

SECTION 606 — BRIDGE RESTORATION AND WATERPROOFING WITH CONCRETE OVERLAYS

606.01 DESCRIPTION. This work shall consist of bridge deck restoration and waterproofing with latex concrete overlays.

606.02 MATERIALS AND EQUIPMENT.

606.02.01 Concrete. Conform to Subsection 601.02 and 601.03.

606.02.02 Latex Admixture. Conform to Subsection 841.

606.02.03 Epoxy for Epoxy-Sand Slurry. Conform to Section 826.

606.02.04 Sand for Epoxy-Sand Slurry. Conform to Subsection 804.

606.02.05 Mortar Sand. Conform to Subsection 804 (for Grout-Bond Coat).

606.02.06 Latex Grout. Conform to Section 601.02.

606.02.07 Joint Materials. Conform to Section 807.

A) **Filler.** Use preformed expansion joint filler, Type II (cork).

B) **Sealers.** Use rapid cure silicone with closed-cell polyethylene foam back-up rod compatible with silicone sealant.

606.02.08 Concrete Curing Material. Conform to Section 823.

606.02.09 Structural Steel. Conform to Subsection 812 (for expansion dams and joint build up).

606.02.10 Equipment. Conform to Subsection 601.02 with the following exceptions and additions:

A) **Mechanical Scarifiers or Grinders.** Furnish mechanical scarifiers or grinders designed specifically for scarifying bridge decks that the Engineer approves. Ensure that the scarifier or grinder is capable of producing a surface matching the existing slab cross section and that each pass of the machine matches the previous pass in elevation.

B) **Hammers.** Provide Power driven Hammers lighter than nominal 45 lb. class.

C) **Sawing Equipment.** Sawing equipment shall be a concrete saw capable of sawing concrete to the specified depth.

D) **Hydraulic Impact/Skid Steer Type Equipment** with a maximum rated striking Energy of 360 ft-lbs are permitted only in areas of concrete removal more than 6 inches away from boundaries of surface areas to remain in service. The Contractor is to provide data information to the engineer on the equipment they wish to utilize to ensure compliance with this note.

E) **Mixers.** In addition to the requirements of Subsection 601.02, furnish continuous mixers having a latex admixture supply portion equipped with a cumulative-type meter that can be read to the nearest 0.1 gallon. Furnish continuous mixers having a water supply portion equipped with a flow meter or other suitable device for calibrating the water supply, and a cumulative type water meter that can be read to the nearest 0.1 gallon. Ensure that the latex and water meters are readily accessible, accurate to within \pm one percent, and legible.

F) **Hand Tools.** In addition to the requirements of Subsection 601.02, furnish sufficient hand tools for placement of stiff, plastic concrete capable of working

the concrete down to approximately the correct elevation for striking off with a screed.

- G) **Finishing Machine.** Conform to the requirements of Subsection 609.02.09.
- F) **Brooms.** Furnish brooms having bristles of sufficient stiffness to treat the surface after finishing.
- G) **Air Compressors.** Furnish air compressors equipped with separators and traps.

606.02.11 Coarse Aggregate. Conform to Section 805, size No. 8 or 9-M.

606.03 CONSTRUCTION.

606.03.01 Scheduling. Notify the Engineer at least 12 hours before placing concrete for the overlay. The Department will not grant a time extension for delay in placing concrete resulting from the Engineer receiving less than the 12-hour notice.

606.03.02 Weather Limitations. Construct the overlay during the night time hours when the ambient temperature will remain below 85 °F, the wind velocity is low, and hot conditions or rain are not expected. During hot weather, place the concrete when the ambient temperature falls to 85 °F or below. Complete placement of concrete before the ambient air temperature reaches 85 °F. Do not place concrete when the ambient temperature away from artificial heat is less than 45 °F and falling, except when using Type III cement. Keep all concrete at a temperature above 45 °F for at least 96 hours after placing. Make provisions for the uniform distribution of heat, and do not allow any area of the concrete surface to be heated to a temperature above 85 °F. To accomplish uniform distribution of heat during cold weather, provide housing, heating, or insulation methods that the Engineer approves. Do not place concrete during rain or drizzle. If it begins to rain or drizzle during placement, cease placement and finish and protect the material already in place.

606.03.03 Removal of Concrete, Restoration of Reinforcement and Cleaning. Treat the entire area of the deck between the curbs (roadway) and the ends of the structure (100 percent of the deck area) by machine preparation consisting of removal of concrete to a depth of at least 1/4 inch below the existing concrete surface. Machine prepare with mechanical scarifiers or grinders. If satisfactory results are not achieved, the Engineer may direct that the work be performed with other equipment. The Department will not require machine preparation on endwalls.

