technician training program.

Structures

A set of three cylinders will be made for the first 100 cubic yards placed and an additional set of three cylinders will be made for the remainder of the concrete placed for each day provided at least 50 cubic yards more is placed. A minimum of three cylinders will be made for each day's placement. One cylinder from each set will be tested at 28 days. The other two cores from each set will be tested at the intervals designated by the engineer. If no intervals are designated, the cylinders will be tested at 7 days and 14 days respectively.

Pavements

A set of four cylinders will be made for each day's placement. These cylinders will be tested at the intervals designated by the engineer unless the pavement does not need to be cored. If the pavement will not be cored, at least one cylinder must be tested at 28 days. The other cylinders will be tested at the intervals designated by the engineer.

If the pavement must be cored and no intervals are designated, the cylinders will be tested at 7, 10, and 14 days or until the specified strength is attained. If needed, the fourth cylinder will also be tested at 14 days and the average strength of the two cylinders reported. If the pavement will not be cored and no intervals are designated, the cylinders will be tested at 7, 10, 14, and 28 days or until the specified strength is attained.

Miscellaneous Concrete

Concrete placements requiring five cubic yards or less and which are noncritical, may be accepted by the engineer without testing. Noncritical refers to placements that will not sustain traffic loading and for which failure is not likely to disrupt traffic or pose a threat of harm to the traveling public.

CONCRETE CYLINDER REQUIREMENTS SUMMARY						
CONCRETE PRODUCT	**REQUIRED NUMBER OF CYLINDERS**	**REQUIRED BREAK DATE**				
		7-DAYS	**10-DAYS**	**14-DAYS**	**28-DAYS**	**OTHER**
STRUCTURES*	**3**				**2**	**2**
PAVEMENTS**	**4**	**1**	**1**	**1**	**1**	
MISCELLANEOUS CONCRETE	**Concrete placements requiring 5-cubic yards or less which are noncritical, may be accepted without testing.**					
*3-cylinders are required for the first 100-yd³ each day and another set of 3-cylinders is required if a total of at least 150-yd³ is required in one day. The Engineer may set the date of the third cylinder break as necessary.						
**Four cylinders are required for each day's placement. The Engineer may designate the date the cylinders are to be broken; if the pavement will not be cored at least one cylinder will be broke at 28-days; if the pavement will be cored then cylinders are broke at dates designated by the Engineer or as shown above.						

@ 1005.00 MATERIAL & RESEARCH DIVISION'S FINAL REVIEW PROCEDURES

The Materials and Research Division's Final Review Section will perform the following steps:

- The Materials and Research Division will receive notification from the Project Manager that the project is complete and ready for the material review.
- The Materials and Research Division's Final Review Section will make a listing of all materials that need to be reviewed.
- This listing will be routed through the various laboratories in the Materials and Research Division. The individual laboratories will review their areas and note if the material is satisfactory or a deficiency exists (i.e.: required samples or certifications not received, materials not meeting specification requirements, deductions in compensation for failing materials).
- When complete this listing will be returned to the Materials and Research Division's Final Review Section.
- The Materials and Research Division will determine which materials are deemed critical and non-critical.
- Non-Critical Materials will be accepted by a blanket letter of acceptance. This letter will be generated by the Materials and Research Division's Final Review Section and sent to the Project Manager by e-mail or fax. By signing this letter the Project Manager is stating that all of the materials met specification requirements and that the necessary documentation is in their files. The Project Manager can fax or mail the signed letter to the Materials and Research Division (fax number 402-479-3975).
- Critical Materials will require that the necessary certifications and samples are on file in the Materials and Research Division. The Materials and Research Division's Final Review Section will send an e-mail to the Project Manager listing these materials and requesting that the required documentation be submitted.
- Once all of the necessary information is received in the Materials and Research Division a letter will be sent to the Project Manager stating that the material review is complete. (There is the possibility that another material shortage could occur if a subsequent estimate adds an item or increases a quantity. If this happens the Project Manager will be notified).

- The Construction Division will contact the Materials and Research Division when a final estimate is ready for our approval. When all necessary documentation has been received we will release this estimate for final payment. A letter will be sent to the Project Manager stating that the Materials and Research Division has released the final estimate.

@

- If you have any questions regarding this procedure please contact Rhonda DeButts @ 402-479-4760 or Dave Hall @ 402-479-4837.

CHAPTER NOTES:

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CHAPTER NOTES:

DIVISION 1100

ENVIRONMENTAL

DIVISION 1100 - ENVIRONMENTAL

1100.10 INTRODUCTION

This Division is provided for information only. It gives you an understanding of the complex laws and regulations that affect environmental issues. You need to be aware of these laws and regulations but you should not advise or direct the contractor regarding "Environmental Issues." However, reporting and recording in the field book all contractor activities is essential.

The phrase Environmental Issues can literally include almost anything from anthropological bones to endangered species, from land use to land disposal, from wetlands to storm water runoff, from wild flowers to underground tanks. For the purposes of this chapter, inferences will be limited to only those issues identified in each section. For this reason, much of the following information contains both general background and specifics. Probably the most important aspects of any environmental issue are:

- Environmental "issues" are to be taken very seriously. Inappropriate action can result in personal fines "and/or" jail. This is not intended as idle gossip or scare tactics. As a user of this chapter, it is important to know the facts of life.

- Contact the Construction Division or Project Development with questions, concerns, and observations. If there is a question about whether or not to notify, always make a notification.

  "IT IS FAR BETTER TO BE SAFE THAN SORRY!"

  Remember, individuals can be held personally liable for not reporting an environmental incident. Through notifying the next higher level, your liability is significantly reduced. While the Construction Division and Project Development may need to refer questions to others, it is important to notify the Construction Division and Project Development so issues can be responded to and tracked.

- ALL contacts with DEQ, OSHA, and/or EPA shall be made by, or through, the Construction Division. The only exceptions will be when some other office is better able to address the issues. For example: On legal issues, the Attorney General is better suited for a response. The inspector's responsibility is to contact the Project Manager and make a diary entry, the Project Manager is to contact the Construction Division, and the Construction Division will in turn contact the most appropriate office for response. **Remember: Timeliness in responses to a regulatory agency is of the utmost importance.**

- When the contractor causes an environmental incident, then he/she is responsible to take the appropriate notification and remediation actions. Our inspectors and Project Managers should notify the appropriate people through our chain of command and document the contractor's actions in the field book.

Normal notification chain of command:

- The Inspector notifies the Project Manager.
- The Project Manager notifies the District Construction Engineer (DCE)
- The DCE notifies the District Engineer and the HQ Construction Division.
- The Construction Division notifies the EPA, DEQ, Attorney General and all other affected agencies.

Emergency notification:

- First person to see/become aware of an environmental incident should take actions to notify the agency that can contain and mitigate the hazard.
- Simultaneously as notification is occurring, actions need to be taken to keep workers and public safe.

1100.11 ENVIRONMENTAL REGULATIONS

Environmental Protection Agency (EPA) is a Federal agency with environmental protection regulatory and enforcement authority. EPA administers such Acts as the Clean Air Act (CAA), Clean Water Act (CWA), Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Toxic Substance Control Act (TSCA), and other federal environmental laws. EPA was created by Congress in 1970. In this landmark legislation the lawmakers established a preamble for the EPA. The preamble states:

> *"Pollution prevention is based on the idea that it makes economic as well as environmental sense to stop producing hazardous waste, rather than attempting to clean-up hazardous substances after they have become released."*

U.S. EPA has, for the most part, delegated authority to the states for management of ongoing environmental functions. All actions and requests must be made to U.S. EPA, Region VII, Kansas City, Kansas, however, Nebraska DEQ does have specific regulatory authorities in Nebraska. Some instances are:

FIRST, DEQ has signoff responsibility for RCRA and CERCLA actions in Nebraska. This means before those actions can become final, DEQ must approve certain aspects of most actions.

SECOND, very often DEQ is asked to be the regulatory agency's on site coordinator. This means that an action and resolution may be developed with U.S. EPA. Once a cleanup action is initiated at a site, DEQ would provide site compliance inspection.

THIRD, and again very often, DEQ will choose to request U.S. EPA's permission to be the lead agency in a particular action. In this case, all direction will be from DEQ, with EPA assuming a secondary "review" role.

A large portion of "who's in charge" confusion can be attributed to the complex nature of environmental laws. This confusion can be, and is, further compounded by the mixture of regulating authorities in charge of enforcing these laws. The laws require action depending on the chemical(s) present and have significantly different action levels depending on how much of any one constituent is found. The final blow often comes when conversation is composed mostly of acronyms.

1100.12 REGULATORY AUTHORITIES

EPA

In Nebraska, U.S. EPA is responsible for CERCLA and RCRA programs. These are administrated by EPA's Region VII in Kansas City, Kansas.

OSHA

In Nebraska, OSHA is administrated by Nebraska Department of Labor. Enforcement of OSHA is the responsibility of the federal Occupational Safety and Health Administration. All complaints regarding maritime operations should be referred to the Federal Office in Kansas City, MO, except those involving State or local governmental employees which continue to be covered by the Nebraska Department of Labor.

Nebraska Department of Environmental Quality (DEQ)

DEQ is responsible for specific environmental regulatory functions. Most of DEQ's environmental authority and powers are listed in its legislated guidance. "Generally" this authority includes:

- Air Quality

  Clean Air Act and Clean Air Act Amendments, plus additional regulations codified by Nebraska legislature.

- Land Quality

  Nonhazardous waste disposal.
  All underground storage tanks.

- Water Quality

  Storm water pollution
  Water pollution
  Wetlands
  Public and private wells

- Waste Reduction

- Compliance and Enforcement

1100.13 ENVIRONMENTAL LAWS

Principle legislative acts which govern most of DEQ's work.

AHERA Asbestos Hazardous Emergency Response Act: Federal law codified in 1986. This act promulgates regulations which require inspection of buildings for materials which contain asbestos. If the material is found, it must be removed prior to demolition for health and environmental protection reasons. NDR has chosen to prepare and let a separate contract for removing asbestos. However, asbestos could be removed in conjunction with demolition.

CAAA Clean Air Act Amendments: Federal law codified in 1990 and regulates air quality issues.

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act: Federal law codified in 1980, sometimes referred to as "Superfund." CERCLA gives the federal government the power to respond to releases, or threatened releases, of any hazardous substance into the environment as well as a substantial danger to public health or welfare.

CERCLA is a remedial statute designed to deal with problems of past mismanagement of hazardous waste. Under CERCLA, the government created a process for identifying liable parties and ordering them to take responsibility for cleanup operations.

CWA Clean Water Act: Federal law codified in 1977. The objective is to restore and maintain the chemical, physical, and biological integrity of the Nations waters.

NPDES National Pollutant Discharge Elimination System: Federal law codified through publication in 55 FR 47990 (November 16, 1990) and 57 FR 11394 (April 2, 1992). In a simple "nutshell", this is the Storm Water Pollution program.

OSHA Occupational Safety and Health Act: Federal law codified in 1968. Established for the regulation of site safety procedures, worker training, and worker safety and health standards.

Health related requirements of OSHA typically key on the presence of "TOTAL" amounts of listed elemental constituents. Be careful when considering constituents because OSHA often considers elements according to valence charges. For example; Trivalent chromium Cr^{+3} has one action level, while hexavalant chromium Cr^{+6} has another, and chromium (metal) has still another. Most of OSHA's regulations are found in *Title 29 Code of Federal Regulations (CFR) Sections 1910 and 1926*. A specific listing of chemicals is found in *Table Z, 29 CFR 1910.1000*.

RCRA Resource Conservation and Recovery Act: Federal law codified in 1976 which provided for the development of federal and state programs for the regulation of land disposal of waste materials and the recovery of materials and energy resources. The act regulates not only the generation,

transportation, treatment, storage, and disposal of hazardous wastes, but also municipal solid waste disposal facilities. Several amendments to RCRA have imposed a series of even more stringent requirements than the original law.

RCRA is a federal statute enacted to ensure that wastes are managed in an environmentally sound manner, and to protect human health and the environment from the potential hazards of waste disposal. Whereas CERCLA focuses on the cleanup of uncontrolled or abandoned sites, RCRA seeks to better manage active hazardous waste treatment, storage, and disposal facilities so new superfund sites will not be created in the future.

SARA Superfund Amendments and Reauthorization Act: A federal law codified in 1986. Amended CERCLA and introduced more stringent and detailed guidelines for cleanups. Also established regulations for industries using chemicals and releasing pollutants into the environment.

TITLE III of SARA requires that communities and the public be supplied with information on chemical inventories, release reporting, accidents/spills. TITLE III also provides for full public participation in planning and preparing for chemical emergencies arising from local industries.

SDWA Safe Drinking Water Act: Federal law codified in 1974. This law is intended to protect drinking water resources at the tap. Establishes control of contaminants in public drinking water and sets baseline national drinking water standards.

TSCA Toxic Substance Control Act: Federal law codified in 1976. Established for the regulation of toxic substances.

1100.14 WETLANDS

Special Environmental Conditions

New procedures have been established to bring specific attention to those environmental issues or documents directly (or indirectly) affecting our construction projects.

Reference is made to the attached Project Development Summary Sheets. These summary sheets will normally be two pages or less in length and pertain to such things as wetlands, waterway permits, historic bridges, and other environmental issues. These sheets will be sent to the districts, and the information shown thereon must be carefully compared to the provisions of the actual permits issued for the work involved.

Additional information will also be shown in the plans. Project Development will be preparing one or more "2W" sheets for inclusion in the plans. The "2W" sheets will provide delineation of wetland areas (on and off the project) and notes pertaining to special conditions or environmental issues. These plan sheets, also, should be checked against the provisions of actual permits issued for the work involved.

In order to insure that all parties involved are aware of the environmental issues affecting a project, please see that the following procedures are followed:

- Thoroughly review the plans and special provisions for environmental issues.

- Discuss all environmental issues at the pre-construction conference.
- Provide the contractor a copy of the environmental conditions summary.
- Invite Project Development to the pre-construction conference (when appropriate).

Protection of the environment has become a very important issue of public concern, and we must consider it to be a very important issue in the performance of our required duties. Please make every effort to see that we and our contractors fully comply with all environmental provisions of the plans and specifications.

Project No.:
Control No.:
Location:

PROJECT DEVELOPMENT SUMMARY SHEET

WATERWAY PERMITS

Type of Permit	Location	Permit Number

Special Plans (to be included in final plan package):

2WA Sheets	Yes____ No____
Mitigation Plan	Yes____ No____
Special Cross Sections	Yes____ No____
Others	Yes____ No____

Description:

Special notes on plans:

Special provisions (see attached):

Special conditions (see attached):

Additional comments:

_____
Wetlands Engineer (Signature & Date)

HISTORIC SITES

Historic Bridges Yes____ No____

Special Provisions (see attached):

Additional comments:

_____
Environmental Engineer (Signature and Date)

OTHER ENVIRONMENT ISSUES

Special conditions:

Special notes on plans:

Additional comments:

_____
Environmental Engineer (Signature and Date)

Army Corps 404 Permits

Over the past year there has been some new developments relative to the Army Corps 404 Permit process.

The General Permit 77-2 requires notifying the District Engineer of the Corps of Engineers of the date that work will commence, suspension of work if for more than one week, resumption of work and its completion. This same requirement exists under the Individual 404 permit which has been the responsibility of the Department's District Engineer and accordingly will be his/her responsibility under the General Permit. Notification is not required under the nationwide permit.

This Section lists the various permits required to construct roads and bridges across streams, wetlands, and flood plains and outlines the procedures to be employed in obtaining them.

Army Corps 404 Permits

The Army Corps 404 Permit process exists in three forms. They are:

1. Nationwide Permit
2. State General Permit (GP77-2)
3. Individual 404 Permit

PMS Activity 340 - Waterway Permits Review is scheduled at a point in time when the designer (Bridge Division or Roadway Design Division whichever is responsible for the project) should be sure that the project concept is firm. The activity requires the designer to contact the Project Development Division for a determination if any of the above listed permits are needed and if they have been acquired.

Permit Determination and Acquisition

On projects that the Nationwide Permit is applicable, no further notice to the Army Corps of Engineers is required. The Project Development Division will prepare a letter to that effect for the project files. If the State General Permit is in effect, or if an Individual 404 Permit is required, the Project Development Division will prepare the necessary applications. When these permits become available, they will be forwarded to the designer. These permits will also become part of the project files and need to be part of the PS&E package. Spaces are provided on the PS&E required sheet so that the designer can identify the type of permit required and, also, if it is included in the package. A flow chart of the 404 Permit Determination Process is attached.

Note on Title Sheet of Plans

The Contract Lettings and Communication Division will place a note on the title sheet of plans for projects requiring a 404 Permit (The Local Liaison Division will place such note for projects developed by that Division). The note will identify the kind of permit in use and the identification number (if applicable). Each of the three types of 404 permits require different special provisions. The Contracts Section is responsible for placing the correct set of special provisions in the contract.

(DEQ) Water Quality Certifications

This is a permit acquired from the State Department of Environmental Quality and is part of the 404 Permit process requirements. The Project Development Division will acquire the certification in conjunction with 404 Permits and retain the original in the project files. No copies will be forwarded to other Divisions unless requested to do so.

Dept. of Water Resources Flood Plain Permits

Flood Plain Permits are required by State Statute. As a general statement, they are required whenever a 404 Permit is necessary. Copies are forwarded to the Roadway Design and Bridge Divisions for the project files. No other copies are distributed unless requests are received. The original is retained by the Project Development Division.

404 Determination Checklist

Any temporary or permanent fill involvement in a stream

- No → No 404 involvement
- Yes ↓

Is it in the Corps Regulatory Jurisdiction? (Check maps - 1/2" county maps available or letter stating limits)

- No → No 404 involvement unless someone(agency) is requesting an individual 404 permit. Note: all streams are in the Corps Limits regardless of flow.
- Yes ↓

Does the Nationwide Permit apply?
1. Minor road crossing (total temporary and permanent fill less than 250 yd^3 (200 m^3). Some wetlands are allowed (100 ft (30 m) from each bank)
2. Backfill for utility lines.
3. Bank stabilization 500 ft (150 m) averaging (1.2 yd^3/ft (3 m^3/m))

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- Yes → No further work necessary.
- No ↓

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Must make up an individual 404 permit application.

Send notice to Corps (by Project Development Division)
1. Vicinity map
2. Legal Description
3. Purpose
4. Typical temporary causeway section
5. Individual 404 permit application

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Receive Letter of Authorization under State General Permit Individual 404 Application
1. Authorization to be forwarded to Construction Division when contract is awarded.
2. Construction Division to forward authorization to NDOR District Engineer
3. NDOR District Engineer to notify Army Corps of Engineers before construction starts and when construction is completed.

I. Corps of Engineers (C.O.E.) Wetland Regulatory Authority

A. Rivers and Harbors Act - 1890 - Navigable Waters

B. Federal Water Pollution Control Act - 1972

1. Section 404 Permits - Regulate discharge of dredged or fill material from or into waters of the United States.

2. Act amended in 1977 and given common name "Clean Water Act" (C.W.A.).

3. Wetlands are under the jurisdiction of Clean Water Act through 1985 court case. Those wetlands covered by the Clean Water Act are called jurisdictional wetlands.

II. C.O.E. Changes Jurisdictional Wetland Policy

A. Regulatory Guidance Letter - November, 1995 - in some cases, wetlands are no longer under the jurisdiction of the C.W.A. - no Corps regulation.

1. Former Policy - Wetlands in roadside ditches were under the jurisdiction of the Clean Water Act, thus regulated by C.O.E. - possible mitigation.

2. Current Policy

(a) Wetlands occurring in typical ditches, in upland areas are nonjurisdictional. Therefore, not under the jurisdiction of C.W.A. No Corps authority. No mitigation for impacts.

(b) If ditch was constructed in a wetland, then the ditch would be under the jurisdiction of C.W.A. Corps has regulatory authority. Possible mitigation for impacts.

(c) Borrow pits which exhibit wetland characteristics are under the jurisdiction of the C.W.A. Corps has regulatory authority. Possible mitigation for impacts.

B. Overall mitigation requirements will lessen which will result in lower costs.

III. C.O.E. Concerns

A. C.O.E. perceives there to be a problem with:

1. Disposal of road materials in waterways and wetlands.

(a) Section 404 of the Clean Water Act

(1) Dredge and fill activities require permit from C.O.E.

(b) Violation of Section 404 - Work done without a permit. Up to $25,000 fine per day that the violation is in place. Examples - filling wetland or dumping old bridge in waterway.

(c) Noncompliance with Section 404 - Not following permit conditions. Up to $10,000 per violation plus remedial costs. Examples - using asphalt or allowing concrete with exposed rebar for bank stabilization.

2. Impacting wetlands not cross hatched on plans. Examples - storing equipment in wetland areas or rock in ditched jurisdictional wetland to prevent the accumulation of mud on the road.

3. Failure to utilize silt fences.

The wetlands point of contact is:

Wetlands Program Manager
Project Development Division
(402) 479-4418

1100.15 WASTED GENERATED

"Solid Waste" means garbage, refuse, rubbish, and other similar discarded solid or semisolid materials, including but not limited to such materials resulting from industrial, commercial, agricultural, and domestic activities. This shall not prohibit the use of dirt, stone, brick, or similar inorganic material for fill, landscaping, excavation, or grading at places other than a sanitary disposal site. It shall be unlawful for any private or public agency to dump or dispose or permit the dumping or depositing of any solid waste at any place other than an approved sanitary landfill.

"Open Dumping" means the depositing of solid wastes on the surface of the ground or into a stream or body of water.

"Toxic and Hazardous Wastes" means waste materials including, but not limited to poisons, pesticides, herbicides, acids, caustics, pathological wastes, flammable or explosive materials, and similar harmful wastes which require special handling. These items must be disposed of in such a manner as to conserve the environment and be protective of public health and safety.

"Free Liquids" or wastes containing free liquids shall not be disposed of in a sanitary landfill. This includes industrial sludge and toxic or hazardous wastes.

1100.16 WATER WELLS

Occasionally contractors request permission to drill water wells on state property in order to secure water to use in the construction of a project. A written agreement should be executed between the state (DEQ) and any contractor who wants to develop a well on state property in order to assure that the contractor assumes responsibility and liability for use of the well.

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1100.17 ARCHEOLOGICAL AND PALENTOLOGICAL DISCOVERIES

If Indian relics, fossils, meteorites or other articles of historical or geological interest are encountered in highway excavation operations, such operations shall be suspended in the area involved "until such times as arrangements are made for their removal and preservation".

Under present procedures, the department is cooperating with the Nebraska State Historical Society and the University of Nebraska State Museum. Preliminary plans for highway improvements are made available to these agencies as far in advance of construction as practical. Their archeologists examine the plan locations and correlate any findings with their records and information. If any known historical relics or Indian habitations or relics are involved with the construction, arrangements are then made cooperatively with the department to remove and preserve such items in advance of the construction of the project.

It is expected that only rarely will such items be encountered during construction. However, if such articles are encountered, the Project Manager will have work suspended in the area involved, and immediately notify the Construction Division. Arrangements will then be made from that office for the removal and preservation of the articles.

Project Managers or their representatives should make a periodic inspection of the work site or sites on all archeological or paleontological work. This inspection is to determine that the work called for in the agreement is being performed. This periodic inspection should be made at least once a week. The Project Manager should keep himself advised of the progress so that no unnecessary delays to the contractor will occur. Confirmation that the contractor can resume work at the site will come from the Construction Division.

1100.20 UNDERGROUND TANKS

@ NDEQ has a website (www.deq.state.ne.us) which is an excellent environmental and underground storage tank reference.

Underground Storage Tanks (USTs) represent one of the more common environmental problems encountered. USTs may have been (or may currently be) used to store almost any kind of viscous material including petroleum products, chemicals, and discarded wastes (some of which could be classified as hazardous). Leaks from these tanks or their auxiliary components (i.e., piping, couplings, pumps, and valves) are not uncommon.

An Underground Storage Tank (UST) is defined as a tank and associated piping with 10% or more of its volume below the ground which has stored or is storing a regulated substance. Regulated substances include petroleum based substances (motor fuels, motor oil, home heating fuels, solvents, etc.) and any other substance which, if released into the environment may present substantial danger to public health, welfare, or the environment.

1100.21 REGISTRATION

EPA established a program for regulating Leaking Underground Storage Tanks (LUSTs). Under this program the design, installation, maintenance, monitoring, and failures of LUSTs are regulated. In Nebraska, this federal program is administrated by DEQ. All underground storage tanks are required to be registered with the State Fire Marshal Office. Tanks that have been registered should have a metal tag affixed to the fill pipe. Owners (including NDR) of underground storage tanks must:

A. Register existing tanks, previously removed tanks, and abandoned tanks. (The "registration" of a tank includes "any" tank from a tank at a gas station to one located in the middle of Timbuktu.)

In Nebraska, the registration includes attaching a numbered metal tag to the fill pipe of any underground tank. The lack of a tag does not necessarily mean the tank is not registered, but obviously the presence of a tag indicates it is registered. If there is a question about registration, contact the Construction Division. This office has access to the registration file at State Fire Marshal Office via computer, and can look up any registered tank with minimal basic information.

NOTE: Currently in Nebraska, there is a registration exclusion for tanks:

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- Farm tanks holding 835 gal (3164 L) or less.
- Tanks on or above the floor of underground areas such as basements.
- Tanks storing home heating oils used on the premises where it is stored.

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- Tanks holding 110 gal (416 L) or less.

B. Meet tank performance standards for new installations.

C. Make tanks leak proof for their entire life.

D. Install leak detection systems.

E. Keep operational records.

1100.22 REMOVAL OF USTs

@ The following procedure for removing underground tanks is based on State Fire Marshall (SFM) regulations. For clarity, the following has been divided into known tank locations and unknown tank locations. (The law considers both the same. But because of bid items, contract administration requires them to be treated differently.) For all removals of underground tanks, follow appropriate Supplemental Specification.

Removal of Known Tanks

These tanks are the ones identified on the project plans and will be noted for removal.

A. Removal Process

IMMEDIATELY upon starting any project requiring UST removal, check the tankfill pipes for a metal Registration Tag.

- If tank has a registration tag, note its number in the inspectors daily diary.
- If the tank does not have a registration tag, the Project Manager must notify the Construction Division immediately. This notification will allow the Construction Division to check Fire Marshal records for a valid registration. Also, it will allow time for registration should the tank not be listed with the Fire Marshal.

  @ Note: Nonregistered tanks cannot be removed until after they have been registered, and that process can take a couple of weeks to complete. In addition, the Construction Division must submit a closure notification to SFM and Closure Assessment Report (CAR) as specified on the permit to close.

B. Closure Notification

- The Project Manager must initiate and submit a "Notification of Tank Closure or Change-in-Service" to the Construction Division 35 days prior to removal.

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- After the form has been submitted and processed, SFM will send removal information and instructions directly to the Project Manager.

C. Tank Removal

@ Contractor's consultant is required to have certified Closure Individual with the SFM on site during the entire removal process. The contractor shall provide the NDOR Project Manager a photocopy of the individual's card and also Contractor's license to close tanks.

- Tanks must have ALL liquids **and** any explosive vapors REMOVED prior to extracting the tank.

  1. All removed liquids must be disposed in accordance with DEQ regulations.

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2. Vapors are typically evacuated by placing dry ice into the tank. As the ice evaporates, carbon dioxide is released and the fuel vapors are displaced.

- State Fire Marshal may be on site to inspect the removal.
- Removed tank must be stenciled according to SFM requirements.
- Any registration tags must be removed and retained by the project inspector. These tags are to be submitted to (SFM) when the closure report is filed.
- Any extracted tanks should be removed from the site on the day of removal.
- A "Certificate of Destruction" must be completed for each tank at the time the tank is disposed.

D. Sampling

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- All removals require soil and/or water samples to be taken by the contractor's consultant and analyzed for potential contamination.
- DEQ requires samples collected from tank sites to be analyzed using specific laboratory methods.
- Soil sampling locations are identified in the removal information and instructions furnished by DEQ. **Soil samples may be required below the Static groundwater table. The water shall be sampled if water is encountered during excavation.**

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E. Contamination

- If contamination is found or suspected during the tank extraction, contact the Construction Division immediately. If appropriate Construction Division personnel are not available, the Project Manager shall notify DEQ directly. The telephone number for DEQ's tank section is (402) 471-4230. (The contractor's consultant will provide site information based on air monitoring if there are any questions.)

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- The NDR has 24 hours to report this contamination unless an immediate threat exists. In that case, reporting times are reduced to 6 hours.
- Immediate threat means a potential exists for explosive conditions, immediate danger to life or health, or an immediate threat to water supplies.

- F. Site Safety

1. If, based on site conditions and situations, the inspector or contractor feels there is an immediate threat for **explosion**, the contractor shall:

   - Immediately shut-off all operating equipment, extinguish all sources of ignition (i.e., cigarettes etc.), and evacuate the area. This includes all personnel.

   - After the site is evacuated, establish controls to prevent site access and contact local and state authorities.

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   - No smoking signs must be in place. (No smoking within 50 feet).

   The inspector shall contact the Construction Division.

2. If, based on site conditions and situations, the inspector or contractor feels there is an **immediate** danger to life or health **other than** by explosion, the contractor shall:

   - Immediately evacuate the area. This includes all personnel and could include equipment.

   - After the site is evacuated, establish controls to prevent site access.

   The inspector shall contact the Construction Division.

3. If, based on site conditions and situations, the inspector or contractor feels there is an immediate danger to a water supply, the contractor shall:

   - Using whatever means are available, immediately establish positive restrictions to limit or prevent migration of contamination to a water supply. **(If threats to life or health from explosion are not present).**

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   - Watch for changing conditions which could present threats due to explosion and/or danger to life or health. If site conditions change, implement the appropriate response as noted above.

   The inspector shall contact the Construction Division.

G. Removal of Contaminated Soil

If the site is determined to be contaminated, one method of remediation is to overexcavate. Contaminated soil which has been over-excavated must be "properly" disposed. **(DEQ may provide approval to over-excavation--see pages 3-5 of the DEQ "Petroleum Contaminated Soils Guidance for Leaking USTs".)**

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H. Disposal Options

There are several approved methods for disposal, however, DEQ must preapprove any disposal option. Some options which have been successfully used include:

1. Removal of soil and disposing in a licensed landfill. This not only requires prior approval by DEQ, but also approval from the local receiving landfill.

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@ Typical costs for this option range from $15 to $40/yd^3 ($15 to $40/m^3) plus trucking.

2. Another option which is limited by physical location is that of "soil burning." The process involves treating petroleum contaminated soil by passing it through a rotating drum where there is high heat and flame. (It is a converted asphalt drum dryer.) During "treatment," soil moisture is driven off, combustible products in the soil are first volatilized and then flashed off. The result is dry "petroleum" free soil.

@ While the remedial concept is reasonably sound, the cost for this remediation is very expensive (costs range from $30 to $70 per Ton (Megagram)) not to mention trucking costs to the plant. However, if a project is in that area, "soil burning" is one option available for remediation.

For completeness, a word of caution must be included about this process. The process, if properly operated, removes petroleum contamination, however, it does not remove other potential contaminants (i.e., heavy metals, pesticides/herbicides, etc.) Often the plant requests anyone bringing soil to the plant to back haul "processed" soil. Obviously, clean/remediated soil is a by-product of this operation. **DO NOT AGREE TO BACK HAUL ANY "REMEDIATED" SOIL FROM THIS OPERATION WITHOUT FIRST CONTACTING THE CONSTRUCTION DIVISION.** This does not mean the facility should not be used, or that the remediated soil is not clean. DEQ needs to be sure there are adequate and quantifiable analytical results to assure back-hauled soils are not contaminated with other substances.

3. Another option is to remove the soil (over-excavate) and spread it out on the surface. This method is called Land Application and also requires preapproved permit from DEQ. The land application of petroleum contaminated soil provides an effective means of treatment through volatilization and biodegradation. Land application has been used successfully in situations where NDR owns (not by temporary easement) a parcel of excess right-of-way.

In situations where contaminated soil must be remediated, the Project Manager should look for and identify suitable locations to the Construction Division. Criteria for land application are:

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- Maximum application rate is 4 inches (100 mm) thick **OR** 500 tons/acre(1.12 Gg/hectare). Based on an estimated excavation volume, the inspector can calculate approximate remediation area.
- Petroleum saturated soil cannot be land applied. (The KEY is "petroleum saturated" not "moisture saturated." Soil excavated below the water table may be land applied, as long as it does contain free (decantable) petroleum products.
- Petroleum contaminated soil cannot be applied any closer than:

@ a. 525 ft (160 m) from a well.

b. 200 ft (61 m) from an occupied residence.

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c. 200 ft (61 m) from a stream, river, lake, pond, sinkhole, or down gradient intake for a tile line or culvert.

- Slopes must be less than 5%.

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- Potential land farming areas with sandy, sandy loamy, and high silty soils are not acceptable. There also must be at least 6 ft (2 m) of existing topsoil over bedrock.

- Obviously the site must be accessible to trucks or hauling equipment and have no other planned traffic or activity during the remediation time.

- Soil for remediation will have to be leveled and disced at least two times during the course of remediation. One discing needs to be soon after placement and leveling, the other about 2 months later. Once the soil has been tested and analytical results indicate it is clean, the area should be fertilized and seeded with a suitable stabilization crop.

I. Closure Report

- Contractor and/or the contractor's environmental consultant are responsible to complete the closure report.

- The report shall locate all removed tank locations by station and offset.

- Closure reports are to be submitted to the Project Manager within 20 days of completion of sample analysis. The Project Manager shall keep a copy of all reports in the project files and forward original to the Construction Division within 5 days of receipt. The State Fire Marshall's Office must receive a copy of the closure report before the deadline listed in the permit to close, usually 45 days from date of tank removal.

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Closure reports are to contain:

1. Completed preprinted SFM closure forms. Check to be sure the following information is included:

   a. All lab reports.

   b. Construction details.

@

   c. Scale dimensional site drawing showing location and depth, location and depth of all piping, location and depth of all sampling and monitoring well locations. NOTE: All locations are to be referenced by station and offset from mainline or side road survey.

2. Tank registration tags.

Removal/Discovery of Unknown Tanks ("Orphan" Tanks)

For the purposes of this chapter, "unknown" tanks should be considered those tanks not identified on the plans but encountered during a project. Most likely the discovery of an unknown tank will come at the worst time. For example, machinery running, work time in a crunch, and "any" appreciable delay will work a severe hardship on the contractor. Therefore, timeliness and notification become critical in dealing with the issues.

Upon finding a previously unknown tank, follow these guidelines:

FIRST: Immediately stop all work in and around the tank.

SECOND: Determine the site conditions. For example:

A. Note tank condition and damage. Is liquid leaking from the tank? If so:

1. If fuel is released, call:

   - NDEQ at (402) 471-4230 during office hours or (402) 471-4545 NSP (State Patrol) afterhours. Leaking Underground Storage Tank/Release Assessment Section (LUST/RA).

@

   - State Fire Marshal's Office (SFM)
     Flammable Liquid Storage Tank Division
     (402) 471-9465 Clark Conklin

   - Construction Division (402) 479-4532

2. If, based on site conditions and situations, the inspector or contractor feels there is an immediate threat for **explosion**, the contractor shall:

   - Immediately shut-off all operating equipment extinguish all sources of ignition (i.e., cigarettes etc.) and evacuate the area. This includes all personnel.

   - After the site is evacuated, establish controls to prevent site access and contact local authorities.

   The inspector shall contact the Construction Division.

3. If, based on site conditions and situations, the inspector or contractor feels there is an immediate danger to life or health other than by explosion, the Contractor shall:

   - Immediately evacuate the area. This includes all personnel and could include equipment.

   - After the site is evacuated, establish controls to prevent site access.

   The inspector shall contact the Construction Division.

4. If, based on site conditions and situations, the inspector feels there is an immediate danger to a water supply, the contractor shall: **(Threats to life or health and explosion are not present.)**

   - Using whatever means are available, immediately establish positive restrictions to limit or prevent migration of contamination to a water supply.
   - Watch for changing conditions which could present threats due to explosion and/or danger to life or health. If site conditions change, implement the appropriate response as noted above.

   The inspector shall contact the Construction Division.

B. If leakage is not apparent determine if any liquid is in the tank.

C. Attempt to determine the size of the tank (volumetric and/or dimensional size estimation).

@ D. Is there any indication of past leakage? (Stained (discolored) soil or smell of fuel are indicators.)

E. Establish tank location by station, offset and approximate depth. Also indicate approximate street address if available.

THIRD: Begin to establish some positive control to eliminate access to the immediate area. (Silt fence, snow fence, or orange safety fencing set on fence posts are examples of temporary restraints.)

FOURTH: Notify the Project Manager or supervisor of the discovery and provide site conditions to them. If the Project Manager will not be available for some time (3 to 5 hours), the inspector shall contact the Construction Division directly.

FIFTH: The Project Manager shall notify the Construction Division. (NDOR has a legal responsibility, and time limit, to report finding previously unknown USTs.)

1. For Reference: Time expired since first discovering the tank shall not be more than 5 hours before contacting the Construction Division.
2. Leave tank in place.
3. @ Post "No Smoking Within 50 ft (15m)" signs near tank and secure from general public. Use snow fence.
4. The Logistics Division will apply for a permit to remove tanks as soon as possible. Permit required from Fire Marshal's Office.
5. Removal by licensed contractor (State or private company) will be scheduled as soon as possible.
6. @ The firm or person in charge of tank removal must notify the Fire Marshal's Office 72 hours before taking out the tank and give the DEQ a minimum of 24 hours advance notice. If NDOR completes a Closure Assessment Report, DEQ advance notice is not needed.

7. Tanks removed from the ground shall be stored in a secure location inaccessible to the general public.

8. A licensed certified closure individual must be present during excavation and tank removal.

9. If contamination is present in the excavation, the State Fire Marshal and the Department of Environmental Quality must be notified within 24 hours if they are not present during the scheduled time of tank removal.

@ 10. Soils will be disposed of as directed by the NDEQ. Land farming may be required. Contact Waste Management Section of NDEQ (402) 471-4210.

11. The excavated area should be backfilled with clean soil and compacted as required by the Project Manager.

12. For more information, refer to Title 159, Rules and Regulations for Underground Storage Tanks. A copy is available in the Lincoln Logistics Division Office.

13. If fuel contaminated soils are encountered during normal construction activities, notify the Lincoln Construction Office even if no tank is found. The Lincoln Office will notify the NDEQ LUST/RA Section and Waste Management Section.

Recap:

- All construction activity around the area of the tank shall be halted, and remain that way, pending further investigation.
- Preliminary site assessment shall be completed. Included in this assessment shall be an evaluation for imminent dangers.
- Site "SPILL CONTROL" measures should be implemented if needed.
- Positive constraints shall be in place to prevent free public access of the site.
- The Construction Division shall be notified of the discovery.

What Happens Next?

- Construction Division notifies NDEQ and SFM about finding an unknown UST.
  - •• DEQ does not need to be notified about an unknown UST unless there has been a release or unless DOR will not be completing a Closure Assessment Report.
- Construction Division will determine if the UST is registered. If not, a registration process will be initiated. (An unregistered UST cannot be removed until after it is registered.)
- The Construction Division will request SFM's approval to remove the tank, once registration status is resolved.

- The Project Manager needs to use this time to negotiate an Change Order for tank removals.

Once SFM authorizes removal, a notice will be provided to the Project Manager. Removal from this point forward is outlined in SFM approval documents.

1100.30 STORM WATER DISCHARGE (NOT YET FULLY IMPLEMENTED)

All NDR construction projects which disturb 2 ha (5 acres) or more are required to have a STORM WATER PERMIT. (The rules also apply to cities and counties with populations of 100,000 or more.)

A Storm Water Permit requires specific actions intended to reduce and/or eliminate the problems associated with runoff, soil erosion, and siltation. To comply with this environmental regulation, the NDR has developed the following procedure:

- Projects which disturb 2 ha (5 acres) or more are identified by Project Development.
- When projects are turned in, Project Development tabulates projects with PPPs and sends NOIs and newspaper notices to the Construction Division.
- The Construction Division forwards required notices to appropriate newspapers for publication. Once publication verification is returned, the Construction Division assembles all parts for NOIs and forwards copies to DEQ and the Project Manager.
- At this point, the Project Manager administering a particular project is notified that a Storm Water Permit is in place. (The contractor may begin work any time after that notification.)

Project Manager shall check to assure that projects requiring a Storm Water Permit have a Pollution Prevention Plan (PPP). Along with a PPP there should be bid items for pollution control items such as silt fence, stabilizing crops, ditch checks, etc. As always, it is important to check preliminary plans whenever possible to be sure all needed contract items have been included. Obviously, if a contract is let without erosion control items, the Project Manager will have to change order those items.

1100.31 NOTICE OF INTENT (NOI)

NOIs are NDR's official notification to DEQ that there is a project located at "xxxxxxxxxxxxxxx," and the project will be disturbing at least 2 ha (5 acres) or more are required to have a STORM WATER PERMIT. (The rules also apply to cities and counties with populations of 100,000 or more.)

1100.32 CONSTRUCTION DIVISION POLICIES

- Project Managers shall have a copy of all contractor NOIs (noncommercial sources) on file in the project documents before allowing a contractor to produce or provide material for the project.
- *SSHC Subsection 204.02* restricts exposing erodible soil to less than 75000 ± m² (90,000 sy) without prior approval of the Project Manager. Criteria for approving a variance to the maximum exposure limit will be based on:

  A. Having current exposed area protected with erosion control measures. Minimum measures would include silt fence around the perimeter of the area, ditch checks, and additional silt fence where sediments may leave the project. This includes all disturbed areas (i.e., borrows, areas within temporary and permanent easements.)

B. The contractor has demonstrated ability and willingness to keep erosion control measures current and maintained within existing work areas.

C. Consideration must be given for the time of year before exposing additional areas. For example: It would not be unreasonable to deny a request for additional working area in a situation where it is late in the grading season and the contractor is falling behind in finishing, applying mulch, or temporary seeding.

Also, it would not be unreasonable to place a condition on approving an additional spread. For example: "Contractor, you may open area "X" as soon as you have finished and stabilized up to Station "Y.""

D. The contractor has successfully followed their erosion control work plan. The Project Manager has not noted storm water violations, and has every reason to believe additional open areas will **not** over-extend the contractor's ability to comply with our Storm Water Pollution Permit.

It is strongly recommended that the Project Manager approve additional area on a case-by-case basis and consider approval on the contractor's previous work experience as well as site conditions.

- Contractors have been told it is their responsibility to maintain the project within storm water compliance. They have also been told about the need to be prepared to complete requirements of their Pollution Prevention Plan should a subcontractor not be able to perform.

@

Pollution prevention is necessary even through most of the erosion control work is subcontracted to DBEs. However, compliance is a must and project administrators **MUST** be sure the project is maintained within storm water requirements and that the Pollution Prevention Plan is followed.

1100.33 QUESTIONS OFTEN ASKED

The weather is not favorable to establish temporary seeding or silt fences. What do we do?

A. Stabilization

Regulations say if an area will not have any activity for 21 days; by the 14th day, some form of stabilization will be required. There is very little latitude in that statement even if it is wet or freezing.

To be in compliance with storm water regulations, something needs to be done. For example, incorporating mulch, using HydroMulch or Soil Binders which are comprised of wood fiber and paper mulch. Both work, but tend to be expensive knowing it is less than temporary and we will have to ultimately seed.

Best solution is to conduct temporary seeding in a timely manner and not let the contractor get so much open that it cannot be stabilized by seeding. At the least keep it to a minimum so if one of the other alternates is necessary, costs can be kept to a minimum.

B. Localized Soil Erosion (Ditch Check and Slit Fences)

Bale checks used as ditch checks are most likely not as effective as "properly" installed silt fence. However, in situations where you are unable to properly install silt fence, bale checks are far superior to nothing at all. For example:

- It is wet and muddy, a trencher cannot get in to place silt fence. Interim ditch check should be bale checks.

- The ground is frozen to a point where a trencher will not work. Winter is coming. Rather than do nothing, bale checks should be installed. At least there is protection in place during the spring thaw. If an "Indian Summer" comes along and silt fence can be installed, by all means replace the bale check.

Bottom Line: Bale checks are very good interim erosion control measures when used in emergency situations. (Check the Road Standards as Roadside Development is resurrecting a standard for bale checks.)

How are borrows evaluated for Storm Water compliance?

All project specified borrows are included in the calculation for a Pollution Prevention Plan (PPP).

A. Pond Borrows

- All pond borrows (wet or dry) during construction must have at least the perimeter protected by erosion control measures. Plus, site specific considerations must be included if there is any dredging involved during construction.

- Temporary stabilization and mulching will not be required on concave slopes within the borrow. However, channels (in-flow and/or out-flow) will require stabilization or erosion control measures.

- Seeding for pond borrows will be required on any disturbed area above normal design pool or ground water elevation.

B. Wetland Mitigation Areas

- Seeding for wet land areas typically does not require special attention. Usually these areas are seeded with the same vegetation crop as any other disturbed segment on a project. Check the contract documents for non-standard situations where special aquatic plants such as cattails, wild rice, etc. may be required.

- Refer to Pond Borrows (Section A, above) for guidance in areas of standing water and selected sections in Normal Borrows (Section C, below) for those areas which are dry during seeding. In either case, all "normal" erosion control practices are required for wet land areas.

C. Normal (Dry) Borrows

- All normal borrows must be protected by perimeter erosion control measures, and are included for temporary erosion control measures if work is halted at that site for more than 21 days.

- All normal borrows, purchased by fee title, shall be included in the area which is permanently seeded.

- Normal borrows obtained by temporary easement:

  1. That require replacement of topsoil **AND** are used for agricultural row crops. The Project Manager needs to ask the property owner if they want the area permanently seeded.

     a. If the property owner requests permanent seeding, provide that seeding.

     b. If the property owner does not want permanent seeding, shape and place temporary seeding on the area. In this case, because the property will be returned to agricultural row crop use, consider temporary seeding as complying with storm water requirements. Note: Other temporary erosion control measures in that area will have to be maintained until the project is accepted.

  2. For temporary easements NOT used for agricultural row crops, permanent seeding will be required. (Examples of this situation would be permanent pastures, timber land, non-farmed land, etc.)

Is snow considered temporary cover in the Storm Water regulations? YES.

Storm water regulations are written recognizing that snow is a **"temporary"** preventive measure. However, just because it snows may or may not fulfill a winter long stabilization and definitely will not comply as spring thaws begin. As soon as the snow is gone, some other means of stabilization is required. ("Gone" could be by melting, wind, or snow plow.) Best advice is to keep working on some form of soil stabilization until it absolutely freezes so hard that work from then on will not be practical.

EXAMPLE: If snow comes in late October and is blown off the site by mid December, then some other form of temporary stabilization is required from that point forward.

Plan notes have designated a plant site within NDR right-of-way. Further, the contractor is told it is their responsibility to provide a permit for this activity. Who is ultimately responsible?

@ The contractor is responsible for that portion of area designated as the "plant site." When this situation occurs, the contractor should modify the project PPP by note to exclude the plant site when the contractor's NOI becomes effective.

1100.40 BRIDGE PAINTING

Few construction tasks have undergone as many significant changes in the last couple of years as bridge painting. Much of this was necessary because of past bridge coatings and changes in environmental regulations. *Supplemental Specifications* were developed for projects which should not produce hazardous wastes. The word “should” is used very carefully, because anything is possible. In an attempt to preclude surprises, pre-project tests for lead (scratch tests) are required for any proposed painting and/or demolition work.

For bridges failing the scratch test (i.e., showing the potential for producing a hazardous waste) a Special Provision (SP) will be written to deal with the added requirements of removal, health & safety, and disposal. The following information about bridge painting is written for the bulk of our work - those projects involving nonhazardous paint wastes.

Note:

A. Nonhazardous paint waste as used herein is referenced strictly from RCRA disposal regulations and the waste's successful passing of the TCLP test.

B. No matter what information is available going into a project one must proceed cautiously, always being protective of human health and the environment. It is essential to sample and analyze wastes for proof.

Background

During the past several decades NDR has used:

- Lead based paints. Usage began about the time Lewis and Clark leisurely floated "up" the Mississippi. Its usage in Nebraska continued until the mid 1970's. By and large, lead paint systems functioned very well and were used in practically all painting applications, from bridges to sign trusses, from light poles to fire hydrants. Experience indicates this paint will produce hazardous waste.
- Solvent based Zinc paint

  A. Zinc Chromate

  In the early 1970's it became apparent there were worker health and safety problems associated with lead based paints. During the time between mid 1970's to late 1970's, NDR began using zinc chromate paint as a primer along with a vinyl top coat. Experience now indicates the Zinc Chromate pigment will produce worker health and safety problems and hazardous wastes.

  B. Zinc Silicate

  Beginning in the late 1970's zinc silicate was specified as a primer for shop and field applied paint. This system along with a vinyl top coat was used until early 1993. Experience indicates this paint will not produce a hazardous waste, but there have been cases where leachable levels of lead are present. Further, there is evidence that low levels of lead are present in airborne dust generated during abrasive blasting.

1100.41 METHODS OF PAINT REMOVAL

Open Abrasive Blast Cleaning

Open blasting uses compressed air to propel abrasive particles against the surface to be cleaned. The system creates high levels of dust which, if not contained, can become airborne causing fugitive dust and respirable dust. All open abrasive blast systems must therefore be contained both for waste collection and dust emissions.

A. Open Blasting using Expendable Abrasive

1. The abrasive used for this method is used once and becomes waste to be disposed. Typically, one of several low cost readily available materials such as sand, furnace slag, aluminum oxide, or garnet is the abrasive of choice.

   Expendable abrasive - open blasting is usually the method of choice for contractors because of familiarity, productivity, and ease of operation. Contractors also consider it the most economical due to readily available equipment and low abrasive costs. However, from an environmental and worker health position, the system is more expensive because of the need to fully contain the operation, increased worker risk to health problems, and significantly large volumes of waste to be disposed.

2. There is a variation of expendable abrasive - open blasting which has been used successfully for minimal touch up and removal of minor amounts of overspray. This variation uses "corn cobs" for abrasive, controlled abrasive usage, and very small diameter blast nozzles.

B. Open Blasting Using Recyclable Abrasive

In this system the abrasive is accumulated after usage, cleaned, and reused more than one time. Recyclable abrasives must be hard and durable. Thus metallic material is typically used.

When recycling abrasives, special equipment is required to collect, classify, separate, and convey collected waste residue. Also, since the abrasive is harder, contractors must pay close attention to abrasive gradation to keep a cleaned surface profile within acceptable ranges. A contractor must also closely monitor the separation process. It is very important to "completely" remove all fine material from abrasives. If the abrasive is improperly or incompletely cleaned, dust concentrations within the containment can be adversely affected.

Several methods are available in the industry to filter discharged air from the system. The NDR will NOT approve a system that uses water for blasting or water filters to remove particulates. This is because the water then becomes another different waste for disposal.

As with all open blasting operations, the recycled abrasive method must also be fully contained. Costs associated with recyclable abrasive include additional equipment and increased initial abrasive costs. This is offset by increased cleaned surface area per unit of abrasive (some times up to 100 cycles) and reduced volume of waste produced.

Closed Abrasive Blast - (Vacuum Blasting)

Compressed air is used to propel abrasive particles against the surface to be cleaned. The blast nozzle is fitted into a localized containment assembly, which is attached to a vacuum. Dust, abrasive, and paint debris are vacuumed simultaneously with the blasting operation. Debris is separated for disposal and the abrasive is returned for reuse. Typically, hard metallic abrasives are used for this system.

As with Open Abrasive blasting, NDR will NOT approve a system that uses water or water filters.

The most limiting factors of vacuum blasting are its reduced production rate and operational problems cleaning edges and irregular surfaces. NOTE: To be completely effective, the whole nozzle assembly must be sealed against a surface. This is the only way to maintain proper suction for the vacuum operation.

Vacuum blasting equipment is expensive, however, both worker exposure to dust and environmental emissions are substantially reduced if the operations are conducted properly. Thus the Special Provisions may allow vacuum blasting to be conducted without requiring full containment.

Hand and Power Tool Cleaning

Supplemental Specifications may identify cleaning by methods other than abrasive blasting. In these cases SSPC - SP 2, SP 3, or SP 11 will typically be noted as acceptable surface preparation standards. (Steel Structures Painting Council "SSPC" is an organization whose purpose is to develop industry standards for painting. The above noted standards, i.e., SP 2, SP 3, etc. are visual standards used to evaluate cleanliness of steel surfaces.)

A. Hand Tool Cleaning

Hand tool cleaning involves manual operated impact, scraping, sanding, and brushing tools. Typical equipment would be slag hammers, chipping hammers, putty knives, paint scrapers, and wire brushes. Hand tool cleaning will produce little dust however, only loose material is removed while intact rust, sound paint, and mill scale remain.

B. Power Tool Cleaning

Power tool cleaning uses electric and/or air operated impact grinding, or brushing tools. Usually power chippers, needle guns, descalers, power wire brushes, and grinding wheels comprise equipment for this. Power tool cleaning produces some dust and can generate airborne debris.

Because airborne dust and debris are generated, workers must have respiratory and dress protection. However, protection for power tool work is considerably less stringent than required for abrasive blasting where the operator and helpers would be required to wear air supplied blasting hoods and some type of encapsulating suits.

1100.42 CONTAINMENT

As currently specified, methods that do not involve open abrasive blasting (i.e., hand tool cleaning and power tool cleaning) do not require total enclosure because minimal fugitive dust is generated. However, because paint residue and other foreign material is generated by the process, some form of debris containment is required.

This can be as simple as a tarp (or diaper) placed under the working area. All material falls onto the tarp, is picked up at the end of each day, and is placed into a waste container for "proper" disposal. Removed paint or other debris shall not be allowed to remain at the site following a cleaning operation. It must be picked up, containerized, and disposed of in accordance with the contract documents.

THERE ARE NO EXCEPTIONS!

Design Considerations

Designing containment and ventilation systems that protect the environment without unduly endangering the health of workers pose a challenge to the painting contractor. A containment system includes:

- Some type or form of structure (i.e., walls, ceiling, floor).
- A ventilation system consisting of forced (or natural flow) air input.
- A mechanical (or natural flow) exhaust passage and exhaust dust collection equipment.

Unfortunately, the containment structure built to protect the environment can expose workers inside to extremely high levels of airborne particulate. Thus various containment and ventilation components must be uniquely combined with consideration to containment design, structure location, method of surface preparation, worker protection requirements, and constraints on emissions.

Containment for the purposes of our specification, is primarily to protect the environment (i.e., keep fugitive dust below regulated levels, capture and accumulate waste, and facilitate recovery and collection of waste material). To accomplish "containment" the structure must be virtually air tight, unless some type of mechanical exhaust system is used.

With all of that said, one could realistically question:

- How can this be accomplished?
- If the containment is air tight, how does it remain so once pressurized during blasting?

The answers to these questions identify the importance and need for some type of exhaust system. As capacity and capability of the exhaust system's efficiency increases, the importance of totally sealed containment decreases. For example: If the exhaust system is capable of evacuating more air than is pumped in during blasting, the difference is allowed for containment.

Often "negative air" is a term used to describe air exhausting systems. For our purposes, this term will be used to signify that the exhaust system is withdrawing at least as much air as:

- Is being supplied by the blasting nozzle(s) and
- The combined effects of all leakage in the containment.

  Obviously in situations described above, **"NO NOTICEABLE DUST"** can escape the containment.

While the exhaust system capacity is important it is only as effective as the system's filtering ability. All exhausted air must be filtered to remove suspended dust and particulate. Typically, a dust collection system (i.e., bag house) is attached to the discharge or exhaust equipment.

Rules-of-Thumb:

Good field checks on the effectiveness of any containment are to:

- Watch for signs of dust escaping the containment and/or dust being discharged from exhaust system.
- Containments with proper air handling systems should appear concave along the walls during blast operations. They should **NEVER** appear to bulge during blasting.
- Containments with proper air handling systems should not be so dusty inside that visibility is severely limited.

1100.43 PAINT WASTE DISPOSAL

Toxic Characteristic Leaching Procedure Testing

All waste generated during removal operations SHALL BE sampled and analyzed by the contractor. The waste sample shall be submitted to a laboratory for a TCLP heavy metals analysis. This analysis is for eight environmentally regulated metals typically found in paint and abrasive wastes.

Hazardous Waste Designation

Paint debris is classified as hazardous due to the characteristic of toxicity, if after testing by TCLP, the leachate contains any of the elements in the concentrations equal to or greater than those listed below.

REGULATED LEVELS *	
METAL	mg/L
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0
* All regulated levels are **"AS OF"** spring 1994.	

The Construction Division will attempt to issue a timely memo to all field Construction Divisions when changes occur.

NOTE: Other elements, chemicals, and characteristics can cause a material to be hazardous as defined in *40 CFR 261*. It is for this reason the *Supplemental Specifications* require that no other waste be mixed with paint waste generated during the cleaning process.

If any analysis indicates the presence of metals in levels close to (or above) those listed, contact the Construction Division **BEFORE** issuing a notice for transporting the waste.

Notice for Transfer of Nonhazardous Paint Waste

For all projects involving the removal of paint wastes, some form of manifesting is required. For "nonhazardous" paint wastes (waste with leachable levels below those listed above), *Supplemental Specifications* states:

@ "Accumulated wastes shall not be removed from the temporary storage area without proper documentation."

This ***notice of disposition*** has been standardized and is used as NDR's internal manifest of material being shipped.

The contract documents will identify an NDR facility which has been designated as the "RECEIVING FACILITY." Currently, for construction projects only (not maintenance projects) this is the central complex at Lincoln, Nebraska. There has been a fenced facility designated for storage of nonhazardous paint, which is located at the NDR Maintenance Facility in Lincoln.

Prior to shipping any waste:

1. Waste analysis results shall have been reviewed and determined that the waste is **NOT** hazardous.

2. A "Notice for Transfer of Nonhazardous Paint Waste" form shall be completed by the contractor. (Instructions for completing the form are printed on the form.)

3. The Project Manager will arrange a delivery schedule with the contractor and receiving facility. For those projects where the waste will be delivered to Lincoln, contact the Project Development Division, (402) 479-4795.

1100.50 DISPOSAL OF CONSTRUCTION WASTES

1100.51 ASBESTOS

Asbestos is the name for a group of natural minerals that separate into strong, fine fibers. The fibers are heat-resistant and extremely durable. There are a number of different types of asbestos including Chrysotile, Amosite, Crocidolite, Anthophylite, Actinolite, and Tremolite. The typical size of asbestos fibers is from 0.1 to 10 micrometers. This makes them usually invisible to the human eye. Because of their fine size, they can remain suspended in air for hours when disturbed. This increases the possibility of human exposure via inhalation.

Health Concerns

Medical studies have shown that the primary exposure route for asbestos is through inhalation. The following diseases can result from inhalation of asbestos fibers:

- Asbestosis - A noncancerous respiratory disease that consists of scarring of lung tissue
- Lung Cancer
- Mesothelioma - A rare cancer of the thin membrane lining of the chest and abdomen
- Other Cancers - Some studies have suggested that exposure to asbestos is responsible for some cancers of internal organs such as esophagus, larynx, stomach, colon, and kidney.

Asbestos Removal

U.S. EPA regulates the removal of asbestos containing material from facilities which are being demolished or renovated. EPA regulations for removal, and subsequent disposal, are set forth in 40 CFR 61. Generally speaking, the following procedures must be followed:

- For all facilities, U.S. EPA must be notified prior to renovation or demolition. This notification must include an estimate of the approximate amount of regulated asbestos containing material to be handled. For the NDR, this notification is handled through the Project Development Office.
- Regulated Asbestos-Containing Material (RACM) must be removed prior to any activities that would disturb the materials or prevent future access to them for removal.
- When RACM has been removed, it must be contained in a leak-proof wrapping or bag and properly labeled for disposal.
- All asbestos removal and handling operations must be performed under the supervision of an individual trained and certified in asbestos handling.
- U.S. DOT regulates the transportation of asbestos and identifies it as a hazardous material. Before accepting RACM for transportation, a transporter must ensure that

wastes, some form of manifesting is required. For "nonhazardous" paint wastes (waste with leachable levels below those listed above), *Supplemental Specifications* states:

@ "Accumulated wastes shall not be removed from the temporary storage area without proper documentation."

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1100.60 WELLS AND WATER POLLUTION

1100.61 SURFACE WATER

"ANY" construction projects involving activities and/or equipment on or near water need to have contingency plans for containment of discharges into or onto the water. 40 CFR 116 defines a discharge as: "Including, but not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping a controlled material or substance into or onto the water."

Further, 40 CFR 117 states any person in charge of a vessel or an onshore or an offshore facility shall, as soon as they have knowledge of any discharge of a controlled substance from such vessel or facility in quantities equal to or exceeding the reportable quantity, immediately notify the appropriate agency of the U.S. Government.

What Does This Mean?

Basically if you are working on, above, or around water (river, creek, lake, or pond) and discharge (spill) a listed or regulated waste, you **MUST** report this discharge and **IMMEDIATELY** take action to contain and clean it up.

Who Do We Report To?

Initial reporting shall be to the Project Manager. The Project Manager must relay this information "as soon as possible" to the Construction Division. Be prepared to give the Construction Division specifics like: who, what, where, when, how much, of what and what is being done to contain and clean it up.

Reportable Quantities

A reportable quantity depends on what has been spilled. 40 CFR 117 lists Federal requirements for Reportable Quantities (RQ's) and 567 IAC Chapter 41 contains others regulated by DEQ. Since it is almost impossible to "after-the-fact" quantify anything spilled into the water, the following will be field guidelines:

- ANY fuel or petroleum products which produce a noticeable sheen have to be reported to the Construction Division. Obviously, some discretion will have to be used since a single drop of oil will produce a sheen. One drop is probably not significant but one 3 L "drop" is.

- ANY paint or paint waste will be reportable. Again some discretion is needed, but there is very little latitude. That is why some type of emergency containment system is recommended for bridge painting projects over water.

- ALL occurrences of herbicides and/or pesticides discharged into water have to be reported.

- ANY foreign liquids such as curing compound discharged into water have to be reported.

What is Meant by Contain and Clean-up?

SSHC Subsection 107.01 notifies the contractor that we expect them to conduct their operations in a manner which minimizes potential water (and air) pollution. Further, for operations which have potential for water pollution, it is recommended to ask contractors how they plan to contain, mitigate, and remediate spills which may occur during the project.

It is strongly suggested that contractors develop a spill kit where individual "supplies" are stored in a closed, open headed 55 gallon drum. This "kit" method will assure spill containment supplies are dry, clean, and available when needed. The drum can be used to contain collected wastes for disposal. "Supplies" could include, but are not necessarily limited to:

- Containment boom. Boom (skimmer type or sorbent type) should be of sufficient length to encircle a large surface slick. Typically 82 to 115 m should be adequate.
- Floating petroleum absorbent pads. Typically two unused cases of 450 x 450 mm (10 x 10 inch) pads are adequate.
- Water skimmer (dippers) to remove floating solids.
- Emulsifying agent. Several different commercially available emulsifying agents are on the market. This chemical is typically a derivative of detergent and, when sprayed onto the surface, breaks down the surface tension and disperses an oil/petroleum slick. **(NOTE: Emulsifying agents shall be used as a "LAST" resort And then only when a slick cannot be contained or absorbed by some other means.)**
- Absorbent material such as floor dry. Typically a couple of bags are sufficient for most spills on land.
- Waste containers to accumulate and temporarily store wastes.

1100.62 WELLS

The Department of Health (DH) has developed rules for plugging and abandoning wells. The rules require that all sealed wells are to be reported by the owner to the DH within 30 days after sealing. They also require a registered well contractor to do the work. This form shall be completed by the contractor and submitted to the Construction Division for forwarding to DH. A copy of the form should be placed in the project file after being completed and signed by the contractor, and registered well contractor. A list of registered well contractors is maintained by DH.

CHAPTER NOTES:

CHAPTER NOTES:

DIVISION 1200

SITEMANAGER

DIVISION 1200 -- SITEMANAGER

1200.01 INTRODUCTION

SiteManager™ is one of the most powerful software support systems available to transportation agencies. It seamlessly integrates field-based data collection, administration of contract records, contractor payments, project-oriented civil rights monitoring, and materials management. All this is combined with a state-of-the-art, client/server environment and is available to field, project, district, laboratory and central office personnel.

1200.02 INFORMATIONAL GUIDANCE

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Each lap top that is used for Construction Inspection and management has the SiteManager documentation installed on the hard drive. This is the official source for guidance and use of SiteManager. In addition, supplemental help files are available on DORSRV81/runtime/how_to.chm.

1200.03 SITEMANAGER SUPPORT LIST

	System Administration		
	Lee Burbach	Information Systems	(402) 479-3982
	Shirley Daugherty	Construction Division	(402) 479-4559
	Jim Ferguson	Construction Division	(402) 479-4454
	Mitch Hendricks	Information Systems	(402) 479-3616
	Bill Hitzeman	Construction Division	(402) 479-4456
@	Jill Danburg	Construction Division	(402) 479-4453

	District Trainers		
	Jeff Kisicki	District 1	(402) 471-0850, Ext. 1910
	Jodie Domenge	District 2	(402) 595-2534, Ext. 223
	Bill Mainquist	District 3	(402) 370-3470
	Terry O'Neel	District 4	(308) 385-6265
@	Scott Clinger	District 5	(308) 262-1920
	Russ Frickey	District 5	(308) 262-1929, Ext. 201
	Ronda Lewis	District 6	(308) 535-8031
	Kelly Doyle	District 7	(308) 345-8490
	Linda Jackson	District 8	(402) 376-1126
	Rhonda DeButts	Materials & Research	(402) 479-4760

	Resident Trainers		
	Craig Washburn	District 1	(402) 471-0850, Ext. 1138
	Jeff Kisicki	District 1	(402) 471-0850, Ext. 1910
	Bill Jasa	District 1	(402) 335-4131
	Russ Eltiste	District 1	(402) 335-4131
	Mel Kuper	District 1	(402) 729-3489
	Bob McClure	District 1	(402) 729-3489
	Karl Burns	District 2	(402) 595-2534, Ext. 269
	Micky Jacobs	District 2	(402) 727-3292
	Gary Mangen	District 2	(402) 595-2534, Ext. 268
@	Darin Brown	District 2	(402) 727-3292
	Lynette Norman	District 3	(402) 370-3474
	Lisa Sudbeck	District 3	(402) 254-6552
	Gary Schmid	District 3	(402) 564-5751
	Lyle Kohmetscher	District 4	(402) 462-4996
	W. T. Farber	District 4	(308) 462-1996
	Richard Kwiatkowski	District 4	(308) 754-5411
	Tom Anderson	District 4	(402) 362-5934
	Arlen Zaruba	District 4	(308) 728-5655
	Scott Griepenstroh	District 4	(308) 385-6265
	Calvin Splattstoesser	District 4	(308) 385-6265

Resident Trainers		
Duane Katen	District 5	(308) 432-6144
@ Sylvia Hilderbrand	District 5	(308) 262-1920
Darryl Steinwart	District 5	(308) 632-1429
Kerri Lewandowski	District 6	(308) 535-8031
Bill Teahon	District 6	(308) 872-6733
Duane Collins	District 7	(308) 345-8490
Gene Colfack	District 8	(402) 336-2051
Mike Freeman	District 8	(402) 387-2471
Dean DeButts	Materials & Research	(402) 479-4809
Chris Dowding	Materials & Research	(402) 479-4753

CHAPTER NOTES:

CHAPTER NOTES:

DIVISION 1300

PROJECT SURVEYS

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DIVISION 1300 -- PROJECT SURVEYS

1300.01 GENERAL REQUIREMENTS

A. General. Horizontal and Vertical Control. *SSHC Section 114*, Construction Surveying, requires that certain vertical and horizontal control stakes be set for the various items of work to be constructed. This is interpreted to mean the Department will provide the contractor with sufficient intermediate grade and alignment points or stakes, so the contractor can construct the work according to contract documents. Remember the contract plans were created from the preliminary survey which may be several years old by the time construction starts.

B. Grade And Alignment Stakes. When grade and alignment stakes, including intermediate points, are set by an NDR survey crew, the Department will be responsible for correctness of staking. The contractor shall be responsible for the correct transposing of data from the construction stakes to the work.

