



SECTION 704

CONCRETE MASONRY REPAIR

704.1 Description. This work shall consist of removing deteriorated concrete, preparing the repair site, forming where required, placing and finishing new concrete or qualified special mortar and applying epoxy in the required areas.

704.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows. The qualified special mortar shall be from the qualified rapid set concrete patching material listing available from Construction and Materials or MoDOT's web site.

Item	Section
Concrete	501
Concrete Bonding Compound and Epoxy Mortar	623
Gradation E Coarse Aggregate	1005
Type III Cement	1019
Type III Epoxy & Epoxy Polymer Concrete Overlay	1039
Water	1070

704.3 Types of Repair.

704.3.1 Repairing Concrete Deck (Half-Soling). This work shall consist of partial removal and replacement of bridge deck concrete in the required areas.

704.3.2 Deck Repair With Void Tube Replacement. This work shall consist of partial removal and replacement of bridge deck concrete and removal and replacement of the deteriorated void tube in the required areas.

704.3.3 Full Depth Repair. This work shall consist of complete removal and replacement of the bridge deck concrete in the required areas.

704.3.4 Modified Deck Repair. This work shall consist of the removal and replacement of visibly loose or spalled bridge deck concrete and placement of concrete in the areas where the reinforcing steel is exposed. The repair concrete for these areas shall be Class B-1.

704.3.5 Superstructure Repair (Unformed). This work shall consist of repairing the deteriorated concrete on the bottom of the bridge deck in the required areas with a qualified special mortar.

704.3.6 Slab Edge Repair. This work shall consist of repairing the edge of the bridge deck by removing deteriorated concrete and patching the required areas with a qualified special mortar. All repairs made within 4 inches (100 mm) of the edge of the bridge deck, regardless of the repair thickness, will be considered slab edge repair. Portions of the bridge deck areas requiring repair that extend more than 4 inches (100 mm) from the edge of the bridge deck shall be repaired as superstructure repair (unformed) or full depth repair.

704.3.7 Substructure Repair (Formed). This work shall consist of formed substructure repair. The required areas shall be patched with Class B-1 concrete. Coarse aggregate shall be Gradation E in accordance with Sec 1005.

704.3.8 Substructure Repair (Unformed). This work shall consist of unformed substructure repair. The required areas shall be patched with a qualified special mortar.

704.3.9 Epoxy Sealing. This work shall consist of applying an epoxy material to the concrete in the required areas.

704.4 Construction Requirements.

704.4.1 Removal Requirements. The type of repair and areas to be repaired will be outlined by the engineer. All loose, deteriorated and unsound concrete in the required repair areas shall be removed by conventional hand/mechanical, hydro demolition or other approved equipment to a depth as specified herein and as directed by the engineer. Slight deck imperfections surrounded by sound concrete shall be cleaned of all dirt, loose material and deteriorated concrete. If reinforcing steel is not exposed, deck repair work will not be required.

704.4.1.1 Bridge Decks to be Covered with Asphalt or Concrete Wearing Surface. The existing bridge deck shall be scarified for the concrete wearing surface as specified in the contract documents and in accordance with [Sec 505](#). Slight bridge deck imperfections of 0.5 inch (13 mm) or less in depth below the prepared deck surface that are surrounded by sound concrete, and the reinforcing steel is not exposed, shall not be half-soled. These areas shall be cleaned by hand tools, sand or hydro blasting to remove all dirt, loose material and deteriorated concrete before the application of the asphalt or concrete wearing surface. Asphalt or concrete for these areas shall be placed monolithic with the wearing surface in accordance with [Sec 403](#) or [Sec 505](#).

704.4.1.2 Bridge Decks to be covered with Epoxy Polymer Concrete Overlay. Preparing and cleaning the existing bridge deck shall be in accordance with [Sec 623](#).

704.4.1.3 Conventional Hand/Mechanical Equipment. Conventional hand/mechanical equipment consisting of jackhammers no heavier than the 35-pound (15.9 kg) class shall be used for concrete removal. For bridge decks rated 5 or below, the jackhammers shall not be heavier than the 65-pound (29.5 kg) class. Chipping hammers from the 15-pound (6.8 kg) class shall be used to remove concrete from beneath any reinforcing bars, where required. The bits shall be sharp in order to reduce pounding. Jackhammers shall be operated to minimize damage to the sound concrete around the patch area. Other methods that would be less damaging to the concrete and reinforcement may be used with approval from the engineer.

