

Designer Note: The subject special provision is intended for use on resurfacing contracts or contracts with bridge repair. This is to be used in lieu of using normal pavement repair procedures on these structural slabs. No details are required on the plans other than showing estimated locations of approach slab repair in a plan view similar to that being done with bridge deck repairs. If the contract includes other bridge repairs then the appropriate pay items should appear on the bridge's total bill of material in addition to the summary of quantities.

The Bureau of Bridges and Structures will monitor implementation through the plan review process.

## **APPROACH SLAB REPAIR**

Effective: March 13, 1997

Description. This work shall consist of bituminous surface removal, when required, the removal and disposal of all loose and deteriorated concrete and the replacement with new concrete to the original top of approach slab. The work shall be done according to the applicable requirements of Sections 501, 503 and 1020 of the Standard Specifications and this Special Provision.

Approach slab repairs will be classified as follows:

- (a) **Partial-Depth.** Partial-depth repairs shall consist of removing the loose and unsound approach slab concrete, disposing of the concrete removed and replacing with new concrete. The removal may be performed by chipping with power driven hand tools or by hydro-equipment. The depth shall be measured from the original concrete surface, at least 20 mm (3/4 inch) but not more than 140 mm (5 1/2 inches) unless otherwise specified on the plans.
- (b) **Full-Depth.** Full-depth repairs shall consist of removing concrete full-depth of the slab, disposing of the concrete removed, and replacing with new concrete to the original approach slab surface. The removal may be performed with power driven hand tools or by hydro-equipment.

Materials. All materials shall comply with the requirements of Sections 503 and 1020 of the Standard Specifications.

Concrete for partial and full-depth repairs shall be proportioned and mixed according to the applicable portions of Section 1020 of the Standard Specifications except as follows:

No calcium chloride will be permitted in the mix.

	Per Bag of Cement		Per Cu M (Cu. Yd.) of Concrete	
	kg.	(Lbs.)	kg.	(Lbs.)
Portland Cement	43	( 94)	436	( 735)
Fine Aggregate*	77	(170)	787	(1,326)
Coarse Aggregate *	80	(175)	810	(1,365)
Water *	19	( 42)	193	( 325)
	18.5 L (4.9 gals.)		194 L (39.2 gals.)	
Air entrainment	6 to 9%		6 to 9%	

\*Based on saturated surface-dry aggregate with a specific gravity of 2.65. The mix will be adjusted by the Engineer to compensate for aggregate specific gravity and moisture. Coarse aggregate shall be gradation CA 13, CA 14 or CA 16, subject to approval of the mix design. Fine aggregate shall be gradation FA 1 or FA 2.

Grout. The grout for bonding new concrete to old concrete shall be proportioned with equal parts by mass (weight) of Portland cement and sand, mixed with sufficient water to form a slurry. The grout may be ready-mixed or mixed at the job site. The bonding grout shall have a consistency allowing it to be scrubbed onto the prepared surface with a stiff brush or broom leaving a thin, uniform coating that will not run or puddle in low spots.

Equipment: The equipment used shall be subject to the approval of the Engineer and shall meet the following requirements:

- (a) Surface Preparation Equipment. Surface preparation and concrete removal equipment shall comply with the applicable portions of Section 1100 of the Standard Specifications and the following:
  - (1) Sawing Equipment. Sawing equipment shall be a concrete saw capable of sawing concrete to the specified depth.
  - (2) Blast Cleaning Equipment. The blast cleaning may be performed by wet sandblasting, high-pressure water blasting, abrasive blasting, or other methods approved by the Engineer. Blast cleaning equipment shall be capable of removing rust and old concrete from exposed reinforcement bars. Oil traps will be required.
  - (3) Power-Driven Hand Tools. Power-driven hand tools will be permitted including jackhammers lighter than the nominal 20 kg. (45 pound) class. Chipping hammers heavier than a nominal 6.8 kg. (15 pound) class shall not be used for removing concrete from below any reinforcing bar for partial depth repairs or final removal at the boundary of full-depth repairs. Jackhammers or chipping hammers shall not be operated at an angle in excess of 45 degrees measured from the surface of the slab.
  - (4) Hydro-Scarification Systems. The hydro-scarification equipment shall consist of filtering and pumping units operating with a remote-controlled robotic device. The equipment may use river, stream or lake water. Operation of the equipment shall be performed and supervised by qualified personnel certified by the equipment manufacturer. Evidence of certification shall be presented to the Engineer. The equipment shall be capable of removing concrete to the specified depth and removing rust and concrete particles from exposed reinforcing bars. Hydro-

scarification equipment shall be calibrated before being used and shall operate at a minimum of 124 MPa (18,000 psi).