Remove epoxy, asphalt, foreign surfaces, and unsound patches in a manner approved by the Engineer. Sound concrete patches are to be left in place as determined by the Engineer. Do not use equipment that may cause damage to the underlying concrete.

Remove all other concrete that the Engineer deems unsound. Remove concrete within areas where the depth of removal exceeds 1/4 inch with hammers or other small equipment. Steel reinforcement damaged by the contractor shall be replaced to the size, type, and lap lengths determined by the Engineer. Remove concrete to a depth of 3/4 inch below any reinforcing bar which is more than 50 percent exposed or that appears not to be bonded to the existing concrete. Protect any underlying sound concrete and steel reinforcement. Ensure that the periphery of routed areas is as nearly vertical as possible. If the removal of unsound concrete extends through two thirds of the concrete slab or more, remove and replace the remaining sound concrete for full depth patching. Ensure that all exposed steel reinforcement is tied according to Subsection 602.03.04.

Remove all inferior concrete in the deteriorated and spalled areas near joints and all joint filler. Reform the joints to exact width and true alignment according to Subsection 609.03.04 for open joints except when a timber template is used, cover it with polyethylene sheeting.

Blast clean all exposed steel reinforcement and structural steel according to Subsection 606.03.04 to remove scale, rust, grease, oil and other material that would prevent adhesion of the concrete. Before placing concrete, replace or supplement deteriorated or damaged reinforcement as the Engineer directs. Remove all dust and chips

of asphalt materials, concrete, or other debris and clean the entire area with compressed air. Ensure that the compressed air is free of detrimental quantities of water, oil, grease, or any other injurious substances. Do not allow leakage of oil, grease, gasoline, or other substances from the compressor or other equipment on the deck. Suspend protective sheeting such as plastic or tarpaulins under all equipment that leaks.

Remove all spalled or deteriorated concrete in curbs, sidewalks, and plinths to a minimum depth of one inch. Blast clean, coat with a grout-bond coat, and restore to the original section with overlay material. Seal with epoxy-sand slurry.

Surface preparation, partial depth, and/or full depth removal of unsound concrete may be accomplished using hydrodemolition. Prior to any hydrodemolition operation, submit a hydrodemolition plan, in writing, for approval by the Engineer. In the hydrodemolition plan state water source, type of machine, water pressure settings and methods to collect and strain waste water and protect the public, structural steel paint, and structural steel. Calibrate the hydrodemolition machine to remove only unsound concrete. Test the machine on an area of concrete as directed by the Engineer.

Use clean water with a rust inhibitor. Collect and strain all waste water from the hydrodemolition operation. The Contractor, at a minimum, shall block all drains on the deck and install aggregate dams, or other Department approved devices, as necessary to strain runoff. The deck shall be used as a settlement basin within itself unless the Engineer or requirements of any associated regulatory agencies state otherwise.

After hydrodemolition operation, sound deck to ensure that all unsound concrete has been removed. Final sounding shall consist of as many successive resoundings as required to ensure that all unsatisfactory concrete has been removed. Additional removal shall be performed with 40 pound maximum weight hammers.

When Hydrodemolition is used, cleaning shall be performed with a vacuum system capable of removing wet debris and water all in the same pass. The vacuum equipment shall be capable of washing the deck with pressurized water prior to the vacuum operation to dislodge all debris and slurry from the deck surface. Cleaning shall be done in a timely manner, before debris and water is allowed to dry on the deck surface.

Full Depth repair shall be paid per cubic yard of concrete used and may not be done in the same operation as the deck overlay.

The Contractor shall comply with all federal, state, regional, and local government agencies that have requirements regarding the control of fugitive dust generated by concrete removal and blasting operations.

606.03.04 Blast Cleaning. Blast clean the entire area of the deck surface and vertical faces of curbs, barrier walls, and plinths up to a height of one inch above the top elevation of the overlay, and areas to receive epoxy-sand slurry to a bright, clean appearance that is free from curing compound, laitance, dust, dirt, oil, grease, asphalt material, paint, and all foreign matter. Perform blast cleaning of an area of the deck within the 24-hour period preceding placement of the overlay on the area. If the project is done under traffic, perform all blast cleaning within 12 hours prior to placement of the overlay. Perform blast cleaning according to the regulations specified in Subsection 107.01.04.