704.4.1.4 Patch Repair Hydro Demolition Equipment. The hydro demolition equipment shall be capable of removing concrete to the specified depth and shall be capable of removing rust and concrete particles from exposed reinforcing bars. All water used in hydro demolition shall be potable in accordance with [Sec 1070](#). Stream or lake water will not be permitted. The contractor shall take necessary precautions during hydro demolition to prevent damage to the remaining structure and adjacent property as a result of runoff. Slab drains receiving runoff from the contractor's operation shall be temporarily plugged. The discharge water shall not be released from the site until the broken concrete, aggregate and other settleable solids have been removed through filtration, sediment basins or other approved methods. The contractor shall control dust and run-off in accordance with applicable governmental regulations. Environmental protection shall be in accordance with [Sec 107](#). Hydro demolition shall not impede or interfere with maintaining traffic. Heavy equipment, such as vacuum trucks for removal of concrete debris, will not be permitted to place wheel loads on the deck areas where deteriorated concrete has been removed.

704.4.1.5 Concrete Removal. A boundary perimeter with one-inch (25 mm) vertical sides shall be established outside the deteriorated area. The deteriorated concrete shall be removed as required to provide good sound concrete on which new concrete can be placed and satisfactorily bonded to the reinforcing bars. The areas of repair shall be made approximately rectangular with the sides generally perpendicular to the surface being repaired. These areas shall be carefully removed such that reinforcement is not disturbed or damaged. For full depth repair, a saw cut outside the deteriorated area shall also be made on the bottom of the bridge deck, except on voided slab, solid slab and box girder bridges without entry access. Other acceptable methods for saw cutting the bottom of the deck may be used with approval from the engineer. No more than one-fourth of the column perimeter shall be removed at any one time, and no more than one-eighth of the column perimeter if the repair is completed under live load. Once the one-quarter or one-eighth limit has been reached, the column shall be repaired before any further column removal is done.

704.4.1.6 Reinforcing Bar Exposed. All exposed reinforcing bars shall be thoroughly cleaned by sand or hydro blasting to the satisfaction of the engineer.

704.4.1.6.1 Superstructure and Substructure Repair. The concrete within the boundary area for superstructure repair (unformed), substructure repair (formed) and substructure repair (unformed) shall be removed a minimum of one inch (25 mm) beyond the inside edge of any exposed reinforcing bars, including the main reinforcement.

704.4.1.6.2 Deck Repairs. The minimum depth of repair for repairing concrete deck (half-soling) or modified deck repair shall expose the upper layer of the top mat of reinforcing steel. When the bond between existing concrete and a reinforcing bar has been destroyed, or more than half the diameter of a reinforcing bar is exposed, the concrete adjacent to the reinforcing bar shall be removed to a depth that will permit the concrete to bond to the entire periphery of the bar. A minimum of one-inch (25 mm) clearance shall be maintained.

704.4.1.6.3 If a reinforcing bar is exposed during slab edge repair, the concrete adjacent to the bar shall be removed to a depth that will permit a qualified special mortar to bond to the entire periphery of the bar. A minimum of one-inch (25 mm) clearance shall be maintained.

704.4.1.7 Reinforcement Repair. Particular care shall be taken not to disturb or damage reinforcing bars. All exposed reinforcing bars shall be thoroughly cleaned by sand or hydro blasting. Cut or broken bars or bars with 10 percent or more cross sectional area lost shall be spliced 24 diameters on each side of the damage with new bars of the same size in accordance with [Sec 706](#). Damaged existing epoxy coated reinforcement shall be repaired in accordance with [Sec 710](#).

704.4.1.8 Material Disposal. All material removed shall be disposed of in accordance with [Sec 202](#).

704.4.2 Preparation of the Repair Area.

704.4.2.1 Patch Preparation Requirements. After removal of deteriorated concrete, the area to be repaired shall be sand or hydro blasted to remove all foreign matter, dirt, free standing water and loose material. The hydro demolition process will not require sand or additional hydro blasting unless the bonding surface of the repair area becomes contaminated or unsatisfactory prior to placement of new concrete. The area to come in contact with new concrete shall be cleaned as stated above, saturated with water and painted with a concrete bonding compound or an epoxy mortar prior to the placement of new concrete. A concrete bonding compound shall be used for all structures with the following exception. An epoxy

mortar shall be used on box girder, voided and solid slab structures and on structures where a cathodic protection system is to be installed.

