

## SECTION 1042—LATEX MODIFIED MORTAR OR CONCRETE WEARING SURFACE

**1042.1 DESCRIPTION**—This work is construction of a one course wearing surface of latex modified mortar or concrete on in-service bridge decks. The indicated or specified depth of the wearing surface is the minimum.

### 1042.2 MATERIAL—

(a) **Cement.** Type I, IP, IS, or II (MH), Section 701.1.

(b) **Fine Aggregate.** Type A, Section 703.1.

(c) **Coarse Aggregate.** Type A, No. 8, Section 703.2.

(d) **Water.** Section 720.1

(e) **Latex Emulsion Admixture.** Section 711.3(e)

(f) **Latex Modified Mortar or Concrete Mix Design.** Use latex modified mortar for depths less than 1 1/4 inches. Use latex modified concrete when the depth is 1 1/4 inches or more.

Provide a concrete technician as specified in Section 704.1(d)2. Provide testing facilities and equipment as specified in Section 704.1(d)3.

The term “latex,” as used in this Section, refers to latex modified mortar or concrete, unless otherwise specified. Provide latex conforming to the following requirements:

Latex Modified Mortar or Concrete Mix Design Requirements	Requirements	
	Mortar	Concrete
Cement Content, bags/cu. yd.	8.0	7.0
Latex Emulsion Admixture Modifier, gal/bag of Cement	3.5	3.5
Air Content, % of Plastic Mix (AASHTO T 152)	1 - 7	1 - 7
Water/Cement Ratio, by Weight	0.35 - 0.40	0.30 - 0.40
Slump <sup>(1)</sup> , inches (AASHTO T 119)	4 - 6	3 - 7
Percent Fine Aggregate as Percent of Total Aggregate, by Weight	100	60 ± 5
Cement/Fine Aggregate/Coarse <sup>(2)</sup> Aggregate Ratio, by Weight	1:3.25	1:2.5:2.0 to 1:2.9:1.6
5-day Compressive Strength (psi) (PTM Nos. 604 & 611) <sup>(3)</sup>	3,000	3,000
28-day Compressive Strength (psi) (PTM Nos. 604 & 611) <sup>(3)</sup>	3,500	3,500

<sup>(1)</sup> Discharge the sample from the mixer and transport it to a point unaffected by vibration. Deposit the sample on the deck in a suitable container and do not disturb for five minutes. Then, remix the sample and perform the slump test according to AASHTO T 119.

<sup>(2)</sup> Dry basis, Aggregate Specific Gravity = 2.65. The dry weight ratios are approximate and should produce good workability, but due to gradation changes, the ratios may be adjusted within limits by the Representative.

<sup>(3)</sup> Cure specimens according to PTM No. 611, Section 11.1, except strip after the first 48 hours (± 2 hours), and air cure as specified in Section 1042.3(d) Table A.

**1. Compatibility Testing During Mix Design.** Verify the compatibility of the mix components during mix design and ensure that the mix provides sufficient time of workability to satisfactorily finish and texture the surface. Re-verify compatibility whenever there is a change in mix components. Provide a technical expert from the latex admixture manufacturer for the design process, if directed.

(g) **Mix Designs Using Potentially Reactive Aggregates.** Section 704.1(g)

**1042.3 CONSTRUCTION—**

**(a) Equipment.** Obtain acceptance of all equipment for the deck preparation, mixing, placing, and finishing of the latex wearing surface, before start of wearing-surface work. Include equipment specifications in the QC Plan specified in Section 1042.3(c).

**1. Surface Preparation Equipment.** Of the following types:

**1.a Sandblasting or Water Blasting Equipment.** Capable of removing partially loosened chips of concrete and removing rust and corrosion from reinforcement bars. Water blasting equipment must have a minimum rated capacity of 7,5000 pounds per square inch.

