

SECTION 602 CONCRETE STRUCTURES

602.01 DESCRIPTION.

This work consists of the construction of bridges, cast-in-place box culverts, retaining walls, or portions thereof as shown on the Plans.

602.02 MATERIALS.

The materials shall meet Section 800.

602.03 CONSTRUCTION REQUIREMENTS.

Construction methods used shall be those specified for the items which constitute the completed structure together with the following requirements:

A. Foundations and Substructures.

1. **General.** Elevations and dimensions of all footings shall be as specified, unless changes are ordered in writing by the Engineer.
2. **Excavation and Backfill.** Excavation and backfill shall meet Section 210.
3. **Placement for Dry Footing.** In stable soils that stand vertically without slough or cave in on the excavation, the footing may be constructed without forms to neat lines at least one inch outside the established footing limits. Payment will not be made for any increase in concrete quantities. Excavation will be computed according to Section 210.

Concrete shall not be placed in any footing until the underlying materials or bearing capability of the piles has been inspected and approved.

4. **Underwater Placement.** Foundation seal concrete shall be placed in forms so the water remains still during placement and curing. The cement content shall be 10% greater than normally required for the class of concrete specified.

Foundation seal concrete deposited under water shall be placed in its final position by a tremie or other method that prevents segregation. The tremie shall have a tube diameter of at least 10 inches and be constructed in sections having flanged couplings fitted with gaskets. The tremie shall be supported to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering to retard or stop the flow of concrete. The discharge end shall be closed and sealed at the start of work to prevent water

entering the tube. The tremie tube shall be kept full and the concrete flow shall be placed by slightly raising the discharge end. The flow shall be continuous until work is completed. The discharge end shall remain in the deposited concrete throughout the pour.

Aluminum tremies shall not be used.

Seal concrete shall be placed continuously from start to finish. The surface of the concrete shall be kept horizontal, and each lift of concrete shall be placed before the preceding layer has taken initial set. The seal concrete shall not be disturbed after placement.

All loose material and seal concrete that interferes with reinforcing steel placement shall be removed.

Foundation seal concrete, which is not part of the regular substructure footing and is not a bid item, will be paid for at the same Contract Unit Price per Cubic Yard as the class of concrete specified for the footings. This price will include the 10% additional cement required in the foundation seal. Foundation seals will be paid for only when specified or authorized by the Engineer.

5. **Column or Wall Placement.** Concrete in columns or walls shall be placed in one continuous operation.

Concrete in the columns shall be allowed to set at least 24 hours before placing pier cap reinforcing and concrete.

B. Superstructure.

1. **General.** Concrete placement in superstructures shall meet Section 602.03 E and the following Sections. Deck concrete shall not be placed until the substructure concrete is at least 14 days old or has reached 70% of design strength.

Concrete placement shall not start if inclement weather is imminent.

Concrete deck slabs shall be placed in one continuous operation at a minimum rate of 25 cubic yards per hour. Concrete curbs and rails are exempt from this minimum rate but shall be placed in one continuous operation.

If concrete pouring operations is stopped, a keyed transverse construction joint shall be installed at a location determined by the Engineer. All concrete beyond the joint shall be removed. If corrective measures are not feasible and the deck is not within the specified tolerances, the unacceptable work shall be removed. Removal, reforming, cleaning or replacement of reinforcing steel, and replacement of concrete shall be at the Contractor's expense.

2. **Deck Finishing.** The deck finishing machine shall meet Section 153.09 B.

Before concrete placement, the finishing machine shall be moved across the rails to check and adjust the screed to assure that proper concrete deck thickness and cover over the reinforcing steel is obtained.

A uniform quantity of concrete shall be carried in front of the strike-off for its entire length to fill all voids and keep the finished surface at the required crown and cross section.

Following the screeding operations, final surfacing shall be obtained by using a scraping straightedge, 10 feet long with a suitable handle. The final surface shall have the required crown and shall not vary more than 1/8 inch from a 10-foot straightedge laid longitudinally thereon.

