ITEM 439

CONCRETE BRIDGE DECK OVERLAYS

439.1. Description. Overlay concrete bridge deck surface with concrete, dense concrete, or latex-modified concrete. Remove and replace deteriorated or delaminated concrete.

439.2. Materials. Provide materials conforming to the pertinent requirements of the following Items except as noted in this Item:

- Item 421, “Hydraulic Cement Concrete”
- Item 428, “Concrete Surface Treatment”
- Item 440, “Reinforcing Steel.”

A. Cement. Use the same type, brand, and source of cement for any 1 structure. Unless otherwise shown on the plans, use Type I or Type II cement.

B. Coarse Aggregate. Provide a crushed or broken coarse aggregate conforming to Grade No. 6 of Section 421.2.E.1, “Coarse Aggregate,” unless used in latex-modified concrete or otherwise shown on the plans. At least 85% of the coarse aggregate particles retained on the No. 4 sieve must have 1 or more mechanically induced crushed faces as determined by Tex-460-A.

Provide an aggregate with an absorption not exceeding 3% when tested in accordance with Tex-403-A, for dense concrete overlays.

For latex-modified concrete, provide aggregate conforming to Grade No. 8 of Section 421.2.E.1, “Coarse Aggregate,” unless otherwise specified.

C. Latex. Provide latex admixture (ASTM C 1438, Type II polymer modifier) meeting the requirements of Table 1.

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total solids</td>
<td>&gt; 47%</td>
</tr>
<tr>
<td>pH</td>
<td>9.0 to 11.0</td>
</tr>
<tr>
<td>Brookfield viscosity, #1 spindle @ 10 rpm</td>
<td>5 to 40 cPs</td>
</tr>
<tr>
<td>Butadiene content</td>
<td>30 to 40%</td>
</tr>
<tr>
<td>Weight per gallon</td>
<td>8.4 to 8.6 lb./gal.</td>
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</tbody>
</table>

Store latex at temperatures between 40°F and 85°F. Do not allow latex to freeze.

D. Grout. When shown on the plans, provide grout for bonding new concrete to existing concrete, consisting of equal parts by weight of hydraulic cement and sand. Mix with sufficient water to form a stiff slurry, which can be applied with a stiff brush or broom to the existing concrete in a thin, even coating that will not run or puddle in low spots.

439.3. Equipment.

A. Surface Preparation Equipment.

1. Scarifying. Provide equipment meeting the requirements of Item 483, “Scarifying Concrete Bridge Slab.”

2. Abrasive Blasting. Provide equipment capable of removing oil, dirt, slurry, curing compound, laitance, etc., from the surface of the concrete.

3. Sawing. When required, provide equipment capable of sawing concrete to the specified depth of overlay.

5. **Chipping Hammers.** Provide chipping hammers not heavier than a nominal 15-lb. class to remove concrete beneath any reinforcing bars.

**B. Proportioning and Mixing Equipment.**

1. **Grout Mixer.** Provide a volumetric continuous or mortar mixer.
2. **Concrete Overlay.** Follow applicable provisions of Item 421, “Hydraulic Cement Concrete.”
3. **Dense Concrete Overlay.** Follow applicable provisions of Item 421, “Hydraulic Cement Concrete.” Proportion and mix the concrete at the project site using a suitable approved mixer capable of thoroughly mixing the ingredients to a uniform consistency.
4. **Latex-Modified Concrete Overlay.** Follow the applicable provisions of Item 421, “Hydraulic Cement Concrete.” Proportion and mix the latex-modified concrete at the project site using a suitable approved mixer capable of thoroughly mixing the ingredients to a uniform consistency.

**C. Placing and Finishing Equipment.**

1. **Hand Tools.** Provide sufficient hand tools for placing, consolidating, striking off, and finishing stiff plastic concrete.
2. **Finishing Equipment for Concrete Overlay.** Provide an approved surface vibrator moving ahead of the finishing machine or an approved vibrating screed for overlay consolidation. Provide work bridges or other suitable facilities to perform all finishing operations.
3. **Finishing Equipment for Dense Concrete or Latex-Modified Concrete Overlay.** Provide a mechanical strike-off to ensure a uniform thickness of concrete in front of the screed. Provide a screed designed to consolidate the dense concrete overlay to 98% of the unit weight as determined in accordance with Tex-417-A. Design the bottom face of the screed to minimize tearing of the surface of the plastic concrete.

   Provide a finishing machine capable of forward and reverse motion under positive control. Make appropriate provisions for raising the screeds to clear the screeded surface for traveling in reverse. Equip the finishing machine to travel on and screed off of any adjacent completed lane without damaging it. Use approved manual screeds and vibrators to consolidate and finish small or irregular areas inaccessible to the finishing machine. Provide work bridges or other suitable facilities to perform finishing operations and density checks.

