

6-09 MODIFIED CONCRETE OVERLAYS**6-09.1 Description**

This Work consists of scarifying concrete bridge decks, preparing and repairing bridge deck surfaces designated and marked for further deck preparation, and placing, finishing, and curing modified concrete overlays.

6-09.2 Materials

Materials shall meet the requirements of the following Sections:

Portland Cement	9-01.2(1)
Fine Aggregate	9-03.1(2)B
Coarse Aggregate	9-03.1(4)C
Burlap Cloth	9-23.5
Admixtures	9-23.6
Fly Ash	9-23.9
Microsilica Fume	9-23.11
Water	9-25.1

Portland cement shall be either Type I or Type II. Type III portland cement will not be allowed.

Fine aggregate shall be Class 1. Coarse aggregate shall be AASHTO grading No. 7 or No. 8.

Fly ash shall be Class F only.

Microsilica admixture shall be either a dry powder or a slurry admixture. Microsilica will be accepted based on submittal to the Engineer of a Manufacturer's Certificate of Compliance conforming to Section 1-06.3. If the microsilica is a slurry admixture, the microsilica content of the slurry shall be certified as a percent by mass.

Latex admixture shall be a non-toxic, film-forming, polymeric emulsion in water to which all stabilizers have been added at the point of manufacture. The latex admixture shall be homogeneous and uniform in composition, and shall conform to the following:

Polymer Type Styrene Butadiene

Stabilizers:

Latex	Non-ionic surfactants
Portland Cement	Polydimethyl siloxane
Percent Solids	46.0 to 49.0
Weight per Gallon	8.4-pounds at 77°F
Color	White
PH (as shipped)	9 minimum
Freeze/Thaw Stability	5-cycles (5°F to 77°F)
Shelf Life	2-years minimum

Latex admixture will be accepted based on submittal to the Engineer of a Manufacturer's Certificate of Compliance conforming to Section 1-06.3.

High Molecular Weight Methacrylate (HMWM) resin for crack and joint sealing shall conform to the following:

Viscosity	<25 cps (Brookfield RVT with UL adaptor, 50-rpm at 77F)... California Test 434
Density	8.5 to 8.8-pounds per gallon at 77°F... ASTM D 2849
Flash Point	>200°F, PMCC (Pinsky-Martens CC)
Vapor Pressure	<0.04-inches Hg at 77°F, ASTM D 323
Tg (DSC)	>136°F, ASTM D 3418
Gel Time	60-minutes minimum

The promoter/initiator system for the methacrylate resin shall consist of a metal drier and peroxide.

Sand for abrasive finish shall be crushed sand, oven dried, and stored in moisture proof bags. The sand shall conform to the following gradation:

Sieve Size	Percent Passing	
	Minimum	Maximum
U.S. No. 10	98	100
U.S. No. 16	55	75
U.S. No. 20	30	50
U.S. No. 30	8	25
U.S. No. 50	0	5
U.S. No. 100	0	3

All percentages are by weight.

6-09.3 Construction Requirements

6-09.3(1) Equipment

6-09.3(1)A Power Driven Hand Tools

Power driven hand tools may be used for concrete scarification in areas not accessible to scarification machines, and for further deck preparation Work, except for the following:

1. Jack hammers more forceful than the nominal 30-pound class.
2. Chipping hammers more forceful than the nominal 15-pound class.

The power driven hand tools shall be operated at angles less than 45-degrees as measured from the surface of the deck to the tool.

6-09.3(1)B Rotary Milling Machines

Rotary milling machines shall be capable of scarifying a minimum width of four-feet per pass, have a maximum operating weight of 50,000-pounds, and conform to the requirements in Section 1-07.7.

Machines known to meet these Specifications will be specified in the Special Provisions.

6-09.3(1)C Hydro-Demolition Machines

Hydro-demolition machines shall consist of filtering and pumping units operating in conjunction with a remote-controlled robotic device. Hydro-demolition machines shall scarify a minimum width of 4-feet per pass, using high velocity water jets to remove ½-inch of sound concrete with the simultaneous removal of all deteriorated concrete. Hydro-demolition machines shall also clean any exposed reinforcing steel of all rust and corrosion products.

Possible sources of machines known to meet these Specifications will be specified in the Special Provisions.

6-09.3(1)D Shot Blasting Machines

Shot blasting machines shall consist of a self contained mobile unit capable of scarifying a minimum width of 6-feet per pass, using steel abrasive to remove ½-inch of sound concrete. The shot blasting machine shall vacuum and store all material removed from the scarified concrete surface into a self contained unit.

Possible sources of machines known to meet these Specifications will be specified in the Special Provisions.

6-09.3(1)E Air Compressor

Air compressors shall be equipped with oil traps to eliminate oil from being blown onto the roadway deck during sandblasting and air cleaning.

6-09.3(1)F Vacuum Machine

Vacuum machines shall be capable of collecting all dust, concrete chips, freestanding water and other debris encountered while cleaning during deck preparation. The machines shall be equipped with collection systems that allow the machines to be operated in air pollution sensitive areas and shall be equipped to not contaminate the deck during final preparation for concrete placement.

6-09.3(1)G Water Spraying System

The water spraying system shall include a portable high-pressure sprayer with a separate water supply of potable water. The sprayer shall be readily available to all parts of the deck being overlaid and shall be able to discharge water in a fine mist to prevent accumulation of free water on the deck. Sufficient water shall be available to thoroughly soak the deck being overlaid and to keep the deck wet prior to concrete placement.

The Contractor shall certify that the water spraying system meets the following requirements:

Pressure	2,200-psi minimum
Flow Rate	4.5-gpm minimum
Fan Tip	15° to 25° Range

6-09.3(1)H Mobile Mixer for Latex Modified Concrete

Proportioning and mixing shall be accomplished in self-contained, self-propelled, continuous-mixing units conforming to the following requirements:

1. The mixer shall be equipped so that it can be grounded.
2. The mixer shall be equipped to provide positive measurement of the portland cement being introduced into the mix. An approved recording meter, visible at all times and equipped with a ticket printout, shall be used.