C. Staking. Refer to NDR training book "Introductory Surveying" for instructions on construction staking for the various types of work (Use the stock control number "70-79600" to obtain the manual from Logistics.). District 4 has a written a "Preliminary Survey Manual" that is available on the "Network Neighborhood". There is also a GeoPak Course Guide "NDOR Survey with GeoPak Survey 98" available from Roadway Design.

D. The Department's ROW Line. The Department's ROW line is not usually placed by registered land surveyors. Therefore it is not usually a legal description of our boundary. Use of rebar to mark the Department's ROW can be misleading. Our NDOR caps should be treated as "temporary" monuments.

E. Consultant Survey Data. Consultant survey data must be electronically compatible with GeoPak.

F. Consultant Surveyors. Consultant Surveyors must provide reports of all on site survey activity either in advance of the activity or immediately following the activity so the Department can readily check all stake locations and other survey information provided.

G. Survey Accuracy

1. The required accuracy for construction survey staking are as shown in Table 1300.1a.

2. The required accuracy for construction survey closures are as shown in Table 1300.1b

3. Bench levels, control points, and any significant location should be checked against two known locations.

4. All computations should be checked by someone on the survey crew, other than the person who did the initial computation. The check should be done in the field while still on site.

Table 1300.1A Survey Staking Accuracy Requirements*		
Description	**Metric (m)**	**English (ft.)**
Alignment (Project) PI's, PT's, etc. and CP's/BM's	0.003	0.01
Farmstead Drives	0.3	1
Field Entrances	0.3	1
County Roads	0.03	0.1
Intersecting Highways	0.003	0.01
Telephone Poles/Power Poles (offset)	0.3	1
Drainage Pipes (Stationing)	0.3	1
Length of Pipe	0.3	1
Box Culverts (Stationing)	0.3	1
Length of Pipe	0.03	0.1
Bridges (Stationing)	0.003	0.01
Wells (Stationing/offset)	0.3	1
Cross-Section Slope Stakes; Rough Grading Stakes; Hub Line	.03	.1
Final Grading (Blue Tops)	.015	.05
Paving Hubs	.0063	.01
POT, PI, PC, PT, ETC	0.003	0.01

***All locations are to be based on a known location and checked against another known location.**

Table 1300.1B **Maximum Closure Allowance For Survey Tasks And Activities*.** **(Checking In At A Known Bench Or Other Control Point)**		
Activity	**Conventional Survey Methods. (Differential Leveling)**	**Modern Survey Methods (Total Station Type, Trigonometric Level, Survey)**
Paving Hubs	< or = 0.05' vertically. (Always adjust out any error encountered on paving grades) Horizontally hubs should always be set sighting thru to the next point, eliminating any error.	It's not recommended that you set paving hubs using this method. As vertical control is not as accurate using trigonometric methods.
Blue Tops	< or = .07' vertically. (Always adjust out any error encountered on blue top grades) Horizontally hubs should always be set sighting thru to the next point eliminating any error in the alignment. Outside hubs should be set pulling a tape perpendicular to centerline.	< or = .07' for vertical closure. < or = to .15' for horizontal closure
Slope Staking	< or = 0.10' vertically. Horizontal alignment is established pulling a tape perpendicular to centerline.	< or = 0.10' vertically. < or = .50' horizontally
Bridges:	< or = .01' horizontally and vertically	It's not recommended that you stake bridges using this method. . As vertical control is not as accurate using trigonometric methods.
Culverts	< or = 0.10' vertically. < Or = to 0.5' horizontally	< or = .10' vertically. < or = 0.5' horizontally
Cross-Sections & Borrow Pits	< or = .15' vertically. < or = 1.0' horizontally	< or = .15 vertically. < or = 1.0' horizontally
Bench Levels	Use formula- .05' multiplied by square root of miles. Any error should be adjusted out thru the entire level run. Use .035' for preliminary bench levels.	It's not recommended that you established benches using this method. . As vertical control is not as accurate using trigonometric methods.
Alignment	< or =. 05' horizontally	< or =. 05' horizontally
Storm Sewer Systems	< or = 0.05' vertically. < or = to 0.1' horizontally. NOTE: Inlets need to be accurate within a couple of hundreds from centerline to insure proper placement of wall, back of curb and inlet throat.	< or = 0.05' vertically. < or = to 0.1' horizontally.

*All units are represented in feet.
*Note: Under no circumstance should accuracy be compromised. This chart is only to be used as a guide to help you understand the closure tolerance that may be allowed before you need to take the time reviewing your work. These numbers may not fit all situations. If you have any questions it's best to consult with your project manager.

1300.02 CONSTRUCTION STAKES

A. General - Construction Staking

1. Construction surveying represents a large proportion of the construction engineering cost and, therefore, requires study to eliminate all needless refinements. The goal to be reached is a satisfactory project constructed according to the approved plans with a minimum of cost. Centerlines, right-of-way monuments and benchmarks should be established within recognized limits. Other stakes should be established to standards commensurate with their use.

   - Rt or Lt is relative to stationing – align yourself looking up to next higher station number to determine left or right.

   - The Department usually stakes the ROW as needed for the relocation and location of utilities before the contract is awarded. Utility companies need references to determine how to move their property before the project begins.

   - Utilities may damage stakes—communicate the Departments desire to maintain stakes and require utilities to relocate damaged stakes where possible.

   - The project manager needs to communicate with the contractor to determine where the contractor plans to start work. With good communication, the Project Manager should be able to accommodate the contractor's need for stakes within time requirements specified in the contract.

   - Today the centerline is generally defined by coordinates however, it is still significant in the majority of the construction staking.

   - The survey crew should set the construction stakes as far ahead of the contractor as practicable. The Project Manager must have the area staked sufficiently in advance to avoid construction delays.

   - The stakes provide the contractor the construction lines and grades and also serve as an inspection guide.

   - Stakes must be accurate.

   - Keep communication with the contractor open so if a change is necessary, staking will not delay the project.

   - The contractor shall be responsible for the protection and integrity of the stakes after placement. The contractor shall take the necessary measures to achieve this.

- All preliminary survey results go to Ken Hartwig, Geodetic Survey Section. Ken checks the data then passes the data onto both Kurt Svoboda, Right-of-Way, and to the Roadway designer responsible for the project.

    - ROW surveys are generally done as part of the Preliminary survey. However, Gene Thomsen does many of the ROW surveys.
    - Hydraulic surveys are also part of the Preliminary survey and the data is provided to Don Jisa,

- The Geodetic Survey Section does Photogrammetric surveys. The Photogrammetry Section plots/maps the survey data.

- GPS Pairs are permanent monuments.

    - On each project the Geodetic Survey Section will provide a GPS pair at the beginning, end and every 2-3 miles along the project.
    - Usually the monuments are offset 500-1,000' left and right of the centerline.

- The GPS establishes the state coordinate system.

    - HARN was created in 1995 with the help of a National Geodetic Survey, which established a grid of accurate points across Nebraska based on GPS sightings.
    - Contact the Bridge or Roadway Design Division if you need the coordinates of any point.

- Geodetic surveys are expensive.

    - Preliminary surveys are estimated at 200 hours per mile in rural areas ± correction factors.
    - Preliminary surveys are estimated at 800 hours per mile in urban areas ± correction factors.
    - If a contract survey is estimated above in-house time allocations, try to find a way to do the work in-house.

B. Minimum Survey Requirements

Each project is unique and has different survey requirements. Table 1300.2 describes the common stakes. Table 1300.3 explains the minimum stakes necessary and their appropriate location in normal conditions for the item listed. Table 1300.4 shows the minimum placement intervals for stakes. Finally Table 1300.5 shows how to stake structures (Bridges & culverts).

Table 1300.2 STAKE DESCRIPTION*	
STAKE	**DESCRIPTION**
Hub (Right of Way)	1” x 2” x 18” (oak)
Hub (Blue Tops)	2” x 2” x 9” (oak) or 1” x 2” x 18”
Hub (Paving Hubs)	2” x 2” x 9” (oak)
Guard Stakes for Marking/Describing Hubs	1/2 “ x 2” X18”
Information Stakes For Use in Right of Way, Structures	1” x 2” x 18” (pine)
Slope Stakes	½” x 2” x 18” (pine)
Lath (marks hub/guard sites)	½” x 2” x 48”
Pink Ribbon	Delineates lath or other objects for visual locating.
Wire Flags – Pink	Marks Bluetops, Paving Hubs, ROW, Structure Stakes, etc.
Rebar	5/8” x 36” Used in establishing control points, ROW breaks.
Aluminum Caps	Placed on rebar to accurately establish a given survey point and stamp point information.

*Ground conditions may require other sizes and or types of stakes, than those indicated.

STAKE DEFINITIONS Table 1300.3		
	DESCRIPTION	**PURPOSE**
HUB LINE	1" x 2" x 18" oak/pine hub stake set usually at 100' intervals or at plan cross section locations between ROW breaks on the ROW boundary. The hub is protected with a 1" x 2" x 18" guard stake with station/offset information, and a ½" x 2" x 48" pine lath.	Establishes the boundary of the Department property, shows the offset location of the centerline and shows stationing. Also may be used to define rough grading. May also be used to mark temporary and permanent easements.
ROW	½" x 2" x18' hub or 5/8" or ?" x 36' rebar rods set at points in the Hub Line where the ROW changes directions (Deflections). Set on PC's, PT's of curves, in Hub Line where tangent sections are over 1,000 feet in length and on hills so ROW may be viewed.	Establishes the boundary breaks of the Department property. Right of Way markers are normally installed on these points by the contractor. (Confirm control points before staking ROW.) Or at ROW hub (See example at Subsection 1300.02 C.)
SLOPE STAKES	½" x 2" x18' pine stake with lath (optional) and guard stake (optional) with information describing the limits of rough grading. Set on the extreme outside points of the designed cross section where the grading work and natural ground intersect. Usually set at 100-foot intervals and where changes in slopes, roadway width, sharp curves or ditch dimension change. Slope stakes are protected by a wire flag or lath for visibility.	Defines rough grading requirements – cut/fill, slope, offset from centerline, toe of backslope distance, hinge point/shoulder distance and ditch dimensions. A cut or fill to centerline may be written on the back of the stake.
BLUE TOPS (A Subgrade Lath is sometimes used instead of a Blue Top in cases of extreme subgrade overfill or deficiency with the PM's approval)	2" x 2" x 9" or 1" x 2" x 18" oak/pine Hub stake depending on soil conditions with plain, blue or white colored top. Set the stake at finished subgrade elevation and place another stake (short lath) or wire flag near it for protection. Sometimes colored fiber tail ("chaser") is placed atop the stake to aid grader. Generally the Department will not color the top of the hub or place a fiber tail chaser – that is the responsibility of the contractor.	Used to establish the final subgrade elevations and final grading slopes. These stakes are set centerline; edge of mainline roadway (¼ points), & edge of shoulder transversely across the roadway. (Additional stakes are needed on multilane highways.) Bluetops are usually set at 100' intervals longitudinally. Additional blue tops may be set at 50' intervals in cases such as vertical curves, sharp horizontal curves, or slope transition areas. Set Blue tops at the exact finish grade elevation—the contractor must make any adjustment.
PAVING HUBS	2" x 2" x 9" oak/pine hub with a tack set at a contractor specified offset distance form the pavement centerline/edge of pavement. A ½" x 2" x 18" pine stake is driven beside the paving hub which explains offset, grade (cut/fill) and station of the paving hub. Usually set at 50' intervals on both sides of the mainline. In cases of sharp vertical curves, horizontal curves over 1 degree, or transition areas, hubs are set at 25-foot longitudinal increments.	Used to set the string line to guide the trimming and pavement-finishing machines. Grade (cut/fill) is indicated on the stake. Need to determine with the contractor whether the offset is level from the edge of pavement or is the projected slope.
DRAINAGE, PIPE, CULVERT, BRIDGE, WALL, DRIVEWAY, CURB, SIDEWALK AND OTHER STRUCTURE STAKES.	1" x 2" x 18" oak/pine Hub set at a specified offset from the structure being staked. A (1" x 2" x 18") pine guard stake which explains offset, grade (cut/fill) and station of the paving hub and a ½" x 2" x 48" lath stake is driven beside the hub for visibility and protection. On long pipe runs usually for storm sewers, offset stakes are set at 50' intervals.	Shows the location of structures in terms of project stationing and offset distances.
SHIM SHOTS	Points on a girder. At locations directed by the Bridge Division. Use a paint mark to mark location.)	Used to determine the final grade of the bridge deck. (Make sure all the Bridge Division knows where on the girder the points were taken.) The actual shim amount is shown with a black marker on steel girders and with paint on concrete girders.
STATIONING LATHS	½" x 2" x 48" pine stake (lath). Usually only needed on asphalt overlay projects.	Defines the project stationing. Usually placed before the subgrade is set to help define/establish pavement quantities. Offset near edge of shoulder.
PAVEMENT STAMP	Imprinted station number on pavement. (3" brass number stamps imprints in plastic concrete). Place stamp every 100-feet or 20-meters. Normally place on the right side, progressing up stationing so the stamp can be read from the shoulder. Avoid rumble strip location.	Defines the project stationing.
ALIGNMENT POINTS OR CONTROL POINTS	May be ? " or ½" x 36" rebar for permanent points; a 60d spike for a less permanent point; or frequently a 1" x 2" x 18" oak/pine hub with a tack. ½" x 2" x 48" pine stake (lath) is used to protect the hub.	Defines the centerline alignment. Such as the beginning or ending of a curve, or the point of deflection of two tangent segments. Control points may also be offset from the centerline at various locations and are tied to the highway with coordinates.

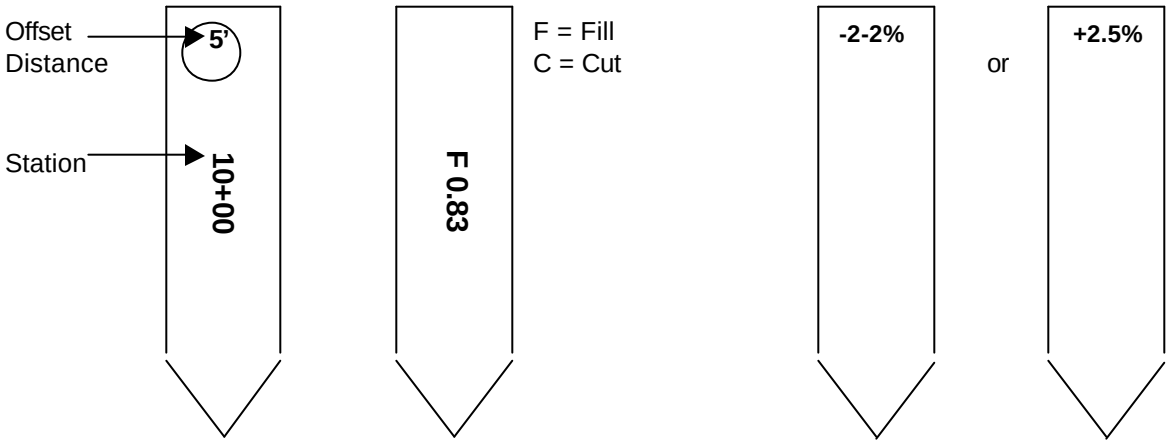
MINIMUM SURVEY REQUIREMENTS Table 1300.4						
MAJOR CONSTRUCTION						
TYPE OF STAKE	**LOCATIONS**	**LEVEL GRADE (feet)**	**HORIZ. CURVES >2 degree (r≤2865') (feet)**	**HOR. CURVES <2 degree (r≥2865') (feet)**	**SHARP VERT. CURVES (feet)**	**OTHER REQUIREMENTS**
Hub Line	Hub, guard and Lath set between ROW Breaks on the ROW boundary	HL(100')	HL(100')	HL(100')	HL(100')	Hubs may be "graded" to centerline for use by the grading contractor.
ROW	Hubs or Rebar rods, guard and lath set at points in the hub line where the ROW changes direction (deflects).					Set a stake at each break point; on level ground every 1000-feet; at Control points; and at the top of hills to provide Line of Sight and at other locations described in Subsection 1300.02. .
Slope Stakes	Slope stake and wire flag or lath to be set at the extreme outside points of the designed cross section where the grading work and the natural ground intersect.	SS(100')	SS(100')	SS(100')	SS(100')	Changes in roadway width, slopes, ditch dimensions or sharp curves may require additional slope stakes.
Blue Tops	White or blue topped hubs with wire flag or colored fiber tail (chaser) set to final grade elevations across subgrade template. Bluetops may be replaced by subgrade lath if approved by the Project Manager. Only a short lath with cut/fill marked on them is placed on subgrade template.	BT(100')	BT(50')	BT(100')	BT(50')	Blue Tops establish the final grading limits. These stakes are set at centerline; ¼ points; & subgrade/foreslope intersection (edge of shoulder). (Additional stakes may be necessary on multilane roads.)
Paving Hubs	Hubs with guard stakes are set at specified offset distance from edge of pavement.	PH(50')	PH(25')	PH(50')	PH(25')	Offset needed for their equipment. Graded to top of proposed pavement surface. (Level or projected grades as required by the contractor.)
Radius Points and Other Control Points	Locate and verify control points and benchmarks from preliminary survey.	As necessary	As necessary	As necessary	As necessary	Add construction benchmarks and roadway alignment as necessary.

PH=Paving Hubs
HL=Hub Line
BT=Blue Tops-Final Grading
SS=Slope Stakes

SURVEY REQUIREMENTS Table 1300.5		
STRUCTURES (BRIDGES AND CULVERTS)		
	STAKES LOCATION	
ABUTMENT CENTERLINE	BS (8 each)	Normally two stakes are placed on each side of the bridge at specified distances from centerline of the bridge at each abutment.
WING ENDS	BS (8 each)	Two stakes are placed at specified distances from the end of the wing. These stakes are on the same azimuth as the wing.
PILE LOCATIONS AND ELEVATIONS		Contractor measures from existing stakes to pile locations. Elevations should be verified by the inspector.
PIER CENTERLINE	BS (4 each/pier)	Two stakes are placed on each side of the pier at specified distances from the center of the bridge pier.
GRADE BEAM CENTERLINE	BS (8 each)	Two stakes are placed on each side of the grade beam at specified distances from the center of the bridge.
SHIM SHOTS ON EACH GIRDER	SSR – As Directed By The Bridge Division.	Used to determine the final grade of the bridge deck. (Make sure all the Bridge Division knows where on the girder the points were taken.) The actual shim amount is shown with a black marker on steel girders and with paint on concrete girders.
PIPE CULVERTS	CS (2 each) @ each end of pipe offset as required.	Hub, guard and lath should be placed at a specified offset from the end of the floor on centerline of the pipe, at each end. Any broken back or horizontal break should also be referenced on the end stakes or staked separately.
BOX CULVERTS	CS (2 each) @ each end of pipe offset as required	Hub, guard and lath should be placed at a specified offset from the end of the floor on centerline of the box, at each end. Some contractors may require parapet stakes and wing stakes (mostly on skewed boxes). These should be set at a specified distance to the centerline of the box or end of wing, on the parapet line or wing line. Any broken back or horizontal break should also be referenced on the end stakes or staked separately.
CS=culvert stakes require a hub, guard and lath. BS=bridge stakes may require a hub with nail, information guard and lathe. SSR=shim shot reading		

C. Survey Stake Minimum Requirement Examples—Suggested Format

PAVING STAKES

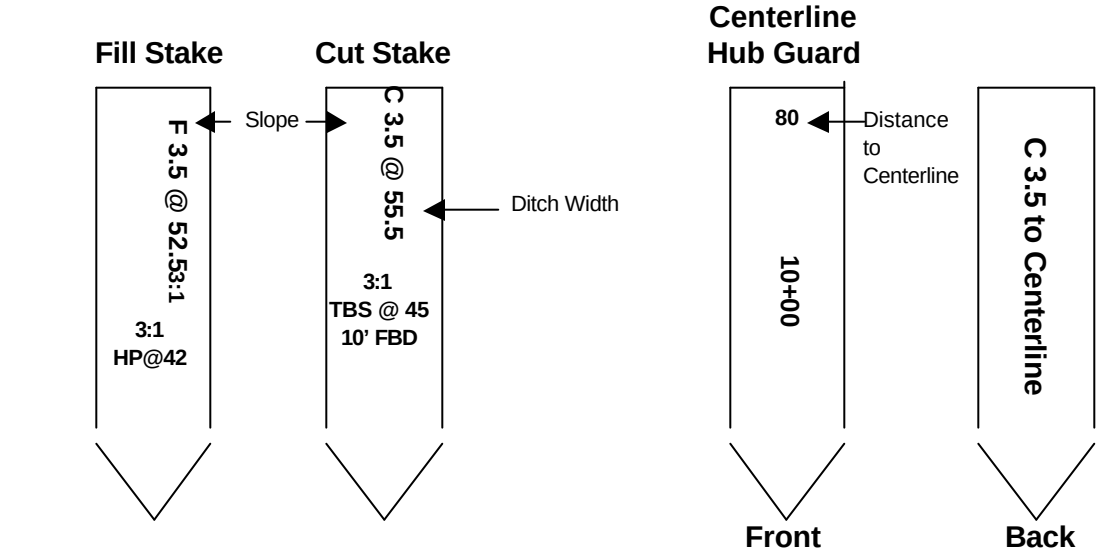


Stakes set at transition points through curves provide changing slope data.

Fill (cut) is to the top of the pavement at outside edge.

Pavement grades may be computed flat from edge of pavement to paving hub, or on projected slope of pavement out to paving hub. Coordinate with contractor for method preferred.

SLOPE STAKES



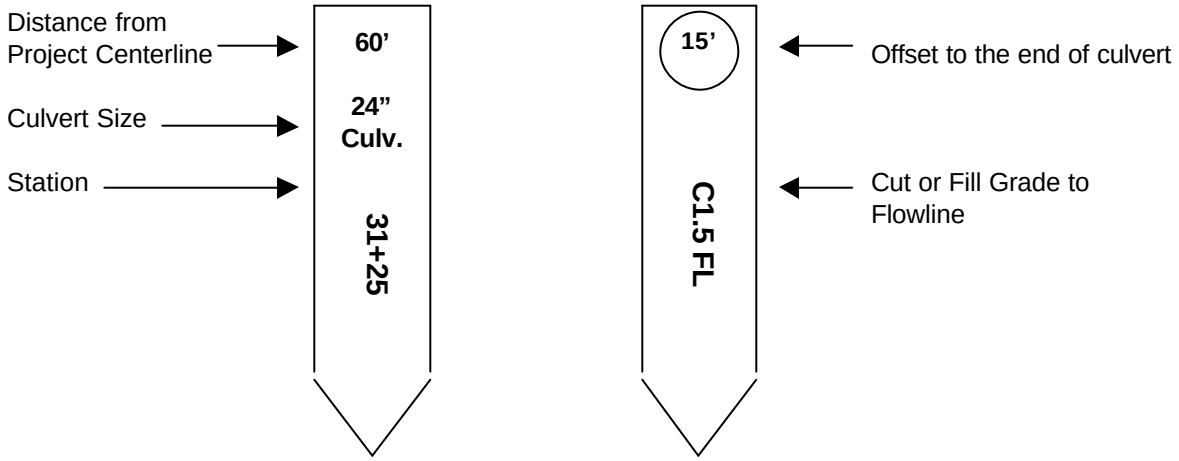
Hinge Point (HP) at 42' from centerline

Toe of Backslope (TBS) 45' from centerline

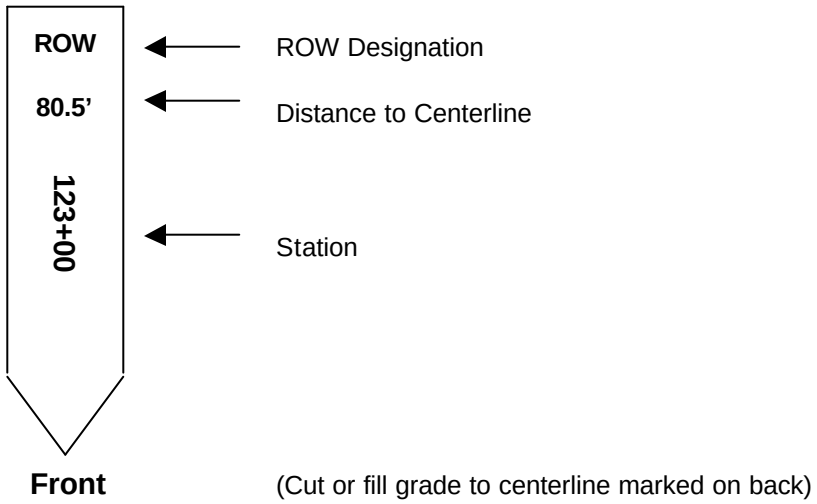
Centerline reference hub normally set at ROW line. C or F to subgrade elevation at centerline.

On 4-lane road, distance is to A or B Line. Profile point is inside edge of Driving lane.

CULVERT STAKES



ROW STAKES



Hub Flags: Green-Yellow flag for easements.
Orange flag for ROW.

1300.03 CONSTRUCTION SURVEY BASIC REQUIREMENTS

A. GeoPak Guidance (Not All Projects Are Available In This Format)

1. GeoPak New Project Instructions:

a. Create a new folder on your C: drive under C:\geoprjs\11111; Name this folder with the 5-digit control number for this project. In this example the control number is 11111.

b. Open microstation. The microstation manager window will be on the screen.

- Set the path on the right to C:\geoprjs\11111.
- Then click file – new. At the bottom of the window select a seed file. Example – C:\users\data\seed3.dgn. Use seed3.dgn for an English survey or mseed3.dgn for a metric survey.
- Then type the control number in the window on the left side and click ok. The control number 11111.dgn will appear on the top left side of the microstation manager window. Click ok.

c. The microstation design screen is now on your screen. The top bar on the screen should read 11111.dgn (3D) – MICROSTATION/J. Click on Applications – GeoPak survey – GeoPak survey tools. The toolbox has four icons.

d. Click on the Project Manager icon. The Project Manager window opens.

- Set the path on the right side to C:\geoprjs\11111. The path appears towards the top of the window.
- Then click project – new. The create new project window opens. Project name: 11111, Working directory: leave blank, Job number: 111, for the job number use the last 3-digits of the control number. Project description: Skyline Dr.- 204th and Dodge.
- Now click on preferences. GeoPak user preferences window opens. Direction: Azimuth, Coordinate: XY, Unit: English or Metric. Working directory: leave blank.
- Then click on feature preferences. Select .smd file, Example- C:\GeoPak_Projects\Standards\ prelim.smd or mprelim.smd for a metric prelim.
- Also toggle on the best match feature. Click ok.
- Then click ok in the GeoPak user preferences window, and click ok in the Create new project window. An alert window appears asking Create Job 111 in directory C:\geoprjs\11111\? Click Yes.

e. In the Project manager window 11111.prj should appear highlited on the left side of the window. Click ok. The Project users window opens. Click users – new. Name: your initials, Full name: your full name, Op code: your initials, Description: your title or your titles initials, Click ok. Do you wish to define a password for this user? Click No. Highlite (aa) Click ok.

f. Click Survey, The Select Run window opens. Click run – new. The run name should correspond with the letter you used for your Sdms project segment. In this example the run is named tra for the traverse segment. The description can be left blank. Highlite tra. Click ok.

g. The Survey project window opens. The title bar should read, Survey….Project (11111) .. User (aa)..Run (tra).

h. Highlite Data Source, click Single file. The Select sdms window opens.

- Set the path on the right side of the window to C:\sdms\prj\11111. On the left side of the window the sdms project segments should appear.
- Select 11111tra.prj and click ok. Toggle on Remove Sdms tag names from point descriptions.
- Now click sdms to obs. Click on mapping option.
- Toggle on draw mapping. The Dgn file should read C:\ geoprjs\11111\11111.dgn. The seed file is grayed out.
- Now click control code. Click open. Click 11111tra.ctl. Click ok. The control file should read C:\geoprjs\11111\11111tra.ctl. Coord fields should now have coordinates.

i. Now click process survey. The standard unit weight should be 3 or less. A larger number indicates a problem with the process of the observations in the obs file and the control file. The Least squares adjustment takes place when processing the survey and creates the reports for review. These are very useful for checking errors and adjustments. Now press any key to continue. Then click import to gpk. This imports the points and chains to a GeoPak database.

j. Clicking on the Bently B and selecting sink can hide the survey project window. You can restore the window by clicking on window – survey project.

k. To view the project on your screen click fit view. In this example you would see the CP's for this projects traverse.

l. Continue by opening the survey project window. Click copy run. Select tra. Click ok. Type in the next segment letter and click ok. Proceed with data source as previously explained.

m. Roadway Design is developing a program to make setup easier and when this is available it will be easier to use GeoPak.

2. Computer Listings Available – For projects developed on the computer, listings will be sent to the Project Manager with the plans or as soon thereafter as they can be printed. If, due to loss or damage, additional listings are needed by the field personnel, they will be supplied upon request. The listings available are discussed under the subsequent paragraphs. GeoPak can reproduce or reformat any of the previous listings/books.

3. **Preliminary Cross Section Listings** – This is a tabulation of the preliminary survey elevations and distance. GeoPak has the capability of projecting cross sections at any location.

4. **Plotted Cross Sections** – Plotted cross sections are available to the Project Manager for all computer designed projects.

   - GeoPak plots both the preliminary and design cross sections. The scale used for both may be modified to any desirable scale. The scale used is printed in the upper left hand corner of each sheet.

5. **Earthwork Computation Listing** – This is a tabulation by stations of areas and volumes.

6. The RDS form is titled **"Earthwork Quantities List for Roadways."**

7. **Grades and Surfacing Elevations Listing** – This is a tabulation of the finish grades at centerline and at the edge of the surfacing. On horizontal curves all grades have been corrected for transitions and superelevations. GeoPak can furnish grades for any point between the two shoulders.

8. **R.O.W. Limit Listings** – This machine listing is discussed later in this subsection.

9. **Blue Top Book** – This listing is discussed later in this subsection.

10. **Slope Stake Book** – This listing is discussed later in this subsection.

11. **Alignment Book** – This listing gives alignment information and is for use when referencing and relocating centerline.

    - Preliminary alignments are available through Ken Hartwig In Roadway Design [(402)-479-4682].
    - Construction Alignments are available through the Roadway Design, Project Designer [(402)-479-4601].

12. **Locations of "No Passing Zones"** – Vertical curve no passing zones can be obtained from Roadway Design. However, the District can run the two vehicle test method to determine the zones. (Two vehicles follow 1200' apart and when sight is obstructed that starts the no passing zone one direction and ends the no passing zone the other direction. When sight distance is returned that ends the zone the first direction and begins the zone the other direction. Logistics Division has the equipment for this operation.

B. Checking Bench Levels

1. Good bench levels are one of the important reference features of any construction project.

2. All benchmarks should be thoroughly checked before any other level work is started. If the preliminary survey party has not established benchmarks at proper intervals, intermediate ones should be set. Permanent benchmarks should be established approximately 1000 ft (300 m) apart and also near all major structure locations.

3. In choosing objects for benchmarks, the Project Manager must keep in mind that such objects must be permanent and easily accessible. Nails in fence posts and pole lines should be avoided. A 3 foot "T" post is normally required for a benchmark however, the PM may authorize the use of steel reinforcing rod, at least ? inch (15.8 mm) round and 3 ft (1.0 m) long driven 2 inches (50 mm) below ground level in a location that will not be disturbed. The location should be marked with a guide stake or lath and red cloth, and the "plus" and "distance right or left of centerline" recorded in the levels book.

4. In running levels, the following rules should be followed:

   a. Equalize sights. In order to eliminate instrumental errors as much as possible, backsight and foresight distances should be of equal length at all turning points.

   b. Reading the rod. Rod readings at turning points shall be taken to the nearest .005 foot (.00152 meter). The rodperson shall use a rod plumb or if plumb is not available may wave the rod away from and toward the instrument parallel to the plane of collimation.

   c. Never take down the instrument without checking on a benchmark other than the one used on the setup or turn.

   d. In establishing benchmarks, it is important to turn on each benchmark.

5. Benchmarks notes may be kept in the alignment notebook. Recorded rod readings shall never be erased. If an error is made, a line should be drawn through the erroneous figure and the correct figure written above. In checking elevations, the plan elevations shall be used unless an error in elevation of 0.05 ft (15 mm) or more is found. If errors are found they should be corrected and documented—some errors will have to be prorated over the intermediate points by the data collector. The final cross section levels may then be corrected to the preliminary datum at preliminary benchmarks or at established benchmarks.

6. If difficulty is encountered in checking preliminary bench levels or the Project Manager has reason to believe that an error was made in transferring preliminary elevations onto the plans, he/she may obtain the original preliminary notes by writing the Roadway Design Division at Lincoln.

C. Reproducing And Referencing Centerline

1. The construction centerline shall be reestablished using the plan information. It is a good policy to establish the centerline and set the reference stakes for the entire project as early as possible, so that property owners may have ample time to lower pipe lines, remove fences, power and telephone poles, buildings, etc., before the construction crew arrives.

2. In reestablishing the centerline, the work should proceed as follows:

   a. Locate and “tie out” all plan transit points.

   b. Establish and “tie out” any additional required control points.

   c. Reestablish the centerline.

   d. Set the centerline reference stakes.

3. Transit points that should be located or established and “tied out” are:

   a. P.O.T. (Point on tangent)

   b. P.I. (Point of intersection)

   c. P.C. (Point of curvature)

   d. P.T. (Point of tangency)

   e. T.S. (Tangent to spiral)

   f. S.C. (Spiral to curve)

   g. C.S. (Curve to spiral)

   h. S.T. (Spiral to tangent)

i. P.O.C. (Point on curve)

(Reference these points to at least four permanent objects which will not be disturbed during construction or shall have coordinates accurate to ≠ 0.01 feet. However, in the absence of available “permanent objects”, tacked stakes set at right angles to and at known distances from the project centerline will be satisfactory. Reference ties should be measured horizontally to the nearest ? ” (3.0 mm) with a steel tape.)

4. After the transit points have been established, proceed to reestablish the centerline markers. The Project Manager should set the centerline markers with an instrument at 100 ft (25 m) intervals, measured horizontally on tangents and horizontal curves up to 9400 ft (2864.789 m) radius. Curves that are less than radius of 9400 ft (2864.789 m) should use 50 ft (15 m) chords. The distance “plumbed up” by the chaining crew should be checked occasionally with a hand level or from the difference in old ground elevations shown on the plans. Intermediate centerline markers on tangents may be set later with a chain stretched between the station markers. Intermediate centerline markers on curves should always be set with the instrument.

5. When obstructions such as fences, etc. are present on the right-of-way and when the removal of such items are not included in the contract items, the appropriate adjacent property owners shall be notified that they must remove such obstructions. Such notification shall be made well in advance of construction operations so that the owners will have sufficient time to make arrangements for performing the work. They should also be advised of the date on which stakes will be set for their information in removing or relocating their property.

6. Provision for the removal of advertisement signs is handled independently by our Right of Way Division. Should any problems arise relative to the removal of advertisement signs, the Construction Division should be contacted.

D. Checking Plan Grade And Calculating Grade Revisions

1. As soon as possible after assignment to the project, all grade elevations shown on the plan-profile sheets of the plans should be thoroughly checked. This includes percent of grade and vertical curve corrections. On structures, it is recommended that all grades be recomputed including pile cutoff, footing, pier cap, abutment seat, and top of girder elevations.

2. It is particularly important to check the profile of the roadway surfacing which connects with the project being constructed. If this elevation is found to differ from that shown on the plans, it is evident that the project grade line will need to be adjusted. This adjustment will cause changes in grade stake elevations and may even affect lengths of proposed culverts in the area.

3. If any appreciable error is found between the preliminary and preconstruction chaining or bench levels, and an equation is introduced, it will be necessary to recalculate the centerline grade from the equation point to the next point of intersection of tangent grades, or if too distant, to some nearer convenient point of the next grade break. This is particularly important on concrete pavement as any equation or correction in levels or distance will be reflected in the pavement form elevation.

E. Staking Right-Of-Way Fence and Right-Of-Way Limit Listing

1. ROW stakes are needed usually before the contract is awarded to provide references for utility relocations.

2. On some projects, right-of-way fence is a contract item and staked and constructed in accordance with the plans or the right-of-way listing. On other projects, fence stakes must be set on the right-of-way line for the guidance of adjacent property owners. The Project Manager should also check the fence setting as it progresses to see that it is set in correct relation to the fence stakes.

3. Right-of-way fence stakes should not be set in borrow pits or channel changes until the contractor has these finished to the landowner's and the District Engineer's satisfaction.

4. Right-of-way limit listings are available for most projects except interstate. Separate listings will be furnished for the left and right sides of centerline of the project. They will give the right-of-way distances at all breaks in the line and at all intermediate full stations. All distances given on the listings are from centerline of the project to the right-of-way line.

5. Right-of-way limit information will not be given for segregated parcels near section corners. The listing will give the station and distance to the point where the normal right-of-way enters the segregated parcel and also at the exit, with a break in the stationing between the two. The section corner will not be given. If right-of-way markers are to be set for segregated parcels, consult the plans or the right-of-way contract for the necessary information.

F. Setting Slope Stakes

1. The "Slope Stake Book" provides the data for locating the slope stakes and this "book"/file is available from the Roadway Design Division, CADD Applications Section, (402) 479-3986.

2. Construction stakes are placed on the project before work begins to outline for the contractor the location and extent of the work. Slope stakes may be set with an instrument on projects having the excavation quantity computed from plotted cross sections. The notes shall be kept in a separate book.

3. For fill sections, slope stakes are set at the toe of the slope and marked to show the vertical distance and slope from the ground at the stake location to the grade elevation at the hinge point and the subgrade shoulder of the fill.

4. For cut sections, slope stakes are set at the top of the backslope and marked to show the vertical distance and slope from the point on the ground where the stake is set to the grade elevation for the bottom of the ditch.

5 Slope stakes are normally set on both sides of the road at every station (100-feet); and every 50 ft (15 m) on horizontal curves having a radius of 2865 feet (873.25 m) or less. Use Type "D" ½" x 2" x 18" (12.5 x 50 x 458 mm) pine stakes.

6. Some intermediate points at which slope stakes should also be set are:

   a. P.C. and P.T. of horizontal curves.

   b. Beginning and ending of superelevation.

   c. Points where shoulder and backslope change.

   d. Change in width of roadbed.

   e. Change in width of side ditch or borrow.

   f. Any other points helpful to the contractor.

7. Balance points shall be well marked on the ground with a lath and red flag. Call the contractor's attention to these points and see that he/she works to them.

8. The plan data pertinent to each station shall be placed in the slope stake notebook. This data gives the trial distance for the first rod reading and also a check between the plan and the stake as actually set in the field. The information from the plans and the staking data should be similar to the example shown in Appendix 3-12. This example also shows the method for setting stakes for high fills when the instrument height (H.I.) is below the new plan grade.

9. The staking party should watch drainage along the toe of fill slopes, intercepting ditches, dikes, etc., as the machine does not now provide for drainage in all cases. Where necessary, special ditch grades must be computed in the field. They should also watch for vertical banks just beyond the limits of construction and correct slope stake locations accordingly.

G. Setting Finishing Stakes

1. The use of a separate notebook is suggested for the finishing stake (blue top) notes. Several satisfactory methods of keeping notes are presently in use. Following is a description of one acceptable method. The left-hand page of the notebook may be used for the plan data; that is, the station number, the centerline grade elevation, the drop to intermediate points and shoulders, the amount of superelevation on curves, etc. The right-hand page of the book can then be used for recording the staking data. The grade rod, for each point on the grading roadway template to be staked, is computed and placed on this page. The actual level rod reading (Read Rod) can be recorded below the corresponding grade rod and the cut or fill from the existing ground to the grade rod computed. Finishing stakes are then driven at these points and “blue-topped”. Only in extreme cases should a cut or fill be marked on the finishing stake. If the grade has been built too high, a hole should be dug deep enough to drive the blue top to grade. The contractor can be expected to protect these stakes so that they will not have to be reset at some future date. If many stake holes are necessary or many stakes are appreciably high [0.3 ft (90 mm) and over], additional work should be done by the contractor before stakes are set.

2. Blue top books are available on all projects designed with the computer. The design information is given for each preliminary cross section on one page with a blank page following for construction information. The elevations included in this information may include an allowance for “trimming”. The Project Manager or party chief must determine exactly what elevations are given. When a trimming allowance is not included, up to 0.1 ft (30 mm) may be added to the elevation of the finished grade stakes.

H. Setting Trimming Or Paving Form Stakes

1. When the roadway is in condition for the surface structure, trimming or paving stakes may be set. They should be aligned and graded by instrument.

2. The riding quality of the surface structure depends to a large extent on the vertical accuracy of the stakes and the accuracy with which the trimming is performed or the forms are set. The approved method is to set accurate grades to millimeters for each side of the surfacing at a uniform offset (consult the contractor). Grades may be indicated by stakes either driven to grade or driven flush with the ground and marked with a cut or fill. Stakes driven flush are least likely to be disturbed. The alignment shall be given on one side only and indicated by tacks in the top of the stakes. The appearance of the grade may be checked visually from both directions by sighting along the contractor’s string line before the trimming or form setting operation begins.

3. On curves, the tack line may be run on the offset line after computing a chord length for the offset radius, or the centerline of the curve may be run and the tack line set by double chaining the offset line, again using the proper chord length for the offset radius.

4. Stakes are normally set at 50 ft (15 m) intervals on tangent alignments and on horizontal curves up to 2° radius which have straight or long vertical curve grades. On horizontal curves over 2° radius and vertical curves having a grade algebraic difference that is more than 1.75 ft (0.532 m) from the tangent grade in 50 ft (15 m), a 25 ft (7.5 m) interval should be used. The ST, CS, SC and TS or PC and PT of all horizontal and the PVC and PVT of all vertical curves should be clearly marked for the contractor. Stake the transitions in and out through the super's of the curves as per the Standard Plan**.**

I. Contractor's Forms on Large Structures

1. On viaducts and bridges, the staking crew shall give the contractor line and grade on all bents, piers, abutments, walls, etc. This duty will be continuous throughout the duration of the construction. Using the stakes previously set, the Project Manager shall stake or check all pile layouts, centerline, and grade on all footings, columns, caps and anchor bolts before and after the pouring of concrete. Columns, pier caps and anchor bolts should be checked while the concrete is still fresh enough to allow for adjusting the forms or anchor bolts to line and grade. In addition to checking the line from the survey stakes, anchor bolts may also be checked by steel taping form pier to pier. Temperature, force on the tape, and plumbing for elevation must all be considered when this method is used. On steel girder bridges, a final check shall be made on span lengths, pier and abutment angles, and bearing plate seat elevations before attempting to set the girders in place. This should be done as soon as possible to allow time for minor adjustments in the girders should they be necessary. The following step are used in making this check:

   a. From a transit setup, mark the centerline of the structure on the pier caps.

   b From a setup, turn the pier angles and mark the centerline of the pier at the center of each set of anchor bolts.

   c. Check the anchor bolts for proper relation to the pier centerlines you have marked.

   d. Steel tape the distance along each line of girders between the abutments and piers as a check on the span lengths. Temperature, pull force, and plumbing for elevation must be accurately used in the measurement. (See the "Introduction to Surveying" page 51 & 52 for the chaining requirements and temperature corrections.)

   e. Take elevations on all bearing plate seats. Across any one pier cap the variation from plan elevation between any two bearing seats should not be more than ¼ inch (6 mm). For example, of all bearing seats across the pier are ¼ inch (6 mm) too high (or low), the floor grade can be adjusted to compensate. However, if one bearing seat is ¼ inch (6 mm) high and the adjacent seat is ? inch (3 mm) low, the variation is more than ¼ inch (6 mm) and the bearing seat elevations should be adjusted by grinding. This will assure the proper fit of the separator angle against the girder web.

J. Checking Culvert Lengths, Culvert Lists, Slope Stakes, Blue Top Stakes, Paving Hubs, etc.

1. General – Another duty of the survey crew is to take cross sections along the centerline of all culvert sites. This includes existing structures which are to be extended as well as proposed structures. The cross section should follow the centerline of the new structure and be taken along the skew line if the structure is not at right angles to centerline. If the inlet or outlet of the proposed structure does not coincide with the flow line of the existing channel or ditch, sufficient rod readings should be taken off-angle [usually extending [200 to 300 ft (60 to 90 m)] in the existing channel to establish the proper flow line design for the new structure. (The pipes off-line distance, change of skew, and length changes should be noted on the cross section sheets.) The elevation of the intersection of the right-of-way line and existing channel should also be determined.

2. The specifications provide that "the contractor shall not order and deliver the (culvert) pipe until a correct list of sizes and lengths is furnished by the Project Manager." Also, the contractor should not order and deliver material for box culverts, inlets, junction boxes, manholes and similar appurtenances, until a correct list of sizes and lengths of such structures is furnished by the Project Manager.

3. The Project Manager should promptly field-check the culvert and drainage structure locations, and prepare the field-checked culvert list. The instructions included herein provide for designing and detailing culvert pipe, reinforced concrete pipe, or corrugated metal pipe in exactly the same manner. This procedure will enable the Project Manager to field check and prepare the "field checked order list" without delaying to determine identity of the contractor and the kind (concrete or metal) of culvert pipe to be furnished. Accordingly, the Project Manager will be able to and should expedite the preparation of the field-checked culvert list to facilitate and provide time for fabrication and delivery of the culvert materials.

4. Culvert List – Pipe Culverts – The "field-checked list" of pipe culverts and appurtenances should include the following information for each pipe culvert:

   a. Station locations.

   b. Diameter and length.

   c. Kind of pipe culvert (concrete pipe, corrugated metal pipe or culvert pipe).

   d. Type of headwalls, inlet, manhole, junction box, or other appurtenance, and applicable standard plan number or numbers, if such items are to be constructed.

   e. Degree of skew if culvert is to be skewed, if skewed on one end only, show direction of flow by sketch.

f. Sketch for each broken back pipe culvert.

g. Direction of flow for all pipe extensions.

5. Do not make any field changes to pipe culverts without approval from the designer.

K. Culvert List – Box Culverts

1. The “field-checked list” of culverts should include all of the following information for each box culvert:

a. Station location.

b. Span, rise and barrel length.

c. Plan number or numbers.

d. Height of fill over the box culvert.

e. The “field-checked list” should include additional information for each box culvert which is to be constructed on skew, as a broken-back structure, with control joints, or an extension of an existing box culvert, as follows:

(1) Skew angle if the box culvert is to be constructed on skew, include a sketch if the ends or parapet walls are not to be constructed as shown in the standard plans.

(2) A sketch for each broken-back culvert, showing dimensions between the ends of barrel and break points and between break points measured on the axis of the culvert, and showing flow line elevations at ends and at break points.

(3) A sketch for each box culvert which is to be constructed with control joints. The sketch should show the dimensions from the ends of the barrel to the first control joint and the spacing between control joints.

(4) When the plans provide for the extension of an existing box culvert, the removal of the endwalls and/or the preparation of the existing structure will usually be performed in accordance with details shown in a standard plan.

(5) Special plans may be provided for large or complicated structure remodeling. The standard plan includes details for connecting to old structures having angle or straight wings, structures with or without floors between wings, etc. The standard plans also give the contractor the option of doweling into the wings of the existing structure, or breaking back and exposing 2 feet (600 mm) of reinforcing steel to connect the extended structure, when the individual structure plan note does not specify the method of extension.

(6) In detailing the extensions or remodeling of existing box culvert structures, the Project Manager must include with the field-checked culvert list (1) an adequate description of the existing structure, and (2) an adequate description of the preparation work and extension. This information is essential to the contractor and the fabricator of the necessary reinforcing steel.

f. The description of the existing structure should include:

(1) Station location, dimensions (span, rise, barrel length) and type of structure.

(2) Plan number if known or available.

(3) Type of wing, angle or straight; for straight wings include wing dimensions “L”, “C” and “H”.

(4) Whether or not concrete floors are between the wings.

(5) Whether the existing box is suitable for doweling.

g. The description of the new work should clearly describe the preparation work and the extension, and should include:

(1) Span, rise and extension length, right and left.

(2) The standard plan numbers both for the removal and preparation and for the extension.

(3) An adequate description of the removal of endwalls and/or preparation work on the existing structure. Typical examples of the preparation work:

(a) “Remove end walls and prepare structure as shown on the Special Plans (in case of special plans for preparation of old structure).”

(b) It will be seen that, depending on the type, suitability for doweling and condition of the old structure, the description of the preparation work may include one or more of the typical examples listed. Include a good sketch, with dimensions, for the contractor’s (and fabricator’s) use when the plan and condition of the existing structure and the new work are difficult to describe in words.

2. Do not make any field changes to box culverts without approval from the designer.

L. Staking Culverts And Structures

1. The centerline of culverts shall be indicted by hubs driven on the centerline and offset at such distance from the end of the structure as to protect them from disturbance. The elevation of tops of the hubs above or below the flow line grade at the ends of the culvert should be given, as well as the offset distance [usually 5 to 10 ft (1.5 or 3 m)] from the hub to the end of the new culvert. Guide stakes shall be set in all cases, giving the necessary information relative to the hubs.

2. Hubs for the alignment of headwalls may be placed on each side of the culvert on the line of the headwall face with the guide stakes clearly indicating the face staked. If the culvert has angling wingwalls, it is suggested that stakes be set marking such angle.

3. The centerline of bridges and viaducts may be indicated by hubs driven on the centerline at pier or bent locations and also on centerline of the structure, offset each way from the pier or bent locations. Pier angles shall be turned with a transit and hubs driven on their centerline at such distances as to protect them from disturbance. If possible, three hubs shall be driven on each side of each pier line. Type “E” or specially prepared 2 to 4 inch (50 to 100 mm) stakes, depending on the soil conditions, should be used as hubs to provide stable reference points. All hubs shall be tacked for line and at least two hubs on each side for distance. Since the centerline hubs will usually be destroyed during construction, a based line should be staked both right and left of centerline.

4. Permanent benchmarks should be established at each end of the structure and intermediate points as required. All elevations and chaining should be checked and rechecked.

5. The purpose of this letter is to provide the District Construction Engineer and the Construction Division with information with which to cross check culvert lists. It is felt that the letter may also be of value to the Project Manager for future reference.

M. Land Survey Monuments

The Department is required by law to notify the county board before undertaking any work that may disturb or destroy any corners of land surveys. It is essential that notification be given the county surveyor so that he/she will have sufficient time to properly witness all corners before work is begun. In the event that there is no county surveyor, or the county surveyor is not willing to perform the work, the Project Manager is responsible to schedule a registered land surveyor to perpetuate a monument.

N. U.S. Survey Monuments

1. Occasionally, benchmarks, triangulation stations, or other monuments of the U.S. Geological Survey or the National Geodetic Survey are located within the limits of construction and must be relocated. Such monuments must not be disturbed until specific permission is received from the director of the survey involved.

2. As soon as it becomes apparent that a monument of this type must be relocated, a letter shall be sent to the director of the appropriate survey, stating the necessity for moving the monument giving its designation and requesting instructions regarding the procedure to be followed in moving it. The condition of the monument and its location with respect to section, range, township, county and nearest town should also be included in the letter. The designation consists of letters and numbers stamped with dies on the disk. It is desirable that a rubbing of the disk be submitted also. The address to use for benches and landmarks is:

   Director, National Geodetic Survey
   601 East 12th Street, Room 1436
   Kansas City, Missouri 64106

   or

   Central Region Engineer
   U.S. Geological Survey
   Rolla, Missouri 65401

3. A rubbing may be made by placing a piece of light or medium weight paper over the disk and then rubbing over the paper with a pencil, preferably a hard one, to bring out the legend case in the disk and any letters or numbers stamped on the disk with dies.

4. Upon receipt of this information, the director will provide for relocation by their forces or will authorize you to move the monument and furnish a new disk to be used in the relocated monument and instruction to be followed in its relocation.

5. The new monument shall be established strictly in accordance with the director's instructions. The old disk and all notes and information requested shall be transmitted to the director immediately after the monument has been relocated. Extreme care and accuracy shall be exercised in all measurements and work performed and reported so that the accuracy of the original monument may be preserved.

6. It is important that the necessity for moving such monuments be reported promptly when it becomes apparent that they must be disturbed so that delays in construction work due to waiting for permission and instructions from the directory may be avoided. The work of relocating such monuments should be performed promptly upon receipt of the necessary authorization so that the survey office may have definite information regarding the status of the monument at the earliest possible date.

O. Preserving, Perpetuating And Witnessing Land Survey Monuments

1. Preserving Land Survey Monuments – In the course of construction operations, it frequently becomes necessary to remove, or cover with embankments or surfacing, section corners or other land subdivision corners. Due to the fact that so few counties maintain county surveyors, considerable expense is incurred by the department each year in locating corners necessary in acquiring right-of-way. In order to preserve all corners and avoid additional expense in relocating the corners when additional improvements are contemplated, Project Managers are requested to take precautionary steps to preserve all existing corners during construction and to establish permanent markers and witnesses after the work is completed.

2. The county board is required by law to "cause to be perpetuated the existing corners of land surveys along he public roads and highways where such corners are liable to destruction, either by public travel or construction or maintenance."

3. In order to comply with the law and cooperate with the county surveyor or Project Manager, the District Engineer will notify the county board in writing at least 120 days prior to construction, listing locations of land survey monuments which are within the construction limits. This notification shall be given on all construction projects including pavement resurfacing (except gravel). Copies of the notification shall be sent to the Deputy State Surveyor in the Roadway Design Division and the Construction Division.

4. Where corners have been located by the county surveyor or deputy state surveyor and properly witnessed, it shall be the responsibility of the Project Manager to protect the witnesses during the construction of the project. The Project Manager shall cooperate with the county surveyor by furnishing information regarding the proposed limits of construction so that witnesses may be placed in locations that will not be disturbed. The county surveyor should be notified promptly if it becomes necessary to disturb any witnesses or if witnesses are discovered during construction. Prompt notification in such instances may avoid inconvenience to the county surveyor. The land surveyor who witnessed the land corners prior to construction should be notified. Do not notify deputy state surveyors since they will be unable to return to the project.

5. The contractor is required by *SSHC Subsection 107.09* in the specifications to "protect carefully from disturbance or damage all land monuments and property markers until the Project Manager has witnessed or otherwise referenced their location and shall not remove them until directed." The Project Manager shall cooperate with the contractor and advise of the location of all monuments which have been located and properly witnessed, marking the location of all witnesses by lath or in some other satisfactory manner and advise regarding any other location where monuments have not been located and where particular care should be exercised in excavating to avoid disturbing the monument if it is uncovered.

6. On resurfacing projects, the written notification directed to the county board shall be considered to have fulfilled the Department's obligation unless the county is not willing or cannot perform necessary work and time and personnel are available to perpetuate known monuments.

7. In the event that the county does not have a county surveyor or the county surveyor is not willing to perform the work, the Project Manager is responsible to get a registered surveyor form the Deputy State Surveyor's Office to set a temporary witness to preserve the location of all existing land monuments during construction and record such temporary witnesses in the project records.

8. After construction, permanent corner markers and witnesses can be established to preserve the location of such monuments. Only existing monuments need to be witnessed since lost or obliterated corners have no status unless their location is established by a registered land surveyor. It is anticipated, however, that when right-of-way is acquired, monuments will be found at all land corners since the Right of Way Division is attempting to have the location of all lost or obliterated corners established by the county surveyor or a deputy state surveyor before construction is begun. In order to avoid confusion in the records, it is important that the following instructions be carefully observed.

9. At some time before construction begins, the county surveyor, if available, should be contacted to determine whether all land corners on the project have been located and witnessed by permanent objects which are on record in his/her office. If witnesses are shown in the plans, they should be compared with those on record and any errors in the plans corrected. Information omitted from the plans should be entered thereon. The witnesses can then be inspected in the field. If it is found that any of the witnesses have been disturbed, or are within the limits of construction, or are in locations where they cannot be protected during construction operations, the county surveyor shall be requested to establish additional witnesses in protected locations.

10. If the county surveyor neglects to set adequate witnesses or if a county surveyor is not available and the witnesses shown in the plans have been disturbed or are inadequate, the Project Manager will be responsible to get a registered land surveyor to establish temporary witnesses to preserve the location of all existing corner monuments. These witnesses shall be set in the same manner as that later prescribed for establishing permanent witnesses, except that they may be set in any protected location without specific relation to right-of-way lines.

11. During construction operations, existing stones or monuments shall not be disturbed unless absolutely necessary. Should construction require disturbing a stone or other government survey monument, the deputy state surveyor in the Roadway Design Division should immediately be contacted before the stone is disturbed. The procedure to be followed in this situation will vary with the situation and the circumstances, however, the deputy state surveyor should be consulted before a government land corner is destroyed. Original monuments which will be under proposed embankments shall not be disturbed and every effort shall be made to protect them during construction operations.

12. If more than one monument is discovered for a land survey corner, the county surveyor and the deputy state surveyor should be contacted so that he/she may determine which marks the legal corner. In the event a county surveyor is not available, both monuments should be witnessed and a detailed description of each monument submitted to the Right of Way Division. In such instances, a very careful examination should be made of the surrounding soil for evidence of any deposit originally placed with the monument and charred stakes or pits and mounds which may have existed when the corner was originally established. These descriptions will be submitted to the state surveyor for a ruling as to which monument marks the legal corner.

P. Perpetuation Of Section Corner Markers

1. After the work on the project is completed, permanent corner markers shall be established. If a county surveyor has not been handling the work, the Project Manager is responsible to schedule the deputy state surveyor to perpetuate section corners using measurements from the temporary witness corners previously set.

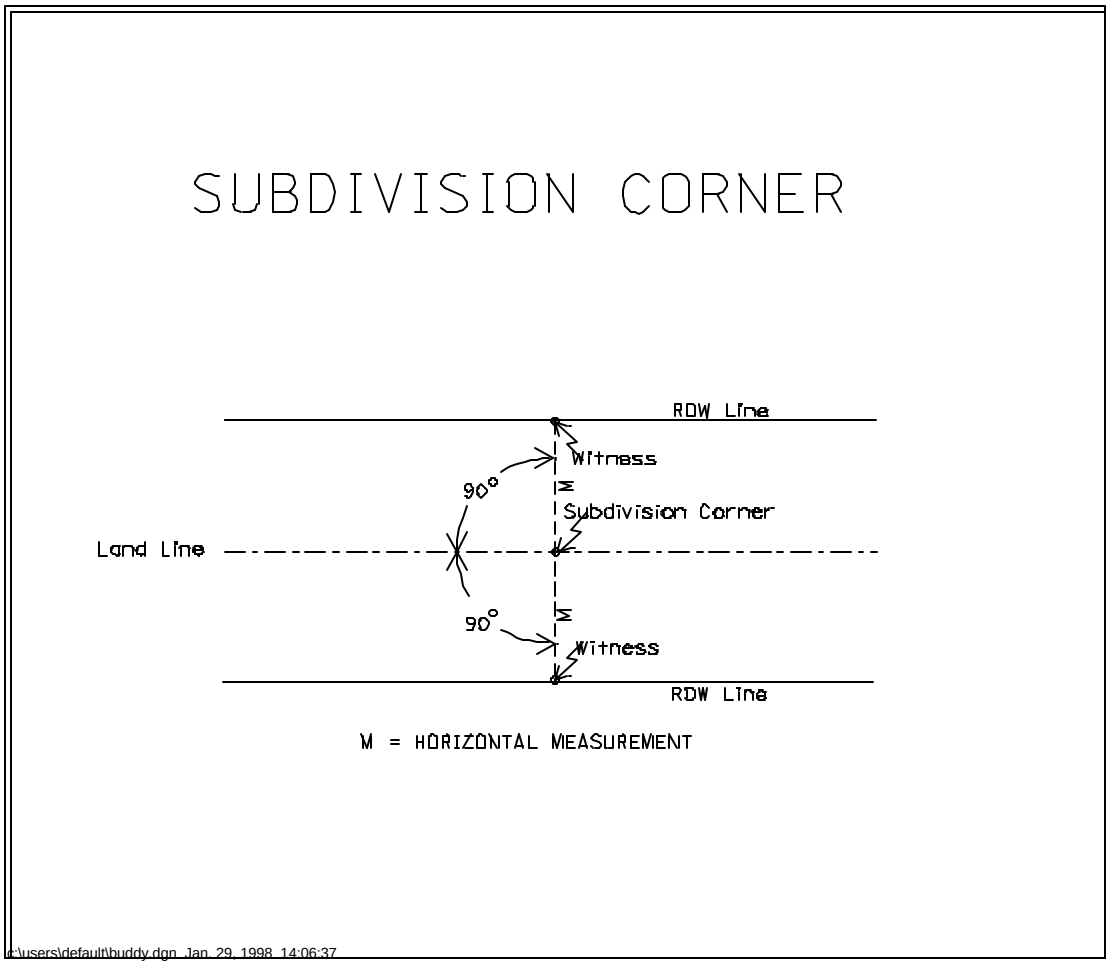
2. Permanent corner markers set by a registered land surveyor shall be ½ inch (12.5 mm) or ¾ inch (19 mm) round steel bars at least 2 ft (600 mm) in length. If monuments are set below paved surface, a hole will be dug each time a corner is needed. Angle irons are also suitable. They shall be driven plumb to an elevation 6 inches (150 mm) below the road or ground surface. Corner markers in bituminous pavement shall be driven to an elevation approximately 2 inches (50 mm) below the surface and any depression filled with bituminous material.

3. Corner locations covered by concrete pavement shall be preserved by taking a core and setting the marker in the core hole flush with the surface of the pavement. The hole in the pavement shall be filled with concrete in the same manner as other cores.

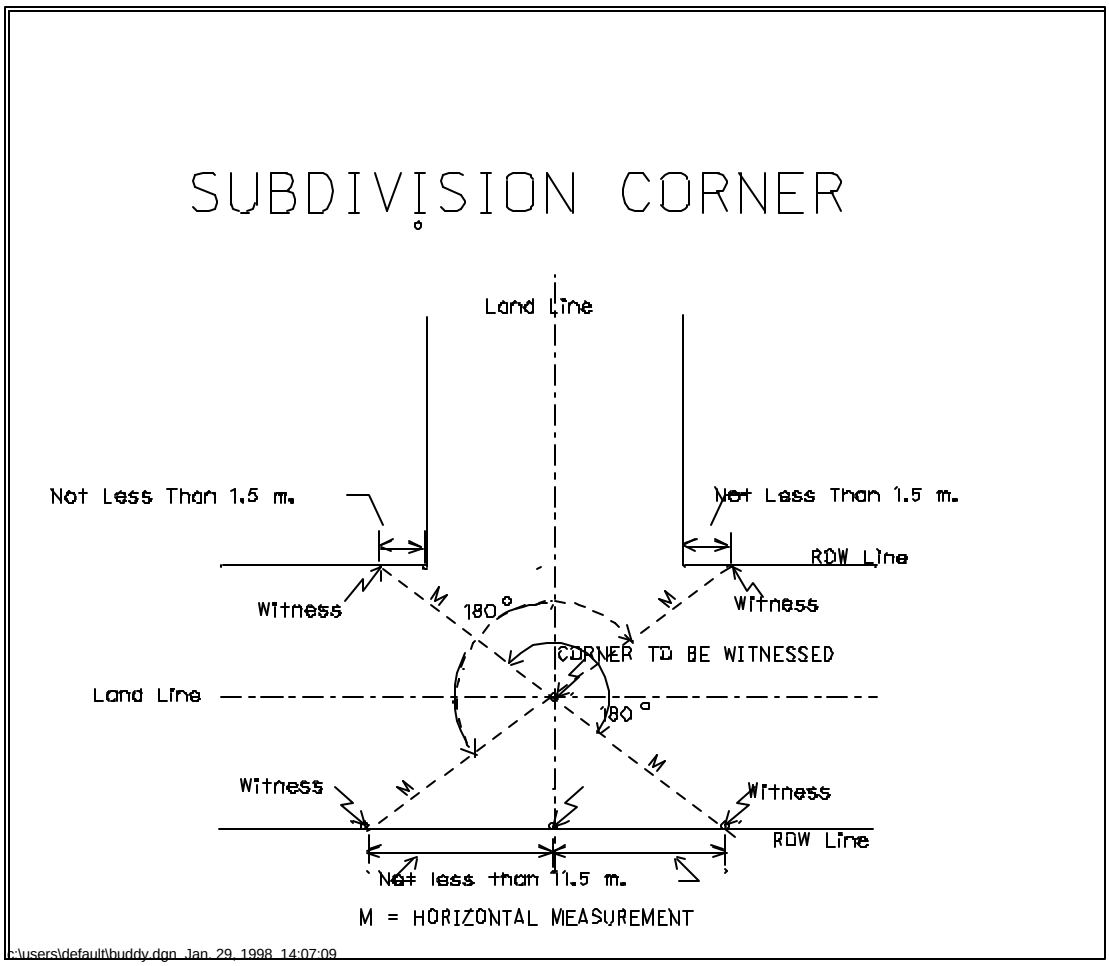
Q. Setting Witness Corners

1. Permanent witness corners to be set by the Project Manager shall be steel bars, angle irons or old grader blades. Steel bars and angle irons shall be driven flush with the ground surface and marked with an oak guide stake. Grader blades shall be approximately 4 ft (1.2 m) in length and set with 2 ft (0.6 m) of the blade below the ground surface. Witness points shall be set with a transit over the corner to be witnessed. The horizontal distance between the corner marker and the witness shall be measured and recorded. If right-of-way markers are in place, they may be used as witness corners and the section corner tied to the near corner of the right-of-way marker.

2. Four witnesses shall be set for each section corner and for each subdivision corner located at an intersection of the project and other roads or streets. They shall be set on the Department right-of-way line not less than 5 ft (1.5 m), back of the right-of-way lines of the intersecting roads or streets. Witnesses for section corners not located at an intersection of the project with another road or street shall be set on the Department right-of-way lines not less than 38 ft (11.6 m) (if possible) from the intersecting landline.



3. Two witnesses shall be set for each subdivision corner, except those located at an intersection with another road or street. They shall be set on the Department right-of-way lines at right angles to the land.



4. A “Section Corner Tie Sheet” DR-70 shall be prepared for each corner perpetuated by the Project Manager. Three copies shall be submitted to the Deputy State Surveyor by the Deputy State Surveyor employed by this Department. The Deputy State Surveyor shall forward one of these copies to the State Surveyor, and forward one to the county for their records. Signatures and addresses of two local residents observing the perpetuation of the corner markers and establishment of witnesses should be secured as witnesses. In the event local residents are not present, signatures and permanent addresses of other members of the party shall be secured as witnesses.

R. Installation Of Right-Of-Way Markers

The Department's right-of-way marker is international orange reinforced concrete block. See *SSHC Section 913.*

S. Location Of Markers

1. Right-of-way markers shall be set accurately on the following points:

   - At each break in the right-of-way line.
   - At apparent intersections of railroad or county right-of-way line.
   - At beginning and end of each curve plus intermediate points on long curves where necessary
   - At apparent intersection of government land lines.
   - At apparent intersection of street right-of-way lines.
   - At lot line intersections if lot corner was in place prior to construction.
   - Refer to Table 1300.4 for stake placement intervals.

2. Block corners at city street intersections must be referenced out if available. This will simplify setting a pin on the apparent intersecting street right-of-way line and projecting the new right-of-way line from street to street for proper location of sidewalks or retaining walls.

T. Benchmarks

1. During construction of a highway project, many benchmarks may be destroyed and alternate ones must be selected for future use. A permanent benchmark should be established at approximately ½ mile (0.8 km) intervals along the highway route in rural areas. Bridge abutments are good locations for permanent benchmarks. Headwalls of culverts have also been a favorite place for benchmark locations, but a certain amount of settlement may take place during the first year in a new culvert and may result in erroneous benchmark elevations. Best results can usually be obtained by establishing a benchmark circuit after initial settlement has been completed, normally one year after construction. After elevations are established on the new benchmarks, a DR Form 70 should be completed and filed with the survey coordinator or the District office.

2. Utility poles, fence posts, ends of drainage pipes, and railroad rails should all be avoided since these objects tend to be disturbed by frost, wind, and farming operations. Casting of a permanent concrete monument within the right-of-way appears to be the best solution in the absence of some other stable, permanent object.

