

## SECTION 509 CONCRETE OVERLAY AND STRUCTURE REPAIR

### 509.1 Description

- (1) This section describes cleaning or scarifying areas of decks and approach pavements to be overlaid; removing and disposing any remaining asphaltic patches or unsound concrete from those areas; the furnishing, placing and curing concrete overlays; and full depth deck, surface, curb and joint repairs, as required.

### 509.2 Materials

- (1) Furnish a neat cement bonding grout. Mix the neat cement in a water-cement ratio approximately equal to 5 gallons (19 L) of water per 94 pounds (42.7 kg) of cement.
- (2) Furnish concrete for the Concrete Masonry Overlay bid items conforming to grade E concrete, section 501.
- (3) Furnish concrete for the Concrete Surface Repair bid item conforming to grade C, C-FA, C-S, C-IS, C-IP or E concrete, section 501, except the contractor may increase the slump for grade E concrete to a maximum of 4 inches (100 mm). The contractor may apply an engineer-approved commercial grout or surface coating to surfaces being repaired instead of the grades of concrete designated above if it is impractical to apply that masonry, if the engineer specifically approves in writing.
- (4) Furnish concrete for Joint Repair, Curb Repair, and Full-Depth Deck Repair conforming to grade C, C-FA, C-S, C-IS, C-IP, D, or E concrete as specified in section 501; except as follows:
  1. The contractor may increase slump of grade E concrete to 3 inches (75 mm).
  2. The contractor may use ready-mixed concrete.

### 509.3 Construction

#### 509.3.1 Equipment

- (1) Use a finishing machine to finish concrete overlays conforming to 502.3.7.8 and the following:
  1. The machine shall have 2 linearly oscillating transverse screeds. For the front screed use, a synchronous vibratory screed with a variable frequency the operator can adjust. Provide a sufficient number of identical vibrators so there are at least 2 vibrators for each 5 feet (1.5 m) of screed length. Ensure that the bottom face of each screed is at least 7 inches (175 mm) wide with a rounded leading edge. Each screed shall have an effective weight of at least 75 pounds per square foot (366 kg/m<sup>2</sup>) of bottom face area. Provide each screed with the capability to positively control of the vertical position, the angle of tilt and the shape of the crown.
  2. The machine shall have an adjustable metering device ahead of the leading screed that traverses the width of the machine.
  3. The machine shall have capability of forward and reverse motion under positive control. Make provisions for raising the screeds to clear the screeded surface for traveling in reverse.
- (2) If placing concrete in a line next to a previously completed lane, equip the side of the finishing machine next to the completed lane, to travel on the lane.

#### 509.3.2 Cleaning

- (1) Under the Cleaning Decks and Cleaning Approaches bid items, clean the decks and approach pavements before placing the concrete overlay.
- (2) Use construction methods conforming to section 502 and the following:
  1. Clean the entire surface of the bridge deck or approach pavement receiving the new concrete by using a suitable mechanical scarifier. Accomplish this in a manner that prevents hooking or tearing the reinforcing steel and that removes at least one inch (25 mm) of concrete from the deck or pavement surface but not more than the maximum depth the plans show.
  2. If scarification is impracticable, as along curb faces or at expansion joints, remove deteriorated concrete to sound material by using chippers conforming to 509.3.3 for chippers.
  3. Perform scarification before preparation. After completing scarification, remove the remaining asphaltic patches and unsound concrete as specified for preparation in 509.3.3.
  4. Blast clean the entire surface of the deck and approach pavements being overlaid, all exposed reinforcing steel, the vertical faces of curbs, sidewalks and parapets to the depth of the adjoining concrete overlay after completing preparation.