- (b) Concrete Equipment: Equipment for proportioning and mixing the concrete shall comply with the applicable requirements of Section 1103 of the Standard Specifications.
- (c) Placing and Finishing Equipment: Placing and finishing equipment shall be according to Article 503.17 of the Standard Specifications. Adequate hand tools will be permitted for placing and consolidating concrete in the patch areas and for finishing small patches.

Construction Requirements:

- (a) Bituminous Surface Removal.

The bituminous concrete surface course shall be removed and disposed of according to applicable portions of Articles 440.03 and 440.06 of the Standard Specifications. If the overlay contains asbestos fibers, removal shall be according to the Special Provision for "Asbestos Waterproofing Membrane or Asbestos Bituminous Concrete Surface Removal". Removal of the bituminous surface by the use of radiant or direct heat will not be permitted.

- (b) Surface Preparation:

All loose, disintegrated and unsound concrete shall be removed from portions of the approach slab shown on the plans or as designated by the Engineer. The Engineer will determine the limits of removal as the work progresses.

If the Contractor elects to use hydro-scarification equipment, he/she shall be responsible for collecting and properly disposing of the runoff water generated. Runoff water will not be allowed to constitute a hazard on adjacent or underlying roadways, waterways, drainage areas or railroads nor be allowed to erode existing slopes.

The Contractor shall take care not to damage reinforcement bars or expansion joints which are to remain in place. Any damage to reinforcement bars or expansion joints shall be corrected at the Contractor's expense. All loose reinforcement bars, as determined by the Engineer, shall be retied at the Contractor's expense.

- (1) Partial-Depth. Areas to be repaired will be determined and marked by the Engineer. A concrete saw shall be used to provide vertical edges approximately 20 mm (3/4 inch) deep around the perimeter of the area to be patched when an overlay is not specified. Where high steel is present, the depth may be reduced as directed by the Engineer. A saw cut will not be required on those boundaries along the face of the curb, parapet or joint or when sharp vertical edges are provided by hydro-scarification. The saw cut may be omitted if the deck is to receive an overlay.

The loose and unsound concrete shall be removed by chipping, with power driven hand tools or by hydro-equipment. All exposed reinforcing bars and newly exposed concrete shall be thoroughly blast cleaned. Where, in the judgment of the Engineer, the bond between existing concrete and reinforcement steel within the patch area has been destroyed, the concrete adjacent to the bar shall be removed

to a depth that will permit new concrete to bond to the entire periphery of the exposed bar. A minimum of 25 mm (1-inch) clearance will be required. The Engineer may require enlarging a designated removal area should inspection indicate deterioration beyond the limits previously designated. In this event, a new saw cut shall be made around the extended area before additional removal is begun. The removal area shall not be enlarged solely to correct debonded reinforcement or deficient lap lengths.

- (2) Full-Depth. Concrete shall be removed as determined by the Engineer within all areas designated for full-depth repair and in all designated areas of partial depth repair in which unsound concrete is found to extend below a depth of 140 mm (5 1/2 inches) unless otherwise specified on the plans. Full depth removal shall be performed according to Article 501.03 of the Standard Specifications. A concrete saw shall be used to provide vertical edges approximately 20 mm (3/4 inch) deep around the perimeter of the area to be patched when an overlay is not specified. A saw cut will not be required on those boundaries along the face of the curb, parapet or joint or when sharp vertical edges are provided by hydro-scarification. The saw cut may be omitted if the deck is to receive an overlay.

All voids under full depth repair areas shall be filled with a suitable material that meets the approval of the Engineer.