3. The mixer shall be equipped to provide positive control of the flow of water and latex admixture into the mixing chamber. Water flow shall be indicated by an approved flow meter with a minimum readability of ½-gallon per minute, accurate to ± 1-percent. The water system shall have a bypass valve capable of completely diverting the flow of water. Latex flow shall also be indicated by an approved flow meter with a minimum readability of 2-gallons per minute, accurate to ± 1-percent. The latex system shall be equipped with a bypass valve suitable for obtaining a calibrated sample of admixture.
4. The mixer shall be equipped to be calibrated to automatically proportion and blend all components of the specified mix on a continuous or intermittent basis as required by the finishing operation, and shall discharge mixed material through a conventional chute directly in front of the finishing machine.

Inspection of each mobile mixer shall be done by the Contractor in the presence of the Engineer and in accordance with the following requirements:

1. Check the manufacturer's inspection plate or mix setting chart for the serial number, the proper operating revolutions per minute (rpm), and the approximate number of counts on the cement meter to deliver 94-pounds of cement.
2. Make a general inspection of the mobile mixer to ensure cleanliness and good maintenance practices.
3. Check to see that the aggregate bins are empty and clean and that the bin vibrators work.
4. Verify that the cement aeration system operates, that the vent is open, and that the mixer is equipped with a grounding strap. Check the cement meter feeder to ensure that all fins and pockets are clean and free from accumulated cement. If the operator cannot demonstrate, through visual inspection, that the cement meter feeder is clean, all cement shall be removed from the bin and the cement meter feeder inspected. The aeration system shall be equipped with a gauge or indicator to verify that the system is operating.
5. Verify that the main belt is clean and free of any accumulated material.
6. Check the latex strainer to ensure cleanliness.

The initial calibration shall consist of the following items:

1. Cement Meter
 - a. Refer to the truck manufacturer's mix setting chart to determine the specified operating rpm and the approximate number of counts required on the cement meter to deliver 94-pounds of cement.
 - b. Place at least 40-bags (about 4,000-pounds) of cement in the cement bin.
 - c. Ensure the mixer is resting on a level surface.
 - d. Ensure the mixer is grounded.
 - e. Adjust the engine throttle to obtain the specified rpm. Operate the unit, discharging cement until the belt has made 1 complete revolution. Stop the belt. Reset the cement meter to zero. Position a suitable container to catch the cement and discharge approximately 1-bag of cement. With a stopwatch, measure the time required to discharge the cement. Record the number of counts on the cement meter and determine the weight of the cement in the container. Repeat the process of discharging approximately 1- bag of cement until 6 runs have been made. Reset the cement meter to zero for each run.

Example:

Run No.	Cement Counts	Weight of Cement	Time In Seconds
1	66	95	31
2	68	96	31.2
3	67	95.5	31.0
4	66	95	29.8
5	67	95.25	30.5
6	66	95	30.8
TOTAL	400	571.75	184.3

Pounds of cement per count on cement meter:

$$\frac{\text{Weight of Cement}}{\text{No. of Counts}} = \frac{571.75}{400} = 1.43 \text{ LB./Count}$$

Counts per bag (94-pounds):

$$\frac{94}{1.43} = 65.7 \text{ Counts Bag}$$

Pounds of cement discharged per second:

$$\frac{\text{Weight of Cement}}{\text{Time in Seconds}} = \frac{571.75}{184.3} = 3.10 \text{ LB./SEC.}$$

Required time to discharge 1-bag:

$$\text{Time} = \frac{94}{3.10} = 30.32 \text{ SEC./Bag}$$

2. Latex Throttling Valve

- a. Check to be sure that the latex strainer is unobstructed.
- b. The latex throttling valve shall be adjusted to deliver 3.5-gallons of latex (29.4-pounds) for each bag of cement. From the above calculation 30.32-seconds are required to deliver 1-bag of cement.
- c. With the unit operating at the specified rpm, discharge latex into a container for 30.3-seconds and determine the weight of latex. Continue adjusting the valve until 29.4 to 29.5-pounds of latex is discharged in 30.3-seconds. Verify the accuracy of this valve setting 3-times.

3. Water Flow Meter
 - a. Set the water flow meter by adjusting it to flow at ½-gallon per minute.
 - b. Collect and weigh the water discharged during a 1-minute interval with the equipment operating at the specified rpm. Divide the weight of water by 8.34 to determine the number of gallons.
 - c. Repeat Items a. and b., above, with the flow meter adjusted to 1½-gallons per minute.
4. Aggregate Bin Gates
 - a. Set the gate openings to provide the amount of aggregate required to produce concrete having the specified proportions.
 - b. Discharge a representative sample of the aggregates through the gates and separate on the U.S. No. 4 sieve. Aggregates shall meet the requirements for proportions in accordance with [Section 6-09.3\(3\)E](#).
 - c. Adjust the gate openings if necessary to provide the proper ratio of fine aggregate to total aggregate.
5. Production of Trial Mix

Each mobile mixer shall be operated to produce at least ½-cubic yard of concrete, which shall be in compliance with these Specifications, prior to acceptance of the mobile mixer for job use. The Engineer will perform yield, slump, and air tests on the concrete produced by each mixer. Calibration of each mobile mixer shall be done by the Contractor in the presence of the Engineer. A complete calibration is required on each mixer on each concrete placement unless, after the initial calibration, the personnel having the responsibility of mixer calibration on subsequent concrete placement were present during the initial calibration of the mixer and during the concrete placement operations and are able to verify the dial settings of the initial calibration and concrete placement.

