

955. Treated Timber

Cubic Meter

SECTION 960

STRUCTURAL STEEL AND MISCELLANEOUS METAL PRODUCTS

DESCRIPTION

960.20 General.

This section shall apply to the furnishing, fabrication, erection and painting of all structural steel and metal work in the contract.

The work shall be done in accordance with the requirements of the AASHTO Standard Specifications for Highway Bridges, the Bridge Welding Code (ANSI/AASHTO/AWS D1.5) and these specifications.

MATERIALS

960.40 General.

Materials shall meet the requirements specified in the following Subsections of Division III, Materials:

Structural Steel	M8.05.0
Steel Pins	M8.04.2
High Tensile Strength Bolts	M8.04.3
Bronze Self-Lubricating Bearing Plates	M8.11.0
Iron Casting	M8.03.0
Paints and Protective Coatings	M7.00.0
Steel Baffles & Drainage Troughs	M8.05.3
Bearing Pad Supports	
Molded Fabric	M9.16.2
Rubber-Cotton Duck	M9.16.1

If a Contractor proposes to use steel from sources other than a mill, the source must be approved by the Engineer. The Contractor shall supply the Engineer with a description of the proposed facility along with the method used by the facility to segregate, identify and otherwise assure the Engineer that the supplied material is in conformance with the specifications. All sources must supply the actual mill test reports.

CONSTRUCTION METHODS

960.60 Shop Drawings.

After the contract has been awarded, and before any shop work is commenced, the Contractor shall submit complete sets of prints of the shop drawings as specified in Subsection 5.02.

On projects that contain more than one bridge, each bridge will be considered separately in submitting shop drawings. Shop work can commence on each bridge as the shop drawings on that bridge are approved.

On projects which contain complicated steel structures such as a viaduct, long span bridge, etc., the Contractor

shall submit a schedule showing how he/she intends to divide the steel structure into sections. After this schedule is approved, shop work can commence on each section as the shop drawings for that section are approved.

960.61 Design, Fabrication, and Erection.

All structural steel and appurtenant material shall be designed, fabricated and erected in accordance with these specifications, the AASHTO Standard Specifications for Highway Bridges, and the AASHTO/AWS Bridge Welding Code (ANSI/AASHTO/AWS D1.5). All aluminum material shall be designed, fabricated, and erected in accordance with these specifications, the AASHTO Standard Specifications for Highway Bridges, and the AWS Structural Welding Code - Aluminum (ANSI/AWS D1.2).

A. Fabrication.

All metal fabricators shall be approved by the Engineer prior to the bid opening date. Fabricators shall be approved for work in one or more of the following categories: Major Bridge Structures, Miscellaneous Steel, or Poles and Sign Structures. Fabricators approved to perform work in the Major Bridge Structure category are also approved to perform work in the Miscellaneous Steel category. Fabricators of major bridge structures including rolled beams with coverplates, girders, and more complex work shall meet the requirements of AISC Category III. Fabricators of miscellaneous steel which includes steel products such as expansion joints, bridge rail, etcetera shall meet the requirements of AISC Category I. Fabricators of poles and sign structures shall meet the requirements of AISC Category I. A list of approved fabricators may be obtained upon request.

Fabricators wishing to be approved by the Department shall submit the following:

1. Description of facility including history, capacity and equipment.
2. Quality Control Manual.
3. Table of Organization.
4. Welding Procedure Specifications and Welding Procedure Qualification Test Records.
5. Welder and Welder Operator Qualification Test Records.
6. Resumes of supervisory personnel and resumes of all personnel involved in quality assurance, quality control and testing.
7. Copy of American Institute of Steel Construction Quality Program Certificate.

After receiving the material listed above, the Engineer shall review it and conduct a shop inspection before approval can be granted.

The Contractor shall submit a shop schedule to the Engineer. The shop schedule shall be provided sufficiently in advance for the Engineer to determine the level of quality verification inspection required and to arrange for the inspector's attendance. No material shall be fabricated until the shop schedule has been reviewed.