Protect the blast cleaned areas with white plastic before placement of the overlay. Blast clean contaminated areas and areas exposed more than 24 hours (12 hours when under traffic) again as the Engineer directs. Remove or roll the white plastic between the mixer truck rear wheels and the overlay placement.

Hydro blasting may be used in lieu blast cleaning. Use hand held high pressure wands with potable water. Water blast the entire area of the deck. Prevent steel reinforcement from rusting.

606.03.05 Full Depth Patching. Fill full depth holes with Class M1 or M2 Concrete. Immediately before placing concrete, dampen and surface dry the contact surface. Then apply a grout-bond coat by vigorously scrubbing or brushing into the

vertical surface of full depth routed areas. Proportion the grout mixture according to Subsection 601.03 using Type I cement. Carefully place the Class M1 or M2 concrete and tamp or vibrate into place. Rough-finish the full depth patched areas to an elevation corresponding to the scarified grade and cure for a period of no less than 7 calendar days, or until the overlay is placed, by means of a double layer of wetted burlap or similar material. If the full depth patch area is encompassed by an area of partial depth patching, finish the full depth concrete patch to an elevation corresponding to the bottom of the partial depth routed areas instead of the elevation of the scarified deck.

After the concrete has hardened sufficiently to maintain the proper shape, remove all joint templates. Avoid chipping or breaking down the edges of the repaired joint. Remove all forming material before completion of the project.

Provide temporary support for existing concrete handrails while removing and replacing full depth concrete. Submit the proposed method of supporting the handrails to the Engineer for approval before beginning work.

Blast clean the surfaces of all patched areas and remove sand before constructing the overlay. Complete all full depth patching in each lane before beginning overlay operations on that lane.

Place latex concrete overlays only when full depth patches have been placed for 24 hours or longer. Do not allow construction equipment on the full depth patches until they have attained a compressive strength of 4,000 psi.

606.03.06 Partial-Depth Patching. The Department may allow monolithic placement of the partial depth patches with the overlay.

606.03.07 Prohibited Field Welding. Do not perform welding on load carrying members of the bridge without the Engineer's written consent, and then only in the manner and at the locations designated.

606.03.08 Mixing and Placing. Mix concrete at the site by either batch or continuous mixers as the Engineer approves. Mix and deliver according to Subsections 601.03.07 and 601.03.08 except discharge within 20 minutes.

Submit to the Engineer for approval proposed methods for anchoring the finishing machine supporting rails to the deck.

Hold the formation of longitudinal joints and transverse joints to a minimum. When constructing longitudinal or transverse joints, thoroughly blast clean and coat with grout-bond coat material before placing plastic concrete against the hardened sides of the joints. Form longitudinal joints using a longitudinal header secured to the deck, 1/4 inch less in thickness than the overlay. Locate longitudinal joints along lane lines. After removal of the header, saw the overlay longitudinally 3 inches or more inside the formed edge and remove the portion of the overlay outside the saw cut before placing the adjacent portion of the overlay. The Department may allow alternate methods of constructing joints on latex overlays.

Produce the mixture at a uniform rate and perform finishing immediately after mixing.

606.03.09 Brooming. Immediately after finishing, broom the surface of the overlay transversely across the bridge deck from curb to curb. Texture the surface according to Subsection 609.03.10 immediately after finishing on new structure overlays, when specified in the Contract, and on Federal Aid projects.

606.03.10 Epoxy-Sand Slurry. After the overlay has been completed and cured, apply a thin coat (approximately 1/16 inch) of an epoxy-sand slurry to the 12 inches of the overlay adjacent to the curbs, concrete barrier walls, or other vertical walls. Extend the epoxy-sand slurry up the faces of the curbs and walls or other vertical walls and extend the epoxy-sand slurry up the faces and tops of the curbs and plinth according to the Standard Drawings. Thoroughly blast clean to a bright appearance and dry the areas to receive the epoxy-sand slurry before applying the slurry. Apply the slurry only after the deck has

been dry for 24 hours. Place strips of masking tape along the joints to prevent the slurry from entering the joints and to ensure a straight line of slurry. Proportion the slurry as follows:

One Gallon of Component A
One Gallon of Component B
2 Gallons of dry, silica sand

The Engineer may allow minor adjustments in the quantity of sand in order to produce a more workable mixture. Thoroughly mix the ingredient materials for 3 to 5 minutes. Then spread the slurry and use a squeegee to completely fill the blast cleaned pitted areas, cracks, and rough surfaces. Finish the slurry to a thickness of no more than 1/16 inch. Sprinkle silica sand very lightly over the slurry to provide skid resistance.