**1.b Power-Driven Hand Tools.** Section 1040.3(c)

**2. Proportioning and Mixing Equipment.** Provide self-contained, mobile equipment, capable of continuous mixing, with the capacity to deliver a minimum of 6 cubic yards of latex per hour, and subject to the following:

**2.a Mixing Equipment.** Provide equipment with a metal plate or plates permanently attached in a prominent place, plainly marked with the gross volume of the unit in terms of mixed mortar, operating speed, auger mixing angle, and the weight-calibrated cement constant of the machine, in terms of a revolution counter or other output indicator, all as rated by the manufacturer.

**2.b Compartments.** Provide separate compartments to carry the necessary ingredients needed for the production of latex modified mortar or concrete. Cover aggregate bins at all times. Provide cement bins free of moisture and contamination at all times. Provide suitable means to carry water and additives on the truck and to incorporate the additives with the mixing water in the mix.

**2.c Feed Systems.** Provide a unit with a feeder system mounted under the compartment bins to deliver the ingredients to the mixing unit. Provide each bin with an accurately controlled, individual gate to form an orifice for volumetrically measuring the material drawn from each respective bin compartment. Maintain belt feeders and scrapers to prevent leakage of materials onto the deck.

Set the cement bin feeding mechanism to discharge continuously, and at a uniform rate, a given volumetric weight equivalent to cement during the mixing operation. Coordinate the aggregate feeding mechanisms with the cement feeding mechanisms to deliver the required proportions.

**2.d Mixing Unit.** Provide an auger-type mixing unit, incorporated into the truck's discharge chute or other suitable mixing mechanism, capable of producing latex of uniform consistency and discharging the mix without segregation.

**2.e Dials and Measuring Devices.** Equip the unit with an accurate revolution counter indicator allowing the reading of the volumetric weight equivalent to cement discharged during the mixing operation. Equip the counter with a ticket printout to record this quantity. Use aggregate dials that allow the setting of required openings for volumetric proportioning.

Equip the unit with a cumulative water meter and a water flow gauge to accurately indicate the discharge rate of water by volume (gallons per minute) entering the mix. Provide an approved device on the mixing unit for the Representative to use to check the rate of flow of the latex modified admixture entering the mix along with the total amount of latex modified admixture contained in the mix. Coordinate the water and additive measuring devices with the cement and aggregate feeding mechanisms. Equip the flow meters with scales appropriate for the type and amount of material being added.

Mount a tachometer on the mixing unit to indicate the drive shaft speed.

Place all required indicating devices in full view and near enough to be accurately read or readjusted by the operator while latex is being produced. Provide the operator with convenient access to all controls.

**2.f Calibration.** Provide a unit constructed to allow convenient calibration of the gate openings

and meters. Have the calibration conducted by the supplier of the latex in the presence of Representatives, and recalibrate after every 100 cubic yards of production for each unit. Document the calibration of Form CS-4342 and keep with the mobile mixer. Have the supplier of the latex make satisfactory arrangements with the Representative at least 7 calendar days in advance of calibration. Provide platform scales calibrated annually. Calibrate using the maximum water/cement ratio, cement, and aggregates listed on the approved mix design. Verify compatibility of components and mix workability time while performing a yield test at the conclusion of the calibration process, if directed.

Conduct a recalibration in the event of a change in source of aggregates. Conduct additional calibration as directed. Have each approved unit carry a copy of the calibration certificate. In addition to calibration, perform a yield test according to AASHTO T 121, if directed.

An additional check may be made using the following procedure:

With the cement meter set on zero and all controls set for the desired mix, activate the mixer discharging mixed material into a 1/4 cubic yard container (36 inches by 36 inches by 9 inches). When the container is level-struck full, making provision for settling the material into all corners, the cement meter is required to show a discharge of 2 bags of cement for modified mortar (8 bags per cubic yard mix) or 1.75 bags of cement for modified concrete (7 bags per cubic yard mix).

