

SECTION 412—WIDENING, REPAIRING, AND RECONSTRUCTING EXISTING STRUCTURES

412.01—Description.

This work shall consist of widening, repairing, or reconstructing existing structures in accordance with plan details and these specifications or as directed by the Engineer.

412.02—Materials.

- (a) **Epoxy and mineral fillers** shall conform to the requirements of Section 243. Epoxy for epoxy mortar shall be Type EP-5. Epoxy used for crack repair shall be Type EP-4 or EP-5, low viscosity.
- (b) **Hydraulic cement concrete and latex hydraulic cement concrete** shall conform to the requirements of Section 217 except that coarse aggregate shall be No. 7 or No. 8 for depths and steel clearances less than 2 inches and may be No. 57, No. 7, or No. 8 for depths more than 2 inches. An approved accelerator may be permitted when justified by traffic conditions.
- (c) **Reinforcing steel** shall conform to the requirements of Section 406.
- (d) **Accelerators** shall be noncorrosive and shall be approved by the Engineer.
- (e) **Materials** for Shotcrete shall be as follows:
 - 1. Portland and blended cements shall conform to the requirements of Section 214.
 - 2. Fly ash, slag, and silica fume shall conform to the requirements of Section 215.
 - 3. Water shall conform to the requirements of Section 216.
 - 4. Air entraining admixtures shall conform to the requirements of Section 215.
 - 5. High-range and regular water reducers shall conform to the requirements of Section 215.
 - 6. Accelerators shall conform to the requirements of Section 215 but may be used only if approved by the Engineer. If used, they shall be added at the nozzle.
 - 7. Fine aggregates shall conform to the requirements of Section 202 for Grading A. Coarse aggregates shall conform to the requirements of Section 203 for size No. 8.

8. Steel fibers shall have a minimum length of 3/4 inches and a diameter between 0.015 and 0.025 inches. They shall have bent or deformed ends or be continuously deformed throughout.
 9. Synthetic fibers shall have a minimum length of 3/4 inches and shall have demonstrated long-term resistance to deterioration in concrete.
- (f) **Welded wire fabric** shall conform to the requirements of Section 223 and shall be galvanized or epoxy coated.
- (g) **Expansion bolts** shall conform to the requirements of Section 226.02(d).

412.03—Procedures.

Repairing concrete structures shall consist of removing and replacing deteriorated material, thoroughly cleaning exposed concrete surfaces and reinforcing steel, and replacing reinforcing steel. Cleaning shall be performed by sandblasting, waterblasting, or other approved methods to remove concrete, rust, oil, and other foreign materials detrimental to achieving a bond. The area and depth of repairs shall be as directed by the Engineer.

Dimensions of existing structures shown on the plans are approximate, and those that are pertinent to the construction of the new portion shall be check measured in the field by the Contractor. Where details of new portions of the structure shown on the plans are not adaptable to the shape of the existing structure, practical modifications may be made during construction with the approval of the Engineer provided neither the existing nor the new portions are impaired in structural strength.

Areas to be repaired shall be outlined with saw cuts to a depth of at least 1 inch or to a depth that will clear the top of the reinforcing steel.

Loose and unsound materials shall be removed by the use of hand tools or pneumatic hammers weighing 30 pounds or less. Pneumatic hammers shall be worked at an angle of 45 to 60 degrees to the plane of the concrete surface being removed. The surface shall be sounded with a masonry hammer to determine the relative concrete strength.

When reinforcing bars are exposed, the exposed length shall be cleaned. Epoxy-coated steel shall not be cleaned by sandblasting. Damaged epoxy coating shall be repaired in accordance with the requirements of Section 243. Care shall be taken to prevent striking reinforcing bars with hammer points. Reinforcing steel that has lost 1/4 or more of its original cross-sectional area shall be lapped with new bars of the same size and shape. New bars shall lap existing bars a length of 30 diameters on each side of the damaged portion if a sufficient length of the existing bar is exposed. Otherwise, new bars shall be welded with a 6-inch arc-welded lap on each side of the damaged portion with a double-flare V-groove weld in accordance with the requirements of Section 407 or mechanically connected in accordance with the requirements of Section 406.

