shall be fully detailed, showing layout of elements, sizes, material specifications and manufacturer's recommendations for installation.

For submittals sent to the Bridge Construction Engineer, a copy of the transmittal letter shall be sent to the Engineer.

725.04 Measurement and Payment. This work will not be measured for payment. No separate payment will be made for compliance with this specification. All costs of the above work shall be considered incidental to the project and included in other items of work.

SECTION 726

BRIDGE DECK REHABILITATION

726.01 Description. This work shall consist of installing a low slump or latex modified portland cement concrete overlay over an existing portland cement concrete bridge deck. The work includes removing deteriorated concrete for the full or partial depth of the deck, preparing the area for the new concrete, placing, curing and finishing the overlay area.

MATERIALS

726.02 Overlay Materials. All overlay materials shall be approved prior to use. The moisture contents of the overlay aggregates, especially the fine aggregate, shall be controlled by the Contractor so that at the time of mixing, the moisture content of each aggregate is relatively uniform. The material shall feed uniformly when continuous type mixers are used; and the moisture contents of the aggregates are not so great that the water-cement ratio or slump requirement for the concrete mixture is violated. Any concrete produced that is not properly proportioned or is not in conformity with the specified

slump and/or water-cement ratio will be rejected by the Engineer, and shall be replaced with concrete meeting the requirements at no cost to the Department. When the water-cement ratio or slump requirements are violated, this condition shall be corrected by the Contractor at his expense before mixing operations are continued. The aggregates shall be stockpiled a minimum of 48 hours prior to placement of the overlay. The stockpiles shall be covered with white burlene or equivalent to assist in maintaining uniformity of temperature and moisture content.

A. Cement. The cement shall be portland cement conforming to the requirements of Subsection **701.02**. The cement shall be stored in such a manner so as to prevent excessive temperature build-up that could be detrimental to the concrete mix.

B. Water. The water shall conform to the requirements of Subsection **701.12**.

C. Fine Aggregates. The fine aggregate for the concrete mixture shall be a natural sand conforming to the requirements of Subsection **701.10**. The Engineer will determine the moisture content of the sand in order to calculate its free water content and the resulting water-cement ratio of the concrete mixture.

D. Coarse Aggregate. Coarse aggregate for the concrete mixture shall be size no. 8M or 789 conforming to the requirements of Subsection **701.11**. The Engineer will determine the moisture content of the coarse aggregate in order to calculate its free water content and the resulting water-cement ratio of the concrete mixture.

E. Air-Entraining Admixture. Air-entraining admixture shall conform to the requirements of Subsection **701.06**.

F. Water-Reducing Admixture. The water-reducing admixture shall conform to the requirements of Subsection **701.07**. The Contractor shall furnish to the Engi-

neer a copy of the manufacturer's recommendations for use.

G. Epoxy Cement.

1. General Requirements. The epoxy cement shall be a moisture insensitive two component system meeting the requirements of AASHTO M 235 (ASTM C 881), Type III. The two components shall be supplied in separate containers that are non-reactive with the materials contained therein. The containers shall be identified as "Component A - Contains Epoxy Resin" and "Component B - Contains Hardener" and shall show the type, mixing directions and usable temperature range. Each container shall be clearly marked with the name of the manufacturer, the lot or batch number, the date of packaging, the type of pigmentation, and the quantity contained therein in pounds and gallons. The epoxy shall be mixed and applied in accordance with the manufacturer's recommendations. Potential hazards shall be stated on the package in accordance with the Federal Hazardous Products Labeling Act.

2. Basis for Acceptance. The Contractor shall present to the Engineer a letter of certification from the manufacturer indicating that the epoxy cement complies with the product specifications.

3. Sampling and Testing. The Engineer may obtain separate unopened, one-quart samples of each component in each lot or shipment and forward them and the certification to the Research and Materials Laboratory. Failure of samples to conform to the applicable specification requirements shall be cause for the epoxy cement to be rejected and removed from the job site.

H. Sand for Epoxy-Sand Slurry Mixture. The fine aggregate for slurry mixtures shall be white silica sand containing no less than 90% insolubles and shall be

rounded to subangular in shape, clean, dry, and non-friable. The gradation shall be as follows:

Sieve	Percent Passing
No. 8	100
No. 50	0-40
No. 100	0-5

Material not meeting this gradation may be used, providing it produces a workable mixture and an acceptable slurry seal as approved by the Engineer.

I. Sand for Grout-Bond Coat. Sand used in the grout-bond coat shall be mortar sand conforming to the requirements of Subsection **701.10** with the exception that the graduation requirements shall not apply.

J. Latex. The Contractor shall select the latex admixture from the listing of acceptable products and their manufacturer on file at the Department's Research and Materials Laboratory. The latex admixture shall be a material that is produced in the United States.

Manufacturers desiring pre-qualification of their products shall have their product tested and evaluated by a qualified independent laboratory, in accordance with the Prequalification Test Program contained in the U.S. Department of Transportation Research Report No. FHWA-RD-78-35.