5. Clean the surface receiving the new concrete by brooming and water pressure using a high-pressure nozzle to remove all loose particles and dust, or water and air pressure. Use water for cleaning conforming to specifications for water under 501.2.4

### **509.3.3 Preparation**

- (1) Under the Preparation Decks and Preparation Approaches bid items, remove all asphaltic patches and unsound or disintegrated areas of concrete decks and approach pavements as the plans show, or as the engineer directs.
- (2) Use construction methods conforming to section 203 and the following:
  1. Under the Preparation Decks Type 1 bid item, remove existing asphaltic patching and unsound bridge deck concrete only to a depth that exposes 1/2 of the peripheral area of the top or bottom bar steel in the top mat of reinforcement.
  2. Under the Preparation Decks Type 2 bid item, remove existing unsound bridge deck concrete below the limit of the type 1 removal described above. One inch (25 mm) below the bottom of the top or bottom bar steel in the top mat of reinforcement is the minimum depth of type 2 removal. The engineer will direct any further removal.
  3. Remove the existing asphaltic patching and unsound concrete using equipment that causes no damage to the bridge floor. If chipping exposes the existing bar steel reinforcement for more than 1/2 of its peripheral area, and where bond between existing concrete and reinforcing bar has been destroyed, remove the adjacent concrete to provide a minimum one-inch (25 mm) clearance around the bar.
  4. For chipping off the old concrete surface, use air chippers or breakers that weigh no more than 35 pounds (16 kg) and are equipped with flat, chisel-type points with a cutting edge not less than 3/4 inch (19 mm) or greater than 3 inches (75 mm) wide.
  5. If the engineer allows, the contractor may use chippers or breakers weighing more than 35 pounds (16 kg) but not more than 60 pounds (27 kg) and equipped with a 3-inch (75 mm) chisel-type point instead of the 35-pound (16 kg) chipper. Discontinue use if damage to steel or concrete designated to remain results.
  6. For removals below the top of and within one inch (25 mm) of the reinforcing steel, do not use hammers heavier than 15 pounds (7 kg).
  7. Dispose of all old concrete and asphaltic patching removed away from the bridge site. Implement necessary procedures to minimize debris dropping into the stream, streambed, roadway, or right-of-way below.

### **509.3.4 Joint Repair**

- (1) Under the Joint Repair bid item, remove and dispose of deteriorated concrete at existing joints over piers, abutments and deck ends and other locations, and form new joints as the plans show, and the engineer directs.
- (2) Use construction methods conforming to section 203, section 502, and the following:
  1. Remove the concrete at an existing joint to be replaced to the limits the plans show, or as the engineer directs. Place a 1/2 inch (13 mm) deep saw cut at the line of removal on the bottom edge of the deck to control concrete breakout or cover the line of removal with a 1 1/2 inch (38 mm) thick layer of concrete to cover all reinforcing steel exposed during joint repair. Use removal equipment that causes no damage to the portion of the concrete floor, curbs, and reinforcing steel remaining in place. Do not use tractor-mounted rams for removal operations within 9 inches (225 mm) of the edge, or within the depth of the slab from the edge, whichever is less.
  2. The contractor shall preserve and utilize the required existing reinforcing steel, and blast clean, realign, and retie, as the engineer considers necessary. Additional required reinforcing steel shall conform to 505.2.3.
  3. Dispose of removed material as specified in 509.3.3.
  4. Clean the surface receiving the new concrete by brooming and water pressure using a high-pressure nozzle to remove all loose particles and dust.
  5. Immediately before placing concrete, coat the surfaces of the old concrete receiving new concrete with neat cement as specified for concrete overlays in 509.3.8.2.
  6. Restore painted surfaces damaged by any construction operation to the satisfaction of the engineer.
  7. Place concrete as specified for joint repair in 509.3.8.1.

### **509.3.5 Curb Repair**

- (1) Under the Curb Repair bid item, remove and dispose of portions of deteriorated concrete on the concrete curbs and form new curb faces, top or back as the plans show.

- (2) Use construction methods conforming to section 203, section 502, and the following:
1. Take the precautions necessary while removing deteriorated concrete to preserve all existing reinforcing steel. Clean, realign, and retie existing reinforcing steel, as the engineer considers necessary.
  2. Remove concrete to sound concrete or at least one inch (25 mm) behind existing reinforcing steel as the plans show and the engineer directs.
  3. Make a 1/2-inch (13 mm) deep saw cut at the limits of curb repair before removing the deteriorated concrete.
  4. Dispose of removed material as specified in 509.3.3.
  5. Clean the surface against which placing the new concrete to remove all loose particles and dust, and keep continuously wet for 2 hours before placing new concrete. Immediately before placing concrete, coat the surfaces of old concrete with neat cement as specified in 509.3.8.2.
  6. Place concrete as specified in 509.3.8.1.