A burlap or artificial grass drag shall be pulled over the surface in a longitudinal direction while the concrete is plastic, followed immediately with the following finish:

- a. **Metal Tine Finish.** The tining device shall meet the requirements of Section 550.04 J.6. The tining shall be stopped 18 inches from the face of the curb and 6 inches from the beginning and end of the deck. Tining machine may be hand operated on bridge decks.
3. **Final Testing.** The entire bridge deck shall be tested for surface irregularities with a 10-foot straightedge after the concrete has hardened. Areas with a deviation greater than 1/8 inch, but less than 1/2 inch, shall be ground down until the deviation is 1/8 inch or less. The tined surface texture removed by grinding shall be restored by cutting transverse grooves with diamond-bladed equipment. All grinding and grooving shall be at the Contractor's expense. In addition to the grinding and grooving, the following penalties will be placed on each square yard or fraction thereof, of any deck surface out of tolerance:

Out of Tolerance

Penalty Per S.Y.

Greater than 1/8 inch and less than or equal to 1/4 inch

2-1/2% of Price Bid per C.Y. of Deck Concrete

Greater than 1/4 inch and less than or equal to 1/2 inch

7-1/2% of Price Bid per C.Y. of Deck Concrete

Greater than 1/2 inch

A determination of serviceability will be made according to Section 105.07.

4. **Barriers.** The Portland Cement Concrete for barriers shall meet Class AAE-3 of Section 802.

Lines of the barrier shall be parallel to the roadway surface and roadway centerlines. Surface tolerance shall be within 3/8 inch in a 10-foot straightedge. Corrections for surfaces out of tolerance shall be made by grinding, filling with an approved epoxy mortar, or replacing.

Barriers shall be constructed using one of the following methods:

- a. **Conventional Forming.** Expansion joint locations shall be as specified. Forms shall be adequately tied to avoid any shifting during concrete placement.

If barrier forms are held in place by concrete inserts in the deck slab, the inserts shall be removed after the forms are removed and the cavities in

the deck slab shall be cleaned and filled flush with an epoxy resin adhesive meeting Section 806.

- b. **Slipforming.** The slipforming equipment shall be set to the required grade and alignment. After the reinforcement is installed, the clear distance between the reinforcement and the slipform shall be checked for the entire length of pour to assure the required depth of concrete cover is obtained.

Slab overhangs may be increased up to one inch in distance, and the outside of the barrier may be battered up to one inch, except that the Plan gutterline shall be maintained as shown.

The barrier ends shall be formed and the forms braced.

Expansion joint locations shall be as specified, and barriers shall be formed for a minimum distance of 4 feet on each side of the expansion joints.

A radius may be used in lieu of a bevel on horizontal and vertical edges of the barrier.

Except at expansion joints, 3/4" V-grooves shall be made in all faces of the barriers at each pier and at equal spaces between substructures at approximately 10-foot spacing.

C. Falsework.

1. **Design and Construction.** The Contractor is responsible for the design, construction, structural adequacy, and maintenance of the falsework. Provisions shall be made for adjusting the falsework while the concrete is plastic. Any falsework adjustment after the initial set will be cause for rejection. The cost to repair damage resulting from failing falsework shall be the Contractor's responsibility.

Deflection of the deck forms or shoring shall be computed using the total dead load plus the weight of the finishing machine. The forming shall be adjusted properly to accommodate the deflection and thereby maintain the total slab thickness specified in the Plans.

2. **Removal of Falsework.** The supporting wedges and falsework for concrete structures shall not be loosened or removed for 14 days after concrete placement or until the concrete has reached 70% of design strength.

Falsework shall be gradually and uniformly lowered to avoid excessive stresses in any part of the structure.

Falsework piles and temporary concrete footings shall be removed.

All open excavations resulting from the construction and removal of falsework shall be backfilled and compacted under Section 210 with suitable material at the Contractor's expense.