**2.g Mixing and Delivery Control.** Proportion, measure, and batch cement and aggregates by a volumetric weight equivalent method. In operation, the entire measuring and batching mechanism is required to produce the specified proportions of each ingredient. Establish volume/weight relationships during the calibration of the measuring devices. Provide tolerances in proportioning the various ingredients as follows:

- |                              |             |
|------------------------------|-------------|
| • Cement, weight %           | 0.0 to +4.0 |
| • Fine Aggregate, weight %   | ±2.0        |
| • Coarse Aggregate, weight % | ±2.0        |
| • Water, weight or volume %  | ±1.0        |
| • Latex, weight or volume %  | ±2.0        |

During mixing, maintain the drive shaft speed as indicated by the tachometer at operating speed  $\pm$  50 rpm. Set the auger mixer angle in the range determined by the manufacturer. Do not exceed one-half hour for the interval between the continuous placement of successive batches. Equip the mixer to spray water.

**2.h Loading.** Charge aggregate bins no more than 6 hours before time of scheduled placement unless otherwise approved by the Representative. Ensure the aggregate is maintained in a uniform wet condition before loading. Determine the amount of free water on the aggregates at the time of loading by performing aggregate moisture tests according to AASHTO T255 and/or ASTM C 70. Adjust mix proportions to account for the amount of available free water. Empty bins and recharge if not utilized within 6 hours or if conditions contribute to variable moisture content of the aggregate. Stock aggregates in a manner that prevents contamination.

Upon arrival at the project site, empty all bins of aggregate that were charged before coming to the current project. Empty the cement bin and latex tank unless use on a previous project can be verified in writing by a Department Representative, or, in the presence of the Representative, obtain a sample of the liquid latex admixture and cement being used in the mixture and deliver the samples to the Representative for testing. The Representative will submit the samples to LTS for testing. Circulate and mix latex tank as recommended by the latex manufacturer.

**3. Placing and Finishing Equipment.** Provide hand tools for placing and brushing-in freshly mixed latex and for distributing latex overlay to approximately the correct level for striking off with the screed. Use approved hand-operated vibrators and screeds to place and finish small areas of work. Do not use gas-powered vibrators.

Use an approved finishing machine complying with the following requirements for finishing all large areas of work:

- Use a finishing machine that is self-propelled and capable of forward and reverse movement under positive control. Make provision for raising all screeds to clear the screeded surface for traveling in reverse.
- Use a revolving-drum type finishing machine with one or more rotating roller augers preceded by a 1,500 vpm to 2,500 vpm vibratory pan. Verify frequency with a tachometer.

For small placements, the finishing machine may be of the type designed to finish the overlay with a vibrating screed. Provide variable vibration frequency with positive control between 3,000 vpm and 11,000 vpm. Use screeds with a metal-covered bottom face no less than 4 inches wide. Provide the screeds with positive control of the vertical position. Consolidate latex with a hand-operated vibrator.

Use a suitable portable lightweight or wheeled work bridge behind the finishing operation.

**(b) Surface Preparation.** Remove unsound concrete and repair as specified in Section 1040.3. Not more than 7 days before the placement of the overlay, scarify the deck surface to a minimum depth of 1/4 inch, as specified in Section 1041.

Not more than 24 hours before placement begins, clean the entire surface by an approved method, including edges of previously placed lanes of latex, to remove any trowel-cut surfaces and promote bond.

Clean the surface thoroughly with a detergent waterblast and rinse, or sandblast and air blast using clean, oil-free compressed air to remove all dust, slurry, blast media, weak or fractured concrete, petroleum stains, leaves, paint, other debris, rust from any exposed bars oil, or other foreign materials detrimental to achieving bond, if necessary. Protect the entire prepared deck surface against contamination by covering with clean full width polyethylene sheeting until the overlay operations are completed. Include cleaning methods in QC Plan, as specified in Section 1042.3(c).

Allow 48 hours of curing to elapse before scarifying or chipping is performed on adjacent concrete within 6 feet of previously placed latex.

**(c) Placing and Finishing.** Prepare and submit a field operation QC Plan for review and acceptance by the Representative, as outlined on CS-1042. Submit the field operation QC Plan at least 15 days before the proposed start of placing the wearing surface. Do not proceed with latex placement until the QC Plan has been accepted. Include in the plan the method of operations and a sketch describing the equipment and showing complete details of supports for the equipment. Include a list of key personnel and relevant experience.