If these criteria are met, a complete calibration need not be repeated provided that a single trial run verifies the previous settings of the cement meter, latex throttling valve, water flow meter, and aggregate gradations, and that the mixer has not left the project and the Engineer is satisfied that a complete calibration is not needed.

6-09.3(1)I Ready Mix Trucks for Fly Ash Modified and Microsilica Modified Concrete

Ready mix trucks shall conform to [Section 6-02.3\(4\)A](#).

6-09.3(1)J Finishing Machine

The finishing machine shall meet the requirements of [Section 6-02.3\(10\)](#) and the following requirements:

The finishing machine shall be equipped with a rotating cylindrical double drum screed not exceeding 60-inches in length preceded by a vibrating pan. The vibrating pan shall be constructed of metal and be of sufficient length and width to properly consolidate the mixture. The vibrating frequency of the vibrating pan shall be variable with positive control between 3,000 and 6,000-rpm. A machine with a vibrating pan as an integral part may be proposed and will be considered for approval by the Engineer. Other finishing machines will be allowed subject to approval of the Engineer.

6-09.3(2) Submittals

The Contractor shall submit the following items to the Engineer for approval in accordance with [Section 6-01.9](#):

1. The type of machine (rotary milling, hydro-demolition, or shot blasting) selected by the Contractor for use in this project to scarify concrete surfaces.
2. The axle loads and axle spacing of the rotary milling machine (if used).
3. The Runoff Water Disposal Plan (if a hydro-demolition machine is used). The Runoff Water Disposal Plan shall describe all provisions for the containment, collection, filtering, and disposal of all runoff water and associated contaminants and debris generated by the hydro-demolition process, including containment, collection and disposal of runoff water and debris escaping through breaks in the bridge deck.
4. The method and materials used to contain, collect, and dispose of all concrete debris generated by the scarifying process, including provisions for protecting adjacent traffic from flying debris.
5. The mix design for concrete Class M, and either fly ash modified concrete, microsilica modified concrete, or latex modified concrete, as selected by the Contractor for use in this project in accordance with [Section 6-09.3\(3\)](#).
6. Samples of the latex admixture and the portland cement for testing and compatibility (if latex modified concrete is used).
7. Paving equipment Specifications and details of the screed rail support system, including details of anchoring the rails and providing rail continuity.

The Contractor shall not begin scarifying operations until receiving the Engineer's approval of Items 1 through 4 as applicable for the Contractor's scarifying method. The Contractor shall not begin placing modified concrete overlay until receiving the Engineer's approval of Items 5 through 7 as applicable for the Contractor's selected type of modified concrete.

6-09.3(3) Concrete Overlay Mixes**6-09.3(3)A General**

For fly ash, microsilica, and latex modified concrete, the Contractor shall adjust the slump to accommodate the gradient of the bridge deck, subject to the maximum slump specified.

For fly ash and microsilica modified concrete, the maximum water/cement ratio shall be calculated using all of the available mix water, including the free water in both the coarse and fine aggregate, and in the microsilica slurry if a slurry is used.

For fly ash and microsilica modified concrete, all water reducing and air entraining admixtures, and superplasticizers, shall be used in accordance with the admixture manufacturer's recommendations, and as approved by the Engineer.

6-09.3(3)B Concrete Class M

Concrete Class M for further deck preparation patching concrete shall be proportioned in accordance with the following mix design:

Portland Cement	705-pounds
Fine Aggregate	1,280-pounds
Coarse Aggregate	1,650-pounds
Water/Cement Ratio	0.37 maximum
Air ($\pm 1\frac{1}{2}$ -percent)	6-percent
Slump (± 1 -inch)	5-inches

The use of a water-reducing admixture conforming to AASHTO M 194 Type A will be required to produce patching concrete with the desired slump, and shall be used in accordance with the admixture manufacturer's recommendations. Air entraining admixtures shall conform to AASHTO M 154 and shall be used in accordance with the admixture manufacturer's recommendations. The use of accelerating admixtures or other types of admixtures is not allowed.

6-09.3(3)C Fly Ash Modified Concrete

Fly ash modified concrete shall be a workable mix, uniform in composition and consistency. Mix proportions per cubic yard shall be as follows:

Portland Cement	611-pounds
Fly Ash	275-pounds
Fine Aggregate	38-percent of total aggregate
Coarse Aggregate	62-percent of total aggregate
Water/Cement Ratio	0.30 maximum
Air ($\pm 1\frac{1}{2}$ -percent)	6-percent
Slump	7-inches maximum

6-09.3(3)D Microsilica Modified Concrete

Microsilica modified concrete shall be a workable mix, uniform in composition and consistency. Mix proportions per cubic yard shall be as follows:

Portland Cement	658-pounds
Microsilica Fume	52-pounds
Fine Aggregate	1,515-pounds
Coarse Aggregate	1,515-pounds
Water/Cement Ratio	0.33 maximum
Air ($\pm 1\frac{1}{2}$ -percent)	6-percent
Slump	7-inches maximum

6-09.3(3)E Latex Modified Concrete

Latex modified concrete shall be a workable mix, uniform in composition and consistency. Mix proportions per cubic yard shall be as follows:

Portland Cement	1.00 parts by weight
Fine Aggregate	2.40 to 2.75 parts by weight
Coarse Aggregate	1.75 to 2.00 parts by weight
Latex Admixture	3.50-gallons per bag of cement
Water/Cement Ratio	0.33 maximum
Air Content of Plastic Mix	6-percent maximum
Slump	7 inches maximum

The aggregates shall be proportioned such that the amount of aggregate passing the U.S. No. 4 sieve is 65 ± 5 -percent of the total aggregate (fine plus coarse). All calculations shall be based on dry weights.

The moisture content of the fine aggregate and coarse aggregate shall be no more than 3.0 and 1.0-percent, respectively, above the saturated surface dry condition.