Dust and debris shall be removed by blowing with compressed air or hosing with water. A fine spray of moisture shall be applied to the surface to outline, as it evaporates, loose fragments that are locked in place. Just prior to placement of repair material, the surface shall be cleaned.

Unsupported areas shall be supported with forms.

Excess material and debris resulting from repairs shall be removed and disposed of in an approved disposal area in accordance with the requirements of Section 106.04.

Wherever concrete is placed against existing concrete, dowels at least 3/4 inch in diameter shall be placed at no more than 2 feet 6 inches center to center over the entire jointing surface and 6 to 12 inches from the edge. Dowels shall be placed perpendicular to the surface of existing concrete by drilling and grouting and shall project into both new concrete and existing concrete to a depth as great as the thickness of the concrete will allow but need not project more than 9 inches.

For footings and neat work of substructures where joining planes are vertical, 3/4-inch headed expansion bolts shall be used instead of dowels. Bolts shall project at least 9 inches into new concrete and shall extend sufficiently far into existing concrete to develop their rated pullout strength, but not less than 6 inches. When drilling holes for expansion bolts, care shall be taken so that existing reinforcing steel is not damaged.

Where necessary to prevent featheredges, existing concrete shall be removed to ensure a thickness for new concrete of at least 6 inches.

Concrete shall be constructed in accordance with the requirements of Section 404 except that surfaces shall be finished to match the existing adjacent surfaces. Superstructure concrete shall be Class A4, and substructure concrete shall be Class A3.

(a) **Bridge Superstructure Repairs:**

1. **Type A milling** shall consist of milling the surface of the bridge deck and concrete approaches to a depth of at least 1/2 inch.

Equipment shall be capable of removing material to the required depth while maintaining a reasonably uniform surface without damaging adjacent areas or the remaining material. Milling equipment shall be capable of removing at least 1/2 inch per pass. Power driven hand tools for removing unsound concrete around reinforcing steel and in confined areas will be required.

2. **Type A patching** shall consist of repairing the deck from the existing deck surface or milled surface to a depth that will not expose reinforcing steel.

3. **Type B patching** shall consist of repairing the deck from the existing deck surface or milled surface to a depth at least 1 inch below the top mat of reinforcing steel.
4. **Type C patching** shall consist of repairing the deck from the existing deck surface or milled surface to its full depth. Forms may be suspended from reinforcing steel by wire ties for areas of less than 3 square feet. In the case of larger area openings, forms shall be supported by blocking. Sound concrete shall be removed to obtain a somewhat vertically shaped surface at the edges of the patch.
5. **Epoxy-mortar patching** shall be performed in accordance with Type A patching and to a depth up to and including 3/4 inch. Proportions of sand and epoxy shall be approved by the Engineer. Surface areas to be patched shall be dry and primed with neat epoxy just prior to mortar placement. Mortar may be troweled in place to feather-edges. The patched surface shall be sprinkled with sand before the epoxy sets or sandblasted just prior to placement of the seal to ensure bonding. When epoxy mortar is to be the finished riding surface, patches exceeding 8 feet in a longitudinal direction shall be tested in that direction in accordance with the requirements of Section 404.04.
6. **Crack repairs** shall be performed as follows: Structural cracks and dormant cracks shall be V-grooved to a depth of approximately 1/2 inch and blown clean. The groove shall be filled with neat epoxy. At the Contractor's option, latex concrete may be brushed into the groove in lieu of epoxy when latex concrete is monolithically placed for Type A, B, or C patching or joint repairs.
7. **Concrete superstructure surface repair** shall include repairing raised medians, median barriers, beams, diaphragms, parapets, posts, rails, curbs, and sidewalks. Superstructure surface repair shall be performed in accordance with Type B patching.

When the thickness of the surface repair is 2 inches or more, 2 by 2 W1.4 by W1.4 welded wire fabric shall be used. The fabric shall be tied to reinforcing steel where possible. If reinforcing steel is not exposed or if the steel has a spacing greater than 1 foot 6 inches, expansion bolts 3/8 inch in diameter shall be placed and the fabric tied to the bolts. The expansion bolts shall be spaced not more than 1 foot 6 inches apart and shall be embedded at least 2 inches into the concrete. The minimum thickness of Class A and Class B shotcrete over reinforcing steel, including expansion bolts and welded wire fabrics, shall be 2 inches, except in transition areas where shotcrete is feathered to existing concrete with less than 2 inches of cover or where patches are made on existing concrete with less than 2 inches of cover. Where shotcrete containing silica fume is used, the minimum cover over reinforcing steel shall be 1 1/2 inches.