704.4.2.2 Epoxy Sealing Preparation. The area to be sealed shall be cleaned by sand blasting. Prior to sealing the concrete, all loose particles and foreign matter shall be removed using oil-free and water-free compressed air or a vacuum of at least 90 psi (620 kPa).

704.4.3 Applying Epoxy. The area to be sealed shall be sealed with a qualified Type III epoxy or epoxy material for epoxy polymer concrete overlay. Sealing shall be completed before the application of any overlay. The cleaning, sealing and epoxy application shall proceed only as approved by the engineer, in accordance with the manufacturer's written recommendations. The epoxy application and rate of coverage shall be in accordance with manufacturer's recommendations, with a maximum coverage of 100 square feet per gallon (2.4 m²/L).

704.4.4 Placement of New Concrete.

704.4.4.1 Concrete Placement Requirements. Concrete shall be placed before the concrete bonding compound or epoxy mortar has begun to set. Deck repair concrete shall be placed in the repair area to match the top of the original deck surface. For bridges to be covered with concrete wearing surface, deck repair concrete shall be placed in the repair area up to the bottom of the proposed concrete wearing surface. The finished repair area shall have a light broom texture for bonding of the deck seal, except bridges to be covered with concrete wearing surface shall have a rough surface for bonding of the concrete wearing surface. All joints shall be formed to match any existing joint pattern.

704.4.4.2 Concrete Requirements. Concrete for concrete deck repair shall be Class B-2, except that solid slab, voided slab and box girder structures shall be the same class as the existing deck concrete and as specified in Secs 704.3.4 and 704.4.4.3. The repair area shall not be opened to any traffic until the concrete has reached a compressive strength of 3200 psi (22 MPa). Type III cement may be used to accelerate the set. The coarse aggregate shall be Gradation E in accordance with Sec 1005. Accelerating additives containing chlorides will not be permitted.

704.4.4.3 Bridge Decks with Cathodic Protection System. Concrete for repairing the concrete deck shall be Class B-1. The repair area shall not be opened to any traffic until the concrete has reached a compressive strength of 3200 psi (22 MPa). Type III cement may be used to accelerate the set. The coarse aggregate shall be Gradation E in accordance with Sec 1005. Accelerating additives containing chlorides will not be permitted. All half-sole repairs made on the deck shall be Class B-1 concrete that has a maximum chloride ion content of 5 pounds per cubic yard (2.97 kg/m³). All full depth repairs made on the deck shall be chloride-free Class B-1 concrete from the bottom of the deck to within one inch (25 mm) of the lowest rebar of the top layer of reinforcing steel. The remainder of the repair shall be Class B-1 concrete with a maximum chloride ion content of 5 pounds per cubic yard (2.97 kg/m³).

704.4.4.4 Curing. The repaired areas shall be cured in accordance with Sec 703. The cleaning and application of the epoxy polymer concrete overlay to the deck shall proceed only as approved by the engineer in accordance with the manufacturer's written recommendations.

704.5 Method of Measurement. The extent of repair may vary from the estimated quantities, but the contract unit price shall prevail regardless of the variation. Final measurement will not be made for preparation of the existing deck. No duplication of measurement will be made for full depth repair, repairing concrete deck (half-soling), deck repair with void tube replacement, slab edge repair, superstructure repair (unformed) or

modified deck repair. No duplication of measurement will be made for substructure repair, unformed and formed.

704.5.1 Repairing concrete deck (half-soling), deck repair with void tube replacement, full depth repair, modified deck repair, superstructure repair (unformed) and substructure repair (formed and unformed) will be measured to the nearest square foot (0.1 m²).

704.5.2 Slab edge repair will be measured to the nearest linear foot (0.5 m).

704.5.3 No measurement will be made for epoxy sealing.

704.6 Basis of Payment. Accepted quantities of concrete masonry repairs will be paid for at the contract unit price for each of the pay items included in the contract. No direct payment will be made for epoxy sealing.