The water limit for calculating the water/cement ratio shall include the added water, the free water in the aggregates, and 52-percent of the latex admixture.

6-09.3(4) Storing and Handling**6-09.3(4)A Aggregate**

Aggregates shall be stored and handled in a manner to prevent variations of more than 1.0-percent in moisture content of the stockpile.

For latex modified concrete, the moisture content of the aggregate at the time of proportioning shall be as specified in [Section 6-09.3\(3\)E](#).

6-09.3(4)B Latex Admixture

The admixture shall be kept in suitable containers that will protect it from freezing and from exposure to temperatures in excess of 85°F. Containers of the admixture shall not be stored in direct sunlight for periods in excess of 10-days. When stored in direct sunlight the top and sides of the containers shall be covered with insulating blanket material.

Storage of the admixture may extend over a period greater than 10-days as long as the conditions specified above are maintained and the latex admixture is agitated or stirred once every 10-days. Stirring or agitation of the admixture shall be done mechanically in accordance with the manufacturer's recommendation and as approved by the Engineer. If the ambient temperature is higher than 85°F at any time during the storage period, the admixture shall be covered by insulated blankets or other means that will maintain the admixture temperature below 85°F.

The admixture shall be strained through a Number 10 strainer at the time it is introduced into the mixing tank from the storage containers.

6-09.3(4)C High Molecular Weight Methacrylate Resin (HMWM)

The HMWM resin shall be stored in a cool dry place and protected from freezing and exposure to temperature in excess of 100°F. The promoter and initiator, if supplied separate from the resin, shall not contact each other directly. Containers of promoters and initiators shall not be stored together in a manner that will allow leakage or spillage from one to contact the containers or material of the other.

6-09.3(5) Scarifying Concrete Surface**6-09.3(5)A General**

The Contractor shall not begin scarifying a concrete bridge deck surface unless completion of the scarification and concrete overlay can be accomplished within the current construction season.

The Contractor shall not begin scarifying a concrete bridge deck surface until receiving the Engineer's written approval of the machine to be used for scarifying

The Contractor shall protect adjacent traffic from flying debris generated by the scarification process in accordance with Item 4 of [Section 6-09.3\(2\)](#) and as approved by the Engineer.

The Contractor shall collect, contain, and dispose of all concrete debris generated by the scarification process in accordance with Item 4 of [Section 6-09.3\(2\)](#) and as approved by the Engineer.

All areas of the deck that are inaccessible to the selected scarifying machine shall be scarified to remove the concrete surface matrix to a maximum depth of ½-inch by a method approved by the Engineer. If these areas are hand-chipped then the equipment shall meet the requirements as specified in [Section 6-09.3\(1\)A](#).

6-09.3(5)B Testing of Hydro-Demolition and Shot Blasting Machines

A trial area shall be designated by the Engineer to demonstrate that the equipment and methods of operation are capable of producing results satisfactory to the Engineer. The trial area shall consist of 2 patches each of approximately 30-square feet, 1 area in sound concrete and 1 area of deteriorated concrete as determined by the Engineer.

In the "sound" area of concrete, the equipment shall be programmed to remove ½-inch of concrete.

Following the test over sound concrete, the equipment shall be located over the deteriorated concrete and using the same parameters for the sound concrete removal, remove all deteriorated concrete. The Engineer will grant approval of the equipment based on successful results from the trial area test.

6-09.3(5)C Hydro-Demolishing

Once the operating parameters of the Hydro-Demolition machine are defined by programming and calibration as specified in [Section 6-09.3\(5\)B](#), they shall not be changed as the machine progresses across the bridge deck, in order to prevent the unnecessary removal of sound concrete below the required minimum removal depth. The Contractor shall maintain a minimum production rate of 250-square feet per hour during the deck scarifying process.

All water used in the Hydro-Demolition process shall be potable. Stream or lake water will not be permitted.

All bridge drains and other outlets within 100-feet of the Hydro-Demolition machine shall be temporarily plugged during the Hydro-Demolition operation. When scarifying a bridge deck passing over traffic lanes, the Contractor shall protect the traffic below by restricting and containing scarifying operations, and implementing traffic control measures, as approved by the Engineer.

The Contractor shall provide for the collection, filtering and disposal of all runoff water generated by the Hydro-Demolition process, in accordance with the Runoff Water Disposal Plan as approved by the Engineer in accordance with Item 3 of [Section 6-09.3\(2\)](#). The Contractor shall comply with applicable regulations concerning such water disposal.

6-09.3(5)D Shot Blasting

Once the operating parameters of the Shot Blasting machine are defined by programming and calibration, as specified in [Section; 6-09.3\(5\)B](#), they shall not be changed as the machine progresses across the bridge deck, in order to prevent the unnecessary removal of sound concrete below the required minimum removal depth. The Contractor shall maintain a minimum production rate of 250-square feet per hour during the deck scarifying process.

6-09.3(5)E Rotomilling

The entire concrete surface of the bridge deck shall be scarified to remove the surface matrix to a maximum 1/2-inch depth of the concrete. The operating parameters of the rotary milling machine shall be monitored in order to prevent the unnecessary removal of sound concrete below the 1/2-inch maximum removal depth.

6-09.3(5)F Repair of Steel Reinforcing Bars Damaged by Scarifying Operations

All reinforcing steel damaged due to the Contractor's operations shall be repaired by the Contractor. For bridge decks not constructed under the same Contract as the concrete overlay, damage to existing reinforcing steel shall be repaired and paid for in accordance with Section 1-09.6 if the existing concrete cover is 1/2-inch or less. All other reinforcing steel damaged due to the Contractor's operations shall be repaired by the Contractor at no additional expense to the Contracting Agency.