Raise expansion dams and scuppers as indicated before placing the wearing surface. Provide anchorage for supporting rails for horizontal and vertical stability. Do not treat screed rails with parting compound to facilitate their removal.

Provide all necessary finishing tools, equipment, and manpower at the site of work, and ensure that key personnel are experienced in the placement of latex wearing surfaces.

Adjust screeds to finished grade before placing the wearing surface. For superelevated bridges, adjust screed guides to compensate for the curvature.

Determine the finished grade by raising the existing grade by the amount indicated. Provide a final setting of the screeds such that a smooth riding surface is achieved. Do not lower the screed to compensate for any wear on the existing deck or for over scarifying.

Immediately before placement of the latex, thoroughly wet the clean surface for a period of not less than one hour. Vacuum or blow out all standing water in depressions, holes or areas of concrete removal with clean, oil-free compressed air. Do not allow two cycle (gas/oil) powered equipment on the prepared deck. Maintain prepared deck in a damp, puddle-free condition. Use a fogger/mister to dampen any visible dry spots before the latex placement.

First, brush latex grout on to the damp, prepared surface. When using latex concrete, collect and discard excess aggregate. Do not over-extract grout from the mix to the point that the grout becomes diluted. If directed, apply a second broomed coat of grout to areas where grout is diluted by excessive surface moisture. Immediately remove any material from the deck that is not properly mixed or proportioned, or lacks any component material, and regrout the area.

Ensure that all vertical and horizontal surfaces receive a thorough, even coating and that the rate of progress is limited so that the brushed material does not become dry before it is covered with additional material, as required for the final grade.

Complete all Type 3 deck repairs and Type 2 deck repairs exceeding 2 inches in depth as specified in Section 1040 before placement of the latex overlay. Type 2 deck repairs as specified in Section 1040 less than 2 inches in

depth can be placed concurrently with the latex overlay. Fill and consolidate each Type 2 deck repair area less than 2 inches in depth before the advancement of the overlay placement operation.

Place and strike-off the mixture to approximately 1/4 inch above final grade. Use spud vibration at the edges, adjacent to joint bulkheads and expansion dams, in depressions, and in areas of bridge deck repair. Finish to final grade with the approved finishing equipment. Hand-finishing with a float may be required along the edge of the placement or on small areas of repair. Edge-tooling is required at joints, except next to metal expansion dams, curbs, and previously placed lanes. Place latex continuously, and complete the finishing of each area within 15 minutes after the initial brooming. Provide finish with a closed surface, free of pock marks, ridges, tears, and other defects.

When placing latex against latex that has not achieved initial set, but has formed a surface crust or film, remove the surface crust until plastic latex is exposed, place fresh latex against the exposed surface and consolidate both until homogeneous.

Separate screed rails and construction bulkheads from the newly placed material by passing a pointing trowel along their inside face. Do not separate metal expansion dams from the wearing surface. Ensure that this trowel cut is made for the entire depth and length of rails after the mixture has stiffened sufficiently.

Conduct all operations behind the finishing machines or screeds from work bridges suspended above the wearing surface. Provide bridges of rigid construction. Do not allow work bridges to come into contact with the surface of the latex.

Straightedge and edge while the latex is still workable, as specified in Section 501.3(k)3. After the straightedge testing and surface corrections have been completed and before the latex becomes nonplastic, texture the surface as specified for concrete pavements in Section 501.3(k)4. Cure the wearing surface as soon as possible without marking the fresh latex. If mechanical texturing is indicated, wait 5 days after placing latex before applying texturing. After the latex has hardened, test the surface again as specified in Section 501.3(o). Resound the deck if directed.

Provide adequate lighting, as indicated on the field operation QC Plan, for any placement not completed in the daylight. Ensure lighting allows proper placement, testing, and inspection operations of the entire surface area and until curing covers are placed over the surface area.