D. Forms.

1. **Design and Construction.** The Contractor shall design, construct, and maintain forms to sustain the pressure and weight of all loads and the effect of

vibration as concrete is placed. Forms may be constructed of plywood, steel, or fiberglass; and all bolt and rivet heads shall be countersunk so a smooth surface is obtained. Aluminum forms shall not be used.

Forms shall be clean and in good condition.

All forms shall be built true to line and grade, mortar tight, and able to hold vibrated concrete.

For continuous steel structures, final adjustment of the deck form risers shall not be made until the deck forms have been placed on a minimum of two adjoining spans in each direction.

Forms shall be beveled at all exposed corners with 3/4-inch triangular moldings.

Forms shall be treated with a form release agent before placing concrete. The release agent shall not come in contact with the reinforcing steel. Material which adheres to or discolors the concrete shall not be used.

All form ties shall be steel or fiberglass. Steel ties shall be entirely removable, or removable to a depth of at least one inch below the finished concrete surface. All fiberglass breakoffs shall be ground flush with the concrete surface. Wire ties shall not be used.

Where the bottom of the forms are inaccessible, temporary openings shall be provided for cleaning out all extraneous material before placing concrete.

Wood used for exposed surfaces shall be dressed lumber of uniform thickness and shall be lined with plywood, pressed wood, sheet metal, or other smooth sheathing materials. Plywood shall be of maximum sizes that can be cut from standard size sheets. Shiplap lumber and plain edge lumber forms may be used for surfaces to be covered with earth.

Steel forms, clamps, pins, or other connecting devices shall be designed to hold the forms rigidly together, true to shape, and to allow removal without damage to the concrete. Steel forms which do not present a smooth surface or line up properly shall not be used. Steel forms shall be free from rust, grease, or other foreign matter that discolors the concrete.

Tubes used for column forms and producing voids shall be impervious to water, and be the proper thickness and strength to remain true to shape under concrete load. Tubes which do not present a smooth surface or line up properly shall not be used.

Deck forms shall be positive riser adjustable and set to the required elevations.

2. **Removal of Forms.** All forms shall be removed, without damaging the concrete. Pry bars against the concrete shall not be used.

Forms shall be removed using the following table. If the concrete has reached 70% of design strength, the forms may be removed earlier than the time

specified. (Days listed are exclusive of days when the temperature is below 40°F.)

Structure Element	Time
Footings	1 day
Columns and Wall Piers	3 days
Pier and Bent Caps	7 days
Abutment and Sills	1 day
Deck Slab	14 days
RCB Roof	5 days
RCB Walls	1 day

3. **Permanent Metal Concrete Forms.** Permanent metal forms for decks shall not be used unless specified. Material for permanent metal forms shall meet Section 834.04. Design and construction shall meet Section 602.03 D.1 plus the following criteria:
- The maximum deflection under the weight of the forms, plastic concrete, and reinforcement, or a load of 120 pounds per square foot, whichever is greater, shall not exceed 1/180 of the form span or 1/2 inch, whichever is less. If the computed deflection exceeds 1/8 inch, forms shall be cambered an amount equal in value and opposite in direction to the calculated deflection.
 - The form span for computation of stress and deflection shall be not less than the clear span of the form plus 2 inches.
 - Physical design properties shall be computed using the requirements of AISI Specifications for the Design of Cold-Form Steel Structural Members, latest published edition.
 - All reinforcing steel shall have a minimum clearance of one inch from the forms. Plan dimensions for all steel shall be maintained.

The Contractor shall submit detailed drawings showing the grade of steel, the physical and section properties for all permanent metal bridge deck form sheets, and the method of installation. The drawings shall be certified by a Registered Professional Engineer before submittal.

Form sheets shall not be placed directly on the top of the beam flanges. Sheets shall be securely fastened to form supports and shall have a minimum bearing length of one inch at each end. Form supports shall be placed in direct contact with the beam flanges. All attachments shall be made by hangers, clips, or other means. Welding to flanges will not be permitted.

Damaged galvanized coating on exposed form metal shall be repaired according to Section 854.02.

E. **Placing Concrete.**

- General.** Before placing concrete, the Engineer shall be provided a 24-hour minimum advance notice to permit inspection of forms, reinforcing steel, and other preparations.