8. **Joint opening repairs** shall be performed as follows: Expansion joint removal shall consist of removing and disposing of concrete, repairing and replacing reinforcing steel, and cleaning exposed surfaces.

Expansion joint reconstruction shall consist of removing and disposing of concrete, repairing and replacing reinforcing steel, cleaning exposed surfaces, and recasting the joint to the limits detailed with hydraulic cement concrete.

When not included in other joint repairs, saw cutting of the joint shall consist of saw cutting concrete to the limits detailed.

9. **Joint Reseal:** Existing joints shall be resealed in accordance with Section 316, unless otherwise specified on the plans.
- (b) **Bridge Deck Overlay Repairs:** Overlays shall not be placed until deck repair concrete has attained 93 percent of the minimum design compressive strength. Vehicular traffic will not be permitted on the bridge until the overlay has attained a compressive strength of 3,500 pounds per square inch.

Unless otherwise specified, the Contractor may use latex hydraulic cement concrete or silica fume hydraulic cement concrete in the overlay.

Expansion joints and dams shall be maintained through the overlay. A bulkhead equal in thickness to the width of the joint shall be installed to the required grade and profile prior to concrete placement.

A construction dam or bulkhead shall be installed in the case of a major delay in placement operations. During minor delays of 1 hour or less, the end of the placement shall be protected from drying.

1. **Latex or Silica Fume:** Within 24 hours immediately preceding the beginning of the overlay operations, the entire surface to be overlaid and the edge of previously placed overlay shall be thoroughly cleaned. This shall include the widened portion of bridge decks that are specified to be overlaid with latex or silica fume concrete.

For at least 1 hour prior to placement of overlay concrete, the surface shall be continuously and thoroughly water soaked. Puddles of standing water shall be removed before overlay is placed.

Overlay shall be placed only when the ambient air temperature is 50 degrees F and rising. At temperatures above 85 degrees F, the Engineer may require placement to be made at night or during early morning hours if a satisfactory surface finish is not being achieved.

Mixers for latex hydraulic cement concrete shall be batch mixers or automatic mobile continuous mixers conforming to the requirements of Section 217. The mixing capacity shall be such that placing and finishing operations can proceed at a uniform rate, with final finishing completed before formation of the plastic surface film. Yield test shall be performed by the Contractor prior to deck placement for each mixing unit, when each unit is moved from the job site for recharging, when the source of stockpiled materials is changed and when there is reason to believe that the calibration may be erroneous. Mixers for Silica Fume Concrete shall be truck mixers conforming to the requirements of Section 217. The amount mixed shall be such that the placing and finishing operations can proceed at a uniform rate. The latex concrete shall be uniform in composition and consistency when discharged from the mixer.

The overlay shall have a thickness of at least 1 1/4 inches of latex or silica fume hydraulic cement concrete. At the Contractor's option, latex or silica fume concrete may be used in lieu of hydraulic cement concrete as required for Types A, B or C patching, or joint and crack repairs, and such material shall be placed monolithically with the overlay.

Prior to placement of overlay, a portion of the latex or silica fume concrete shall be brushed onto the prepared surface. Care shall be taken to ensure that both vertical and horizontal surfaces receive a thorough even coating, and that the rate of progress is limited so that the brushed material does not become dry before it is covered with additional material and brought to final grade. Excess coarse aggregate remaining after brushing shall be removed.

If the rate of evaporation of surface moisture from the latex modified or the silica fume concrete exceeds 0.05 pounds per square-foot per hour during placement, measures shall be taken to reduce the rate of evaporation. One effective method is to increase the relative humidity near the surface by fogging.