#### **509.3.6 Concrete Surface Repair**

- (1) Under the Concrete Surface Repair bid item, remove those portions of abutments, piers, girders, and other elements that the plans show, and the engineer directs, and replace those portions with concrete.
- (2) Use construction methods conforming to section 203, section 502, and the following:
1. Take necessary precautions while removing deteriorated concrete to preserve all existing reinforcing steel. Clean, realign and retie existing reinforcing steel, as the engineer considers necessary.
  2. Remove concrete to sound concrete or to one inch (25 mm) behind the existing reinforcing steel, whichever depth is greater, at locations the plans show or as the engineer directs.
  3. Make a 1/2-inch (13 mm) deep saw cut at the limits of the concrete surface repair before removal of the deteriorated concrete.
  4. Dispose of removed material as specified in 509.3.3.
  5. Clean the surfaces against which placing the new concrete to remove all loose particles and dust, and keep continuously wet for a period of 2 hours before placing new concrete.

#### **509.3.7 Full Depth Deck Repair**

- (1) Under the Full-Depth Deck Repair bid item, perform full-depth removal of unsound concrete at locations on the deck as the engineer directs, and then prepare and form these areas.
- (2) Use construction methods conforming to section 203, section 502, and the following:
1. Completely remove the existing concrete deck areas being repaired using equipment that causes no significant damage to that portion of the structure remaining in place. The contractor shall preserve and utilize the required existing reinforcing steel.
  2. If damage occurs to anything designated for re-use in the new work repair, or replace it at no expense to the department.
  3. Dispose of removed material as specified in 509.3.3.
  4. Blast clean, realign, and retie the existing reinforcing steel to be re-used, as the engineer considers necessary.
  5. Clean the vertical surface receiving the new concrete by brooming and water pressure to remove all loose particles and dust, and keep continuously wet for 2 hours before placing concrete. Immediately before placing concrete in the full depth deck replacement, coat the entire surface receiving the new concrete with neat cement as specified in 509.3.8.2.
  6. Place the concrete for the repair as specified in 509.3.8.1.

#### **509.3.8 Concrete**

##### **509.3.8.1 General**

- (1) Under the Concrete Masonry Overlay Decks and Concrete Masonry Overlay Approaches bid items, construct a concrete overlay course on concrete deck and approach pavement to the lines, grades, thickness, and cross section the plans show, or the engineer directs.
- (2) Use construction methods conforming to section 502 and the following:
1. For joint repair, place the concrete and consolidate by vibrating in the prepared joints before placing the overlay.

2. For curb repair, place the concrete, consolidate, and strike off to the required alignment for curb faces, tops, and backs.
3. For full depth deck repair, place the concrete; consolidate by internal vibration, and strike off to the existing deck elevation before placing the overlay.

#### **509.3.8.2 Placing Concrete Overlays**

- (1) Immediately before placing the concrete overlay, coat the surface of the bridge decks or approach pavement being overlaid, and all vertical joints with a neat cement mixture. Ensure the surface of the existing deck is moist without any standing water before coating with the neat cement mixture. Brush the neat cement over the prepared concrete surface to ensure all parts receive an even coating and do not allow excess neat cement to collect in pockets. Apply the neat cement at a rate that ensures the cement does not dry out before covering with the new concrete.
- (2) Place concrete for deck preparation immediately in front of the overlay course and vibrate internally in addition to surface screed vibration. Place concrete in a single operation, with no construction joints in the overlay section except as the plan show or the engineer directs. Do not place concrete if the ambient air temperature is above 88 F (31 C).
- (3) The contractor may operate the finishing machine with the transverse screeds normal to the centerline of the structure. Conduct bridge deck finishing operations so that the elapsed time between depositing the concrete on the deck and final screeding does not exceed 10 minutes.
- (4) If the plan requires construction joints, make them sharp-edged, perpendicular to the overlay surface, at the locations the plan show, and true to the alignments the plan show.
- (5) Provide the final surface finish specified in 502.3.7.8 for floors of structures having approach pavements with design speeds of 40 mph (65 km/h) or greater, except there is no requirement for the turf drag or broom finish.
- (6) Form or saw contraction joints to the width, depth, and at locations the plans show and seal as the plans show. Begin sawing joints within 6 hours after placing the concrete, unless the engineer directs otherwise, and complete within 12 hours.