All extraneous matter shall be removed from the interior of the forms. Struts, stays, and braces used to temporarily hold forms in correct shape and alignment shall be removed when fresh concrete has reached an elevation rendering their service unnecessary. These temporary members shall not be left in the concrete.

2. **Placement.** Concrete shall be placed and consolidated without causing segregation of the aggregates. Concrete shall be placed in continuous horizontal layers. Each layer shall be placed before the preceding layer attains its initial set. Concrete shall be placed as nearly as possible in its final position.

Free fall of concrete shall not exceed 5 feet, except in thin wall construction where the reinforcement prohibits the use of tremies or chutes. In these cases, placement methods shall prevent segregation.

Open chutes shall extend, if necessary, down inside the forms or through holes left in the forms. Chutes shall be arranged to avoid steep slopes. When steep slopes are necessary, the chutes shall be equipped with baffle boards, made in short lengths that reverse the direction of movement, or terminate into a hopper with a vertical down-spout.

Tremies shall be kept full of concrete during placement. The lower end of the tremie shall be kept buried in the newly-placed concrete throughout the pour. An exception may be made by the Engineer if the rate of discharge prevents segregation.

When placing concrete in caisson foundations, the lower end of the tremie shall be buried at least 5 feet in the newly-placed concrete throughout the pour.

Concrete may be pumped from the mixer or the truck to the point of deposit in the forms. To prevent air entrainment loss, segregation of the concrete, and damage to the epoxy-coated reinforcing steel, one of the following will be required: an s-shaped configuration at the discharge end of the conduit, or a 90 degree elbow with a minimum of 10 feet of flexible conduit placed parallel to the deck at the discharge end.

Aluminum hoppers, downspouts, chutes or tremies shall not be used.

3. **Vibration.** The concrete shall be consolidated by internal or external vibration. The vibration shall be done without displacement of reinforcing or forms. The vibration shall be of sufficient duration and intensity to thoroughly consolidate the concrete without causing segregation or localized areas of grout.

Vibrators shall be capable of visibly affecting the concrete mixture a distance of at least 18 inches from the vibrator.

Vibration shall not be applied directly to reinforcement which extends into non-plastic sections or layers of concrete. Vibrators shall not be used for moving concrete in the forms.

4. **Removal of Excess Mortar.** All accumulations of mortar from previously placed concrete on reinforcing steel and surfaces of forms shall be removed.

Reinforcing steel shall be cleaned without damaging or breaking the concrete-steel bond at and near the surface of the previously placed concrete. Surfaces of unset concrete shall be kept clean.

5. **Defective Concrete.** Any section of defective concrete (spalled, honey-combed, etc.) shall be corrected to the satisfaction of the Engineer.

F. **Curing Concrete.**

1. **General.** All concrete surfaces not covered by forms shall be protected against evaporation of moisture for at least 7 days. The curing period shall be 10 days when pozzolans in excess of 10%, by weight, of the Portland cement are used in the mix. If the concrete is exposed to air temperatures as low as 35°F. or the mean temperature is lower than 40°F. on any day, the curing period shall be extended the number of days the concrete is exposed to these low temperatures.
2. **Methods.** All concrete surfaces except for deck slab concrete shall be protected from evaporation by one of the following:
 - a. **Formwork.** Forms shall remain in place or be replaced immediately after the concrete is finished.
 - b. **Liquid Membrane Curing Compounds.** Concrete shall be sealed by spraying a uniform film of curing compound over exposed surfaces immediately after the free water has disappeared or if forms are removed before the end of the 7-day curing period.

Liquid membrane curing compound shall meet Section 810.

Liquid membrane curing compound shall be continuously agitated and applied at a minimum rate of one gallon per 150 square feet of surface in one or more sprayings. The curing membrane shall be reapplied at the above-specified rate over any area where the membrane has been disturbed or damaged.