**439.4. Construction.**

**A. General.** Provide for approval a detailed work plan including equipment and manpower before beginning any work.

The Engineer will inform the Contractor if night placements become necessary. No additional compensation will be provided for night placements of concrete. Provide sufficient lighting to make quality workmanship and adequate inspection possible during night placements. Lighting must be approved before operations begin.

Provide sufficient labor and equipment for proportioning, mixing, placing, and finishing concrete overlay at a rate of at least 40 ft. of finished overlay per hour. Do not allow traffic other than construction equipment for the overlay on any portion of the prepared bridge deck before the overlay has been placed. Provide side and end forms for supporting the screed and containing the overlay concrete. Provide reinforcement, when required, in accordance with Item 440, “Reinforcing Steel,” and the details shown on the plans.

Place concrete only when the air or deck temperature is 40°F or above and the concrete temperature is between 50°F and 85°F. Do not cart concrete batches over the completed overlay until the overlay concrete has attained a 3,000-psi compressive or 425-psi flexural strength. If carts are used, provide timber planking of at least 3/4-in. thickness for the remainder of the curing period. Provide carts equipped with pneumatic tires. Do not interrupt curing operations for the purpose of carting concrete over finished slabs.

Open the structure with the completed overlay to normal construction traffic or to the traveling public in accordance with Section 420.4.A, “Schedule Restrictions.”
B. **Surface Preparation.** Do not scarify concrete surfaces with a grooved or tined finish unless shown on the plans. Prepare these surfaces by abrasive blasting or water-injected abrasive blasting as required to remove dirt, oil, curing compound, laitance, surface mortar, and other material that would inhibit bonding of the overlay but leave the striations intact.

Scarify the surfaces of slabs to be rehabilitated to the depths shown on the plans in accordance with Item 483, “Scarifying Concrete Bridge Slab.”

Remove and dispose of deteriorated or delaminated areas of concrete as shown on the plans or as determined by the use of a sounding hammer, chain drag, or other acceptable device and by visual inspection after scarifying as approved.

Type 1 Slab Repair consists of removing deteriorated concrete from the top of the scarified surface to 1/2 the depth of the slab, and replacing it with concrete as specified for the overlay. Areas where deteriorated concrete extends below mid-depth of the slab will be designated as Type 2 repairs.

Type 2 Slab Repair consists of removing deteriorated concrete from the top of the scarified surface to the bottom of the slab and replacing it with concrete as specified for concrete overlays or Class S concrete for dense concrete or latex-modified concrete overlays. Remove any unsound areas of a Type 1 repair that extend below the maximum depth for a Type 1 repair in accordance with the requirements for a Type 2 repair. This area will be designated as a Type 2 repair for payment.

Use a jackhammer not heavier than a nominal 30-lb. class to remove deteriorated concrete in small areas not accessible to the mechanical scarifier, and to spot-remove small areas of deteriorated concrete to a depth down to the existing top reinforcing steel. This class of jackhammer may also be used for concrete removal between existing reinforcing bars to a greater depth. Use chipping hammers not heavier than a nominal 15-lb. class to remove concrete from beneath any reinforcing bars. Avoid cutting, stretching, or damaging exposed reinforcing steel by direct impact of these power tools. Repair or replace reinforcing steel damaged during the concrete removal process at no additional expense to the Department. Operate all jackhammers and chipping hammers at an angle of 45° or less measured from the surface of the slab.

When the bond between existing concrete and reinforcing steel that will remain in place has been destroyed, remove the concrete adjacent to and below the bar to a minimum depth of 1 in. below the bar to permit the new concrete to bond to the entire periphery of the exposed bar.

Clean all exposed reinforcing steel, scarified surfaces, and newly exposed concrete surfaces including construction joints against curbs or parapet walls by wet or dry grit blasting before placing the concrete. Blast corroded reinforcing steel to gray metal. Remove and place all blast debris in an approved disposal site. Repair or replace damaged reinforcing steel as required.

Water-blast surfaces prepared by abrasive blasting or water-injected abrasive blasting. Remove windblown dust, dirt, debris, or standing water from the surface with a high-pressure filtered air-blasting just before placing the grout.

C. **Classification and Mix Design.** Provide a mix design in accordance with Item 421, “Hydraulic Cement Concrete.” Use a water reducing chemical admixture as necessary to achieve the desired consistency without exceeding the specified water to cementitious material ratio. Provide a mix design with an entrained air content of the fresh concrete of 6% with a tolerance of ±1% when tested in accordance with Tex-414-A, “Air Content of Freshly Mixed Concrete by the Volumetric Method,” or Tex-416-A, “Air Content of Freshly Mixed Concrete by the Pressure Method,” together with the following requirements:

1. **Concrete Overlay.** Provide Class CO concrete with a coarse aggregate factor of at least 0.55.

2. **Dense Concrete Overlay.** Provide Class DC concrete with a coarse aggregate factor that will provide equal absolute volumes of fine aggregate and coarse aggregate with a tolerance of ±5%.