The repair shall be as follows or as directed by the Engineer:

1. Damage to epoxy coating, when present on existing steel reinforcing bars, shall be repaired in accordance with Section 6-02.3(24)H.
2. Damage to bars resulting in a section loss of 20-percent or more of the bar area shall be repaired by chipping out the adjacent concrete and splicing a new bar of the same size. Concrete shall be removed to provide a 3/4-inch minimum clearance around the bars. The splice bars shall extend a minimum of 40 bar diameters beyond each end of the damage.
3. Any bars partially or completely removed from the deck shall have the damaged portions removed and spliced with new bars as outlined in Item 2 above.

6-09.3(5)G Cleanup Following Scarification

After scarifying is completed, the lane or strip being overlaid shall be thoroughly cleaned of all dust, freestanding water and loose particles. Cleaning may be accomplished by using compressed air, water blasting, with a minimum pressure of 5,000-psi, or vacuum machines. Vacuum cleaning shall be used when required by applicable air pollution ordinances.

6-09.3(6) Further Deck Preparation

Once the lane or strip being overlaid has been cleaned of debris from scarifying, the Contractor, with the Engineer, shall perform an inspection of the completed Work and the Contractor shall mark those areas of the existing bridge deck that are authorized by the Engineer for further deck preparation by the Contractor. When hydro-demolition is used as the method of scarification, the inspection for further deck preparation shall take place after 1 pass of the hydro-demolition machine.

Further deck preparation will be required when any one of the following conditions is present:

1. Unsound concrete.
2. Lack of bond between existing concrete and reinforcing steel.
3. Exposure of reinforcing steel to a depth of $\frac{1}{2}$ of the periphery of a bar for a distance of 12-inches or more along the bar.
4. Existing non-concrete patches as authorized by the Engineer.

Further deck preparation performed beyond the areas authorized by the Engineer will be at the Contractor's expense in accordance with Section 1-05.7. If the concrete overlay is placed on a bridge deck as part of the same Contract as the bridge deck construction, then all Work associated with the further deck preparation shall be performed at no additional expense to the Contracting Agency.

6-09.3(6)A Equipment for Further Deck Preparation

Further deck preparation shall be performed using either hand operated tools conforming to Section 6-09.3(1)A, or hydro-demolishing machines conforming to Section 6-09.3(1)C.

6-09.3(6)B Deck Repair Preparation

All concrete in the repair area shall be removed by chipping, hydro demolishing, or other approved mechanical means to a depth necessary to remove all loose and unsound concrete. If unsound concrete exists around the steel reinforcing bars, or if the bond between concrete and steel is broken, concrete must be removed to provide a $\frac{3}{4}$ -inch minimum clearance around the steel reinforcing bars.

Care shall be taken in removing the deteriorated concrete to not damage any of the existing deck or steel reinforcing bars that are to remain in place. All removal shall be accomplished by making neat vertical cuts and maintaining square edges at the boundaries of the repair area. Cuts made by using sawing or hydro demolishing machines shall be made after sufficient concrete removal has been accomplished to establish the limits of the removal area. In no case shall the depth of the vertical cut exceed $\frac{3}{4}$ -inch or to the top of the top steel reinforcing bars, whichever is less.

The exposed steel reinforcing bars and concrete in the repair area shall be sandblasted or hydro-blasted and blown clean just prior to placing concrete. Bridge deck areas outside the repair area or steel reinforcing bar inside or outside the repair area damaged by the Contractor's operations, shall be repaired by the Contractor at no additional expense to the Contracting Agency, and to the satisfaction of the Engineer.

All steel reinforcing bars damaged due to the Contractor's operations shall be repaired in accordance with Section 6-09.3(5)F.

6-09.3(6)C Placing Deck Repair Concrete

Deck repair concrete for modified concrete overlays shall be either modified concrete or concrete Class M.

Before placing any deck repair concrete, the Contractor shall flush the existing concrete in the repair area with water and make sure that the existing concrete is well saturated. The Contractor shall remove any freestanding water prior to placing the deck repair concrete. The Contractor shall place the deck repair concrete onto the existing concrete while it is wet.

All deck repairs with exposed bottom layer steel reinforcing bars, all full depth deck repairs, and all deck repairs of an area greater than 10-square feet (measured at the top layer of steel reinforcement) shall be repaired, and wet cured for 42-hours in accordance with Section 6-09.3(13), prior to placing the concrete overlay. During the curing period, all vehicular and foot traffic shall be prohibited on the repair area.

Small deck repairs, defined as those of an area equal to or less than 10-square feet (measured at the top layer of steel reinforcement), shall be filled with concrete overlay material during the placement of the concrete overlay.

6-09.3(7) Surface Preparation For Concrete Overlay

Following the completion of any required further deck preparation the entire lane or strip being overlaid shall be cleaned.

If either a rotary milling machine or a shot blasting machine is used for concrete scarification, then the concrete deck shall be sandblasted or shot blasted, using equipment approved by the Engineer, until sound concrete is exposed. Care shall be taken to ensure that all exposed reinforcing steel and the surrounding concrete is completely blasted. Bridge grate inlets, expansion dams and barriers above the surface to be blasted shall be protected from the blasting.

If a hydro-demolition machine is used for concrete scarification, then the concrete deck shall be cleaned by an approved method of water blasting with 7,000-psi minimum pressure, until sound concrete is exposed.

The final surface of the deck shall be free from oil and grease, rust and other foreign material that may reduce the bond of the new concrete to the old. These materials shall be removed by detergent- cleaning or other method as approved by the Engineer followed by sandblasting.

After all scarifying, chipping, sandblasting and cleaning is completed, the entire lane or strip being overlaid shall be cleaned in final preparation for placing concrete using either compressed air or vacuum machines. Vacuum machines shall be used when warranted by applicable air pollution ordinances.