Liquid membrane curing compound shall not be applied to any surface which is to receive Surface Finish "C" or "D," any surface which is to receive a penetrating water repellent treatment, or any surface which forms a cold joint where fresh concrete will be placed against hardened concrete.

- c. **Wet Cure.** The concrete shall be covered with a geotextile fabric or double thickness of burlap if forms are removed before the end of the 7-day curing period, 10 days when pozzolans in excess of 10 percent are used. The geotextile fabric or burlap shall be kept continuously moist by a fog spray for 7 days or covered with a waterproof material such as polyethylene until the end of the 7-day curing period.

Surface moisture shall be maintained between the final finish and placement of the covering by periodic applications of a light fog spray.

3. **Deck Slab Concrete.** The deck concrete shall be cured according to Section 602.03 F.2.c, except that waterproof material shall not be used to cover the

fabric or burlap. If the concrete surface begins to dry between the final finish and the beginning of the wet-cure, it shall be kept moist by means of a light fog spray applied so as not to damage the surface of the concrete. The wet-cure shall begin when the concrete has achieved initial set. The burlap or fabric shall be moistened at a minimum of every 4 hours. If conditions exist such as strong winds or high temperatures, causing the burlap or fabric to become dry, the watering rate shall be increased. The use of curing compounds on the deck will not be allowed.

G. Operational Limits.

1. **General.** No concrete shall be mixed, placed, or finished without adequate natural or artificial lighting.
2. **Mixing.** Concrete mixing operations shall be suspended whenever rain, wind, blowing dirt, extreme temperatures, or other adverse conditions occur which damage the work. The previously placed plastic concrete shall be immediately protected from damage.

After mixing, the concrete temperature shall be maintained at not less than 50°F. nor more than 90°F. until placed in the work.

If the specified temperature range cannot be maintained, the aggregates, mixing water, or both shall be heated or cooled as required. Aggregates shall not be heated by a direct flame or to a temperature exceeding 150°F. If the aggregate or the water is heated to a temperature exceeding 100°F., the aggregate and water shall be combined before being placed in contact with the cement. When heated by live steam, aggregates shall be drained as provided in Section 802.04 A.2 before being measured into the batches. Heating equipment or methods which do not heat the materials uniformly, or alter or prevent the entrainment of the specified concrete air content shall not be used. Materials containing frost or lumps of frozen material shall not be used.

3. **Placing.** Concrete shall not be placed when the air temperature is below 35°F. or is expected to fall below 35°F. within the following 24-hour period. Concrete placement shall be discontinued when a descending air temperature falls below 40°F. Concrete shall not be placed on or against frozen ground.

If the Contractor wishes to place concrete when the air temperature is below 35°, a written request must be submitted that provides provisions for adequately enclosing the concrete and maintaining the specified temperatures. Enclosures shall be heated with electric heaters or if combustible heaters are used, be properly vented to prevent the buildup of carbon dioxide. If the request is approved, the removal and replacement of concrete that is damaged or not cured within the specified temperature control shall be at the Contractor's expense.

4. **Curing.** When the temperature falls below 35°F., the concrete surface temperature shall be maintained between 40°F. and 90°F. for the duration of the curing period.

If high early strength Portland Cement is used to reduce curing time, the temperature shall be maintained at a minimum of 50°F. during the first 72-hour curing period.

Heating operations shall be discontinued so that sudden temperature changes in the concrete are avoided. Before removing the housing, the concrete's surface temperature shall be decreased to the air temperature at a rate not to exceed 15°F. per hour.

The concrete shall be protected against damage from construction operations or traffic.

Damaged concrete shall be repaired or removed and replaced at the Contractor's expense.

H. Joints.

1. **Construction Joints.** Construction joints shall be of the type, size, and spacing specified.

Before placing new concrete, the existing concrete surface and any extending steel shall be cleaned of all loose material, laitance, dirt, and other foreign matter. The existing concrete surface shall be painted with a bonding grout. The grout shall be one part cement to one part sand.

The surface shall be dry to permit some absorption of the bonding grout. Placement of the grout shall be controlled so it does not dry before concrete placement.