The Department will allow placement of thoroughly mixed neat epoxy according to Subsection 510.03.

606.03.11 Cleaning and Sealing Joints. Rework each joint according to the Standard Drawings and as follows:

A) **Joint Preparation.** Remove any old sealant and joint filler. Use tools and techniques as approved by the Engineer.

When joint is dry, sandblast to remove all contaminants. Sandblast each joint a minimum of 2 passes, one for each face, with nozzle held at an angle to the joint face and within 1 to 2 inches of the pavement. After sandblasting, air blast each joint to remove sand and other contaminants. Air blast in only one direction to prevent recontamination of the joint. Compressed air used for air blasting will be at a pressure of at least 90 psi. The air compressor used will be equipped with traps capable of removing moisture, and oil from the air. Apply primer as recommended by the sealant's manufacturer.

B) **Sealant Filler and Installation.** Seal joints on same day that preparation occurs. When joints are prepared, but not sealed on the same day, sandblasting, removal of sand and debris, and primer application will be repeated as directed by the Engineer. Also any joint that has become contaminated will be recleaned as directed by the Engineer.

Prior to installation of sealant, each joint will be inspected by the Engineer for proper depth, width, alignment, and cleanliness. Install sealant at a minimum of 1/2 inch below the pavement face and in accordance with the manufacturers' recommendations.

606.03.12 Bridge End Transitions. Overlay the end sections of the bridge and finish as follows:

A) **Rigid Approach.** Set the finishing machine rails to provide a 50-foot transition on the ends of the bridge to match the finished grade of the overlay with the existing grade of the adjacent pavement. Remove the existing concrete as necessary to maintain the minimum specified thickness of the overlay.

B) **Non-Rigid Approach or a Rigid Approach with Asphalt Overlay.** The Department will not require a transition.

606.03.13 Expansion Dam Treatment. Treat the existing expansion dams according to the Standard Drawings. The Department will not require painting of structural steel.

606.03.14 Material Hauling. Haul all material for latex concrete overlays with vehicles which do not exceed the regulation for either the legal axle weights or axle spacing contained in 603 KAR 5-066. Prior to doing any overlay work on a structure, furnish to the Engineer a certified statement listing the empty weight of each hauling

vehicle, axle weights when empty, axle weights when fully loaded, gross weight of each vehicle when loaded with a specific number of cubic yards, and the spacing of axles. The Engineer will use this information for the purpose of determining the allowable quantity of materials to be hauled. The Engineer will determine the allowable quantity of materials to be hauled based on the capacity and condition of the bridge after the removal of unsound concrete and prior to the placement of the overlay. Under no circumstances will the Department allow loads which exceed legal gross or axle load limits.

606.03.15 Damage to Structures. Take responsibility for all damage to the structure during construction until all work is completed, including the replacement of entire spans that fail as a result of this construction.

606.03.16 Unacceptable Work. When the Engineer deems necessary, the Department will core any areas of the overlay that display extensive cracking or other characteristics indicating the waterproofing effectiveness or expected life of the overlay may be reduced, or that the overlay may not be intimately bonded to the underlying deck. Remove and replace with acceptable concrete all areas shown by the cores to either have cracks exceeding a depth of 1/4 inch or to not be intimately bonded to the underlying deck. The Engineer may require removal and replacement without coring when significant cracking or lack of bond are apparent. Seal all cracks that are not significant enough to require removal of the overlay with a latex grout as the Engineer directs.

Correct all individual areas of hardened grooved concrete of 25 square feet or larger in which the texture is unsatisfactory using methods the Engineer approves.

606.03.17 Special Requirements for Latex Concrete Overlays.

A) Existing Bridges and New Structures.

- 1) Prewetting and Grout-Bond Coat. Thoroughly and continuously wet the blast cleaned areas to receive the overlay with water at least one hour before placing the overlay is started. Keep the areas wet and cooled with water until placing the overlay.

Disperse or remove all accumulations of water before applying the grout-bond coat. Immediately ahead of placing the overlay mixture, thoroughly brush and scrub a thin coating of the latex concrete mixture to be used for the overlay onto the wetted surface as a grout-bond coat. Do not allow accumulations of coarser particles of the mixture which cannot be scrubbed into intimate contact with the surface.

Apply the grout-bond coat only for a short distance in advance of placing the overlay. Do not allow the grout-bond coat to show any signs of drying before placing the overlay. Thoroughly recoat all areas showing signs of drying with fresh grout.