3. Establishment of permanent benchmarks should be considered near the end of every major grading and paving project. Monument location should be at the direction of the Project Manager. Occasionally, the Project Manager will have cast-in-place concrete monuments placed by contractor and paid by extra work order. Standard brass shall be provided by the Project Manager to be set in plastic concrete.

4. Locations for permanent benchmarks in urban areas include fire hydrants, concrete sign bases, and other permanent objects. Interval of benchmarks should be established at about one per city block.

U. Permanent Benchmarks Along Rural Highways

1. Permanent cast-in-place concrete benchmarks should be constructed using the following guidelines. These should be considered minimum dimensions:

   - Excavate a 1 ft (300 mm) diameter hole 5 ft (1.5 m) deep.
   - Insert a #6 English (#20 metric) size diameter reinforcing bar in the center of the excavation.
   - Place concrete around reinforcing bar to a depth of approximately 2 inches (50 mm) below ground elevation.
   - Finish concrete so surface is slightly rounded.
   - Insert a brass cap in center of plastic concrete.

2. Monument shall be tied to construction centerline by station and distance and recorded on “as built” plans.

3. The DR Form 70 is required to report and describe all permanent benchmarks on any construction project. “Bridge Plans” include details for placing benchmarks, (brass caps), at bridge ends. (A district file with copies of these forms is recommended.)

4. All permanent benchmarks must be tied into the highway reference system and this information included on DR Form 70.

5. The benchmark’s DR Form 70 shall be sent to:

   Nebraska Department of Roads
   Roadway Design Division
   Mr. Ken Hartwig, Preliminary Surveys
   P.O. Box 94759
   Lincoln, Nebraska 68509-4759

6. A district file of copies of these forms is also recommended.

7. A computer file of these permanent benchmarks will be maintained and the highway reference post system will be used to identify the benchmarks.

1300.04 TAKING PRECONSTRUCTION CROSS SECTIONS

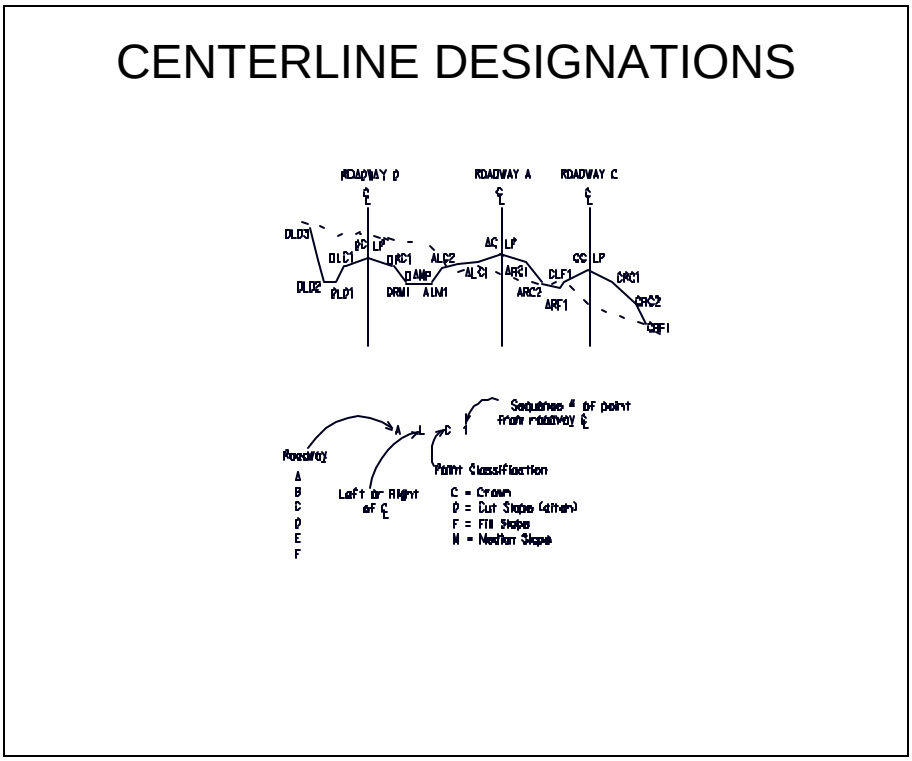
A. Preliminary Survey Requirements: The designer and the District will work together to determine the "Preliminary Survey Requirements". The requirements can vary for each project.

B. Preliminary Survey with Data Collector/GeoPak – When the preliminary survey is put in a "Husky" or some other Data Collector and loaded in **GeoPak**, then preconstruction cross sections can be taken mathematically at any plane.

C. Preconstruction Cross Sections. The preconstruction cross sections will, in most cases, consist of additional and extended sections omitted from the preliminary survey. Cross sections must be taken wherever necessary to show the true excavation quality. Some of these points will include:

1. Zero sections between cut and fill.
2. P.C. and P.T. (T.S. and S.T.) of horizontal curves.
3. Points where width of side ditch and borrow changes.
4. Points where backslope changes.
5. Points where width of roadway changes in cut section.
6. Beginning and end of side borrow pits.
7. Extending preliminary cross sections where necessary.

D. Cross Section Accuracy. Cross sections shall be taken accurately, at right angles to the centerline, at known locations so that final cross sections may be taken at the same stations. Each section shall be an accurate profile of the ground at that location. The rod shall be held vertically and the tape shall be read to the nearest 1 ft (300 mm) from the centerline of the project. The rod shall be read to the nearest 1/10 foot (30 mm). All sections shall be taken both left and right of centerline and shall extend at least 10 ft (3 m) beyond the construction limits.



E. Preliminary Cross Sections Used to Compute Final Quantities. When final quantities are to be computed in the field office and the preliminary cross sections are to be used as the preconstruction sections, the Project Manager should request the plotted cross sections by letter to the Construction Division. These cross sections should then be carefully checked to determine that they are of sufficient width to cover the construction limits. Preliminary cross sections are sometimes extended arbitrarily beyond the actual cross section limits when the project is designed in the Lincoln Office.

F. Intersections. The Project Manager should take preconstruction cross sections on intersections occurring in excavation sections. These cross sections shall be taken at right angles to the intersecting road and may begin at the centerline of the project or at the right-way-way line. In either case, they should “close” on a cross section taken at right angles to the centerline of the project on each side of the intersecting road. The notes should include a complete sketch showing the following:

1. The station of the intersecting road or approach road.

2. The location of the cross sections.

3. Ties to the project centerline and to the approach road line extended.

4. Angle of intersection.

5. North point.

6. Station or plus of project cross sections on which intersecting road cross sections are to “close”.

G. Other Excavation Areas – Channel changes and borrow pits that are not parallel to the centerline of the project shall be cross sectioned separately and tied to the project centerline in a manner similar to that described for intersections. Waste banks shall be cross sectioned if overhaul is involved. They shall be tied to the project centerline and haul routes shown.

H. Cross Section Notes. Notes on intersections, channels, approaches, etc., are usually kept in a separate notebook. Cross section notes should be kept in a manner similar to the example in Division III. Do not crowd the notes.

1300.05 FINAL CROSS SECTIONS AND FINAL QUANTITIES

A. General

As a general rule, final cross sections are not required as long as the contractor has not disputed the plan quantities and any correction made during construction and agreed to accept the plan quantity as the final pay quantity.

B. Final Cross Section Guidance

When final cross sections must be taken, the following is provided as guidance:

1. Final cross sections may be taken on each 1 mile (1.7 km) as soon as the grading work on that 1 mile (1.7 km) section has been completed and accepted. Final cross sections may be taken while awaiting acceptance if the Project Manager is sure there will be no further work which might change the elevation of any excavation cross section.

2. Final cross sections must be taken at all points where a preconstruction or preliminary cross section was taken, if excavation was made at that point. If it develops that a final cross section must be taken at some plus station which has no preconstruction cross section, a preconstuction section must be interpolated at that point. The final cross section should extend well beyond the construction limits [5 to 10 ft (1.5 to 3 m)]. A rod reading should always be taken on the first definite “natural ground” and this information recorded in the notebook. In addition the surveyor must locate all breaks in each cross section and the maximum distance between shots in each cross section is 20-feet.

3. The excavation involved in undercutting slopes, ditches, borrow pits and shoulders in preparing such areas for the placement of topsoil is not measured for payment and final cross sections shall be taken after the topsoil has been placed.

4. The Project Manager must clearly separate each borrow pit quantity from one another. If the borrow pit is adjacent to the roadway excavation, the final cross section notes must include a rod reading at the R.O.W. line (shear section) and cross sections for the adjacent borrow pit must be separate from the roadway cross sections and computed separately.

5. The option pit block on the plans should be stamped participating and at the end of the detailed estimate breakdown of costs for each such borrow pit will appear. The borrow material costs will be computed in the Lincoln Office. These instructions are in addition to those required in Subsection 109.11, Paragraph V. of this manual.

6. On normal grading contracts, in which no changes in plans are made which would involve overhaul, final cross sections will not be taken for sections which include embankment only. However, when taking the final cross sections for excavation, centerline and shoulder shots should be taken on the embankment at each full station. At locations involving excavation only, or excavation and embankment in the same location, final cross sections shall be taken as necessary to include the excavation.

7. On linear grading contracts where the plans show a grade line elevation (not county agreement projects), the Project Manager shall take a final cross section at each station consisting of shots on centerline and each shoulder of the finished roadway. This may be done at the time the final check is made on the roadway surface to see that it meets the tolerance set forth in the specifications and/or special provisions, and should be submitted as part of the final records. On projects constructed under agreement by county forces, sufficient checks should be made of the finished grade to substantiate conformance with plans, specifications and special provisions.

8. Preconstruction surveys for rebalancing, or additional preconstruction cross sections might be necessary to determine pay quantities. Changes in plan or grade line which might involve overhaul cannot be anticipated during design or at the start of work. It is essential that preconstruction information be complete, so that if necessary, the final cross sections may be adjusted to reflect the existing ground elevations at the start of the project if different from the original preliminary cross sections.

9. When changes in plans involve overhaul, the final cross sections must include all embankment as well as excavation for the balance that the overhaul has occurred in. See Subsection 105.07 of this manual for additional instructions.

C. Earthwork Calculations

1. The final earthwork quantities on all in-house projects can be computed/verified via Microsoft/GeoPak. The Finals Section of the Construction Division can assist with or perform these calculations. However, the specific quantities and their location are necessary to verify or calculate quantities. There are two basic ways that projects are surveyed currently:

   - Total Stationing
   - Conventional Surveying

   The Construction Division will convert conventional data to a Microsoft/GeoPak file to accomplish any quantity calculations. The following are required when requesting convention survey verification of quantities:

   a. Final cross section notes

   b H.I. data

c. Curve data

d. Surfacing data

e. Preconstruction cross section notes

f. Zero-zero sections

g. Interpolated cross sections

h. Width of preconstruction (preliminary) cross sections

i. Preparation and submittal of records

2. Field Notebooks

a. Final Cross Section Notes – A special effort should be made to keep the notes clear and legible. Do not crowd the notes. Not more than four single line cross sections should be recorded on each page of a 4½ x 7½ inch (115 x 190 mm) field book. It is suggested that a 3H pencil be used in taking notes.

b. Notes should be recorded with the stationing reading from the bottom of the page to the top. If there is insufficient room for all readings on one line, the readings should be completed on the next line. The station of each line shall be shown. All shots must be recorded on the proper side of the centerline. See Division III of this manual for example.

c. Rod readings shall be expressed in ± 1/10 foot (30 mm) on dirt. Surfacing shots will be expressed in 1/100 foot (3 mm). Use a slightly elevated decimal figure in lieu of a decimal point. All plus rod readings shall be indicated by a plus symbol (+) preceding the reading. Horizontal distances shall be recorded to the nearest 1 ft (300 mm).

d. A cross section shall be taken at all equations.

e. Final roadway cross sections may originate on either the right or left side of centerline of the project. The cross section must have a centerline (zero distance) rod reading. This also applies to borrow pits or channels cross sectioned from a base (zero distance) line.

f. When it becomes necessary to take the final cross sections after completion of the surfacing work, sufficient room shall be left by the note recorder for inserting calculated rod readings. These rod readings will reflect the elevation of the typical grading section shoulder-subgrade point.

g. Don't use any harder pencil than 3H. When the final earthwork computation listing sheet is returned to the field, the correction notes are to be reviewed thoroughly. All notes indicating further action are to be addressed at the field office.

h. H.I. Data – The H.I. shall be shown on each page of notes near the location of the centerline shots. When one cross section has been taken from two or more H.I.'s, the portion of the section represented by each H.I. shall be clearly indicated.

i. The Project Manager shall check the reduction of all H.I.'s with care. It is essential that the following details be recorded:

(1) Six digits in the elevation shall be recorded for each H.I. entered in the notes such as 1225.75 or 0925.87.

(2) If a correction in levels is made when "checking in " or turning on a benchmark, the correction shall be shown in the notes in the following manner.

+5.20 0930.00 Correct to - B.M. Elev. 0924.80
^

-1.00 0924.75

0925.75
^

3. Curve Data – In order to permit the computation of corrections for curvature electronically, it is essential for a cross section to be taken at each P.C. and P.T., for each P.C. and P.T. to be properly identified and the degree of curvature to be shown in the notes for all simple curves. The direction of the curve shall be shown as right or left. The degree of the curve shall be recorded to the nearest hundredth of a degree (not degrees and minutes). The following example shows the proper method of recording information for a 2º25' simple curve to the left.

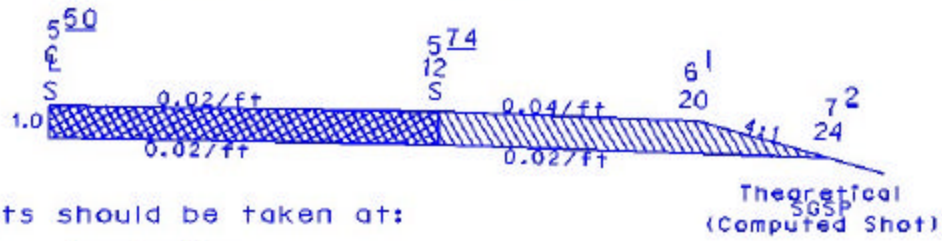
125 + 16.21 P.C. 2° 25'12" Curve Left	10^2	10^6	11^3
	75	60	53
	OG	**OG**	

The correction for a spiral curve is applied near the mid-points of the spiral curvature. Accordingly, the cross section nearest the mid-points of spiral curvature for curves with spiral easements shall be designated by the Project Manager as the point to begin the curve correction.

D. Surfacing Data

1. Portland Cement Concrete Pavement – The Project Manager should take complete final cross sections after grading is complete prior to performing any surfacing structure work. If cross sections are taken after the surfacing is complete, the following three examples show where rod readings must be taken to reflect the excavation due the contractor in each instance. The letter “S” which indicates surfacing shall be placed under rod readings as shown in the examples. If pavement thickness, foundation course and surfaced shoulders are constructed other than as shown on the typical cross section of improvement sheet of the plans or the station limits are changed from those shown on this plan sheet, this information shall be shown in the notebook and also in the letter of transmittal.

Sufacing w/ Earth Shoulder
English
Concrete Pavement



Shots should be taken at:

- Centerline
- Edge of driving surfaces or at lane breaks for multiple lane roadways
- Edge of surfaced shoulders
- Hinge points
- All ground breaks - not to exceed 20' between shots

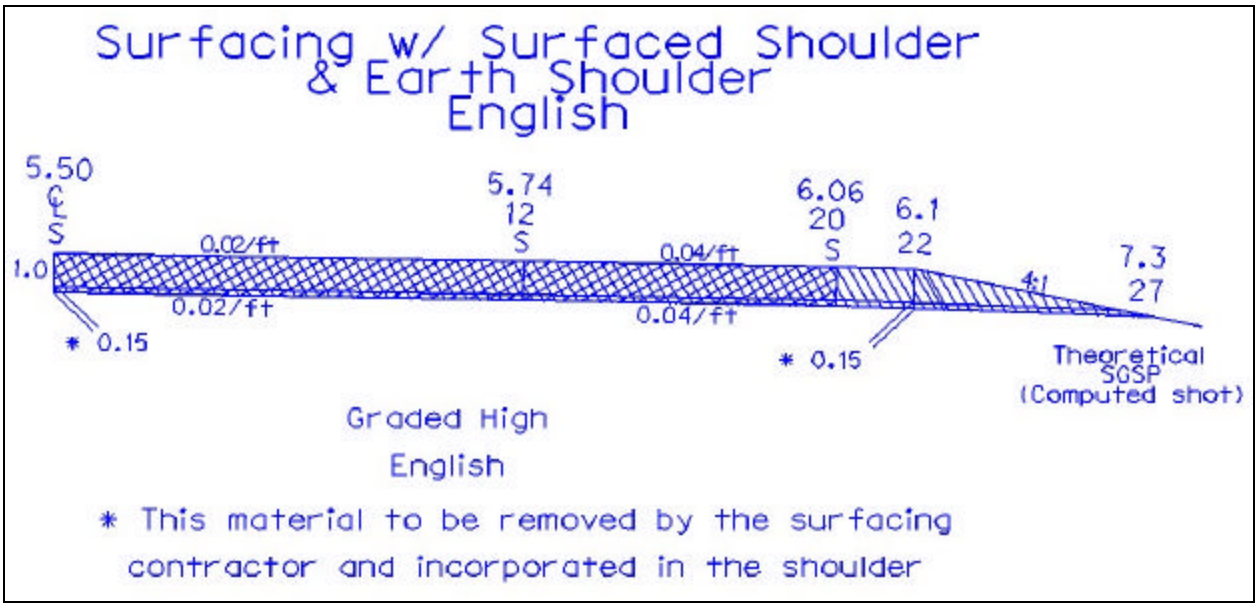
Theoretical Subgrade Shoulder Point (SGSP) should be computed and inserted into the x-section.

English

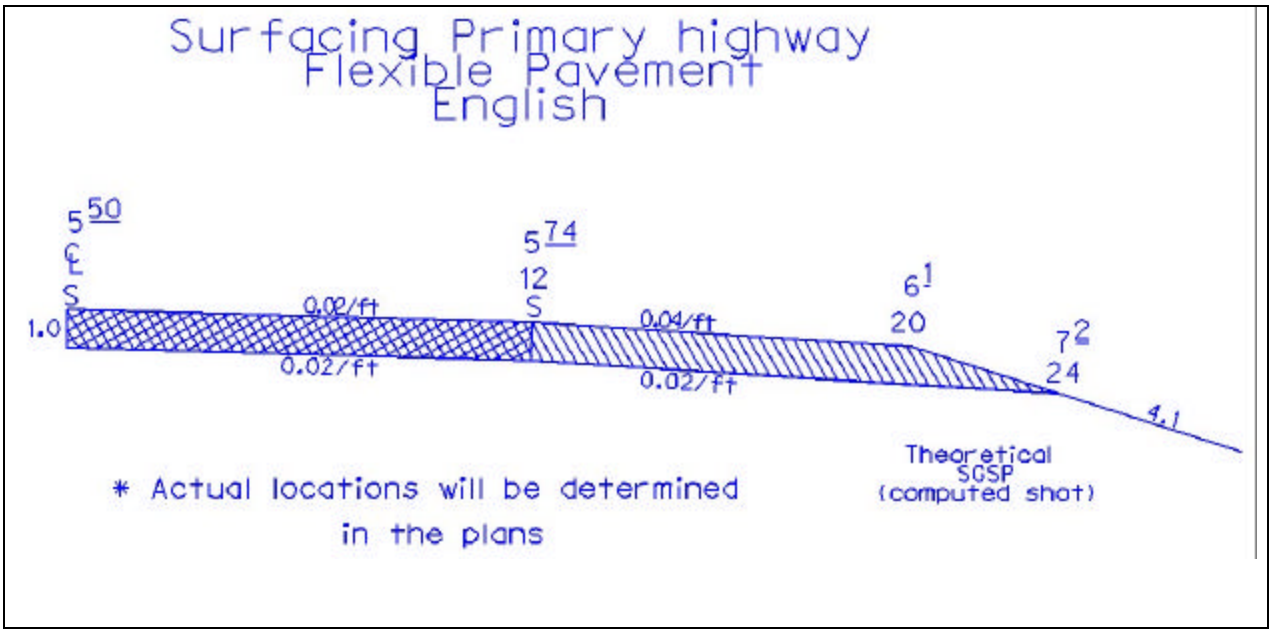
- Surfacing shots read to the nearest hunredth of a foot.
- Ground shots read to the nearest tenth of a foot.

Metric

- Surfacing shots read to the nearest thousandth of a meter.
- Ground shots read to the nearest hundredth of a meter.



2. Flexible Pavements (Asphaltic Concrete, Bituminous, and Base and Armour Coat Surface Courses) – The Project Manager should take complete final cross sections after grading is complete prior to surfacing and shoulder construction. When cross sections are taken after the surfacing is complete, all rod readings taken on the surfacing shall be identified with the letter “S” (indicating surfacing) under the distance. If the surface structure is constructed other than as shown on the typical cross section of the improvement sheet of the plans or the station limits are changed from those shown on this plan sheet, this information shall be shown in the notebook and also in the letter of transmittal. The following sketch shows the rod readings and distances required on the roadway for a 7.3 m (24 ft) asphaltic surface course constructed directly on the subgrade.



3. Any rod readings, other than those shown in the above sketch, necessary to show additional excavation required to be made in constructing variable width surfacing shall be taken, recorded and identified by the letter “s” under the rod reading. One such case would be at channelized intersections.

4. Rod readings beyond the shoulder will not be necessary in embankment sections unless the elevation of the subgrade is below the grade line of the existing embankment prior to grading (locations where the old embankment is lowered or cored out to place a subbase or base course) or it is necessary to accurately determine the quantity of embankment in order to compute overhaul.

5. The Project Manager will be responsible for inserting the shoulder rod readings into the final cross sections.

6. Two (2) methods will be used to determine the shoulder point:

   a. Slope Stake Data (preferred)

   b. Theoretical Shoulder Point

   (The Project Manager will state, in the transmittal letter, what method(s) was used and where.)

E. Shoulder Construction

1. On both rigid and flexible pavements, the quantity of material required for the earth portion of the shoulder construction will usually be either subsidiary to the subgrade preparation work or measured for payment as “Shoulder Construction”. Accordingly, the excavation for the shouldering material is not a pay item. The Project Manager should take complete final cross sections after grading is complete and prior to surfacing and shoulder construction. If final cross sections cannot be taken until shouldering is complete, the quantity of excavation for shoulders should be deducted from the excavation pay quantity. If possible, this deduction should be computed by cross section method of material at the source. When it is not possible to cross section the material at the source, the volume may be computed by using the typical section for shouldering and multiplying by a balance factor of 1.35. If the typical cross section provided for the subgrade to be graded “high” and the material trimmed is to provide the shoulder material, no deduction is required.

2. Topsoil Placement – When the plans provide for topsoil placement as a part of the grading construction, final cross sections should be taken after the topsoil has been placed. This is in accordance with Subsection 929.04 of the specifications which provides no payment for undercutting the topsoil placement.

F. Preconstruction Cross Section Notes

Where preconstruction cross section notes are taken to supplement or replace preliminary cross sections, this fact shall be noted in the letter of transmittal. Give the book and page number location of such notes. The letter of transmittal shall also contain the book and page number location of all extensions to preconstruction and preliminary cross sections.

G. Zero-Zero Sections

The location of zero areas for cut may be shown in the notes without taking a final cross section when there is no cut whatever at the location. Examples: (1) Cut on Lt., C=00 Rt. take final cross section of Lt. (2) Cut on Rt., C=00 Lt. take final cross section on Rt. (3) No Cut Rt. or Lt., C=00 Rt. or Lt., no final cross section is necessary.

H. Interpolated Cross Sections

Final cross sections for which a preliminary or preconstruction cross section is not included in the original notes shall be identified by a note in the final cross section book giving the location in the records where the interpolated cross section may be found. The necessary interpolation shall be made by the Project Manager before submitting the note to the Lincoln Office and shall consist of elevations and distances.

I. Width Of Preliminary And Preconstruction Cross Sections

The Project Manager shall check the preliminary cross section notes, the “Slope Stake Book” and his/her own preconstruction cross section notes to determine whether in all instances these cross sections extend at least as far from centerline as the final cross sections he/she has taken at the same locations. In instances where the preliminary or preconstruction cross sections are not as wide as the final cross section, it will be necessary to extend the preliminary cross section using other available information. This will usually consist of reference hub elevations, slope stake elevations, or as a last resort, the final cross section elevation. The data on which the closure is based shall be entered in the final notes on the left-hand page opposite the inadequate cross section.

J. Example Of Note. The note should show the elevation and the distance from centerline of the point to be used to extend the preliminary (preconstruction) cross section and the manner in which it was established as shown in the following example.

17 Extd. Prelim. to El. 55.6 @ 90 m Lt. S.S. Bk. No. 4
+50 Extd. Prelim. to El. 55.0 @ 90 m Lt. Final Elev.
16 Extd. Prelim. to El. 54.4 @ 100 m Lt. S.S. Bk. No. 4

K. Extension Made Without Note. When no preliminary cross section extension note is given by the Project Manager, the extension will be made by using the last final shot as the last preliminary elevation and distance.

L. Preparation And Submittal of Records

The elevations of all H.I.’s should be reduced and carefully checked to insure their accuracy.

1. The notes should not be reduced to show the elevations of the individual shots on the cross sections except where necessary to check closing shots.

2. The closing shots of all final cross sections in excavated areas shall be checked in the field office to verify closure with the preliminary survey. Cross sections normally will be closed on undisturbed ground. However, this ground often is a plowed field where 6-inch elevation differences are to be expected. Therefore the Department’s tolerance on all cross section closures at or near the limits of construction shall be ± 6 inch (150 mm). Cross sections which do not close within these limits shall be field checked or explained by an entry in the final notes. If an error in the preliminary can be substantiated, for example, with slope stake elevations, then an entry correcting the preliminary cross section elevations should be placed in the final notes.

3. Notebooks shall be given a permanent number and completely indexed in the front to show the location of all data included therein. The project number and the name and address of the Project Manager shall be entered on the inside of the front cover.

4. Final cross section notebooks shall be prepared in accordance with these instructions and submitted to the Construction Division. Projects up to approximately 10 km long shall be submitted in their entirety. Projects over 10 km may be submitted in two sections if this will speed up the processing of the final records. If the preliminary notes are at the field office, those stations covered by the final cross sections being submitted shall also be sent to the Construction Division. Final notebooks will not be returned to the field unless specifically requested by the Project Manager. The data submitted to the Construction Division shall be addressed as follows:

Department of Roads
Construction Division – Finals Section
1500 Hwy 2
P.O. Box 94759
Lincoln, Nebraska 68509-4759

M. Plotting Cross Sections

1. Microstation/GeoPak may be used in lieu of hand calculations.

2. Final cross sections need to be plotted only on those projects not designed under the computer program or those portions of projects (channels, borrow pits, intersections, etc.) which are being computed in the field office.

3. For those projects computed in the field office, after checking all H.I.'s, the preconstruction and final cross section notes are reduced and checked. The points are then accurately plotted on cross section paper using a scale of 1 inch=5 ft (25 mm equals 1.5 m) vertically and 5 ft (1.5 m) horizontally, or 5 ft (1.5 m) vertically and 10 ft (3.0 m) horizontally. All plotting should be checked by reading the elevations and distances back form the cross section sheets. Preconstruction cross sections shall not be inked.

4. The final cross sections for excavation only are plotted over the preliminary or the preconstruction cross sections using the same coordinates and drawing in the final with a dashed line.

1300.06 CONTRACTOR FURNISHED CONSTRUCTION SURVEY

A. Construction Staking And Surveying As Contract Item. On projects with "Construction Staking and Surveying" included as a contract item, the contractor is responsible for construction staking. The prime contractor may subcontract this item.

B. Additional Survey Work Payment. Additional survey work required because of plan revisions or changes directed by Project Manager shall be paid for as extra work according to *SSHC Subsection 109.05* or be done by the Department.

C. Contractor's Responsibilities Include:

- The Contractor's Surveyor must comply with the minimum requirements in Tables 1300.1 through 1300.5 and all other surveying requirements in this manual.
- Provide survey data in a format that is compatible with GeoPak.
- Stake right-of-way, temporary easements, and right-of-entry reference.
- Preserve and reestablish all centerline control points-point of curve (PC), point of tangent (PT), point of intersection (PI), and point on tangent (POT); and all spirial points (TS, SC, CS, and ST).
- Establish relocation centerline and related points, including extensions of cross sections, if not established in field by time of advertising for bids.
- Staking culverts, bridges, sewers and all other structures and pavement requirements.
- Perform a level circuit to check benchmarks prior to start of construction. Report the results of this survey to the PM immediately upon completion.
- Stake right-of-way break points.
- Establish permanent benchmarks and permanent ties to all required points. A copy of all ties must be provided to the Project Manager.
- Reestablish land corners and section corners. If this is pay item in the contract then this is a contractor requirement.
  - Section corners are usually reestablished by the county.
  - In rural areas the property corners are usually <u>not</u> reestablished by a registered land surveyor.
  - In urban areas property corners are reestablished by a registered land surveyor and this is a separate pay item.

D. Department Responsibilities:

- Take elevation reading of settlement plates.
- Perform work identified in the special provisions of the contract.

E. Special Attention Items

1. The Project Manager should be notified and/or consulted for guidance if the following conditions occur:

    - Proposed culvert is staked and its location does not fit existing ground elevations.
    - Conflicting conditions occur such as existing water line located at same location as the proposed sewer line.
    - Farm subdrains are present. Contractor will determine their location, size, and elevation. The Project Manager will establish final size, location, and elevation for construction of tile line to be staked by the contractor.
    - Slope stakes do not match design cross section.

F. Documentation

1. Field notes are to be kept in the bound field books. After project completion, field books become the property of the Department.

G. Contract Administration

1. By Specification, “construction survey” is identified as a “specialty item.”
2. “Construction survey” is considered a professional service, therefore Davis-Bacon requirements do <u>not</u> apply.
3. If survey work is performed by someone other than the contractor, a “Subcontract Request and Approval” form shall be submitted. All requirements of subcontractors are to be fulfilled with the exception of Davis-Bacon requirements.

1300.07 ENGINEERING EQUIPMENT, SUPPLIES AND SERVICES

A. General

Engineering equipment and supplies are a significant annual expenditure of the Department of Roads. It is Department policy to maintain equipment in reliable condition, supplies in adequate amounts, and that expenditures be controlled. All employees are expected to support this policy.

B. Responsibility

1. The employee is charged with full responsibility for the care of all equipment issued to him/her. The employee should instruct assistants in the proper care and handling of all equipment, particularly the more delicate equipment such as transits, levels, balances, etc. When accepting responsibility for an instrument, whether new or old, the person should inspect it carefully and make sure that it is in good conditions and complete when received. When returning an instrument, all missing or damaged parts should be reported.

2. The employee is held directly responsible for the loss or damage of equipment in his/her charge caused by negligence or carelessness and may be required to pay for repair or replacement of this equipment. Equipment when not in use should be stored in a place where it is secure from damage or loss. When equipment is left in an unattended automobile, the vehicle should be locked to prevent theft or damage.

C. Engineering, Surveying And Testing Equipment

A supply of this equipment is maintained at Logistics. Equipment will be issued directly to the employee as ordered and approved by the District Engineer or Division Head. Equipment which is no longer needed should be returned to Logistics.

D. Requisition And Transfer

1. The following example cases are given to explain the procedures to be followed. If your question is not answered, contact the Logistics Division.

Case I - Requests for Engineering, Surveying and Testing Equipment listed in the Department's Statewide Inventory System (SWIS) and included in the Supply Catalog in Class 59, are non-stocked items and must be budgeted by districts and purchased by the Logistics Division, Engineering Equipment Section.

Case II - Requests for Engineering, Surveying and Testing Equipment not listed on the Department's SWIS and included in the Supply Catalog in classes other than Class 59 will be ordered on a DR Form 146, Stock Requisition. Equipment not included in the Supply Catalog will be purchased on a DR Form 151, Purchase Order. It will be coded in the District/Division ONE and Activity 5099.

Case III – Material Sampling and Other Miscellaneous Supplies, sacks, cans, molds, lath, stakes, nails, field books, cloth, etc. included in the Supply Catalog will require a DR Form 146, Stock Requisition. Items not included in the Supply Catalog will require a DR Form 151, Purchase Order. These are "direct purchase" items and are to be charged to specific projects. "O" for participating, "I" for nonparticipating, the OE code for your District/Division and the appropriate activity (Constructing, Design, etc.).

Case IV – Office Supplies, Safety Gear and Medical Supplies included in the Supply Catalog will require a DR Form 146, Stock Requisition. Items not included in the Supply Catalog will require a DR Form 151, Purchase Order. These items are not "direct purchase" items and are to be charged to OE code for your District/Division and Activity 5099. Safety equipment is coded to AFE Y500.

Case V- Transfers of Engineering, Surveying and Testing Equipment listed on the Department's SWIS between Divisions, Districts or returned to Logistics will be documented on DR Form 332, Furniture and Equipment Issue/Transfer. A DR Form 332 must accompany the equipment transferred. Logistics Division will always receive the original. The transferee, transferor and the Districts or Divisions will all receive copies. The transferee is responsible for submitting this form.

Case VI – Transfer of Engineering, Surveying and Testing Equipment not listed on the Department's SWIS and in classes other than 59 to Logistics will require a DR Form 147 for cataloged equipment and a DR Form 147a for non-cataloged equipment. A copy of the form will accompany the equipment. OE code for your District/Division and Activity 5099 will be used.

2. All forms except the copies required to accompany the equipment will be routed through the District/Division Office and then to the Logistics Division.

E. Precautions And Maintenance Of Survey Equipment

1. Total Stations (Precautions)

a. Never place the Total Stations directly on the ground. Avoid damaging the tripod head and centering screw with sand or dust.

b. Do not aim the telescope at the sun. Avoid damaging the LED of the EDM.

c. Protect the Total Stations with an umbrella against direct sunlight, precipitation, and humidity.

d. Never carry the Total Station on the tripod to another site.

e. Handle the Total Stations with care. Avoid heavy shocks or vibration.

f. Always switch the power off before removing the standard battery.

g. Remove the standard battery from the Total Station before putting it in the case.

h. When the Total Station is placed in the carrying case, follow the layout plan.

i. Make sure that the Total Stations and the protective lining of the carrying case are dry before closing the case. The case is hermetically sealed and if moisture is trapped inside, damage to the instrument could occur.

j. Someone should always be near the instruments when it is set up in the roadway or in any other location where it may be disturbed.

F. Total Stations (Maintenance)

1. Wipe off moisture completely if the instrument gets wet during survey work.

2. Always clean the instrument before returning it to the case. The lens requires special care. Dust it off with the lens brush first, to remove minute particles. Then after providing a little condensation by breathing on this, wipe it with a soft clean cloth or lens tissue.

3. Do not wipe the displays and keyboard or carrying case with an organic solvent.

4. Store Total Stations in a dry room where the temperature remains fairly constant.

5. If the battery is discharged excessively, its life may be shortened. If it is stored, it should have somewhat of a charge in it.

6. Check the tripod for loose fit and loose screws.

7. When removing the Total Stations from the carrying case, never pull it out by force. The empty carrying case should be closed to protect it from moisture.

8. Check the Total Stations for proper adjustment periodically to maintain the instrument accuracy.

G. Electronic Digital Theodolite/Transit (Precautions)

1. When the theodolite/transit is not used for a long time, check it at least once every three months.

2. Handle the theodolite/transit with care. Avoid heavy shocks or vibration.

3. If any problems are found with the rotatable portion, screws or optical parts (e.g., lens) send it in to the Engineering Equipment Shop.

4. After removing the theodolite/transit from the carrying case, close the case to exclude dust and moisture. Never place the theodolite/transit directly on the ground. (Attached dirt may damage the base plate and centering screw.)

5. Never carry the theodolite/transit on the tripod to another site.

6. Protect the theodolite/transit with an umbrella against strong sunlight and precipitation of any kind.

7. When the operator leaves the theodolite/transit, the vinyl cover should be placed over the instrument.

8. Always switch the power off before removing the internal battery on the theodolite.

9. Make sure the theodolite/transit and the protective lining of the carrying case are dry before closing the case. (The case is hermetically sealed; if moisture is trapped inside, damage to the instrument could occur.)

10. Someone should always be near the instrument when it is set up in the roadway or in any other location where it may be disturbed.

H. Electronic Digital Theodolite/Transit (Maintenance)

1. Wipe off any moisture if the instrument gets wet during operation.

2. Always clean the instrument before returning it to its case. The lens requires special care. Dust it off with the lens brush first, to remove minute particles. Then, after providing a little condensation by breathing on the lens, wipe it with a soft, clean cloth or lens tissue. (Theodolite only) when cleaning the display, keyboard and carrying case, never use any organic solvent (e.g., thinners).

3. Store the instrument in a dry room where the temperature remains fairly constant.

4. Check the tripod for loose fitting and loose screws.

I. Survey Levels (General Precautions)

1. Be sure to carry the instrument to the job site in the plastic case.

2. Handle with care.

3. Do not place the instrument directly on the ground.

4. After taking the instrument and accessories out of the plastic case, be sure to close the case cover to keep out dust and dirt.

5. Use both hands to hold the instrument when carrying it at the job site. Remember that when moving the instrument form one job site to another, it must be removed from the tripod for transporting.

6. If the instrument is left mounted on the tripod for any length of time, cap the objective lens and cover the entire instrument with the vinyl cover.

7. Be careful not to expose the instrument to direct sunlight and precipitation. If it gets wet, wipe it with a dry cloth before putting it back in the plastic case.

8. Store the accessories in the specified places in the case.

9. Use neutral cleanser or water to clean up the plastic case.

10. Someone should always be near the instrument when it is set up in the roadway or in any other location where it may be disturbed.

J. Survey Levels (Maintenance)

1. Moisture affects the surveying instrument. Completely wipe off any moisture if the instrument gets wet during surveying work.

2. After use, clean every part of the instrument before putting it back in the case. Breathe on the lens to moisten them and gently clean then with a lens cloth, a clean cloth (preferable, worn out cotton), or soft tissue paper.

3. The tripod shoes may become loose or the legs may become shaky due to faulty wing nuts when used for a long period. Check them periodically.

4. If foreign matter appears to have entered any movable parts or screws or when condensation or fungi appears on the lens, prisms, etc., in the telescope, put on work order and send in to Engineering Equipment Shop.

5. It is recommended to subject the instrument to annual or semi-annual checking and inspection to maintain the high quality necessary for your surveying work.

K. Adjustment Of Instruments

1. All instruments issued to Project Managers should be in proper adjustment when received from the Lincoln Office. They should, however, be checked for accuracy and necessary adjustments made at regular intervals. Adjustments should be made only by the Project Manager or a qualified member of the party who had been authorized by the Project Manager to perform such work. All adjustments should be carefully made strictly in accordance with methods prescribed in surveying handbooks. Any adjustment which requires dismantling must be made in the Lincoln repair shop.

2. All Total Station adjustments should be made in the Lincoln repair shop.

L. Transporting Equipment

1. Surveying equipment should be loaded into cars or trucks in such a manner as to minimize the possibility of damage. Leveling rods, range poles, etc., are easily damaged by rubbing or scratching against other objects. It is suggested that a holder be installed on the car for each of these articles. Level rods should be kept in a canvas case which may be ordered from Logistics.

2. Transits and levels should be carried in their cases when being transported by car or truck over any appreciable distance. It is good practice to provide a special protected holder within the vehicle for these cases. Instruments may be carried out of case over short distances if carefully held in someone's lap.

3. Equipment shall be placed in or on vehicles in the most "safe" position both for the equipment and for the operator and passengers of the vehicle. Employees are encouraged to conceive safe methods of transporting equipment. Any alterations, etc., to the vehicle must be made only with the approval of the District Mechanic.

M. Damaged Equipment

1. All damaged equipment listed in the Department's Statewide Inventory System missing (lost or stolen) is to be reported on DR Form 159.

2. Damaged equipment, especially surveying instruments, should not be used or motions tested to determine the extent of damage until it has been inspected in the Lincoln repair shop. This precaution is necessary for the reason that all damage to the instrument may not be visible. For example, after an instrument has had a fall, the delicate graduated edges of the plates may be seriously damaged by the slightest movement of the plates.

3. All damaged equipment, together with all worn or broken parts, should be promptly shipped to the Logistics Division for repair. Equipment returned to the Logistics Division for repair, adjustment or exchange must be accompanied by DR Form 124, Shop Work Orders. The action desired must be described on this form. The appropriate OE and Activity Coding shall be shown.

N. Shipping

1. If at any time it becomes necessary to ship an instrument, it should be packed securely in its case and arrangements shall be made through the District Construction Engineer for the transfer of the instrument to Lincoln. Total stations and electronic theodolites should be by truck or car and not be shipped.

2. Other equipment shall be carefully packed in the cases provided for that purpose. If cases are not provided, the equipment should be packed in a box or carton of ample strength for protection during shipment. All equipment should be sent to Lincoln in the same manner as transits and levels.

O. Care of Equipment

1. Cloth tapes, pie-tins and other items of similar nature are considered to be expendable equipment for the reason that they depreciate rather rapidly with normal use. The fact that these items are expendable does not relieve the employees of the responsibility for their proper care and conservation.

2. Rods and range poles shall be carried in protective coverings or in holders which prevent marring and scratching. To avoid breakage, they should never be used for any purpose except that for which they are designed.

3. Chains are easily damages by kinking and by the action of traffic. When practical, a cloth tape should be used instead of a chain, especially if measurements are being made across the line of traffic. When wet or muddy, chains should be cleaned and dried before rolling. They should be cleaned, oiled and inspected occasionally and all kinks removed by hammering on a flat wood surface. Splices are available for use in repairing broken chains.

P. Salvage Of Equipment

1. Marred, broken or worn rods and range poles, badly kinked or broken chains, cut or torn cloth tapes, etc., shall be returned to the Engineering Equipment Repair Section for painting, repair or salvage. Many other items of equipment, usually considered expendable, may often be reconditioned for further use. District Construction Engineers should make periodic checks with Project Managers having such equipment. All broken or salvage equipment should be assembled at the District Headquarters Office and sent to the Engineering Equipment Repair Section using state transportation. The following items of equipment are considered to have salvage value:

Cylinder molds	Paving station numbers
Level rods	Stoves (gasoline and electric)
Range poles	Tapes, 100 ft, 200 ft, 300 ft [30 m, 60m, 90 m] steel
Sieves	Tapes, 50 ft (15 m) filler
	Tapes, 50 ft (15 m) steel, case

2. Also, any other broken or damaged equipment which the Project Manager believes has salvage value.

Q. Supplies

1. The Department policy is to have central procurement of supplies. The Supply Catalog lists the items usually stocked. The Supply Catalog can be accessed via computer terminal. Items not listed in the Supply Catalog may be ordered on DR Form 151, “Purchase Order”. Be sure and list adequate description of the item desired.

2. The Project Manager shall prepare a stock requisition DR Form 146 for such office and field supplies as may be required for a reasonable length of time. Additional stock requisitions may be submitted as field supplies are depleted. The carrying of large quantities of supplies in the field office should be avoided.

R. Stakes

Construction stakes are stored at the Department's supply base in Lincoln. The following types of stakes are available and are listed in the Supply Catalog.

Class	Stock No.	Type	Dimensions	Packaged	General Use
58	85700	"A" Oak	1" x 2" x 18"	50	Reference Stake; Blue Top
58	85705	"A" Oak	1" x 2" x 12"	50	Reference Stake; Blue Top
58	85712	"B" Oak	2" x 2" x 9"	50	Pavement Hub; Location Hub
58	85740	"C" Pine	1" x 2" x 16"	50	Reference Stake; Blue Top
58	85730	"D" Pine	½" x 2" x 16"	100	Lath; reference, guard and ROW stakes
58	85720	"E" Oak	2" x 2" x 20"	25	Reference Hub
58	09700	Lath	½" x 2" x 36"	50	Reference Stake; Lath

S. Local Purchase Of Services

Local services shall be processed for payment by the Project Manager by coding attachments and by indicating his/her approval signing and dating the bill. Coding attachments are DR Form 160 for all services except telephone bills and DR Form 57 for telephone bills. Chapter 4 of the accounting and DOR-1 80-9 should be reviewed.

T. Equipment Inventory

Equipment listed in the Department's Statewide Inventory System will be inventoried when requested by Logistics. The internal control and inventory of equipment not listed will be established by the District/Division.

U. Non-NDOR Equipment Calibration Policy

1. Highway Construction Work

This policy is applicable to all non-NDOR equipment used for the inspection of highway construction work under the jurisdiction of the Nebraska Department of Roads.

a. NDOR will not provide calibration services for consultants, contractors, or other testing firms performing inspection work; however, the calibration must be performed by a commercial laboratory or business.

b. All equipment shall be calibrated at least annually and at any other time when the results of tests are questionable or unreliable. (With the development of Nebraska's Quality Assurance Program for Construction, a set calibration schedule will be implemented for the various types of inspection equipment. This calibration schedule may be other than annual.)

c. A "Certificate of Calibration" shall be available for inspection by NDOR personnel at any time. The "Certificate of Calibration" shall provide, at a minimum, the following information:

- Serial number or identification number of the equipment.
- Date of calibration.
- Results of the calibration.
- Name of the laboratory or company performing the calibration.

d. NDOR inspection personnel have the right to verify the calibration of any inspection equipment owned by a consultant, contractor, or other testing firm by performing an independent calibration check. The decision to perform an independent calibration check rests solely with NDOR personnel and will not be performed on a request basis.

CHAPTER NOTES:

CHAPTER NOTES:

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GENERAL ADMINISTRATION FORMS

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TO:
Ray Maxson
Engr. Equip. Repair
5001 S. 14th
Lincoln, NE

FROM: *(Name and Address)*
(Your Name and Address)

SHOP WORK ORDER

COPY DISTRIBUTION
Originator - Keep Goldenrod copy and forward White, Canary and Pink copies to shop.

After shop work is completed*
Shop returns Pink copy with order.
Shop keeps the Canary copy.
Shop forwards White copy to the Controller Division.
* If material is sent to supply inventory, use proper forms and follow procedures for returning stock to inventory. Destroy White copy of this order.

No. 093092

SHOP ORDER NUMBER:

ACCOUNT NUMBER:

[x] REPAIR FOR STOCK [ ] REPAIR & RETURN [ ] MANUFACTURE

OE CODE (1): 541

DOCUMENT SOURCE CODE: 20

ITEM DESCRIPTION/WORK ORDER RECAP

IDENTIFICATION (Brand Name, Model No., Serial No., Inventory No.)	QUANTITY REQUESTED	QUANTITY SHIPPED	QUANTITY BACK ORDERED	UNIT PRICE	TOTAL PRICE	WORK IDENTIFICATION (District, Equipment, Yard, Radio, Scale, Building, Material, I.D., etc.)	PROJECT NUMBER	PROJECT UNIT	AFE OR CONTR. OR PREMIX SITE NUMBER	FEDERAL 0 = PARTICIPATING 1 = NON-PARTICIPATING	ACTIVITY (2)	ACCOUNT (2)
Dietzgen Transit	1										5099	8821

(1) Requesting Individuals O.E. Code

(2) Use appropriate Activity and Commodity

TO BE COMPLETED BY SHOP

LABOR

DATE	HRS.	INIT.	DATE	HRS.	INIT.

PART OR STOCK NUMBER	DESCRIPTION OR REQUISITION NUMBER	QTY.	PRICE

DESCRIBE PROBLEM:

COMMENTS FROM SHOP:
1. Telescope binds
2. Screws worn

TOTAL LABOR HOURS ▶ | TOTAL PARTS & ACCESSORIES COST ▶ | TOTAL LABOR COST ▶ | TOTAL COST ▶

REQUESTED BY: *(Name)* (Your Signature) DATE: 1-1-96

ORDER COMPLETED BY: *(Name)* DATE:

APPROVED BY: *(Name)* DATE:

INSPECTED BY: *(Dist. Mech. - Shop Supt.)* DATE:

SHIPPED BY
[x] SUPPLY VEHICLE
[ ] COMMERCIAL
[ ] PICKED UP

DR Form 124, Apr 87

THIS FORM REPLACES DR FORM 124, JUL 79, PREVIOUS EDITIONS WILL BE USED UNTIL EXHAUSTED

TO: Purchasing & Supply

SHIP TO: *(Name & Address)*

(Your Name & Address)

STATE OF NEBRASKA
DEPARTMENT OF ROADS

STOCK REQUISITION

Your O.E. Code

No. 611152

O.E. CODE: 541

RADIO CALL NO.: (your #)

NO. PIECES SHIPPED:

	MATERIAL													COST ACCOUNTING						
	IDENTIFICATION				QUANTITY					LOCATION				WORK IDENTIFICATION						
	CLASS	STOCK NUMBER	KEY WORD	U/M	REQUESTED	SHIPPED	BACK ORDER	UNIT PRICE	TOTAL PRICE	SUPPLY BASE	SECTION	BAY	BIN	DISTRICT, EQUIPMENT, YARD, RADIO, SCALE, BUILDING, MATERIEL I.D., ETC. / HIGHWAY NUMBER	PROJECT NUMBER / BRIDGE	PROJECT UNIT / REFERENCE POST FROM	REFERENCE POST TO	AFE OR CONTR. OR PREMIX SITE NUMBER	FEDERAL 0 = PART 1 = NON-PART	ACTIVITY	ACCOUNT
1	12	00500	Antifreeze	gl	10									46825						② 4104	
2																					
3																					
4																					
5																					
6		①	Don't mix Class on a requsition. If you have 2 items each from a different Class, use 2 forms.																		
7			② See Accounting Manual (Brown Book) for Class & Stock #'s. Also available thru CICS On-line.																		
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					

REQUESTED BY: *(Name)* Your Name	DATE:	FILLED BY: *(Name)*	DATE:
APPROVED BY: *(Name)* District Approver	DATE:	RECEIVED BY: *(Name)*	DATE:

SHIPPED BY
- [ ] MATERIEL VEHICLE
- [ ] COMMERCIAL
- [ ] PICKED UP

11

DR Form 146, May 91

THIS FORM REPLACES DR FORM 146, JUN 87, PREVIOUS EDITIONS WILL BE USED.

PRINTED WITH SOY INK

printed on recycled paper

To Supply Base:

Purchasing & Supply

From: *(Name and Address)*

Your Name
Your Address

STATE OF NEBRASKA
DEPARTMENT OF ROADS

STOCK RETURNED FOR CREDIT
NON-CATALOGED ITEMS

569851 B

O.E. CODE	NO. PIECES SHIPPED:
① 540	8

MATERIEL										COST ACCOUNTING								
IDENTIFICATION		QUANTITY				RETURNED TO LOCATION				HIGHWAY CONSTRUCTION			OTHER		ACTIVITY		
										PROJECT							
CLASS	NON-CATALOGED ITEMS	RETURNED	RECEIVED	UNIT PRICE	TOTAL PRICE	WAREHOUSE OR STORAGE AREA NO.	SECTION	BAY	BIN	PREFIX / HIGHWAY NUMBER	NUMBER / BRIDGE / REFERENCE POST FROM	UNIT / TO	DISTRICT EQUIPMENT RADIO SCALE YARD & BUILDING OR ADMIN. PROJ. NO. ETC.	AFE OR WORK ORDER OR CONTR. NUMBER	CLASS	ITEM	COMMODITY
②	Volumeasure - Parts	(See CICS Online Catelog)								District		Info				5099	8821
	Listed below																
	Rubber Pressure Bulb	1														5099	8821
	Quick Coupler	4														5099	8821
	Central Valve	3														5099	8821

① O. E. Code is for Returnee

② See Accounting Manual for Class # & Stock #.
(Brown Book)

RETURNED BY: *(Name)*	DATE:	RECEIVED BY: *(Name)*	DATE:	SHIPPED BY	
Your Signature	1-1-82			[X] MATRL TRUCK	07
APPROVED BY: *(Name)*	DATE:			[ ] COMMERCIAL	
				[ ] UNIT VEHICLE	

DR Form 147a, May 71

THIS FORM REPLACES DR FORM 147A, NOV 70
PREVIOUS EDITIONS WILL BE USED UNTIL EXHAUSED.

440

VENDOR: FTIN/SS No. - TYPE

STATE OF NEBRASKA
DEPARTMENT OF ROADS

PURCHASE ORDER

ENTRY PERSONNEL ONLY
Date to Pay:
ENTERED Date: By:

PURCHASE ORDER NO.
531730

REQUEST NUMBER

ORIGINATING O.E. CODE
(1) 540

VENDOR: *(Name & Address)*
Buyers will fill this out by putting vendor's name here.

INVOICE TO: *(Name & Address)*
Purchasing & Supply

SHIP TO: *(Name & Address)*
Direct
Your Address
ATTN:

ITEM NO.	CLASS	STOCK NUMBER	KEY WORD	ITEM DESCRIPTION	U/M	QUANTITY REQUESTED	UNIT PRICE	TOTAL PRICE
	(3)	(4)	Book	Computer Manual	ea	10	100.00	1000.00
	(1)	Use your O.E. Code						

Salesman:
Promised Delivery Date:
Method of Shipment:
Terms:
F.O.B. Point:
Follow-up Action:

TRANSPORTATION CHARGES
TOTAL

REQUESTED BY	APPROVED BY	RECEIVED BY
SIGNATURE: (Your Signature)	SIGNATURE: (District Approver)	SIGNATURE:
DATE:	DATE:	DATE:

ITEM NUMBER (2)	CLASS (2)	STOCK NUMBER (3)	U/M	QUANTITY	LOCATION: SUPPLY BASE	SECTION	BAY	BIN	VENDOR INVOICE BILLING ACCOUNT	INVOICE BILLING DATE	TRANSACTION CODE	O.E. CODE	ACTIVITY (2)	ACCOUNT NUMBER	AMOUNT $ (Indicate credit by coding a minus in the right-hand box.)	DISTRICT YARD, SCALE RADIO, EQUIPMENT, BUILDING, REST AREA, PARCEL NO.	PROJ. NO.	UNIT	INTERSTATE/ SECTION	FED. PART. 0/1	AFE	LIQUIDATION (P or C)
1	58		ea	10									5099			(2)						

HIGHWAY NUMBER | BRIDGE | SIGNAL | REF. POST | PERF. GUAR. | FROM | TO | PREMIX SITE NO.

(2) Use the numbers that pertain to your Division, on item ordered
(3) & (4) See Accounting Maual for Class & Stock #'s.

TOTAL

STATE P.O. NUMBER

DR Form 151, May 86

PRINTED WITH SOY INK

THIS FORM REPLACES DR FORM 151, MAY 85,
PREVIOUS EDITIONS WILL BE USED UNTIL EXHAUSTED.

Accountable Equipment Inventory Missing (Lost or Stolen)/Damage Report

DISTRIBUTION
White - Forward for Signatures
Canary - Retain

DATE:

ITEM DESCRIPTION:

COST		Inventory Tag No.:				Serial No.
Purchase Price	$	PURCHASE ORDER NO.:				PURCHASE DATE:
Residual Value	$	ITEM LOCATION	DIST./DIV.:	BUILDING:	ROOM NO.:	DATE LAST PHYSICAL INVENTORY HELD:

LOST OR STOLEN

DATE STATE PATROL CONTACTED:

PERSON/PERSONS CHARGED WITH ITEM CUSTODY:

DETAILS:

IF LOST OR STOLEN FROM INVENTORY, STATE EFFORTS TO LOCATE AND RESPONSIBILITY:

Self explanatory but may need to contact Purchasing & Supply to obtain purchase price & date

DAMAGED

CITE CIRCUMSTANCES AND NECESSARY DETAILS:

PURCHASING & SUPPLY COMMENTS:

(Attach separate sheet if more space is needed.)

REPLACEMENT REQUIRED YES ☐ NO ☐

APPROVAL TO DELETE FROM INVENTORY

DIVISION HEAD/DISTRICT ENGINEER: *(Signature)* DATE:

APPROPRIATE DEPUTY: *(Signature)* DATE:

AFTER SIGNATURES ARE COMPLETE, PLEASE RETURN TO PURCHASING & SUPPLY DIVISION FOR RECORD DELETION.

DELETED BY: DATE:

DR Form 159, Jul 93

THIS FORM REPLACES DR FORM 159, OCT 82. PREVIOUS EDITIONS WILL BE DESTROYED.

printed on recycled paper

State of Nebraska
Department of Roads

This form required when materials furnished for a project are transferred to Maintenance.

DISTRIBUTION OF COPIES
White - Maintenance Division
Canary - District
Pink - Superintendent
Goldenrod - Supervisor

Maintenance Management Systems

Imprest Inventory Adjustment

No.

SUPERVISOR NO.: | YARD NO.:

Trans. Type	COST ACCOUNTING BY TRANSACTION TYPE								
1	SUPV. NO.				Transfer Premix Site				
2	O.E.	WORK IDENTIFICATION: District, Equipment, Yard, Radio, Scale, Building, Materiel I.D., etc.	PROJECT NUMBER	PROJECT UNIT	AFE OR CONTR. OR PREMIX SITE NUMBER	Federal 0 = Participating 1 = Non-participating	Activity	Account
4	902	HIGHWAY NUMBER	BRIDGE					
			REFERENCE POST FROM	REFERENCE POST TO				
5	O.E.							

Date of Issue (Mo./Day/Yr.)	Material Identification	Premix Site (with cold mix only)	Quantity (99999.9)	Transaction Type*	Transaction Unit Price (Transaction Type 4 only)	Trans. Type	SUPV. NO.		PROJECT NUMBER	PROJECT UNIT	AFE OR CONTR. OR PREMIX SITE NUMBER	Federal	Activity	Account
9-1-96	0906		18.7	4	21.92		904		23	1007	x600	1	6002	4344
			.		.									
			.		.									
			.		.									
			.		.									

1 This the ratio call #.
2 District Maintenance Office can provide this information.
3 This # is in the Chapter C of MMS manual - always 6 digits.
4 Always put "4" in this column.
5 Always put "902" in this column.
6 Always put "X600" in this column.
7 Always put "1" in this column.
8 A number between 6002 and 6260 from Accounting Manual goes here.
9 Always put "4344" in this column.
10 Make sure when paying bills for material charged to 4220 that you use correct unit of measure. May have to convert cu. yds. to tons for aggregates, etc.
Call Joy Lapsley at (402) 479-4545 if you have questions.

TRANSACTION TYPES *

1 = Transfer of material to another Supervisor's Inventory
2 = Issue of material to a noncrew card activity
4 = Reusable material charged to the Imprest Inventory
5 = Stockpiling of state-owned material *(Quantity Only)*

Sold To or Comments:

Material Received/
Used By: Maintenance Supt. Date:

Approved By: Dist. Maint. Supt. Date:

DR Form 329, Apr 95

THIS FORM REPLACES DR FORM 329, APR 91. PREVIOUS EDITIONS WILL BE DESTROYED.

printed on recycled paper

DISTRIBUTION

White - Purchasing & Supply
Canary - Purchasing & Supply *(Return Receipt)*
Pink - Engineering Equipment
Goldenrod - Originator *(Retain)*

FURNITURE AND EQUIPMENT ISSUE/TRANSFER DOCUMENT

DATE:

	O.E.	DIVISION/DISTRICT:		
FROM	your	District 1		
TO	O.E.	BLDG.	ROOM	DIVISION/DISTRICT:
			19	District 8

ITEMS

	INVENTORY TAG NUMBER	DESCRIPTION	SPECIAL INSTRUCTIONS/NOTES
1	xxxxxxxxxxxxxx	Desk, Grey Metal	
2			
3			
5			
6			
7			
8			
9			

RECEIVED BY:	ENTERED BY:	AUTHORIZED BY:
	Your Name	District Authority

DR Form 332, Nov 82

THIS FORM REPLACES DR FORM 332, NOV 82, PREVIOUS EDITIONS WILL BE USED.

printed on recycled paper

CONTRACT ADMINISTRATION FORMS

DR 16	Contract Time Extension Document	1 - 13
DR 42	Field Approval of Subcontract Work	1 - 14
DR 44	Summary and Distribution of Costs	1 - 15
DR 58	Force Account Agreement	1 - 16
DR 84	Record of Contractor Payrolls Received	1 - 17
DR 87	Safety Inspection Checklist	1 - 18
DR 90	Flagger Certification	1 - 20
DR 91	Notification of Project Completion	1 - 21
DR 96	Inspectors Working Day Report	1 - 22
DR 98	Report of Labor Compliance Interviews	1 - 24
DR 188	Work Order	1 - 25
DR 203	DBE Performance Record	1 - 26
DR 204	Weekly Force Account Statement	1 - 27
DR 289	Special Training Provision Monthly On-the-Job Training Report	1 - 28
DR 344	Evaluation of Contractor	1 – 29
DR 439	EEO Contractor's Self-Analysis	1 - 30
DR 441	Identification of DBE Goal Achievement	1 - 34
DR 442	Identification of Work Performed	1 - 35
	Contractor EEO Compliance Record	

DISTRIBUTION
1. Lincoln Construction Office
2. District Engineer
3. Project Manager
4. Contractor
5. FHWA
6. City or County

CONTRACT TIME ALLOWANCE EXTENSION DOCUMENT

CONTRACTOR: Cyclone Construction Co.	DATE: 7-24-96
CONTRACTOR NO.: 1948	PROJECT NO.: PEP-30-6(1031)
GROUPS OF WORK: 7B	LOCATION: Columbus-Schuyler
DOCUMENT NO.: #2 (i.e., 2nd extension processed)	CONTRACT NO.: 1143

THE CONTRACT TIME ALLOWANCE IS BEING EXTENDED AS DETAILED BELOW, FOR THE FOLLOWING REASON(S): *(Continue on reverse side if more space is needed).*

Columbus City engineer requested that work be shut down until intersection being constructed by the City at Station 100.15 is complete.

(Use of this is encouraged.)
(Not necessary if days are added by a change order.)
(Do not ignore charging a working day in lieu of filling out this form for a valid "extra" requirement.)
(This form helps the Finals Section track days and allows accurate retention of payments.)

TIME ALLOWANCE TYPE	ORIGINAL * DAYS ALLOWED	PREVIOUSLY EXTENDED NUMBER OF DAYS	EXTENDED UNDER THIS DOCUMENT	ADJUSTED TOTAL
OVERALL CONTRACT	115	12	20	147
HEAD TO HEAD	55	0	5	60
DETOUR	60	0	6	66
EARTH SHOULDERING	5	0	1	6

* WD *(Working Days)* * CD *(Calendar Days)*

FOR THE DEPARTMENT OF ROADS	FOR THE FEDERAL HIGHWAY ADMINISTRATION
APPROVED: *(Project Manager)*	APPROVED:
APPROVED: *(District Engineer)*	
APPROVED: *(Construction Engineer)*	

DR Form 16, Jun 87

FIELD APPROVAL OF SUBCONTRACT WORK

(Maximum Amount $10,000)

White - Lincoln Construction Office
Canary - District Office
Pink - Contractor
Goldenrod - Project Manager

PRIME CONTRACTOR: *(Name)* Cyclone Construction Co.	PROJECT NUMBER: F-6-7(1030)
NUMBER: 1948	LOCATION: 152nd Street - 162nd St., Omaha
SUBCONTRACTOR: *(Name)* Windy Construction Co.	CONTRACT DATE: 4-27-96
NUMBER: 2021 ☐ NONE	CONTRACT NUMBER: 1143
ADDRESS: 12905 South 70th, Papillion, NE 68133	CONTRACT AMOUNT: $ 561,100.75

Subcontractor is qualified by one of the following:

- [X] Prime Contractor on a current State of Nebraska project.
- [ ] Approved Subcontractor on a State of Nebraska project.
- [ ] Addition to subcontract on subject project.
- [ ] Checked with Lincoln Construction Office.

Subcontractor's insurance is current:

- [X] Checked on computer.
- [ ] Checked with Lincoln Construction Office.

CONTRACT GROUP NO. /Line No.	DESCRIPTION OF WORK *(Item etc.)*	QUANTITY	UNIT MEAS.	CONTRACT UNIT PRICE	CONTRACT VALUE
7B	1,000 m of 2 m high chain-link fence	100	m	$5.00	$5,000.00
4	500 mm culvert 80 m in length	80	m	6.50	520.00
	(include line number to help locate specific				
	item)				

REMARKS:

Total Amount of Subcontract	$5520.00
% of Contract Amount Subcontracted	1
% Previously Subcontracted	10
TOTAL % Subcontracted *	11

* Cannot exceed the % permitted under the contract.

As representative of the prime contractor, I am hereby requesting permission to subcontract the above described work.

(Contractor) .....
(Signature)

Permission to subcontract the above described work is hereby granted as of ..... on
(Time)

.... A formal written
(Date) *(Project Manager)*

approval will be forwarded to the contractor by the Lincoln Construction Office.

This method of approving subcontract work is to be used only in case of emergency, when time does not permit direct approval from the Lincoln Construction Office. **PLEASE TRANSMIT TO LINCOLN CONSTRUCTION OFFICE NO LATER THAN NEXT WORKING DAY.**

DR Form 42, Feb 87

STATE OF NEBRASKA
DEPARTMENT OF ROADS

SUMMARY AND DISTRIBUTION OF COSTS

PROJECT NO.: F-7-1(106)
CONTROL NO.: 10169
CONTRACTOR: AllDone Construction Company, Inc.
GROUPS: 1, 3, 6, 8B & 9A
CONTRACT DATE: July 15, 1996
COUNTY: Lancaster

GROUP NO.	ENTIRE PROJECT AMOUNT	Participating Federal-City Roadway Section Sta.390+20 to 429+00 AMOUNT	Participating Federal-State Roadway Section Sta.0+00 to 349+00 AMOUNT	Participating Bridge Section Bridge @ Sta. 250+93 AMOUNT	Non-Participating Detour Section County Funds Only AMOUNT
1 - Grading	$ 545,919.82	$ 10,453.78	$ 443,966.04	--	--
3 - Concrete Pavement	1,340,848.71	479,239.99	861,608.22	--	--
6 - Bridges	592,779.03	--	--	$592,779.03	--
8B - Lighting	64,319.45	53,904.50	10,914.95	--	--
9A - Detour	130,484.52	--	--	--	$130,484.52
SUBTOTAL – CONSTRUCTION	$2,674,351.53	$634,598.27	$1,316,489.71	$592,779.03	$130,484.52
Engineering Items	4,200.00				
PROJECT GRAND TOTAL	$2,678,551.53				

REMARKS:
This form is required for each project. Any funding split which which is not readily accessible on Final Estimate, should be shown in field book and noted in "Remarks" section. (i.e. I-IR Fund) Splits - Bridge Section within Group 4 Culverts, etc.)

Engineering items will be included for payment in group totals. Separate entry or engineering items will not be necessary. Contractors name shall be exactly as it appears on contract.

PREPARED BY:
CHECKED BY:
APPROVED BY:

DR Form 44, Nov 81

THIS FORM REPLACES DR FORM 44A, FEB 71,
PREVIOUS EDITIONS OF THIS FORM WILL NOT BE USED.

STATE OF NEBRASKA
DEPARTMENT OF ROADS

FORCE ACCOUNT AGREEMENT

– ORIGINAL AND FIVE (5) COPIES MUST BE SUBMITTED TO THE LINCOLN OFFICE –

DATE: (Date form prepared)	
PROJECT NUMBER: (As shown on contract)	
CONTRACTOR: Cyclone Construction Co.	CONTROL NUMBER: (As shown on contract)
LOCATION: City/Highway	STATION:
FOR WORK ON PROJECT NUMBER: (Complete Project Number)	DATE OF ORIGINAL CONTRACT:

PERFORMANCE OF WORK **NOT** INCLUDED IN THE ORIGINAL CONTRACT PROVISIONS SHALL BE PAID AT THE RATES INCLUDED IN THIS AGREEMENT. THE **EXTRA WORK** TO BE PERFORMED UNDER THIS AGREEMENT SHALL BE THE FOLLOWING:

Explain why work is being done, what is to be done by the Contractor, and if applicable, what the Department will do.

(Only use for a real "Force Account" situation.)

(Rarely used.)