2. **Expansion Joints.** Preformed joint filler meeting Section 826.02 C or D, used in expansion joints, shall be placed and accurately fitted to adjacent concrete. Preformed joint filler shall not be spliced.

Concrete shall be trimmed neatly and tooled along all exposed edges of preformed fillers after removal of forms, and where necessary after rubbing. Joint filler shall not extend beyond the inner level edge on all finished surfaces.

I. Finish.

1. **General.** All formed surfaces of concrete shall receive surface finish "A." All unformed upper surfaces shall receive surface finish "B." All surfaces of concrete visible to the traveling public shall receive surface finish "C," unless surface finish "D" is specified.
2. **Surface Finish "A."** Within 24 hours after form removal, all fins and irregular projections shall be removed from all surfaces to be exposed or water-proofed.

All form ties shall be removed to a minimum depth of 1 inch without causing spalling or damage to the concrete surface.

Cavities resulting from removing form ties, sand pockets, honeycombed areas and other holes shall be cleaned, saturated with water, and completely filled with mortar consisting of 1 part cement and 2 parts fine sand. The mortar shall not be more than 1 hour old. The mortar shall be compacted with sufficient pressure applied in pointing to fill all voids.

3. **Surface Finish “B.”** All unformed upper surfaces such as tops of rails, barrier wall, posts, caps, parapets, copings, and bridge seats, (not including floors, curbs, or sidewalks), shall be struck off with a wooden template. The coarse aggregate shall be forced below the mortar surface and the surface worked with a wooden or cork float to obtain a fine-grained, smooth, but sanded texture. Mortar topping shall not be used and a steel trowel finish shall not be used on these surfaces.
4. **Surface Finish “C.”** Surface finish “C” shall leave a surface that is uniform in texture and appearance, free of imperfections, depressions, or extrusions due to form marks or other reasons. Surface finish “C” shall be performed in 2 rubbings; the first immediately after surface finish “A” or “B” is completed and the second after the curing period is over.

All filled holes, patches, or blemishes shall be neatly rubbed to blend with adjacent surfaces.

After completion of surface finish “A” or “B,” the entire surface receiving surface finish “C” shall be thoroughly saturated with water. Surfaces to be finished shall be rubbed with a medium coarse carborundum stone or mechanical finisher, using a small amount of mortar. The mortar shall be composed of cement and fine sand mixed in the proportions used in the concrete being finished. Rubbing shall be continued until objectionable form marks and imperfections are removed and a smooth, dense surface without pits or irregularities is produced. Rubbing shall not expose the coarse aggregate. Patches shall not be rubbed until they set, but the rubbing of the remainder of the surface shall not be delayed. The paste produced by rubbing shall be spread or brushed uniformly over the surface and allowed to reset.

The final surface finish shall be obtained by rubbing the concrete with a fine carborundum stone or an abrasive of equal quality, and water.

The final rubbing shall be done after the curing period has expired and after all concrete above the surface being finished has been cast. Rubbing shall continue until the entire surface has a smooth texture and is uniform in color and appearance. Dust, mud, or other foreign matter shall not be rubbed into the finish.

Painting or plastering concrete surfaces with neat cement or mortar shall not be used as a substitute for the specified surface finish or used with the rubbing operation.

5. **Surface Finish “D.”** Surface finish “D” is required on all surfaces as designated.

After receiving surface finish “A” or “B,” the surface shall be roughened by sandblasting to increase the bond between the surface and surface finish material. Surface finish “D” shall not be applied until the curing period is completed.

The surface finish “D” consists of an application, or applications, of a cement-based, commercially-packaged masonry coating material at the rate and application method recommended by the manufacturer. The color of the

finished surface shall be that specified on the Plans or designated by the Engineer. The finish shall have a uniform texture, color, and appearance free from fins, projections, cavities, and porous spots.

J. Penetrating Water Repellent Treatment of Concrete Surfaces. Penetrating water repellent treatment solution shall meet Section 822.