- (3) Reinforcement Treatment. Care shall be exercised during concrete removal to protect the reinforcement bars from damage. Any damage to the reinforcement bars to remain in place shall be repaired or replaced to the satisfaction of the Engineer at the Contractor's expense. All existing reinforcement bars shall remain in place except as herein provided for corroded bars. Tying of loose bars will be required. Any existing reinforcement bars which have a loss of more than 25% of their cross section through corrosion shall be replaced in kind with new steel as directed by the Engineer. No welding of bars will be permitted and new bars shall be lapped a minimum of 32 bar diameters to existing bars. An approved "squeeze type" mechanical bar splicer capable of developing in tension at least 125 percent of the yield strength of the existing bar shall be used when it is not feasible to provide the minimum bar lap.
- (4) Cleaning. Immediately after completion of the concrete removal and reinforcement repairs, the repair areas shall be cleaned of dust and debris. Once the initial cleaning is completed, the repair areas shall be thoroughly blast cleaned to a roughened appearance free from all foreign matter. Particular attention shall be given to removal of concrete fines. Any method of cleaning which does not consistently produce satisfactory results shall be discontinued and replaced by an acceptable method. All debris, including water, resulting from the blast cleaning shall be confined and shall be immediately and thoroughly removed from all areas of accumulation. If concrete placement does not follow immediately after the final cleaning, the area shall be carefully protected with well-anchored polyethylene sheeting.

Exposed reinforcement bars shall be free of dirt, detrimental scale, paint, oil, or other foreign substances which may reduce bond with the concrete. A tight non-scaling coating of rust is not considered objectionable. Loose, scaling rust shall be removed by rubbing with burlap, wire brushing, blast cleaning or other methods approved by the Engineer.

(c) Placement & Finishing of Concrete Repair:

(1) Grout Placement. After the repair areas have been cleaned and immediately prior to concrete placement, the grout shall be applied to a dampened surface. A thin layer of grout shall be thoroughly scrubbed into the deck surface. All vertical as well as horizontal surfaces shall receive a thorough, even coating. The rate of grout placement shall be limited so the brushed grout does not dry out before it is covered with concrete. Grout that has become dry and chalky shall be blast cleaned and replaced at the Contractor's expense. No concrete shall be placed over dry grout.

(2) Concrete Placement.

The concrete shall be placed and compacted according to Article 503.07 of the Standard Specifications and as herein specified.

All concrete shall be vibrated internally with hand-held vibrators. When an overlay system is not specified, the patches shall be finished according to Article 503.17 of the Standard Specifications, followed by a light brooming.

(d) Curing.

Concrete patches shall be cured by the Wetted Burlap Method as per Article 1020.13 of the Standard Specifications. The curing period shall be 72 hours followed by a 72-hour minimum drying period before scarifying or surfacing.

(e) Opening to Traffic.

No traffic or construction equipment will be permitted on the repairs until after the specified cure period and the concrete has obtained a minimum compressive strength of 27.6 MPa (4,000 psi) or flexural strength of 4.65 MPa (675 psi) unless permitted by the Engineer.

Method of Measurement. When specified, bituminous surface removal and full or partial depth repairs will be measured for payment and computed in square meters (square yards).

Basis of Payment. The bituminous concrete surface removal will be paid for at the contract unit price per Square Meter (Square Yard) for BITUMINOUS CONCRETE REMOVAL (DECK). Areas removed and replaced up to and including a depth of 140 mm (5 1/2-inch) or as specified will be paid for at the contract unit price per Square Meter (Square Yard) for APPROACH SLAB REPAIR (PARTIAL). Areas requiring removal greater than a depth of 140 mm (5 1/2-inch) shall be removed and replaced full depth and will be paid for at the contract unit price per Square Meter (Square Yard) for APPROACH SLAB REPAIR (FULL DEPTH).

When corroded reinforcement bars are encountered in the performance of this work and replacement is required, the Contractor will be paid according to Article 109.04 of the Standard Specifications.

No payment will be allowed for removal and replacement of reinforcement bars damaged by the Contractor in the performance of his/her work or for any increases in dimensions needed to provide splices for these replacement bars.

Removal and disposal of asbestos waterproofing and/or asbestos bituminous concrete will be paid for as specified in the Special Provision for ASBESTOS WATERPROOFING MEMBRANE OR ASBESTOS BITUMINOUS CONCRETE SURFACE REMOVAL.