Certified test results from the independent laboratory and a one-quart sample of the latex admixture shall be submitted to the Department's Research and Materials

Laboratory prior to the Contractor beginning work. Approval of the latex admixture will be based upon the submitted information and evaluation of the sample.

The latex admixture shall not contain any chlorides. Each shipment of latex admixture shall be accompanied by a report of tests performed in accordance with the Certification Program contained in Report No. FHWA-RD-78-35. In addition to actual test results, the report shall include the date of manufacture, batch or lot number(s), quantity represented, manufacturer's name, place of manufacture, a statement that all test results are satisfactory, and the date on which the 1-year certification period will expire.

Each lot of latex will be sampled and tested. A representative one-gallon sample shall be submitted by the manufacture. A material safety data sheet and a test report shall accompany the sample.

The latex admixture shall be packaged and stored in containers and storage facilities that will protect the material from freezing and from temperatures above 85°F. Additionally, the material shall not be stored in direct sunlight and shall be shaded when stored outside of building during moderate temperatures. No latex admixture that has been exposed to freezing or elevated temperatures (i.e. above 85°F) shall be used without approval from the Research and Materials Engineer.

If latex is used, the Contractor shall have the manufacturer of the latex material furnish a representative who will be available for technical assistance as needed during the placement of the latex overlay.

726.03 Concrete for Full Depth Patching. Concrete for full depth patching shall be Class 4000 concrete conforming to the requires of Section **701**.

CONSTRUCTION REQUIREMENTS

726.04 General Requirements. These general requirements shall apply to both Latex Concrete Overlays and Portland Cement Concrete Overlays. For special requirements

for overlays, see Subsections **726.05** and **726.06**.

The sequence of operations shall be as follows: machine preparation of existing deck, removal of unsound concrete, rehabilitation of joints, full depth patching and blast-cleaning of the machine prepared deck, application of the grout bond coat, mixing, placing, and consolidating the concrete overlay mixture; finishing, texturing, curing, sealing joints and cracks, application of the epoxy-sand slurry, and sawing textured grooves if specified. When longitudinal construction joints are necessary, each section of overlay shall be cured in accordance with the requirements of Subsections **726.05D** and **726.06E** before the adjacent overlay is placed.

A. Scheduling. The Contractor shall notify the Engineer at least twelve (12) hours in advance of the date and time he intends to begin placing concrete for the overlay. When placing of concrete is not begun within two (2) hours after the scheduled time, then all engineering costs from the scheduled time until the time placing actually begins or is canceled will be deducted from monies due or to become due the Contractor. No engineering costs will be deducted when placing is delayed for reasons beyond the control of the Contractor, such as inclement weather or equipment failure after placing begins. No time extensions will be granted for delay in placing concrete resulting from the Engineer receiving less than twelve (12) hours notice specified above.

B. Weather Limitations. The work on placing the concrete overlay shall be performed between the hours of 7:00 P.M. and 9:30 A.M. when the deck and weather conditions are such that the rate of evaporation does not exceed 0.2 pounds per square foot per hour for portland cement concrete overlay or 1.5 pounds per square foot per hour for latex concrete overlay. The "Nomograph For Determining Rate Of Evaporation" located in the Appendix of these specifications shall be used in determining the rate of evaporation. In no case shall the concrete overlay be placed when the air temperature is above 85°F or the

air temperature away from artificial heat is less than 45°F. In all instances, all of the concrete shall be placed and kept at a temperature above 50°F for at least 96 hours. This will require approved housing and heating or insulation methods during cold weather. In no case will the concrete be placed when raining or drizzling. If during the process of placing the concrete it should begin to rain or drizzle, the placement shall be stopped and the material already in place shall be finished and protected.

C. Removal of Concrete, Restoration of Reinforcement, and Cleaning. The entire area of the deck between the parapets and the ends of the structure (i.e. 100% of the deck area) shall receive machine preparation consisting of removal of the concrete to a depth of at least 1/4 inch below the existing concrete surface. The Engineer may require removal of concrete to depths greater than 1/4 inch for designated portions of the deck in order to provide a uniform surface profile upon which to place the overlay. Unless authorized otherwise by the Engineer, the machine preparation of the deck shall be accomplished by alternate passes of the mechanical scarifiers. This operation shall be accomplished by use of mechanical scarifiers or grinders designed specifically for scarifying bridge decks and shall be subject to approval of the Engineer. The scarifier or grinder shall produce a surface matching the existing slab cross-section and each pass of the machine shall match the previous pass in elevation. If satisfactory results were not achieved, the Engineer may direct that the work be performed with other equipment. End walls will not require the machine preparation unless otherwise noted. No deductions in area will be made for existing deck drains, castings, expansion dams, patches of foreign material, etc. Epoxy, bituminous and foreign surfaces, and patches shall be removed in a manner approved by the Engineer. Hammers exceeding 40 pounds in weight or any other equipment that may cause damage to the underlying concrete shall not be used. Generally, removal of epoxy, bituminous, and foreign surfaces (overlays) placed over the existing slab or surface profile

will be listed as a separate bid item entitled *Removal of Epoxy, Bituminous, and Foreign Overlays* and will be paid for as a separate item. If, however, no bid item for the removal of these overlays is contained in the proposal, the removal shall considered as being incidental to the placement of the new concrete overlay.