Surfaces to be treated with a penetrating water repellent treatment solution shall be free of dirt, dust, oil, curing compound, asphalt, salt, or other foreign material which inhibits the coverage and penetration of the water repellent solution. Cleaning shall be performed with sandblasting or water washing equipment meeting the following requirements:

1. **Sandblasting Equipment.** Sandblasting equipment shall be the compressed air type of proper size and capacity to clean concrete surfaces.
2. **Water-Washing Equipment.** Water-washing equipment shall meet the requirements of one of the following:
 - a. Hot water pressure washer shall utilize 160°F. water temperature at 1800 psi minimum nozzle pressure.
 - b. Hydroblast washer shall utilize cold water at 7000 psi minimum nozzle pressure.
 - c. Steam Cleaning Unit shall utilize 320°F. water temperature at 305 psi operating pressure.

Surface preparation includes the application of pre-treatment cleaning agents before the use of water-washing cleansing methods.

Solvents and hand tools shall be used to remove bonded foreign materials.

To facilitate water-washing methods, detergent may be added to the cleansing water. Final rinsing with clear water shall follow the washing procedure.

The cleaning process shall not damage the concrete surface, remove or alter the existing surface finish, or expose the coarse aggregate.

Before treatment, the concrete surface shall be free of surface moisture which inhibits the penetration of the water repellent solution. If necessary, the surface shall be allowed to dry until it meets the specific requirements of the repellent manufacturer.

Penetrating water repellent treatment solution shall be applied after the barrier forms have been removed and the air or concrete surface temperature is 40°F. and rising or at temperatures recommended by the manufacturer. Airless application equipment shall be used with 15 to 40 psi application pressure. Treatment solution shall be uniformly applied at the rate recommended by the solution manufacturer.

K. Anchor Bolts. Anchor bolts for bearing may be set directly in the plastic concrete, grouted in preformed holes, or grouted in drilled holes. Equipment for drilling anchor holes shall be capable of drilling through reinforcing steel for proper anchor bolt position.

- L. **Bearings.** Masonry bearing plates, pedestals, etc., shall be accurately set in position to within .01 feet of the specified elevation. Bearing areas shall be finished to a true plane and elevation by grinding, if necessary, before bearing plates or pads are set. The sliding surfaces of expansion bearings shall be cleaned and lubricated.
- M. **Live Load.** Vehicles shall not be permitted on any span until the concrete has attained at least 70% of its design strength.

602.04 METHOD OF MEASUREMENT.

- A. **General.** Quantities which constitute the completed and accepted structures will be measured for payment. Only work accepted by the Engineer will be included, and the dimensions used will be those shown on the Plans or ordered in writing.
- B. **Concrete.** The pay quantity of concrete will be computed by the cubic yard based on the dimensions shown on the Plans or authorized by Change Orders. Each Class of Concrete or High Early Strength Concrete designated as a pay item will be measured separately.
- C. **Cement.** When separate payment is provided, the Portland Cement will be measured by the Ton or Cwt. The pay quantity will be the number of Tons or Cwt. used as authorized. Cement used according to Section 802.01 C.2.a and cement which is lost, wasted, or used in concrete poured outside the authorized dimensions will not be included in the quantity measured for payment.

602.05 BASIS OF PAYMENT.

- A. **General.** Payment will be made at the Contract Unit Price for the items listed in the Contract.

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

- B. **Concrete.** When designated in the Contract, Concrete or High Early Strength Concrete will be paid for at the Contract Unit Price bid per Cubic Yard for the class of Concrete specified and furnished.
- C. **Cement.** When designated in the Contract, Cement will be paid for at the Contract Unit Price bid per Ton or Cwt. of Cement used as authorized.

Cement not designated as a Contract pay item will be considered as an integral part of the concrete and no separate payment will be made except for Cement used under circumstances described in Sections 802.01 C.2 and 802.01 E.2. Cement used as described in Sections 802.01 C.2 and 802.01 E.2 will be paid for at the rate of 1.25 times the delivered cost of the Cement based upon receipted invoices and freight charges. This payment will be considered full compensation for any added costs incurred by the Contractor in the work.