The surface shall be protected from drying or cracking by prompt application of wet burlap. Care shall be taken to ensure that the burlap is well drained, and that it is placed as soon as the surface will support it without deformation. The burlap and surface of the concrete shall be maintained in a continuously moist condition during the initial curing period. For the latex concrete, the initial moist curing period shall be 48 hours, unless otherwise specified, followed by an additional 48 hours of air curing before opening to traffic. For the silica fume concrete, the initial moist curing period shall be 72 hours, unless otherwise specified, followed by the immediate application of a liquid membrane-forming curing compound conforming to Section 220. The curing compound shall be completely dry before opening the overlay to traffic.

2. **Polymer:** Polymer overlays shall be placed in accordance with the applicable special provisions.
- (c) **Removing Asphalt Concrete Overlay:** Removal of the asphalt wearing surface from bridge decks and approach slabs shall be performed in a manner such that underlying sound concrete can be prepared to receive necessary treatment. The asphalt material shall be disposed of in an approved manner. Sound concrete damaged as a result of the Contractor's operations shall be repaired in accordance with (a) herein at the Contractor's expense. Fuel oils or other materials that will prevent subsequent treatments from bonding to remaining concrete shall not be used.
- (d) **Bridge Substructure Repairs:** Concrete substructure surface repair shall include repairing piers, wing blocks, and abutments. Substructure surface repair shall be performed in accordance with Type B patching. Removal of concrete shall be to a depth as specified on the plans or as directed by the Engineer. Welded wire fabric shall be installed in accordance with the requirements of (a)7. herein.
- (e) **Blocking and Jacking Beams:** The Contractor shall submit to the Engineer for approval his method of jacking and blocking beams to repair beam seats. Unless approved by the Engineer in writing, structures supported on jacks will not be subjected to traffic loadings.
- (f) **Shotcrete**—When specified for repairs or approved in lieu of hydraulic cement concrete, shotcrete repairs shall be performed in accordance with the requirements of (a) 7. and (d) herein.
1. **Classes of Shotcrete and Mixture Proportions:** Two classes of shotcrete are established. The minimum amount of cementitious material shall be 658 pounds per cubic yard for Class A, and 635 pounds per cubic yard for Class B. The classes are as follows:
 - a. **Class A**—Class A shotcrete shall be reinforced by either steel or synthetic fibers as specified on the plans and shall have a minimum compressive strength at 28 days of 5,000 pounds per square inch. When steel fibers are used, the minimum fiber content shall be 60 pounds per cubic yard. When synthetic fibers are used, the minimum fiber content shall be 6 3/4 pounds per cubic yard. Shotcrete shall also contain silica fume at a minimum of 7 percent by mass of the cementitious material. Use of fly ash (maximum 20 percent by mass of the cementitious material) or slag (maximum 50 percent by mass of the cementitious material) will be permitted. Minimum thickness of Class A shotcrete cover over reinforcing steel shall be 2 inches except in transition areas where shotcrete is feathered to existing concrete with less than 2 inches of cover or where patches are made on existing concrete with less than 2 inches of cover over reinforcing steel.

- b. **Class B**—Class B shotcrete shall have a minimum 28-day compressive strength of 4,000 pounds per square inch. The cementitious material shall be either all portland cement; portland cement and fly ash (maximum 20 percent by mass of the cementitious material); portland cement and slag (maximum 50 percent by mass of the cementitious material); or portland cement and silica fume (minimum 7 percent by mass of the cementitious material). The minimum thickness of Class B shotcrete cover over reinforcing steel shall be 2 inches except in transition areas where shotcrete is feathered to existing concrete with less than 2 inches of cover or where patches are made on existing concrete with less than 2 inches of cover over reinforcing steel. Where shotcrete containing silica fume is used, the minimum cover over reinforcing steel shall be 1 1/2 inches.

The Contractor shall submit for the Engineer's approval shotcrete mixture proportions and performance test data for each class of shotcrete based on the materials to be used in the project. If appropriate recent test data does not exist, the Contractor shall prepare trial mixtures and submit the test results as obtained from tests specified in Section B.

Wet Process: Shotcrete subject to freezing and thawing shall contain an air content of 7.0 percent \pm 1.5 percent as delivered to the job site. The materials for wet process shotcrete shall be mixed in accordance with the requirements of Section 217 and applied within 90 minutes after batching.