**(d) Curing and Protection.** Begin curing as soon as the latex has been placed, finished, and textured, if applicable. Do not use membrane-forming or monomolecular curing compounds:

**1. Curing Temperatures and Records of Temperature.** Sections 1001.3(p)1, 1001.3(p)2 and as follows: Maintain cure temperatures of 45F or greater throughout the wet and dry cure period. Do not count as a curing day, a day on which the curing temperature drops below 45F at any time during that day. If at any time during the curing period, the curing temperature falls below 35F, the Department will consider the work unsatisfactory and it will be rejected. Protect the overlay using methods prescribed in Section 1001.3(p)4 during cool weather and Section 1001.3(p)5 during cold weather.

**2. Wet Cure.** Promptly cover the surface with a single layer of clean, wet burlap as soon as the surface will support it without deformation. Within 15 minutes of covering with wet burlap, place a layer of white polyethylene film, 4 mil minimum thickness, on the wet burlap and cure the surface as specified in Table A. Secure the edges of the polyethylene film to prevent wind intrusion. Keep the burlap material saturated during the wet cure period. Wet, burlap-backed, white polyethylene sheets may be substituted for the polyethylene film with the approval of the Representative, but do not use them to replace the initial wet burlap.

**3. Dry Cure.** After wet-curing, remove the curing covers and dry cure for an additional period, as specified in Table A. Maintain the surface of the overlay in a dry condition for the entire dry cure period. Cover the surface with waterproof coverings as required. If the overlay surface becomes wet during the dry period, extend the dry cure period to the equivalent time that the overlay surface was wet.

**TABLE A**  
**Curing Times and Application of Live Load**

<b>Depth</b>	<b>Wet Cure (hours)</b>	<b>Dry Cure (hours)</b>	<b>Live Load Application Total Cure Time (hours)</b>	<b>Live Load Application Comp. Strength psi</b>
<2 inches	48	72	120	3,000
>2 inches	48	96	144	3,000

**(e) Limitations of Operations.** Place the latex during periods where the ambient and substrate deck temperatures are between 45F and 85F. At ambient temperatures above 80F, conduct the overlay placement at night or early morning hours, when directed by the Representative, if in their opinion, a satisfactory placement cannot otherwise be achieved. If the ambient temperature is expected to reach 80F at any time 24 hours before the overlay placement, take any steps necessary, but not limited to the following to mitigate the mix component temperatures that are acceptable to the Representative:

- cover the latex admixture tanker and cement tanker with wet burlap or station the latex admixture tanker and cement tanker in shaded areas;
- condition aggregates with cool water, cover with light-colored tarps and/or stockpile in shaded areas;
- charge the water tank on the mobile mixer with cool water as close to the time of placement as possible, or condition with ice;
- park mobile mixes in shaded areas or cover with wet burlap before the placement.

Place latex at a plastic latex mixture temperature between 50F and 85F. Stop the placement at any time the Representative determines that a satisfactory surface finish is not being achieved.

Install a bulkhead in case of a major delay in the placement operation resulting in the formation of a surface film. During minor delays, protect the placement from drying with several layers of wet burlap.

Take adequate precautions to protect freshly placed latex from rain. Stop all placement operations when it starts to rain. The Representative may order removal of any material damaged by rainfall.

Do not place latex when the evaporation rate exceeds 0.10 pound per square foot per hour as determined by ACI 305R, Figure 2.1.5. Wind breaks, sunshades, or fogging may be used to reduce evaporation to below the maximum allowable rate.

Discontinue any placement when the Representative determines that flash set of the latex does not provide a suitable placement or finish. Submit redesign and corrective action plan as directed.

**(f) Testing and Acceptance.**

**1. Concrete Field Testing Technician.** Section 704.1(d)2.a

**2. Testing Facilities and Equipment.** Section 704.1(d)3

**3. QC and Acceptance Testing.**

**3.a QC Sampling and Testing of Plastic Latex.** Perform testing according to the accepted QC Plan. Include in the QC Plan, testing and sampling frequencies and target points to initiate corrective measures. Furnish a copy of the QC Plan to be maintained in the Department's field office.

Test each 5 cubic yards of latex for plastic air content, temperature, and slump. Continue testing the load until control is established. Do not wait for the completion of the initial test before collecting subsequent samples. Perform slump tests as specified in Section 1042.2(f) and air content tests according to AASHTO T 152. Notify the Inspector when sampling and QC testing are to be performed. The Inspector will witness the sampling and QC testing. Report test results to the Inspector promptly. Coordinate and facilitate changes as needed in a timely manner.