The Contractor will be required to submit to the Department's Inspector, for approval, 3 certified copies of the mill test reports for each kind of steel and aluminum furnished. These certificates shall certify compliance with the specifications and shall give the chemical and physical analysis of the metal. Any cost involved in furnishing the certificates shall be borne by the Contractor.

B. Inspection.

Quality Control inspection and testing is the responsibility of the fabricator and shall be performed by a sufficient number of qualified inspectors to guarantee product integrity. Quality control inspection shall be performed throughout the entire fabrication process from receiving material to shipping material. The fabricator shall maintain adequate inspection records. Such records will be provided to the Engineer upon request.

Quality control inspectors at the fabricating shop shall be certified by the American Welding Society in accordance with the provisions of the Standard for Qualification and Certification of Welding Inspectors (AWS QC1). The Engineer, upon written request from the fabricator, may accept other certifications or experience and training consistent with AWS QC1. Assistant inspectors may be used to perform specific inspections under direct supervision of a Quality Control Inspector.

Quality Verification Inspectors will be employed by the Engineer and act on his/her behalf. The inspector has the authority to act for the Engineer on matters relating to quality including inspection and testing, within the scope of the contract. Quality Verification Inspectors will be assigned at the discretion of the Engineer. The presence or absence of the Verification Inspector does not relieve the Contractor of quality control responsibility.

The fabricator shall provide facilities, for the Department's inspectors, in direct proximity to the work. These

facilities shall include a secured office with a desk and chair for each inspector, a file cabinet provided with a lock, a plan rack and a table adequate to review plans and drawings. The office shall have a minimal floor area of 12 square meters. The office shall contain a telephone and a system of heating and cooling that will maintain a temperature of 22 °C.

No material shall be shipped to the job site until the Quality Control Inspector certifies that the material has met all provisions of the Contract. Such certificate shall be endorsed by the Verification Inspector who then shall place his/her stamp on the material. The Verification Inspector shall affix his/her stamp only when the material is ready for shipment and properly loaded on trucks or rail cars. Material delivered to the job site without such stamp affixed will be considered rejected and immediately returned to the Contractor.

C. Process.

Steel shall be blast cleaned prior to starting fabrication. Fabrication includes, but is not limited to, drilling, cutting, welding and stripping of plate. The blast cleaning shall conform to the Steel Structures Painting Council Surface Preparation Specification "Near-White Blast Cleaning", SSPC-SP10.

Heat numbers shall be transferred, in the presence of the Verification Inspector, to all pieces which are to be major component parts of a main member. Main members are considered to be all webs, flanges, coverplates, floor beams and stringers as well as any other member as specified on the drawings. Heat numbers are not required to be transferred to component parts of secondary members or to minor components of a main member, i.e., stiffeners, clip angles, etc.

Welding shall not commence until the welding procedures and welder certifications have been approved by the Engineer. All welding procedures shall conform to the applicable welding code (i.e., AASHTO/AWS Bridge Welding Code, the AWS Structural Welding Code - Aluminum, AWS Structural Welding Code - Reinforcing Bars, etc.) as determined by the Engineer. Shop welders shall be certified in accordance with the applicable AWS Welding Code as determined by the Engineer. All field welders shall be certified by the Department and possess the Department's Welder Qualification Test Record and the Welder Qualification Certificate.

Material fabricated that does not meet the plans and specifications will not be incorporated into the work. Repair procedures, other than those allowed under the Bridge Welding Code, shall be submitted to the Engineer for approval.

Structural rolled beams shall be cambered to the amount shown on the plans with a tolerance of -0, +12 millimeters for beams 15 meters or less. For beams greater than 15 meters, the plus tolerance of 12 millimeters shall be increased by 3 millimeters for each 3 meters or fraction thereof in excess of 15 meters.