Dry Process: Solid ingredients for dry-mix shotcrete shall be predampened as needed and mixed in a batch type or continuous mixer. Most of the mixing water shall be added at the nozzle. Dry-mix shotcrete material shall be applied within 45 minutes after batching or predampening.

2. **Equipment and Personnel:**

- a. **Equipment:** Shotcrete delivery equipment shall be approved by the Engineer before the commencement of the work. It shall be capable of discharging the shotcrete mixture in a continuously smooth stream of uniformly mixed ingredients. Air added at the nozzle shall be free from oil or other contaminants, and the air pressure shall be capable of maintaining sufficient nozzle velocity to all parts of the work.
- b. **Personnel:** Nozzlemen with at least 100 hours of recent similar shotcrete application experience and supervisors with at least 3 years of recent similar shotcreting experience who can provide references showing satisfactory performance on at least three

similar jobs may be approved as being qualified without gunning prequalifying panels.

When proposed nozzlemen do not have the required experience or when the Engineer deems the work to be done is of a sufficiently critical nature to require prequalifying tests for nozzlemen, approval will be based on test panels as described herein prior to the commencement of the work. The Engineer will observe the gunning of such test panels and judge the qualifications of the nozzleman on the basis of the texture, uniformity of work, and adequacy of the encasement of shotcrete around the reinforcement.

3. Surface Preparation

- a. The perimeter of all areas where concrete is removed shall be tapered at approximately a 45-degree angle, except that the outer edges of all areas removed by chipping shall be sawcut perpendicular to the surface to a minimum depth of 1/2 inch to prevent featheredging unless otherwise approved by the Engineer.
- b. Earth surfaces shall be trimmed to line and grade and shall have adequate support to prevent displacement during shotcrete placement. Shotcrete shall not be placed on an earth surface that is frozen, spongy, or subject to free running water at the time of the application of shotcrete. Active seeps, drips, and flowing water shall be controlled by installation of suitable drain systems such that water pressure does not build behind shotcrete linings. The Contractor shall prevent excessive loss of mixing water from the shotcrete. This shall be accomplished by one of the following procedures:
 - (1) Wet the soil prior to the time of gunning to the extent that it is damp but with no visible free water on the surface. Puddling, ponding, or freestanding water shall be eliminated from areas to be shotcreted.
 - (2) As an alternative or when specified, install a moisture barrier system to inhibit the movement of moisture from the newly placed shotcrete into the earth. Wrinkling and folding of moisture barrier will not be permitted.
- c. Rock surfaces shall be free of loose material, debris, chips, mud, dirt, and other foreign matter. Surfaces shall be damp at the time of gunning, but puddling, ponding, or freestanding water shall not be permitted.

- d. Wood forms which are to be removed after use shall have a form release agent applied to prevent the absorption of moisture and inhibit the bond between shotcrete and the form.

4. Application:

- a. When applied, shotcrete shall have a temperature of at least 50 degrees F but not more than 85 degrees F. The ambient and surface temperature shall be 50 degrees F and rising. At ambient air temperatures above 85 degrees F the Engineer may require placement to be made at night or during early morning hours.
- b. Shotcrete to be applied to uneven and previously repaired surfaces shall first be applied to any deep hole, deeply excavated sections, corners, or areas where rebound cannot escape or be blown free. The thickness of the shotcrete layer shall be such that no sloughing, sagging, tearing, or debonding will occur. Existing concrete shall be sandblasted within 24 hours of application and the surface shall be damp just prior to application.
- c. Where a layer of shotcrete is to be covered by a succeeding layer, it shall be first allowed to develop its initial set. Then all loose, uneven, or excess material, glaze, and rebound shall be removed by brooming, scraping, or other means. Any surface deposits that take a final set shall be removed by sandblasting, and the surface cleaned with an air-water blast from the nozzle. Curing compounds shall not be applied to surfaces that will be covered by an additional layer of shotcrete.
- d. Shooting wires, ground wires, or other devices acceptable to the Engineer shall be used to control the line, grade, and thickness of the shotcrete.
- e. During the shotcrete application, the nozzle shall be held perpendicular to, and when possible, 3 to 5 feet away from the receiving surface and rotated steadily in series of small oval or circular patterns. Whenever possible, sections shall be gunned in one layer to the full design thickness. However, for multiple layers of reinforcement, gunning of one layer of shotcrete may be required for each layer of reinforcement.
- f. When encasing reinforcement, the nozzle shall be held closer than normal and at a slight upward angle. The mixture may be wetter than normal, but not so wet that sloughing behind the reinforcement will occur.
- g. Vertical surfaces shall be gunned starting at the bottom. Rebound or previously expended material shall not be incorpo-