Scarifying with either rotary milling machines or shot blasting machines, hand tool chipping, sandblasting and cleaning in areas adjacent to a lane or strip being cleaned in final preparation for placing concrete shall be discontinued when final preparation is begun. Scarifying and hand tool chipping shall remain suspended until the concrete has been placed and the requirement for curing time has been satisfied. Sandblasting and cleaning shall remain suspended for the first 24-hours of curing time after the completion of concrete placing.

If the hydro demolishing scarification process is used, scarification may proceed during the final cleaning and overlay placement phases of the Work on adjacent portions of the Structure so long as the hydro demolisher operations are confined to areas which are a minimum of 100-feet away from the defined limits of the final cleaning or overlay placement in progress. If the hydro demolisher impedes or interferes in any way with the final cleaning or overlay placement as determined by the Engineer, the hydro demolishing Work shall be terminated immediately and the hydro demolishing equipment removed sufficiently away from the area being prepared or overlaid to eliminate the conflict. If the grade is such that water and contaminates from the hydro demolishing operation will flow into the area being prepared or overlaid, the hydro demolishing operation shall be terminated and shall remain suspended for the first 24-hours of curing time after the completion of concrete placement.

If, after final cleaning, the lane or strip being overlaid becomes wet, the Contractor shall flush the surface with high-pressure water, prior to placement of the overlay. All freestanding water shall be removed prior to concrete placement. Concrete placement shall begin within 24-hours of the completion of deck preparation for the portion of the deck to be overlaid. If concrete placement has not begun within 24-hours, the lane or strip being overlaid shall be cleaned by a light sand blasting followed by washing with the high-pressure water spray or by cleaning with the high-pressure spray as approved by the Engineer.

Traffic other than required construction equipment will not be permitted on any portion of the lane or strip being overlaid that has undergone final preparation for placing concrete unless approved by the Engineer. To prevent contamination, all equipment allowed on the deck after final cleaning shall be equipped with drip guards.

6-09.3(8) Quality Assurance

6-09.3(8)A Quality Assurance for Microsilica Modified and Fly Ash Modified Concrete Overlays

The Engineer will perform slump, temperature, and entrained air tests for acceptance after the Contractor indicates that the concrete is ready for placement. Concrete from the first truckload shall not be placed until tests for acceptance have been completed by the Engineer and the results indicate that the concrete is within acceptable limits. Sampling and testing will continue for each load until 2 successive loads meet all applicable acceptance test requirements. Except for the first load of concrete, up to ½-cubic yard may be placed prior to testing for acceptance. After 2 successive tests indicate that the concrete is within specified limits, the sampling and testing frequency may decrease to 1 for every 3 truckloads. Loads to be sampled will be selected in accordance with the random selection process outlined in FOP for WAQTC TM2.

When the results of any subsequent acceptance test indicates that the concrete does not conform to the specified limits, the sampling and testing frequency will be resumed for each truckload. Whenever 2 successive subsequent tests indicate that the concrete is within the specified limits, the random sampling and testing frequency of 1 for every 3 truck loads may resume.

The test for determining the slump of the concrete will be conducted in accordance with the WSDOT FOP for AASHTO T 119 and the test for determining the percentage of entrained air will be conducted in accordance with the WAQTC FOP for AASHTO T 152.

The Engineer will test for slump and/or air any load of concrete the Engineer deems necessary.

6-09.3(8)B Quality Assurance for Latex Modified Concrete Overlays

The Engineer will perform operational control testing as the concrete is being placed. The Contractor shall provide the Engineer with a ¼-cubic yard container and assistance in obtaining and handling samples. The ¼-cubic yard container shall have a 9-inch minimum depth and shall be placed on a level surface. A minimum of 1 test per mobile mixer per shift will be conducted. The test will be conducted after 8 minutes of mixer operation.

The Engineer will perform slump and air tests as the concrete is being placed. The minimum number of tests will be 1 slump test and 1 air test per mobile mixer, beginning with the first charge and every other charge thereafter. The sample will be taken after the first 2-minutes of continuous mixer operation. The concrete will be sampled as follows:

1. While concrete is being deposited onto the bridge deck, the stream will be diverted into a wheelbarrow or other suitable container. Approximately 1-cubic foot of concrete will be sufficient to conduct 1 slump test and 1 air test.
2. Take the sample to the test site. The test site should be located away from the mobile mixer and off the end of the bridge if practical.
3. Allow the sample to stand undisturbed. The fresh concrete sample must be protected from sunlight and wind until the conclusion of the testing. Total time from discharge to time of start of slump testing will not exceed 6½ minutes.

The test for determining the slump of the concrete will be conducted in accordance with WSDOT FOP for AASHTO T 119 and the test for determining the percentage of entrained air will be conducted in accordance with WAQTC FOP for AASHTO T 152.

During the initial proportioning, mixing, placing, and finishing operations, the Engineer may require the presence of a technical representative from the latex admixture manufacturer. The technical representative shall be capable of performing, demonstrating, inspecting, and testing all of the functions required for placement of the latex modified concrete as specified in Section 6-09.3(11) and as approved by the Engineer. This technical representative shall aid in the proper installation of the latex modified concrete. Recommendations made by the technical representative on or off the jobsite, and approved by the Engineer, shall be adhered to by the Contractor at no additional expense to the Contracting Agency. The Engineer will advise the Contractor in writing a minimum of 5-working-days before such services are required.

6-09.3(9) Mixing Concrete For Concrete Overlay

6-09.3(9)A Mixing Microsilica Modified or Fly Ash Modified Concrete

Mixing of concrete shall be in accordance with Section 6-02, with the following exceptions:

1. The mixing shall be done at a batch plant.
2. The volume of concrete transported by truck shall not exceed 6-cubic yards per truck.

6-09.3(9)B Mixing Latex Modified Concrete

The equipment used for mixing the concrete shall be operated with strict adherence to the procedures set forth by its manufacturer.