(Used in conjunction with DR Form 204)

THE FOLLOWING RATES SHALL APPLY

SUPERVISORY LABOR

TITLE	RATE	
(Foreman)	per	
(Do not use Superintendent)	per	
	per	
	per	

Social Security, Workman's Compensation and Public Liability _____ %

Profit on Labor, Insurance, Taxes, Health and Welfare, Pension, Training and Vacation (Provided by Contractor) _____ %

OTHER LABOR

CLASSIFICATION	HOURLY (Min.)	** BASIC RATE (Max.)	BENEFITS (per hour)
(Enter Std. Labor Classifications)			

** DOES NOT REFLECT APPLICABLE OVERTIME

EQUIPMENT (Type)	SIZE	HOURLY RATE	*
List all required equipment and the negotiated rate.			

* STATUS: **FO** - Fully Operated; **WO** - Without Operator; **R** - Rented

MATERIAL (Type)	ESTIMATED COST
(Enter entire Material Estimate)	$

TOTAL ESTIMATED COST OF THIS AGREEMENT (See reverse side for computations) $

CONTRACTOR'S AUTHORIZED AGENT:	DATE:	DEPARTMENT OF ROADS APPROVAL	
		DISTRICT ENGINEER:	DATE:
AUTHORIZED AGENT FOR CITY-COUNTY:	DATE:	CONSTRUCTION ENGINEER:	DATE:

DR Form 58, Jan 82 THIS FORM REPLACES RC FORM 317, PREVIOUS EDITIONS ARE OBSOLETE AND DESTROYED 2200

@ Cost Overrun/Underrun Notification

This form is to be prepared by the Project Manager and submitted to the Controller Division in accordance with the instructions printed in the Construction Manual.

Date: 1-5-2001

☒ Overrun ☐ Underrun

Project No.:	Location:	Control No.:
F-2-7(106)	Nebraska City East	12345

Contractor:	Contractor No.:	Letting Date:	10/21/99
ABC Construction	9876	Contract No.:	1345X

Group	Item of Work	Quantity	Units	Unit Price	Amount
1	**Excavation of Unsuitable Material**	**25,000.00**	**Cu Yds**	**$3.17**	**$79,250.00**
4	**Granular Material for Bedding**	**26.00**	**Tons**	**$40.00**	**$1,040.00**
3	**8" Concrete Paving**	**-1,395.00**	**Sq Yds**	**$21.16**	**($29,518.20)**
3	**9" Concrete Paving**	**1,395.00**	**Sq Yds**	**$23.59**	**$32,908.05**
				$	**$0.00**
				$	**$0.00**
				$	**$0.00**
				$	**$0.00**
				$	**$0.00**
				$	**$0.00**
				$	**$0.00**
				$	**$0.00**
		Net Change this Report ➔			$83,679.85

Brief explanation of reason for Overrun / Underrun:

The marshy area shown on the plans was found to extend approximately 800 feet further than anticipated (Station 60+00 and 68+00). The construction of a 48" pipe in the area was revised to be bedded with crushed rock.

The pavement at several locations was changed from 8" PCC to 9" PCC using contract items for each to accommodate heavy trucks.

Prepared by:	**Date:**
Jack Frost, Project Manager	1/5/01
Approved by: ***(Construction Engineer)*** Controller will obtain proper approval	**Date:**
Signature: *(Deputy Director for Engineering) – If over $150,000*	Date:

Approval signatures not required for underruns.

DR Form 74, Dec 00/unique file name

RECORD OF CONTRACTOR PAYROLLS RECEIVED

STATE OF NEBRASKA
'PARTMENT OF ROADS

Project No. I-80-0(100)

Contract Date March 27, 1996

Contractor Avid Construction Company, Inc.

Subcontractor

WEEK ENDING	DATE REC'D	REMARKS	WEEK ENDING	DATE REC'D	REMARKS
4-24-96	4-29-96		10-2-96	10-2-96	Payroll errors letter sent to contractor 10-7-96
* 5-1-96	5-6-96	Payroll errors letter sent to contractor 5-7-96	10-9-96	10-13-96	
5-8-96	5-19-96		10-2-96	10-14-96	Corrected Payroll
5-15-96	5-21-96		10-16-96	10-29-96	
* 5-1-96	5-24-96	Corrected Payroll	10-23-96	10-27-96	
5-22-96	5-27-96		10-30-96	11-3-96	
5-29-96	6-3-96		10-6-96	11-11-96	
6-5-96	6-10-96		11-13-96	11-19-96	Work suspended
6-12-96	6-18-96				
6-19-96	6-22-96				
6-26-96	6-30-96		4-16-96	4-20-97	
7-3-96	7-7-96		4-23-97	4-26-97	
7-10-96	7-15-96		4-30-97	5-3-97	
7-17-96	7-20-96		5-7-97	5-12-97	
7-24-96	7-29-96		5-14-97	5-18-97	
7-31-96	8-3-96		5-21-97	5-28-97	
8-7-96	8-11-96		5-28-97	5-31-97	
8-14-96	8-17-96		6-4-97	6-9-97	
8-21-96	8-24-96		6-11-97	6-18-97	Project completed
8-28-96	8-31-96				
9-4-96	9-8-96				
9-11-96	9-14-96				
9-18-96	9-24-96				
9-25-96	9-28-96				

Payrolls Complete 6-18-97
(Date)

Project Manager
Signature Title

ORIGINAL: To Lincoln Office With Final Computations

Section 110, Exhibit #6

Form 84 Sep 70

SAFETY INSPECTION CHECKLIST

(Safety and Health Regulations for Construction)

This complimentary inspection is intended to give a general view of possible violations a Federal Compliance Officer may find.

In the event of a Federal Compliance Inspection, neither the Federal Compliance Officer nor the State of Nebraska Department of Roads will be bound by any comments made by Department personnel that are contained herein, nor by the failure of the Department personnel to point out a specific hazard or hazards.

Statements contained herein are not to be construed as the Department of Roads approval or disapproval of the contractor's methods of complying with Federal Safety Regulations.

Project: I-80-0 (100)	Contractor: Avid Construction Company, Inc.
Project Manager: Arthur Jones	
Inspected By: Bill Smith	Date: June 31, 1996

	Satisfactory	Unsatisfactory	Not Applicable
SUBPART C - GENERAL SAFETY AND HEALTH PROVISIONS			
1. Housekeeping (1926.25)	X		
SUBPART D - OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROLS			
1. Medical Services (1926.50)	X		
2. First Aid Kits (1926.50)	X		
3. Telephone Numbers Posted (1926.50)		X	
4. Drinking Water (1926.51)	X		
5. Toilets (1926.51)	X		
SUBPART E - PERSONNEL PROTECTIVE AND LIFE SAVING EQUIPMENT			
1. Hard Hats (1926.100)	X		
2. Hearing Protection (1926.101)	X		
3. Eye and Face Protection (1926.102)	X		
4. Respiratory Protection (1926.103)	X		
5. Safety Belts and Lifelines (1926.104)	X		
6. Safety Nets (1926.105)			X
7. Life Jackets and Skiff (1926.106)	X		
SUBPART F - FIRE PROTECTION AND PREVENTION			
1. Fire Protection Program (1926.150)	X		
2. "No Smoking Signs" in Hazardous Areas (1926.151)		X	
3. Open yard storage of combustible material (1926.151)	X		
4. Approved containers and portable tanks (1926.152)	X		
5. Fire extinguishers (1926.152)	X		
6. Temporary Heating Devices (1926.154)			X
SUBPART G - SIGNS, SIGNALS AND BARRICADES			
1. Traffic Signs Posted (1926.200)	X		
2. Inapplicable Signs covered or removed (1926.200)	X		
3. Flagmen Wearing Red Orange Garments (1926.201)	X		
4. Barricades (1926.202)	X		
SUBPART H - MATERIALS HANDLING, STORAGE, USE AND DISPOSAL			
1. Material stac[illegible] secured (1926.250)	X		
2. Rigging eq[illegible] checked (1926.251)	X		

	Satisfactory	Unsatisfactory	Not Applicable
SUBPART I - TOOLS - HAND AND POWER			
1. Power tools guarded (1926.300)	X		
2. Pressure release shut-off switch on certain hand-held power tools (1926.300)	X		
3. Hand tool condition (1926.301)		X	
4. Safety Clips on pneumatic tools (1926.302)	X		
5. Fuel powered tools stopped while being refueled, serviced or maintained (1926.302)	X		
SUBPART J - WELDING AND CUTTING			
1. Gas cylinder valves protected (1926.350)	X		
2. Fire extinguisher available (1926.352)	X		
SUBPART K - ELECTRICAL			
1. Electrical tools - Grounded (1926.401)	X		
2. Extension cords, 3 wire type (1926.401)	X		
SUBPART L - LADDERS AND SCAFFOLDING			
1. Ladder condition (1926.450)	X		
2. Ladders extend not less than 36" above landing and secured (1926.450)		X	
3. Scaffolding - sound footing (1926.451)	X		
4. Guard Rails above 10' (1926.451)	X		
5. Guard Rails 42" high (1926.451)	X		
6. Toeboards 4" high (1926.451)		X	
SUBPART N - CRANES, DERRICKS, HOISTS, ELEVATORS, AND CONVEYORS			
1. Rated load capacities, recommended operating speeds, hazard warnings, posted at operators position (1926.550)	X		
2. Moving parts - guarded (1926.550)	X		
3. Swing radius of crane barricaded (1926.550)		X	
4. Crane Booms - Minimum 10' clearance from energized powerlines (1926.550)	X		
5. Conveyors - Audible Warning System (1926.555)			X
SUBPART O - MOTOR VEHICLES, MECHANIZED EQUIPMENT, AND MARINE OPERATIONS			
1. Unattended equipment, parked adjacent to highways at night have lights, reflectors or barricades (1926.600)	X		
2. Blades, buckets, or dump bodies grounded or blocked when not in use (1926.600)	X		
3. Motor vehicles in safe [illegible]ting condition (1926.601)	X		

	Satisfactory	Unsatisfactory	Not Applicable
4. Rubber-tired motor vehicle equipped with fenders (when required) (1926.602)	X		
5. Earthmoving equipment equipped with seatbelts (1926.602)	X		
6. Equipment with obstructed view has audible reverse signal alarm or signalman (1926.602)		X	
7. Site-clearing equipment equipped with rollover guards, overhead and rear canopy guards (1926.604)	X		
SUBPART P - ESCAVATIONS, TRENCHING AND SHORING			
1. Excavations Inspected After Rainstorm or other hazard (1926.651)	X		
2. Excavated Material Stored and Retained at least 2' from edge of the excavation (1926.651)		X	
3. Banks more than 5' high shored or sloped to the angle of repose (1926.652)	X		
4. Exit ladder within 25' of work area 3' above the top (1926.652)		X	
SUBPART Q - CONCRETE, CONCRETE FORMS AND SHORING			
1. Tying reinforcing steel in walls, piers, etc. - safety belts worn (1926.700)	X		
2. Protection of persons working above vertically protruding steel (1926.700)	X		
3. Employees do not ride on concrete buckets, or work under concrete buckets (1926.700)	X		
SUBPART S - TUNNELS AND SHAFTS, CAISSONS, COFFERDAM, AND COMPRESS AIR			
1. Cofferdams - two means of rapid exit provided (1926.802)	X		
SUBPART U - BLASTING AND THE USE OF EXPLOSIVES			
1. Employer has inventory and use record of all explosives (1926.900)			X
2. No blasting during the progress or approach of a thunderstorm (1926.900)			X
3. Qualified blaster (1926.901)			X
4. Explosives not transported with other materials or cargoes (1926.902)			X
5. Blasting caps and explosives not transported in same vehicle (1926.902)			X
6. Detonators and explosives stored in separate facilities (1926.904)			X
7. No smoking signs posted at storage facility (1926.904)			X
8. Highway traffic stopped during bl[illegible] operations (1926.909)			X

DR Form 87, Mar 75

1830

OPTIONAL

INSTRUCTION FOR USE OF SAFETY INSPECTION CHECKLIST

@

The Safety Inspection Checklist was developed from the Informational Guide on Occupational Safety on Highway Construction Projects published by A.A.S.H.O Construction Safety and HeaLth Regulations published in the Federal Register. Each item on this checklist is referenced by subsection number to the Informational Guide and it will be necessary for Project Managers and their designated representatives to be familiar with each specific subsection listed on the checklist, prior to making the inspection.

This inspection shall be performed by the Project Manager or the designated representative and shall be signed and dated by whomever, in fact, performs the inspection.

This inspection shall initially be required when substantial construction begins on a contract by the prime contractor or subcontractor on the contract at that time, until the work is completed, with the exception that monthly inspections will not be required when the work is suspended. In the case of the prime contractor, the safety checklist shall be made in triplicate with one copy becoming part of the project records. The original shall be given to the contractor's supervisor on the site, while the other copy shall be sent to the contractor's home office to the attention of the contractor's safety officer.

In the case of a subcontractor, the safety checklist shall be made in triplicate with one copy becoming part of the project records. The original shall be given to the subcontractor's supervisor on the site, while the other copy shall be given to the prime contractor's supervisor on the site.

If, in the opinion of the Project Manager or the designated representative, a possible violation of the OSHA regulations exists, he shall place a check in the satisfactory column for the specific area provided on the checklist.

In the case where the Project Manager or the designated representative has indicated an unsatisfactory condition on the safety checklist, he/she shall, at the time he/she presents the original to the contractor's supervisor on the site, explain to the contractor's supervisor the basis of his/her opinion that an unsatisfactory condition exists. In no case should the Project Manager or the designated representative advise the contractor on the method(s) to correct the unsatisfactory condition.

In cases where, in the opinion of the Project Manager or the designated representative, a situation which constitutes an imminent danger to life or limb exists, he/she shall request immediate abatement of the danger or if immediate abatement is not possible, removal of the employees from the danger area. in the event of contractor refusal to cooperate in eliminating an imminent danger situation, the Project Manager or the designated representative shall suspend work on the project and notify the nearest OSHA office immediately. In the case where the work is suspended the District Engineer, the Lincoln Construction Division and the contractor's home office should be notified immediately.

The Project Manager or the designated representative should not assume that the performance of these monthly inspections relieve him/her of his/her duty to notify the contractor of possible violations which may be discovered at any time during the course of the work. The Project Manager or the designated representative should notify the contractor's representative on the site, of any possible violation, at any time the Project Manager or the designated representative believes a possib violation exists.

Flagger Certification Report

(Please print or type)

CARD NO.	DATE ISSUED	NAME	SOC. SEC. NO.	SCORE
1	10-1-96	Flaggers Name	(Flagger SSN)	2

I certify that the individuals listed above have met the requirements for Nebraska Department of Roads flagger certification as spelled out in the Standard Specifications, Supplemental Specifications, or Special Provisions and the Guidelines for Flagger Training and Certification of Flaggers.

1. Number is on card when sent out by the Construction Division

2. 80% is minimum passing score

3. Fax to 402-479-4854 to get the Flaggers put into the NDR computer file.

(The Contractor's Instructor's Signature)
(Signature of Certifying Instructor)

(Printed or Typed Name of Certifying Instructor)

(Date)

(Name of person & company)
(Contractor)

DR Form 90, Jun 93

printed on recycled paper

Notification of Project Completion

PROJECT NO.:	CONTROL NO.:
PEP-30-6(1031)	21623

LOCATION:
(City/Highway/Station limits)

CONTRACTOR:
Cyclone Construction Co.

PROJECT CATEGORY

- [ ] FHWA Full Oversight (non-exempt Interstate over $1,000,000)
  (NHS over $1,000,000 let prior to 2-1-93)
- [ ] FHWA Certification Acceptance (National Highway System over $1,000,00 let since 2-1-93)
- [X] FHWA Exempt
- [ ] Other

Completion Date: 9-5-96

- [X] This completes all work on this project.
- [ ] Other contracts remain to be completed on this project. (List them)
- [ ] I certify that the construction of this project has been completed in accordance with the Certification Acceptance Agreement dated December 31, 1992. (see block 2 above)

.....
(Signature of Department of Roads' official)

.....
(Title)

FOR FHWA USE ONLY

FHWA INSPECTION MADE BY:	DATE:

IN COMPANY WITH:

REMARKS:

SIGNATURE:		DISTRIBUTION:
TITLE:	DATE:	[ ] FHWA *(all FHWA projects)* [ ] Controller - Programming and Disbursements *(all projects)* [ ] Construction *(all projects)*

DR Form 91, Jul 93

printed on recycled paper

(OPTIONAL - Not needed if information is in the Diary. Check with Project Manager)

INSPECTORS WORKING DAY REPORT

CONTRACTOR:	GROUP:	MONTH:
Cyclone Construction Co	76	July 96
INSPECTOR:	PROJECT NO.: PEP-30-6(1031)	

DATE	WEATHER	HOURS WORKED	REMARKS: GIVE WORK IN PROGRESS EACH DAY AND STATIONS
SUN 14	Sunny	0	No work
MON 15	Rain	0	No work
TUE 16	Sunny	4	Wet and muddy in AM. PM: Contractor placed poles from Station 210+1 to 250+10, on North side of Highway 30
WED 17	Sunny	8	Contractor placed poles from station 210+1 to 250+10, on South side of Highway 30
THU 18	Sunny	8	Contractor placed chainlink fence fabric from Station 210+1 to 250+10 on North and South sides of Highway 30
FRI 19	Sunny	8	Contractor finish graded and seeded all disturbed areas Station 210+1 to 250+10. 6 ha = Total area seeded
SAT 20	Sunny	0	No work

DR Form 96, Sep 84

THIS FORM REPLACES DR FORM 96, OCT 70, PREVIOUS EDITIONS WILL BE USED UNTIL EXHAUSTED.

NEBRASKA DEPARTMENT OF ROADS
WEEKLY PROGRESS / WORKING DAY REPORT

WEEK ENDING 09/27/97
REPORT NO. 006

CONTRACT: 1290 CONTRACTOR: 0574 CONSTRUCTORS, INC.

GROUP NO. 8C

CONTROL NO.	PROJECT NUMBER	PROJECT LOCATION
12290	STPP-STWD(33)	DISTRICT 1 - DISTRICTWIDE

DAY OF WEEK	DATE	HRS WORKED	WORKING DAY	REMARKS
SUN	09/21/97	0	NO	
MON	09/22/97	0	NO	CCO-4" YELLOW EPOXY LINE PREVENTED BY RAIN MOST OF DAY.
TUE	09/23/97	0	NO	SAME
WED	09/24/97	0	NO	SAME
THR	09/25/97	5	YES	COMPLETED PAINTING YELLOW EPOXY LINE. WORK SUSPENDED. TILL '98, TAPE IN AUBURN.
FRI	09/26/97	0	NO	
SAT	09/27/97	0	NO	

** DATES **		** WORKING DAYS **		** PERCENT **	
ESTABLISHED BEGINNING	08/18/97	PREVIOUS	11		
ACTUAL START	08/20/97	THIS WEEK	1		
TENTATIVE ACCEPTANCE		TOTAL TO DATE	12	COMPLETE	81 %
REGULAR WORKING DAYS		ALLOWED	010	TIME ELAPSED	120 %
WORK STATUS: SUSP		DAYS BEHIND	3-	% BEHIND	19- %

PROJECT MANAGER: SCOTT, C. W.

SUBCONTRACTORS ON PROJECT THIS WEEK:
2372 ALL IOWA CONTRACTING CO.

ORIGINAL – Construction Engineer
COPIES – District Engineer & Project Manager

REPORT OF LABOR COMPLIANCE INTERVIEWS

Project No. I-80-0(100)
Report No. 3
Contractor Avid Constr. Co., Inc.
Groups of Work 1, 4, 6 and 9

Sheet 1 of 1

Work Operations Checked Grading, Culverts and Bridge
(Grading, Culverts, Bridges, etc.)

DATE INTERVIEWED	EMPLOYER (CONTRACTOR OR SUBCONTRACTOR	EMPLOYEE	PAYROLL CLASSIFICATION	TYPE OF WORK BEING PERFORMED OR EQUIPMENT OPERATED	WAGE RATE	
					PAID	MINIMUM
6-26-96	Avid Constr. Co Inc	Carl Blue	Carpenter	Forming Bridge Deck	$15.85	$11.70
"	"	Tom Elder	Scraper Operator over 16 Cu. Yds	Scraper, over 16 Cu. Yds. Grading	$15.15	$11.30
"	"	Bill Arden	Laborer	Assisting Carpenters	$13.75	$ 8.50
6-27-96	"	Arnold Brott	Cement Finisher	Concrete Finishing on Box Culverts and Bridge	$15.75	$11.00
"	"	Bob Tolen	Bulldozer 115 D.B. Horsepower and over	Bulldozer, over 115 DB HP Grading	$15.30	$11.30

(Use Reverse Side for Remarks)

(Jerry Quintana - Hauling the main Source)

Interviewer Larry Lee

Submitted by Arthur Jones *(Project Manager)* 6-27-96 *(Date)*

DR Form 98, Feb 88

THIS FORM REPLACES DR FORM 98, JUL 74
PREVIOUS EDITIONS WILL BE DESTROYED.

Section 100, Exhibit #3

DISTRIBUTION
White - Construction Engineer
Canary - Contractor
Pink - District Engineer
Goldenrod - Project Manager

Work Order

TO: *(Contractor, Name and Address)* Cyclone Construction Co. 12607 So. 70th St Papillion, NE 68133	PROJECT NO.: PEP-30-6(1031) ORDER NO.: #1 STATION: 210+10.02

You are hereby ordered to perform the extra work described below in compliance with Subsection 104.03 of the Specifications and the conditions listed herein. Reimbursement will be in accordance with the option marked below and the provisions of Subsection 109.05. Equipment rental rates, when applicable, will be established by applying prevailing Department policies and formulae to the rates established in the **Rental Rate Blue Book for Construction Equipment.**

Agreed Total Price or Unit Price

[X] Supplemental Agreement will be issued to incorporate agreed total price or unit price shown herein.

Undefined Total Price

[ ] Supplemental Agreement will be prepared following completion of the work to pay for labor, equipment, and material. Payment will be according to the provisions of Subsection 109.05. If the total cost is estimated to exceed $50,000.00, then a Force Account Agreement should be considered.

[ ] Force Account Agreement will be completed. Weekly force account statements will be prepared.

DESCRIPTION OF WORK: *(Include specifications if non-standard items)*

Vehicle access gate added at the request of Sarpy County Engineer Gate is 3.m wide 1.2m. high with chain and lock. Standard chain link fence fabric.

ITEM OF WORK	UNIT	APPROX. QUANTITY	AGREED UNIT PRICE	AMOUNT
Chainlink fence Vehicle access gate	ea	1	$510.00	$510.00
			TOTAL PRICE	**$** $510.00

FOR THE DEPARTMENT OF ROADS	FOR THE CONTRACTOR
SIGNATURE:	We Concur SIGNATURE:
NAME:	NAME:
TITLE:	TITLE:
DATE:	DATE:

DR Form 188, Jul 94

THIS FORM REPLACES DR FORM 188, AUG 78, PREVIOUS EDITIONS WILL BE DESTROYED.

@

This information must be given to the project manager prior to beginning work, preferably at the preconstruction conference.

DBE PERFORMANCE RECORD

Submitted by John Jones of Small Construction Co.

Project Number F-6-7 (1030) Location

Prime Contractor Cyclone Construction Co Amount of Subcontract $50,000.00

Description of work to be performed. Identify by group or line item and type of work.
Group 7B - 1000 m of 1.83 m high chain link fencing to be

List of owned equipment to be used on this project.
300 mm post hole auger
Mobile cement mixer

List of leased equipment to be used on this project. Attach a copy of the lease.
Grader

Name of superintendent assigned to this project John Jones of Small Construction Co

Names of foremen assigned to this project Paul Jones

If local labor is to be used, who is responsible for hiring Paul Jones

Who is responsible for ordering materials John Jones

Who is authorized to accept deliveries John or Paul Jones

List of materials and supplies needed for this project and source of supply

300 poles at 37.5 mm diam x 2.1 m length	Menards Lumber, Paillion
1000 m of chainlink fence fabric	" " "
Cement 300 Sacks	" " "

Do you have an agreement for the issuance of joint checks for supplies? Yes X No

List workers to be used on this project. If worker is a regular employee, show their name. If not yet hired, indicate it to be local hire. Use another sheet if necessary.

Trade	Name	Local Hire
Carpenter	James Green	Yes
Carpenter	Sheila Smith	Yes

DR Form 203, Apr 92

printed on recycled paper

Sheet.....of.....

STATE OF NEBRASKA
DEPARTMENT OF ROADS

WEEKLY FORCE ACCOUNT STATEMENT

NOTE: *Read instructions on back of sheet.*

PROJECT NO.: F-6-7(1030)

NAME OF ROAD: US Highway 6

WEEK ENDING: 1
7-13-96

Description of work.....

.....

.....

at Station.....on Project No.....

for which rates have been established in Force Account Agreement dated.....

ITEM (Labor, Equipment, Materiel, Freight and Haulage)	HOURS OR UNITS	RATE OR UNIT PRICE	AMOUNT
	(2)		
3			
4			
1 This date varies with different contractors.			
2 Hours or units for weekly paid employee are the hours worked divided by the hours			
in the week. Show as a fraction in column.			
3 When employees receive subsistence in addition to salary, the rate and amount earned			
shall be computed separately from salary because subsistence is subject to profit only.			
4 Receipted invoices must accompany force account statements which include materials or			
rented equipment.			
5 Show this amount on the progress estimate in the pertinent group as a contingency.			

Workmen's compensation, public liability, and property damage insurance @ $.....per $100.	$
Social security taxes..... .....% of labor payroll.	$
Profit on labor, materials, insurance, social security taxes, freight and items of work and haulage not performed with the contractor's own labor and/or equipment.	$
The above is a true statement of labor, equipment and material used during the week ending. — SHEET TOTAL	$

CONTRACTOR:	APPROVED *(District Engineer)*
AUTHORIZED AGENT:	DATE:
APPROVED: *(Project Manager)*	

DR Form 204, Aug 72

THIS FORM REPLACES RC FORM 318, PREVIOUS EDITIONS WILL BE USED.

Special Training Provision
Monthly On-Job-Training Report

Sheet 1 of 1

CONTRACTOR: *(Name and Address)*

Cyclone Construction Co.
12699 So 70th St
Papillion, NE

INSTRUCTIONS: This summary report must be made each month in triplicate. Original and one copy to Project Manager in sufficient time for inclusion in monthly progress estimate. Keep copy for file.

NOTE: *Remarks column to be used for reporting when a trainee completes training, terminates employment or is replaced by another trainee.*

PROJECT NO.:

MONTH AND YEAR: July 1996

LEGEND

B - Black **A** - Asian American Pacific Islander **W** - Women
AI - American Indian/Alaska Native **H** - Hispanic

TRAINEE NAME AND SOCIAL SECURITY NUMBER *(one Trainee per line)*	RACE OR NATIONAL ORIGIN	WORK CLASSIFICATION	GROUP BEING TRAINED	WAGE RATE PAID	HOURS TRAINED THIS MONTH		TOTAL HOURS TRAINED TO DATE		REMARKS
					THIS PROJECT	OTHER PROJECTS	THIS PROJECT	OTHER PROJECTS	
John J. Kneu	B	Carpenter		8.50	35	25	150	250	None
Jose L, Knnesto	H	Carpenter		8.50	25	35	50	200	None
		(PM submit to the Construction Division, Minority Business Office.)							

CONTRACTOR'S REPRESENTATIVE: *(Signature & Title)*

DATE:

REVIEWED FOR DEPARTMENT OF ROADS: *(Signature & Title)*

(PM)

DATE:

DR Form 298, Jan 94

THIS FORM REPLACES DR FORM 298, FEB 74.
PREVIOUS EDITIONS WILL BE DESTROYED

(On Computer)

Evaluation of Contractor

Number (2) (5)

Contractor: Jones Construction Company

Project No. 0091 0021 (6) (13) Coding for Project RF-91(21)

1

1 [x] (14) Prime Contractor

2 [ ] (14) Subcontractor for: _____ (Name of Prime Contractor)

Location Omaha-Ft. Calhoun (15) (54)

County Washington (55) (70)

[ ] (71) Project = Blank, Patrol = 1, Bridge = 2, Other = 3

[ ] (72) Add = Blank, Change = C, Delete = D

2

District No. 2 (14)

Groups of Work 1 and 3 (15) (54)

Amount of Contract or Subcontract $ 7436025.8 (55) (64)

3

Progress of Work

	Month	Day	Year						
A. Contract Starting Date	5	10	78	(14)	(19)	C. Actual Starting Date	5	13	78	(26)	(31)	E. Working Days Allowed	90	(38)	(41)
B. Notice to Proceed Date	5	10	78	(20)	(25)	D. Completion Date	12	2	78	(32)	(37)	F. Working Days Used	100	(42)	(45)

Evaluation

	Unsatisfactory 1	Poor 2	Fair 3	Good 4	Excellent 5	Superior 6
Quality of Equipment (46)				X		
Amount of Equipment (47)				X		
Quality of Personnel (48)			X			
Amount of Personnel (49)			X			
Quality of Work (50)				X		
General Attitude (51)				X		
Prosecution of Work (52)			X			
Employee Safety (53)			X			
Public Safety (54)				X		

Note: *If you wish to make any remarks concerning the above data or ratings, place a checkmark here* [ ] (55) *and enter remarks on reverse side of this form.*

Instructions:

Complete required information for all contractors and subcontractors for each contract. Submit with final computations.

Report Date: Month 1, Day 3, Year 79 (56) (61)

Project Manager: Last Name Smith (62), Initials A T (78)

Signed: A T Smith
Project Manager

RDP Form 344, Nov 78

(Contractor fills out this form
Submits to Construction Division)

STATE OF NEBRASKA DEPARTMENT OF ROADS

E.E.O. CONTRACTOR'S SELF-ANALYSIS

MONTH AND YEAR: January 1996

INSTRUCTIONS

This self-analysis form is designed for contractors to indicate their affirmative action practices and for equal employment opportunity procedures. It is required of all prime contractors and subcontractors on Federal-aid projects of $10,000 or more and is valid for one year. Self-analysis forms should be submitted at the beginning of each year. **You cannot begin work on any federal aid project for that current year until your affirmative action practices and equal employment opportunity procedures have been accepted.** The prime contractor must assure that their subcontractors have filed their self-analysis form prior to the start of the project. This self-analysis will cover any affiliated companies if names and addresses are furnished. Additional forms are available upon request from the Department of Roads' Minority Business Office in Lincoln or any district office.

NAME AND ADDRESS OF CONTRACTOR:

Cyclone Construction, Inc., PO Box 1000
Liberal, KS 67901-2000

GENERAL

1 Is our company aware of the equal employment opportunity requirements? ☒ YES ☐ NO

2 Our key company personnel are aware of equal employment opportunity requirements as set forth in Form FHWA 1273, "Required Contract Provisions Federal-Aid Construction Contracts" and the Special Provisions. ☒ YES ☐ NO

EQUAL EMPLOYMENT OPPORTUNITY POLICY

It is the policy of this company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, or national origin. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training.

☐ YES ☐ NO

Is this E.E.O. policy posted at all Federal-aid project sites? ☒ YES ☐ NO *(Indicate where posted)*

On a bulletin board located at the job site.

Are the required E.E.O. posters posted near the E.E.O. policy? ☒ YES ☐ NO

Are all employee facilities on a nonsegregated basis? ☒ YES ☐ NO

E.E.O. OFFICER: *(Name and address)*

Ken Michael
124 Kansas Ave.
Liberal, KS 67901

AFFILIATED COMPANY(S)

Smith Construction Co.
PO Box 668
Lincoln, NE 68123

John Construction Co.
5601 So 48 St.
Omaha, NE 68444

Has the E.E.O. officer adequate knowledge, authority and responsibility to carry out the E.E.O. provisions of the contract? ☐ YES ☐ NO *(Summarize the duties, authority and responsibilities of the company E.E.O. officer)*

Complete authority, familiar with all requirements, checked minority groups

DISSEMINATION OF POLICY

1 All members of our staff who are authorized to hire, supervise, promote and discharge employees, or recommend such action, are made fully cognizant of E.E.O. policy in the following manner:

Superintendents are required to take "orientation" which is a training session that includes provisions of our EEO policy. Also, we hold year end meetings annually to review and revise policies.

2 Our E.E.O. officer will hold a meeting with all supervisory and personnel office employees, prior to the start of work on Federal-aid projects, to explain our E.E.O. policy and how affirmative action can be carried out? ☒ YES ☐ NO *(Summarize dates and locations of such meetings)*

Office employees go over each contract prior to the start of a job to check and verify EEO requirements. "Tailgate" meetings are held at the jobsite whenever and wherever employees can be assembled prior to the start of a Federal Aid project.

3 Our E.E.O. officer has established the following schedule to conduct meetings with supervisory employees relative to E.E.O. provisions. *(Meetings must be conducted at least every six months)*

Weekly safety meetings are held in which all EEO changes or problem areas can be discussed. Also, one large meeting is held at the start of each year; smaller meetings are held at the start of each Federal Aid project.

4 Are all new supervisory personnel given a thorough indoctrination by our E.E.O. officer, or other knowledgeable company official, within thirty days after reporting to work? ☒ **YES** ☐ **NO** How is this accomplished?

In addition to "orientation", the EEO officer gives new personnel an EEO Policy Statement to read and sign before they start work. Office personnel verify that the forms are promptly submitted and signed. The EEO Officer is available to all employees to answer questions they may have.

5 Are all applicants and new employees informed of our company's E.E.O. policy when they report for an interview or work? ☐ **YES** ☐ **NO** How is this accomplished?

Complete EEO Polciies are located on bulletin boards at the shop where applicants apply. New-hire employees are given the same EEO Policy Statement to read and sign as are Supervisory personnel.

RECRUITMENT

1 When advertising for employees, our advertisements carry the notation "An Equal Opportunity Employer." ☐ **YES** ☐ **NO** *(Attach a copy of advertising previously used)*

2 Are advertisements for employees carried in newspapers and other publications which have a large circulation among female and minority groups? ☒ **YES** ☐ **NO** *(Specify papers or publications)*

In addition to newspapers, we send recruitment letters to the following organizations: Job Service Centers in Hays, Colby, Junction City, McPherson, Salina, Dodge City, Garden City, Goodland, Liberal, Tabor College, Fort Hays, Bethany College, KS Wesleyan, Salvation Army, American G.I. Forum, YMCA, YWCA, and St. Mary's of the Plains.

3 Are supervisory employees instructed to keep a record of all personnel who apply for employment at the job site? ☒ **YES** ☐ **NO** How is a record kept as to whether applicant is a minority or female and the details as to why applicant is or is not hired?

Information is submitted to the office where an applicant roster is entered on the computer.

4 Does our company maintain a list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and community organizations when we have employment opportunities available, and maintain a record of the organization responses? ☒ **YES** ☐ **NO** *(Give dates and locations of such recruitment)*

We mailed letters to minority agencies soliciting help for several projects in Nebraska and Iowa. Their letters are on file and listing of minority agencies is also on file for future use.

5 Our company is: ☐ Union ☒ Non-union

6 We rely ☐ solely on or ☐ partly upon unions as a source of our work force. n/a

7 How many minority and female employees have the union referred for hiring? 0

8 Has our company made an effort to incorporate an E.E.O. clause in all union agreements to the end that such unions will be contractually bound to refer applicants without regard to race, religion, sex, color or national origin? ☐ **YES** ☐ **NO** *(Specify)*

We currently do not have any union agreements. However, all EEO requirements are made an integral part of each contract/subcontract agreement.

9 Are present employees encouraged to refer minorities and females for employment? ☒ **YES** ☐ **NO** *(Specify)*

Letters to employees are posted in our shop encouraging referrals of minorities, women, and veterans of the Vietnam Era.

PERSONNEL ACTIONS

1 Are all wages, working conditions, and employee benefits established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination taken without regard to race, color, religion, sex, or national origin? ☒ **YES** ☐ **NO** *(Specify)*

See EEO Policy.

2 How often are project site inspections made to insure nondiscrimination in working conditions and employee facilities? Who makes these inspections?

Monthly inspections are made by the EEO Officer.

3 How are all employees instructed as to whom they can contact if they believe discrimination is occurring?

The name, address and phone number of the EEO Officer is listed on the EEO Policy Statement which every employee signs. It is posted at the shop and on the bulletin boards at the job site. It is listed in the Employee Handbook which not only names the EEO officer but outlines steps to take if there is a grievance.

4 How are investigations made of all complaints, and how is a record made of the appropriate action?

See the section on grievances in the employee handbook. The date, the names of parties involved, the compliant and the action taken will be logged. When a mutual understanding is reached, the log will be considered closed.

5 How is a periodic review made of the spread of wages in each classification to determine any evidence of discriminating wage practices?

Twice a year all wages are reviewed by classification of employee and are updated accordingly. We have a set wage scale for each class of employee, regardless of age, race, sex, etc.

6 How are our employees informed of any training programs available and the entrance requirements of each?

There is a memo posted on the bulletin board at the shop regarding the Manpower Training Program. Also, employees are informed of training rograms on a pre-employment form, and given an opportunity to enroll upon employment. Letters are sent out to each employee prior to new session of "Our University", our in-house training program.

7 What provisions have been made for upgrading employees through on-the-job training?

Employees are eligible to participate in "Our University" training sessions free of charge during the lay-off season.

SUBCONTRACTING

1 How are subcontractors informed as to E.E.O. requirements of the company?

EEO requirements are included in each subcontract agreement. See attached.

2 What steps have been taken to assure our company that all subcontractors are complying?

The EEO officer visits each job site at least once a month to ensure that subcontractors are in compliance. Also, a Project Superintendent is available on a daily basis to ensure that requirements are being met.

3 Does our company try to utilize minority group subcontractors or subcontractors with meaningful minority group representatives among their employees? ☒ **YES** ☐ **NO** *(Specify)*

Minority contractors are used as subconstractors whenever possible. Please note: Brown & Brown, Inc. works primarily as a subcontractor rather than a prime contractor.

RECORDS AND REPORTS

How are records kept for the following items:

1 The number of minorities and females employed in each work classification on the project.

Labor reports are completed as required. See attached. Periodic reports are prepared by the office and forwarded to the EEO Officer with recommendations on hiring.

2 The progress and efforts being made in cooperation with unions to increase employment opportunities for minorities and females.

We do not have previous experience with unions.
or
We are Non-Union.

3 The progress and efforts being made in locating, hiring, training, qualifiying, and upgrading minority and female employees.

All applications are considered, applications are on file if any job openings are available. We are trying to recruit minority and female employees.

4 The progress and efforts being made in securing the services of minority group subcontractors or subcontractors with meaningful minority group and female representation among their employees.

Quotations requested for State and Federal projects.

5 Are all records retained for a period of three years and available for review by the Nebraska Department of Roads or the Federal Highway Administration? ☒ **YES** ☐ **NO** *(Indicate at what location these records are available for review)*

Cyclone Cosntruction, Inc., 124 Kansas Avenue, Liberal, KS 67901

6 What procedure is followed to assure all E.E.O. forms required by the Nebraska Department of Roads and the Federal Highway Administration have been submitted as required?

The contractural agreement is read carefully with particular attention to EEO requirements. We complete many EEO steps regardless of whether or not they are required by a particular state to ensure that our EEO obligations are fulfilled.

UPON COMPLETION SEND TO:

Nebraska Department of Roads
Minority Business Office
PO BOX 94759
LINCOLN NE 68509-4759

CONTRACTOR PREPARES AND SUBMITS THIS FORM

RETURN TO:

Nebraska Department of Roads
Contract Lettings Division
P. O. Box 94759
Lincoln, NE 68509-4759

Date: 9-16-96

NEBRASKA DEPARTMENT OF ROADS

IDENTIFICATION OF DBE GOAL ACHIEVEMENT

DBE I

Project No.: F-16-3(222) Location: Nebraska City-South ST.

Letting Date: 2-22-96

Total dollar goal commitment at time of contract award: $ $275,905.99

Contractor's Name and Address: Ford & Ford Construction Company, Inc.
2134 Denver Avenue
Seward, Nebraska 21689

	Name of Certified DBE	Description of Work Subcontracted or Services Provided	$ Amount of Subcontract	$ Amount of Payment Issued	$ Amount of Retainage
1.	Orlando Construction Co., Inc.	Group 7	82,443.00	81,443.00	1,000.00
	Gemini Construction Co.	Group 4A	193,462.99	191,528.36	1,934.63
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

By _____ Total Actual DBE $ 275,905.99
Signature

DR Form 441, Jan 89 *LOCAL REPRODUCTION NOT ALLOWED* printed on recycled paper

SUBCONTRACTOR PREPARES AND SUBMITS THIS FORM

RETURN TO:
Nebraska Department of Roads
Construction Division - Business Minority
P.O. Box 94759
Lincoln, NE 68509-4759

Date: 2-16-96

Nebraska Department of Roads

Identification of Work Performed

DBE II

Project No.: F-16-3(222) Location: Nebraska City-South St.

Letting Date: 2-22-96

DBE Subcontractor's Name and Address: Orlando Construction Co., Inc.
PO Box 1061
Geneva, Nebraska 69205

Name of Prime Contractor: Ford & Ford Construction Company, Inc.

	Description of Work Subcontracted or Services Provided	$ Amount of Subcontract	$ Amount of Payment Received	$ Amount of Retainage
1.	Items Group 7	82,443.00	81,443.00	1,000.00
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				

By _____
Signature

Total Actual Payment Received $ 81,443.00

DR Form 442, Jan 89 *LOCAL REPRODUCTION NOT ALLOWED.* *printed on recycled paper*

EARTHWORK FORMS

DR 8	Water Applied Haul Sheet	1 - 37
DR23	Moisture Density Relations of Soils	1 - 38
DR 64	Site Release	1 - 39
DR 86	Weekly Report of Moisture ad Density Tests (or Computer Printout)	1 - 40
DR 99	Earthwork Computations	1 - 41
DR 101	Truck Capacity Computations	1 - 42
DR 210	Moisture Density Test	1 - 43
DR 232	Final Status Material and Site Releases	1 - 44
DR 264	Field Gradation Tests of Gravel For...	1 - 45
DR 309A,B,C	Contractor's Estimate (Fuel Adjustment Computations)	1 - 46
DR 324	Source of Aggregate to be Used	1 - 51
DR 348	Material Pit Contract Release	1 - 52
DR 478	Nuclear Density Record	1 - 53

WATER APPLIED HAUL SHEET

PROJECT NO.:	ROAD:
F-6-7(1030)	US Highway 6
COUNTY:	CLASS OF WORK:
Douglas	(1) Group 1 - Grading

TRUCK NO.:	TANK NO.:	TANK CAPACITY:	DATE:	SHIFT:
1412	105	20,150 L	7-12-96	(2) 0600-1800 hr

LOAD NO.	HAULING TIME			LOADING POINT	LOCATION APPLIED	CAUSE LOST TIME
	OUT	IN	TOTAL			
1	0630	0647	17 m	Johnson Well	Sta 205.00	
2	0650	0930	2hr 40m	Johnson Well	Sta 205.25	Water line broke
3						
4						
5						
6						
7	(1) Put Group number for work being watered.					
8	(2) Put time in use if not operating on shifts.					
9	3 Have contractor fill out if inspector can't be present.					
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

DR Form 8, Dec 91

THIS FORM REPLACES DR FORM 8, NOV 69. PREVIOUS EDITIONS WILL BE USED.

Date: 2-3-97
Revised:

Nebraska Department of Roads
Materials and Tests Division
Lab Worksheet

MOISTURE-DENSITY RELATIONS OF SOILS
TEST METHOD: AASHTO T 99 AND T 180

DENSITY DETERMINATION								
DETERMINATION NO.	1	2	3	4	5	6	7	8
PERCENT MOISTURE ADDED	81 ml +2	76 ml +2	71 ml +2	66 ml +2	59 ml +2			
WT. WET SOIL & MOLD, gm	3866	3951	4045	4051	4001			
WT. MOLD NO. 05 gm	2031							
WT. WET SOIL, gm								
VOLUME OF MOLD, cc	940	→						
WET DENSITY, gm/cc								
DRY DENSITY, gm/cc	1.812	1.866	1.918	1.889	1.817			
MOISTURE DETERMINATION (TEST METHOD: AASHTO T 265)								
CONTAINER NO.	6	7	8	9	10			
WT. WET SOIL & CONT., gm	291.0	288.5	321.1	367.4	383.0			
WT. DRY SOIL & CONT., gm	276.0	270.6	296.0	332.9	342.9			
WT. OF WATER, gm								
. OF CONTAINER, gm	82.4	81.9	82.2	82.1	81.7			
WT. OF DRY SOIL, gm								
PERCENT MOISTURE	7.75	9.49	11.74	13.76	15.35			

PROJECT: AASHTO

LAB IDENT.: #128

M/D CURVE NO.: I-140

MAX. DENSITY, gm/cc: 1.920 / 119.8 lb/ft³

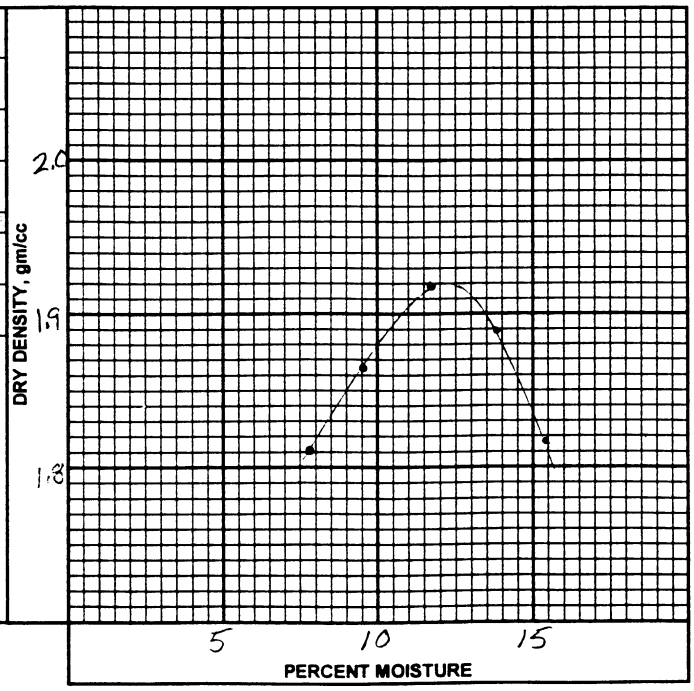
OPT. MOISTURE, PERCENT: 12.1

OPERATOR: Rick

DATE TESTED: 8-12-97

DATE REPORTED:

REMARKS:



FORM MT 23

PROJECT F-6-7(1030)
LOCATION Highway 6 (2 mi west of Gretna)
CONTRACTOR Cyclone Construction Company (Bob R. Gates)

(When releasing a Option Pit, use DR Form 348)

SITE RELEASE

This release is made by Dave Johnson,
Owner of property located and described as follows:

SE ¼ of Sec 27 T12 N R30 W

WITNESSETH:

That by previous lease or rental agreement, the Owner leased to Nebraska Department of Roads (Contractor) the above land for Borrow Material (Option Pit No. 1)

That said lease was for the term of 21 January 1997 to 21 January 1998,

or until the completion of project F-6-7(1030).

That the Owner has been notified by the Contractor that the use and occupancy of the lease property is no longer needed and that the lease is terminated. Wherefore, the Owner, under the terms of the lease, acknowledges that he has carefully inspected the property that was leased by the Contractor and that he has found the property to be in a neat and presentable condition and that the Contractor has fulfilled all of the terms of the lease.

THEREFORE, the Owner, by this instrument, does release the Nebraska Department of Roads, from any and all damages that arose by the use of the property as described above. That the Owner acknowledges that he has received full payment by way of just compensation for the use, occupancy and any and all damages caused by such use and occupancy by the Contractor. That this release is effective as of this 21st day of January, 19 97. The Owner further acknowledges that the Contractor has removed all property from the site.

Excuted this 21st day of January, 19 97.

Project Manager
Witness

Dave Johnson
Owner

cc: Property Owner
Construction Office
District Engineer
Project Manager

1. Not required for Contractor obtained areas.
2. Complete only on Pits/Areas that Department obtains.
3. PM should get site release while Contractor still on site.

DR Form 64, Aug 74

Distribution:
1. Materials & Tests Division
2. District Engineer
3. Project Manager

(Not needed if you use Nuclear Density Gauge Computer Print Out.)

STATE OF NEBRASKA
DEPARTMENT OF ROADS

WEEKLY REPORT OF MOISTURE AND DENSITY TESTS

(Eliminates the need for this information in the field notebooks)

PROJECT NO.: F-281-2(1009)
NAME OF ROAD: St Paul South
REPORT NO.: 30
WEEK ENDING: 13 July 96

TYPE OF WORK *(embankment, subgrade, foundation course, soil-aggregate base, etc.)*
Shoulder
SUBGRADE

METHOD OF COMPACTION	
CLASS	TYPE
III	

COLUMN NUMBER		1	2	3	4	5	6	7	8
Date		7-9	7-10	7-10	7-10	7-10	7-10	7-10	7-10
Sample No.		439	440	441	442	443	444	445	446
Curve No.		G-15	G-15	G-15	G-15	G-15	G-15	G-15	G-15
Opt. Moist. From Curve		11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
Max. Dens. *(Dry)* from Curve		1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87
Required Moist. Limits		As Needed	As Needed	As Needed	As Needed	As Needed	As Needed	As Needed	As Needed
Required % of Max. Dry Dens.		100%	100%	100%	100%	100%	100%	100%	100%
SAMPLE TAKEN AT	Station	660+00	680+00	700+00	820+00	830+00	840+00	850+00	720+00
	Ft. Rt. or Lt. of ¢	SHO 4'RT	SHO 3'RT	SHO 4'RT	SHO 5'RT	SHO 4'RT	SHO 3'RT	SHO 6'RT	SHO 4'RT
	Depth Below Finish Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade
ACTUAL VOLUME	Final Reading *(cc or cu ft)*	820	880	890	860	870	850	940	910
	Initial Reading *(cc or cu ft)*	410	410	410	410	410	410	410	410
	Difference *(cc or cu ft)*	410	470	480	450	460	440	530	500
	Volume of Sample *(cc)*	410	470	480	450	460	440	530	500
ACTUAL MOISTURE	Wet Wt. *(gms)*	200	200	200	200	200	200	200	200
	Dry Wt. *(gms)*	184	184	184	183	183	186	183	184
	Loss *(gms)*	16	16	16	17	17	14	17	16
	Moisture *(%)*	9.0	9.0	9.0	9.2	9.2	8.0	9.2	9.0
ACTUAL DENSITY	Wet Wt. *(gms)*	867	978	998	942	947	890	1099	1019
	Wet Dens. *(gms/cc)*	2.11	2.08	2.04	2.09	2.06	2.02	2.07	2.04
	Dry Dens. *(gms/cc)*	1.94	1.91	1.87	1.91	1.89	1.87	1.89	1.87
Maxium Density *(% of)*		104%	102%	100%	102%	101%	100%	101%	100%
Thickness *(GFC, SABC, etc.)*		*	*	*					*

REMARKS:
Final Trim *Ck samples due to rain

INSPECTOR:

APPROVED: *(Manager)*

DR Form 86, Feb 72

330

STATE OF NEBRASKA
DEPARTMENT OF ROADS

EARTHWORK COMPUTATIONS

Project No. F-6-7(1030)
(1) Preliminary—Final Quantities
Sheet No. 1 of 5

STATION 100 m LT	DIS-TANCE m	EXCAVATION End Area ~~Sq. Ft.~~ m2	Sum End Areas ~~Sq. Ft.~~ m2	Sum End Areas Corrected For Dis-tance m2	Cubic ~~Yards~~ meters	EMBANKMENT End Area ~~Sq. Ft.~~ m2	Sum End Areas ~~Sq. Ft.~~ m2	Sum End Areas Corrected For Dis-tance	Cubic Yards
360+0.0	0	0	0	0					
361+0.0	100	325	325	325					
362+0.0	100	250	575	575					
362+25	25	80	80	20					
Sum: 2.25	225	655	980	(2) 920	46,000				

(1) Circle Prelim or Final
(2) Mutiply this number by 50 to get cubic meters
(920x50=46,000)

ENGLISH Example

260+0.0	0	0	0	0					
361+0.0	100	325	325	325					
362+0.0	100	250	575	575					
362+25	25	80	80	20					
Sum 2.25	225	655	980	920	2				

2 Multiply this number by 1.8518519 to get cubic yards
Divide by .54 to get cubic yards.

Col. (Total)	Col. (Total)	Col. (Total)	(Col. Total)	(Col. Total)	(Col. Total)	(Col. Total)	(Col. Total)	(Col. Total)

Computed by BCC
Checked by SB

DR Form 99, Oct 70

NO CONVERSIONS WITH METRIC UNITS

STATE OF NEBRASKA
DEPARTMENT OF ROADS

TRUCK CAPACITY COMPUTATIONS

Project No. F-6-7(1030)

Truck No. 2412

Contractor Cyclone Construction Co

License No. 7810

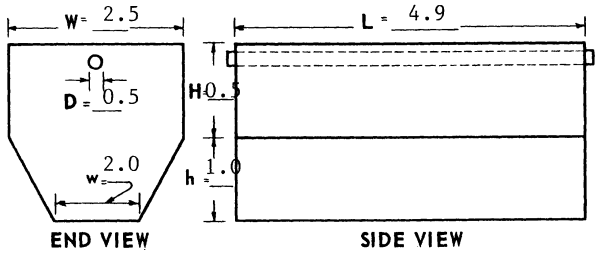
~~R.C. License No.~~ (N.A.)

Truck Owner James Baker

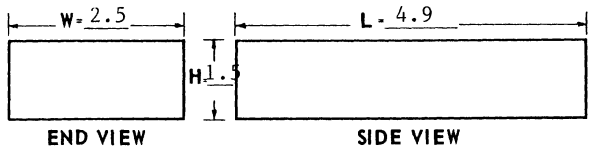
Material Being Hauled Gravel

~~License Capacity~~ (N.A.) Tons

Date 6-20-96



Make all measurements of dimensions inside the box, in feet and tenths. Show location and dimensions of all braces, blocks, pipes, etc.



TRAPEZOIDAL BOX

Gross Volume..... $\left[\left(W \times H\right) + \left(\frac{W + w}{2} \times h\right)\right] \times L$

$\left[\left(2.5 \times 0.5\right) + \left(\frac{2.5 + 2.0}{2} \times 1.0\right)\right] \times 4.9 = 17.15$ m ~~cu. ft.~~

Deduction for pipe $3.14 \times \frac{D \times D}{4} \times L$

$3.14 \times \frac{0.5 \times 0.5}{4} \times 4.9 = 0.31$ cu. ~~ft.~~ m

Other Deductions..... Ledge in bed = 2.10 cu. ~~ft.~~ m

Net Volume ..... 17.15 (Gross Volume) − 2.41 (Total Deductions) = 14.74 cu. ~~ft.~~ m

$\frac{\text{cu. ft.}}{27}$ = cu. yds.

RECTANGULAR BOX

Gross Volume..... W × H × L

2.5 × 0.5 × 4.9 = 6.13 cu. ~~ft.~~ m

Deductions..... None = 0 cu. ~~ft.~~ m

Net Volume ..... 6.13 (Gross Volume) − 0 (Total Deductions) = 6.13 cu. ~~ft.~~ m

$\frac{\text{cu. ft.}}{27}$ = cu. yds.

If box is not trapezoidal or rectangular, show by a detailed sketch on reverse side of this sheet, all dimensions and computations.

This truck box was built by MACK Serial No. J-187S51 and the measurements and capacity as shown on Sketch No. 1.1 capacity of 20.85 m^3 ~~cu. yds.~~ have been checked and verified.

This is to certify that we will accept payment for 20.85 m^3 cubic yards per load measured in this box rather than reduce the capacity.

Measured by John Sharp Const Tech III (Title)

Address NDR D-1

Cyclone Construction Co (Contractor) By I.AA. Freeswing

Checked by James Sharper PM (Title)

2-7-96 (Date) Owner-Superintendent (Title)

Date 2-7-96

Original to Field District office as soon as measurements and computations are completed, second copy for your files.

DR Form 101, Oct 70

2710

STATE OF NEBRASKA
DEPARTMENT OF ROADS

MOISTURE DENSITY TEST

AASHO T-99, METHOD

DENSITY DETERMINATION								
DETERMINATION NUMBER	1	2	3	4	5	6	7	8
PERCENT MOISTURE ADDED	4	6	8	10	12			
WT. WET SOIL & MOLD, GM	3742	3838	3937	3942	3908			
WT. MOLD NO. GM	2036	----------	----------	----------	----------			
WT. WET SOIL, GM								
VOLUME OF MOLD, CC.	940	----------	----------	----------	----------			
WET DENSITY, GM/CC								
DRY DENSITY, GM/CC	1.610	1.668	1.726	1.701	1.642			
MOISTURE DETERMINATION								
CONTAINER NO.	1	2	3	4	5			
WT. WET SOIL & CONT., GM	348.1	394.3	404.6	394.7	430.9			
WT. DRY SOIL & CONT., GM	318.1	353.8	357.4	344.2	369.6			
WT. OF WATER, GM								
WT. OF CONTAINER, GM	82.1	82.1	82.9	81.4	81.7			
WT. OF DRY SOIL, GM								
PERCENT MOISTURE	12.7	14.9	17.2	19.2	21.3			

PROJECT: 6-6(126) and L80H(105)

LAB. IDENT.: S95-381

SPECIFIC GRAVITY:

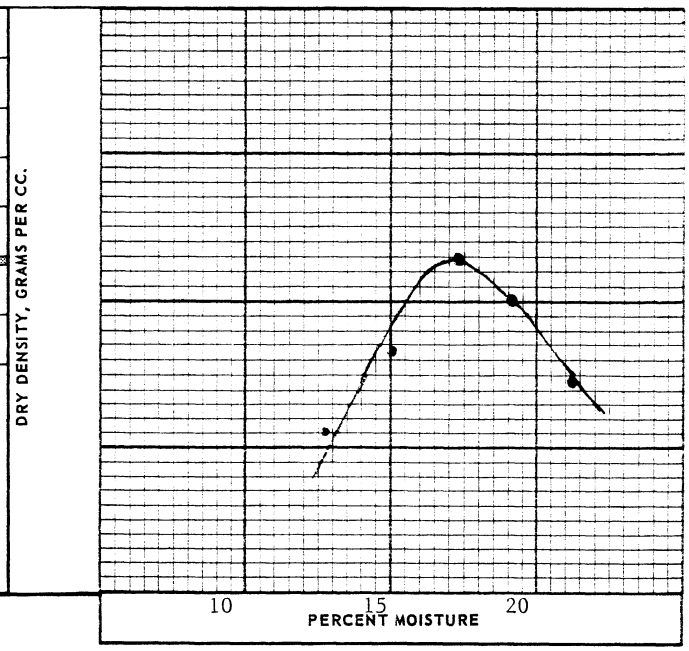
MAX. DENSITY, GM/CC: 1.73

OPT. MOISTURE, PERCENT: 17.2

OPERATOR: Allen

DATE: 7-27-95

REMARKS: MDC#G-119



DR Form 210, Sep 72

printed on recycled paper

Final Status Material & Site Releases

White - L. O. Finals Section
Yellow - District Final Review
Pink - Project Manager

PROJECT NO.:	DATE:
F-81-1(1018)	7-11-96
CONTRACTOR: Cyclone Construction Company	GROUP NO.: 1

INSTRUCTIONS

(Refer to the Construction Manual, Pages 123 and 124)

Circle the number in the "Material or Site From" column that applies.

1 - Project Right of Way Limits
2 - Commercial Producer
3 - Railroad Property
4 - Private Property
5 - City or County *(Other than project right-of-way)*

Numbers 1 and 2 are the only "Material or Site From" locations which do not require a site release. Letters to the Right of Way Office with a copy to the Construction Office are necessary for all option pits whether used or not. If options other than free are noted and used, the letter should be addressed to the contractor. A letter of concurrence from the contractor is then required.

MATERIAL OR SITE	MATERIAL OR SITE FROM	RELEASE REQUIRED		PLAN OPTION		ALL LETTERS FOR PLAN OPTIONS COMPLETED		REMARKS
		YES	NO	YES	NO	YES	NO	
SHOULDER MATERIAL	1 2 3 4 5		x		x			No action required
ROADWAY GRADING	1 2 3 4 5		x		x			No action required
BORROW	1 2 3 4 5	x		x		x		
FINE SAND	1 2 3 4 5		x		x			No action required
SOIL BINDER	1 2 3 4 5							
MINERAL FILLER	1 2 3 4 5							
COURSE SAND	1 2 3 4 5	(Only need site releases for Pits/Land the Department obtained.)						
SAND GRAVEL	1 2 3 4 5	(Only projects let prior to March 1995 need this form.)						
	1 2 3 4 5							
	1 2 3 4 5							
	1 2 3 4 5							
CAMP SITE	1 2 3 4 5							
PLANT SITE	1 2 3 4 5							
WASTE SITE	1 2 3 4 5							
STORAGE SITE	1 2 3 4 5							
	1 2 3 4 5							
	1 2 3 4 5							
	1 2 3 4 5							

SIGNATURE:	DATE:
Project Manager	7-11-96

DR Form 232, Jul 92

THIS FORM REPLACES DR FORM 232, OCT 79. PREVIOUS EDITIONS WILL BE USED

STATE OF NEBRASKA
DEPARTMENT OF ROADS

Check One
[ ]
[x]

FIELD GRADATION TESTS OF GRAVEL FOR SURFACING AND MINERAL AGGREGATE FOR ARMOR COAT

(Eliminates the need for this information in the field notebook)

PROJECT NUMBER: Sheet 1 of 4
REPORT NUMBER: P. O. #545329

NAME OF ROAD: Hwy. 59 M. P. 24.8 ½ mile West of Jct. 121/59
COUNTY: KNOX

PIT NUMBER:
LOCATION: NE ¼
SECTION: 18
T. 26 N
R. 1W
6 Miles NE of Pierce (Town, City, Landmark)

NAME OF PRODUCER: Backus Sand & Gravel
CONTRACTOR: SAME
DELIVERY POINT: Stockpile
SAMPLED FROM: SAME

SPECIFICATIONS — SECTION: — SUBSECTION:
SPECIAL PROVISIONS — SECTION: — SUBSECTION:

MECHANICAL ANALYSIS OF MATERIAL Spacer sieves *(were) (were not)* used

DATE	SAMPLE NUMBER	WASH OR DRY TEST		DRY WEIGHT OF SAMPLE	TOTAL WEIGHT RETAINED ON SIEVE / TOTAL PERCENT RETAINED ON SIEVE 1"	3/4"	3/8"	No. 4	No. 10	No. 50	No. 200	QUANTITY OF MATERIAL REPRESENTED BY THIS TEST & CAR NUMBER	STATION
06/20	1	DRY	Weight	50			1		37	49	50	50 cu. yd.	Stockpile
			Percent				2		74	98	100		
06/20	2		Weight	75			1		57	74	75		
			Percent				1		76	99	100		
06/20	3		Weight	37			1		28	37	37		
			Percent				1		76	100	100		
06/20	4		Weight	46			1		33	46	46		
			Percent				1		72	100	100		
06/20	5		Weight	61			1		44	60	61		
			Percent				2		72	98	100		
Computation for Deduction =				Sum of % Retained on No. 10 Sieve= divided by Number of Tests Performed=					370 / 74 = Ave %			____ % Deduction (From Tables in Specifications) x Contract Unit Price $ ____ = $ ____ Per C.Y. for Lot No. ____ .	
06/21	6	DRY	Weight	57			1		43	57	57	50 cu. yd.	Stockpile
			Percent				2		75	100	100		
06/21	7		Weight	62			0		46	61	62		
			Percent				0		74	98	100		
06/24	8		Weight	35			0		24	34	35		
			Percent				0		69	97	100		
06/24	9		Weight	42			1		30	41	42		
			Percent				1		71	98	100		
06/24	10		Weight	54			1		41	54	54		
			Percent				2		76	100	100		
Computation for Deduction =				Sum of % Retained on No. 10 Sieve= divided by Number of Tests Performed=					365 / 73 = Ave %			____ % Deduction (From Tables in Specifications) x Contract Unit Price $ ____ = $ ____ Per C.Y. for Lot No. ____ .	
	SPECIFICATION RANGE						0-6		59/81	90/100	96/100		

DISTRIBUTION
1 - Materials and Tests Division
2 - CHECK ONE
[ ] Construction Division *(Submit with Final Computations)*
[x] Maintenance Division *(Submit with Purchase Order)*
3 - District Engineer
4 - Project Manager

Duplicate of Sample Number MA-96-2 Submitted to Lincoln Laboratory for Correlation.

REMARKS: *(Indicate disposal of material failing Specification Requirement)*

INSPECTOR: Amy Rezac

APPROVED: *(Project Manager)* Robert Shoyler

DR Form 264, Jan 77

THIS FORM REPLACES OR FORM 264, OCT 74, PREVIOUS EDITIONS WILL BE USED UNTIL EXHAUSTED.

(Form is on the computer.)

1. Lincoln Estimate File
2. Controller Division
3. Contractor
4. District Engineer
5. Project Manager

Contractor's Estimate

(Fuel Adjustment Computations)

Sheet 3 of 4 Sheets

Project Number(s) EACNH-BRF-136-6(108)
Beatrice East
Control Number 11141
Estimate Number 29-Additional
Estimate Date 7/21/95

Contractor: Constructors, Inc.

Contract Letting Date: November 5, 1992

Base Price Diesel Fuel ..... @ Gallon
Current Price Diesel Fuel ..... @ Gallon
Difference ..... @ Gallon

Quantity Excavation this Estimate = 6,602
Quantity Excavation Previous Estimates = 6,602
Quantity Excavation this Fuel Adjustment = 0

Quantity Earthwork Measured in Embankment this Estimate = ...
Quantity Earthwork Measured in Embankment Previous Estimates = ...
Quantity Earthwork Measured in Embankment this Fuel Adjustment = ...

Excavation Fuel Use Factor = 0.15 Gallons @ Cubic Yard
Earthwork Measured in Embankment Fuel Use Factor = 0.20 Gallons @ Cubic Yard

Fuel Adjustment this Estimate = FCA = QFd (Dc - D_b)

Therefore, FCA = ... × ..... × .....

FCA = 0

Fuel Cost Adjustment this Estimate = 0
Fuel Cost Adjustment Previous Estimates = Minus $43.91

Total Fuel Cost Adjustment this Estimate = Minus $43.91

Remarks: Item No. 021, Excavation (Established Quantity)

No excavation since December, 1993.

Computed by: Don H. Hitzeman Date: 7/24/95

Checked by: Charles W. Jasa Date: 7/25/95

DR Form 309A, Aug 92

printed on recycled paper

(Form is on the computer.)

1. Lincoln Estimate File
2. Controller Division
3. Contractor
4. District Engineer
5. Project Manager

Contractor's Estimate

(Fuel Adjustment Computations)

Sheet 1 of 4 Sheets

(1) Fuel price changes daily.
(2) Estimate date is date used to make adjustment. -- Make sure your estimate dates are current.

Project Number(s) EACNH-BRF-136-6(108)
Beatrice East
Control Number 11141
Estimate Number 29-Additional
Estimate Date 7/21/95

Contractor: Constructors Inc.

Contract Letting Date: November 5, 1992

Base Price Diesel Fuel ..... @ Gallon
Current Price Diesel Fuel ..... @ Gallon
Difference ..... @ Gallon

Quantity Excavation this Estimate = ...
Quantity Excavation Previous Estimates = ...
Quantity Excavation this Fuel Adjustment = ...

Quantity Earthwork Measured in Embankment this Estimate = ...
Quantity Earthwork Measured in Embankment Previous Estimates = ...
Quantity Earthwork Measured in Embankment this Fuel Adjustment = ...

Excavation Fuel Use Factor = 0.15 Gallons @ Cubic Yard
Earthwork Measured in Embankment Fuel Use Factor = 0.20 Gallons @ Cubic Yard

Fuel Adjustment this Estimate = FCA = QFd (Dc - D_b)

Therefore, FCA = ... × ..... × .....

FCA = ...

Fuel Cost Adjustment this Estimate = ...
Fuel Cost Adjustment Previous Estimates = ...

Total Fuel Cost Adjustment this Estimate = ...

Remarks: .....

Sheet No. 2 of 4	334,327.7	Cu. Yds. minus	$	781.81
Sheet No. 3 of 4	6,602	Cu. Yds. minus	$	43.91
Sheet No. 4 of 4	37,140.8	Cu. Yds. minus	$	218.02
Sheet No.		Cu. Yds.	$	
Totals =	378,070.5	Cu. Yds. minus	$	1,043.74

Computed by: Don Hitzeman Date: July 24, 1995

Checked by: Charles W. Jasa Date: July 25, 1995

DR Form 309B, Aug 92

printed on recycled paper

(Form is on the computer.)