#### **509.3.8.3 Curing Concrete Overlays**

- (1) Cure concrete overlays as specified for curing concrete in floors, wearing surfaces, and sidewalks in 502.3.8, including fogging, and allow to cure for 3 days.

#### **509.3.8.4 Opening to Traffic**

- (1) Do not allow traffic on the completed overlay for a minimum of 3 days after placement. The engineer may extend this time if conditions warrant.

#### **509.4 Measurement**

- (1) The department will measure Preparation Approaches and the Preparation Decks bid items by the square yard acceptably completed. The department will not subtract areas of type 2 removal from areas of type 1 removal. The department will subtract areas of full-depth deck repair, the engineer directs before beginning the type 1 or type 2 deck removals, from the areas of the type 1 or type 2 removals. The department will not subtract areas of full-depth deck repair, the engineer directs after type 1 or type 2 deck removals are underway, from the areas of the type 1 or type 2 removals. The department will not measure areas of joint repair under these bid items.
- (2) The department will measure Cleaning Decks, Cleaning Approaches, Joint Repair, and Full-Depth Deck Repair by the square yard acceptably completed.
- (3) The department will measure Curb Repair by the linear foot acceptably completed.
- (4) The department will measure Concrete Surface Repair by the square foot acceptably completed, measured as the exposed surface area, following removal, as delineated by the saw cuts.
- (5) The department will measure the Concrete Masonry Overlay bid items by the cubic yard acceptably completed. The department will measure concrete used in joint repair, curb repair, and in full-depth deck repair as part of the Concrete Masonry Overlay bid items. The department compute yardage based on the nominal cubic yard of concrete defined in 501.3.2.2. The department will not measure wasted concrete.

#### **509.5 Payment**

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
509.0200	Preparation Approaches	SY
509.0300 - 0399	Preparation Decks (type)	SY
509.0500	Cleaning Decks	SY
509.0600	Cleaning Approaches	SY
509.1000	Joint Repair	SY
509.1200	Curb Repair	LF
509.1500	Concrete Surface Repair	SF
509.2000	Full-Depth Deck Repair	SY
509.2500	Concrete Masonry Overlay Decks	CY
509.2600	Concrete Masonry Overlay Approaches	CY

#### **509.5.1 Preparation**

- (1) Payment for Preparation Approaches and the Preparation Decks bid items is full compensation for removing asphaltic patches and unsound concrete; and for disposing of waste materials.

#### **509.5.2 Cleaning**

- (1) Payment for Cleaning Decks and Cleaning Approaches is full compensation for scarifying, and cleaning the deck or approaches; and for blast cleaning the entire deck or approaches, including all exposed existing reinforcing steel.

#### **509.5.3 Joint Repair**

- (1) Payment for Joint Repair is full compensation for removing and disposing of deteriorated concrete, and for forming new joints.
- (2) The department will pay for concrete used under the Concrete Masonry Overlay bid items.
- (3) The department will not pay for restoration of painted surfaces damaged by construction operations.

#### **509.5.4 Curb Repair**

- (1) Payment for Curb Repair is full compensation for removing and disposing of deteriorated concrete; for forming; and for disposing of waste material.
- (2) The department will pay for concrete used under the Concrete Masonry Overlay Decks bid item.

#### **509.5.5 Concrete Surface Repair**

- (1) Payment for Concrete Surface Repair is full compensation for removing and disposing of deteriorated concrete; and for cleaning reinforcing steel; for forming, furnishing, hauling, placing, curing, and protecting all materials.

#### **509.5.6 Full Depth Deck Repair**

- (1) Payment for Full-Depth Deck Repair is full compensation for completely removing the deteriorated concrete areas; for disposing of waste material; for forming; and for salvaging and using the existing bar steel reinforcement. The department will pay for this bid item at the contract unit price regardless of whether the engineer directs it before or after beginning the type 1 or type 2 removals.
- (2) The department will pay for concrete used under the Concrete Masonry Overlay Decks bid item.

#### **509.5.7 Concrete Overlays**

- (1) Payment for the Concrete Masonry Overlay bid items is full compensation for providing, hauling, preparing, placing, finishing, curing and protecting concrete; and for sawing and sealing joints, if applicable, unless specified otherwise.