A minimum of 2 mixers will be required at the overlay site for each concrete placement when the total volume of concrete to be placed during the concrete placement exceeds the material storage capacity of a single mixer. Additional mixers may be required if conditions require that material be stockpiled away from the jobsite. The Contractor shall have sufficient mixers on hand to ensure a consistent and continuous delivery and placement of concrete throughout the concrete placement.

Charging the mobile mixer shall be done in the presence of the Engineer. Mixing capabilities shall be such that the finishing operation can proceed at a steady pace.

6-09.3(10) Overlay Profile and Screed Rails

The overlay shall have a thickness of 1½-inches or as specified by the Engineer. The thickness shall be verified prior to the placement of concrete by attaching a filler block, having a thickness of ¼-inch less than the overlay thickness, to the bottom of the screed. The filler block shall pass freely over the surface to be overlaid. With the screed guides in

place, the finishing machine shall be passed over the entire surface to be overlaid and the final screed rail adjustments shall be made.

If the overlay thickness does not verify, the profile of the new concrete surface shall be adjusted as approved by the Engineer.

After the overlay thickness has been verified, changes in the finishing machine elevation controls will not be allowed.

Rails upon which the finishing machine travels shall be placed outside of the area to be overlaid, in accordance with Item 7 of Section 6-09.3(2) and as approved by the Engineer. Interlocking rail sections or other approved methods of providing rail continuity are required.

Hold-down devices shot into the concrete are not permitted unless the concrete is to be subsequently overlaid. Hold-down devices of other types leaving holes in the exposed area will be allowed provided the holes are subsequently filled with a sand/cement grout (sand and portland cement in equal proportions by volume). Hold-down devices shall not penetrate the existing deck by more than $\frac{3}{4}$ -inch.

Rails may be removed at any time after the concrete has taken an initial set. Adequate precautions shall be taken during the removal of the finishing machine and rails to protect the edges of the new surfaces.

The Contractor shall be responsible for setting screed control to obtain the nominal overlay thickness specified as well as the finished surface smoothness requirements.

6-09.3(11) Placing Concrete Overlay

Prior to concrete placement, the Contractor shall review the equipment, procedures, personnel, and previous results with the Engineer. Inspection procedures shall also be reviewed to ensure coordination.

Concrete placement shall be made in accordance with Section 6-02 and the following requirements:

1. After the lane or strip to be overlaid has been prepared and immediately before placing the concrete, it shall be thoroughly soaked and kept continuously wet with water for a minimum period of 6-hours prior to placement of the concrete. All freestanding water shall be removed prior to concrete placement. During concrete placement, the lane or strip shall be kept moist.

The concrete shall then be promptly and continuously delivered and deposited on the placement side of the finishing machine.

If latex modified concrete is used, the concrete shall be thoroughly brushed into the surface and then brought up to final grade. If either microsilica modified concrete or fly ash modified concrete are used, a slurry of the concrete, excluding aggregate, shall be thoroughly brushed into the surface prior to the overlay placement.

Care shall be exercised to ensure that the surface receives a thorough, even coating and that the rate of progress is limited so that the brushed concrete does not become dry before it is covered with additional concrete as required for the final grade. All aggregate which is segregated from the mix during the brushing operation shall be removed from the deck and disposed of by the Contractor.

If either microsilica modified concrete or fly ash modified concrete are used, the Contractor shall ensure that a sufficient number of trucks are used for concrete delivery to obtain a consistent and continuous delivery and placement of concrete throughout the concrete placement operation.

When concrete is to be placed against the concrete in a previously placed transverse joint, lane, or strip, the previously placed concrete shall be sawed back 6-inches to straight and vertical edges and shall be sandblasted or water blasted before new concrete is placed. The Engineer may decrease the 6-inch saw back requirement to 2-inches minimum, if a bulkhead was used during previous concrete placement and the concrete was hand vibrated along the bulkhead.

2. Concrete placement shall not begin if rain is expected. Adequate precautions shall be taken to protect freshly placed concrete in the event that rain begins during placement. Concrete that is damaged by rain shall be removed and replaced by the Contractor at no additional expense to the Contracting Agency, and to the satisfaction of the Engineer.
3. Concrete shall not be placed when the temperature of the concrete surface is less than 45°F or greater than 75°F, when the combination of air temperature, relative humidity, fresh concrete temperature, and wind velocity at the construction site produces an evaporation rate of 0.15-pound per square foot of surface per hour as determined from Table 6-02.3(6), or when winds are in excess of 10-mph. If the Contractor elects to Work at night to meet these criteria, adequate lighting shall be provided at no additional expense to the Contracting Agency, and as approved by the Engineer.
4. If concrete placement is stopped for a period of ½-hour or more, the Contractor shall install a bulkhead transverse to the direction of placement at a position where the overlay can be finished full width up to the bulkhead. The bulkhead shall be full depth of the overlay and shall be installed to grade. The concrete shall be finished and cured in accordance with these Specifications.
Further placement is permitted only after a period of 12-hours unless a gap is left in the lane or strip. The gap shall be of sufficient width for the finishing machine to clear the transverse bulkhead installed where concrete placement was stopped. The previously placed concrete shall be sawed back from the bulkhead, to a point designated by the Engineer, to straight and vertical edges and shall be sandblasted or water blasted before new concrete is placed.
5. Concrete shall not be placed against the edge of an adjacent lane or strip that is less than 36-hours old.

6-09.3(12) Finishing Concrete Overlay

Finishing shall be accomplished in accordance with the applicable portions of Section 6-02.3(10) and as follows. Concrete shall be placed and struck-off approximately ½-inch above final grade and then consolidated and finished to final grade with a single pass (the Engineer may require additional passes) of the finishing machine. Hand finishing may be necessary to close up or seal off the surface. The final product shall be a dense uniform surface.