1. Lincoln Estimate File
2. Controller Division
3. Contractor
4. District Engineer
5. Project Manager

Contractor's Estimate

(Fuel Adjustment Computations)

Sheet 4 of 4 Sheets

Project Number(s) EACNH-BRF-136-6(108)
Beatrice East
Control Number 11141
Estimate Number 29-Additional
Estimate Date 7/21/95

Contractor: Constructors, Inc.

Contract Letting Date: November 5, 1992

Base Price Diesel Fuel ..... @ Gallon
Current Price Diesel Fuel ..... @ Gallon
Difference ..... @ Gallon

Quantity Excavation this Estimate = 37,140.8
Quantity Excavation Previous Estimates = 41,080.0
Difference of Excavation this Fuel Adjustment = minus 3,939.2

Quantity Earthwork Measured in Embankment this Estimate = ...
Quantity Earthwork Measured in Embankment Previous Estimates = ...
Difference of Earthwork Measured in Embankment this Fuel Adjustment = ...

Correction Ratio = 37,140.8 ÷ 41,080.0 = 9.9041091

Remarks: Item No. 022, Excavation Borrow
No actual excavation performed since December 1993

Correction Computation:

Estimate No. 1	thru 9 = 0	×	0.9041091	=	$	0.00
Estimate No. 10 =	minus $241.14	×	"	=	$	-218.02
Estimate No. 11	thru 29 = 0	×	"	=	$	0.00
Estimate No. =		×		=	$	
Estimate No. =		×		=	$	
Estimate No. =		×		=	$	
Estimate No. =		×		=	$	
Estimate No. =		×		=	$	
Estimate No. =		×		=	$	
Estimate No. =		×		=	$	

Corrected Fuel Cost Adjustment = minus $ 218.02

Computed by: Don Hitzeman Date: 7/24/95

Checked by: Charles W. Jasa Date: 7/25/95

DR Form 309C, Aug 85

(Form is on the computer.)

1. Lincoln Estimate File
2. Controller Division
3. Contractor
4. District Engineer
5. Project Manager

Contractor's Estimate

(Fuel Adjustment Computations)

Sheet 2 of 4 Sheets

Project Number(s) EACNH-BRF-136-6(108)
Beatrice East
Control Number 11141
Estimate Number 29 - Additional
Estimate Date 7/21/95

Contractor: Constructors, Inc.

Contract Letting Date: November 5, 1995

Base Price Diesel Fuel ..... @ Gallon
Current Price Diesel Fuel ..... @ Gallon
Difference ..... @ Gallon

Quantity Excavation this Estimate = 334,327.7
Quantity Excavation Previous Estimates = 316,497.0
Difference of Excavation this Fuel Adjustment = Plus 17,830.7

Quantity Earthwork Measured in Embankment this Estimate = ...
Quantity Earthwork Measured in Embankment Previous Estimates = ...
Difference of Earthwork Measured in Embankment this Fuel Adjustment = ...

Correction Ratio = 334,327.7 ÷ 316,497.0 = 1.0563377

Remarks: Item No. 020, Excavation
No actual excavation performed since Dec. 1993

Correction Computation:

Estimate No. 1 thru 9 = 0	×	1.0563377	= $	0.00
Estimate No. 10 = minus $615.52	×	"	= $	650.20
Estimate No. 11 thru 16 = 0	×	"	= $	0.00
Estimate No. 17 = minus $124.59	×	"	= $	131.61
Estimate No. 18 thru 29 = 0	×	"	= $	0.00
Estimate No.	×		= $	
Estimate No. =	×		= $	
Estimate No. =	×		= $	
Estimate No. =	×		= $	
Estimate No. =	×		= $	

Corrected Fuel Cost Adjustment = minus $ 781.81

Computed by: Don Hitzeman Date: 7/24/95

Checked by: Charles W. Jasa Date: 7/25/95

DR Form 309C, Aug 85

1. Lincoln Estimate File
2. Controller Division
3. Contractor
4. District Engineer
5. Project Manager

Contractor's Estimate

(Fuel Adjustment Computations)

Sheet 4 of 4 Sheets

Project Number(s) EACNH-BRF-136-6(108)
Beatrice East
Control Number 11141
Estimate Number 29-Additional
Estimate Date 7/21/95

Contractor: Constructors, Inc.

Contract Letting Date: November 5, 1992

Base Price Diesel Fuel ..... @ Gallon
Current Price Diesel Fuel ..... @ Gallon
Difference ..... @ Gallon

Quantity Excavation this Estimate = 37,140.8
Quantity Excavation Previous Estimates = 41,080.0
Difference of Excavation this Fuel Adjustment = minus 3,939.2

Quantity Earthwork Measured in Embankment this Estimate = ...
Quantity Earthwork Measured in Embankment Previous Estimates = ...
Difference of Earthwork Measured in Embankment this Fuel Adjustment = ...

Correction Ratio = 37,140.8 ÷ 41,080.0 = 9.9041091

Remarks: Item No. 022, Excavation Borrow
No actual excavation performed since December 1993

Correction Computation:

Estimate No. 1	thru 9 = 0	×	0.9041091	= $	0.00
Estimate No. 10 =	minus $241.14	×	"	= $	-218.02
Estimate No. 11	thru 29 = 0	×	"	= $	0.00
Estimate No. =		×		= $	
Estimate No. =		×		= $	
Estimate No. =		×		= $	
Estimate No. =		×		= $	
Estimate No. =		×		= $	
Estimate No. =		×		= $	
Estimate No. =		×		= $	

Corrected Fuel Cost Adjustment = minus $ 218.02

Computed by: Don Hitzeman Date: 7/24/95

Checked by: Charles W. Jasa Date: 7/25/95

DR Form 309C, Aug 85

SOURCE OF AGGREGATES TO BE USED

PROJECT: F-6-7(1030) - - 152nd St. Omaha

NAME OF ROAD: US Highway 6

MATERIAL	PRODUCER	LEGAL DESCRIPTION OF SOURCE *(Quarter, Section, Township, Range)*	COUNTY	80 LB. SAMPLE REQUIRED FOR QUALITY TESTS *(Materials & Tests Use Only)*
FINE AGGREGATE FOR CONCRETE	Pound Sand Inc	SE¼ of Sec 27, T 12 N, R 30 W	Douglas	
SAND GRAVEL AGGREGATE FOR CONCRETE	Break Rock Co	SW¼ of Sec 3, T 55, R 21 W	Douglas	
MINERAL AGGREGATE *(Gravel)* FOR ASPHALTIC CONCRETE				
MINERAL AGGREGATE NO. 3-A *(Before Crushing)*				
MINERAL AGGREGATE *(Gravel)* FOR SOIL AGGREGATE BASE COURSE				
MINERAL AGGREGATE *(Gravel)* FOR FOUNDATION COURSE				
GRAVEL FOR SURFACING				
MINERAL AGGREGATE FOR ARMOR COAT				

PROJECT NUMBER: F-6-7(1030)	ADDRESS: D-2, Omaha
SUBMITTED BY: John Bigpockets - Cyclone Construction Co.	DATE: 8-2-96
RETURNED BY: Paula Carlisle PM, D-2	DATE: 8-3-96

DR Form 324, Apr 89

THIS FORM REPLACES DR FORM 324, MAY 76, PREVIOUS EDITIONS WILL BE DESTROYED.

Material Pit Contract Release

(Use for Option Pit)

Project No. F-6-7(1030)

Location 152nd St., Omaha, NE

Contractor Cyclone Construction

Material 47B gravel Pit No. 12 located on

Real Property described as SE¼ of Sec 27, T 12 N, R 30 W

This Release made by Dave Johnson, the property owner, hereinafter called the owner.

WITNESSETH: That the owner has carefully inspected the property from which the material was taken and does release the State of Nebraska, Department of Roads, from any and all damages caused by the removal of material from the owner's land.

Release made this 21 day of January, 1997.

Project Manager
Witness

Dave Johnson
Owner

Submitted by I. B. Sharp
Project Manager

Date 01-21-96

Original copy of this release, together with the quantity of material removed from the pit, to be forwarded to the Right of Way Division before payment for the material is made.
(Need Contractor's letter of concurrence with this.)

Original: R.O.W. Division
cc: Property Owner
District Engineer
Project Manager
Construction Division - Finals

DR Form 348, Sep 76

High Density/Low Slump Concrete Nuclear Density Record

DISTRIBUTION
White - Final Record
Canary - Project Manager
Pink - Materials & Tests

DATE	PROJECT	PROJECT LOCATION	REPORT NUMBER
7-11-96	F-81-1(1018)	Hebron North & South	1 of 20

TEMPERATURE	WIND SPEED	TIME START	TIME STOP	DOWNTIME
Hi: 35° Low: 20	16 Km/h	0620	1213	1 hr

PERCENT AIR Truck 1 2	SLUMP Truck 1 2	YIELD (From Concrete Proportioning Report)	WATER-CEMENT RATIO	CYLINDER NUMBERS	CONTRACTOR
6.0 5.5	.75 .625				

TEST NO. →	1.							
A. Mass of Bucket and Concrete	41.5 Kg							
B. Mass of Bucket	1.5							
C. Volume of Bucket	0.02 M^3							
D. Rodded Density $\frac{A - B}{C}$	2000 Kg/M^3							
E. Mass of Box and Concrete								
F. Mass of Box	2.5 Kg							
G. Volume of Box	.656 M^3							
H. Density of Concrete $\frac{E - F}{G}$								
I. Nuclear Density Gauge Density of Box								
J. Density Offset H - I								
K. Station								
L. Rt. or Lt. and Distance from ℄								
M. Depth of Concrete at Test Site								
N. In Place Density								
O. % of Rodded Density = $\frac{N \times 100}{D}$								

MIXER				MIXER			
AEA		STONE		AEA		STONE	
RETARDER		SAND		RETARDER		SAND	
WATER		RPM's		WATER		RPM's	

SERIAL NUMBER OF NUCLEAR DENSITY GAUGE:

A Field Book Record of data recorded on lines "A" thru "O" is not required.

INSPECTOR:

DR Form 478, Jun 96

THIS FORM REPLACES DR FORM 478, MAY 91. PREVIOUS EDITIONS WILL BE DESTROYED

printed on recycled paper

LIGHTING, SIGNS & TRAFFIC CONTROL FORMS

DR 502 Construction Signs and Posts ..... 1 - 55

(OPTIONAL)

CONSTRUCTION SIGNS AND POSTS

(On Computer)

Sheet 1 of 1

PROJECT NUMBER:	GROUPS OF WORK:
PEP-30-6(1031)	1 and 9

CONTRACTOR: Cyclone Construction Co

MATERIALS LISTED BELOW WERE [x] FURNISHED [ ] RETURNED [ ] TRANSFERRED TO: [ ] TRANSFERRED FROM:

SIGN NUMBER OR POST SIZE	QTY.	SQ. FT. @ SIGN	TOTAL SQUARE FEET			REMARKS (condition, make deduction, etc.)
			WOOD	METAL	DAMAGED	
W21-5-36	2	9		18		New Signs
1						2
1	See Nebraska Supplement to the MUTCD for a list of sign numbers and sizes.					
2	Finals Sections no longer requires this form.)					

DISTRIBUTION
White - Contractor
Green - Final Records
Canary - Maintenance Superintendent
Pink - District Engineer
Goldenrod - Project Manager

DEPARTMENT REPRESENTATIVE:	DATE:
John Sharp	7-15-96
CONTRACTOR REPRESENTATIVE:	DATE:
Ron Hardwork	7-15-96

DR Form 502, Oct 80

ASPHALT FORMS

DR 29	Daily Summary of Scale Weights	1 - 57
DR 62	Weight Ticket	1 - 58
DR 173	Test and Pay Factor Summary	1 - 59
DR 193	Transfer of Asphaltic Material	1 - 60
DR 194	Pavement Profile Measurements Using a California-Type Profilograph	1 - 61
DR 418	Asphaltic Aggregate Design (Computer Generated Replacement)	1 - 62

Sheet No. 1 of 1

Daily Summary of Scale Weights

Date: 7-15-96

Type of Material: Gravel Name of Road: Hebron North & South Project No.: F-81-1(1018)

Ticket No.	Truck No.	Gross ~~Weight~~ Mass	Tape ~~Weight~~ Mass	Net Weight	Remarks	✓
01	1215	16171	9071	7100		X
02	1360	17201	9101	8100		
03	1215	16571	9071	7500		
Subtotal		49943	27243	22700		
Subtotal						
Subtotal						
Subtotal						
Sheet Total						

Weight Inspector: I. M. Eagleye Project Engineer: (PM)

DR Form 29, Feb 71

TEST AND PAY FACTOR SUMMARY

PROJECT NO. PEP 34-2 (1018) DATE 7-3 & 7-9-96

LOT NO. 7 TYPE OF ASPHALTIC CONCRETE 14R

TEST NO.	STATION	LANE	LIFT	DISTANCE FROM ℄	JOB MIX NO.	TARGET	ASPHALT CONTENT	DEVIATION	AVERAGE DEVIATION	TIME: SAMPLE RECEIVED	TIME: RESULTS POSTED
	QC/QA Asphalt does not require entry here										
								PAY FACTOR			

TEST NO.	TARGET	RETAINED NO. 10	DEVIATION	AVERAGE DEVIATION
QC/QA Asphalt does not require entry here				
			PAY FACTOR	

TEST NO.	TARGET	RETAINED NO. 50	DEVIATION	AVERAGE DEVIATION
QC/QA Asphalt does not require entry here				
			PAY FACTOR	

TEST NO.	TARGET	RETAINED NO. 200	DEVIATION	AVERAGE DEVIATION
~~QC/QA Asphalt does not require entry here~~				
			PAY FACTOR	

TEST NO.	STATION	LANE	LIFT	DISTANCE FROM ℄	DENSITY	VOIDLESS DENSITY	% OF VOIDLESS	AVERAGE
31	383+76	Rt	Top	4'	2.21	2.39	92.5	
32	782+44	Lt	Top	10'	2.21	2.39	92.5	92.5
33	810+53	Lt	Top	8'	2.22	2.39	92.9	92.6
34	813+27	Lt	Top	11'	2.23	2.39	93.3	92.8
35	875+71	Lt	Top	1	2.20	2.39	92.1	92.7
							PAY FACTOR	1.00

Calculate individual test results and averages to the accuracy indicated below.

	TEST RESULT	AVERAGE
Asphalt Content	0.01%	0.01%
Retained 3/8"	0.1%	0.1%
Retained No. 4	0.1%	0.1%
Retained No. 10	0.1%	0.1%
Retained No. 50	0.1%	0.1%
Retained No. 200	0.1%	0.1%
Density, gm/cc	0.01	0.01
Percent of Voidless Density	0.1%	0.1%

Pay Factor for Lot = Asph. Content Factor x Retained No. 10 Factor x Retained No. 50 Factor x Retained No. 200 Factor x Density Factor.

Pay Factor for Lot = ____ x ____ x ____ x ____ x 1.00 = 1.00

DISTRIBUTION
White - Materials & Tests Division
Yellow - District Engineer
Pink - Project Manager
Goldenrod - Quality Assurance Manager

INSPECTOR:	APPROVED: *(Project Manager)*

DR Form 173, Mar 80

THIS FORM REPLACES DR FORM 173, MAR 79, PREVIOUS EDITIONS WILL BE DESTROYED.

STATE OF NEBRASKA
DEPARTMENT OF ROADS

TRANSFER OF ASPHALTIC MATERIAL

FROM:	TO:	DATE:
(PM)	Materials & Tests Division	7-15-96

Material Originally shipped to Project ....PEP-30-6(1031)....

Type of Material - - - - - - - - - - - - - - ....Asphalt Emulsion....

Refinery and Location - - - - - - - - - - ....Smoke Stack Inc., Omaha NE....

(1) Shipment Identification - - - - - - - - - - ....0980-0239617178....

Original Quantity Shipped, ~~gallons~~ L - - ....270.000....

Specific Gravity, 60/60 F - - - - - - - - ....1.0207....

Distillate to 680 F, % by Volume - - - ....(If unknown, leave blank)....

Field Identification Number - - - - - - - ....NDR#1....
(if field sample taken)

The distribution of this shipment was as follows:

120,000 .... ~~gallons~~ L used on Project ....PEP-30-6(1031)....

90,000 .... ~~gallons~~ L used on Project ....PEP-81-1(1081)....

60,000 .... ~~gallons~~ L transferred to Project ....F-6-7(1030)....

.... gallons transferred to Project ....

.... gallons transferred to Project ....

270,000 .... TOTAL

(1) Supplier's # goes here

....(PM Signature)....

Copies to:
Each District where Emulsion is used.

DR Form 193, Feb 72

printed on recycled paper

Template Correction should not be added. (TOP Lift Only)

NEBRASKA DEPARTMENT OF ROADS

Pavement Profile Measurements Using a California-Type Profilograph

Sheet 1 of 1

Project No.: F-81-1(1018) Begin Sta.: 698+04 Contractor: Cyclone Construction Company

Location: Hebron North & Suoth End Sta.: 745+56 Profilograph Operator(s): Tom Osborn

Surface Type: Asphalt Bump Height Specification: 0.3 Comments:

Lane: S.B. Driving Lane Lift:

Test Section Begin & End Stations	Profile Index, Inches per Mile: Run No. 1 Date (NDOR)	Run No. 1 PI	Run No. 2 Date (Cyclone)	Run No. 2 PI	Run No. 3 Date	Run No. 3 PI	No. of Bumps: Run No. 1	Run No. 2	Run No. 3
698 + 04 – 703 + 32	7/10	16.5	6/19	14.5			0	0	
703 + 32 – 708 + 60	x	15.0	x	15.0			1	1	
708 + 60 – 713 + 88	x	5.5	x	7.5			0	0	
713 + 88 – 719 + 16	x	14.5	x	14.0			1	0	
719 + 16 – 724 + 44	x	4.0	6/21	4.0			0	0	
724 + 44 – 729 + 72	x	15.0	x	14.0			0	0	
729 + 72 – 735 + 00	x	4.5	x	3.5			0	0	
735 + 00 – 740 + 28	x	14.5	x	8.5			2	1	
740 + 28 – 745 + 56	x	7.0	x	15.5			1	0	
+ – +									

Lane: S.B. Passing Lane Lift:

Test Section Begin & End Stations	Profile Index, ~~Inches per Mile~~ mm/Km: Run No. 1 Date (NDOR)	Run No. 1 PI	Run No. 2 Date (Cyclone)	Run No. 2 PI	Run No. 3 Date	Run No. 3 PI	No. of Bumps: Run No. 1	Run No. 2	Run No. 3
+ x +	7/10	14/5	6/19	13.5			0	0	
+ x +	x	11.5	x	11.0			0	0	
+ x +	x	2.5	x	2.5			0	0	
+ x +	x	14.5	x	15.5			1	1	
+ x +	x	3.5	6/21	2.5			0	0	
+ x +	x	13.5	x	13.0			0	0	
+ x +	x	5.0	x	6.5			0	0	
+ x +	x	8.0	x	9.0			0	0	
+ x +	x	12.5	x	12.5			0	0	
+ +									

DR Form 194, Jan 92

STATE OF NEBRASKA

DEPARTMENT OF ROADS
ASPHALTIC CONCRETE DESIGN

PROJECT MANAGER:L.WATER
Project No.:F-81-1(1018)
Name of Road:Hebron North & South

DATE:7-11-96

Type of Asphaltic Concrete: 17

Design No.:96-2

ASPHALT CEMENT
Source:Sinclair
Grade:AC-10

GRADATION OF MATERIALS PROPOSED						SIEVE ANALYISIS(WASH)							
MATERIAL		PIT LOCATION				19.0	12.7	9.51	4.75	2.0	0.6	0.3	.075
	%	1/4	SEC	T	R	3/4"	1/2"	3/8"	#4	#10	#30	#50	#200
MA96-315 gravel	40.0	NE	8	3N	2W	100.	95.7	92.5	75.6	29.9	8.1	3.3	0.9
MA96-318 fine sand	30.0	NE	8	3N	2W				100.	97.8	59.5	24.6	3.7
MA96-316 47b	20.0	NE	8	3N	2W	100.	98.3	94.7	77.6	50.2	21.7	5.9	0.2
CR96-133 screening	10.0	Kerford						100.	92.2	60.1	32.6	24.7	16.9
	COMBINED GRADATION					100.	98.0	95.9	84.9	57.3	28.1	12.4	3.2
	PROPOSED GRADATION					100.	98.0	95.7	84.6	56.9	30.6	13.6	3.4
	SPECIFICATION RANGE					100.	94+	8096	5288	3270	1738	1024	3/7

LABORATORY MIXES				
MIX	1	2	3	4
EBM 96-	123			
%Added	5.80			
%Extr.	5.73			

MATERIAL CRUSHED VALUE			
AGG.	CR.VALUE	%	TOTAL
CR-133	100.0	10.0	10.0
TOTAL CRUSHED VALUE			10.0

Plasticity index of material passing the #200 sieve: NR
Combined mineral aggregate samples for plasticity index are not required.

The target asphalt content is 6.00% (By weight of mix.)

This constitutes approval of the job-mix gradation and crushed value of the materials proposed by the contractor. If it is necesary to change the job mix either before or after the job starts, the contractor should notify the engineer. The target value for asphalt content will remain at or above the calculated minimum.

Remarks:LAB. MINIMUM ASPH. CONT. IS 6.00%

cc:C.McCann
CYCLONE CONSTRUCTION CO.
C.Splattstoesser
R.A.Henrichson
L.G.Watermeier
L.E.Weishahn
D.F.Mazour
File

Approved by Laird E. Weishahn
FAX (402) 479-3882

COMPUTER GENERATED

PCC PAVEMENT FORMS

DR 45	Concrete Proportioning and Cylinder Identification Report	1 - 64
DR 85	Daily Report of Concrete Pavement Laid	1 - 65
DR 478	Low Slump/High Density Concrete Nuclear Density Record	1 - 66

C.N. #11971

CONCRETE PROPORTIONING AND CYLINDER IDENTIFICATION REPORT

Eliminates the need for this information in the field notebooks.

DISTRIBUTION
White - Green - Materials & Tests
Canary - Cylinder Identification
Pink - Project Manager
Goldenrod - District Engineer

PROJECT NO.:	
F-2-7(1016)	
NAME OF ROAD: Neb. City Interchange	DATE: 07-02-96
CLASS OF CONCRETE: 47BD	REPORT NO.: 131

Time	Wash or Dry Test	Wt. or %	SIEVE ANALYSIS - PERCENT RETAINED: Dry Wt. Sample	Fine Aggregate 1"	No. 4	No. 10	No. 30	No. 200	Dry Wt. Sample	Coarse Aggregate 1½"	1"	3/4"	3/8"	No. 4	No. 20	% Moisture Fine	Coarse	Quantities Used Per Batch: Moist Weight-Aggregate Fine	Coarse	Water Added at Mixer-Lb.	Total Water Per Batch-Lb.	Water-Cement Ratio Lb./Lb.
AM	D	Wt.	1277	0	243	540	908	1273	3114	0	72	726	2030	2856	3055			(29)	(3)			
		%		0	19	42.3	91.1	99.7		0	2.3	23.3	65.2	91.7	98.1	1.4	0.3	2069	878	231	262	.398
		Wt.																				
		%																				
		Wt.																				
		%																				
		Wt.																				
		%																				

See 1987 NDR Portland Cement Concrete Guide for instructions to fill out

Time	% Air Adj.	% Air Meter	Weight Per Cu. Ft. Concrete	Weight Per Cu. Yd. Concrete	Weight Per 1 Cu. Yd. Concrete	QUANTITIES USED PER BATCH: Cement Lb.	Fly Ash Lb.	Cement-Fly Ash Total Lb.	Dry Fine Aggregate Lb. (SSD)	Dry Coarse Aggregate Lb. (SSD)	Water Lb.	Total Lb.	Yield of Batch Cubic Yard	Lb. of Cement Per Cubic Yard Concrete	% of Required Cement	Corrected Weight of Dry Aggregate Per Batch (SSD): Fine - Lb.	Coarse - Lb.	Slump Inches
6 15/A	6 15	6 4	141.9	3831	3831	658	--	658	2040	875	262	3835	1.001	657.3	99.9			3½

NAME AND LOCATION OF PLANT:	NBC
BRAND AND TYPE OF CEMENT:	ALI
LOCATION OF CEMENT MILL:	AL
CLASS AND SOURCE OF FLY ASH:	--
SOURCE OF FINE AGGREGATE:	F252 (1/4 Sec. T - R -)
SOURCE OF COARSE AGGREGATE:	C105
AVERAGE SPECIFIC GRAVITY OF TOTAL AGGREGATE:	2.63

KIND, BRAND AND QUANTITY OF ADDITIVES PER 100 LB. CEMENT

1	MB AE90	.7447	4.9027 cy	2 Procrete Prochem	1.9757 1302 cy

AIR TEMP. DURING PLACEMENT	HIGH:	LOW:
	82	73

CONTRACTOR	United Contractors
CYLINDER NUMBER	131 AB
TIME & LOCATION CYLINDERS MADE	AM-Project

STRUCTURE	LOCATION	GROUP	CUBIC YARDS Required	Used	Wasted
Paving Section	Abut 1 @ Example 132T-9.33RT 22.08RT-34.88RT	6D	40.62	43.25	.75

CURING INFORMATION

METHOD OF CURING: WORK:	CYLINDERS:	MIN. TEMP. DURING CURING	DAYS CYLINDER CURED IN FIELD
White Pkg. Cure	Plastic	59	6+

PLANT INSPECTOR:	FIELD INSPECTOR:	PROJECT MANAGER:
R J Stutz	Larry Jobman	Larry Jobman

FOR LAB USE ONLY

DATE RECEIVED: 7-9-96

LAB IDENTIFICATION: 713

AGE	TEST DATE	PSI
7	7-9	29.7
28	7-20	

DR Form 45, Mar 85

THIS FORM REPLACES DR FORM 45, MAR 82, PREVIOUS EDITIONS WILL BE DESTROYED.

DISTRIBUTION
White - Construction Engineer
Canary - District Engineer
Pink - Project Manager
Goldenrod - Field Inspector

DAILY REPORT OF CONCRETE PAVEMENT LAID

PROJECT NO.:	F-81-3 (1019)
NAME OF ROAD:	Norfolk South
DATE:	7-13-94
REPORT NO.:	5

CONTRACTOR: Paulsen Inc.	WEATHER: Sunny & Mild	TEMPERATURE: 70 F	CLASS OF CONCRETE: PR

PAVEMENT CONSTRUCTED IN ACCORDANCE WITH	POUNDS OF CEMENT/FLY ASH	SIZE AND TYPE OF MIXER: 9 1/2 yd transit
STANDARD PLAN NO.: 30/K4 328R2	PER CUBIC YARD: 750	CUBIC YARDS PER BATCH: 7
SPECIAL PLAN NO.: GC	PER BATCH: 5250	THICKNESS OF SLAB: 11"

STATION FROM	STATION TO	LENGTH ~~FEET~~ meter	WIDTH ~~FEET~~ meter	SQUARE ~~YARDS~~ meter	CU. ~~YARDS~~ meter CONCRETE REQUIRED	CU. ~~YARDS~~ meter CONCRETE BATCHED	CU. ~~YARDS~~ *meter CONCRETE WASTED	CU. ~~YARDS~~ meter CONCRETE USED	PERCENT OF REQ'D. CONC. USED	WATER ADDED AT MIXER ~~(Gallons)~~ Liter	TIME LAID BEGAN	TIME LAID FINISHED	NUMBER OF BATCHES
706+89.4	707+04.9	15.5	3.38	52.44	19.11	20.0	0.50	19.50	110	525	10:45	11:15	1
707+04.9	707.24.9	20.0	3.38	67.60	24.62	25.0	0.1	24.9	109	675	1:00	1:20	1
	TODAY'S TOTAL OR AVERAGE	35.5		120.04									
	TOTALS TO DATE	35.5		120.04									

* REASON FOR WASTE:

WORK SHUT DOWN	FROM: 1130	TO: 1230	REASON: Water line broke

METHOD OF CURING:

INSPECTOR: NDR Inspector

APPROVED: *(Project Manager)* PM

DR Form 85, Sep 88

Note: Irregular areas to be shown by attached detailed sketch.

Sketch Attached, Yes ..... No ..X...

High Density/Low Slump Concrete Nuclear Density Record

White - Final Record
Canary - Project Manager
Pink - Materials & Test

DATE	PROJECT	PROJECT LOCATION	REPORT NUMBER
9-15-96	F-81-1(1081)	Hebron North and South	1

TEMPERATURE Hi:	Low:	WIND SPEED:	TIME START:	TIME STOP:	DOWNTIME:
		15 Knots	11:15	11:40	None

PERCENT AIR Truck 1	2	SLUMP: Truck 1	2	YIELD: (From Concrete Proportioning Report)	WATER-CEMENT RATIO:	CYLINDER NUMBERS:	CONTRACTOR:
6.0	5.5	.20 mm	19 mm		0.46	3	Cyclone Construction Co

TEST NO. →								
A. Mass of Bucket and Concrete	41.16							
B. Mass of Bucket	8.50							
C. Volume of Bucket	0.01416							
D. Rodded Density $\frac{A-B}{C}$	2306 Kg/M							
E. Mass of Box and Concrete	72.1							
F. Mass of Box	28.7							
G. Volume of Box	0.01867							
H. Density of Concrete $\frac{E-F}{G}$	2323.9							
I. Nuclear Density Gauge Density of Box	2322.0							
J. Density Offset H - I	1.9							
K. Station	100+00	100+05	100+10					
L. Rt. or Lt. and Distance from ℄	1.2 m	4 m	2.2 m					
M. Depth of Concrete at Test Site	75 mm	87 m	80 mm					
N. In Place Density	2221	2224	2322					
O. % of Rodded Density = $\frac{N \times 100}{D}$	100.6	100.7	100.7					

MIXER	1			MIXER	NA		
AEA	_	STONE	_	AEA		STONE	
RETARDER	_	SAND	_	RETARDER		SAND	
WATER	_	RPM's	25	WATER		RPM's	

SERIAL NUMBER OF NUCLEAR DENSITY GAUGE: J37 31 S1

A Field Book Record of data recorded on lines "A" thru "O" is not required.

INSPECTOR: Construction

DR Form 478, Jun 96

THIS FORM REPLACES DR FORM 478, MAY 91. PREVIOUS EDITIONS WILL BE DESTROYED

printed on recycled paper

BRIDGES, CULVERT & RELATED STRUCTURE FORMS

DR 24	Driveway Drainage Structures	1 - 68
DR 97	Pile Record	1 - 69
DR 175	Reinforcing Steel Sample Identification Report	1 - 70
DR 214	Report of Shipment of Prestressed and/or Precast Concrete Units From Tested Stock	1 - 71
RDP	Girder Shims	1 - 72

STATE OF NEBRASKA
DEPARTMENT OF ROADS

(OPTIONAL)

DRIVEWAY DRAINAGE STRUCTURES

(Grading Item)

FINAL QUANTITIES

Project No. F-81-1(1018)

Sheet No. 1 of 10

STATION	OLD STRUCTURE	NEW STRUCTURE	PIPE CULVERTS – DRIVEWAY CULVERT PIPE 24"	30"	36"	42"	48"	SALVAGE REMOVAL OF EXISTING DRIVEWAY CULVERT PIPE
698+04	CMP	CMP	15 m					
	600 mm x 15 m	(See plans for construction						
		details)						
	(See notes on							
	plans for dis-							
	position of old)							
	(Don't need this							
	form if you have							
	this information							
	summarized in the							
	field book.)							
		TOTALS	15					

DATE: 7-15-96 | CHECKED BY: Construction Tech or PM | DATE: 7-22-96

DR Form 24, Jun 76

2070

STATE OF NEBRASKA
DEPARTMENT OF ROADS

PILE RECORD

Distribution of Copies
White - Lincoln Office
Canary - Lincoln Office
Pink - District Engineer
Goldenrod - Project Manager

DESCRIPTION OF STRUCTURE:	TYPE AND SIZE OF PILE:	PROJECT NO.:
PRESTRESSED CONC. BRIDGE	12" x 33" CAST IN PLACE	BRF -64-7 (111)
STATE ROAD:	TYPE OF HAMMER:	STATION:
VALLEY WEST HWY 64	LINK BELT 520	139 + 61
COUNTY:	WEIGHT OF STRIKING PARTS:	ABUT. NO.:
DOUGLAS & SAUNDERS	5070 Lbs.	4
CONTRACTOR:	WEIGHT OF DRIVING CAP:	PIER OR BENT NO.:
KLAASMEYER	1415 Lbs.	

Pile Number	Original Length (Ft.)	Additional Length (Ft.)	Order Length (Ft.)	Revised Order Length (Ft.)	Length in Place (Ft.)	Pay Length (Ft.)	Pay Cut-Off (Ft.)	Non-Pay Cut-Off (Ft.)	Pay Splices	Penetration Below ~~Ground~~ (C.O.) (Ft.)	Date Driven	Energy Ft-Tons	Average Penetration of Pile (Inches per Blow)	Calculated Bearing Power (Tons)	Weight of Pile
1B	58.8		60		57.3	57.3	1.5			57.3	1-15-96	13.13	.2	78.4	1940
2B	61		60		57.3	57.3	2.7	1.0		57.3	1-15-96	13.13	.15	94.1	2013
3B	59		60		57.9	57.9	1.1			57.9	1-15-96	13.13	.175	85.6	1947
4B	60.7		60		57.3	57.3	2.7	0.7		57.3	1-15-96	13.13	.15	94.1	2003
5B	58.6		60		58.3	58.3	0.3			58.3	1-15-96	13.13	.175	85.6	1934
6B	61		60		58.3	58.3	1.7	1.0		58.3	1-15-96	13.13	.125	104.6	2013
7B	58.9		60		58.3	58.3	0.6			58.3	1-15-96	13.13	.125	104.6	1944
8B	60.7		60		58.2	58.2	1.8	0.7		58.2	1-15-96	13.13	.15	94.1	2003
9B	59.3		60		57.9	57.9	1.4			57.9	1-15-96	13.13	.15	94.1	1957
10B	60.8		60		58.3	58.3	1.7	0.8		58.3	1-15-96	13.13	.15	94.1	2006
11	59		60		57.2	57.2	1.8			57.2	1-15-96	13.13	.075	134.4	1947
12	60.7		60		58.2	58.2	1.8	0.7		58.2	1-15-96	13.13	.075	134.4	2003
13	58.4		60		58.1	58.1	0.3			58.1	1-15-96	13.13	.138	99.1	1927
14	61		60		57.7	57.7	2.3	1.0		57.7	1-15-96	13.13	.075	134.4	2013
15	60.9		60		56.6	56.6	3.4	0.9		56.6	1-15-96	13.13	.125	104.6	2010
16	60.8		60		57.1	57.1	2.9	0.8		57.1	1-15-96	13.13	.15	94.1	2006
17	58.6		60		56.6	56.6	2.0			56.6	1-12-96	13.13	.15	94.1	1934
18	58.7		60		58.3	58.3	0.4			58.3	1-15-96	13.13	.088	125.5	1937
19	60.7		60		60.0	60.0		0.7		60.0	1-15-96	13.13	.15	94.1	2003

Pile Number	Original Length (Ft.)	Length in Place (Ft.)	Penetration Below Ground (C.O.) (Ft.)	Energy Ft-Tons	Average Penetration of Pile (Inches per Blow)	Calculated Bearing Power (Tons)
14	61	25	25	7.75	.75	16.4
14	61	30	30	9.25	.65	22.2
14	61	35	35	9.25	.65	22.2
14	61	40	40	11	.425	37.7
14	61	45	45	11.5	.4	41.4
14	61	50	50	10.75	.7	24.2
14	61	55	55	12.25	.25	63.0
14	61	56	56	13.13	.25	67.2
14	61	57	57	13.13	.138	99.1
14	61	57.7	57.7	13.13	.075	134.4

DESIGN CAPACITY: 52 Tons per Pile

MINIMUM PENETRATION REQUIRED: 56 Feet

AVERAGE BEARING POWER: 102.3 Tons per Pile

EFFICIENCY: 196.79 Per Cent

INSPECTOR:

DATE: 1-16-96

REMARKS:

DR Form 97, Jul 80

THIS FORM REPLACES DR FORM 97, OCT 70
PREVIOUS EDITIONS WILL BE DESTROYED.

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Reinforcing Steel Sample Identification Report

NAME OF MATERIAL: Epoxy Coated Reinforcing Steel	FIELD I.D.:	LAB REPORT NO.: 2
COUNTY: Sarpy	PROJECT NO.: TMT-77(29)	
DATE SAMPLED: 4-17-96	CONTROL NO.: 21593	
SAMPLE TAKEN FROM: Contractor Supplied	NAME OF ROAD: LaVista West	
MATERIAL FOR USE IN: (Type of work or kind of structure) Abutments & Piers, Superstructure		
LOCATION TO BE USED: (Station or other information) Sta. 83+04.75, RT, E, LT		
SAMPLED BY: Douglas N. Bock	TITLE: Proj. Mgr.	ADDRESS: 8611 Blondo St., Omaha, NE
REPORT TO BE SENT TO: Chuck Riesen	TITLE: State Proj. Mgr.	ADDRESS:
PRIME CONTRACTOR: Cyclone Construction Co.	CONTRACTOR NO.:	ADDRESS:

BAR SIZE (Eng)	WEIGHT ~~POUNDS~~ kg	GRADE	MANUFACTURER	HEAT NUMBER	CERTIFICATIONS	
					ATTACHED	PREVIOUSLY SUBMITTED
9	6,029		North Star	NS/S16794	X	
6	461		North Star	NS/S15937	X	

OTHER INFORMATION

TO BE FILLED IN AT LABORATORY

Date received at Laboratory 4-25-96

Laboratory Identification

SUBMITTED BY: Jim Paillot

TITLE: Insp. Sides Assoc., Inc.

ADDRESS: Omaha, NE

DR Form 175, Sep 94

printed on recycled paper

Duane Emerson
464 5145

REPORT OF SHIPMENT OF PRESTRESSED AND/OR PRECAST CONCRETE UNITS FROM TESTED STOCK

Copies to:
Engineer of Materials and Tests
Plant Coordinator

MANUFACTURED BY: Wilson Concrete (1)	ADDRESS: Bellevue, NE
DATE SHIPPED: 7-15-96	PROJECT: BRF-64-7(111)
SHIPPED TO: District - 2	LOCATION: Valley West Hwy 64
UNIT TYPE: Prestressed Concrete Bridge	BRIDGE STATION: 139 + 61

IDENTIFICATION MARK	SIZE OR LOCATION	IDENTIFICATION MARK	SIZE OR LOCATION
NDR	(2)		
(1) Either Contracted Supplier or	NDR		
Prestress/Precast Plant.			
(2) Size of unit, usually length.			

The above units were shipped from approved stock. The cement, aggregate and all steel reinforcement (prestressing strand, cold-drawn steel wire, reinforcing steel, etc.) used in the units comply with the requirements of the specifications and are covered by test reports.

The units may be used when received on the project providing that a field inspection shows that they carry the proper identification taken from the accompaning DR Form 214 and have not been damaged by handling or shipping.

	SIGNED: (Wilson Concrete ReP)	
DIVISION ENGINEER: DE	TITLE:	PHONE:
PROJECT ENGINEER: (PM)	ADDRESS: U.S. 75 Bellevue, NE	

DR Form 214, Oct 72

1,1	//SHIM EXEC SHIMS
1,1	//GO.SYSIN DD *
1,1	REMARKS-
1,1	

STATE OF NEBRASKA
DEPARTMENT OF ROADS
DATA PROCESSING DIVISION

GIRDER SHIMS

FOR GIRDERS WITH ℄ ON CIRCULAR CURVE OR STRAIGHT LINE

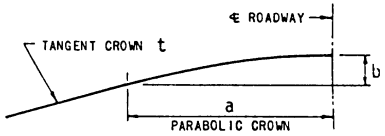
FORM 1 OF 2

	IDENT.	PROB NO.	P.I. STATION	P.I. ELEVATION	LENGTH V.C. (FT.)
1 2	3 4 5 6	7 8	9 10 11 12 13 14 15 16	17 18 19 20 21 22 23	24 25 26 27
2,2			+		
2,2			+		
2,2			+		
2,2			+		
2,2			+		

NOTES:

P.I. STATIONS NOT USED MUST BE LEFT BLANK AND UNPUNCHED.
P.C. STATION AND P.T. STATION MUST BE LEFT BLANK AND UNPUNCHED IF ONLY STRAIGHT ROADWAY IS INVOLVED.
TRANSITION DATA MUST BE LEFT BLANK AND UNPUNCHED IF NO SUPERELEVATION IS INVOLVED.
USE "X" ABOVE CROSS HATCHED BOXES TO INDICATE SITUATION.

DASHED LINES INDICATE DECIMAL POINTS.



CROWN TEMPLATE

	IDENT.	PROB NO.	STATION A, BASELINE INTERSECTS ℄ PROJECT	STATION B, BASELINE INTERSECTS ℄ PROJECT	CONTROL DISTANCE (FT.)	SKEW ANGLE DEG.	SKEW ANGLE MIN.	SKEW ANGLE SEC.	SKEW RHB	SKEW LHB	DEGREE CURVE DEG.	DEGREE CURVE MIN.	DEGREE CURVE SEC.	DIRECTION OF CURVE LT.	DIRECTION OF CURVE RT.	MAX. CROWN CORRECTION (IN.)	ROAD SUPER ELEVATED? YES	ROAD SUPER ELEVATED? NO	a FEET	b INCHES	t INCHES/FOOT
1 2	3 4 5 6	7 8	9 10 11 12 13 14 15 16	17 18 19 20 21 22 23 24	25 26 27 28 29	30 31	32 33	34 35 36	37 38	39 40	41 42	43 44	45 46	47 48	49 50	51 52 53 54 55	56 57	58 59	60 61 62	63 64 65 66 67	68 69 70 71 72
2,3			+	+					1	1				1	1		1	1			

	IDENT	PROB NO	P.C. STATION	P.T. STATION	TRANSITION FROM NORMAL CROWN TO SUPER ELEV. BEGINNING STATION	TRANSITION FROM NORMAL CROWN TO SUPER ELEV. ENDING STATION	TRANSITION FROM SUPER ELEV. TO NORMAL CROWN BEGINNING STATION	TRANSITION FROM SUPER ELEV. TO NORMAL CROWN ENDING STATION	RATE OF SUPER ELEVATION (IN.)	EXTERIOR ROADWAY ℄ RISE (IN.)
1 2	3 4 5 6	7 8	9 10 11 12 13 14 15 16	17 18 19 20 21 22 23 24	25 26 27 28 29 30 31 32	33 34 35 36 37 38 39 40	41 42 43 44 45 46 47 48	49 50 51 52 53 54 55 56	57 58 59 60 61	62 63 64 65 66 67
2,4			+	+	+	+	+	+		

7/17/70

	SPAN NO.	L' IN FEET	L IN FEET	L" IN FEET
1 2	3 4	5 6 7 8 9 10	11 12 13 14 15 16 17	18 19 20 21 22 23
2,5	0,1			
2,5	0,2			
2,5	0,3			
2,5	0,4			
2,5	0,5			

	SPAN NO.	L' IN FEET	L IN FEET	L" IN FEET
1 2	3 4	5 6 7 8 9 10	11 12 13 14 15 16 17	18 19 20 21 22 23
2,5	0,6			
2,5	0,7			
2,5	0,8			
2,5	0,9			
2,5	1,0			

	SPAN NO.	L' IN FEET	L IN FEET	L" IN FEET
1 2	3 4	5 6 7 8 9 10	11 12 13 14 15 16 17	18 19 20 21 22 23
2,5	1,1			
2,5	1,2			
2,5	1,3			
2,5	1,4			
2,5	1,5			

RDP Form 50,Sep 78

printed on recycled paper

GIRDER SHIMS FOR GIRDERS WITH ℄ ON CIRCULAR CURVE OR STRAIGHT LINE SHEET 2 of 2

	IDENT.	PROB. NO.	GIRD. NO.	DIST. ℄ PROJECT TO ℄ ROADWAY (Feet)	℄ PROJ. TO ℄ RDWY. LT.	℄ PROJ. TO ℄ RDWY. RT.	e (Feet)	e FROM BASELINE LT.	e FROM BASELINE RT.	H.I. ELEVATION (Feet)
1 2	3 4 5 6	7 8	9 10	11 12 13 14 15 16 17	18 19	20 21	22 23 24 25 26 27 28	29 30	31 32	33 34 35 36 37 38
26					1	1		1	1	

	ROD READING (Feet)	DISTANCE (Feet)
1 2	3 4 5 6	7 8 9 10 11 12
27		
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	ROD READING (Feet)	DISTANCE (Feet)
1 2	3 4 5 6	7 8 9 10 11 12
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	ROD READING (Feet)	DISTANCE (Feet)
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RDP Form 50a, Sep 78

	IDENT.	PROB. NO.	GIRD. NO.	DIST. ℄ PROJECT TO ℄ ROADWAY (Feet)	℄ PROJ. TO ℄ RDWY. LT.	℄ PROJ. TO ℄ RDWY. RT.	e (Feet)	e FROM BASELINE LT.	e FROM BASELINE RT.	H.I. ELEVATION (Feet)
1 2	3 4 5 6	7 8	9 10	11 12 13 14 15 16 17	18 19	20 21	22 23 24 25 26 27 28	29 30	31 32	33 34 35 36 37 38
26					1	1		1	1	

	ROD READING (Feet)	DISTANCE (Feet)
1 2	3 4 5 6	7 8 9 10 11 12
27		
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	ROD READING (Feet)	DISTANCE (Feet)
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	ROD READING (Feet)	DISTANCE (Feet)
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FORM NO. DPU SHIMS 1-2

ROADSIDE DEVELOPMENT FORMS

DR 61 Project Seeding Record ..... 1 - 75
DR 125 Fertilizer Certification ..... 1 - 76

Project Seeding Record

(First and last day reporting only-
Send to Roadside Development)

For: [x] Seeding
[ ] Slope Protection
[ ] Erosion Control

Project No.: F-81-1(1018)

Contractor doing the work: Green Thumbs Nurseries

Start Date: 6-2-96 Finish Date: 6-30-96

Fertilizer supplied by: DeHass & Sons

Analysis or brands: 16-480 & 37-0-0 bland

Equipment for:

Fertilizing Bulk Spread

Seeding Drill

Mulching

Crimping Bale Buster

Comments about the contractor or project: - Concerns how job progressed.

DR Form 61, Jun 92

(This form is filled out by the Fertilizer Supply Co and given to the PM)

FERTILIZER CERTIFICATION

(For Bulk Shipments of Fertilizer for Use on Nebraska Department of Roads' Projects)

NOTE: *Original and one (1) copy of this form must accompany each load or shipment.*

Fertilizer covered by this certification was delivered to or picked up by:

.....
(Name of Person or Firm that will use fertilizer)

.....
(Business Address of User)

Destination of Shipment .....

Quantity ..... Pounds

Identification of Load or Shipment (Weight Ticket No.) .....

Date of Delivery or Pick-up .....

Name and Address of Person Guaranteeing the Fertilizer: .....

.....

.....

Brand of Fertilizer: .....

Grade of Fertilizer: .....
(Type - e.g., Ammonium Nitrate, Urea-Formaldehyde)

Guaranteed Analysis of Fertilizer: Total Nitrogen ..... Percent

Available Phosphoric Acid (P_2O_5) ..... Percent

Soluble Potash (K_2O) ..... Percent

This is to certify that this brand and grade of fertilizer is registered with the Nebraska Department of Agriculture and Inspection and complies with the provisions of the State of Nebraska Fertilizer Act of 1955, with subsequent amendments and revisions thereto.

Dealer .....

By .....

Title .....

Date .....

Distribution by Project Engineer:
Original - Project Engineer
Copy - Materials & Tests

DR Form 125, Feb 71

printed on recycled paper

INCIDENTAL CONSTRUCTION FORMS

DR 5	Operation and Equipment Rental Agreement	1 - 78
DR 195	Guardrail	1 - 79
DR 247	Report of Shipment of Precast Concrete Right-of-Way Markers from Approved Stock	1 - 80
DR 284	Report of Shipment of _____ Guardrail and/or Fittings	1 - 81

STATE OF NEBRASKA
DEPARTMENT OF ROADS

OPERATION AND EQUIPMENT RENTAL AGREEMENT

NOTE: All copies to be mailed to the Lincoln Maintenance Division for approval before work is started.

District 2 Highway I-80/F-81-1(1080) Reference Posts 425 to 435

This agreement made and entered into on the 6th day of August 1996 by and between the State of Nebraska Department of Roads and Cyclone Cosntruction Company is for the purpose of fixing certain rates for equipment rental or work operations as itemized and described below:

TYPE OF EQUIPEMNT	MAKE & MODEL	RATE PER HOUR WHILE IN OPERATION
Loader	Kobelco TLK 750	$31.00/hr
Compactor, Self Propelled, Tandem Vibrator	Case 752B	55.00/hr

The Cyclone Construction Company (State or Owner) will furnish all fuel, oil and grease for said equipment or operation and will [X] or will not [ ] pay the salaries of the equipment operators or the employees performing the operation.

All labor and repairs necessary for repairing rented equipment will be furnished by the owner without cost to the State. Payment for rental will be made in the regular manner by the State receipt and voucher.

The owner agrees to furnish satisfactory proof that the vehicle or vehicles herein described by this rental agreement are insured in conformity with the requirement and amounts as set forth in Section 60-509, Revised Statutes, Re-issue of 1960.

The approximate date of rental will start August 6 1996 and finish August 20 1996.

Cyclone Construction Company
Organization or Owner

BY: John D. Owner

DEPARTMENT OF ROADS

(DE)
District Engineer

(ME)
Maintenance Engineer

DR Form 5, Jul 71

printed on recycled paper

GUARD RAIL

Project F-81-1 (1018)

STATION TO STATION	LT. OR RT.	CABLE PLAN 701				SAFETY BEAM PLAN 704								OTHER							
		PAY LENGTH	TERMINAL ANCHORAGE SECTION	INTERMEDIATE ANCHORAGE SECTION	DRIVEWAY ANCHOR	PAY LENGTH	BREAKAWAY TERMINAL SECTION	END ANCHORAGE SECTION	SPECIAL POSTS TYPE ""	BRIDGE APPROACH SECTION TYPE "A"	BRIDGE APPROACH SECTION TYPE "B"	BRIDGE APPROACH SECTION TYPE "C"		REMOVING & RESETTING G.R.			SAFETY BEAM G.R., TYPE "A"	SAFETY BEAM G.R., TYPE "C"	GUARD RAIL ADAPTER		
360 + 20.5/360 + 80.5	LT	80	1	-	-																
360 + 80.5 to 361.105		30				30	1		25		1										
361 + 10.5 to 362. + 00														89.5							
		(If this information is in your field book, then do not fill this out.)																			
TOTAL		L.F. M	EA.	EA.	EA.	L.F. M	EA.	EA.	EA.	EA.	EA.	EA.		L.F. M			L.F. M	L.F. M	EA.		

PREPARED BY: Construction Technician DATE: 7-15-96 CHECKED BY: PM DATE: 7-16-96

DR Form 195, Aug 79

THIS FORM REPLACES DR FORM 195, FEB 72, PREVIOUS EDITIONS WILL BE DESTROYED.

STATE OF NEBRASKA
DEPARTMENT OF ROADS

REPORT OF SHIPMENT OF PRECAST CONCRETE ROW MARKERS FROM APPROVED STOCK

(1) This form is filled out & submitted by the supplier.

Manufactured by Cement Specialty Products Inc At Omaha

Date Shipped 7-15-96 Project No. F-81-1(1031)

Location Hebron North and South

Contractor Cyclone Construction Company

QUANTITY SHIPPED	INSPECTORS IDENTIFICATION MARK
52	BC-96-0001 to BC-96-1052

The above markers were shipped from approved stock and substantially conformed to the applicable Standard Plans.

The markers may be used when received on the project providing that a field inspection shows that they carry the proper identification and have not been damaged by handling and shipping.

Copies to:
Engineer of Mat'ls & Tests

Div. Engr. Cosntruction Engineer

Proj. Engr. (PM)

Signed (Supplier)

Title Phone

Address

DR Form 247, May 73 3220

(This form is filled out and submitted by the supplier)

STATE OF NEBRASKA
DEPARTMENT OF ROADS

REPORT OF SHIPMENT OF W-Beam **GUARD RAIL AND/OR FITTINGS**

Date Shipped 7-15-96 Project F-81-1(1081)

Supplier U.S. Steel At Pittsburgh, PA

Contractor Cyclone Construction Company

QUANTITY	DESCRIPTION	TAKEN FROM SHIPMENT REPRESENTED BY			
		STOCK REPORT NO.	CERTIFICATION FURNISHED	JOBBER'S ORDER NO.	MFG'S ORDER NO.
10	10 m "W" beam sections	21	yes	001-96	PP0710

This form to be filled out by supplier and mailed to the: **Materials & Tests Division**
Box 94759
Lincoln, Nebr. 68509

The guard rail and/or fittings listed were shipped from a tested and approved stock or are covered by a certification as indicated.

Signed _____
Supplier

DR Form 284, Aug 73 **2800**

MATERIALS FORMS

DR 12	Sample Identification Form	1 - 83
DR 181	Letter of Certification by Project Manager	1 - 84
DR 274	Test Status Report	1 - 85

Nebraska Department of Roads

SAMPLE IDENTIFICATION FORM

Name of Material: Concrete Pavement Class 47 BD 30

County: Douglas | Project Number: F-6-7(1030)

Date Sampled: 7-15-96 | Control Number: 175-001

Sample taken from: Sta 360 + 20.5 @ 1.1 m Lt Center | Name of Road: US 6

Material for use in *(type of work or kind of structure)*: 14" Pavement

Location to be used *(Station or other information)*: Sta 360 + 20.5 @ 1.1 m Lt Center

Sampled by: Construction Tech | Title: | Address: District Office

Report to be sent to: | Title: | Address: M @ T Lab Lincoln

Contractor *(Prime)*: Cyclone Construction Co. | Contractor No.: | Address:

AGGREGATE-SOIL-FILLER — ROAD GRAVEL

Field Identification No.	NA			
Location *(Hole No., etc.)*				
Depth of Sample				
Depth of Overburden				
Thickness of Stratum				

Type or Class

Pit Location ¼ Sec.____, T-____, R-____

Kind of Pit *(Dry or Wet)* Quantity, Cu. Yd.

Owner of Pit

Produced By

ASPHALT AND ASPHALTIC OIL

Field Identification No.	NA			
Type				
Ticket No.				
Lot No.				
Quantity, Gal.				
Manufactured By				
Location of Refinery				
Specific Gravity				

BITUMINOUS AGGREGATE — ASPHALTIC CONCRETE

Field Identification No.	NA	
Sampled from Sta.		
Lift, Lane, Dist. from Edge		
Stations Rep: From		
To		
Asph. Oil, Gal./Sta. *(Bit. Agg.)*		
Agg., Tons/Sta. *(Bit. Agg.)*		
Type of Asph. Conc.		
Job Mix No. *(Asph. Conc.)*		
Asph. % *(Asph. Conc.)*		
Type Asph. or Asph. Oil		
Mfr. Asph. or Asph. Oil		
Specific Gravity		

OTHER INFORMATION

CONCRETE CYLINDERS (6×12)

Field Identification No. D2-002-175

Class of Concrete 47 BD Class 47 BD 30

Water/Cement Ratio .45

Air Voids, Percent 5

Slump, ~~Inches~~ 20 mm

Quantity, Cu.Yd. 100

Method of Curing Structure or Pavement Spray Curing Compound

Method of Curing Cylinders Spray Curing Compound

Days Cured in Field 10

Brand and Class of Fly Ash NA

Location of Power Plant

Brand and Type of Cement Ashgrade

Location of Mill Louisville, NE

Air Entraining Agent None

Admixture Name None

Source of S.G. or Fine Aggregate Johnson Pits

Pit Location Weeping Water, NE

Source of Coarse Aggregate Johnson Pits

Pit Location Weeping Water, NE

CEMENT — FLY ASH

Field Identification No.	NA	
Brand		
Type *		
Mill Location		
Ready Mix Plant		
Quantity, Tons		
Place of Storage		
Length of Storage		

* *Type I, Type II, Type III, Type I-II*

OTHER MATERIALS

Field Identification No. NA

Kind of Material

Brand

Quantity Represented

Size and Weight Specified

To Comply with Spec. No.

Manufactured By

Jobber

TO BE FILLED IN AT LABORATORY

Date received at Laboratory:

Laboratory Identification:

Submitted by:

Title:

Address:

DR Form 12, Nov 91

THIS FORM REPLACES DR FORM 12, OCT 74, PREVIOUS EDITIONS WILL BE USED.

Printed on recycled paper

LETTER OF CERTIFICATION BY PROJECT MANAGER

MATERIALS & TESTS DIVISION
NEBRASKA DEPARTMENT OF ROADS
P.O. BOX 94759
LINCOLN, NEBRASKA 68509-4759

Date: 7-15-96

Project No.: 7-6-7 (1030)

Location: US Highway 6 @ 150th St Omaha

Contractor: Cyclone Construction Co

THIS IS TO CERTIFY THAT:

(1) All of the items listed below have been declared to be "Small Quantities of Non-critical Materials" as defined in the "Materials Sampling Guide". The basis for waiving the State's normal, established sampling and testing policies and procedures is one of the following:

(a) Accepted on the basis of visual examination and knowledge that these sources have recently furnished similar material which was found to be satisfactory under the State's normal sampling and testing procedures.

(b) Accepted on the basis of notarized Certifications by the producers or suppliers stating that the material complies with the specification requirements.

(2) Documentation of acceptance of material classified as either (a) or (b) above, consisting of a daily inspector's report with a statement as to the basis of acceptance of the material and the approximate quantity of material covered by the acceptance and/or the producer or supplier's notarized certification, is available for inspection in the project files.

DATE	NAME OF MATERIAL	PRODUCER OR SUPPLIER	GROUP	APPROXIMATE QUANTITY
7-15-96	Asphaltic Concrete	Cyclone Construction Co	9	300 Kg

To the best of my knowledge, all other materials which were incorporated into the work on this contract, were sampled and tested in the normal manner.

Very truly yours,

DEPARTMENT OF ROADS

Project Manager

Original to Materials and Tests Division
upon completion of contract.

DR Form 181, Feb 73

2850

TEST STATUS REPORT
MATERIALS & TESTS DIVISION

@

To	**John Plow (Project Manager)**	Project No.	**F-81-1(1018)**
		Location	**I-80**
Date	**April 2, 1996 – Second Notice** **February 13, 1996 – First Notice**	Contractor	**Cyclone Construction**

The following summary shows the status of test data in the files on this date for the above project. Possibly some of the missing tests have been completed but not yet reported. Some of the test data may have been lost, or the materials may be represented by tests on other state work. Would you please review your files and send us copies of the missing reports, or advise us of any pertinent information which you might have regarding these tests.

Need reports for the following items:

fasteners & reflectors for Type 1 delineators

5'chain link fence – 200 lineal feet
posts
std steel pipe
fittings & hardware
tie wire

pull box type PB-5 – 20 required

traffic signals, Types:

TS-1 – 30 required

TS-1LL – 4 required

TS-1A – 4 required

pedestrian signal, type PS-1 – 16 required

pedestrian push button, PPB – 4 required

power installed foundations

luminaires types:

UD-200 – 4 required

HPS – 20 required

Conduits types:

2" PVC

3" PVC

2" PVC augered

2" on bridge

1) Rhonda Hergenrader, Materials & Tests Division, sends this form out

2) First Notice to Project Manager is E-Mailed thru Office Vision

cc: District Engineer
District Construction Engineer

DR Form 274, Jan 82

THIS FORM REPLACES DR FORM 274, AUG 73,
PREVIOUS EDITIONS WILL BE USED.

APPENDIX 2 - FEDERAL FORMS

FORM FHWA-47	Statement of Materials and Labor Used by Contractors on Highway Construction Involving Federal Funds	2 - 2
FORM WH-348	Statement of Compliance + Outline of Labor Requirements	2 - 3
FORM FHWA 1022	Notice	2 - 10
FORM FHWA-1391	Federal-Aid Highway Construction Contractor's Annual EEO Report	2 - 11
STANDARD FORM 1444	Request for Authorization of Additional Classification and Rate	2 - 12
LIST	Standard Labor Classifications and Descriptions for Highway Construction	2 - 13
FORM FHWA-1495	Wage Rate Information Federal-Aid Highway Project	2 - 21
POSTER	EEO is the Law	2 - 22
POSTER	Federal Minimum Way	2 - 23
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OMB NO. 2125-0033

U.S. Department of Transportation
Federal Highway Administration

STATEMENT OF MATERIALS AND LABOR USED BY CONTRACTORS ON HIGHWAY CONSTRUCTION INVOLVING FEDERAL FUNDS

ALL *To be completed by Washington Headquarters Personnel* 2 4 5 8 9 12 13 15 16 18 19 27 28 30 31 33

PART A *To be completed by FHWA or State Highway Personnel (See instructions on reverse)*

STATE*	COUNTY	FEDERAL PROJECT NO.*	URBAN ( ) RURAL ( )*

CARD A

ITEM	DESCRIPTION		ROADWAY	BRIDGE *(Over 20 ft)*	DATE STARTED*
	CONSTRUCTION TYPE CODES				
1	LENGTH OF PROJECT	MILES			DATE COMPLETED*
2	FINAL* CONSTRUCTION COST	DOL			TOTAL NO. BRIDGES

PART B *To be completed by; contractor – see instructions on reverse (REMARKS Attach a plain sheet of paper)*

3	**LABOR*** TOTAL PROJECT	TOTAL LABOR-HOURS	GROSS EARNINGS

	ITEM	DESCRIPTION	UNIT	PROJECT QUANTITY
CARD B	4	TOTAL COST OF ALL MATERIALS & SUPPLIES*	DOL.	
	5	PETROLEUM PRODUCTS*	GAL.	
	6	CEMENT	BBL.	
	7		LB.	
CARD C	8	AGGREGATES PURCHASED	TON.	
	9		CU. YD.	
	10	BITUMINOUS MATERIAL	GAL.	
	11	LUMBER	THSD. BD. FT.	
CARD D	12	REINFORCING STEEL	LB.	
	13	STRUCTURAL STEEL	LB.	
CARD E	14	READY-MIXED CONCRETE	CU. YD.	
	15	PREMIXED BITUMINOUS PAVING MATERIALS	TON.	
	16	AGGREGATES PRODUCED	TON.	
	17		CU. YD.	
CARD F	18	MISCELLANEOUS STEEL	LB.	
	19	NOISE BARRIERS	LIN. FT.	
	20	GUARDRAIL	LIN. FT.	
	21	BRIDGE RAIL	LIN. FT.	
CARD G	22	FINAL CONTRACT AMOUNT FOR SIGNS	DOL.	
	23	FINAL CONTRACT AMT. FOR LIGHTING	DOL.	
	24	FINAL CONTRACT AMT. FOR TRAFFIC SIGNALS	DOL.	

CARD H — **CULVERT ITEMS**

25 CORR. STEEL CULVERT	SIZE *(In.)*	LGTH *(Lin ft)*

CARD J

26 CONCRETE PIPE	SIZE *(In.)*	LGTH *(Lin ft)*

CARD K

27 CLAY PIPE	SIZE *(In.)*	LGTH *(Lin ft)*

CARD L

28 CORR. ALUMINUM CULVERT	SIZE *(In.)*	LGTH *(Lin ft)*

CARD M

29 PLASTIC PIPE	SIZE *(In.)*	LGTH *(Lin ft)*

Blocks 48– 70 to be completed by FHWA Washington Headquarters Personnel
48 52 53 61 62 70

***MUST BE REPORTED ON ALL REPORTS** **REVIEWED BY** **DATE:**

FORM FHWA-47 (Rev. 6–90) **PREVIOUS EDITIONS ARE OBSOLETE**

U.S. DEPARTMENT OF LABOR
WAGE AND HOUR AND PUBLIC CONTRACTS DIVISIONS

STATEMENT OF COMPLIANCE

Form Approved
Budget Bureau No. 44-R1093

Date Febr. 29, 19-- Project No. I 80-0(100)

I. I.Q. Ames (Name of signatory party) Timekeeper (Title) do hereby state:

(1) That I pay or supervise the payment of the persons employed by Avid Constr. Co., Inc. (Contractor or subcontractor) on the Bridges (Building or work); that during the payroll period commencing on the 22 day of Febr, 19--and ending the ____ day of Febr. 29, 19--, all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said Avid Constr. Co., Inc. (Contractor or subcontractor) from the full weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 CFR Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948.63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. 276c), and described below.

(List, If Any)

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ - In addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in Section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ - Each Laborer or mechanic listed in the above referenced payroll has been paid as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS

NAME AND TITLE	SIGNATURE
I.Q. Ames Timekeeper	/S/ I. Q. Ames

THE WILFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE

Form WH-348 (1/68)

OUTLINE OF SPECIAL FEDERAL REQUIREMENTS APPLICABLE TO LABOR FOR FEDERAL-AID CONTRACTS

The following outline is suggested in connection with preconstruction conferences relative to labor compliance, but if no such conference is held, the State is required to distribute copies of this outline to the contractor and his subcontractors.

Copeland Anti-Kickback Act (40 U.S.C. 276c; 18 U.S.C. 874):

a. Full wages earned must be paid.

b. Deductions from wages must be authorized.

c. Proper records must be kept.

d. Weekly statements must be submitted by the contractor and all subcontractors.

Prevailing Wages (23 U.S.C. 113):

a. Wages paid to laborers and mechanics must not be less than the determined hourly wage rates, including fringe benefits, shown in the minimum wage schedules.

b. Laborers and mechanics must be properly classified and paid according to the work actually performed.

c. Laborers and mechanics must be paid not less often than once a week.

d. The minimum wage schedule and supplements thereto must be posted at the project site.

Work Hours Act of 1962 (Public Law 581, 87th Congress, approved August 13, 1962):

a. Forty hours standard workweek.

b. One and one-half basic rate of pay exclusive of fringe benefit payments for all hours over 40 hours per week.

c. Liable to workers for unpaid wages.

d. Liable to Federal Government for liquidated damages at $10 per day per man per violation.

e. Subject to withholdings for unpaid wages and liquidated damages.

f. Comptroller General authorized to pay workers directly from withholdings.

g. Appeals to Federal Highway Administrator, Secretary of Labor, and Court of Claims, within 60 days from withholding or final order; and,

h. Intentional violations a Federal misdemeanor ($1,000 fine and/or six months in prison).

Fair Labor Standards Act (29 U.S.C. 201-219):

a. Time and one-half pay for overtime in excess of 40 hours worked in a workweek;

b. Limitations on child labor; and,

c. Contractors' responsibility to request ruling from U.S. Department of Labor relative to applicability of Act.

False Information Act (18 U.S.C. 1001):

a. The making or use of false statements is a felony.

Sanctions:

a. Violations of acts may result in withholding, termination of contract, administrative debarment and/or criminal prosecution.

Classification or Reclassification of Employees:

a. The minimum wage schedule should be examined with the contractor to ascertain the need for classification or reclassification of laborers and mechanics.

b. Where classification or reclassification of laborers and mechanics is undertaken, a report thereof must be submitted to the Secretary of Labor for approval. (This is to be accomplished on Standard Form 1444, to be obtained from the transmitted through the Project Manager.)

Apprentices:

a. Apprentices can be employed only under a registered program.

b. Contractor or subcontractor must submit written evidence of registration (apprenticeship agreement or statement of registration).

c. Employees classified as apprentices who are not registered must be paid rates shown in minimum wage schedule, on the basis of the classification of work they actually performed.

d. Proper ratio of apprentices to journeymen must be maintained.

printed on recycled paper

Payrolls and Records:

a. A certified copy of each weekly payroll must be submitted by the prime contractor and each subcontractor within seven days of the payment date thereof.

b. Payrolls must be complete.

c. Delay in submittal of payrolls will result in delay in processing payment estimate.

d. Prime contractor is responsible for the submittal of payrolls by subcontractors.

e. All basic records pertaining to the payrolls, including time cards, must be preserved for a period of three years after completion of the contract.