3. **Latex-Modified Concrete.** Provide Class LMC concrete with a minimum cement content of 658 lb. per cubic yard, a minimum latex admixture content of 24.5 gal. per cubic yard, and a maximum water content of 18.9 gal. per cubic yard. Provide a mix design using a coarse aggregate volume of 30 to 45% by weight of the total aggregate and a weight ratio of cement to sand to coarse aggregate of 1.0:2.8:1.7 based on aggregate in a saturated surface-dry condition. Use a
commercially available antifoaming agent with the polymer modifier as necessary to control the air content in the mix.

D. Placing and Finishing Concrete. Grade the screed rails or headers to ensure the concrete is finished to the required profile. Place the rails or headers outside the area to be overlaid. Provide anchorage of headers or supporting rails for horizontal and vertical stability as necessary. A hold-down device anchored into the concrete will not be permitted unless the concrete is to be subsequently overlaid. Obtain approval for plans for anchor support of headers or rails before beginning work.

Provide the overlay thickness specified on the plans. Adjust the screed and screed rail as necessary to provide the approved grade and required thickness. For nonreinforced overlays, check the clearance between the screed and existing surface by attaching a filler block with a thickness of 1/8 in. less than the overlay thickness to the bottom of the screed. With the filler block in place, pass the screed over the area to be overlaid. Correct any areas having insufficient clearance by adjusting the screed and rail system or by chipping or scarifying as approved by the Engineer. For reinforced overlays, check screed clearance and reinforcement cover as approved by the Engineer.

Construct longitudinal joints at locations shown on the plans or as approved. Construct a straight and vertical edge at transverse and longitudinal construction joints. Saw joints before placing the adjacent overlay course.

Install expansion joints in the overlay at the same locations as the expansion joints in the deck.

Moisten the prepared surface to a saturated surface-dry condition just before placing the overlay concrete. Remove standing water from the surface before placing the overlay concrete.

Do not use bonding grout unless otherwise required on the plans or by this Item. When bonding grout is required, moisten the prepared surface to an approximately saturated surface-dry condition before placing bonding grout. Scrub a thin coating of grout into the prepared surface immediately before placing the concrete. Ensure that all surfaces including vertical joints receive a thorough, even coating and that no excess grout collects in pockets. Apply the grout so that it does not become dry before it is covered with concrete. Coat areas of the bridge deck where concrete has been removed below the top mat of reinforcing steel with bonding grout if required, and fill them with overlay concrete or Class S concrete as applicable to cover the reinforcing steel. Adequately consolidate and rough float these areas just ahead of the overlay placement.

Place and mechanically strike off the overlay concrete slightly above the final grade. Follow this strike-off by mechanically consolidating and screeding the surface to the final grade. Vibrate all concrete into the corners and angles of the edges. Hand-finish the surface with a float as necessary to produce a tight, uniform surface.

Consolidate dense concrete to 98% density as determined in accordance with Tex-451-A after screeding and before applying the surface texture.

Assure dense, watertight construction joints by properly consolidating the concrete and float-finishing the top surface of the joint flush with the adjacent concrete.

Meet the straightedge and finishing requirements specified in Section 420.4.I, “Finish of Bridge Slabs,” for the finishing of the concrete overlay.

E. Curing. Wet-burlap cure the overlay as soon as possible after the concrete has been textured. Overlay that dries out or cracks before the wet burlap is applied will be rejected. Keep the burlap continuously wet for 24 hr. Water-cure the overlay in accordance with Section 420.4.J, “Curing Concrete,” for an additional 7 days. Maintain the surface temperature of the concrete above 40°F for the required curing period. Remove and replace rejected overlay concrete at no additional cost to the Department.

F. Concrete Surface Treatment. Apply concrete surface treatment to the overlay in accordance with Item 428, “Concrete Surface Treatment.”

439.5. Measurement. The removal of deteriorated or delaminated concrete for slab repair will be measured by the square yard of surface area, measured in place.

Concrete overlay, dense concrete overlay, and latex-modified concrete overlay will be measured by the square yard of surface overlaid using the dimensions shown on the plans. Overlay is a plans quantity
measurement item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2, “Plans Quantity Measurement.” Additional measurements or calculations will be made if adjustments of quantities are required.

439.6. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Slab Repair (Type 1)” and “Slab Repair (Type 2)” and for “Concrete Overlay,” “Dense Concrete Overlay,” and “Latex-Modified Concrete Overlay” of the specified depth.

Payment for “Slab Repair (Type 1)” and “Slab Repair (Type 2)” is full compensation for removal of deteriorated or delaminated concrete below the top of scarified surface, cleaning and restoration of reinforcing steel, and replacement with concrete.

Payment for “Concrete Overlay,” “Dense Concrete Overlay,” or “Latex-Modified Concrete Overlay” is full compensation for abrasion blasting of the surface; furnishing and placing grout; reinforcing steel; and furnishing, placing, finishing and curing the concrete overlay. Scarifying will be paid for in accordance with Item 483, “Scarifying Concrete Bridge Slab.”

These prices are full compensation for materials, tools, equipment, labor, and incidentals.