Plate girders shall be cambered to the amount shown on the plans with a tolerance as specified in the AASHTO/AWS Bridge Welding Code.

The beams and girders shall be handled and stored in such a manner that they will have the required camber after erection.

When steel beams or girders are to be spliced in the field, they shall be assembled in the no load position in order that the assembly, including camber, alignment, accuracy of punched holes and fit of beam or girder ends may be done in accordance with the requirements of the type of splice. When members are assembled with the webs vertical, they shall be supported at intervals no greater than 6 meters. The requirements of AASHTO for shop assembly shall apply. Reaming of holes shall be performed in accordance with AASHTO. Hand held reamers shall not be used.

All detrimental material, such as oil, grease, dirt, slag, etc. shall be removed from unpainted portions of M 270 Grade 50W steel prior to shipping.

All structural parts shall be provided with adequate drain holes at points where water could otherwise accumulate.

Unless otherwise noted, dimensions indicated at expansion joints and similar construction are determined for a temperature of 10° C. The proper adjustments for temperature must be made by the Contractor when the structure is placed at any other temperature.

If steel expansion joint assemblies are used, they must be properly fitted in the shop and shipped with a device for maintaining proper spacing and fit as shown on the plans. Bolts on shipping device must be loosened within one hour after concrete is placed, so that movement may take place. The device shall be removed after concrete has set on both sides of the assembly.

D. Erection.

Within sixty days of the date of the Notice to Proceed, the Contractor shall submit an erection procedure. The submitted method of erection is subject to review, comment, and approval by the Engineer. The method must be submitted with a detailed procedure which includes drawings and calculations sufficient to enable the Engineer to determine the adequacy of the proposed method.

Massachusetts Highway Department
1995 Standard Specifications for Highways and Bridges

The method and all submissions shall be prepared under the supervision of a professional engineer registered in Massachusetts. Such Engineer must be familiar with these Specifications, those of the American Association of State Highway and Transportation Officials (AASHTO), the work, and be experienced in this technical field. All submitted sheets shall be stamped by the supervising engineer.

As a minimum the following information shall be included in the submittal:

1. Plan showing the location of all roadways, utilities, railroad tracts and other appurtenances in areas of erection.
2. The location of cranes, both horizontally and vertically, and their operating radii.
3. Lifting equipment information including rating data. Information shall include counter weights to be used and boom capability. The capacity of the crane and of all lifting and connecting devices shall be adequate for 125% of the total pick load including spreaders and other material except that in the area of railroads or other traffic, the capacity shall be adequate for 150% of the total pick load.
4. The type, size and arrangements of slings, shackles or other lifting and connecting devices including relative technical data.
5. The order of lifts, repositioning of equipment and counterweights, and location and method of attaching deadmen.
6. Methods and materials for temporary structures or the strengthening or bracing of a member (either temporarily or permanently) for erection purposes.

The stresses shall be investigated at each stage of erection with allowance for wind pressure determined by the table shown below.

Height of Members Above Ground * (meters)	West of Longitude 71 °41' Shrewsbury (kiloPascals)		East of Longitude 71 °41' Shrewsbury (kiloPascals)	
	<u>Beams & Girders</u>	<u>Trusses</u>	<u>Girders & Girders</u>	<u>Trusses</u>
5	0.800	1.150	1.050	1.500
10	0.950	1.400	1.250	1.850
15	1.050	1.550	1.350	2.050
30	1.200	1.800	1.550	2.300
90	1.450	2.150	1.900	2.800

* For heights not given wind pressures shall be interpolated.

Curved girders and long span straight girders shall be stabilized with falsework, temporary braces, or holding cranes until a sufficient number of adjacent girders are erected with all diaphragms and cross frames connected to provide necessary lateral stability. All trusses shall be erected on falsework unless otherwise approved by the Engineer. The falsework shall provide for proper camber and alignment and shall be properly designed, constructed, and maintained for the loads which will be imposed upon it. When erecting trusses, the falsework shall be left in place until all connections are bolted and accepted by the Engineer unless otherwise provided in the approved erection procedure. Care shall be taken in the use of falsework and other temporary supports to insure that the temporary elevation of structural steel provided by the falsework is consistent with the deflections that will occur as the structure is completed.