- 2) Proportioning and Requirements. Proportion as follows:

When adjusting, ensure the mixture contains no less than 658 pounds per cubic yard of cement nor less than 24.5 gallons per cubic yard of latex admixture.

<u>Material</u>	<u>Quantity</u>
Type I or Type III Cement	94 lbs
Latex Admixture	3.5 gal
Fine Aggregate	215 to 245 lbs ⁽¹⁾
Coarse Aggregate	165 to 195 lbs ⁽¹⁾
Water ⁽²⁾	22 lbs ⁽¹⁾

⁽¹⁾ Determine actual quantities and submit to the Engineer for approval.

⁽²⁾ Includes free moisture on the fine and coarse aggregates.

Furnish latex concrete with the following properties:

Property	Value
Slump ⁽¹⁾	4 – 6 in (KM 64-302)
Maximum Air Content	7% (KM 64-303)
Maximum W/C ratio ⁽²⁾	0.40
7 - day compressive strength ⁽³⁾	3,000 psi

⁽¹⁾ The Department will perform the slump test 4 to 5 minutes after discharging from continuous type mixers.

⁽²⁾ Consider all the non-solids in the latex admixture as part of the total water.

⁽³⁾ Attain a 28-day compressive strength of 4,000 psi when compressive strength is tested at 28 days or later due to unusual circumstances.

- 3) Placing, Consolidating, and Finishing the Overlay. Place the latex concrete overlay on the blast cleaned and prewetted deck immediately after applying the grout-bond coat. The Department will require a minimum latex concrete overlay thickness of one inch except on textured finishes. On textured finishes, the Department will require a minimum latex concrete overlay thickness of 1 1/4 inches. Ensure that the surface of the overlay conforms to the existing deck section while maintaining the minimum thickness. The Engineer will determine the deck section in the field, including the cross slope or crown. Pass the finishing machine over the existing deck prior to placing the overlay so that the Engineer can make measurements to ensure the proper cross slope and thickness.

Construct a transverse construction joint whenever placing is interrupted for any reason for 20 minutes or longer.

Ensure that the top surface of the overlay is uniform, smooth, and even-textured after finishing with a finishing machine. Thoroughly consolidate the concrete by vibration during the finishing operations. Ensure that the finished surface does not vary more than 1/8 inch in 10 feet as measured from a straightedge.

- 4) Curing. Immediately following the brooming operation or texturing, when texturing is required, cover the overlay with a thoroughly wetted layer of burlap immediately followed by a layer of polyethylene film 4 mils or more in thickness. Place sections or strips of burlap transversely, so that the overlay can be covered immediately after finishing or texturing. Leave the burlap and polyethylene film in place for at least 24 hours, and rewet the burlap if any signs of drying appear. Soak new burlap in water for at least 12 hours before the first use.

After the 24-hour period has ended, remove the burlap and polyethylene and allow the overlay to air-cure. Continue the air-cure for an additional 48 hours when using Type I cement or an additional 24 hours when using Type III cement at an ambient air temperature of 50 °F or more.

When the overlay has cured, give the tops of all longitudinal and transverse construction joints a thorough coating of grout of the same proportions as the latex concrete mixture used for the grout-bond coat material. Neatly and uniformly apply a 2-inch wide or wider coating to seal any minute cracks at these locations. Do not use epoxy-sand slurry to seal construction joints in lieu of grout.

The Department will allow the overlay to be opened to traffic as soon as curing is completed, all full depth patches are at least 7 days old or have attained a compressive strength of 4,000 psi, all construction joints are

sealed, and gutterline and curb slurry is applied.

B) Special Requirements for New Structures. Construct according to A) above with the following exceptions and additions:

- 1) The Department will not require machine preparation of the top 1/4 inch of the deck.
- 2) Construct an overlay having a thickness of 1 1/2 inch.
- 3) Texture the overlay surface according to Subsection 609.03.10.
- 4) Perform operations in the following sequence: blast clean the existing deck; apply the grout-bond coat; mix, place, and consolidate the overlay mixture; finish; texture; cure; seal joints and cracks; then apply the epoxy-sand slurry.
- 5) Do not overlay the deck until it is at least 14 calendar days old.
- 6) When longitudinal construction joints are necessary, completely cure each section of the overlay before placing the adjacent section of the overlay.

606.04 MEASUREMENT.

606.04.01 Removal of Epoxy, Asphalt, and Foreign Overlay. When listed as a bid item, the Department will measure the quantity in square yards.