Do not incorporate any latex into the work that does not conform to specification requirements. Immediately separate and remove nonconforming material from the deck surface.

**3.b Acceptance Testing.** Latex will be accepted on a lot-by-lot basis. Test for plastic air content according to AASHTO T 152; temperature; and compressive strength according to PTM No. 611 and PTM No. 604. Each lot will consist of 20 cubic yards or a day's placement, whichever is less.

The Inspector will select acceptance samples (n=1) according to PTM No. 1. Obtain samples of fresh latex at the point of placement under the direction and supervision of the Inspector and according to PTM No. 601. Acceptance testing of plastic concrete will be performed at a site near the point of placement, as selected by the Inspector. Latex will be tested for yield as directed. Latex not conforming to specification requirements at the point of placement will be rejected.

If the results of testing the plastic latex conform to specification requirements, mold a sufficient number of acceptance cylinders for 5-day compressive strength tests. Compressive strength cylinder molds of 4-inch diameter by 8-inch height may be substituted for cylinder molds of 6-inch diameter by 12-inch height. Perform compressive testing according to PTM No. 604. The Inspector will identify the cylinders as acceptance cylinders. Field cure cylinders as specified in Section 1042.2(f). The compressive strength of the sample will be determined as the average of the compressive strength of two individual cylinders. The lot will be accepted when the 5-day compressive strength meets or exceeds 3,000 pounds per square inch.

**(g) Application of Live Loads.** After latex placement, do not allow heavy equipment or vehicular traffic on the latex surface until the end of the period specified in Section 1042.3(d), Table A, and until the latex has achieved the minimum strength specified in Section 1042.3(d), Table A.

**(h) Defective Work.** Sections 105.12 and 1001.3(u), and as follows:

When latex overlays exhibit cracking or surface tears, perform an investigation with the Representative to determine the type of cracking, source of cracking, and extent of cracking. Measure the width, depth, and length of each crack and establish the locations of the ends of each crack with respect to permanent reference points. Coring may be necessary if crack depths cannot be accurately determined using a mechanical probe. If coring is required, obtain two cores at each location, submit one core to an independent laboratory for analysis of the cracks and submit one core to the Representative for analysis of the cracks at the LTS.

If the investigation indicates the type of cracking to be nonstructural cracks (plastic shrinkage, drying shrinkage, temperature related, or surface tears caused by finishing and texturing) that are evidence of defects in materials or workmanship, repair surface cracks and tears greater than 1/4 inch depth and between 0.007 inch and 0.016 inch width at no expense to the Department. Use a high molecular weight methacrylate penetrating crack sealer, a low viscosity epoxy resin, or other suitable material to repair the surface cracks and tears.

Submit for review, a detailed Quality Control and Action Plan that includes, at a minimum, the proposed crack sealing material data sheet from the manufacture and conditions for use, including ambient and substrate temperature and moisture conditions. Do not perform any crack sealing before the Quality Control and Action Plan has been reviewed by the Representative.

Keep cracks clean, covered, and dry until the crack sealing operation is performed to the satisfaction of the Representative.

Unless directed in writing by the District Executive, remove and replace wearing surface deficient in surface tolerance as specified in Section 501.3(o); defective in air content as specified in Section 1042.2(f); defective in compressive strength as specified in Section 1042.3(f)3.b; failing to bond to the substrate; exhibiting nonstructural cracks or tears greater than 1/4 inch depth and greater than 0.016 inch width; or showing surface defects resulting from the effects of rain, improper finish, improper cure, or honeycombing, which, in the Representative's opinion, cannot be repaired.

#### **1042.4 MEASUREMENT AND PAYMENT—Square Yard**

As indicated, for the type specified, for the item indicated.

The Department will pay for grade adjustments of expansion dams and scuppers, and scarification, separately.

The Department will pay for repairs to the bridge deck separately under the respective type of concrete bridge deck repair items.