Latex shall not be sprayed on a freshly placed latex modified concrete surface; however, a light fog spray of water is permitted if required for finishing, as determined by the Engineer.

As the finishing machine progresses along the placed concrete, the surface shall be given a final finish by texturing with a comb perpendicular to the centerline of the bridge. The texture shall be applied immediately behind the finishing machine. The comb shall consist of a single row of metal tines capable of producing ⅛-inch wide striations

approximately 0.015-foot in depth at approximately ½-inch spacing. The combs may be operated manually or mechanically, either singly or in gangs (several combs placed end to end). This operation shall be done in a manner that will minimize the displacement of the aggregate particles. The texture shall not extend into areas within 2-feet of the curb line. The non-textured concrete within 2-feet of the curb line shall be hand finished with a steel or magnesium trowel.

Screed rails and construction dams shall be separated from the newly placed concrete by passing a pointing trowel along the inside surfaces of the rails or dams. Care shall be exercised to ensure that this trowel cut is made for the entire depth and length of rails or dams after the concrete has stiffened sufficiently that it does not flow back.

After the burlap cover has been removed and the concrete surface has dried, but before opening to traffic, all joints and visible cracks shall be filled and sealed with a high molecular weight methacrylate resin (HMWM). Cracks 1/16-inch and greater in width shall receive 2 applications of HMWM. Immediately following the application of HMWM, the wetted surface shall be coated with sand for abrasive finish.

6-09.3(13) Curing Concrete Overlay

As the texturing portion of the finishing operation progresses, the concrete shall be immediately covered with a single layer of clean, new or used, wet burlap. The burlap shall have a maximum width of 6-feet. The Engineer will determine the suitability of the burlap for reuse, based on the cleanliness and absorption ability of the burlap. Care shall be exercised to ensure that the burlap is well drained and laid flat with no wrinkles on the deck surface. Adjacent strips of burlap shall have a minimum overlap of 6-inches.

Once in place the burlap shall be lightly fog sprayed with water. A separate layer of white, reflective type polyethylene sheeting shall immediately be placed over the wet burlap. The concrete shall then be wet cured by keeping the burlap wet for a minimum of 42-hours after which the polyethylene sheeting and burlap may be removed.

Traffic shall not be permitted on the finished concrete until the specified curing time is satisfied and until the concrete has reached a minimum compressive strength of 3,000-psi as verified by rebound number determined in accordance with ASTM C 805.

6-09.3(14) Checking for Bond

After the requirements for curing have been met, the entire overlaid surface shall be sounded by the Contractor, in a manner approved by and in the presence of the Engineer, to ensure total bond of the concrete to the bridge deck. Concrete in unbonded areas shall be removed and replaced by the Contractor with the same modified concrete as used in the overlay. Removal and replacement of the overlay in unbonded areas shall be performed at the expense of the Contracting Agency, except as specified in Section 6-09.3(6) when the overlay is placed on a bridge deck as part of the same Contract as the bridge deck construction. All cracks, except those that are significant enough to require removal, shall be thoroughly filled and sealed as specified in Section 6-09.3(12).

After the curing requirements have been met, the Contractor may use compressed air to accelerate drying of the deck surface for crack identification and sealing.

6-09.4 Measurement

Scarifying concrete surface will be measured by the square yard of surface actually scarified.

Modified concrete overlay will be measured by the cubic foot of material placed. For latex modified concrete overlay, the volume will be determined by the theoretical yield of the design mix and documented by the counts of the cement meter less waste. For both microsilica modified concrete overlay and fly ash modified concrete overlay, the volume will be determined from the concrete supplier's Certificate of Compliance for each batch delivered less waste. Waste is defined as the following:

1. Material not placed.
2. Material placed in excess of 6-inches outside a longitudinal joint or transverse joint.

Finishing and curing modified concrete overlay will be measured by the square yard of overlay surface actually finished and cured.

When further deck preparation is measured by volume, it will be measured by the cubic foot of material removed from the deck repair locations. The depth measurement at each deck repair location will be the average depth beneath a straightedge placed at the level of the existing deck surface. The area measurement at each deck repair location will be the surface area of the removed concrete.

6-09.5 Payment

Payment will be made in accordance with Section 1-04.1, for each of the following Bid items that are included in the Bid Proposal:

“Scarifying Conc. Surface”, per square yard.

The unit Contract price per square yard for “Scarifying Conc. Surface” shall be full pay for performing the Work as specified, including testing and calibration of the machines and tools used, containment, collection, and disposal of all water and abrasives used and debris created by the scarifying operation, measures taken to protect adjacent traffic from flying debris, and final cleanup following the scarifying operation.

“Modified Conc. Overlay”, per cubic foot.

The unit Contract price per cubic foot for “Modified Conc. Overlay” shall be full pay for furnishing the modified concrete overlay, including the overlay material placed into small deck repairs in accordance with Section 6-09.3(6)C.

“Finishing and Curing Modified Conc. Overlay”, per square yard.

The unit Contract price per square yard for “Finishing and Curing Modified Conc. Overlay” shall be full pay for performing the Work as specified, including placing, finishing, and curing the modified concrete overlay, checking for bond, and sealing all cracks.

“Further Deck Preparation”, per cubic foot.

When “Further Deck Preparation” is measured by volume, the unit Contract price per cubic foot for “Further Deck Preparation” shall be full pay for performing the Work as specified, including removing and disposing of the concrete within the repair area, and furnishing, placing, finishing, and curing the repair concrete.

“Further Deck Preparation”, force account.

When “Further Deck Preparation” is not measured by volume, payment for the Work required will be by force account in accordance with Section 1-09.6. For the purpose of providing a common Proposal for all Bidders, the Contracting Agency has entered an amount for the item “Further Deck Preparation” in the Bid Proposal to become a part of the total Bid by the Contractor.