606.04.02 Machine Preparation of Existing Slab. The Department will measure the quantity in square yards. The Department will not deduct parts of the deck that are not concrete such as deck drains, castings, expansion dams, and patches of foreign material for payment.

606.04.03 Concrete, Class M for Full-Depth Patching. The Department will measure the quantity in cubic yards. The Department will not measure removal of epoxy, asphalt, or foreign overlays for payment, unless listed as a bid item, and will consider it incidental to this item of work.

606.04.04 Structural Steel. The Department will measure the quantity according to Subsection 607.04.

606.04.05 Blast Cleaning. The Department will measure the quantity in square yards. Before placement of the overlay the Department will measure the area of the deck and the vertical part of the curb which will be in direct contact with the overlay (distance equal to the thickness of the overlay) plus one inch for payment. After placement of the overlay and before placement of the epoxy-sand slurry, the Department will measure the 12-inch width of the overlay and the sides and tops of curbs that are to receive the epoxy-sand slurry for payment. The Department will not measure any repeated blast cleaning for payment and will consider it incidental to this item of work.

606.04.06 Latex Concrete Overlay Concrete Overlay. The Department will measure the quantity in cubic yards as metered from an accurately calibrated mixing unit. The Department will measure the overlay partial depth patches and material used to patch spalled or deteriorated sections of curbs, sidewalks or plinths for payment. The Department will not measure the volume of material wasted or not incorporated in the work; grout used for the bond coat; crack sealing; or sand blast cleaning of reinforcing steel, longitudinal or transverse construction joints, areas of curbs, sidewalks, plinths, and other areas to be patched; or temporary supports for existing concrete handrails while removing and replacing full depth concrete for payment and will consider them incidental to this item of work.

606.04.07 Epoxy-Sand Slurry. The Department will measure the quantity in square

yards. The Department will measure the entire area covered, including the 12-inch width of the overlay and the sides and tops of curbs, barrier walls, and plinths for payment.

606.04.08 Joint Sealing. The Department will measure the quantity in linear feet.

606.04.09 Hydrodemolition. When listed as a bid item, the Department will measure the quantity in square yards. Otherwise, the Department will not measure Hydrodemolition for payment and will consider it incidental to the overlay.

606.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
08510	Removal of Epoxy, Asphalt, or Foreign Overlay	Square Yard
08551	Machine Preparation of Slab	Square Yard
08526	Concrete, Class M for Full Depth Patching ⁽¹⁾⁽³⁾	Cubic Yard
08160	Structural Steel	See Subsection 607.05
08549	Blast Cleaning	Square Yard
08534	Concrete Overlay, Latex ⁽¹⁾⁽²⁾⁽³⁾	Cubic Yard
08504	Epoxy-Sand Slurry	Square Yard
08540	Joint Sealing	Linear Foot
08550	Hydrodemolition	Square Yard

⁽¹⁾ The Department will establish an adjusted unit price according to the supplemental formulas established for excessive overruns and underruns in Subsection 104.02.02 when this pay item is a major item and either an overrun or an underrun of more than 25 percent occurs.

⁽²⁾ The Department will adjust the Contract unit price of overlays on new structures by the Schedule for Adjusted Payment for Thickness Deficiency. The adjusted quantity is equal to the measured quantity of the pay item multiplied by the Contract unit price for the pay item and the Price Adjustment. As an option, remove and replace overlays with an average deficiency in thickness of no more than 1/2 inch with an overlay of the specified thickness at no cost to the Department. The Department will not make additional payment for average thicknesses of overlay in excess of the specified thickness.

**Schedule for Adjusted Payment for
Thickness Deficiency**

Average Thickness Deficiency (inches)	Price Adjustment (Percent of Contract Unit Bid Price)
0	100.0
1/16	95.0
1/8	90.0
3/16	80.0
1/4	70.0
5/16	57.5
3/8	45.0
7/16	25.0
1/2	0.0
Greater than 1/2	^(a)

^(a) Remove and replace with an overlay of the specified thickness at no expense to the Department.

⁽³⁾ When placing concrete on overlays is not begun within 2 hours after the scheduled

time, the Department will deduct all engineering costs from the scheduled time until the time placing begins or is canceled from the Contract amount. The Department will not deduct engineering costs for uncontrollable circumstances such as inclement weather or equipment failure after placing begins.

The Department will consider payment as full compensation for all work required under this section.

SECTION 607 — STRUCTURAL STEEL BRIDGES

607.01 DESCRIPTION. Build steel bridges, and perform other structural steel and miscellaneous metal construction.

The dimensions specified in the Plans are for a normal temperature of 60° F with dead load on the structure.