In instances where falsework is required by the contract or proposed as part of the erection procedure, it shall be properly designed, constructed, and maintained for the loads that it will bear. Plans for falsework along with necessary engineering data shall be submitted to the Engineer for review, comment, and approval under the same guidelines as the erection procedure. Plans, details, and calculations shall be submitted to the Engineer in those instances where changes in an existing structure are necessary to maintain traffic

The Contractor shall keep a full record of piles driven for falsework. If the Contractor does not make a pile loading test, the pile bearing formulas of Subsection 940.61 shall be used to determine the bearing values.

Erection drawings shall show bolting or welding procedures necessary to complete erection. Procedures shall include sequence and method of connecting main members and secondary members. For stringer and girder spans, the following minimum information shall be included in the notes, modified as necessary to conform to design and erection requirements for each structure:

1. Splices and field connections of main stress carrying members shall be made with a minimum of 50% of the holes filled with approved high strength bolts and erection pins before the external support system is released. At least one-half of this percentage shall be bolts, tightened to specification requirements. The bolts and pins shall be installed uniformly throughout the connection except that erection pins shall be used in the extreme corners of all main connections.

2. Members to be assembled on the ground before erection shall be blocked to their proper "no load profile" and 100 percent of the approved high strength bolts shall be installed and tightened to specification requirements before erecting the member.

3. All diaphragms and crossframes shall be installed between stringer lines as the work progresses.

4. Unless otherwise noted, dimensions indicated at expansion joints and similar construction are determined for a temperature of 10 °C. Proper adjustments must be made when the structure is placed at any other temperature.

After the erection of beams and girders has been completed, expansion bearing sole plates shall be re-aligned so that they will be centered at 10 °C.

E. Connections Using High Strength Bolts.

The certification, testing, installation and inspection for all high strength bolts shall conform to the requirements of the current edition of the AASHTO Standard Specifications for Highway Bridges, except as amended herein.

Documentation

Mill Test Reports shall be furnished for all mill steel used in the manufacture of bolts, nuts or washers. These reports shall indicate the place where the material was melted and manufactured.

The manufacturer shall furnish Manufacturers Certified Test Reports for the items supplied. These reports shall show the relevant information required. The manufacturer performing the rotational-capacity test shall include in the test report:

1. The lot number of each item tested.

2. The rotational-capacity lot number.

3. The results of all tests.

4. The location and date of tests.

5. A statement that the Manufacturer's Certified Test Report for the items are in conformance to this specification and the appropriate AASHTO specifications.

6. The location where the bolt assembly components were manufactured.

The Distributor shall include the Manufacturer's Certified Test Reports for the various bolt assembly components. The rotational-capacity test may be performed by the distributor (in lieu of the manufacturer) and reported on a Distributor Certified Test Report. This report shall show all the information required on the Manufacturers Certified Test Report. The Distributor shall certify that the manufacturer's reports are in conformance to this specification and the appropriate AASHTO specifications.

Installation.

All bolting shall be performed using the calibrated wrench method in accordance with the current edition of AASHTO. Particular care should be exercised so that the snug tight condition is achieved. In addition, the rotational-capacity tests described in Section M8.04.3 shall be performed on each rotational-capacity lot number prior to the start of bolt installation. Hardened washers are required as part of the test even though they may not be required in the actual bolt assembly.

A Skidmore-Wilhelm Calibrator or an acceptable equivalent tension measuring device shall be required at each job site during erection. The Contractor shall submit to the Engineer a certification that the calibration device has been checked by qualified personnel acceptable to the Engineer within the previous thirty days. The device must also be checked for accuracy upon completion of the work on the project and proof of this certification must be submitted to the Engineer.