rated in the applied layer, and all such material shall be removed from the surface and work area prior to final set and before placement of shotcrete on adjacent surfaces. Shotcrete shall not be placed if drying or stiffening of the mixture is occurring.

5. Finishing:

Prior to the initial set, the shotcrete surface shall be scraped or cut with a trowel or metal template to obtain an even and aesthetically acceptable appearance. The final finishing shall be with a wet sponge unless otherwise specified. Trowel or float smoothing will not be allowed.

6. Curing:

After gunning, the surfaces of shotcrete shall be protected from drying or cracking. When necessary, fogging shall be used prior to the application of moist curing or a curing compound. Shotcrete shall be moist cured for a period of at least 7 days or cured using a curing compound conforming to the requirements of Section 220. The rate of application shall be not less than 1 gallon of curing compound per 100 square feet of surface. The color of the curing compound shall be approximately that of the existing concrete.

7. Quality Assurance and Testing:

- a. Preconstruction testing may be waived by the Engineer if it can be shown that the crew to be used is qualified and that the mixture has been successfully used in similar work.

Test panels 24 inches by 24 inches by 4 inches deep containing steel reinforcement representative of that to be used on the project shall be prepared. Each crew shall gun two test panels with the mix design to be used on the project and for each gunning orientation to be encountered on the job. Panels will be cured in the field in the same manner as the structure for 1 day and transported to the laboratory, where curing shall be continued until time of testing. For shotcrete jobs of less than 200 square feet the Contractor shall cut one of the test panels with a trowel or a metal template before the initial set, in the presence of the Engineer, to check visually for possible voids under the reinforcement. For larger jobs where specific evidence of good encasement of reinforcing bars is needed, the Contractor shall cut cores from the test panels after the concrete has hardened for at least 3 days. Cores shall be cut through the steel.

The second panels for all jobs shall be used to determine the compressive strength of the applied shotcrete. Cores shall be 2 inches to 4 inches in diameter and shall be taken between the

reinforcement and tested by the Department at the specified age in accordance with the requirements of ASTM C42.

- b. In-place shotcrete shall be of uniform quality and free from segregation, honeycombing, sand pockets, sand lenses, sagging, dry patches, overspray, rebound, or incomplete encasement of reinforcement. It shall also be free from delamination, cracking, or single voids with dimensions in excess of 1/4 inch.

The Department reserves the right to test any section and reject shotcrete that does not conform to the specification requirements in terms of test values, soundings, and visual examination. Cost of any additional testing of disputed shotcrete that results in rejection shall be borne by the Contractor.

The Contractor shall remove and replace or correct defective shotcrete to the satisfaction of the Engineer.

- c. For compressive strength tests, one test panel shall be prepared for each day's production or for each 200 square feet of shotcreting by each crew using the same ingredients and gunning orientation as the shotcrete applied to the job. These panels shall be cured and delivered to the designated testing laboratory as earlier specified in this section.

Test values on such panels shall equal or exceed the required 28-day strength requirements. Should failures occur, acceptance of the material will be determined by tests on cores from the applied work. A minimum of three cores shall be taken from the area in question. The average compressive strength of the cores taken from the work shall equal or exceed the specified strength for the class of shotcrete applied, and no single core shall have a strength less than 85 percent of the specified value. If deemed necessary by the Engineer, the adequacy of bond between the existing concrete and the shotcrete shall be determined by pull-off tests in accordance with the requirements of ACI 503. A minimum bond strength of 250 pounds per square inch will be accepted as satisfactory. Bond failure at less than 250 pounds per square inch due to failure of existing concrete will not be cause for rejection. The cost of up to three pull-off tests will be the responsibility of the Contractor, additional pull-off tests will be the responsibility of the Department.