Subcontractors:

a. Laborers and mechanics employed by the prime contractor and subcontractors are covered by the contract labor provisions, but employees of material suppliers are not. (*)

b. The prime contractor is responsible for violations of labor provisions by his subcontractors.

c. The contract clauses stipulated in the Required Provisions must be physically incorporated in all subcontracts.

Convict Labor: Use of convict labor is forbidden.

(*) Certain Materials Suppliers and Nearby Site Operations May Be Subject to Contract Labor Compliance.

It is the responsibility of the prime contractor to ascertain in advance whether or not the work to be performed or materials supplied under the contract is "covered work" relative to compliance with contract labor requirements especially when the sites of such operations are located reasonably nearby and off of the project limits such as used for job headquarters, storage yards, prefabrication or assembly yards, quarries or borrow pits, batch plants, and similar facilities, and when they are set up for and primarily serve only Federal-Aid construction or direct Federal-Aid construction, with only token amounts of sales or services on or from these nearby sites to other than these types of Federal-Aid construction. Normally the contract labor provisions are not applicable to independent material suppliers who are well established in business at a nearby location furnishing similar materials to others.

1. Form WH-348 Weekly Statement of Compliance

a. As provided in the "Required Contract Provisions", this form shall be prepared and executed by the contractor or subcontractor or by their

authorized agent who supervises payment of wages. It shall be attached to a copy of the applicable weekly payroll and submitted to the Project Engineer not later than the seventh day after the date on which the employees are paid.

3. If fringe benefit payments are required in addition to the basic hourly wage rates paid to each employee, the appropriate block on the Form WH-348 must be marked according to the section to which the benefit payments are being made. (See attached Form WH-348)

2. Payroll Requirements

Contractors and subcontractors shall use their own payroll forms. The payroll may be a legible carbon copy, or reproduced from the original by means of a photographic process, also a true transcript may be made from the original form. The following minimum information is required on all payrolls. (See attached typical payroll.)

a. The heading of the payroll must contain the following minimum information: (1) The project number, (2) Contractor or subcontractor's name and address, (3) The page number of the total pages, and (4) The ending date of the weekly pay period.

b. The employee's full name, address, and social security number. The address and social security number of an employee need not be repeated (optional) after the first payroll submitted in which his name appears (unless there is a change of address), however, instead the symbol "Rept'd" shall be entered.

c. The employee's classification and rated capacity of equipment operated shall be the same as those listed in the wage decision schedule in the special provisions. Recognizable title abbreviations may be used.

d. The payroll shall contain sufficient separate horizontal lines to record each employee's basic and overtime hourly wage rate. (If by machine method, horizontal lines on the form are not required provided computations are extended uniformly). Both basic and overtime hourly rates shall be shown for convenient review of computations.

e. If the employee performs work under more than one classification, his name-classification identity must be entered on separate lines for each classification even though the rates per hour remains unchanged. However, the authorized deductions and total amount earned may be combined. Combined total hours worked in all different classifications in a week shall govern payment of overtime computations.

f. The payroll shall have sufficient vertical columns with descriptive headings. (See the attached typical payrolls.)

3. Additional Classifications and Apprentice Schedule

In the event it is impossible to accomplish the designated work with the employee classifications listed in the contract wage rate decision, an application

(Standard Form 1444) must be obtained from and submitted through the Project Engineer for the additional classification. This application must be submitted at the time or before the employee begins work. The same form and rules apply to an apprentice schedule if the apprentice employees are registered under a bona fide apprenticeship program.

4. Posting Labor Regulations

   a. The Equal Employment Opportunity Posters shall be posted in conspicuous places available to employees and applicants for employment.

   b. The Wage Rate Information Poster with attached Contract Wage Rate Decision shall be posted by the contractor at the site of the work in a prominent place where it can easily be seen by the workers.

   c. The False Statements Poster shall be posted in one or more places where it is readily available to all personnel concerned with the project.

The foregoing posting requirements are in accordance with the Required Contract Provisions in the contract. The posting items will be furnished to the contractor by the Project Engineer for posting prior to any work on the project and shall be maintained throughout the construction.

CST2-D.G

Page 1 of 1 Project I-80-0(100) Payroll No. 1 for week ending February 29, 19__

Contractor: Avid Construction Co., Inc.
Address: Cincinnati, Nebraska

Type of Work: Bridges

Location: Big City - Rural

	Name and Address of Employee / Social Security Number	Classification	Hours Worked M	T	W	T	F	S	S	Total Hours	Rate Per Hr	Total Earned	Deductions F.I.C.A.	W.H.TAX	St.TAX	Other	Net Pay
(1)	D. E. Seavers 278-00-4567 Box 53, Freewater, NE 60000	Supt.									Weekly	500.00	35.14	70.16	13.33		381.37
(2)	E. B. Beats 357-00-3568 511 So. 13th, Big City, NE 61003	Front End Loader Over 3½ Cu.Yd.					11			11	12.00						
			10							10	8.00						
	" "	Carpenter									12.00	502.31	35.31	71.16	13.52	Group Ins. 27.16	355.16
				10	10	2				22	8.00						
	" "	Cement Finisher						4½		4½	11.625						
						8				8	7.75						
(3)	J. E. York 869-00-8765 Rt. 3, Rural, NE 62103	Ironworker, Appr. 3rd Period					5	5		10	16.50	605.00	42.35	84.70	16.09		461.86
			9	9	9	9	4			40	11.00						
(4)	A. B. Seemann 123-00-4567 2701 Pump St., Pool, NE 67001	Carpenter Helper					6	5		11	8.625	324.88	22.74	45.48	8.64		248.02
			8	10	10	9	3			40	5.75						
			PAYROLL CORRECTION														
(5)	A. B. Seeman Back Pay for	Carpenter Helper					6	8		14	8.625	350.75	(Should have been shown)				
			9	10	10	9	2			40	5.75						
	" " Week Ending Feb. 22, 19__	" "	9	10	10	9	8	8		54	5.75	310.50	(As shown)				
	(Amount due for overtime over 40 hours in a workweek)											40.25	2.82	5.64	1.07		30.72

(1) Hours per day and rate per hour need not be shown for supervisory and clerical employees. A working foreman must be shown in the same manner as any other employee under the classification involved.

(2) If one employee works under more than one classification, each classification must be shown on a separate line. Authorized deductions and pay computations may be combined.

(3) The applicable progressive interval period of apprenticeship must be shown.

(4) A typical "over 40 hours in one week" overtime example is shown. Nature of "Other Deductions" must be identified.

(5) A typical payroll correction for overtime is shown.

(The foregoing classifications are not intended to represent a typical crew during any week)

CERTIFIED CORRECT /s/ I. Q. Ames
TIMEKEEPER

COMPUTATIONS VERIFIED /s/ T. S. Green

APPROVED FOR PAYMENT /s/ John J. Jones
SUPERINTENDENT

U.S. Department of Transportation
Federal Highway Administration

NOTICE

The highway construction underway at this location is a Federal or Federal-aid project and is subject to applicable State and Federal laws, including Title 18, United States Code, Section 1020, which reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the costs thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction of any highway or related project submitted for approval to the Secretary of Transportation; or

"Whoever knowingly makes any false statement, false representation, false report, or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

"Whoever knowingly makes any false statement or false representation as to a material fact in any statement, certificate, or report submitted pursuant to the provisions of the Federal-Aid Road Act approved July 11, 1916 (39 Stat. 355), as amended and supplemented,

"Shall be fined not more than $10,000 or imprisoned not more than five years, or both."

Any person having reason to believe this statute is being violated should report the same to the agency representative(s) named below.

(Federal-Aid projects only) STATE HIGHWAY DEPARTMENT	*(Both Federal and Federal-Aid projects)* FEDERAL HIGHWAY ADMINISTRATION

Form FHWA-1022 (Rev. 6-90)

FEDERAL-AID HIGHWAY CONSTRUCTION CONTRACTORS ANNUAL EEO REPORT

OMB NO. 2125-0019

Report For

JULY _____ 19 __

1. CHECK APPROPRIATE BLOCK	2. NAME AND ADDRESS OF FIRM	3. FEDERAL-AID PROJECT NUMBER	4. TYPE OF CONSTRUCTION
☐ Contractor ☐ Subcontractor			

5. COUNTY AND STATE	6. PERCENT COMPLETE	7. BEGINNING CONSTR. DATE	8. DOLLAR AMOUNT OF CONTRACT	9. ESTIMATED PEAK EMPLOYMENT	
				Month and Year (a)	Number of Employees (b)

10. EMPLOYMENT DATA

Table A

JOB CATEGORIES	TOTAL EMPLOYEES		TOTAL MINORITIES		BLACK *Not of Hispanic Origin*		HISPANIC		AMERICAN INDIAN OR ALASKAN NATIVE		ASIAN OR PACIFIC ISLANDER		WHITE *Not of Hispanic Origin*	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
OFFICIALS *(Managers)*														
SUPERVISORS														
FOREMEN / WOMEN														
CLERICAL														
EQUIPMENT OPERATORS														
MECHANICS														
TRUCK DRIVERS														
IRONWORKERS														
CARPENTERS														
CEMENT MASONS														
ELECTRICIANS														
PIPEFITTERS, PLUMBERS														
PAINTERS														
LABORERS, SEMI-SKILLED														
LABORERS, UNSKILLED														
TOTAL														

Table B

JOB CATEGORIES	APPRENTICES		ON THE JOB TRAINEES	
	M	F	M	F
OFFICIALS *(Managers)*				
SUPERVISORS				
FOREMEN / WOMEN				
CLERICAL				
EQUIPMENT OPERATORS				
MECHANICS				
TRUCK DRIVERS				
IRONWORKERS				
CARPENTERS				
CEMENT MASONS				
ELECTRICIANS				
PIPEFITTERS, PLUMBERS				
PAINTERS				
LABORERS, SEMI-SKILLED				
LABORERS, UNSKILLED				
TOTAL				

Table C

APPENTICES																		
ON THE JOB TRAINEES																		

11. PREPARED BY: *(Signature and Title of Contractors Representative)* DATE

12. REVIEWED BY: *(Signature and Title of State Highway Official)* DATE

This report is required by law and regulation (23 U.S.C. 140a and 23 CFR Part 230). Failure to report will result in noncompliance with this regulation.

Form PR-1391 (Rev. 4-91) PREVIOUS EDITIONS ARE OBSOLETE 50526 M Form 1

FORM APPROVED OMB NO. 9000-

REQUEST FOR AUTHORIZATION OF ADDITIONAL CLASSIFICATION AND RATE

CHECK APPROPRIATE BOX
☐ SERVICE CONTRACT
☐ CONSTRUCTION CONTRACT

NOTE: THE CONTRACTOR SHALL COMPLETE ITEMS 3 THROUGH 16 AND SUBMIT THE REQUEST, IN QUADRUPLICATE, TO THE CONTRACTING OFFICER

1. TO: ADMINISTRATOR, Employment Standards Administration
WAGE AND HOUR DIVISION
U.S. DEPARTMENT OF LABOR
WASHINGTON, D.C. 20210

2. FROM: (REPORTING OFFICE)

3. CONTRACTOR

4. DATE OF REQUEST

5. CONTRACT NUMBER	6. DATE BID OPENED (SEALED BIDDING)	7. DATE OF AWARD	8. DATE CONTRACT WORK STARTED	9. DATE OPTION EXERCISED (IF APPLICABLE) (SCA ONLY)

10. SUBCONTRACTOR (IF ANY)

11. PROJECT AND DESCRIPTION OF WORK (ATTACH ADDITIONAL SHEET IF NEEDED)

12. LOCATION (CITY, COUNTY AND STATE)

13. IN ORDER TO COMPLETE THE WORK PROVIDED FOR UNDER THE ABOVE CONTRACT, IT IS NECESSARY TO ESTABLISH THE FOLLOWING RATE(S) FOR THE INDICATED CLASSIFICATION NOT INCLUDED IN THE DEPARTMENT OF LABOR DETERMINATION

NUMBER: _____ DATED: _____

a. LIST IN ORDER: PROPOSED CLASSIFICATION TITLE(S); JOB DESCRIPTION(S); DUTIES; AND RATIONALE FOR PROPOSED CLASSIFICATIONS (SCA ONLY) (Use reverse or attach additional sheets, if necessary)	b. WAGE RATE(S)	c. FRINGE BENEFITS PAYMENT
(Contractor prepares and submits this form)		

14. SIGNATURE AND TITLE OF SUBCONTRACTOR REPRESENTATIVE (IF ANY)	15. SIGNATURE AND TITLE OF PRIME CONTRACTOR REPRESENTATIVE	
16. SIGNATURE OF EMPLOYEE OR REPRESENTATIVE	TITLE	CHECK APPROPRIATE BOX—REFERENCING BLOCK 13. ☐ AGREE ☐ DISAGREE

TO BE COMPLETED BY CONTRACTING OFFICER (CHECK AS APPROPRIATE—SEE FAR 22.1019 (SCA) OR FAR 22.406-3 (DBA)

☐ THE INTERESTED PARTIES AGREE AND THE CONTRACTING OFFICER RECOMMENDS APPROVAL BY THE WAGE AND HOUR DIVISION. AVAILABLE INFORMATION AND RECOMMENDATIONS ARE ATTACHED.

☐ THE INTERESTED PARTIES CANNOT AGREE ON THE PROPOSED CLASSIFICATION AND WAGE RATE. A DETERMINATION OF THE QUESTION BY THE WAGE AND HOUR DIVISION IS THEREFORE REQUESTED. AVAILABLE INFORMATION AND RECOMMENDATIONS ARE ATTACHED.

(Send copies 1, 2, and 3 to Department of Labor)

SIGNATURE OF CONTRACTING OFFICER OR REPRESENTATIVE	TITLE AND COMMERCIAL TELEPHONE NO.	DATE SUBMITTED

NSN 7540-01-268-0631

DEPARTMENT OF LABOR

STANDARD FORM 1444 (10-
Prescribed by GSA
FAR (48 CFR) 53.222(f)
1444-101

STATE OF NEBRASKA

DEPARTMENT OF ROADS

STANDARD LABOR CLASSIFICATIONS AND DESCRIPTIONS FOR HIGHWAY CONSTRUCTION

SEPTEMBER 1, 1996

STATE OF NEBRASKA
DEPARTMENT OF ROADS

STANDARD LABOR CLASSIFICATIONS
AND DESCRIPTIONS
FOR
HIGHWAY CONSTRUCTION

Individual Crafts

Carpenter

Perform wide variety of duties, including working from plans and building in place of prefabricating units of wood, timber or steel forms. Frequently supervises placing of steel, structural or reinforcing. May perform other related duties.

Cement Finisher

Finishes fresh concrete in structures, roads, curbs, gutters, sidewalks and similar surfaces to desired grade, contour and texture by use of steel trowels and wooden floats. May use mechanical finishing tools. May form and finish edges and joints. Is assisted by laborers in striking off, leveling and bullfloating. May perform other related duties.

Electrician

Makes all wiring connections for lighting, traffic signals and controller installations. May use all tools of the trade and perform other related duties.

Flaggers

Acts as flagperson or may be a pilot vehicle driver to direct traffic through or around construction areas. May perform other traffic control related duties.

Form Setter

Places and removes forms used in construction of concrete structures. Checks placement for desired grade and alignment before and during pour. Sets curb, curb and gutter and paving forms to line and grade. May make alternations and repairs. Is assisted by laborers. May perform other related duties.

Laborers

Duties include but are not limited to the following tools and tasks: pick and shovel, raking and shoveling asphalt, spreading and handling concrete, operating manual bullfloats and screeds, bushing, grouting, patching, and rubbing concrete structures, assisting carpenters, and form setters with

materials, plus hammering and sawing; dismantling or wrecking and removing concrete forms, clearing and grubbing, flagging and directing traffic.

The duties also include tying reinforcing steel under supervision of a foreman, carpenter; carrying, cutting and bending reinforcing steel and wire mesh.

A laborer also lays drainage, irrigation, sewer pipe, conduit, and all temporary lines, such as water, steam, air, gas, etc. A laborer lays permanent water and sewer lines, including cast iron, steel and all other types of pipe for this purpose.

A laborer operates air compressors, pumps, batching bins and small power machines and tools (with mass less than 450 kg) which are incidental to labor work such as air tools or internal combustion engines, or electric tools which perform the same work as air tools, small light plants, concrete mixers for mixing grout, vibrators, spray machines, chain saws, earth drills, power buggies, etc. A laborer may operate scales used to weigh materials and may make weight tickets and related records.

A laborer also may paint guard rail, timber bridges, bridge handrail, steel sheet and bearing piling, and other similar appurtenances.

Manhole Builder

Constructs a means of permanent access to water and sewer lines for maintenance purposes, such as manholes, junction boxes, inlets, and rough masonry work for revetments, ditch checks and ditch linings. May apply coating of concrete to interior and exterior surfaces. May be assisted by laborers. May perform other related duties.

Mechanic

Assembles, adjusts, maintains and repairs all types of construction equipment. May perform the duties of a welder or other craftsman in the repair of equipment. May perform other related duties.

Painter

Paints structural steel framework of bridges and other portions of structures requiring painting, including bridge handrail, steel sheet and bearing piling, and other similar appurtenances. May be assisted by laborers. May perform other related duties.

Pile Driver Leadworker

Rigs pile driving equipment and guides hammer and follower on to pile head. May operate jetting equipment. May perform other related duties.

POWER EQUIPMENT OPERATORS:

Asphalt Distributor

Drives truck equipped with a tank for spraying asphaltic oil, or bituminous emulsions on road surfaces or slopes. Fills tank, regulates burner, adjusts valves, pump and spray bars. May oil, grease or otherwise services and make necessary adjustments and repairs to machine. May perform other related duties.

Asphalt Paving Machine

Operates asphalt paving machine, manipulates levers to control movements of machine, which spreads and levels asphaltic concrete. May oil, grease or otherwise service and make necessary adjustments and repairs to machine. May perform other related duties.

Asphalt Paving Machine, Screed

Regulates screed and may perform same duties as operator, but under supervision of operator.

Asphalt Roller, Self-propelled

Operates self-propelled machine used to compact and smooth plant mixed bituminous road surfaces. May oil, grease or otherwise service and make necessary adjustments or repairs to machine. May perform other related duties.

Concrete Finishing Machine or Slip Form Paver

Operates finishing machine or spreader straddling the fresh concrete. Adjusts attachments to produce desired surface. May include operation of attached equipment for mesh placement, vibrating, texturing, and curing. May oil, grease or otherwise service and make necessary adjustments and repairs to machine. May perform other related duties.

Concrete Saw Operator

Operates power saw with one or more diamond or other abrasive blades to saw concrete, asphalt, or other paving. May oil, grease, or otherwise service and make necessary repairs to machine. May perform other related duties.

Concrete Cure Machine

Operates separate machine or power equipment used in the application of liquid curing compound to concrete pavement surfaces. May oil, grease or otherwise service and make needed adjustments and repairs to equipment. May perform other concrete finishing related duties.

Concrete Texture Machine

Operates separate machine used in the texturing or tining of concrete pavement surfaces. May oil, grease or otherwise service and make needed

adjustments and repairs to equipment. May perform other concrete finishing related duties.

Bulldozer or Push Tractor (less than 86 kw)

Operates a tractor of less than 86 kw equipped with bulldozer blade or push plate. May oil, grease or otherwise service and make needed adjustments and repairs to equipment. May perform other related duties.

Bulldozer or Push Tractor (86 kw and over)

Same duties as less than 86 kw operator, except tractor is 86 kw and over.

Material Stockpiler

Operates loader or dozer and/or other related equipment for stockpiling of material aggregates. May oil, grease or otherwise service and make necessary adjustments or repairs to equipment. May perform other related duties.

Motor Grader (Finisher)

Operates motor grader to fine grade for pavement, level dirt, strip, maintain haul roads, windrow, mix, aerate and assist on laydown of asphalt and base materials and similar operations. May oil, grease or otherwise service and make necessary adjustments or repairs to equipment. May perform other related duties.

Motor Grader (Rough)

Operates motor grader to level dirt, strip, maintain haul roads, windrow, mix, aerate and assist on laydown of asphalt and base materials and similar operations. May oil, grease or otherwise service and make necessary adjustments or repairs to equipment. May perform other related duties.

Power Broom

Operates machine used to clean pavement surfaces. May oil, grease or otherwise service and make needed adjustments and repairs to equipment. May perform other related duties.

Roller or Compactor (Earthwork) Self-propelled

Operates self-propelled equipment, or a tractor with integrated or towed compacting equipment, used to compact all types of materials except asphaltic concrete surface courses. May oil grease, or otherwise service and make repairs to equipment. May perform other related duties.

Scraper (Under 10.7 m3)

Operates tractor pulling carryall scraper or operates self-contained or integrated scraper unit with a capacity or under 10.7 m3. May oil, grease or otherwise service and make necessary adjustments and repairs to equipment. May perform other related duties.

Scraper (10.7 m3 and Over)

Perform same duties of operator of scraper under 10.7 m3 except that capacity is 10.7 m3 and over.

Traveling Plant (Stabilization)

Operates self-propelled traveling plant that pulverizes and/or mixes material of or for roadbed with asphalt, water, cement or other stabilizing material. May oil, grease or otherwise service and make necessary adjustments and repairs to equipment. May perform other related duties.

Water Tanker (Less than 23 kL)

Operates water tanker less than 23 kL capacity. May oil, grease or otherwise service and make necessary adjustments and repairs to equipment. May perform other related duties.

Water Tanker (23 kL and Over)

Operates water tanker 23 kL and over. May oil, grease or otherwise service and make necessary adjustments and repairs to equipment. May perform other related duties.

All Purpose Spreader

Operates self-propelled machine which deposits and spreads material on road surface, in trench, or on road shoulder. May oil, grease or otherwise service and make necessary adjustments and repairs to machine. May perform other related duties.

Clamshell, Dragline, Crane, Pile Driver, or Shovel

Operates any of above track type or rubber tired equipment. May oil, grease or otherwise service and make necessary adjustments and repairs to equipment. May perform other related duties.

Backhoe Excavator (tracktype)

Operates track type backhoe excavator. May oil, grease or otherwise service and make necessary adjustments and repairs to equipment. May perform other related duties.

Dredge Pump

Operates and makes minor repairs to dredge type pumping equipment. Starts power unit. Operates and maintains suction pump and line that sucks up material through an intake pipe line and ejects it through a discharge pipe. May be assisted by laborers. May perform other related duties.

Front End Loader (4 m3 or Less)

Operates tractor front end loader with a maximum capacity of 4 m3 for excavating, handling, or loading materials. May oil, grease or otherwise service and make necessary adjustment or repairs to equipment. May perform other related duties.

Front End Loader (Over 4 m3)

Same duties as 4 m3 or less operator, except capacity is over 4 m3.

Hydrohammer

Operates hydraulic driven hammer used to drive posts, break concrete or etc. May oil, grease or otherwise service and make necessary adjustments and repairs to equipment. May perform other related duties.

Loader Backhoe (Rubber-Tired)

Operates farm type tractor with fixed backhoe attachment operated from tractor. May oil, grease or otherwise service and make necessary adjustments and repairs to machine. May perform other related duties.

Power Grade Machine (Trimmer and Profiler)

Operates machine with power unit which, by the use of a grade-reference system, mechanically trims the subgrade, foundation or base course to the elevations or section specified, operates machine used to scarify and remove materials from bridge decks or pavement surfaces. May oil, grease or otherwise service and make necessary adjustments to equipment. Performs other related duties.

Skid Steer Loader (Bobcat)

Operates skid steer loader with fixed attachments for excavating, handling, or loading materials. May oil, grease or otherwise service and make necessary adjustments or repairs to equipment. May perform other related duties.

Tractor (Farm Type)

Operates farm type tractor less than 86 kw to tow agricultural and construction equipment without power control units operated from tractor. May oil, grease or otherwise service and make necessary adjustments and repairs to machine. May perform other related duties.

Trenching Machine

Operates power-driven wheel or chain-type trenching machine. May oil, grease or otherwise service and make necessary adjustments and repairs to machine. May perform other related duties.

Stationary Plant (Base or Stabilization)

Supervises, directs and controls the operation of a plant producing base or foundation course materials. Responsible for the adjustment and setting of gates, scales, pumps or other devices which control the preparation of the various materials incorporated in the finished product. May physically operate any component part or unit of the plant. May service and make necessary adjustments or repairs to plant equipment, and perform other related duties.

Stationary Plant (Asphalt or Concrete)

Supervises, directs and controls the operation of a plant proportioning and/or mixing portland cement concrete, or a plant producing asphaltic concrete. Responsible for the adjustment and setting of gates, scales, pumps or other devices which control the preparation of the various materials incorporated in the finished product. May physically operate any component part or unit of the plant. May service and make necessary adjustments or repairs to plant equipment, and perform other related duties.

Crusher (Including Those With Integral Screening Plant)

Operates plant including crusher and/or screens and conveyors to crush rock, gravel or other material. May oil, grease or otherwise service and make necessary adjustments and repairs to machine. May perform other related duties.

TRUCK DRIVERS:

Single Axle

Drives single-rear-axle-type truck which may have various kinds of beds attached such as dump, flat, tank, etc. Work includes loading and unloading materials. May oil, grease or otherwise service and make necessary adjustments and repairs to vehicle. May perform other related duties.

Tandem Axle

Drives tandem-rear-axle-type truck which may have various kinds of beds attached such as dump, flat, tank, etc. Work includes loading and unloading materials. May oil, grease or otherwise service and make necessary adjustments and repairs to vehicle. May perform other related duties.

Semi-Trailer or Lowboy

Drives truck tractor pulling a semi-trailer which may have various kinds of beds attached. Work includes loading and unloading material or equipment. May oil, grease or otherwise service and make necessary adjustments and repairs to vehicle. May perform other related duties.

Transit Mix

Drives truck on which is mounted a concrete mixer. Operates mixer and assists in loading and unloading. May oil, grease or otherwise service and make necessary adjustments and repairs to vehicle. May perform other related duties.

U.S. Department of Transportation

Important

U. S. DEPARTMENT OF LABOR

Wage Rate Information
Federal-Aid Highway Project

Construction work on this project is subject to the minimum wage rate provisions of Section 113, Title 23, United States Code and the overtime wage provisions of the Contract Work Hours and Safety Standards Act.

As an employee of the contractor or a subcontractor, you are entitled to be paid not less than the hourly rate for the particular classification of work performed as set forth in the schedule affixed below.

The schedule affixed below contains no minimum wage rates for the following employees:

1. Apprentices properly registered under approved Federal or State apprenticeship programs. Each approved program contains the applicable rates.

2. Persons employed pursuant to apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting equal employment opportunity in connection with Federal-aid highway construction programs. Programs thus certified will set forth the rates applicable.

Call any failure to receive the required rates to the attention of the representative of the contracting agency shown below or the nearest representative of the Federal Highway Administration.

(State highway department representative)

Additional information may be obtained from the Federal Highway Administration, Washington, D.C. 20590.

Any communication should list the name, location, and type of project, the name of the contractor and his address, your name and address, and a statement of what you do, what rate you are paid, and what rate you think you should be paid.

(Attach Secretary of Labor minimum wage rate schedule)

Form FHWA-1495 (9-61)

PREVIOUS EDITIONS ARE OBSOLETE

Equal Employment Opportunity is (FEDERAL)

THE LAW

Employers Holding Federal Contracts or Subcontracts

Applicants to and employees of companies with a Federal government contract or subcontract are protected under the following Federal authorities:

RACE, COLOR, RELIGION, SEX, NATIONAL ORIGIN

Executive Order 11246, as amended, prohibits job discrimination on the basis of race, color, religion, sex or national origin, and requires affirmative action to ensure equality of opportunity in all aspects of employment.

INDIVIDUALS WITH HANDICAPS

Section 503 of the Rehabilitation Act of 1973, as amended, prohibits job discrimination because of handicap and requires affirmative action to employ and advance in employment qualified individuals with handicaps who, with reasonable accommodation, can perform the essential functions of a job.

VIETNAM ERA AND SPECIAL DISABLED VETERANS

38 U.S.C. 4212 of the Vietnam Era Veterans Readjustment Assistance Act of 1974 prohibits job discrimination and requires affirmative action to employ and advance in employment qualified Vietnam era veterans and qualified special disabled veterans.

Any person who believes a contractor has violated its nondiscrimination or affirmative action obligations under the authorities above should contact immediately:

The Office of Federal Contract Compliance Programs (OFCCP), Employment Standards Administration, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210 or call (202) 523-9368, or an OFCCP regional or district office, listed in most telephone directories under U.S. Government, Department of Labor.

Private Employment, State and Local Governments, Educational Institutions

Applicants to and employees of most private employers, state and local governments, educational institutions, employment agencies and labor organizations are protected under the following Federal laws:

RACE, COLOR, RELIGION, SEX, NATIONAL ORIGIN

Title VII of the Civil Rights Act of 1964, as amended, prohibits discrimination in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment, on the basis of race, color, religion, sex or national origin.

DISABILITY

The Americans with Disabilities Act of 1990, as amended, protects qualified applicants and employees with disabilities from discrimination in hiring, promotion, discharge, pay, job training, fringe benefits, classification, referral, and other aspects of employment on the basis of disability. The law also requires that covered entities provide qualified applicants and employees with disabilities with reasonable accommodations that do not impose undue hardship.

AGE

The Age Discrimination in Employment Act of 1967, as amended, protects applicants and employees 40 years of age or older from discrimination on the basis of age in hiring, promotion, discharge, compensation, terms, conditions or privileges of employment.

SEX (WAGES)

In addition to sex discrimination prohibited by Title VII of the Civil Rights Act (see above), the Equal Pay Act of 1963, as amended, prohibits sex discrimination in payment of wages to women and men performing substantially equal work in the same establishment.

Retaliation against a person who files a charge of discrimination, participates in an investigation, or opposes an unlawful employment practice is prohibited by all of these Federal laws.

If you believe that you have been discriminated against under any of the above laws, you immediately should contact:

The U.S. Equal Employment Opportunity Commission (EEOC), 1801 L Street, N.W., Washington, D.C. 20507 or an EEOC field office by calling toll free (800) 669-4000. For individuals with hearing impairments, EEOC's toll free TDD number is (800) 800-3302.

Programs or Activities Receiving Federal Financial Assistance

RACE, COLOR, NATIONAL ORIGIN, SEX

In addition to the protection of Title VII of the Civil Rights Act of 1964, Title VI of the Civil Rights Act prohibits discrimination on the basis of race, color or national origin in programs or activities receiving Federal financial assistance. Employment discrimination is covered by Title VI if the primary objective of the financial assistance is provision of employment, or where employment discrimination causes or may cause discrimination in providing services under such programs. Title IX of the Education Amendments of 1972 prohibits employment discrimination on the basis of sex in educational programs or activities which receive Federal assistance.

INDIVIDUALS WITH HANDICAPS

Section 504 of the Rehabilitation Act of 1973, as amended, prohibits employment discrimination on the basis of handicap in any program or activity which receives Federal financial assistance. Discrimination is prohibited in all aspects of employment against handicapped persons who, with reasonable accommodation, can perform the essential functions of a job.

If you believe you have been discriminated against in a program of any institution which receives Federal assistance, you should contact immediately the Federal agency providing such assistance.

U.S. GOVERNMENT PRINTING OFFICE 1993-0-330-478

EEOC-P/E-1

Federal Minimum Wage

$4.75 per hour *beginning October 1, 1996*

$5.15 per hour *beginning September 1, 1997*

Employees under 20 years of age may be paid $4.25 per hour during their first 90 consecutive calendar days of employment with an employer.

Certain full-time students, student learners, apprentices, and workers with disabilities may be paid less than the minimum wage under special certificates issued by the Department of Labor.

Tip Credit – Employers of "tipped employees" must pay a cash wage of at least $2.13 per hour if they claim a tip credit against their minimum wage obligation. If an employee's tips combined with the employer's cash wage of at least $2.13 per hour do not equal the minimum hourly wage, the employer must make up the difference. Certain other conditions must also be met.

Overtime Pay

At least 1½ times your regular rate of pay for all hours worked over 40 in a workweek.

Child Labor

An employee must be at least 16 years old to work in most non-farm jobs and at least 18 to work in non-farm jobs declared hazardous by the Secretary of Labor. Youths 14 and 15 years old may work outside school hours in various non-manufacturing, non-mining, non-hazardous jobs under the following conditions:

No more than –

- 3 hours on a school day or 18 hours in a school week;
- 8 hours on a non-school day or 40 hours in a non-school week.

Also, work may not begin before 7 a.m. or end after 7 p.m., except from June 1 through Labor Day, when evening hours are extended to 9 p.m. Different rules apply in agricultural employment.

Enforcement

The Department of Labor may recover back wages either administratively or through court action, for the employees that have been underpaid in violation of the law. Violations may result in civil or criminal action.

Fines of up to $10,000 per violation may be assessed against employers who violate the child labor provisions of the law and up to $1,000 per violation against employers who willfully or repeatedly violate the minimum wage or overtime pay provisions. This law prohibits discriminating against or discharging workers who file a complaint or participate in any proceedings under the Act.

Note:
- Certain occupations and establishments are exempt from the minimum wage and/or overtime pay provisions.
- Special provisions apply to workers in American Samoa.
- Where state law requires a higher minimum wage, the higher standard applies.

For Additional Information, Contact the Wage and Hour Division office nearest you — listed in your telephone directory under United States Government, Labor Department.

This poster may be viewed on the world wide web at this address: http://www.dol.gov./dol/esa/public/minwage/main.htm

The law requires employers to display this poster where employees can readily see it.

U.S. Department of Labor
Employment Standards Administration
Wage and Hour Division
Washington, D.C. 20210

WH Publication 1088
Revised October 1996

U.S. DEPARTMENT OF LABOR

EMPLOYMENT STANDARDS ADMINISTRATION

Wage and Hour Division
Washington, D.C. 20210

NOTICE

EMPLOYEE POLYGRAPH PROTECTION ACT

The Employee Polygraph Protection Act prohibits most private employers from using lie detector tests either for pre-employment screening or during the course of employment.

PROHIBITIONS

Employers are generally prohibited from requiring or requesting any employee or job applicant to take a lie detector test, and from discharging, disciplining, or discriminating against an employee or prospective employee for refusing to take a test or for exercising other rights under the Act.

EXEMPTIONS*

Federal, State and local governments are not affected by the law. Also, the law does not apply to tests given by the Federal Government to certain private individuals engaged in national security-related activities.

The Act permits *polygraph* (a kind of lie detector) tests to be administered in the private sector, subject to restrictions, to certain prospective employees of security service firms (armored car, alarm, and guard), and of pharmaceutical manufacturers, distributors and dispensers.

The Act also permits polygraph testing, subject to restrictions, of certain employees of private firms who are reasonably suspected of involvement in a workplace incident (theft, embezzlement, etc.) that resulted in economic loss to the employer.

EXAMINEE RIGHTS

Where polygraph tests are permitted, they are subject to numerous strict standards concerning the conduct and length of the test. Examinees have a number of specific rights, including the right to a written notice before testing, the right to refuse or discontinue a test, and the right not to have test results disclosed to unauthorized persons.

ENFORCEMENT

The Secretary of Labor may bring court actions to restrain violations and assess civil penalties up to $10,000 against violators. Employees or job applicants may also bring their own court actions.

ADDITIONAL INFORMATION

Additional information may be obtained, and complaints of violations may be filed, at local offices of the Wage and Hour Division, which are listed in the telephone directory under U.S. Government, Department of Labor, Employment Standards Administration.

THE LAW REQUIRES EMPLOYERS TO DISPLAY THIS POSTER WHERE EMPLOYEES AND JOB APPLICANTS CAN READILY SEE IT.

**The law does not preempt any provision of any State or local law or any collective bargaining agreement which is more restrictive with respect to lie detector tests.*

U.S. DEPARTMENT OF LABOR
EMPLOYMENT STANDARDS ADMINISTRATION
Wage and Hour Division
Washington, D.C. 20210

*U.S. GPO: 1989—(247-870)

WH Publication 1462
September 1988

Your Rights
Under The
Family and Medical Leave Act of 1993

FMLA requires covered employers to provide up to 12 weeks of unpaid, job-protected leave to "eligible" employees for certain family and medical reasons. Employees are eligible if they have worked for a covered employer for at least one year, and for 1,250 hours over the previous 12 months, and if there are at least 50 employees within 75 miles.

Reasons For Taking Leave:

Unpaid leave must be granted for *any* of the following reasons:

- to care for the employee's child after birth, or placement for adoption or foster care;
- to care for the employee's spouse, son or daughter, or parent, who has a serious health condition; or
- for a serious health condition that makes the employee unable to perform the employee's job.

At the employee's or employer's option, certain kinds of *paid* leave may be substituted for unpaid leave.

Advance Notice and Medical Certification:

The employee may be required to provide advance leave notice and medical certification. Taking of leave may be denied if requirements are not met.

- The employee ordinarily must provide 30 days advance notice when the leave is "foreseeable."
- An employer may require medical certification to support a request for leave because of a serious health condition, and may require second or third opinions (at the employer's expense) and a fitness for duty report to return to work.

Job Benefits and Protection:

- For the duration of FMLA leave, the employer must maintain the employee's health coverage under any "group health plan."
- Upon return from FMLA leave, most employees must be restored to their original or equivalent positions with equivalent pay, benefits, and other employment terms.
- The use of FMLA leave cannot result in the loss of any employment benefit that accrued prior to the start of an employee's leave.

Unlawful Acts By Employers:

FMLA makes it unlawful for any employer to:

- interfere with, restrain, or deny the exercise of any right provided under FMLA:
- discharge or discriminate against any person for opposing any practice made unlawful by FMLA or for involvement in any proceeding under or relating to FMLA.

Enforcement:

- The U.S. Department of Labor is authorized to investigate and resolve complaints of violations.
- An eligible employee may bring a civil action against an employer for violations.

FMLA does not affect any Federal or State law prohibiting discrimination, or supersede any State or local law or collective bargaining agreement which provides greater family or medical leave rights.

For Additional Information:

Contact the nearest office of the Wage and Hour Division, listed in most telephone directories under U.S. Government, Department of Labor.

U.S. Department of Labor
Employment Standards Administration
Wage and Hour Division
Washington, D.C. 20210

WH Publication 1420
June 1993

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APPENDIX 3 - FIELD BOOK RECORDS

General - Field Book Requirements

The most important entries in the field books and diaries are records of conversations with the contractor especially when agreements are made. Most agreements made in the field should be documented in a diary or field book and both the inspector and the contractor should sign the entry.

It is fairly easy to remeasure or estimate material quantities and those entries although important are reproducible. This is not the case with agreements.

Verbal agreements are frequently misinterpreted or forgotten with significant adverse consequences so get them in writing.

The examples of field book records included in this division are intended as examples that fulfill the minimum record requirements. It is not mandatory that these exact methods be used. when they are not used, the Project Manager shall ascertain that the minimum requirements for contract records are being satisfied. If you have a simpler or better method for any of these records you are encouraged to submit examples of your method to the Construction Office for possible inclusion in this manual.

Book number, project number, project location, contractor when applicable, book name, field district, property of notation, addresses and telephone numbers are required inside the front covers of all books. All books will be indexed and have the pages numbered. Project Managers Diaries shall be the first books in the numbering sequence. Inspectors Diaries can be any number/numbers after Project Manager Diaries.

Field books for each contract should be numbered in sequence as the final documents for all groups included in a contract are submitted to the Construction office in one transmittal. The binding edge of the field book should not be marked because identification for storage in the archives will be listed there by the Construction office. Utility diary records should not be numbered or submitted with the final documents. they should be sent directly to the Utilities Officer when the utility rehabilitation is complete.

Erasures shall not be made in source documents. This includes field books. If a corrected entry is made, a line should be drawn through the original entry without obliterating it and the correct information written above, below or to the side of the original entry. Erasures destroy the legal validity of the records. Records with erasures are not admissible as evidence in a court of law.

The examples in this section have been grouped together under subheadings of groups of work that generally require the example records. Similar records may be required for other than the groups of work used in this index.

General Information

Project Records and Reports (Except Measurement and Payment Records -- Included in Section 109)

A. General - The project construction records are the basis for all claims for reimbursement under the contract and they verify that the work conforms to the requirements specified. Accordingly, they should be authentic, complete, understandable and open only to the interpretation intended by the recorder. The project manager shall outline to his assistants the manner in which the various records should be kept and should make certain that they are being properly and adequately maintained. It is the responsibility of the project manager to see that the project records are accurate and complete.

MEASUREMENT OF PAY QUANTITIES AND RETENTION OF RECORDS

Measurement of Pay Quantities

Measurements in the units prescribed in the Specifications shall be entered directly in the proper field book. Each entry must include the date, type of work covered, location, proper measurements, and extensions. Names or initials of each inspector making measurements must be included. Each entry shall close with the signature of the individual who makes the entry. The location should be accurately identified by means of station numbers, right or left side, pier number, etc.

Computation of areas, volumes, or lengths should be checked by a different inspector using the figures entered in the field book. All checks are to be initialed by the inspector making this verification.

Specifications provide that some items, such as reinforcing steel and structural steel, are to be paid on the basis of design mass. Other items to be paid on a mass basis must be supported by scale tickets. Scale tickets are to be authenticated by an inspector or scalemaster at the point of measurement and again at the point of delivery at the job site by the project inspector. For small quantities 200 Mg or less/day of granular material delivered to the job site, minimum acceptable authentication may be initialing by the inspector of the scale ticket at the point of delivery.

Quantities for each contract item and all extra work must stand on their own merits in every case. Payment for legitimate work by means of increasing quantities on another item to equal the money is not permitted.

Retention of Records

Project records retention is according to the current NDR Records "DOR1". The required retention periods are minimums and may be increased at the direction of the District Engineer. The Controller Office will notify field offices of the date of final reimbursement.

At the time project files are disposed of by the Project Manager, some project data may be determined to be of value in future years and selected for future retention, preferably in the District Engineer's files. Examples include correspondence on drainage problems, notice of pending litigation, or adjacent property owner concerns about the right-of-way.

After completing a project, prepare the final estimate, complete the as-built plans, assemble all field books relating to that project (including diaries, cross-section notes, bridge and culvert inspection books, paving, grading, right-of-way, etc.) and then ship the documents with a copy of the final estimate to the Construction Division.

Payrolls and scale tickets are to be stored in each District and are not to be forwarded to the Construction Division.

PROJECT DIARY

The project manager's diary is one of the important records of any project. It shall be kept daily and show the following information: Date, day of the week, year, progress of the work and any data not covered in other records which might have a bearing should any details come into dispute. It shall be signed (not initialed) by the party making the entry. The diary shall also contain the following:

1. Weather conditions during the day, noting rain, exceptional wind, maximum and minimum temperatures, etc. If possible, show amount of rainfall.

2. Major developments of any important matters pertaining to the contract.

3. Any understanding with the contractor or his representative.

4. Record of important conversations or verbal discussions with the contractor relative to the work. These statements shall be specific, an entry as: "Told the contractor that ***" is not satisfactory, whereas, "I told Jones that ***" is satisfactory; or "The contractor seems to feel that his progress is satisfactory" should be written, "Jones said that he is not worried, that he will make up for lost time in June and July with more men on the job". A general conclusion as to the effect of a conversation in not helpful; whereas a statement of the conversation is important.

5. Important verbal instructions should also be confirmed by letter.

* 6. Dates on which major equipment or sizeable work forces are moved onto or away from the job.

* 7. List general location where equipment is working each day, and a record of major equipment not working or idle for repairs.

8. List the controlling operation each day.

9. Detail information regarding equipment and cost of exploratory work made by the contractor on any state designated pit. The Construction Division will then have supporting information on costs submitted by the contractor in case he is obliged because of inadequate or unsuitable material to move to a new location.

10. Agreements with property owners shall also be entered in the diary.

11. Official visitors and inspections.

12. Work or materials rejected and reasons.

13. Time of shutting down of work or resuming of work and explanations.

14. Account of any time spent by contractor's men or equipment on disputable items or work.

15. Length or cause of any delay.

16. Record of telegrams and telephone calls.

17. Unusual conditions, if any, such as high water, bridge failures, slides, etc.

18. Running total of working days.

19. Progress of surveying and staking.

20. All Internal Time Allowance information. A separate Project Manager diary shall be kept for each time allowance in the contract.

[*May be recorded in inspector diaries by inspectors.]

The diary information shall be recorded in a bound field notebook. Other contract records may be contained in the diary. Separate field notebooks are required for diary information pertinent to each contract time allowance. Subcontractor diary records shall be included with the diary record of the prime contractor. The diary shall be available to department and Federal Highway Administration personnel on their visits to the project. The diary must be submitted with the project records and final computations.

FIELD NOTEBOOKS

1. General - All measurements, placement records and other information, except certain test results, taken in the field shall be entered directly in a bound field notebook and initialed and dated. It will not be permissible to enter any records or loose sheets, etc., and later copy them in a bound notebook. All records shall be legible. No erasures shall be made in the records. Erasures destroy the value of the notes in case of legal disputes. Any corrections in the notes shall be made by drawing a line through the original entry in such a manner that it will remain legible.

   Inspector I.D. page is required.

   The inside of the front cover of each notebook shall be labeled to indicate the project number, book number and the character of the notes, or records therein. Do not write on the outside of the notebook cover with ink as they will be permanently labeled on reaching the Lincoln Office. The project manager's diary record must be lowest book

numbers in a set of books. Do not use numbers preceded by letters, i.e. 1-A, as this confuses the book of books' numbering. The project manager's name and address, and the return address of the department shall be shown on the inside of the cover. Each leaf in the notebook shall be numbered; the first two to four pages to be reserved for indexing.

Separate notebooks and field records shall be kept for each project or group of projects under one contractor and for each contract awarded on the same project. Each contract may then be submitted individually as soon as work is completed.

Colored pencils shall be reserved for use in the District and Construction Offices and should not be used for any computations or checking of notebooks in the District offices.

2. Survey Staking Notebooks - The date and names of each member of the survey party performing the work shall be recorded at the beginning of each day's work and each page of notes should be dated when the work is performed. The job performed by each person may be recorded graphically:

7-13-96
Notes - J. P. Doe
Transit - R. A. Johnson
Rod - M. A. Smith
Chain - T. R. Brown

3. Inspection Notebooks - Field notebooks pertaining to construction inspection should include the name of engineering personnel inspecting work items or operations, particularly those for which inspection is not documented by printed work report forms or test reports which would be signed and dated by the person inspecting the work. Typical examples of work items or operations which may not be documented by reports are placement of reinforcing steel and forms for structures, backfilling structures, bridge painting, rolling of armor coat, seeding and slope protection work.

The construction and finish of such work items or operations shall be done in accordance with specified requirements and should be attested to by the engineer inspecting and approving the construction, include the date of such inspection. In order that the same methods are used statewide, use the following method of documentation: For each section or pour, a notation shall be made in the notebook attesting to the acceptance of that portion of work to the effect that "forms and reinforcing steel have been inspected and are in accordance with the specified requirements". A brief description of the section or pour covered, date, and inspector's signature must be included.

An inspector's diary record shall be included in the field inspection notebooks for contractor's operations. Example - concrete paving

operation with five inspectors, only two diary records will be required, one for roadway operations and one for plant operations.

4. As Built Plans - As builts shall be a full size set of plans. They are prepared and submitted as a part of the final records for each project. They are used as a reference in checking the final quantities and also as a reference for future construction. They should be complete and accurate. The preparation of as built plans is covered in Subsection 109.11, Paragraph VIII. of this manual.

Metric Survey Guidelines

Alignment:

Station = 100M with +25 +50 +75 between stations.

For curves, use soft conversion (to convert foot distance to meters, divide by 3.2808333 or multiply by 0.30480061).

Levels:

Accuracy: 1st order = .003M V Kilometers
2nd order = .007M V Kilometers
3rd order = .010M V Kilometers (most work)

Three Wire Levels:

Rod readings to thousandths (3.102).

Difference between top hair and middle hair to bottom hair can be 4 mm (.004).

Cross Sections:

Dirt Shots: Read to nearest hundredth of a meter (3.11)

Hard Surface Shots: Read to nearest thousandth of a meter (3.105).

Topography:

Station plus (+) to nearest tenth of a meter (20.1)

Distance Rt./Lt. to nearest tenth of a meter (20.1)

Critical items measure to nearest hundredth of a meter (20.02)

Scale for Topog

1 mm = 1 m	is	1 to 1000
2 mm = 1 m	is	1 to 500

Identification Page and Index Page

Group 1 Grading Book #7
FIELD or TRANSIT BOOK

Property of	*Nebr. Dept. of Roads* *Box 94759* *Lincoln, NE 68509*
Address	*James E. Erin* *Box 77* *Smith Square, NE 68881*
Telephone	*(308) 741-3999 Office* *(308) 741-4112 Home*

Project RS-601-1(102)
Smith Square - North
Contractor - O.K. Contractors
District 4

This book is manufactured of a High Grade 50% Rog Paper having a Water Resisting Surface, and is sewed with Nylon Waterproof Thread.

Index

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This type of index can be kept current if entries are indexed as they are added to the book.

Inspector Information and Party Information

Inspector Information

Date	*Printed Inspector's Name*	*Job Title*	*Inspector's Signatures Used*
4-4-96	*Stanley D. Donnelson*	*EA II*	*S.D.D., S.D.D. & Stanley D. Donnelson*
4-1-96	*Ivan C. Smith*	*Constructor's Supt.*	*I. C. Smith*
4-7-96	*Donald D. Dugger*	*EA I*	*D.D.D., D.D.D., & Donald D. Dugger*
5-9-96	*Joseph L. Lunar*	*PM II*	*J.L.L. & J. L. Lunar*

This information should be shown in each field book, for inspectors making entries in the book.

Contractor

4-1-96
T. E. Simm

This information should be entered on the first page of Survey Records for a day.

This information should be entered on Subsequent pages of Survey Records for a day.

Project Diary Record

3-29-96 Friday
Mr. John Goodhammer (Keywitt Const.) requested that wet unsuitable material be replaced with granular fill at Sta. 101+25.020 to Sta. 101+35.010. Estimated volume is 2000 m^3.
I. M. Good, P.M., gave the contractor permission to remove 2000 m^3 of unsuitable material.

x_____ x_____
I. M. Good, P.M. John Goodhammer, Keywitt Const.

Project Diary Record

Date: Thursday, 4-21-96
Weather: Cloudy & Cool
C.C.O.: Finishing Sta. 16+ to 43+
Hours Worked C.C.O.: 0 Hrs. 7-6+10 1/2 Other Working Day No Total W.D. to Date 18
Official Visitors: Mr. R. T. Dooley DCE and Mr. F. D. Good, DE Foreman

The contractor worked on clearing and grubbing with three men, one D-7 dozer and one pickup from Sta. 268+ to 300+, worked on rough grading with nine men, four DW-31 scrapers, two patrols, one self-propelled sheepsfoot roller and one pickup, two men worked on repairing water trucks & tractor and drill for covercrop, one mechanic and one greaser also working. Rough grading from Sta. 83+ to 110+ today. No water hauled as soil moisture good from yesterday rain. No working day charged as too wet from rain (1 1/2") yesterday to finish 750,000 m^2 plus open. Blue tops set today from Sta. 43+ to 80+.

Subcontractor, Water-Well, Inc. Working on prewatering from Sta. 330+ to 360+ with women, one pickup, pipe and pump. Moving pipe most of morning 9 hrs. work for men.

DE & DCE looked at trees to be saved left Station 412+ to 417+ and concurred that trees as marked and counted are okay.

J. P. Jones
H.P.M.

A project diary is required for each Time Allowance included in the contracts for a project. Diary entries may be made prior to the date the contractor begins work on the Project in order to document informal discussions with the contractor's representatives, landowners or other interested parties. Diary entries shall begin on the day the contractor begins work on the project or the Notice to Proceed beginning date whichever is first. Diary entries, for such minor preliminary work as the stockpiling of aggregates or the moving of equipment onto the project site, are not required. Diary entries should be made for all other work done on the project, including the setting of signs and placing of barricades regardless of whether or not the work is a pay item.

Final Cross-Sections Roadway
Final Closure Notes

HS checked & OG & Red T.T.B. 5-7-96 *4-26-96*
Checked Red R.L.L. 5-9-96 *R.L.L.*

1009+91	*Correct Prelim. Lt.*	*3^{8}*	*4^{5}*	*5^{1}*	*4^{55}*	*4^{60}*	*4^{32}*	*4^{55}*	*5^{00}*	*5^{7}*	*4^{7}*	*5^{2}*
	to Elev. 1243.340 m	*78*	*66*	*57*	*28*	*20*	*0*	*20*	*43*	*50*	*56*	*82*
	@ 24.384 m SS Book	*OG*	*OG*		*5*	*5*	*5*	*5*	*5*		*OG*	*OG*
	#2 Pg. 19	*C*									*C*	

BM #12 *+59.10 1244.520 Corr. To 1242.7180*
Transit 04.070 1212.7120

76.1
75.8

1009+56	3^{1}	4^{32}	4^{55}	4^{98}	5^{12}	4^{87}	4^{62}	4^{37}	4^{62}	4^{99}	4^{56}	4^{45}	5^{1}	5^{4}
	106	96	84	65	49	35	20	0	20	40	60	81	95	102
	OG	5	S	S	S	S	S	S	S	S	S	S	OG	OG
		78.1	77.5	C						C				75.6
	72.4	78.0												76.2

1009+42	3^{8}	3^{1}	3^{2}	3^{7}	5^{3}	6^{2}	5^{60}	5^{11}	5^{41}	4^{73}	4^{96}	5^{98}	6^{21}	6^{2}	6^{0}	5^{0}
PC begin	117	105	97	82	74	66	58	40	27	20	0	20	40	56	63	66	67
1.25°																	
Curve Rt.	OG	OG		C			S	S	S	S	S	S	S	S		OG	OG
												1243.9530					C

Transit

Final Cross-Sections Borrow Pit
How to Wrap Section Closure Shots (StaM)

Borrow Pit #1 *HS checked & Red TID 4-25-96*
3-3-96 *Checked Red R.L.L. 4-25-96*
Ptly. Cldy.-Wind-Cold
R. S. Smith (Transit)
1 T. T. Dome (Rod)
8 J. S. Lane (Chain) *138+00* *Lt.* *8^{8}* *6^{0}* *4^{8}* *3^{5}*
R. L. Lane (Notes) *400* *382* *367* *353*

138+00	*0^{4}*	*0^{7}*	*0^{6}*	*1^{1}*	*1^{5}*	*1^{5}*	*3^{2}*	*5^{1}*	*4^{6}*	*4^{4}*	*4^{4}*	*4^{2}*	*3^{2}*	*3^{1}*	*3^{1}*
*	*139*	*137*	*174*	*191*	*200*	*202*	*202*	*220*	*237*	*253*	*273*	*290*	*300*	*317*	*335*
	OG	*OG*													

138+00	*0^{7}*	*1^{6}*	*2^{6}*	*4^{1}*	*5^{5}*	*6^{6}*	*6^{5}*	*7^{2}*	*7^{8}*	*7^{8}*	*7^{0}*	*8^{0}*	*8^{1}*	*8^{0}*	*8^{0}*	*8^{1}*	*8^{2}*	*8^{4}*	*8^{5}*	*8^{7}*	*8^{7} Rt.*
	129	*100*	*86*	*70*	*53*	*37*	*27*	*17*	*0*	*8*	*25*	*42*	*57*	*72*	*90*	*107*	*126*	*145*	*160*	*180*	*200*
									L											*OG*	*OG*

137+00	*Rt.*	*8^{2}*	*8^{7}*	*8^{5}*	*8^{0}*	*6^{1}*	*6^{1}*	*6^{0}*	*6^{0}*	*6^{1}*	*5^{9}*	*5^{8}*	*5^{4}*	*4^{9}*	*4^{7}*	*4^{7}*	*4^{5}*	*4^{0}*
		200	*183*	*163*	*144*	*126*	*109*	*89*	*71*	*55*	*35*	*17*	*0*	*28*	*46*	*64*	*80*	*100*
		OG	*OG*										*L*					

137+00 Lt.	*4^{0}*	*4^{2}*	*4^{0}*	*1^{6}*	*0^{3}*	*+0^{7}*	*^{09}*	*0^{6}*	*6^{1}*	*6^{1}*	*6^{0}*	*6^{0}*	*6^{1}*	*5^{9}*	*5^{4}*	*4^{9}*	*4^{7}*	*4^{7}*	*4^{5}*	*4^{0}*
	400	*393*	*373*	*350*	*332*	*316*	*380*	*283*	*267*	*252*	*236*	*219*	*208*	*203*	*200*	*180*	*160*	*137*	*112*
	OG	*OG*																	

TP Stake on Base Line 137+00 *+7.19* *1256.172* *-7.110* *1249.038*

1256.148

* Arrows are helpful. Transit

Slope Stake Book

PROJECT NO. T-130(17) *RDS* PLAN DATA Page 1

Station	Lt. Cut Stake	Lt. Fill Stake	CL	Rt. Full Stake	Rt. Cut Stake	
931+60 CLE=53.8 -0.9 -0.9 @ 27.0 @ 27.0	C 1.0 @ 53.1 TO ELEV. 50.8 BS = 3.0 TBS = 50.0 10.0 FBD		F 1.4		C 3.0 @ 00.7 TO ELEV. 50.8 BS = 3.0 TBS = 50.0 10.0 FBD	
931+60 CLE=52.1 -0.9 -0.9 @ 27.1 @ 27.1	C 3.3 @ 60.0 TO ELEV. 50.2 BS = 3.0 TBS = 50.0 10.0 FBD		F 1.0		C 2.5 @ 57.0 TO ELEV. 50.2 BS = 3.0 TBS = 50.0 10.0 FBD	
931+0 CLE=52.1 -0.8 -0.8 @ 27.0 @ 27.0 -3.3 -3.3 @ 41.8 S 41.8		F 1.0 @ 45.7 FS = 4.0 TO HP	F 3.7	F 0.2 @ 42.7 FS = 0.0 TO HP		

4-13-96

PROJECT NO. T-130(17) *RDS* STAKING DATA *J. Jones* Page 2

Station	Lt. Hub	Lt. Cut Stake	Lt. Fill Stake	C.L.	Rt. Fill Stake	Rt. Cut Stake	Rt. Hub
931+60 *60.0 60.9* *53.8 50.8* *7.1 10.1*	*7.1* *4.8* *@ 2.3* *C to H*	*10.1* *9.2* *C 0.9* *C 52.7* *3:1* *10'FB*	*8.7* *8.0* *F 0.6* *8* *30.6* *6:1*	*8.4* *7.1* *F 1.3*	*8.5* *8.0* *F 0.5* *C* *30.0* *6:1*	*10.1* *6.6* *C 3.5* *C* *60.5* *3:1* *10'FB*	*7.1* *5.3* *C 1.8* *C* *66.3* *H*
TP Hub 65'Rt. Sta. 931+00 TBS = 50			*+7.47*	*1860.85*	*-6.36 1853.38*	*TBS = 50*	
931+60 *59.7 59.7* *53.2 50.8* *6.5 9.5*	*6.5* *5.2* *C 1.3* *C* *H @ 70*	*9.5* *6.1* *C 3.4* *C 60.2* *3:1* *10'FB* *TBS = 50*	*8.0* *7.4* *F 0.6* *C* *30.6* *6:1*	*8.4* *7.1* *F 1.9*	*8.2* *7.4* *F 0.8* *C* *31.2* *6:1*	*9.5* *7.0* *C 2.5* *C* *57.5* *3:1* *10'FB* *TBS = 50*	*6.5* *6.4* *C 1.8* *C* *6.3* *H*
930+0 *59.74* *52.1* *7.6*	*13.8* *7.6* *C 6.2* *C* *H @ 70*		*8.4 13.0* *11.7* *F 1.3* *C* *47.0* *4:1*	*11.4* *7.6* *F 3.8* *1859.74* Transit	*8.4 12.1* *11.7* *F 0.4* *C* *44.2* *6:1*		*12.6* *7.6* *F 5.0* *C* *65* *H*

Blue Tops

			4-13-96					
			J. L. From					
PROJECT NO. T-130(17)			RD BLUE-TOPS					Page 3
STATION RDWY.		LEFT SHLD.		LEFT EDGE		RIGHT EDGE		RIGHT SHLD.
435+0.0	A	-0.65 @ 22.0		-0.24 @ 12.0		-0.24 @ 12.0		-0.65 @ 22.0
CL = 4254.880		*4.550*		*4.140*		*4.140*		*4.550*
58.780		*4.500*		*4.100*		*4.150*		*4.660*
3.900	*C*	*0.050*	*C*	*0.040*	*F*	*0.010*	*F*	*0.110*
3.890								
C *0.040*								
435+0.0	A	-0.65 @ 22.0		-0.24 @ 12.0		-0.24 @ 12.0		-0.65 @ 22.0
CL = 4254.130		*5.300*		*4.890*		*4.890*		*5.300*
58.780		*5.170*		*4.780*		*4.900*		*5.350*
4.650	*C*	*0.130*	*C*	*0.110*	*F*	*0.010*	*F*	*0.050*
4.610								
C *0.040*								
931+95.00	A	-0.56 @ 22.0		-0.25 @ 12.0		-0.25 @ 12.0		-0.65 @ 22.0
CL = 4254.09								
						Correct		*(4249.710)*
						-6.14		*4249.720*
BM #17		*+9.07*		*4258.78*				Transit

Pavement Grades

F(130)17	RDS PAVEMENT GRADES			PAGE 2
STATION	LEFT EDGE	CENTERLINE HI	RIGHT EDGE	
	59.680	*59.680*	*69.680*	*4-13-96*
931+75.000	4254.310	4254.550	4254.310	*Mild*
	5.370 GR	*5.130 GR*	*5.370 GR*	*J. R. Smith*
	5.320	*5.100*	*5.380*	*T. S. Bliss*
	C0.050	*C09.030*	*F0.010*	*J. B. From*
	59.680	*59.680*	*59.680*	
931+50.000	4254.080	4254.320	4254.080	
	5.600 GR	*5.360 GR*	*5.600 GR*	
	5.620	*5.400*	*5.600*	
	F0.020	*F0.040*	*C0.000*	
	HI			
	59.680	*59.680*	*59.680*	
931+25.000	4253.850	4254.090	4253.850	
	5.830 GR	*5.590 GR*	5.830 GR	
	5.810	*5.600*	5.800	
	C-0.002	*F 0.01*	C-0.03	
TP RT. STA. 931+000	*+6.110 4259.68*		*-2.040 4258.57*	
	Transit			
	55.610	*55.610*	55.610	
931+0.000	4253.610	4253.350	4253.610	
	2.000 GR	*1.760 GR*	2.000 GR	
	2.210	*1.800*	2.040	
	F0.210	*F0.04*	F0.040	
	4255.61 Transit			

F(130)17	RDS PAVEMENT GRADES			PAGE 3
STATION	LEFT EDGE	CENTERLINE HI	RIGHT EDGE	
	59.680	*59.680*	*59.680*	
932+75.000	4255.100	4255.340	4255.100	
	4.580 GR	*4.340 GR*	4.580	**Grade Rod*
	4.550	*4.400*	4.610	*should be)*
	C0.030	*F0.060*	F0.030	*identified. (GR)*
	59.680	*59.680*	*59.680*	
932+50.000	4254.920	4255.100	4254.720	
	4.760 GR	*4.520 GR*	*4.760 GR*	
	4.560	*4.500*	*4.500*	
	C0.200	*C0.020*	*C0.260*	
	59.680	*59.680*	*59.680*	
932+25.000	4254.720	4254.960	4254.720	
	4.960 GR	*4.720 GR*	4.960 GR	
	4.920	*4.700*	4.500	
	C0.040	*C0.020*	C0.460	
	59.680	*59.680*	*59.680*	
932+0.000	4254.520	4254.760	4254.520	
	5.160 GR	*4.920 GR*	5.160 GR	
	5.100	*4.900*	5.090	
	C0.060	*C0.020*	C0.070	

Mobilization and Field Laboratory Records

Group 1 - Mobilization

Item No. 3 - Mobilization 1 Lump Sum
Contract Price = $ 8,500.00
5% Group = $13,6550.00
5% Group = 50% pay = $ 4,250.00
10% Group = 100% pay = $ 8,500.00

3-10-96
Contractor begin moving equipment to the project. T. T. Smith

3-23-96 6% of group work complete. T. T. Smith

3-30-96 over 10% of group complete pay all at this item. T. T. Smith

Final Quantity 1 Lump Sum

Comps T. T. Smith 3-28-96

Group 10 - Field Lab

Item No. 2 - Field Laboratory
Type "C", 1 each @ $300.00
3-11-96
Set up on job and inspected at Station 17+50 T. T. Smith

3-23-96 Estimate 100% T. T. S.

3-31-96 moved to Sta. 84+60 T.T.S.

4-18-96 moved to Sta. 270+10 T.T.S.

5-10-96 finished with lab and contractor advised. Removed D.O.R. equipment T.T.S.

Final Quantity 1 Each

Comps T.T.S. 3-30-96

Estimate Quantities Excavation

Plan Balances Sta. to Sta.	Plan Quantity Excavation (m^3)	Estimate #1 %	Estimate #1 m^3	Estimate #2 %	Estimate #2 m^3	Estimate #3 %	Estimate #3 m^3	Estimate #4 %	Estimate #4 m^3	
5+73 25+10	21,000	40	8400	90	18900	95	19950	100	21,000	
25+10 72+160	71,045	10	7105	90	63941	95	67493	100	71,045	#1 3-15-96
72+60 98+05	14,310			90	12879	95	13594	100	14,310	#2 4-1-96
48+05 117+40	14,989			90	13490	95	14240	100	14,989	#3 4-5-96
117+40 147+00	37,005			80	29604	95	33305	100	37,005	finish grade
147+00 170+00	24,063			15	3609	90	21657	100	24,063	to Sta. 120
170+00 211+00	48,702					90	43832	100	48,702	
211+00 224+76	9,574					90	8617	100	9,574	
224+76 260+01	21,001					80	40801	100	21,001	
260+01 272+00	25,321					90	22784	100	25,321	
	317,010		15505		142433			100	317,010	

Grading Diary

Typical Grade Inspector's Diary Entry

Date: 3-10-96 Thursday
Weather: Clear, Windy and Cool
Hours Worked: 6:30 to 6 = 11 hours
Official Visitors: Debra Blum, DCE & friend
Quality Assurance

Subcontractor, Tree Removal, Inc. working on clearing and grubbing today. Removing trees from Station 5+ to 25+ with 1 D-7 Dozer, 1 truck, 1 pickup and 3 men. Mr. Nollet supt. for sub plans to sell the saw logs, chip the limbs and bury the stumps, that aren't ground, on private property. I gave the project manager a copy of the agreement for burying the stumps on Howard Plum's property.

Subcontractor, Great Plains irrigation began prewatering today from Station 41+ to 62+ working with 2 men, 1 pickup, 1 pump and assorted pipe. Contractor's supt. Nick Winkle was on the job today. He plans to be here once or twice a week while the subcontractors only are working. We discussed prewatering of farm ground and need for ripping to assure runoff is kept to a minimum. Nick advised that a dozer with a ripper would arrive on the project tomorrow and the necessary ripping will be performed. I talked with John Adams, landowner, right of Sta. 70+60 to 140+ about moving fence. He plans to begin moving it next week.

D. D. S.
Grade Inspector

3-10-96 I discussed with the project manager this evening the need for contractor's supt. on job while the subs are working. He said that Nick Winkle plans to be on job every day settling up equipment, etc. and when he isn't, will be reachable by phone #473-6632.