Shipping.

Bolts, nuts and washers from each rotational-capacity lot shall be shipped in the same container. If there is only one production lot number for each size of nut and washer, the nuts and washers may be shipped in separate containers.

Each container shall be permanently marked with the rotational-capacity lot number such that identification will be possible at any stage prior to installation.

F. Nondestructive Testing.

Personnel.

Personnel performing radiographic, magnetic particle and dye penetrant tests shall be certified by a Level III technician who shall have attained certification by examination. Personnel performing radiographic, magnetic particle and dye penetrant tests shall be qualified in accordance with the current edition of the American Society for Nondestructive Testing, Recommended Practice SNT-TC-1A. Only individuals qualified for NDT Level II and certified as noted above may perform these tests.

When ultrasonic testing is required, it shall be performed by technicians who meet the qualifications above and who shall be qualified by a written examination and performance test administered by the Engineer. The Engineer, at his/her discretion, may accept other properly documented certifications and tests.

Procedures.

Nondestructive testing shall be performed by the Contractor in accordance with the procedures and standards set forth in the AASHTO/AWS Bridge Welding Code. The Department reserves the right to perform additional testing at its own cost during fabrication and up to final acceptance of the project. All welding must meet acceptable quality standards which are defined by the acceptance criteria for the particular test method.

All nondestructive testing shall be witnessed by the Department's Verification Inspector. Certification that all tests were performed in the presence of the Inspector shall be furnished to the Engineer. In addition to that required by the Bridge Welding Code, all radiographs shall be identified as to date, bridge number and girder or beam number. All costs for these tests, including necessary rework and repair, shall be at the Contractor's expense.

960.62 Preparation of Bridge Seats.

Masonry bearing plates shall not be placed upon bridge seat bearing areas which are improperly finished, deformed or irregular. Bearing plates shall be set to grade and level in exact position and shall have full and even bearing upon the masonry after the following preparation.

Bearing plates shall be set to grade on a system of cotton duck impregnated with rubber or molded pads with a full and even bearing. The bearing area of concrete 75 millimeters outside of the bearing plate shall be constructed at least 6 millimeters above the proposed finished grade, and shall then be dressed down sufficiently so that the cotton duck or molded pads will bring the area to the correct grade.

960.63 Painting.

General.

Before painting can begin, each batch of paint shall be sampled, tested and approved in accordance with Section M7.

The surfaces of structural steel which are to be in contact with concrete shall be painted with a shop coat of paint meeting the requirements of a modified M7.02.21 as noted hereinafter. All other structural steel shall receive three coats of paint except as noted. Structural steel meeting AASHTO specification M 270 Grade 50W shall not receive a coat of paint except as noted on the plans.

No paint shall be applied to shear connectors nor to the flange surface of the beams to which the shear connectors are to be welded.

Steel shall not be painted until shop welding is complete. Prior to painting, the welds shall be cleaned thoroughly in accordance with good practice and shall have a suitable surface to accept the primer; the steel shall have no visible rusting or detrimental material, such as oil, grease, dirt, etc. If rusting or other detrimental material has appeared on the steel, the steel shall be re-blasted to a SSPC-SP10 cleaned surface.

Paint shall not be applied when the air temperature is below 5 °C nor shall the paint be applied when the air temperature is greater than 50 °C. Painting shall not be undertaken in rain, fog, snow or mist or when the temperature of the metal surface is less than 3° above the dew point. Paint shall not be applied when the relative humidity exceeds 85%. When paint must be applied in damp or cold weather, the steel shall be painted under cover and shall remain under cover until dry or the weather conditions permit its exposure in the open. Paint shall not be applied when in the Engineer's judgment conditions are unsatisfactory for painting.

The Contractor shall supply mechanical paint mixers on the job. Paints shall be mixed in clean containers and agitated thoroughly before drawing off paint through a strainer into the painter's buckets or spray machines. Paint shall be kept thoroughly stirred in spray pots or containers during application and the zinc rich primers shall have continuous agitation.