607.02 MATERIALS AND EQUIPMENT.

607.02.01 Paint. Conform to Section 821.

607.02.02 Structural Steels. Conform to Section 812.

607.02.03 Miscellaneous Metals. Conform to Section 813 for pins and rollers; bearing and expansion plates (rockers and expansion dams); aluminum; high-strength steel bolts, nuts, and washers; and welding. Use flat and smooth circular washers and square or rectangular beveled washers.

Ensure that bolt dimensions conform to the heavy hexagon structural bolt requirements of ANSI B18.2.1 and Section 813.

Ensure that nut dimensions conform to the heavy hexagon nut requirements of ANSI B18.2.2 and Section 813.

Identify heavy hexagonal structural bolts, manufactured according to ASTM A 325, on the top of the head by 3 radial lines, the legend “A 325”, and the manufacturer’s mark.

Identify Grade 2H nuts on at least one face by the marking “2H” or “2HB”, and Grade DH by the marking “DH”. Ensure that all nuts bear the manufacturer’s identification mark.

Heavy hexagonal structural bolts have shorter thread lengths than other standard bolts. Depending on the amount of bolt length added to adjust for incremental stock lengths, the full thread may extend into the grip as much as 3/8 inch for the following bolt sizes; 1/2 inch, 5/8 inch, 3/4 inch, 7/8 inch, 1 1/4 inch and 1 1/2 inch, and as much as 1/2 inch for the following bolt sizes; one inch, 1 1/8 inch, and 1 3/8 inch. The fabricator may include some of the thread run-out into the plane of the shear. When the thickness of an outside part adjacent to the nut is less than these values, the fabricator may use the next increment of bolt length together with a sufficient number of flat circular washers to ensure full seating of the nut.

607.02.04 Wrenches. Use manual or power torque wrenches. Use power wrenches of adequate capacity and of sufficient air supply to perform the required tightening of bolts in approximately 10 seconds.

607.02.05 Direct Tension Indicators. When specified on the plans, use direct tension indicators conforming to ASTM F 959. Determine correct bolt tension by examining the gap between the washer and bolt head remaining after tightening.

Include with each shipment of direct tension indicators, reports of actual tests showing the bolt tension achieved when the indicators are loaded. Ensure that the bolt tension is ± 20 percent greater than the tension specified in the Bolt Tension table in Subsection 607.03.05. Furnish test reports for representative samples of each lot or heat and each size tension indicator in the shipment, and provide packaging that easily identifies individual lots or heats. The Department may perform any additional sampling or testing the Engineer deems necessary.

Mark the tension indicators with the correct grade (A 325 or A 490) to ensure ready verification on the job.

607.02.06 Tapes. Use only tapes that are correctly calibrated with NIST to ensure correct fit of the work.

607.03 CONSTRUCTION.

607.03.01 Shop Drawings and Welding Procedures. Submit to the Division of Structural Design detailed shop drawings and welding procedures. The Department will furnish plans showing sufficient details to prepare detailed shop drawings. Include welding procedures and details, when required, as part of the shop drawings. The Department will not consider the shop drawing review process to be complete without the submittal of welding procedures. Make all initial drawing submittals on sheets of paper, 11 inches by 17 inches. Ensure that all drawings provide clear, sharp lines on prints. Submit initially to the Division of Structural Design 3 sets (6 for railroad bridges) of prints of the detailed shop drawings and welding procedures. The Division of Structural Design will return one set of reviewed shop drawings with all required corrections noted. When corrections are necessary, submit 3 sets of prints of the corrected drawings. After final review, furnish to the Division of Structural Design 10 sets of correct shop drawing prints for distribution. After fabrication is complete and the Engineer has approved the structural steel for shipment, furnish to the Engineer one electronic set of the reviewed shop drawings, including the welding procedures, in a 22 inch by 36 inch Portable Document Format (PDF) which will produce clear prints.

Do not make any changes to any drawing after the Engineer has reviewed it without the Engineer's written approval or written direction.

Allow at minimum 30 days for review of shop drawings of welded plate girders or rolled steel sections and per panel of steel trusses after receipt in the Division of Structural Design. Special designs may require longer. Partial submittals are allowed for trusses and special designs, but reviews may not be complete until full submittals are received.

Only make substitutions of sections different from those shown on the drawings when the Engineer approves in writing.

Although the drawings may have been reviewed, take responsibility for the correctness of the drawings and for shop fits and field connections.

Take responsibility for any material ordered or work done before the Engineer reviews the drawings and welding procedures.