D. D. S.
Grade Inspector

Large Tree Removal (Rarely Used)

Sta. to Sta.		Side	Large Trees	Meas. by	Date	Trees Removed (Date & Init.)		Clearing/Grubbing Complete Date	Init.	Remarks
3	6	Lt	26	KPB	6-3-96	6-21-96	GDP	6-22-96	GDP	
6	10	Lt	17	KPB	6-3-96	6-24-96	CTV	6-28-96	CTV	Hauled stumps
10	12	Lt	22	KPB	6-3-96	6-24-96	CTV	6-28-96	CTV	off project.
12	14	Lt	29	KPB	6-3-96	6-24-96	CTV	6-28-96	CTV	
3	5	Rt	23	KPB	6-4-96	6-21-96	GDP	6-22-96	GDP	
5	6	Rt	20	KPB	6-4-96	6-21-96	GDP	6-22-96	GDP	
6	10	Rt	41	KPB	6-4-96	6-18-96	GDP	6-20-96	GDP	Burning by permit.
10	12	Rt	32	KPB	6-4-96	6-18-96	CTV	6-20-96	GDP	
12	14	Rt	8	KPB	6-4-96	6-17-96	CTV	6-20-96	GDP	
26	30	Lt	14	KPB	6-6-96	6-20-96	GDP	7-3-96	CTV	
26	30	Rt	21	KPB	6-6-96	6-21-96	GDP	7-8-96	CTV	
30	40	Lt	31	KPB	6-6-96	6-25-96	GDP	7-10-96	CTV	
30	40	Rt	41	KPB	6-6-96	6-27-96	GDP	7-10-96	CTV	
			325							

Final Pay Quantity = 325 Each CTV 7-11-96

General Clearing & Grubbing

Sta. to Sta.		Side	Date Complete	Inspect. Init.	% Complete	Total to Date	Remarks
1+00	8+00	Lt	5-3-96	AJB	5	5	Clearing trees entire project.
1+00	8+00	Lt	5-10-96	AJB	20	25	
8+10	15+00	Lt&Rt	5-10-96				
15+00	20+00	Lt&Rt	5-17-96	CLD	30	55	Burning trees by permit.
20+00	27+00	Rt	5-17-96				Hauling stumps and trash off of project.
20+00	27+00	Lt	5-22-96	CLD	10		Last trees cut and burned.
27+00	40+00	Lt	5-23-96	CLD	20		
27+00	40+00	Rt	5-24-96	AJB	15	100	Finished last of clearing brush on
40+00	50+00	Lt&Rt	5-24-96	AJB			left. Clearing and grubbing complete.

Final Pay Quantity = 1 lump sum AJB 5-24-96

Driveway Culvert Pipe Record

Driveway Culvert Pipe Record					
Plan Data				*Construction Data*	
Station	*Side*	*New Pipe (mm x m)*	*Installed Pipe (mm x m)*	*Date & Init.*	*Remarks*
10+60	*Lt.*	*150 x 11*	*None*		*Moved drive. No pipe required. 3-30-96 DDS*
41+30	*Rt.*	*300 x 12*	*300 x 12*		*HT#372207-12 DDS 4-7-96*
41+30	*Lt.*	*300 x 12*	*300 x 12*		*HT#312207-12 DDS 4-7-96*
87+70	*Rt.*	*300 x 9.75*	*300 x 9.75*		*HT#488806-9.75 DDS 4-7-96*
122+80	*Rt.*	*300 x 9.75*	*300 x 11*		*HT#372207-9*
					HT#488306-6 DDS 4-7-96
145+10	*Lt.*	*400 x 12*	*450 x 17*		*HT#266309-12*
					HT#407737-16 DDS 4-25-96
174+30	*Rt.*	*300 x 11*	*300 x 17*		*HT#7114117-56 DDS 4-7-96*
					#372207 = 12+12+9 - 110 m
					#488806 = 7.78 +2 = 11.75 m
					#266309 = 12 = 12 m
					#7114117 = 17
					17 m
					#1077377 = 5
					5 m

Pre-Watering Computations

Pre-Watering Computations

Sta. to Sta.	m^3 Excavation	Soil Curve Number	Optimum Moisture %	Actual Moisture %	Moisture Add. %	* Mass (kg) of Soil per m^3	*ML Water Required	Date	Comps by
10+ 31+	27,000	576-112	13.1	5.0	8.1	2746 kg	720.0	3-7-96	DDS
48+ 73+	69,000	576-118	17.4	9.9	7.5	2611 kg	1621.5	3-12-96	DDS
130+ 152+	58,000	576-117	15.5	9.8	5.7	2645 kg	1049.8	3-17-96	DDS
234+ 265+	71,000	576-117	15.5	10.1	5.4	2561 kg	1178.6	3-23-96	DDS

** See Pg. #34 for computations*
Actual moisture is the average of tests reported on DR Form 86

Sta. 10+ to Sta. 31+
Max. Density = 1.81 kg/l
Estimated in place density = 90% of Max.
In Place Density = 1.63 kg/l
Mass of Cubic Meter of Water = 1000 kg
Mass of Cubic Meter inplace soil
1.63 x 1000 = 1630.0 kg — *1810.0*
Water required per m^3 = 180 L — *- 1630.0*
Completed in place mass of soil 1810.0 — *180.0*
Dry it to get dry mass of soil and mass of water
Mass in place - mass dry = In place water mass

$$\% \text{ Moisture in place} = \frac{\text{mass of water}}{\text{dry mass}}$$

Mass density species a certain moisture content per soil type
% Moisture at Max. Density
-% Moisture in-place
% Moisture deficit (Note if negative number "in place"is too wet and it must be dried).
(% Moisture deficit) 1000 = liters of water to add per cubic meter.
Mass = (in place density) (1000)
Water in liters = Mass in kilograms (1000 kg = 1000 Liters water)

Calibration of Water Equipment

Calibration of Water Equipment

Truck #3 filled from meter #73268
Truck Full = 6276.1 kg
Truck Empty = 1250.1 kg
See Scale Ticket #1 = 5026.1 kg

Truck Full = 6321.1 kg
Truck Empty = 1250.0 kg
See Scale Ticket #2 = 5071.1 kg

Av. Capacity of Truck #3 = 5026.1+5071.1 ¸ 2

Say 5,050 L ZOK 3-8-96

Meter Full = 1002000
Meter Empty = 996979
5021

Meter Full = 1007070
Meter Empty = 1002000
5070

Mass = 10097.2 kg
Meter = 10091.0 L

10097.2 ¸ 10091.0 = 1.0006144 Factor
No factor required ZOK 3-8-96
Calibration 3-7-96 DDS
Check Comps 3-8-96 ZOK

To convert gallons to liters, multiply the number of gallons times 3.79 to get liters.

Water, Applied Record, Meter

Water Applied Record *Pre-Watering Meter #73268*

Date	Sta.	Sta.	Beg. Meter Reading	Ending Meter Reading	Meter M. Gal. Applied	Calib. Factor	Pay M. Gallon	Total to Date	Insp.	Time	Remarks
3-8-96	10	31	07316	14450	7.074	1.000	7.074	7.074	DDS	4:30 p.m.	
3-9-96	10	31	14450	5447	40.020	1.000	40.020	47.094	DDS	2:00 p.m.	
3-10-96	10	31	54470	110760	56.290	1.000	56.290	103.384	DDS	4:00 p.m.	
3-11-96	10	31	110760	207530	96.770	1.000	96.770	200.154	DDS	4:30 p.m.	
3-14-96	10	31	207530	500250	292.720	1.000	292.720	492.874	DDS	2.00 p.m.	
3-15-96	10	31	500250	600010	99.760	1.000	99.760	592.634	DDS	3:00 p.m.	Est. #1
3-16-96	10	31	600010	728110	128.100	1.000	128.100	720.734	DDS	5:30 p.m.	Area Comp.
3-17-96	5+	45+	728110	83730	83.730	1.000	83.730	83.130	DDS	5:30 p.m.	Loaded
3-19-96	130	152 +	83730	205600	121.870	1.000	121.876	121.870	DDS	4:00 p.m.	truck
3-21-96	130	152 +	205400	408310	202.710	1.000	202.710	324.580	DDS	4:00 p.m.	

To convert to metric, multiply number of gallons by 3.79 to get number of liters

Water, Applied Record, Truck

Water, Applied Record Trucks

Date	Sta.-Sta.		Load Tally	Truck	Total Loads	Cap. M. L. @ Load	Pay M. Liter	Accum. Total	Inspect.	Remarks
3-1-96	10	31	11	3	2	5.050	10.10	10.10	AAW	Cut Section
3-1-96	10	31	11	5	2	1.020	4.02	14.12	AAW	Estimate #1
3-28-96	5	17	1111 1	3	6	5.050	30.30	44.42	AAW	
3-28-96	5	35	1111 1111	5	10	1.020	10.20	54.62	AAW	
3-29-96	5	35	111	3	3	5.050	15.15	69.77	AAW	
3-29-96	5	35	1111	5	4	1.020	4.08	73.85	AAW	Estimate #2

To convert gallons to liters, multiply number of gallons times 3.79 to get number of liters

Clear Tract Record and Remove Building Record

Clear Tract #4 @ Sta. 71+37

Plan Data: Sta. 71+37
Clear Tract #4

3-17-96 This tract was cleared today.
Complete.
DDS 3-17-96

Remove Building @ Sta. 71+40

Plan Data: Sta. 71+40
Remove Building

3-15-96 This building was removed today.
Complete.
DDS 3-15-96

Select Placement Record and Undercut Excavation

Select Placement	*Undercut Excavation*
Plan Note: Sta. 31+20 to Sta. 42+80 *All material excavated from these stations shall be placed 1.2 m below finished subgrade or more than 30 m right or left of centerline.*	*3-11-96* *00 Section at Sta. 10+14 to Sta. 10+40* *(Drawing)* *Area Width: 45 m* *Area Depth: 1.5 m* *Area Length: 26 m*
3-27-96 *This material was all placed at depths greater than 1.2 m below finished subgrade.* *DDS 3-27-96*	*26 x 1.5 x 48 = 2702.7 m^3* *Call 69 m^3* *Comps DDS 3-11-96* *It was necessary to undercut this area as it is an 00 Section and unstable under contractor's hauling equipment.* *DDS 3-11-96*

Record of Right-of-Way Markers

Record of Right-of-Way					Markers				
LEFT					RIGHT				
Station	Distance	MARKERS	Staked by & Date	Inspected by & Date	Station	Distance (meters)	MARKERS	Staked by & Date	Inspected by & Date
5+73.2	60	1	2-3-96 JBK	DDS 3-1-96	5+76.2	40	1	2-3-96 JBK	DDS 3-2-96
5+74.8	33	1	VOL & RCE	DDS 3-1-96	5+77.9	60	1	VOL & DCE	DDS 3-2-96
			Pt. cldy & mild						
7+00	60	1	2-3-96 JBK	DDS 3-1-96	9+00	60	1	2-3-96 JBK	DDS 3-2-96
17+00	60-70	2	2-3-96 JBK	DDS 3-1-96	15+00	80	1	2-3-96 JBK	DDS 3-2-96
20+80	74-32	1	2-3-96 JBK	DDS 3-1-96	25+00	80	1	2-3-96 JBK	DDS 3-2-96
26+00	80	1	2-3-96 JBK	DDS 3-1-96	30+00	70	1	2-3-96 JBK	DDS 3-2-96
34+00	80-60	2	2-3-96 JBK	DDS 3-2-96	33+00	70	1	2-3-96 JBK	DDS 3-2-96
42+00	60	1	2-3-96 JBK	DDS 3-2-96	39+60	70	1	2-3-96 JBK	DDS 3-2-96
51+17	60	1	2-3-96 JBK	DDS 3-2-96	47+00	60	1	2-3-96 JBK	DDS 3-2-96
51+89	60	1	2-3-96 JBK	DDS 3-2-96	51+05	60	1	2-3-96 JBK	DDS 3-2-96
59+00	60	1	2-3-96 JBK	DDS 3-2-96	51+85	60	1	2-3-96 JBK	DDS 3-2-96
64+00	65	1	2-3-96 JBK	DDS 3-2-96	60+00	60	1	2-4-96 JBK	DDS 3-4-96
								Fair & mild	DDS 3-4-96
69+00	70	1	2-3-96 JBK	DDS 3-1-96	65+00	90	1	2-4-96 JBK	DDS 3-4-96
76+00	70	1	2-3-96 JBK	DDS 3-1-96	67+00	90	1	2-4-96 JBK	DDS 3-4-96
85+00	70	1	2-3-96 JBK	DDS 3-1-96	70+00	81.0	1	2-4-96 JBK	DDS 3-4-96
89+30	70	1	2-3-96 JBK	DDS 3-1-96	77+00	60	2	2-4-96 JBK	DDS 3-4-96
98+00	70	1	2-3-96 JBK	DDS 3-1-96	86+00	60-80	1	2-4-96 JBK	DDS 3-4-96
102+30	70	1	2-3-96 JBK	DDS 3-1-96	96+00	80	1	2-4-96 JBK	DDS 3-4-96
103+20	70	1	2-3-96 JBK	DDS 3-1-96	102+30	80	1	2-4-96 JBK	DDS 3-4-96
108+00	70	1	2-3-96 JBK	DDS 3-1-96	103+20	80	1	2-4-96 JBK	DDS 3-4-96
Total Pay		22	2-3-96		Total Pay		21		
								Comps 2-4-96 JBK	
								Comps 3-2-96 DDS	

COVERCROP SEEDING RECORD

(NOT FOR PAYMENT -- USE TO DOCUMENT QUANTITY APPLIED)

Covercrop Seeding Record

Sta. to Sta.	*Side of Centerline*	*Approx. Hectare*	*Kilogram of Seed Required*	*Kilogram of Seed Used*	*Date*	*Inspect.*	*Remarks*
5+73 to 30+	*Rt. & Lt.*	*7.5*	*528*	*500*	*4-11-96*	*AWL*	*Oats bin ran 64+10% = 70.4 kg @ Ha using drill*
30+ to 98+	*Rt.*	*8.1*	*570*	*600*	*4-12-96*	*DDS*	
30+ to 98+	*Lt.*	*8.1*	*570*	*550*	*4-16-96*	*DDS*	*Flat tire on tractor 4-13, 14 & 15, 1996*
98+ to 120+	*Rt. & Lt.*	*8.0*	*563*	*570*	*4-16-96*	*DDS*	
120+ to 170+	*Rt.*	*9.2*	*648*	*650*	*4-22-96*	*DDS*	
120+ to 170+	*Lt.*	*9.2*	*648*	*700*	*4-23-96*	*DDS*	
170+ to 225+	*Rt. & Lt.*	*20.1*	*1415*	*1400*	*4-25-96*	*DDS*	
250+ to 272+	*Rt. & Lt.*	*16.0*	*1126*	*1200*	*4-26-96*	*DDS*	
225+ to 250+	*Rt.*	*8.4*	*591*	*600*	*4-28-96*	*DDS*	
225+ to 250+	*Lt.*	*8.4*	*591*	*600*	*4-29-96*	*DDS*	*Complete today*
		103.0	*7251.2*	*7370*			

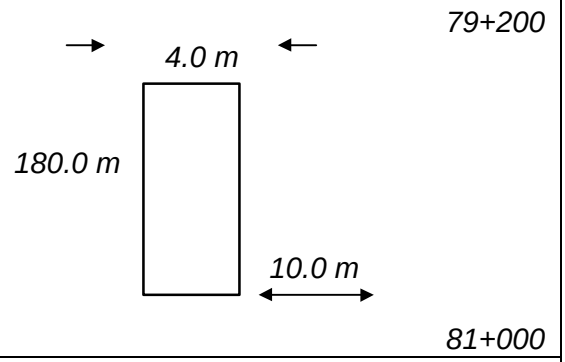
To convert pounds to kilograms, multiply number of pounds x 0.4536 to get kilograms.
To convert acres to hectares, multiply number of acres x 0.4047 to get hectares.

A notebook record similar to this is required for Slope Protection Seeding work and the same notification requirements to Roadside Development Section is required.

Erosion Control Record

Erosion Control Record

Plan Data: Sta. 79+16 to Sta. 81+16 Lt.
Build 767 m^2 Erosion Control
Construction Data: Sta. 79+20 to Sta. 81+00 Lt.
Built 720 m^2 Erosion Control
Soil Prep: by hand 4-16-96 DDS
Fertilizer: 25 kg Special Blend 4-16-96 DDS
Seed: 8 kg Blend 4-16-96 DDS
(Drawing)
4 x 180 = 720 m^2
Measurements & Comps DDS 4-17-96



Roadside Development Section must be notified the first and last day work is performed or suspended. Include Project No., contractor performing work, type of equipment used, seed used, etc., in the notification. 0.1 ha or larger areas shall be deducted from the seeding area if Erosion Control is in the seeding area.

Hay Bale Erosion Checks Record

Hay Bale Erosion Checks

Station	* Rt. or Lt.	Plans Quantity (Bales)	As-Built Quantity (Bales)	Date	Inspect.	Remarks
8+70	Rt.	14	16	3-19-96	JDD	
9+00	Rt.	14	14	3-19-96	JDD	
9+30	Rt.	14	14	3-19-96	JDD	
9+40	Rt.	14	14	3-20-96	JDD	
9+50	Rt.	16	18	3-20-96	JDD	
		72	76			
59+71	Lt.	10	10	4-1-96	JDD	
59+91	Lt.	10	10	4-1-96	JDD	
60+11	Lt.	10	10	4-1-96	JDD	
60+31	Lt.	10	10	4-1-96	JDD	
60+46	Lt.	12	14	4-2-96	JDD	
60+61	Lt.	---	14	4-2-96	JDD	Additional check approved ZOK 4-1-96
		52	68			
64+10	Rt.	10	10	4-3-96	JDD	
64+30	Rt.	10	10	4-3-96	JDD	
64+50	Rt.	10	10	4-3-96	JDD	
64+70	Rt.	10	10	4-3-96	JDD	Estimate quantity = 76+68+40 = 184
64+90	Rt.	10	10	4-6-96	JDD	
65+15	Rt.	10	10	4-6-96	JDD	

Page Totals = 184 204 Bales

Comp. JDD 4-6-96
Comp. 30% 6-1-96

* Show the distance Rt. or Lt. when deducting areas from seeding area.

Shipping Record and Summary Asphaltic Oil or Cement

Shipping Record & Summary					*Asphaltic Oil Emulsion for Tack or Prime*						
						(Proj. Ident.)		*(Proj. Ident.)*		*Other Use*	
Date Received	*Load Ident. Number*	*Refin. kg*	*Dist. kg*	*Factor*	*Insp.*	*Refin. kg*	*Dist. kg*	*Refin. kg*	*Dist. kg*	*Refin. kg*	*Dist. kg*
3-29-96	*151676*	*5409*	*---*	*1.000*	*HHH*	*5409*					
3-29-96	*151707*	*5503*	*5493*	*1.00182*	*HHH*	*5002*	*4993*	*501*	*500*		
3-29-96	*157703*	*5527*	*5530*	*0.99946*	*HHH*	*3005*	*3007*	*2422*	*2423*	*100*	*100*
3-29-96	*157710*	*5631*	*5580*	*1.00914*	*HHH*	*570*	*565*	*5061*	*5015*		
3-29-96	*157691*	*5312*	*5413*	*0.98134*	*HHH*	*4907*	*5000*	*405*	*413*		
3-30-96	*158041*	*5376*			*HHH*						
		(1)				*(2)*		*(3)*		*(4)*	
The sum of column (2), (3), and (4) should equal column (1).											
Totals		*32758*				*18893*		*8389*		*100*	
										Comps HHH 6-3-96	

Distribution of Asphaltic Oil or Cement

Distribution Record of Asphaltic Oil Emulsion for Tack or Prime

Load Ident. No. TDR11337 — *Date Received 3-30-96*
Type of Oil SSH-1 — *Sp. Gravity .9813*
Refinery Gallons 6.703 (x 3.79) = Liters — *Water Added Liters (6700 x 3.79 = 25,362 Liters*

Sta. to Sta.	Net Dist. Sta.	Load No.	Side & Width	°C Temp.	Start Liter	Stop Liter	Net Liter	Liter 15.5°C	Liter per StaM	Liter per Sq. m.	Remarks
30+00-75+00	45.00	1	Rt. 4	63	700	430	270	264	5.87	0.0147	4-1-96 MLP
75+00-220+00	145.00	1	Rt. 4	66	430	40	390	381	2.63	0.00672	4-1-96 MLP
0+00 - 220+00	220.00	2	Lt. 4	54	1210	300	910	894	4.06	0.01034	4-2-96 MLP

Daily Scale Record

Daily Scale Check
Digital or Platform Scale

Daily Scale Record

			Scale Check	
7-5-96	Friday		Plant	Commercial
6:50 A.	Balanced Scales	Loaded Mass	88050	88020
7:00 A.	First Load #714	Unloaded Mass	37000	37010
8:00 A.	Begin Taring Trucks		51050	51010
9:00 A.	Cleaned Scales Platform & Balance	Tolerance = 0.5% of 88050 = 440 kg diff.		
9:15 A.	Completed Taring Trucks	= 40 kg		
3:00 P.	Cleaned Scales & Balance Begin Taring Trucks	Load #747 is check load.		
3:00 P.	Trucks All Tared			
4:30 P.	Cleaned Platform & Balance		J. C. Smith	
5:35 P.	Last Load #787		Inspector	

7-6-96	Saturday - No Work			
7-7-96	Sunday - No Work			
7-8-96	Monday	Scale Check		
7:00 A.	Balanced Scales & First Load #758		Plus 500 kg	
8:00 A.	Begin Taring Trucks	Loaded Mass	87400	87910
9:00 A.	End Taring Trucks (Plant down)	Unloaded Mass	35980	36480
9:30 A.	Balanced & Cleaned Scales			
4:00 P.	Balanced & Cleaned Scales	Truck #7 Used Load #796		
5:35 P.	Last Load. Only one tare today due to Plant only operating 4+ hours. #815		J. C. Smith Inspector	

Trimming Tolerance Checks and Record of Density Samples

Subgrade/Foundation Course

Trimming Tolerance Checks — *Template (mm)*

Date	Sta.	Insp.	4200 840	3600 660	3000 600	2400 480	1800 360	1200 240	700 160	CL 0	600 160	1200 240	1800 360	2400 480	3000 600	3600 720	4000 840
4-1-96	750	EEL	780	660	510	420	390	240	160	030	160	270	450	510	600	720	840
4-1-96	760	EEL	810	660	540	450	360	240	160	00	160	240	360	540	630	690	810
4-1-96	765	EEL	840	720	600	450	360	210	909	030	090	240	360	570	630	690	810
4-5-96	770	EEL	840	780	600	480	360	240	090	060	060	210	390	570	600	690	810
4-5-96	780	EEL	810	720	600	480	390	210	090	00	060	240	360	480	600	720	840
4-5-96	784	JES	840	750	600	480	390	270	160	030	090	270	360	480	600	750	840
4-5-96	790	JES	840	720	600	480	360	240	160	00	060	180	330	480	600	780	870
4-5-96	800	JES	540	420	300	180	030	000	060	180	240	060	060	180	300	360	480
4-7-96	800	EEL	840	720	600	480	390	240	160	00	120	270	390	510	570	690	810

Record of Density Samples and Thickness of Asphaltic Concrete Cores

Sta.	Dist. & Side	First Lift				Second Lift				Third Lift				Totals	
		Date	Th mm	% Dens.	Ins.	Date	Th mm	% Dens.	Ins.	Date	Th mm	% Dens.	Ins.	Th. Act. mm	Thick Reqd. mm
67+20	2 m Rt	4-1-96	60	100	JDS	4-21-96	37	97	JDS	5-2-96	35	97	JDS	137	125
89+35	3 m Rt	4-1-96	50	98	JDS	4-21-96	38	98	JDS	5-3-96	38	98	JDS	132	125
52+70	2 m Rt	4-2-96	55	98	JDS	4-21-96	38	98	JDS	5-2-96	40	99	JDS	137	125
50+10	2 m Lt	4-2-96	65	97	JDS	4-21-96	37	98	JDS	5-10-96	45	96	JDS	142	125
10+00	5 m Lt	4-7-96	70	98	JDS	4-30-96	25	96	JDS	5-17-96	25	93	JDS	100	112
25+00	2.5 m Lt	4-7-96	70	93	JDS	4-16-96	25	92	JDS	5-10-96	38	93	JDS	137	125

Record of Pavement Patching and Equipment Rental Record

Record of Pavement Patching

Date Patched	Station	Station	Lane (Rt. Or Lt.)	Size Ave. Width Ave. Length)	Type "A" (m^2)	Type "B" (m^2)	Type "C" (m^2)	Insp.	Remarks
4-4-96	7+40	7+95	Rt.	10 m x 55 m			550	SDD	
4-5-96	10+15	10+27	Rt.	8 m x 10 m		80		SDD	
4-5-96	20+63		Rt.	8 m x 3 m	24			SDD	
4-5-96	62+20	62+31	Rt.	6 m x 11 m		66		SDD	
4-12-96	23+10	23+29	Rt.	8 m x 18 m			144	SDD	
				Totals		24	146	694	
				Call		24	146	695	

Equipment Rental - Motor Graders

Equipment No. 3-712 Conforms to Specification Requirements DDD 4-4-96
Equipment No. 3-610 Conforms to Specification Requirements DDD 4-5-96
Equipment No. 3-606 Conforms to Specification Requirements DDD 4-5-96

Date	Equip. No.	Location Worked StaM to StaM	No Pay	Pay	Accum. Total	Insp.	Contractor Rep.	Remarks
4-1-96	3-112	4+23-60+00	1/2	7.00	7.00	DDD	JCSmith	ripped wet spots
4-5-96	3-712	4+23-60+00	2.00	5.50		DDD	JCSmith	flat tire 1/2 hr.
4-5-96	3-606	4+23-60+00	2.00	2.50		DDD	JCSmith	
4-5-96	3-610	81+00-97+00	0	2.50	17.50	DDD	JCSmith	drying
4-6-96	3-610	81+00-97+00	0	2.00		DDD	JCSmith	replacing

Cement Car Shipment Record and Record of Cure Compound

Cement Car Shipment Record

Shipment Ident. Number		Date Received	Date Empty	Kilograms of Cement	Accum. Total Cement	Insp.	Sample No.	Remarks
MP	2146	5-3-96	5-4-96	151,520	151,520	FRS	C-1	
MP	2008	5-3-96	5-4-96	149,300	300,820	FRS	C-2	
MP	2248	5-3-96	5-5-96	151,680	452,500	FRS	C-3	
MP	3218	5-3-96	5-5-96	153,180	605,680	FRS	C-4	
MP	4157	5-4-96	5-6-96	143,320	749,000	FRS	C-5	
MP	2161	5-4-96	5-6-96	154,620	903,620	FRS	C-6	
MP	4188	5-5-96	5-6-96	148,000	1,051,620	FRS	C-7	
MP	2193	5-5-96	5-9-96	150,460	1,202,080	FRS	C-8	
MP	2003	5-5-96	5-9-96	156,700	1,358,780	FRS	C-9	
MP	2236	5-5-96	5-9-96	154,400	1,513,180	FRS	C-10	everything empty for C.C.

Cure Inspector Entry

Record of Cure Compound

					Application Checks				
Date	Liters Received	Lot No.		Insp.	Date	Square Meters Concrete	Liters Used	App. Rate	Insp.
4-29-96	550		White Pigmented	KEE	5-4-96	1867	100	84.8	KEE
5-2-96	1100	N012	White Pigmented	KEE	5-6-96	5600	261	254.5	KEE

To convert gallons to liters, multiply number of gallons by 3.79 to get liters.

Required Application Rate _____

Ready Mix Truck Checks and Shipping Record

Random Check

Ready Mix Truck

Date	*Time*	*Truck No.*	*Load No.*	*Zero Setting Rev. Counter*	*Mixing Rev. Per Min.*	*Rev. Change to Agitate*	*Agitate Rev. Per Min.*	*Time Unloaded*	*Insp.*
4-20-96	*9:00 A*	*3*	*17432*	*OK*	*16*	*53*	*6*	*9:45 A*	*MRD*
4-20-96	*11:15 A*	*8*	*17449*	*OK*	*17*	*51*	*6*	*12:10 A*	*MRD*
4-20-96	*3:40 P*	*5*	*17471*	*OK*	*16*	*57*	*5*	*4:28 P*	*MRD*
4-21-96	*7:00 A*	*4*	*17497*	*OK*	*16*	*57*	*6*	*7:16 A*	*MRD added water*

Record for Culvert Pipe

Box or Pipe Culvert

Plan Data: Station 74+35 — *Drawing*
450 mm x 46 m: CMP with headwalls, Remove
Build 915 mm x 72 m reinforced concrete
pipe with flared end sections Plan 410
Excavation = 43 m^3

Construction Data: Station 74+35
450 mm x 15 m CMP with headwalls, Removed
Built 915 mm x 72 m reinforced concrete
pipe with flared end sections Plan 410
Excavation = D.Q.

Hub=1779.43 @ 47 — *Hub=1777.30 @ 55*
FL-1779.00 2 32 — *FL=1777.00 @ 40*
C=0.43 = 15 — *C=0.30 = 15*

Elevation Check Centerline 75+00

FL JDK 4-3-96

Elevation Check Centerline 74+00 — *FL DLL 4-9-96*

(1782.80)
-4.29 *1782.76*
(1784.20)
-2.85 *1784.20*

Final Pay Quantities

80.52 79.31 79.10 80.77 82.92 80.33 77.85 77.30 77.22 76.11
80.1 79.40 78.92 82.55 82.51 78.35 77.51 77.30 76.71
74+35 *6^3 7^0 7^8 7^{62} 8^0 8^2 6^4 4^6 4^2 4^6 6^8 8^8 9^3 9^6 9^8 9^{75} 9^9 10^4 11^0*
250 150 70 47 30 22 22 14 CL 15 24 24 26 37 52 55 60 150 250
off angle off hub angle ROW FL FL hub off angle ROW off angle

TP ROW Hub Lt Sta. 72+00 — *+3.07 1787.05 -9.37 1783.98*

BM #8 — *+7.01 1793.35 1786.34*
Station 74+35
5-3-96 It was necessary to
excavate the following area
for backfill material. (Also use to
show unsuitable material volume removed.)
D W L
2.0 m x 30.0 m x 35.0 m = 2100 m^3
Say 2100 m^3 required for additional
excavation for embankment and
backfill. This culvert had to be
backfilled completely for local
traffic's convenience.
As a general rule, the unsuitable
material replacement volume should equal
the volume excavated.

Inspection Record
Excavation - Removal - Bedding OK 5-1-96 WAL
No Salvage
Laying - Backfill OK 5-3-96 WAL
See Moisture-Density Test No. 6

Final Pay Quantities:
Excavation for Pipe Culverts
& Headwalls = 43 m^3
Additional Excavation for
Backfill or Embankments = 2100 m^3
1.0 m Reinforced Concrete Pipe = 72 m^3
1.0 m Flared End Sections = 2 each
Salvaging Culvert Pipe = None
Removal of Existing Headwalls = 2 each
Comp. 5-3-96 WAL

Besides the Final Record of Quantities shown below, the inspector should maintain a summary record of all pay items, completed to date, for the Project Manager's use in preparing weekending reports.

Culvert Summary

Construction Inspection:		Pay Quantities
6-10-96 Excavated for box complete, rock at grade elevation.	DEB	202 m^3 exca.
6-11-96 Excavated rock and backfilled. Rock = 6 m x 6.5 m x 0.6 mm = 23.4 m^3 exca.		
Backfill = 30 m x 20 m x 2 m = 1200 m^3	DEB	1200 m^3 add. exca.
6-12-96 Begin forming footing. Mois. Density Test #17 represents backfill.	DEB	
6-14-96 Steel & forms inspected, footing.	DEB	1945 kg re-steel
6-15-96 Poured footing 38 m^3 poured. Cylinders 4A & B	DEB	3571 m^3 Concrete
6-16-96 Checked burlap cure for dampness. Stripped forms on footing.	DEB	
6-20-96 Begin setting barrel forms.	DEB	
6-21-96 Forming barrel placing steel	DEB	
6-22-96 Forming barrel placing steel	DEB	
6-23-96 Forming barrel placing steel	DEB	
6-24-96 Barrel ready to pour. Steel & forms okay.	DEB	4135 kg re-steel
6-25-96 Poured barrel. 75 m^3 batched. 1 m^3 wasted - burlap cure.	DEB	7125 m^3 Concrete
6-26-96 Checked burlap.	DEB	
6-30-96 Stripping outside forms.	DEB	
7-5-96 Stripping forms.	DEB	
7-6-96 Completed stripping forms & grouted tie rod holes.	DEB	
7-15-96 Backfilling box.	DEB	m^3
7-16-96 Backfilling, excavation necessary for backfill = 20 m x 90 m x 3.76 m =	6768.0 m^3 add. exca.	
7-20-96 Complete	DEB	

Summary of Culverts -- Group 4
Weekly Accumulative Totals
(See Pg. XXX-XXX for locations)

Rem. Inlets (ea)	Rem. Of Exist. Head-Walls (ea)	Exc. For Pipe (m^3)	Exc. For Box Culverts (m^3)	Conc. For Head-Walls (m^3)	Conc. For Box Culv. (m^3)	Conc. For Inlets (m^3)	Conc. For Collars (m^3)	Reinf. For Head-Walls (m^3)	Reinf. For Box Culv. (kg)	Reinf. For Inlets (kg)	Reinf. For Collars (kg)
			181		31.36				2158.65		
			565.75		115.341				13445.4		
			1029.25		160.182				17402.4		
			1412.0		270.548				28694.4		
			1660.75		384.813				41978		
	2	176	1660.75		432.582		1.31		49006.7		99
	6	517	1660.75		432.582		1.31		49006.7		99
	6	594	1660.75		432.582		1.31		49006.7		99
	9	1328	1660.75		432.582		1.31		49006.7		99
	9	2184	1660.75		432.582	.348	2.146		49006.7	38	150
	9	2184	1660.75		432.582	.348	2.146		49006.7	38	150
	9	2184	1660.75		432.582	.348	2.146		49006.7	38	150
	9	2875	1660.75		432.582	3.408	2.146		49006.7	230	150
	9	3362	1660.75		432.582	5.76	2.146		49006.7	363	150
	11	4168			426.814	5.76	2.15		48975.9	363	150
	11	4244	1660.75		426.814	5.76	2.15		48975.9	363	150
	11	4251	1660.75		426.814	5.76	2.15		48975.9	363	150
	11	4345	1660.75		426.814	5.76	2.15		48975.9	363	150
	11	4408	1660.75		426.814	5.76	2.15		48975.9	363	150
	11	4846	1660.75		426.814	5.76	2.15		48975.9	363	150
	11	4893	1660.75		426.814	5.76	2.15		48975.9	363	150
	11	5211	1660.75		436.814	5.76	2.15		48975.9	363	150

600 mm Culv. Pipe (m)	900 mm Culv. Pipe (m)	600 mm F.E.S. (ea)	900 mm F.E.S. (ea)	450 mm Conc. Pipe (m)	600 mm Conc. Pipe (m)	750 mm Conc. Pipe (m)	900 mm Conc. Pipe (m)	1050 mm Conc. Pipe (m)	1200 mm Conc. Pipe (m)	1350 mm Conc. Pipe (m)	500 mm Conc. Pipe (m)
				16							
				16							
				16		32	66			112	
				32	132	32	328			144	
				32	132	32	484			144	
				40	469	163	609			144	
				40	469	163	609	112	142	144	
				40	469	281	609	112	142	144	
				40	469	521	609	112	142	144	
				80	559	528	609	112	142	144	106
				80	559	528	609	112	142	144	106
				88	559	660	609	112	142	144	106
				88	607	704	609	112	142	144	106
				88	617	704	609	112	142	144	106
82	60	2	2	88	617	704	609	112	142	144	106
82	60	2	2	88	663	704	609	112	142	144	106
82	60	2	2	98	713	704	609	112	142	144	106
144	60	4	2	98	759	704	609	112	142	144	106
144	60	4	2	98	759	760	609	112	142	144	106

Summary of Group 4 Continued

1800 mm Culv. Pipe (m)	600 mm Class V Pipe (m)	750 mm Class V Pipe (m)	900 mm Class V Pipe (m)	1050 mm Class V Pipe (m)	1200 mm Class V Pipe (m)	600 mm Conc. FES (ea)	750 mm Conc. FES (ea)	900 mm Conc. FES (ea)	1050 mm Conc. FES (ea)	1200 mm Conc. FES (ea)	1350 mm Conc. FES (ea)
			84				2				
			174			1	2	3			1
	94		174		52.5	1	2	5			1
	222	60	174	60	6	11	3	6			1
	249	60	174	60	68	11	3	6	2	2	1
	249	128	174	60	68	11	5	6	2	2	1
	249	128	174	60	68	11	9	6	2	2	1
	249	286	174	60	68	12	9	6	2	2	1
106	249	286	174	60	68	12	9	6	2	2	1
106	222	284	174	60	68	12	11	6	2	2	1
106	222	284	174	60	68	14	13	6	2	2	1
106	222	284	174	60	68	14	13	6	2	2	1

1500 mm Conc. FES (ea)	1800 mm Conc. FES (ea)	JACK 600 mm Class V Pipe (m)	JACK 450 mm Class V Pipe (m)	JACK 400 mm Class V Pipe (m)	JACK 1050 mm Class V Pipe (m)	JACK 1200 mm Class V Pipe (m)	Rock Rip Rap Type "B" (kg)	Gravel for Unsuitable Material (m^3)	Add Exc. for Backfill & Embank. Box (m^3)	Week Ending
								21	21	10-9-96
								33	56	10-16-96
								95	118	10-23-96
								126	148	10-30-96
								151	173	11-6-96
				84			39.13	151	173	11-13-96
				174			39.13	151	196	11-20-96
		94		174		52.5	39.13	151	74	Add exc. for pipe
									84	11-27-96
		222	60	174	60	68	313.03	151	84	12-4-96
		222	68	174	60	68	313.03	151	84	12-11-96
		222	68	174	60	68	313.03	151	84	12-18-96
		222	286	174	60	68	459.40	151	84	12-25-96
1		222	286	174	60	68	750.31	151	84	1-1-97
1	1	222	286	174	60	68	750.31	151	84	1-8-97
1	1	222	284	174	60	68	1044.03	151	89	1-22-97
1	1	222	284	174	60	68	1044.03	151	89	5-14-97
1	1	222	284	174	60	68	1044.03	151	93	5-21-97

Estimate Quantities Record

Culvert Pipe Summary

Item No. 46 600 mm Culvert Pipe

Station (meter)	Pipe Leng. (m)	Add. Allow Elb.	Total Leng. (m)	Date Const.	Ins.	Heat Numbers Lengths Include Y'Distances (m) 262096	161834	260916	160935	260915A	162159
381+00	90	0	90	9-1-96	DMS	69	28				
414+91	48	0	48	9-9-96	DMS	53					
Rt											
426+91	90	0	90	8-26-96	DMS	72	23				
586+45	92	0	92	8-19-96	DMS	72		28			
590+72	130	0	130	8-25-96	DMS	110	6	20			
602+00	110	0	110	8-25-96	DMS	96	19				
99+00	128	0	128	7-26-96	DMS			120		12.5	
106+90	88	0	88	9-9-96	DMS				80	13	
4616+30	54	0	54	9-10-96	DMS			23	40		
396+40	44	5.0 m	49	10-13-96	DMS	20					28
Rt											
160+00	70	0	70	7-26-96	DMS				60	18	
	944	5	949			492	76	191	180	43.5	28
						392 #2	-42 #2	-143 #1	Report	Report	Report
198 week ending 7-31-96					DMS	100 bal	34 bal	48 bal			
198 week ending 8-9-96					DMS	Report	Report	Report			
198 week ending 8-14-96					DMS						
290 week ending 8-21-96					DMS			Total		1990.5 m	
290 Estimate #2 8-23-96					DMS						
710 week ending 9-4-96					DMS						
900 week ending 9-11-96					DMS						
900 week ending 9-18-96					DMS						
900 Estimate #3 9-23-96					DMS						

A record similar to this for each pay item in a group may be recorded in a field book separate from other inspection records. The inspector keeps these pay quantities up to date and then the project manager needs only the one book for week ending quantity calculations.

Staking Information

Bridge at Station 310+41
3 - 40 m spans

3-10-96 Ptly. Cldy. - Cold
- WAL
- DDS
- JAM
- TSE

Abut #2 - 311+08

Bent #2 - 310+61

Bent #1 - 310+21

Abut #1 - 309+81

° = 1/2"rebars with center punch mark.
• = tacked hubs
LO = Line Only
Δ = 60 penny spike

Excavation Record

Bridge Summary

Excavation for Abutment #1 (Lump Sum)

Date	*Bridge Station*	*Location in Bridge*	*Accumulative % Complete*	*Inspector*	
3-3-96	*310+41*	*Abut #1*	*10*	*IMM*	
3-9-96	*310+41*	*Abut #1*	*30*	*IMM*	
3-16-96	*310+41*	*Abut #1*	*50*	*IMM*	
3-16-96	*310+41*	*Abut #1*	*70*	*IMM*	
3-20-96	*310+41*	*Abut #1*	*95*		
3-22-96	*310+41*	*Abut #1*	*100*		
3-3-96	*310+41*	*Bent #1*	*5*		
3-27-96	*310+41*	*Bent #1*	*15*		
3-28-96	*310+41*	*Bent #1*	*45*		
3-31-96	*310+41*	*Bent #1*	*65*		
4-2-96	*310+41*	*Bent #1*	*90*		
4-4-96	*310+41*	*Bent #1*	*100*		

Concrete Protection Barrier Rail,
Cold Weather Concrete Temperature Data
and Sheet Piling Record

Concrete Protection Barriers

Sta. to Sta.	Side	m	Date Installed	Insp.	Date Removed	Insp.	Remarks
703+17 700+62	Rt	255	4-7-96	WOL			
703+17 704+62	Lt	145	4-12-96	WOL			

Cold Weather Concrete Temperature (°C) Data

					Concrete Temperature								
Pour Date	Sta.	Sect. Poured	°C Min. Air Time of Pour	°C Water Temp at Plant	°C in Forms	1st 12 Hrs.	1st 24 Hrs.	2nd Day	3rd Day	4th Day	5th Day	Insp.	Remarks
12-19-96	310+	Foot. Abut#1	2	54	12							WEB	Installed forms air
1-13-96	310+	Abut#2	1	60								WEB	air temp.
1-15-96	310+	Abut#1	1	60	14							WEB	24-hour forms loosened air

Sheet Piling Record *Station 310+41*

Date Driven	Location	Length of Sheet (m)	Width of Sheets (mm)	Number Driven	Square Meters	Accum. m^2	Insp.	Remarks
1-3-96	Abut #1	8.5	450	30	114.75	114.75	WEB	Concrete sheets
1-3-96	Rt. Wing Abut #1	7.5	450	18	60.75	175.50	WEB	Estimate #1
1-4-96	Lt. Wing Abut #1	7.5	450	14	47.25	222.75	WEB	

Concrete Placement Record, Form and Reinforcing Steel Inspection Record and Structural Steel Record

Bridge/Culvert Records

Concrete Placement Record *Type 47-B*

Date	Section Poured	m^3 Reqd.	m^3 Placed	Cylinder Nos.	Total Pay m^3	
12-19-96	Footing Abut #1	12.109	12 1/2	1A & B	12.109	Station 310+41 WEB
1-13-96	Footing Abut #2	12.109	12 1/2	2A & B	24.218	Station 310+41 WEB
1-15-96	Abut #1	39.100	40	3A & B	63.318	Station 310+41 WEB

Forms & Reinforcing Steel Inspection *Record Bridges*

Station	Section	Forms	Re-Steel	kg Reqd.	Accum. Total kg	Insp.	Date	Remarks
310+	Abut #1	OK	OK	1010	1010	WEB	12-18-96	23 A-402 bars & checked A-501 bars
310+	Abut #2	OK	OK	1010	2020	WEB	1-10-96	All bars checked. Tying very good.
310+	Abut #1	OK	OK	17107	19126	WEB	1-15-96	All bars checked. Tying very good.

Structural Steel for Substructure

Station	Location	Date Installed	kg Reqd.	Accum. Total	Insp.	Remarks
310+	Abut #1	4-1-96	640	640	WEB	2 coats red lead.
310+	Abut #2	5-20-96	640	1984	WEB	2 coats red lead.
612+	Abut #1	5-19-96	704	1344	WEB	2 coats red lead.
612+	Pier #1	6-2-96	704	2688	WEB	2 coats red lead.
612+	Pier #2		704			
612+	Abut #2		704			

Seed Received and Seeding Diary Records

Seed Received

3-17-96 *7 1/2 bags Type "B" mixture at 2 bags/ha for 3.65 ha. 178 bags at 2 bags/ha where Type A Mixture for the 89 ha. stored in barn at Edward Hayes. tagged by DOR inspector D. Gray. There are 3.65 ha of Type "B" seeding and 89 ha Type "A".*

AWL

Seeding Diary

Date: 3-21-96 Monday
Weather: Ptly. Cldy. & Mild
Hours: 7-5:30 = 9 hours
Equipment on job includes 2 straight trucks, 1 trailer, 1 mulch blower, 2 tractors, 1 disc, 1 drill, 3 m wide and 2 pickups. One man began soil preparation today with tractor and disc. Working from Sta. 12 to 60 on the Rt. Supt. John James on job. He plans to use native hay for mulch, the fertilizer will be bulk and from co-op. Will have a load of fertilizer here tomorrow. They will try to work 6 to 9 hr. days a week.
Mulch began arriving on the job today, 2 loads. Two passes with disc is giving good soil condition.
I marked with lathe 2.0 ha of Type "B".
Fertilizer arrived today, so begin spreading from 12+ to 40+ Rt. They broke the drive chain.

AWL
Seeding Inspector

Seeding Diary

Date: 3-22-96, Tuesday
Weather: Fair, wind, & mild
Hours: 7-5:30 = 9 hours
Fertilizer spreader fixed and completed spreading fertilizer to Station 63 on Rt.
Began seeding Type "A" seed from Station 12+ to 63+ on Rt. This is 32 ha. Started out with 5-2 ha areas until drill well adjusted and then used a total of 16 bags from Sta. 12+ to 63+ on Rt.
Contractor is unable to get fertilizer until 3-25 due to prior commitments by co-op.
Begin mulching today; hay is blowing real well. 1,340 bales used 12+ to 40+ Rt. slightly over. Using straight disc for punching mulch. It arrived on project last evening. Same tractor used on cupped disc used on puncher. Project Manager over job today. No comments on work. Mulch being stored on right of way.

AWL
Seeding Inspector

Contractor's Crew: 1 supt., 1 foreman, 12 men
Date: 3-23-96
Weather: Ptly. cldy., & Windy
Hours: 7-5:30 = 9 hours
Trying to mulch today but too windy from 10:00 to 3:30. Only got 300 bales spread. One man working with tractor and disc on soil prep. to Sta. 80 Rt., then worked from Sta. 5+ to 70+ on left.
Seeded Type "B" from Station 12+ to 63+ on Rt. one acre. Type "B" is 3 m wide. I talked with Mr. James about using flagmen when mulching from road. He thought flashers on equipment were working and light traffic. I asked Mr. Sharp about it, and he said we needed flagmen. I then advised Mr. James. He said he would set the temporary signs and use flagmen when he has equipment on the roadway. The signs were picked up today.
See Page #94 for list of signs.

AWL
Seeding Inspector

Seeding Measurement Record

Seeding Comps. Type "A" *					
Station	**Width m**	**Remarks**	**Station**	**Width m**	**Remarks**
6+70	0	3-17-96 Ptly. Cldy.-Warm JJE CFV, EJJ	5+10	0	3-19-96 JJE, CFN, EJJ
7+00	7		+80	10	
7+10	30		6+00	41	
9+00	35		8+00	40	
12+20	35		11+00	40	
14+00	37		14+00	39	
15+20	30		16+00	40	
15+25	0		16+10	31	
			16+10	0	
Drive			Drive		
15+65	0		16+40	0	
15+80	27		16+45	7	
17+00	30		17+00	40	
17+00	73		20+00	40	
20+00	75		21+40	36	
23+00	75		23+00	37	
26+00	75		26+00	39	
27+40	75		27+00	40	
27+50	30		29+00	35	
30+00	30		29+50	35	
30+00	30		30+00	41	

** Use Marv Lech's seed comp. program to compute and document areas seeded.*

Fertilizer Records

Fertilizer Record Received				and Used by kg							
Date	**Ship. Ident.**	**Quant. Recd. kg**	**Remarks**	**Date**	**Sta.-Sta.**	**Side**	**Ha**	**kg Fert. Req.d**	**kg Fert. Used**	**Insp.**	**Remarks**
3-21-96	TL127741	10,000	Bulk-300 kg/ha spec. blend JAS	3-21-96 3-22-96	12+ 40+ 40+ 63+	Rt. Rt.	21 12.3 33.3	10,000	10,000	AWL	
3-25-96	TL127894	10,000	same as above AWL	3-25-96	5+ 60+	Lt.	33.3	10,000	10,000	AWL	
3-28-96	TL127897 TL127898	10,000 15,000	same as above AWL	3-28-96 3-29-96	60+ 103+ 63+ 129+	Lt. Rt.	33.3 33.0	10,000 15,000	10,000 15,000	AWL AWL	
3-30-96	TL127941	10,220	same as above AWL	3-30-96	127+143 103+143	Rt. Lt.	16.2 17.7 33.9	10,170	10,220	AWL	comp. today
Totals		55,220					183.8	55,140	55,220		

Mulch Received Record

Mulch Received							
Date	***Mass Ticket No.***	***Lb. Quantity Received***	***Mg Received***	***Mass Bale***	***Type of Mulch***	***Insp.***	***Remarks***
3-20-96	*19877*	*18400*	*8.346*	*28.48*	*Hay*	*AWL*	*293 bales*
3-20-96	*19878*	*17020*	*7.720*	*26.62*	*Hay*	*AWL*	*290 bales*
3-21-96	*None*	*488*	*0.221*	*27.67*	*Hay*	*AWL*	
3-22-96	*None*	*450*	*0.204*	*25.51*	*Hay*	*AWL*	*8 bales*
3-22-96	*19903*	*17800*	*8.073*	*27.84*	*Hay*	*AWL*	*290 bales*
3-22-96	*19904*	*18320*	*8.309*	*28.56*	*Hay*	*AWL*	*291 bales*
				27.45			*30 kg*
x lb. x 0.000454 mg/lb = mg				*Avg.*			*A record similar to this may be used for documentation of the require amount of hay or straw in Slope Protection Work.*

Mulch Placed Record

Mulch Placed Record

Date	Sta.-Sta.	Side	Hectare	Mulch Reqd Mg	Mulch Used Mg	Insp.	Remarks
3-22-96	12+17-40+	Rt.	21	42	42.143	`AWL	1340 bales @ 31.5 kg = 42.143
3-23-96	40+ -63+	Rt.	12.3	24.6	9.435		Mg
3-24-96	40+ -63+	Rt.	---	---	15.411	AWL	blower broke down @ 11:00 a.m.
			12.3	24.6	24.846		490 bales @ 31.5 = 15.411 Mg
							blower fixed @ 1:00 p.m.
3-26-96	5+ -60+	Lt.	33.3	66.6	30.507	AWL	970 bales @ 31.5 = 30.507 Mg
3-28-96	5+ -60+	Lt.	---	---	25.537	AWL	812 bales @ 31.5 = 25.537 Mg
3-29-96	5+ -60+	Lt.	---	---	10.064	AWL	320 bales @ 31.5 = 10.064 Mg
			33.3	66.6	66.108		
3-29-96	63+ -127+	Rt.	50.0	100.0	28.714	AWL	913 bales @ 31.5 = 28.714 Mg
3-30-96	63+ -127+	Rt.	---	---	31.450	AWL	1000 bales @ 31.5 = 31.450 Mg.
3-31-96	63+ -127+	Rt.	---	---	35.224	AWL	1120 bales @ 31.5 = 35.224 Mg
4-1-96	63+ -127+	Rt.	---	---	6.290	AWL	200 bales @ 31.5 = 6.290 Mg
			50	100.0	11.678		
							Complete today

Example #1 Excess Placed — *0.30 Mg*

Amount Required: 8.20 Mg
Amounted Placed: 11.25 Mg
Excess 3.05 Mg
Amount Paid: 8.20 Mg

Example #2 Additional Order
Plan Required Amount: 8.20 Mg
Engineer Ordered Amount: 11.25 Mg
Difference 3.05 Mg
Amount Paid: (8.20) (1.05) = 8.61
11.25 - 8.61 = 2.64
8.20 + 2.64 = 10.84 Mg

Example #3 Order Cut by Engineer
Plan Amount: 8.20 Mg
Engineer Ordered Amount: 5.15 Mg
Difference 3.05 Mg
Amount Paid: 5.15 + 0.41 = 5.56

Example #4 Less Than 5% Excess Placed
Amount Specified: 8.20 Mg
Amount Placed: 8.50 Mg
Excess: 0.30 Mg
Amount Paid: 8.20 Mg

Example #5 Less Than 5% Short of Specified Amount
Amount Specified: 8.20 Mg
Amount Placed: 7.90 Mg
Deficit: 0.30 Mg
Amount Paid: 8.20 Mg

Project Totals	183.8	423.635	432.311
105% Example			

A record similar to this may be used for documentation of the required amount of hay or straw in Slope Protection Work

Nuclear Densities
QA/QC

Date: May 31, 1996 *Operator: A Leinen* *Gauge: Troxler Thin Lift Density Gauge* *Density #2-4* *Station: 251+81* *Lane: Eastbound Rt.* *Lift: Top* *Dist. from outside edge: 1.2 m* *Mix Type: 13R* *Lift Thickness: 2"* *1"Plate Used: Yes* *EBM Voidless: Specific Gravity - 2.402* *(Rice) Density - 2402 kg/m^3* *Note: S.G. = density/1000 (metric)* *Required: 94% of voidless=2402x.94=2257.88* *Spec.* *Gauge: N - 2200* *Readings E - 2250* *S - 2300* *W - 2350* *= 9100* *Ave. of Readings: 91+00 ÷ 4 = 2275* *Density: 2275* *S.G.: 2275 ÷ 1000 = 2.275* *Correction Factor: ±0.0* *Corrected S.G. = 2.275* *% Voidless Density (Nuclear) = 2.275 / 2.402 = 94.7%* *Correction Core Density = 2.30* *From QA/QC Lab* *% Voidless Density (Core) = 2.30 / 2.402 = 95.8%* *Correlation within 1 1/2%: Yes, use nuclear density # w/o correction factor* *Correction Factor = N.A.*	*Remarks:* *- correlate with a minimum of three core densities for each mix type* *- the four readings were taken as follows:* *(See Operator's Manual)* *- if the densities were off by more than 1 1/2%, a correction factor would be computed as shown below:* *Core S.G. - Nuclear S.G. = ± correction factor* *- periodically, you may want to run an extra correlation core to insure accuracy of gauge.* *A. Leinen* *Inspector's Signature*

Record of Nuclear Densities for Asphalt

Date: 5-24-96 Operator: R. Vajgrt *Density 1-1* *Station 263+66 EB-Lt. Dist. Outside Edge = 8'* *Type 13R* *Gauge Reading = 2258 Mg/m^3* *Specific Gravity = 2258 / 1000 = 2.258* *Voidless (Rice) = 2.402* *Density = 2.254 / 2.402 = 93.8%* *Correlation Core = 2.220* *Correlation Density = 2.200 / 2.402 = 91.6%* *Notified contractor that density measured failed.*	*Date: 5-24-96 Operator: R. Vajgrt* *Density 1-2* *Station 286+19 EB-Lt. Dist. outside Edge=7'* *Type 13R* *Gauge Reading = 2225* *Specific Gravity = 2225 / 1000 = 2.225* *Voidless (Rice) = 2.402* *Density = 2.225 / 2.402 = 92.6%* *Correlation Core = 2.237* *Correlation Density = 2.237 / 2.402 = 93.1%* *Notified contractor that density measurement failed.*

Asphalt Plant Book Records
Daily Plant Records

Date: 6-2-96 Weather: Sunny-Ptly. Cldy.
Type 11
Job Mix Start: 11:00 a.m.

ACC

Mg Produced: 2783.07 Stop: 7:30 p.m.
Mg Waste: 133.52 Temp: 80 °
Mg Pavement Pay: 2626.0 Mix Temp. 300 °
Mg Patching Pay: 23.55
Mg Prod.: 2783.07 Accum. Mg.: 5731.92

Plant Waste: -133.52
Mg Delivered Total: 2649.55 Mg
Road Waste: 0
Mg Plant Waste: 133.52
Mg Total Waste: 133.52

Asphalt Cement
Start: 82.073 Mg.
Added: 124.75 + 82.073 = 206.823 Mg.
Stop: 1.96 m @ 138 °=12643 gal. x (.9253) = 10434 gal. @ 15 °C
8.4104 lb/gal ¸ 2000 lb/ton =
43.878 Ton x .907 Mg/Ton = 39.796 Mg
Used: 39.796 Mg
A Cement Mg/ACC Mg = 0.058548653
AC Non-Pay Mg.: 1.902 (waste=4.78%)
AC Pay Mg.: 37.894

AGG. 5.22%
Mix 5.85
KKF

Load ID	Wt Per Gal	Spec. Gravity	Net Mg
16761	8.3960	1.0086	24.61
17167	8.4320	1.0129	25.27
17169	8.4320	1.0129	25.22
16795	8.3960	1.0086	25.10
16806	8.3960	1.0086	25.55
	8.4104		124.75

To convert ton to Mg., multiply number of tons 0.907 to get Mg.

Date: 6-3-96 Weather: Cldy., occ. rain
Type 11
*Job Mix Start: 1:15 p.m. **

ACC
Mg. Produced: 1282.41 Stop: 5.30 p.m.
Mg. Waste: 28.95 Temp.: 20 °C
Mg. Pavement Pay: 1237.46 Mix Temp.
*Mg. Patching Pay: 16.00 * Due to yesterday's rain-plant site saturated/fire in heated tank @ 4:00 p.m.-No damage*
Mg. Proc.: 1282.41 Accum. Mg.- 3082.37

Plant Waste: 28.95
Mg Del. Total: 1253.46
Road Waste: 0
Plant Waste: 28.95
Total Waste: 28.95

Asphalt Cement
Start: 41.168 Mg. (volume may not be stop volume)
Added: 120.04 + 41.168 = 161.208 Mg.
Stop: 1.27 m @ 149 °C = 19467 gal. = 81.863 Tons
(81.863 Tons) x .907 Mg/tons=74.249 Mg
% Waste: 2.257%
Used: 74.249
AC Mg/ACC Mg: 0.0586491139
AC Non-Pay Mg.: 1.677 Mg
(Waste = 0.02257 x 74.299)
AC Pay Mg.: 72.572 Mg

BIBA AGG. 6.58%
DOR AML 6-2-96 Mix 6.17
KKF

Load ID	Kg/L	Spec. Gravity	Net Mg
17062	2.2275	1.0129	24.33
17064	2.2275	1.0129	23.42
17066	2.2275	1.0129	24.96
17070	2.1955	1.0129	23.12
17074	2.1955	1.0129	24.21
	2.2147		120.04
	Avg.		

Excavation Record for Estimating Purposes Only
(Not for Final Payment Measurements)

*Excavation: * Truck haul 10 m^3 Per Load*
*Entries without * are 25 m^3 Scraper Loads*

(End Work) Date	Load Count	Daily Total	Accum. m^3	Insp.	Location/Remarks
9-10-96	1040	26000.00	26000.00	DD	63800 to 62240
*9-12-96	377	3770.00	29770.00	SW	657+00-586
*9-17-96	2020	20200	49970	SW	
9-17-96	1600	41600	91570	SW	664+00-603+00
9-24-96	1368	34200	125770	DW	528+00 Rt. - 477+00 Lt.
*9-24-96	1088	10880	136650	DW	664+00 - 570+00
*10-1-96	1654	12546	153190	DW	670+00 Lt. - 653+00
10-1-96	1652	41300	194490	DW	480+00 - 465+00
10-8-96	36	972	195462	SW	530+00
*10-8-96	600	6000	201462.0	DW	553+00 - 587 Rt.
*10-14-96	1453	14530	215992.0	SW	560+00 - 571+00 Rt. Side
10-14-96	1374	37071	253063.0	DD	445+00 - 480+00 Rt.
10-22-96	677	18279	271342.0	SW	470+477+00 1655+00 - 632+00
10-29-96	665	17955	289297.0	SW	
11-5-96	448	12096	301393.0	DD	470+00 - 445+00 Lt.
11-11-96	378	10206.00	311599.0	GW	664+00 - 650+00
2-4-97	Deduct. to be paid		19967.50	DW	30045.5 farm site - 10068.0 credit
	as borrow		291632.0	DW	summary from exc. borrow

Summary of Pavement Items

	255 mm PCC Pave.		255 to 205 mm PCC Pavement		Subgrade Preparation		Foundation Course		
Date	Daily Total m^2	Accum. Total m^2	Daily Total m^2	Accum. Total m^2	Daily Total m^2	Accum. Total m^2	Daily Total m^2	Accum. Total m^2	Insp.
8-2-96 Wed.	638.48		1890.63						X
8-3-96 Th.	4105.56	10493.04	1214.68	3105.31	Subgrade preparation and foundation course area is				X
8-4-95 Fr.	8487.00	18980.04	2514.67	5619.98	same as the area paved				X
8-5-96 Sat.	8061.00	27041.04	2388.44	8008.42					X
8-7-96 Mon.	9888.52	36929.56	2776.48	10,784.90					X
8-8-96 Tu.	7646.07	44575.63	2268.92	13,053.82					X
8-9-96 Wed.	7462.56	52038.19	2061.34	15115.16					X
8-10-96 Th.	10446.00	62484.19	3095.11	18210.27					X
8-11-96 Fr.	6107.13	68591.32	1805.79	20016.06					X

Sign Day Records

August 1993

								Weekly Total
	1	**2**	**3**	**4**	**5**	**6**	**7**	
	8	9	10	11	12	13	14	
	15	16	17	18	19	20	21	
Date	22	23	24	25	26	27	28	
No. of Signs						6	6	12
	29	30	31					
	6	6	6					18

				1	2	3	4	
				6	6	6	6	24
	5	6	7	8	9	10	11	
	6	6	6	6	6	6	6	42
	12	13	14	15	16	17	18	
	6	6	6	6	6	6	6	42
Date	19	20	21	22	23	24	25	
No. of Signs	6	6	6	6	6	6	6	42
	25	27	28	29	30			
	6	6	6	6	6			30

Sign Day

Weekly Accum. Total	Locations	Insp.
12	Co. Rd. Closure @ 1859+80	JS
30	Co. Rd. Closure @ 1859+80	JS
54	Co. Rd. Closure @ 1859+80	JS
96	Co. Rd. Closure @ 1859+80	JS
138	Co. Rd. Closure @ 1859+80	JS
180	Co. Rd. Closure @ 1859+80	JS
210	Co. Rd. Closure @ 1859+80	VH

10-5-96 VH

Barricade Records

Item No.
August 1993

								Weekly Total
	1	***2***	***3***	***4***	***5***	***6***	***7***	
	8	*9*	*10*	*11*	*12*	*13*	*14*	
	15	*16*	*17*	*18*	*19*	*20*	*21*	
Date	*22*	*23*	*24*	*25*	*26*	*27*	*28*	
No. of Signs						*4*	*4*	*8*
	29	*30*	*31*					
	4	*4*	*4*					*12*

September 1993

				1	*2*	*3*	*4*	
				4	*4*	*4*	*4*	*16*
	5	*6*	*7*	*8*	*9*	*10*	*11*	
	4	*4*	*4*	*4*	*4*	*4*	*4*	*28*
	12	*13*	*14*	*15*	*16*	*17*	*18*	
	4	*4*	*4*	*4*	*4*	*4*	*4*	*28*
Date	*19*	*20*	*21*	*22*	*23*	*24*	*25*	
No. of Signs	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*28*
	25	*27*	*28*	*29*	*30*			
	4	*4*	*4*	*4*	*4*			*20*

Type III Barricades

Weekly Accum. Total	***Locations***	***Insp.***
8	*Co. Rd. Closure @ 1859+80*	*JS*
20	*Co. Rd. Closure @ 1859+80*	*JS*
36	*Co. Rd. Closure @ 1859+80*	*JS*
64	*Co. Rd. Closure @ 1859+80*	*JS*
92	*Co. Rd. Closure @ 1859+80*	*JS*
120	*Co. Rd. Closure @ 1859+80*	*SH*
140	*Co. Rd. Closure @ 1859+80*	*VH*

Sign Type		Signs in a Group (1)	(1A)		Number of Barricades
Road Closed	=	2	2		
Road Closed 1 Mi. Ahead			2	Totals	
		2	4		
Type II Barr.					4

		(2)	(2A	(2B)
Rt. Lane Closed Ahead	=	1	2	2
Drop Off	=	1	2	2
Shoulder Work	=	1	2	2
Bump				2
Totals		3	6	8

		(3)	(3A)
Left Lane Closed 1/2 Mile	=	1	1
Left Lane Closed 1500'	=	1	
Merge	=	1	1
Shoulder Work	=	2	2
Drop Off	=		4
Totals		5	8

64 Vertical Panels as of 6-22-96
53 Vertical Panels as of 8-6-96

	Sign Group	Purpose
4-17-96	Group 1	Shoulder Work
4-18-96	Group 1A	Shoulder Work
4-19-96	Group 2	Shoulder Work
4-20-96	Group 2 & (Group 2 Waverly Road)	Shoulder Work
4-21-96	Groups 1 & 3	Shoulder Work
4-22-96	Groups 1A & 3A	Shoulder Work
4-23-96	Groups 1 & 3	Shoulder Work
4-24-96	Groups 1 & 3	Shoulder Work
4-25-96	Groups 1 & 3	Shoulder Work
4-26-96	Groups 1 & 3	Shoulder Work
4-27-96	Groups 1 & 3	Shoulder Work
4-28-96	Groups 1 & 3	Shoulder Work
4-29-96	Groups 1, 2A, & 3	Shoulder Work
4-30-96	Groups 1 & 3	Shoulder Work
5-1-96	Groups 1 & 3	Shoulder Work
5-2-96	Groups 1 & 3	Shoulder Work
5-3-96	Groups 1 & 3	Shoulder Work
5-4-96	Groups 1 & 3	Shoulder Work
5-5-96	Groups 1 & 3	Shoulder Work
5-6-96	Groups 1 & 3	Shoulder Work
5-7-96	Groups 1 & 3	Shoulder Work
5-8-96	Groups 1 & 3	Shoulder Work
5-9-96	Group 1	Shoulder Work

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Metric Conversion Tables

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Base Units

Quantity	Unit	Symbol
length	meter	m
mass*	kilogram	kg
time	second	s
electric current	ampere	A
temperature	kelvin	K
luminous intensity	candela	cd

* "Weight" in common practice often is used to mean "mass".

Decimal Prefixes

Prefix	Symbol	Order of Magnitude	Expression
nano	n	10^{-9}	0,000,000,001 (1 billionth)
micro	µ	10^{-6}	0.000001 (one millionth)
milli	m	10^{-3}	0.001 (one thousandth)
kilo	k	10^{3}	1000 (one thousand)
Mega	M	10^{6}	1,000,000 (1 million)
Giga	G	10^{9}	1,000,000,0000 (1 billion)

Derived Units

Quantity	Name	Symbol	Expression
frequency	hertz	Hz	$Hz = s^{-1}$
force	newton	N	$N = kg \cdot m/s^{2}$
pressure, stress	pascal	Pa	$Pa = N/m^{2}$
energy, work, quantity of heat	joule	J	$J = N \cdot m$
power, radiant flux	watt	W	W = J/s
electric charge, quantity	coulomb	C	$C = A \cdot s$
electric potential	volt	V	V = W/A or J/C
capacitance	farad	F	F = C/V
electric resistance	ohm	Ω	Ω = V/A
electric conductance	siemens	S	S = A/V or Ω^{-1}
magnetic flux	weber	Wb	$Wb = V \cdot s$
magnetic flux density	tesia	T	$T = Wb/m^{2}$
inductance	henry	H	H = Wb/A
luminous flux	lumen	lm	$lm = cd \cdot sr$
illuminance	lux	lx	$lx = lm/m^{2}$

Project Definition

	Quantity	Metric Unit	Symbol	English Unit
Surveying	Length	kilometer, meter	km, m	mile, foot
	area	square kilometer hectare square meter	km^2 ha m^2	square mile acre square foot
	plane angle	degree minute second	° ‘ “	° ‘ “
Excavating	length	meter, millimeter	m, mm	foot, inch
	volume	cubic meter	m^3	cubic yard
Haul	distance	kilometer	km	mile
	volume	cubic meter	m^3	cubic yard
	mass	metric ton	t	English ton
Paving	length	meter, millimeter	m, mm	foot, inch
	area	square meter	m^2	square yard
Concrete	length	meter, millimeter	m, mm	foot
	area	square meter	m^2	square foot
	volume	cubic meter	m^3	cubic yard
	temperature	degree Celsius	°C	°F
	water capacity	liter	L	gallon, MG
	mass (weight)	kilogram, gram	kg, g	pound
	x-sectional area	square millimeter	mm^2	square inch
Drainage	length	meter, millimeter	m, mm	foot
	area	hectare	ha	acre
		square meter	m^2	square foot
		square kilometer	km^2	square mile
	volume	cubic meter	m^3	square foot
	discharge	cubic meter/second	m^3/s	cubic foot/s
	velocity	meter/second	m/s	foot/second
	slope	millimeter/meter	mm/m	feet/foot

Area, Length, and Volume Conversion Factors

Quantity	From Inch-Pound Units	To Metric Units	Multiply By
Length	* mile (U.S. Statute)	m	1609.347
	mile (international)	km	1.609344
	yard	m	0.9144
	foot	m	0.3048
	* foot (U.S. Survey)	m	0.30480061
		mm	304.8
	inch	mm	25.4
Area	* square mile (U.S. Statute)	km^2	2.589998
	* acre	m^2	4046.873
		ha (10,000 m^2)	0.4046873
	square yard	m^2	0.83612736
	square foot	m^2	0.09290304
	square inch	mm^2	645.16
Volume	acre foot	m^3	1233.4894
	cubic yard	m^3	0.7645549
	cubic foot	cm^3	28316.85
@	cubic foot	L (1000 cm^3)	28,31685
	cubic foot	m^3	0.02831685
	100 board feet	L (1000 cm^3)	0.235974
	gallon	kL (1000 L)	3.785412×10^{-3}
	1000 gallons	cm^3	3785412.
	cubic inch	mm^3	16387.064

Note: Underline denotes exact number.