Paints specified are formulated ready for application and if for any reason it is necessary to thin the paint, the method used shall not produce a dry film thickness less than that specified. The method used to thin the paint and the thinner used shall be approved by the paint manufacturer and the Engineer. The date (year, month) of painting and the maintenance bridge number shall be stencilled on the bridge as directed by the Engineer. The stencils shall be furnished by the Contractor at his/her expense.

Shop Paint.

Unless otherwise noted, the steel shall receive one shop coat of inorganic zinc-rich primer (modified M7.02.21) having after application a minimum dry film thickness of 76.2 micrometers. The steel shall not be shipped from the fabricator to the job site in less than 2 days after application of the shop coat of paint. Paint shall not be applied to shop contact surfaces. Field contact surfaces shall receive a shop coat of paint. Machined finished surfaces, except abutting joints and base plates, shall be coated with a material suitable to the Engineer. Surfaces not in contact but inaccessible after assembly erection shall be painted in the shop with one coat of inorganic zinc-rich primer (modified M7.02.21) having after application a minimum dry film thickness of 76.2 micrometers and followed with one coat of coal tar epoxy polyamide paint (M7.05.21) having after application a minimum dry film thickness of 203.2 micrometers.

Erection marks for field identification shall be painted on previously painted surfaces with a paint or ink compatible to the coating system being used.

Field Paint.

When erection of steel work is fully completed, all adhering rust, scale, concrete dirt laitance, grease welding flux and slag, white rust or other foreign matter shall be removed. Immediately after cleaning of the steel has been done to the satisfaction of the Engineer and prior to the application of the first field coat of paint, all steel surfaces that require painting (bolts, welds, etc.), the base metal that has become exposed, or any surface from which the shop coat has become defective shall be thoroughly covered with one coat of the same paint used in the shop. The minimum dry film thickness after application shall be 76.2 micrometers.

The steel shall receive a second coat of high build epoxy having after application a minimum dry film thickness of 101.6 micrometers. Within 24 hours of application of the second coat, the steel shall receive a finish coat of aliphatic polyurethane having after application a minimum dry film thickness of 76.2 micrometers. All coats of paint shall be from the same manufacturer.

The colors of the shop coat, second coat and top coat shall have a definite color contrast between them. The shop coat shall be tinted with red so as to contrast with the blast cleaned steel.

Full protection shall be provided in the field for all surfaces that are not to be painted and for all private property.

In order to avoid subsequent discoloring or staining due to dripping or running of concrete, the finish coat of paint shall not be done until all concrete nearby has been placed and all forms have been removed. Concrete, stone, masonry and other parts of the structure that are not to be painted shall be fully protected by covers during the painting operations.

960.64 Galvanizing.

Masonry plates, sole plates, diaphragms, cross frames and bottom lateral bracing shall be hot dipped galvanized in accordance with AASHTO M 111. The galvanizing bath shall contain nickel, 0.05% to 0.09% by mass.

Galvanized members requiring shop fabrication and assembly shall be cut, welded, milled and/or drilled prior to galvanizing. All structural steel conforming to AASHTO M 270 Grade 50W (ASTM A 709 Grade 50W), with the exception of masonry plates and sole plates, shall not be galvanized.

Galvanized members that are to be field welded or which are to be shop welded to ungalvanized members shall be masked 25 millimeters on either side of the weld line prior to galvanizing. After welding, the weld areas shall be cleaned in accordance with the Steel Structures Painting Council Surface Preparation Specification "Power Tool Clean" SSPC-SP3 and coated with "High Zinc Dust Content" paint (M7.04.11). The galvanizing shall be repaired in accordance with ASTM 780 "Repair of Hot Dip Galvanizing". The paint shall be applied such as to achieve a dry film thickness of a minimum of 76.2 micrometers and not more than

127 micrometers. Application shall be in accordance with the manufacturer's recommendations.