412.04—Measurement and Payment.

Volumes outlined by the completed excavation, formwork, and surfaces of the existing concrete will be measured prior to concrete placement so that quantities can be accurately computed.

Hydraulic cement concrete for the class specified will be measured and paid for in accordance with the requirements of Section 404.

Type A milling will be measured and paid for in square yards for the depth specified.

Types A, B, and C patching and concrete substructure or superstructure surface repair will be measured in square yards of surface area and will be paid for at the contract unit price per square yard. This price shall include furnishing and placing concrete to fill the prepared areas.

Epoxy-mortar patching will be measured in gallons of epoxy-mixed system used as a binder for mortar in place and for priming prior to application of epoxy mortar and will be paid for at the contract unit price per gallon.

Expansion joint removal, expansion joint reconstruction, and back wall reconstruction will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include furnishing and placing concrete to fill the prepared areas for expansion joint reconstruction and backwall reconstruction.

Saw cutting, when a pay item, will be measured in linear feet of concrete sawed and will be paid for at the contract unit price per linear foot.

Jacking and blocking of beams as required to complete beam seat repair, when a pay item, will be paid for on an each basis per beam end.

Furnishing latex and silica fume hydraulic cement concrete used in placing will be measured in cubic yards and will be paid for at the contract unit price per cubic yard. Measurement for furnishing latex hydraulic cement concrete produced by batch mixers will be determined by truck tickets, assuming a 95 percent yield; and, when produced by automatic mobile mixers, measurement will be by metered ticket. Measurement for furnishing silica fume will be by truck tickets, also assuming a 95 percent yield. Reductions in quantity for both latex and silica fume hydraulic cement concrete will be made for any volume used at the Contractor's option in lieu of hydraulic cement concrete used in deck repairs, for any unnecessary overruns such as over depth milling, and for any waste. This item shall include, and will be full compensation to produce the mixture only, including all handling and delivery to the work site.

Placing latex and silica fume hydraulic cement concrete will be measured and paid for at the contract unit price per square yard and paid for on a plan quantity basis. This price shall include and will be full compensation for preparing the surface in accordance with the requirements of Section 412.03, placing, handling, finishing and curing the latex or silica fume hydraulic cement concrete.

Crack repair will be measured in linear feet and will be paid for at the contract unit price per linear foot.

Removal of asphalt concrete overlay will be measured in square yards of surface area and will be paid for at the contract unit price per square yard.

Shotcrete, when specified as a pay item, will be measured in square feet of surface to which it is applied and will be paid for at the contract unit price per square foot or per cubic foot for the type specified.

These prices shall include cutting, drilling, hammering, and all other work involved in the complete removal and disposal of concrete and other materials necessary to provide for joining the new and old portions of the structure according to the plans or as directed by the Engineer. The contract unit price shall also include dowels or other approved anchoring devices, disposing of surplus material, cleaning and repairing reinforcing steel, and welded wire fabric, if necessary. If Class A shotcrete is used, the price shall also include steel or synthetic fibers.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Type A milling (depth)	Square Yard
Type A patching	Square yard
Type B patching	Square yard
Type C patching	Square yard
Epoxy-mortar patching	Gallon
Concrete substructure surface repair	Square yard
Concrete superstructure surface repair	Square yard
Expansion joint removal	Linear foot
Expansion joint reconstruction	Linear foot
Back wall reconstruction	Linear foot
Saw cutting	Linear foot
Jacking and blocking	Each
Furnishing (latex or silica fume) hydraulic cement concrete	Cubic Yard
Placing (latex or silica fume) hydraulic cement concrete	Square Yard
Crack repair	Linear foot
Removal of asphalt concrete overlay	Square yard
Pneumatically applied mortar	Square foot
Shotcrete (Class)	Square foot or cubic foot

SECTION 413—DISMANTLING AND REMOVING EXISTING STRUCTURES OR REMOVING PORTIONS OF EXISTING STRUCTURES

413.01—Description.

This work shall consist of dismantling and removing all or portions of existing structures in accordance with these specifications and in reasonably close conformity with the lines, grades, and details shown on the plans or as established by the Engineer.