When design drawings differ from the shop drawings, the design drawings govern. When the requirements of this section differ from the shop drawings, the requirements of this section govern.

When the design drawings differ from the requirements of this section, the design drawings govern.

607.03.02 Workmanship.

- A) **Quality of Workmanship.** Ensure that workmanship and finish are equal to the AISC best general practices in modern bridge shops.
- B) **Storage of Materials.** Store structural material, either plain or fabricated, at the fabricating shop above ground upon platforms, skids, or other supports. Keep it free from dirt, grease, and other foreign matter and protect it from corrosion.
- C) **Straightening Materials.** Before measuring or working rolled material, ensure that it is straight. When straightening is necessary, use methods that will not injure the metal. If sharp kinks and bends are evident, the Engineer will reject the material.
- D) **Finish.** Blast clean all structural steel prior to beginning any fabrication. Provide a neat finish to the work. Shear, flame cut, grind, and chip carefully and accurately. Remove all burrs resulting from reaming or drilling.

607.03.03 Bolt Holes. Either punch or drill all holes for connections.

A) **Punched Work.** Punch all holes full-size except:

- 1) When there are more than 5 thicknesses, or when any of the main material is thicker than 3/4 inch in structural carbon steel, 5/8 inch in high-strength low

alloy steel, or 1/2 inch in quenched and tempered alloy steel, sub-punch all holes, and ream them after assembling according to the requirements of C) below.

- 2) When the metal is thicker than the size of the bolts, drill the holes according to the requirements of D) below.
- 3) Sub-punch and ream punched holes for stringer and floor beam field connections according to the requirements C) below, or sub-punch and ream to a metal template no less than one inch thick, without assembling.
- 4) Sub-punch and ream punched holes in field connections of main truss or arch members, skew portals, skew portal bracing plate, girder spans, continuous I-beam spans and rigid frames. Punch holes in connection plates or other parts of such members according to the requirements of C) below. Main truss members are the top and bottom chords, end posts, and web members forming the truss.

- B) Punched Holes.** Punch full-size holes 1/16 inch larger than the nominal diameter of the bolt. Do not allow the diameter of the die to exceed the diameter of the punch by more than 3/32 inch. Ensure that holes are cut cleanly without torn or ragged edges.

Punch holes so that, after assembling the component parts of a member and before reaming, a cylindrical pin 1/8 inch smaller than the nominal diameter of the punched hole may be passed through at least 75 of any group of 100 contiguous holes, or in like proportion for any smaller group of holes. When 10 percent or more of any group of 100 or fewer holes will not pass a pin 3/16 inch smaller than the nominal diameter of the punched hole, the Engineer will reject the mispunched pieces. Ream any holes that must be enlarged to admit bolts.

- C) Sub-Punched and Reamed Holes.** Punch sub-punched and reamed holes for bolts 3/16 inch smaller than the nominal diameter of the bolts. Ensure that the punch and die have the same relative sizes as specified for full size punched holes.

After assembling, ream sub-punched holes to a diameter of 1/16 inch larger than the nominal diameter of the bolt.

After assembling and firmly bolting pieces forming a built member perform reaming. Do not interchange reamed parts.

Ream holes with twist drills or with short taper reamers. Do not direct reamers by hand unless the Engineer approves. Use solvents, detergents, or other Engineer approved means before cleaning and painting, to thoroughly remove any oil or grease used as a reaming lubricant.

- D) Drilled Holes.** Ensure that drilled holes are 1/16 inch larger than the nominal diameter of the bolt. However, do not allow drilled holes for turned bolts to be more than 1/32 inch larger than the diameter of the finished bolt. Hold parts securely together while drilling assembled members.

Do not use numerical tape or electronic computer controlled drills unless the fabricator can provide a history showing defect free work of this type. This means that previous work was free of misdrilled holes caused by human errors or machine errors.

Drill holes according to the requirements of E) below. Submit to the Engineer for review with the shop drawings, the proposed procedure for drilling holes and assuring correct fit of members. When using numerical tape or electronic computer controlled drills, the Department will require shop assembly of at least 25 percent of the splices and at least 10 percent of floor beam and bracket main member connections as proof of accurate fit. In the event holes do not match as prescribed for the assembled pieces, assemble and ream all splices to fit and use metal templates to ream all other floor beam connections.

- E) Accuracy of Reamed and Drilled Holes.** Ensure that reamed or drilled holes are cylindrical and perpendicular to the member. After reaming or drilling, do not allow 85 of any group of 100 contiguous holes, or in like proportion for any