COMPENSATION

960.80 Method of Payment

Payment will be based only on computed masses of steel complete in place in the structure. No additional allowance in mass will be made for the shop coat of paint or for any other coat of paint or other protective covering.

The mass of the rolled shapes and of the plates, regardless of the width of the plates, shall be computed on the basis of their nominal mass and of their dimensions as shown on the approved shop drawings, deducting for copes and cuts, and for all open holes that are not to be filled with rivets, bolts or plug welded.

Steel for expansion assemblies at the roadway level of bridges and similar structures (whether or not attached to the structural steel of the deck) and bronze or other metal for expansion bearings, drainage troughs and baffles, shall be included in the mass to be paid for as structural steel. Where no separate items are in the contract for galvanized nose angles on piers, or curb plates or angles in bridge curbs, such steel will be paid for by the kilogram as structural steel, with no additional compensation for the galvanizing.

The computed mass shall not include the mass of welds. The density of the various metals shall be assumed as follows:

Steel (Structural, Cast, Galvanized)	7850 kilograms per cubic meter
Cast Iron	7210 kilograms per cubic meter
Bronze	8680 kilograms per cubic meter

The mass of the nuts and heads of bolts shall be included in the computed mass, assuming the mass to be as shown below.

Payment for bolt heads and nuts will be made by the kilogram. Where rivets are used in the permanent construction, the heads of the rivets shall be considered, for purpose of payment, as bolt heads for bolts equal in diameter to the rivets, regardless of the material of which they are composed or the materials which they fasten.

All permanent washers will be paid for by the kilogram. The shank of a bolt will be considered as part of the material through which it passes and will be paid for as that material. No allowance or payment will be made for that part of a bolt shank that extends through and past the nut.

Diameter of Bolt (millimeters)	Mass Per 100 Bolts (heads and nuts) (kilograms)
M14	1.8
M16	3.2
M20	5.4
M22	8.2
M24	11.8
M27	16.3

M30	21.8
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960.81 Basis of Payment.

The furnishing, fabricating, erecting and painting of all structural steel and all metal work for the structure not otherwise provided for, will be paid for at the contract unit price per kilogram under the item for Structural Steel, complete in place.

To avoid delay in computation of the mass for partial and final payment, the Contractor shall submit his/her computations for the steel shown on each of the approved shop drawings as soon as practicable after the sheet has been approved. The computation by the Contractor shall show the mass for each member, except that duplicate members may be grouped together.

960.82 Payment Items

960.	Structural Steel	Kilogram
999.960	Structural Steel on Hand	Kilogram

SECTION 965

**MEMBRANE WATERPROOFING AND
 PROTECTIVE COURSE FOR BRIDGE DECKS**

DESCRIPTION

965.20 General.

Membrane waterproofing applied to the surface as indicated on the plan and elsewhere as directed shall consist of one of the following systems:

1. Coal tar emulsion reinforced with two plies of coated glass fabric.
- *2. Hot applied rubberized asphalt membrane.
- **3. Preformed sheet systems - either reinforced rubberized asphalt or reinforced tar and resin.

The protective course will be bituminous concrete. Type of mix shall be Dense Binder Course as specified in Table A of Section M3.11.03 and placed in accordance with Item 965.62 hereinafter.

- * System 2 shall *not* be used on grades in excess of 3 percent.
- ** System 3 is the only system acceptable for butted deck beam and box beam superstructures.

MATERIALS

965.40 General.

Materials shall meet the requirements specified in the following Subsections of Division III, Materials:

Protective Seal Coat Emulsion (Coal Tar Emulsion)	M3.03.3
Coated Glass Fabric	M3.06.1
Bituminous Concrete	M3.11.00
Thermoplastic Asphalt Membrane	M3.04.2
Asphalt Primer	M3.02.1
Preformed Sheet Membrane	M9.08.0