* Any data, in feet, derived from and published as a result of geodetic surveys will remain with the U.S. Survey foot including all stationing, land measure, and coordinate conversions.

The U.S. Survey foot, as established in the U.S. Metric Law of 1886, is based on the relationship of 1 m = 39.37 inches or 1 foot = 1200/3937 m. All conversion factors for units of land measure in this table referenced to this footnote (*) are based on the U.S. Survey foot.

Civil and Structural Engineering
Conversion Factors

Quantity	From Inch-Pound Units	To Metric Units	Multiply By
@ Mass	lb kip (1000 lb) ton	kg **megagram** (1000 kg) **MG**	0.4535924 0.435924 0.9071847
Mass/unit length	plf	kg/m	1.488164
Mass/unit area	psf	kg/m^2	4.882428
Mass density	pcf	kg/m^3	16l01846
Force	lb kip	N kN	4.448222 4.448222
Force/unit length	plf klf	N/m Kn/m	14.59390 14.59390
Pressure, stress modulus of elasticity	psf ksf psi @ psi	Pa kPa kPa Mpa	47.88026 47.88026 6.894757 0.006894757
Bending moment, torque, moment of force	ft-lb ft-kip in-lb	N•m kN•m N•m	1.355818 1.355818 0.1129848
Moment of mass	lb-ft	kg•m	0.138255
Moment of inertia	$lb\text{-}ft^2$	$kg\bullet m^2$	0.0421401
Second moment of area	in^4 ft^4	mm^4 m^4	416,231.4 0.008630975
Section modulus	in^3	mm^3	<u>16,387.064</u>

Note: Underline denotes exact number.

Metric/English Area Conversion

Quantity	To Convert		Multiply By
	From	To	
Length	Meter (m) Foot	Foot Meter (m)	3937/1200=3.280833 ft/m 0.30480061 m/ft
Acre	Acre Acre Hectare (ha) Square Meter (m^2) Hectare (ha)	Hectare (ha) Square Meter (m^2) Acre Square Foot Square Meter (m^2)	0.40468726 ha/Acre 4046.87260988 m^2/Acre 2.47104393 Acre/ha 10.76386736 ft^2/m^2 10,000 m^2/ha

Drawing Sizes

ISO Designation	Metric Sheet Size	Replaces
A0	841 x 1189 mm	34 x 44 inches
A1	594 x 841 mm	22x34 inches
A2	420 x 594 mm	17 x 22 inches
A3	297 x 420 mm	11 x 17 inches
A4	210 x 297 mm	8 1/2 x 11 inches

Units for Structural Steel Design

Fraction (in.)	Exact Conversion (mm)	Rounded to: (mm)
1/16	1.5875	2
1/8	3.175	3
3/16	4.7625	5
1/4	6.35	6
5/16	7.9375	8
3/8	9.525	10
7/16	11.1125	11
1/2	12.7	13
5/8	15.875	16
3/4	19.05	19
7/8	22.225	22
1	25.4	25

Metric Bolt Designation

Designation	Diameter (mm)	Diameter (in.)
M16	16	0.63
M20	20	0.79
M22	22	0.87
M24	24	0.94
M27	27	1.06
M30	30	1.18
M36	36	1.42

Structural Steel for Bridges

Grade S.I.	Grade U.S.	Yield Strength (MPa)
205	30	205
250	35	240
250	36	250
275	40	275
310	45	310
345	50	345
345W	50W	345
415	60	415
450	65	450
485W	70W	485
620	90	620
655	95	655
690	100	690
690W	100W	690
725	105	725
795	115	795
860	125	860
895	130	895
1000	145	1000
1035	150	1035
1105	160	1105
1140	165	1140
1240	180	1240
1450	210	1450
1795	260	1795

Reinforcing Steel

Metric Bar Designation	U.S. Customary Designation	Diameter (in.)	Area (in.^{2})	Diameter (mm)	Area (mm$^{2)}$
	#3	0.375	0.11	9.5	71
10				11.3	100
	#4	0.500	0.20	12.7	127
	#5	0.625	0.31	15.9	198
15				16.0	200
	#6	0.750	0.44	19.1	285
20				19.5	300
	#7	0.875	0.60	22.2	388
25				25.2	500
	#8	1.000	0.79	25.4	507
	#9	1.125	1.00	28.6	641
30				29.9	700
	#10	1.270	1.27	32.3	817
35				35.7	1000
	#11	1.410	1.56	35.8	1007
	#14	1.693	2.25	43.0	1452
45				43.7	1500
55				56.4	2500
	#18	2.257	4.00	57.3	2581

Hard Conversions for Construction Materials

Reinforcing Bars, M31M				
Grade		Tensile and Yield Strengths		
Metric Value	English Value	Tensile Strength (Mpa)	Minimum Yield Strength (Mpa)	Minimum Yield Strength (ksi)
300	40	500	300	40
400	60	600	400	60

Coefficient of Thermal Expansion		
	Metric Value	English Value
Steel	0.0000117/°C	0.0000065/°F
Concrete	0.0000108/°C	0.000006/°F

Unit Weights		
	Metric Value	English Value
Steel	7848.3 kg/m^3	490 pcf
Concrete	2402.5 kg/m^3	150 pcf

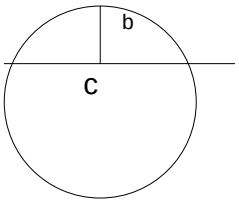
Sieves

Sieve Designation, (W)	
SI Standard[B]	**English Alternative**
125 mm	5 in.
106 mm	4.24 in.
100 mm	4 in.
90 mm	3 1/2 in.
75 mm	3 in.
63 mm	2 1/2 in.
53 mm	2.12 in.
50 mm	2 in.
45 mm	1 3/4 in.
37.5 mm	11/2 in.
31.5 mm	1 1/4 in.
26.5 mm	1.06 in.
25.0 mm	1 in.
22.4 mm	7/8 in.
19.0 mm	3/4 in.
16.0 mm	5/8 in.
13.2 mm	0.530 in.
12.5 mm	1/2 in.
11.2 mm	7/16 in.
9.50 mm	3/8 in.
8.00 mm	5/16 in.
6.70 mm	0.265 in.
6.30 mm	1/4 in.
5.60 mm	No. 3 1/2
4.75 mm	No. 4
4.00 mm	No. 5
3.35 mm	No. 6
2.80 mm	No. 7
2.36 mm	No. 8
2.00 mm	No. 10
1.70 mm	No. 12
1.40 mm	No. 14
1.18 mm	No. 16
1.00 mm	No. 18
850 µm	No. 20
710 µm	No. 25
600 µm	No. 30
500 µm	No. 35
425 µm	No. 40
355 µm	No. 45

Sieves (*Continued*)

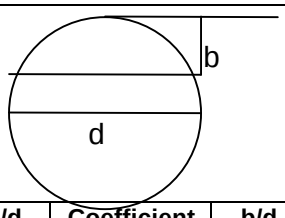
Sieve Designation, (W)	
SI Standard[B]	**English Alternative**
300 µm	No. 50
250 µm	No. 60
212 µm	No. 70
180 µm	No. 80
150 µm	No. 100
125 µm	No. 120
106 µm	No. 140
90 µm	No. 170
75 µm	No. 200
63 µm	No. 230
53 µm	No. 270
45 µm	No. 325
38 µm	No. 400
32 µm	No. 450
25 µm	No. 500
20 µm	No. 635

Areas of Circular Segments



Given: rise, b x chord, c x coefficient for b/c
Example. Given: rise = 2.10 and chord = 5.65.
b/c = 2.10/5.65 =0.3717
Coefficient by interpolation = 0.7354
Area = b x c x coeffi. = 2.10 x 5.65 x 0.7354 = 8.7255

A•	Coefficient	b/c	A•	Coefficient	b/c	A•	Coefficient	b/c	A•	Coefficient	b/c
1	.6667	.0022	46	.6722	.1017	91	.6895	.2097	136	.7230	.3373
2	.6867	.0044	47	.6724	.1040	92	.6901	.2122	137	.7249	.3404
3	.6667	.0066	48	.6727	.1063	93	.6906	.2148	138	.7290	.3436
4	.6667	.0067	49	.6729	.1086	94	.6912	.2174	139	.7270	.3489
5	.6667	.0109	50	.6732	.1109	95	.6918	.2200	140	.7281	.3501
6	.6667	.0131	51	.6734	.1131	96	.6924	.2226	141	.7292	.3634
7	.6668	.0153	52	.6737	.1154	97	.6930	.2282	142	.7303	.3867
8	.6668	.0175	53	.6740	.1177	98	.6936	.2279	143	.7314	.3600
9	.6669	.0197	54	.6743	.1200	99	.6942	.2305	144	.7325	.3633
10	.6670	.0218	55	.6746	.1224	100	.6948	.2332	146	.7326	.3806
11	.6670	.0240	56	.6749	.1247	101	.6954	.2388	148	.7248	.3700
12	.6671	.0282	57	.6752	.1270	102	.6961	.2386	147	.7380	.3794
13	.6672	.0284	58	.6755	.1293	103	.6967	.2412	148	.7372	.3786
14	.6672	.0306	59	.6758	.1316	104	.6974	.2439	149	.7384	.3802
15	.6673	.0328	60	.6761	.1340	105	.6980	.2466	150	.7396	.3837
16	.6674	.0350	61	.6784	.1363	106	.6987	.2493	151	.7408	.3871
17	.6874	.0372	62	.6788	.1387	107	.6994	.2520	152	.7421	.3908
18	.6675	.0394	63	.6771	.1410	106	.7001	.2548	153	.7434	.3942
19	.6678	.0416	64	.6775	.1434	109	.7008	.2575	154	.7447	.3977
20	.6677	.0437	65	.6779	.1457	110	.701`5	.2603	155	.7480	.4013
21	.6678	.0459	66	.6782	.1481	111	.7022	.2631	156	.7473	.4049
22	.6679	.0481	67	.6788	.1505	112	.7030	.2659	157	.7488	.4085
23	.6880	.0504	68	.6790	.1529	113	.7037	.2887	158	.7500	.4122
24	.6681	.0582	69	.6794	.1553	114	.7045	.2715	159	.7514	.4159
25	.6682	.0548	70	.6797	.1577	115	.7052	.2743	160	.7528	.4196
26	.6684	.0570	71	.6801	.1901	116	.7080	.2772	161	.7542	.4233
27	.6685	.0592	72	.6805	.1625	117	.7088	.2800	162	.7567	.4270
28	.6687	.0614	73	.6809	.1649	118	.7076	.2829	163	.7571	.4308
29	.6688	.0636	74	.6814	.1673	119	.7084	.2858	164	.7596	.4346
30	.6890	.0658	75	.6818	.1697	120	.7092	.2887	165	.7801	.4385
31	.6691	.0681	76	.6822	.1722	121	.7100	.2916	168	.7818	.4424
32	.6693	.0703	77	.8826	.1748	122	.7109	.2945	167	.7832	.4463
33	.6894	.0725	78	.8831	.1771	123	.7117	.2975	167	.7948	.4502
34	.6696	.0747	79	.6835	.1795	124	.7128	.3004	169	.7864	.4542
35	.6698	.0770	80	.6840	.1820	125	.7134	.3034	170	.7680	.4582
36	.6700	.0792	81	.6844	.1845	126	.7143	.3064	171	.7896	.4822
37	.6702	.0814	82	.6849	.1869	127	.7152	.3094	172	.7712	.4663
38	.6704	.0637	83	.6854	.1894	1`28	.7161	.3124	173	.7729	.4704
39	.6706	.0859	84	.6859	.1919	129	.7170	.3155	174	.7746	.4745
40	.6708	.0882	85	.6864	.1944	130	.7180	.3185	175	.7763	.4787
41	.6710	.0904	86	.6869	.1970	131	.7189	.3216	178	.7781	.4828
42	.6712	.0927	87	.6874	.1996	132	.7199	.3247	177	.7799	.4871
43	.6714	.0449	88	.6879	.2020	133	.7209	.3278	178	.7817	.4914
44	.6717	.0972	89	.6884	.2046	134	.7219	.3309	179	.7835	.4967
45	.6719	.0995	90	.6890	.2071	135	.7229	.3341	180	.7854	.5000



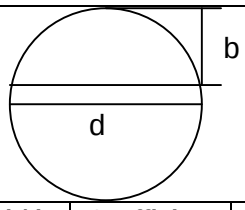
Areas of Circular Segments

for Ratios of Rise and Diameter

b = Rise; d = Diameter

Area = d^2 x Coefficient

b/d	Coefficient	b/d	Coefficient	b/c	Coefficient	b/c	Coefficient	b/d	Coefficient
.001	.000042	.051	.015119	.101	.041477	.151	.074590	.201	.112625
.002	.000119	.052	.015561	.102	.042081	.152	.075307	.202	.113427
.003	.000219	.053	.016008	.103	.042687	.153	.076028	.203	.114231
.004	.000337	.054	.016458	.104	.043296	.154	.076747	.204	.115036
.005	.000471	.055	.016912	.105	.043908	.155	.077470	.205	.115842
.006	.000619	.056	.017369	.106	.044523	.156	.078194	.206	.116651
.007	.000779	.057	.017831	.107	.045140	.157	.078921	.207	.117460
.008	.000952	.058	.018297	.108	.045759	.158	.079650	.208	.118271
.009	.001135	.059	.018766	.109	.046381	.159	.080380	.209	.119084
.010	.001329	.060	.019239	.110	.047006	.160	.081112	.210	.119898
.011	.001533	.061	.019716	.111	.047633	.161	.081847	.211	.120713
.012	.001746	.062	.020197	.112	.048262	.162	.082582	.212	.121530
.013	.001969	.063	.020681	.113	.048894	.163	.083320	.213	.122348
.014	.002199	.064	.021168	.114	.049529	.164	.084060	.214	.123167
.015	.002438	.065	.021660	.115	.050165	.165	.084801	.215	.123938
.016	.002685	.066	.022155	.116	.050805	.166	.085545	.216	.124811
.017	.002940	.067	.022653	.117	.051446	.167	.086290	.217	.125634
.018	.003202	.068	.023155	.118	.052090	.168	.087037	.218	.126459
.019	.003472	.069	.023660	.119	.052737	.169	.087785	.219	.127286
.020	.003749	.070	.024168	.120	.053385	.170	.088536	.220	.128114
.021	.004032	.071	.024680	.121	.054037	.171	.089288	.221	.128943
.022	.004322	.072	.025196	.122	.054690	.172	.090042	.222	.129773
.023	.004619	.073	.025714	.123	.055346	.173	.090797	.223	.130606
.024	.004922	.074	.026236	.124	.056004	.174	.091555	.224	.131438
.025	.005231	.075	.026761	.125	.066684	.175	.092314	.225	.132273
.026	.005546	.076	.027290	.126	.057327	.176	.093074	.226	.133109
.027	.005867	.077	.027821	.127	.057991	.177	.093837	.227	.133948
.028	.006194	.078	.028356	.128	.058658	.178	.094601	.228	.134784
.029	.006527	.079	.028894	.129	.059328	.179	.095367	.229	.135624
.030	.006866	.080	.029435	.130	.059999	.180	.096135	.230	.136465
.031	.007209	.081	.029979	.131	.060673	.181	.096904	.231	.137307
.032	.007559	.082	.030526	.132	.061349	.182	.097675	.232	.138151
.033	.007913	.083	.031077	.133	.062027	.183	.098447	.233	.138996
.034	.008273	.084	.031630	.134	.062707	.184	.099221	.234	.139842
.035	.008638	.085	.032186	.135	.063389	.185	.099997	.235	.140689
.036	.009008	.086	.032746	.136	.064074	.186	.100774	.236	.141538
.037	.009383	.087	.033308	.137	.064761	.187	.101553	.237	`.152388
.038	.009764	.088	.033873	.138	.065449	.188	.102334	.238	.143239
.039	.010148	.089	.034441	.139	.066140	.189	.103116	.239	.144091
.040	.010538	.090	.035012	.140	.066833	.190	.103900	.240	.144945
.041	.010932	.091	.035588	.141	.067528	.191	.104686	.241	.145800
.042	.011331	.092	.036162	.142	.068225	.192	.105472	.242	.146658
.043	.011734	.093	.036742	.143	.068924	.193	.106262	.243	.147513
.044	.012142	.094	.037324	.144	.069626	.194	.107051	.244	.148371
.045	.012555	.095	.037909	.145	.070329	.195	.107843	.245	.149321
.046	.012971	.096	.038497	.148	.071034	.196	.108636	.246	.150091
.047	.013393	.097	.039087	.147	.071741	.197	.109431	.247	.150953
.048	.013818	.098	.039681	.148	.072450	.198	.110227	.248	.151816
.049	.0145248	.099	.040277	.149	.073162	.199	.111025	.249	.152681
.050	.014681	.100	.040875	.150	.073875	.200	.111824	.250	.153548



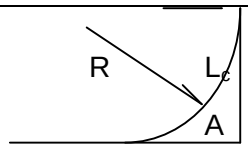
Areas of Circular Segments (cont.)

for Ratios of Rise and Diameter

b = Rise; d = Diameter

Area = d^2 x Coefficient

b/d	Coefficient	b/d	Coefficient	b/c	Coefficient	b/c	Coefficient	b/d	Coefficient
.251	.154413	.301	.199085	.351	.245935	.401	.294350	.451	.343778
.252	.155281	.302	.200003	.352	.246890	.402	.295330	.452	.344773
.253	.156149	.303	.200922	.353	.247845	.403	.296311	.453	.345768
.254	.157019	.304	.201841	.354	.248801	.404	.297292	.454	.346764
.255	.157891	.305	.202782	.355	.249758	.405	.298274	.455	.347760
.256	.158763	.306	.203683	.356	.250715	.406	.299256	.456	.348756
.257	.159636	.307	.204605	.357	.251673	.407	.300238	.457	.349752
.258	.160511	.308	.205528	.358	.252632	.408	.301221	.458	.350749
.259	.161386	.309	.206452	.359	.253591	.409	.302204	.459	.351745
.260	.162263	.310	.207376	.360	.254551	.410	.303187	.460	.352742
.261	.163141	.311	.208302	.361	.255511	.411	.304171	.461	.353739
.262	.164020	.312	.209228	.362	.256472	.412	.305156	.462	.354736
.263	.164900	.313	.210155	.363	.257433	.413	.306140	.463	.355733
.264	.165781	.314	.211083	.364	.258395	.414	.307125	.464	.356730
.265	.166663	.315	.212011	.365	.259358	.415	.308110	.485	.357728
.266	.167546	.316	.212941	.366	.260321	.416	.309096	.466	.358725
.267	.168431	.317	.213871	.367	.261285	.417	.310082	.467	.359723
.268	.169316	.318	.214802	.368	.262249	.418	.311068	.468	.360721
.269	.170202	.319	.215734	.369	.263214	.419	.312055	.469	.361719
.270	.171090	.320	.216666	.370	.264179	.420	.313042	.470	.36271`7
.271	.171978	.321	.217600	.371	.265145	.421	.314029	.471	.363715
.272	.172868	.322	.218534	.372	.266111	.422	.315017	.472	.364714
.273	.173758	.323	.219469	.373	.267078	.423	.316005	.473	.365712
.274	.174650	.324	.2204040	.374	.268046	.424	.316993	.474	.366711
.275	.175542	.325	.221341	.375	.269014	.425	.317981	.475	.367710
.276	.176436	.326	.222278	.376	.269982	.426	.318970	.476	.368706
.277	.177330	.327	.223216	.377	.270951	.427	.319959	.477	.369707
.278	.178226	.328	.224154	.378	.271921	.428	.320949	.478	.370706
.279	.179122	.329	.225094	.379	.272891	.429	.321938	.479	.371706
.280	.180020	.330	.226034	.380	.273861	.430	.322928	.480	.372704
.281	.180918	.331	.226974	.381	.274832	.431	.323919	.481	.373704
.282	.181818	.332	.227916	.382	.275804	.432	.324909	.482	.374703
.283	.182718	.333	.228858	.383	.276776	.433	.325900	.483	.375702
.284	.183619	.334	.229801	.384	.277748	.434	.326891	.484	.376702
.285	.184522	.335	.230745	.385	.278721	.435	.327883	.485	.377701
.296	.185425	.336	.231689	.386	.279695	.438	.328874	.486	.378701
.287	.186329	.337	.232634	.387	.280669	.437	.329866	.487	.370701
.288	.18725	.338	.233580	.388	.281643	.438	.330858	.488	.380700
.289	.188141	.339	.234526	.389	.282618	.439	.331851	.489	381700
.290	.189048	.340	.235473	.390	.283593	.440	.332843	.490	.382706
.291	.189956	.341	.236421	.391	.284569	.441	.333836	.491	.383700
.292	.190865	.342	.237369	.392	.285545	.442	.334829	.492	.384690
.293	.191774	.343	.238319	.393	.286521	.443	.335823	.493	385699
.294	.192685	.344	.239268	.394	.287499	.444	.336816	.494	.386890
.295	.193597	.345	.240219	.395	.288476	.445	.337810	.495	.387699
.296	.194509	.384	.241170	.396	.289454	.446	.338804	.496	.388690
.297	.195423	.347	.242122	.397	.290432	.447	.339796	.498	.389698
.298	.196337	.348	.243074	.398	.291411	.448	.340793	.498	.390699
.299	.197252	.349	.244027	.399	.292393	.449	.341788	.499	.391698
.300	.198168	.350	.244980	.400	.293370	.450	.342783	.500	.392699



Areas of 90° Fillets

R = Radius

L_c = Length of Curve

Area = R^2 x .214602

L_C = .0174533 R90°

= 1.570796 x 12

R	L_c	Area	R	L_c	Area
1	1.57	0.22	13.5	21.21	39.11
1.5	2.36	0.48	14	21.99	42.06
2	3.14	0.86	14.5	22.78	45.12
2.5	3.93	1.34	15	23.56	48.29
3	4.71	1.93	15.5	24.35	51.56
3.5	5.50	2.63	16	25.13	54.94
4	6.28	3.43	16.5	25.92	58.43
4.5	7.07	4.35	17	26.70	62.02
5	7.85	5.37	17.5	27.49	65.72
5.5	8.64	6.49	18	28.27	69.53
6	9.42	7.73	18.5	29.06	73.45
6.5	10.21	9.07	19	29.84	77.47
7	11.00	10.52	19.5	30.63	81.60
7.5	11.78	12.07	230	31.42	85.84
8	12.57	13.73	20.5	32.20	90.19
8.5	13.35	15.50	21	32.99	94.64
9	14.14	17.38	21.5	33.77	99.20
9.5	14.92	19.37	22	34.56	103.87
10	15.71	21.46	22.5	35.34	108.64
10.5	16.49	23.66	23	36.13	113.52
11	17.28	25.97	23.5	36.91	118.51
11.5	18.06	28.38	24	37.70	123.61
12	18.85	30.90	24.5	38.48	128.81
12.5	19.63	33.53	25	39.27	134.13
13	20.42	36.27	25.5	40.05	139.54

Areas of Fillets Other Than 90° =
R^2 [tan 4/2 - (.008727 x 4)]

Length of return other than 90° =
.0174533 x 4R

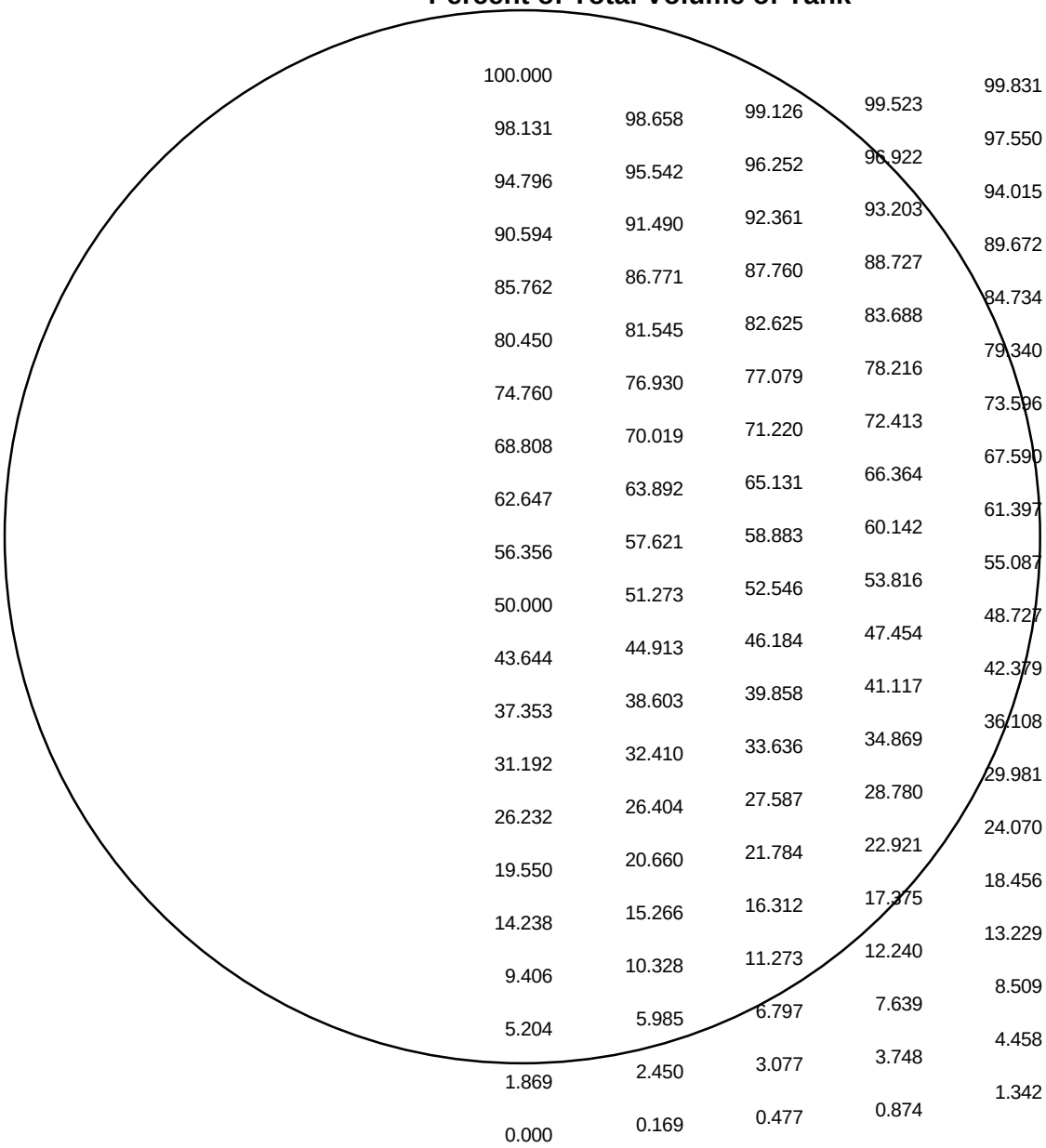
R	L_c	Area	R	L_c	Area
26	40.84	145.07	38.5	60.47	318.09
26.5	41.63	150.70	39	61.26	326.41
27	42.41	156.44	39.5	62.05	334.83
27.5	43.20	162.29	40	62.83	343.36
28	43.98	168.25	40.5	63.62	352.00
28.5	44.77	174.31	41	64.40	360.75
29	45.55	180.48	41.5	65.19	369.60
29.5	46.34	186.76	42	65.97	378.56
30	47.12	193.14	42.5	6.76	387.62
30.5	47.91	199.63	43	67.54	396.80
31.0	48.69	206.23	43.5	68.33	406.08
31.5	49.48	212.94	44	69.11	415.47
32	50.26	219.75	44.5	69.90	424.97
32.5	51.05	226.67	45	70.68	434.57
33	51.84	233.70	45.5	71.47	444.28
33.5	52.62	240.84	46	72.26	454.10
34	53.40	248.08	46.5	73.04	464.02
34.5	54.19	255.43	47	73.83	474.06
35	54.98	262.89	47.5	74.61	484.20
35.5	55.76	270.45	48	75.40	494.44
36	56.55	278.12	48.5	76.18	504.80
36.5	57.33	285.90	49	76.97	515.26
37	58.12	293.79	49.5	77.75	525.83
37.5	58.90	301.78	50	78.54	536.50
38	59.69	309.89			

Volume of Cylinder Tank

Sketch showing the relation between the depth and the volume of a liquid in a right cylinder tank when the axis of the tank is level. Percent of volume is set opposite percent of depth.

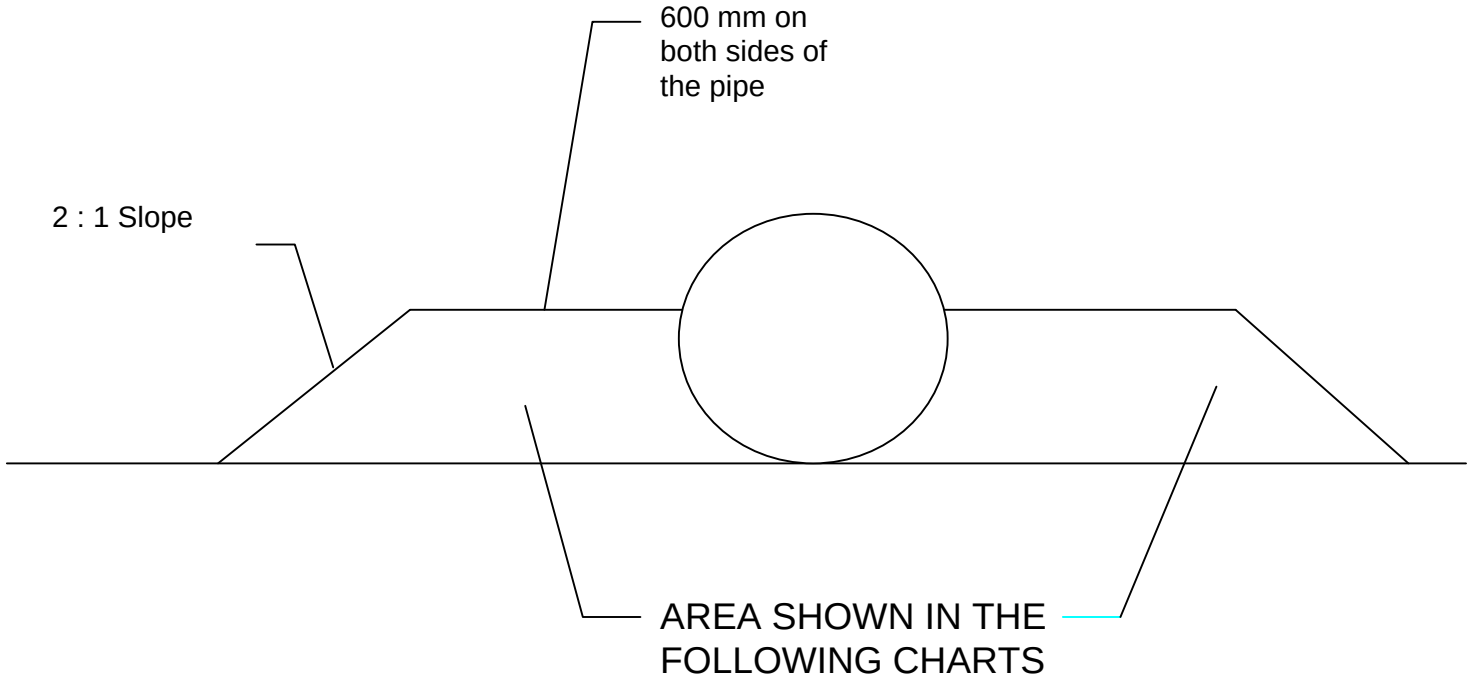
Exact Only for Right Cylinder tank

Percent of Total Volume of Tank



For Tanks with Crowned Ends, add to Volume of Right Cylinder Part of the Tank, the Volume of the **Two Crowned Ends** and use table **As Is** for results which will be considerably less than **One Percent In Error** when **Height (h)** of crown does not exceed **Twelve Percent** of the **Diameter** of the **Tank** and also when **Length (L)** of the right cylinder part of the tank is not less than the **Diameter (D)** of the tank. Percent of **Error** decreases as **L/D** increases.

CULVERT PIPE FILL



English Culvert Pipe-Arch Embankment Areas As Ft²

(Y=Height to Widest Section of Pipe as Feet)
Equivalent Round Size

Y	**24”**	**30”**	**36”**	**42”**	**48”**	**54”**	**60”**	**66”**	**72”**
0.1	0.6	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.3
0.2	1.1	1.1	1.1	1.2	1.3	1.4	1.5	1.7	1.8
0.3	1.6	1.6	1.6	1.7	1.8	1.9	2.1	2.2	2.4
0.4	2.0	2.2	2.2	2.2	2.4	2.5	2.6	2.8	2.9
0.5	2.8	2.7	2.7	2.7	2.9	3.1	3.2	3.4	3.5
0.6	3.7	3.6	3.5	3.4	3.4	3.7	3.8	4.0	4.2
0.7	4.6	4.6	4.5	4.4	4.2	4.1	4.5	4.7	4.9
0.8	5.5	5.6	5.6	5.5	5.3	5.0	4.9	5.4	5.6
0.9	6.5	6.6	6.7	6.7	6.5	6.2	5.9	5.8	5.7
1.0	7.5	7.7	7.8	7.9	7.8	7.5	7.1	6.8	6.7
1.1	8.6	8.8	9.0	9.1	9.1	8.9	8.6	8.1	7.8
1.2	9.7	10.0	10.2	10.4	10.4	10.3	10.0	9.6	9.2
1.3	10.8	11.2	11.5	11.7	11.8	11.7	11.5	11.2	10.8
1.4	12.0	12.4	12.8	13.1	13.2	13.2	13.1	12.8	12.4
1.5	13.2	13.7	14.1	14.5	14.7	14.7	14.6	14.4	14.1
1.6	14.5	15.0	15.5	15.9	16.2	16.3	16.3	16.1	15.8
1.7	15.8	16.4	16.9	17.4	17.7	17.9	17.9	17.8	17.6
1.8	17.1	17.8	18.4	18.;9	19.3	19.5	19.6	19.6	19.4
1.9	18.5	19.2	19.9	20.4	20.9	21.2	21.4	21.4	21.3
2.0	19.9	20.7	21.4	22.0	22.6	22.9	23.1	23.2	23.2
2.1	21.4	22.2	23.0	23.7	24.3	24.7	25.0	25.1	25.1
2.2	22.9	23.8	24.6	25.4	26.0	26.5	26.8	27.0	27.0
2.3	24.4	25.4	26.3	27.1	27.8	28.3	28.7	29.0	29.1
2.4	26.0	27.0	28.0	28.8	29.6	30.2	30.7	31.0	31.1
2.5	27.6	28.7	29.7	30.6	31.5	32.1	32.6	33.0	33.2
2.6	29.3	30.4	31.5	32.5	33.4	34.1	34.7	35.1	35.3
2.7	31.0	32.2	33.3	34.3	35.3	36.1	36.7	37.2	37.5
2.8	32.7	34.0	35.2	36.3	37.3	38.1	38.8	39.3	39.7
2.9	34.5	35.8	37.1	38.2	39.4	40.2	41.0	41.5	41.9
3.0	36.3	37.7	39.0	40.2	41.4	42.3	43.1	43.8	44.2
3.1	38.2	39.6	41.0	42.2	43.5	44.5	45.4	46.1	46.6
3.2	40.1	41.6	43.0	44.3	45.7	46.7	47.6	48.4	48.9
3.3	42.0	43.6	45.1	46.4	47.8	48.9	49.9	50.7	51.3
3.4	44.0	45.6	47.2	48.6	50.1	51.2	52.3	53.1	53.8
3.5	46.0	47.7	49.3	50.8	52.3	53.5	54.6	55.6	56.3
3.6	48.1	49.8	51.5	53.0	54.6	55.9	57.1	58.1	58.8
3.7	50.2	52.0	53.7	55.3	57.0	58.3	59.5	60.6	61.4
3.8	52.3	54.2	56.0	57.6	59.4	60.7	62.0	63.1	64.0
3.9	54.5	56.4	58.3	60.0	61.8	63.2	64.6	65.7	66.6
4.0	56.8	58.7	60.6	62.4	64.3	65.7	67.1	68.4	69.3
4.1	59.0	61.0	63.0	64.8	66.8	68.3	69.8	71.0	72.0
4.2	61.3	63.4	65.4	67.3	69.3	70.9	72.4	73.8	74.8
4.3	63.7	65.8	67.8	69.8	71.9	73.6	75.1	76.5	77.6
4.4	66.0	68.2	70.3	72.4	74.5	76.2	77.9	79.3	80.5
4.5	68.5	70.7	72.9	75.0	77.2	79.0	80.6	82.2	83.4
4.6	70.9	73.2	75.5	77.6	79.9	81.7	83.5	85.0	86.3
4.7	73.4	75.8	78.1	80.3	82.6	84.5	86.3	88.0	89.3
4.8	76.0	78.4	80.7	83.0	85.4	87.4	89.2	90.9	92.3
4.9	78.5	81.0	83.4	85.7	88.2	90.2	92.2	93.9	95.3
5.0	81.2	83.7	86.2	88.5	91.1	93.2	95.1	97.0	98.4

English Elliptical Culvert Pipe-Arch Embankment Areas as Ft²

(Y=Height to Widest Section of Pipe as Feet)

Equivalent Round Size

Y	24”	30”	36”	42”	48”	54”	60”	66”	72”
0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
0.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
0.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
0.4	2.0	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9
0.5	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5
0.6	3.3	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
0.7	4.0	4.0	3.9	3.9	3.9	3.9	3.9	3.9	3.9
0.8	4.9	4.8	4.7	4.7	4.7	4.6	4.6	4.6	4.6
0.9	5.9	5.7	5.6	5.5	5.5	5.4	5.4	5.4	5.4
1.0	6.9	6.7	6.5	6.4	6.4	6.3	6.3	6.2	6.2
1.1	8.0	7.8	7.5	7.4	7.3	7.2	7.2	7.1	7.1
1.2	9.1	9.0	8.6	8.4	8.3	8.2	8.2	8.1	8.1
1.3	10.3	10.2	9.9	9.5	9.4	9.3	9.2	9.1	9.1
1.4	11.5	11.5	11.2	10.8	10.6	10.4	10.3	10.2	10.1
1.5	12.7	12.8	12.6	12.2	11.9	11.6	11.5	11.4	11.3
1.6	14.0	14.1	14.0	13.7	13.3	12.9	12.7	12.6	12.5
1.7	15.3	15.5	15.4	15.2	14.9	14.3	14.1	13.9	13.7
1.8	16.6	16.9	16.9	16.7	16.5	15.9	15.5	15.2	15.1
1.9	18.0	18.3	18.4	18.3	18.1	17.6	17.0	16.7	16.5
2.0	19.4	19.8	19.9	19.9	19.8	19.4	18.7	18.2	18.0
2.1	20.9	21.4	21.5	21.6	21.5	21.1	20.6	19.9	19.6
2.2	22.4	23.0	23.2	23.3	23.3	23.0	22.5	21.7	21.2
2.3	24.0	24.6	24.8	25.0	25.1	24.8	24.4	23.7	23.0
2.4	25.6	26.2	26.6	26.8	26.9	26.7	26.4	25.7	24.9
2.5	27.2	27.9	28.3	28.6	28.8	28.7	28.4	27.9	27.1
2.6	28.9	29.7	30.1	30.5	30.7	30.7	30.4	29.9	29.2
2.7	30.6	31.4	31.9	32.4	32.7	32.7	32.5	32.1	31.5
2.8	32.3	33.3	33.8	34.3	34.7	34.8	34.7	34.8	33.7
2.9	34.1	35.1	35.7	36.3	36.7	36.9	36.8	36.5	38.0
3.0	35.9	37.0	37.7	38.3	38.8	39.0	39.1	38.8	38.4
3.1	37.8	38.9	39.7	40.4	40.9	41.2	41.3	41.1	40.7
3.2	39.7	40.9	41.7	42.5	43.1	43.4	43.6	43.4	43.2
3.3	41.7	42.9	43.8	44.6	45.3	45.7	45.9	45.8	45.6
3.4	43.7	45.0	45.9	46.8	47.5	48.0	48.3	48.2	48.1
3.5	45.7	47.1	48.1	49.0	49.8	50.4	50.7	50.7	50.6
3.6	47.8	49.2	50.3	51.3	52.1	52.7	53.2	53.2	53.2
3.7	49.9	51.4	52.5	53.6	54.5	55.2	55.7	55.8	55.8
3.8	52.0	53.6	54.8	55.9	56.9	57.6	58.2	58.4	58.5
3.9	54.2	55.9	57.1	58.3	59.3	60.1	60.8	61.0	61.2
4.0	56.4	58.2	59.4	60.8	61.8	62.7	63.4	63.7	63.9
4.1	58.7	60.5	61.8	63.2	64.3	65.3	66.0	66.4	66.7
4.2	61.0	62.9	64.3	65.7	66.9	67.9	68.7	69.1	69.5
4.3	63.4	65.3	66.7	68.3	69.5	70.6	71.5	71.9	72.4
4.4	65.8	67.8	69.3	70.8	72.1	73.3	74.2	74.8	75.3
4.5	68.2	70.3	71.8	73.5	74.8	76.0	77.1	77.6	78.2
4.6	70.7	72.8	74.4	76.1	77.5	78.8	79.9	80.5	81.2
4.7	73.2	75.4	77.0	78.8	80.3	81.6	82.9	83.5	84.2
4.8	75.7	78.0	79.7	81.6	83.1	84.5	85.7	86.5	87.3
4.9	78.3	80.6	82.4	84.3	85.9	87.4	88.7	89.5	90.4
5.0	80.9	83.3	85.2	87.2	88.8	90.4	91.7	92.6	93.5

English Circular Culvert Pipe Embankment End Areas as Ft²

(Y=Height to Center of Pipe as Feet)

Pipe Diameter

Y	12”	15”	18”	24”	30”	36”	42”	48”	54”	60”	72”
0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
0.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
0.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
0.4	2.0	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
0.5	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
0.6	3.3	3.3	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.1	3.1
0.7	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.8
0.8	4.9	4.9	4.8	4.7	4.6	4.6	4.6	4.6	4.6	4.5	4.5
0.9	5.7	5.7	5.7	5.5	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.0	6.6	6.6	6.6	6.4	6.3	6.2	6.2	6.2	6.2	6.1	6.1
1.1	7.5	7.6	7.6	7.4	7.2	7.1	7.1	7.1	7.0	7.0	7.0
1.2	8.5	8.6	8.6	8.5	8.2	8.1	8.0	8.0	7.9	7.9	7.9
1.3	9.5	9.6	9.6	9.6	9.4	9.1	9.0	9.0	8.9	8.9	8.8
1.4	10.5	10.7	10.7	10.7	10.6	10.3	10.1	10.0	10.0	9.9	9.8
1.5	11.6	11.8	11.9	11.9	11.8	11.5	11.2	11.1	11.0	11.0	10.9
1.6	12.7	12.9	13.0	13.1	13.1	12.8	12.5	12.3	12.2	12.1	12.0
1.7	13.9	14.1	14.2	14.4	14.4	14.1	13.7	13.5	13.4	13.3	13.2
1.8	15.1	15.3	15.5	15.7	15.7	15.5	15.2	14.8	14.7	14.5	14.4
1.9	16.3	16.6	16.8	17.0	17.1	17.0	16.7	16.2	16.0	15.8	15.6
2.0	17.6	17.9	18.1	18.4	18.5	18.5	18.2	17.7	17.4	17.2	17.3
2.1	18.9	19.2	19.5	19.8	20.0	20.0	19.8	19.3	18.9	18.6	18.3
2.2	20.3	20.6	20.9	21.3	21.5	21.5	21.4	21.0	20.5	20.1	19.8
2.3	21.7	22.0	22.3	22.8	23.1	23.1	23.0	22.7	22.2	21.7	21.3
2.4	23.1	23.5	23.8	24.3	24.7	24.8	24.7	24.4	24.0	23.4	22.9
2.5	24.6	25.0	25.4	25.9	26.3	26.5	26.4	26.2	25.8	25.2	24.5
2.6	26.1	26.6	26.9	27.5	28.0	28.2	28.2	28.0	27.7	27.1	26.2
2.7	27.7	28.1	28.5	29.2	29.7	29.9	30.0	29.9	29.6	29.1	28.0
2.8	29.3	29.8	30.2	30.9	31.4	31.7	31.9	31.8	31.5	31.1	29.8
2.9	30.9	31.4	31.9	32.6	33.2	33.6	33.8	33.7	33.5	33.1	31.8
3.0	32.6	33.1	33.6	34.4	35.0	35.5	35.7	35.7	35.5	35.2	33.9
3.1	34.3	34.9	35.4	36.2	36.9	37.4	37.7	37.7	37.6	37.3	36.1
3.2	36.1	37.6	37.2	38.1	38.8	39.3	39.7	39.8	39.7	39.5	38.3
3.3	37.9	38.5	39.0	40.0	40.8	41.3	41.7	41.9	41.9	41.7	40.6
3.4	39.7	40.4	40.9	41.9	42.8	43.4	43.8	44.0	44.1	43.9	43.0
3.5	41.6	42.3	42.9	43.9	44.8	45.5	45.9	46.2	46.3	46.2	45.4
3.6	43.5	44.2	44.8	45.9	46.9	47.6	48.1	48.4	48.6	48.5	47.8
3.7	45.5	46.2	46.8	48.0	49.0	49.7	50.3	50.7	50.9	50.9	50.2
3.8	47.5	48.2	48.9	50.1	51.1	51.9	52.6	53.0	53.2	53.3	52.7
3.9	49.5	50.3	51.0	52.2	53.3	54.2	54.9	55.3	55.6	55.7	55.3
4.0	51.6	52.4	53.1	54.4	55.5	56.5	57.2	57.7	58.0	58.2	57.9
4.1	53.7	54.5	55.3	56.6	57.8	58.8	59.6	60.1	60.5	60.7	60.5
4.2	55.9	56.7	57.5	58.9	60.1	61.1	62.0	62.5	63.0	63.3	63.1
4.3	58.1	58.9	59.7	51.2	62.5	63.5	64.4	65.1	65.6	65.9	65.8
4.4	60.3	61.2	62.0	63.5	64.9	66.0	66.9	67.6	68.2	68.5	68.6
4.5	62.6	63.5	64.4	65.9	67.3	68.5	69.4	70.2	70.8	71.2	71.4
4.6	64.9	65.9	66.7	68.3	69.8	71.0	72.0	72.8	73.5	73.9	74.2
4.7	67.3	68.2	69.1	70.8	72.3	73.5	74.6	75.5	76.2	76.7	77.0
4.8	69.7	70.7	71.6	73.3	74.8	76.1	77.3	78.2	78.9	79.5	79.9
4.9	72.1	73.1	74.1	75.8	77.4	78.8	80.0	80.9	81.7	82.3	82.9
5.0	74.6	75.6	76.6	78.4	80.0	81.5	82.7	83.7	84.5	85.2	85.9

Metric Circular Culvert Pipe Embankment End Areas as m²

(Y=Height to Center of Pipe as mm)

Pipe Diameter

Y	12”	15”	18”	24”	30”	36”	42”	48”	54”	60”	72”
30	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161
60	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613
90	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064
122	0.185806	0.185806	0.176516	0.176516	0.176516	0.176516	0.176516	0.176516	0.176516	0.176516	0.176516
152	0.241548	0.241548	0.241548	0.232258	0.232258	0.232258	0.232258	0.232258	0.232258	0.232258	0.232258
183	0.30658	0.30658	0.29729	0.29729	0.29729	0.29729	0.29729	0.29729	0.29729	0.287999	0.287999
213	0.380902	0.371612	0.371612	0.362322	0.362322	0.362322	0.353032	0.353032	0.353032	0.353032	0.353032
244	0.455225	0.455225	0.445935	0.436644	0.427354	0.427354	0.427354	0.427354	0.427354	0.418064	0.418064
274	0.529547	0.529547	0.529547	0.510967	0.501676	0.501676	0.501676	0.492386	0.492386	0.492386	0.492386
305	0.61316	0.61316	0.61316	0.594579	0.585289	0.575999	0.575999	0.575999	0.575999	0.566709	0.566709
335	0.696773	0.706063	0.706063	0.687482	0.668902	0.659612	0.659612	0.659612	0.650321	0.650321	0.650321
365	0.789676	0.798966	0.798966	0.789676	0.761805	0.752515	0.743224	0.743224	0.733934	0.733934	0.733934
396	0.882579	0.891869	0.891869	0.891869	0.873289	0.845418	0.836127	0.836127	0.826837	0.826837	0.817547
427	0.975482	0.994063	0.994063	0.994063	0.984772	0.956901	0.938321	0.92903	0.92903	0.91974	0.91045
457	1.077675	1.096256	1.105546	1.105546	1.096256	1.068385	1.040514	1.031224	1.021933	1.021933	1.012643
488	1.179869	1.198449	1.20774	1.21703	1.21703	1.189159	1.161288	1.142707	1.133417	1.124127	1.114836
518	1.291352	1.309933	1.319223	1.337804	1.337804	1.309933	1.272772	1.254191	1.244901	1.23561	1.22632
550	1.402836	1.421417	1.439997	1.458578	1.458578	1.439997	1.412126	1.374965	1.365675	1.347094	1.337804
580	1.51432	1.54219	1.560771	1.579352	1.588642	1.579352	1.551481	1.505029	1.486449	1.467868	1.449287
610	1.635094	1.662964	1.681545	1.709416	1.718706	1.718706	1.690835	1.644384	1.616513	1.597932	1.607223
640	1.755867	1.783738	1.811609	1.83948	1.858061	1.858061	1.83948	1.793029	1.755867	1.727997	1.700126
670	1.885932	1.913803	1.941674	1.978835	1.997415	1.997415	1.988125	1.950964	1.904512	1.867351	1.83948
700	2.015996	2.043867	2.071738	2.118189	2.14606	2.14606	2.13677	2.108899	2.062447	2.015996	1.978835
732	2.14606	2.183221	2.211092	2.257544	2.294705	2.303995	2.294705	2.266834	2.229673	2.173931	2.12748
762	2.285415	2.322576	2.359737	2.406189	2.44335	2.461931	2.45264	2.43406	2.396898	2.341157	2.276124
793	2.424769	2.471221	2.499092	2.554834	2.601285	2.619866	2.619866	2.601285	2.573414	2.517672	2.43406
823	2.573414	2.610575	2.647737	2.712769	2.75922	2.777801	2.787091	2.777801	2.74993	2.703478	2.601285
854	2.722059	2.768511	2.805672	2.870704	2.917155	2.945026	2.963607	2.954317	2.926446	2.889285	2.768511
884	2.870704	2.917155	2.963607	3.028639	3.084381	3.121542	3.140123	3.130832	3.112252	3.075091	2.954317
914	3.028639	3.075091	31.21542	3.195865	3.251606	3.298058	3.316639	3.316639	3.298058	3.270187	3.149413
944	3.186574	3.242316	3.288768	3.36309	3.428122	3.474574	3.502445	3.502445	3.493154	3.465283	3.3538
974	3.3538	3.409542	3.455993	3.539606	3.604638	3.651089	3.688251	3.697541	3.688251	3.66967	3.558186
1005	3.521025	3.576767	3.623219	3.716122	3.790444	3.836896	3.874057	3.892637	3.892637	3.874057	3.771863
1036	3.688251	3.753283	3.799734	3.892637	3.97625	4.031992	4.069153	4.087734	4.097024	4.078443	3.994831
1066	3.864766	3.929799	3.98554	4.078443	4.162056	4.227088	4.26425	4.29212	4.301411	4.29212	4.217798
1097	4.041282	4.106314	4.162056	4.26425	4.357153	4.422185	4.468636	4.496507	4.515088	4.505797	4.440765
1127	4.227088	4.29212	4.347862	4.459346	4.552249	4.617281	4.673023	4.710184	4.728765	4.728765	4.663733
1158	4.412894	4.477927	4.542959	4.654442	4.747345	4.821668	4.8867	4.923861	4.942442	4.951732	4.89599
1188	4.5987	4.673023	4.738055	4.849539	4.951732	5.035345	5.100377	5.137538	5.165409	5.174699	5.137538
1219	4.793797	4.868119	4.933151	5.053925	5.156119	5.249022	5.314054	5.360505	5.388376	5.406957	5.379086
1250	4.988893	5.063216	5.137538	5.258312	5.369796	5.462699	5.537021	5.583473	5.620634	5.639215	5.620634
1280	5.19328	5.267602	5.341925	5.471989	5.583473	5.676376	5.759988	5.80644	5.852892	5.880762	5.862182
1311	5.397667	5.471989	5.546311	5.685666	5.80644	5.899343	5.982956	6.047988	6.094439	6.12231	6.11302
1341	5.602053	5.685666	5.759988	5.899343	6.029407	6.131601	6.215213	6.280246	6.335987	6.363858	6.373149
1372	5.81573	5.899343	5.982956	6.12231	6.252375	6.363858	6.447471	6.521793	6.577535	66.14696	6.633277
1402	6.029407	6.12231	6.196633	6.345278	6.484632	6.596116	6.689019	6.763341	6.828373	6.865535	6.893406
1433	6.252375	6.335987	6.4196	6.577535	6.71689	6.828373	6.930567	7.01418	7.079212	7.125663	7.153534
1463	6.475342	6.568245	6.651858	6.809793	6.949147	7.069921	7.181405	7.265018	7.33005	7.385792	7.422953
1494	6.698309	6.791212	6.884115	7.04205	7.190695	7.32076	7.432243	7.515856	7.590178	7.64592	7.701662
1524	6.930567	7.02347	7.116373	7.283598	7.432243	7.571598	7.683081	7.775984	7.850307	7.915339	7.980371

Metric Culvert Pipe-Arch Embankment Areas as m²

(Y=Height to Widest Section of Pipe as mm)

Equivalent Round Size

Y	24”	30”	36”	42”	48”	54”	60”	66”	72”
30	0.055742	0.055742	0.065032	0.065032	0.074322	0.083613	0.092903	0.111484	0.120774
60	0.102193	0.102193	0.102193	0.111484	0.120774	0.130064	0.139355	0.157935	0.167225
90	0.148645	0.148645	0.148645	0.157935	0.167225	0.176516	0.195096	0.204387	0.222967
122	0.185806	0.204387	0.204387	0.204387	0.222967	0.232258	0.241548	0.260129	0.269419
152	0.260129	0.250838	0.250838	0.250838	0.269419	0.287999	0.29729	0.31587	0.325161
183	0.343741	0.334451	0.325161	0.31587	0.31587	0.343741	0.353032	0.371612	0.390193
213	0.427354	0.427354	0.418064	0.408773	0.390193	0.380902	0.418064	0.436644	0.455225
244	0.510967	0.520257	0.520257	0.510967	0.492386	0.464515	0.455225	0.501676	0.520257
274	0.60387	0.61316	0.62245	0.62245	0.60387	0.575999	0.548128	0.538838	0.529547
305	0.696773	0.715353	0.724644	0.733934	0.724644	0.696773	0.659612	0.631741	0.62245
335	0.798966	0.817547	0.836127	0.845418	0.845418	0.826837	0.798966	0.752515	0.724644
365	0.901159	0.92903	0.947611	0.966192	0.966192	0.956901	0.92903	0.891869	0.854708
396	1.003353	1.040514	1.068385	1.086966	1.096256	1.086966	1.068385	1.040514	1.003353
427	1.114836	1.151998	1.189159	1.21703	1.22632	1.22632	1.21703	1.189159	1.151998
457	1.22632	1.272772	1.309933	1.347094	1.365675	1.365675	1.356384	1.337804	1.309933
488	1.347094	1.393546	1.439997	1.477158	1.505029	1.51432	1.51432	1.495739	1.467868
518	1.467868	1.52361	1.570061	1.616513	1.644384	1.662964	1.662964	1.653674	1.635094
550	1.588642	1.653674	1.709416	1.755867	1.793029	1.811609	1.8209	1.8209	1.802319
580	1.718706	1.783738	1.84877	1.895222	1.941674	1.969544	1.988125	1.988125	1.978835
610	1.84877	1.923093	1.988125	2.043867	2.099609	2.12748	2.14606	2.155351	2.155351
640	1.988125	2.062447	2.13677	2.201802	2.257544	2.294705	2.322576	2.331866	2.331866
670	2.12748	2.211092	2.285415	2.359737	2.415479	2.461931	2.489801	2.508382	2.508382
700	2.266834	2.359737	2.44335	2.517672	2.582705	2.629156	2.666317	2.694188	2.703478
732	2.415479	2.508382	2.601285	2.675608	2.74993	2.805672	2.852123	2.879994	2.889285
762	2.564124	2.666317	2.75922	2.842833	2.926446	2.982188	3.028639	3.0658	3.084381
793	2.722059	2.824252	2.926446	3.019349	3.102962	3.167994	3.223735	3.260897	3.279477
823	2.879994	2.991478	3.093671	3.186574	3.279477	3.3538	3.409542	3.455993	3.483864
854	3.037929	3.158703	3.270187	3.37238	3.465283	3.539606	3.604638	3.651089	3.688251
884	3.205155	3.325929	3.446703	3.548896	3.66038	3.734702	3.809025	3.855476	3.892637
914	3.37238	3.502445	3.623219	3.734702	3.846186	3.929799	4.004121	4.069153	4.106314
944	3.548896	3.67896	3.809025	3.920508	4.041282	4.134185	4.217798	4.28283	4.329282
974	3.725412	3.864766	3.994831	4.115605	4.245669	4.338572	4.422185	4.496507	4.542959
1005	3.901928	4.050573	4.189927	4.310701	4.440765	4.542959	4.635862	4.710184	4.765926
1036	4.087734	4.236379	4.385023	4.515088	4.654442	4.756636	4.858829	4.933151	4.998184
1066	4.27354	4.431475	4.58012	4.719474	4.858829	4.970313	5.072506	5.165409	5.230441
1097	4.468636	4.626571	4.784507	4.923861	5.072506	5.19328	5.304764	5.397667	5.462699
1127	4.663733	4.830958	4.988893	5.137538	5.295473	5.416247	5.527731	5.629924	5.704247
1158	4.858829	5.035345	5.20257	5.351215	5.518441	5.639215	5.759988	5.862182	5.945795
1188	5.063216	5.239731	5.416247	5.574182	5.741408	5.871472	6.001536	6.10373	6.187342
1219	5.276893	5.453408	5.629924	5.79715	5.973665	6.10373	6.233794	6.354568	6.438181
1250	5.481279	5.667085	5.852892	6.020117	6.205923	6.345278	6.484632	6.596116	6.689019
1280	5.694956	5.890053	6.075859	6.252375	6.438181	6.586826	6.72618	6.856244	6.949147
1311	5.917924	6.11302	6.298826	6.484632	6.679729	6.837664	6.977018	7.107083	7.209276
1341	6.131601	6.335987	6.531084	6.72618	6.921276	7.079212	7.237147	7.367211	7.478695
1372	6.363858	6.568245	6.772632	6.967728	7.172115	7.33934	7.487985	7.63663	7.748114
1402	6.586826	6.800503	7.01418	7.209276	7.422953	7.590178	7.757404	7.896758	8.017532
1433	6.819083	7.04205	7.255727	7.460114	7.673791	7.850307	8.017532	8.175468	8.296241
1463	7.060631	7.283598	7.497275	7.710952	7.93392	8.119726	8.286951	8.444886	8.574951
1494	7.292889	7.525146	7.748114	7.961791	8.194048	8.379854	8.56566	8.723595	8.85366
1524	7.543727	7.775984	8.008242	8.221919	8.463467	8.658563	8.835079	9.011595	9.141659

Metric Elliptical Culvert Pipe-Arch Embankment Areas as m²

(Y=Height to Widest Section of Pipe as mm)

Equivalent Round Size

Y	24”	30”	36”	42”	48”	54”	60”	66”	72”
30	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161	0.037161
60	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613	0.083613
90	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064	0.130064
122	0.185806	0.185806	0.176516	0.176516	0.176516	0.176516	0.176516	0.176516	0.176516
152	0.241548	0.241548	0.241548	0.232258	0.232258	0.232258	0.232258	0.232258	0.232258
183	0.30658	0.29729	0.29729	0.29729	0.29729	0.29729	0.29729	0.29729	0.29729
213	0.371612	0.371612	0.362322	0.362322	0.362322	0.362322	0.362322	0.362322	0.362322
244	0.455225	0.445935	0.436644	0.436644	0.436644	0.427354	0.427354	0.427354	0.427354
274	0.548128	0.529547	0.520257	0.510967	0.510967	0.501676	0.501676	0.501676	0.501676
305	0.641031	0.62245	0.60387	0.594579	0.594579	0.585289	0.585289	0.575999	0.575999
335	0.743224	0.724644	0.696773	0.687482	0.678192	0.668902	0.668902	0.659612	0.659612
365	0.845418	0.836127	0.798966	0.780386	0.771095	0.761805	0.761805	0.752515	0.752515
396	0.956901	0.947611	0.91974	0.882579	0.873289	0.863998	0.854708	0.845418	0.845418
427	1.068385	1.068385	1.040514	1.003353	0.984772	0.966192	0.956901	0.947611	0.938321
457	1.179869	1.189159	1.170578	1.133417	1.105546	1.077675	1.068385	1.059095	1.049804
488	1.300643	1.309933	1.300643	1.272772	1.23561	1.198449	1.179869	1.170578	1.161288
518	1.421417	1.439997	1.430707	1.412126	1.384255	1.328513	1.309933	1.291352	1.272772
550	1.54219	1.570061	1.570061	1.551481	1.5329	1.477158	1.439997	1.412126	1.402836
580	1.672255	1.700126	1.709416	1.700126	1.681545	1.635094	1.579352	1.551481	1.5329
610	1.802319	1.83948	1.84877	1.84877	1.83948	1.802319	1.737287	1.690835	1.672255
640	1.941674	1.988125	1.997415	2.006706	1.997415	1.960254	1.913803	1.84877	1.8209
670	2.081028	2.13677	2.155351	2.164641	2.164641	2.13677	2.090318	2.015996	1.969544
700	2.229673	2.285415	2.303995	2.322576	2.331866	2.303995	2.266834	2.201802	2.13677
732	2.378318	2.43406	2.471221	2.489801	2.499092	2.480511	2.45264	2.387608	2.313286
762	2.526963	2.591995	2.629156	2.657027	2.675608	2.666317	2.638446	2.591995	2.517672
793	2.684898	2.75922	2.796382	2.833543	2.852123	2.852123	2.824252	2.777801	2.712769
823	2.842833	2.917155	2.963607	3.010058	3.037929	3.037929	3.019349	2.982188	2.926446
854	3.000768	3.093671	3.140123	3.186574	3.223735	3.233026	3.223735	3.186574	3.130832
884	3.167994	3.260897	3.316639	3.37238	3.409542	3.428122	3.418832	3.390961	3.344509
914	3.335219	3.437412	3.502445	3.558186	3.604638	3.623219	3.632509	3.604638	3.567477
944	3.511735	3.613928	3.688251	3.753283	3.799734	3.827605	3.836896	3.818315	3.781154
974	3.688251	3.799734	3.874057	3.948379	4.004121	4.031992	4.050573	4.031992	4.013411
1005	3.874057	3.98554	4.069153	4.143476	4.208508	4.245669	4.26425	4.254959	4.236379
1036	4.059863	4.180637	4.26425	4.347862	4.412894	4.459346	4.487217	4.477927	4.468636
1066	4.245669	4.375733	4.468636	4.552249	4.626571	4.682313	4.654442	4.710184	4.700894
1097	4.440765	4.57083	4.673023	4.765926	4.840248	4.89599	4.942442	4.942442	4.942442
1127	4.635862	4.775216	4.87741	4.979603	5.063216	5.128248	5.174699	5.18399	5.18399
1158	4.830958	4.979603	5.091087	5.19328	5.286183	5.351215	5.406957	5.425538	5.434828
1188	5.035345	5.19328	5.304764	5.416247	5.50915	5.583473	5.648505	5.667085	5.685666
1219	5.239731	5.406957	5.518441	5.648505	5.741408	5.825021	5.890053	5.917924	5.936504
1250	5.453408	5.620634	5.741408	5.871472	5.973665	6.066569	6.131601	5.239731	6.196633
1280	5.667085	5.843601	5.973665	6.10373	6.215213	6.308116	6.382439	6.4196	6.456761
1311	5.890053	6.066569	6.196633	6.345278	6.456761	6.558955	6.642567	6.679729	6.72618
1341	6.11302	6.298826	6.438181	6.577535	6.698309	6.809793	6.893406	6.949147	6.995599
1372	6.335987	6.531084	6.670438	6.828373	6.949147	7.060631	7.162824	7.209276	7.079212
1402	6.568245	6.763341	6.911986	7.069921	7.199986	7.302179	7.422953	7.478695	7.543727
1433	6.800503	7.004889	7.153534	7.32076	7.460114	7.580888	7.701662	7.757404	7.822436
1463	7.03276	7.246437	7.404372	7.580888	7.720243	7.850307	7.961791	8.036113	8.110435
1494	7.274308	7.487985	7.65521	7.831726	7.980371	8.119726	8.2405	8.314822	8.398435
1524	7.515856	7.738823	7.915339	8.101145	8.24979	8.398435	8.519209	8.602822	8.686434

Weights of Prestressed Concrete Bearing Pile

For computing bearing capacity required on Form RD-209

Pile Type	Constant Section Wt. Per Lin. Ft. (Pounds)	Tapered Section Total Weight (Pounds)
I	148	None
II	200	None
III	173	None
IV	212	None
V	124	1740
VI	169	2500
VII	221	2950

This table is based on and is for use only with Standard Plan 1720-C-R2.

Steel Pipe Pile Data

	ARMCO		Union Metal
Size O.D. (ins)	12	12¾	12 (Nominal)
Wall T. (ins)	.188	.188	7 Ga.
Wt. per Lin. Ft. (lbs.)	23.72	25.16	25.3
Conc. per Lin. Ft. (C.Y.)	.0273	.0309	.0255

Union Metal 30'tapered Se. Type F. Total Wt. 589 Lbs. Conc. 0.55 Cu.Yd.

Size O.E. (ins.)	14	14 (Nominal)
Wall T. (ins.)	.188	7 Ga.
Wt. per Lin. Ft. (Lbs.)	27.66	29.5
Conc. per Lin. Ft. (C.Y.)	.0375	.0350

Union Metal 40'tapered Sec. Type F. Total Wt. 895 Lbs. Conc. 0.95 Cu.Yd.

For Raymond step tapered pile contact your District Construction Engineer.