All other concrete deemed unsound by the Engineer shall be removed. Removal of concrete within areas where the depth of removal exceeds 1/4 inch may be accomplished by use of hammers not exceeding 40 pounds in weight or other such small equipment approval by the Engineer. Caution shall be exercised by the Contractor not to damage any existing deck steel reinforcement. Concrete shall be removed to a depth of 3/4 inch below any reinforcement bar that is more than 1/2 exposed or any others that appear not to be bonded to the existing concrete. Caution shall be exercised to protect any underlying sound concrete and steel reinforcement. The periphery of routed areas shall be as nearly vertical. Should removal of unsound concrete extend through 1/2 of the depth of the concrete slab or more, the remaining sound concrete shall be removed and replaced as outlined herein for full depth patching. Any exposed steel reinforcement that is not tied shall be tied. Any rebar damaged by the Contractor shall be replaced at no expense to the Department.

Inferior concrete in the deteriorated or spalled areas near the joints shall be removed, and all joint filler removed. The joints shall be reformed to exact width specified and true alignment by the installation of a template made of styrofoam, or timber covered with polyethylene sheeting, or of other suitable material or as otherwise specified in the plans. The removal of concrete within the area of the joint rehabilitation may be accomplished by use of jackhammers not exceeding 60 pounds in weight or other such small equipment down to the mid depth of the deck.

All exposed steel reinforcement and structural steel shall be blast cleaned to remove scale, rust, grease, oil, etc. Before placing concrete, deteriorated or damaged reinforcement shall be replaced or supplemented as directed by the Engineer. All dust, chips of bituminous materials, concrete, or other debris shall be disposed of in a manner approved by the Engineer. The entire area shall be cleaned with compressed air supplied by an air compressor having suitable separators and traps. The compressed air shall be free of detrimental quantities of water, oil, grease, or any other injurious substances. Leakage of oil, grease, gasoline, or other substances from the compressor(s) or other equipment on the deck shall be prohibited. Protective sheeting (plastic, tarpaulins, etc.) shall be suspended under any equipment that leaks.

Hydro-demolition instead of the above mechanical scarifiers and/or hammers may be allowed, subject to the approval of the Engineer, and compliance with all South Carolina and Federal Laws pertaining to air, water pollution, safety, and health regulations.

D. Blast Cleaning. The entire area of the deck surface shall be blast cleaned to a clean appearance that is free from curing compound, laitance, dust, dirt, oil, grease, bituminous material, paint, and foreign matter. The blast cleaning of an area of the deck shall be performed within the 24-hour period preceding placement of the overlay on the area. However, if any portion of the bridge is open to traffic, the area to be overlaid shall be blast cleaned within 12 hours before placing the overlay.

Blast cleaning may be performed by either wet sandblasting, high pressure water blasting, blasting grits, shrouded dry sandblasting, dry sandblasting with dust collectors or other methods approved by the Engineer. The method used shall be performed to conform to air and water pollution regulations applicable to the county or city where the work site is located and to any state (DHEC) and federal (EPA) regulations. Work shall conform to ap-

plicable safety and health regulations (OSHA). Any method that does not consistently provide satisfactory results and does not conform to the above requirements shall be discontinued immediately and replaced by an acceptable method. All debris, including dirty water, resulting from the blast cleaning operation shall be reasonably confined during the performance of the blast cleaning work and shall be immediately and thoroughly removed from the blast cleaned surfaces and all other area where any escaped debris may have accumulated.

Water or other approved materials shall be applied by the Contractor to effectively prevent dust from becoming an air pollutant, safety hazard, or other type of nuisance during the blast cleaning operation. Failure to perform this item of work satisfactorily will be cause for deferring the processing of any pay estimates due the Contractor for the project.

When water or other material is used for control dust, no separate payment will be made as all costs for furnishing and applying the materials will be considered incidental to the pay items in the contract.

The blast-cleaned areas shall be protected, as necessary, against contamination before placement of the overlay. Contaminated areas and areas exposed more than 24 hours (12 hours when under traffic) shall be blast cleaned again as directed by the Engineer at the Contractor's expense.

E. Full Depth Patching. The area of removal of the concrete to full depth shall extend from center of girder to center of girder. In the event that the full depth holes are small (less than 6 square feet) the Engineer will consult with a representative of the Bridge Construction Engineer's Office for the method in which they are to be repaired. Otherwise, full depth holes shall be filled with Class 4000 Concrete. Immediately before placement of concrete, the contact surface shall be dampened and

surface dried, and a grout-bond coat shall then be applied by vigorously scrubbing or brushing it into the contact surfaces of full depth patch areas. The grout shall consist of a one-to-one (1:1) mixture by weight of Type I portland cement and mortar sand plus sufficient water to produce a slurry of uniform spreading consistency. The Class 4000 Concrete shall be carefully placed and tamped or vibrated into place. Full depth patched areas shall be rough finished to an elevation corresponding to the top of the scarified deck and shall be wet cured for a period of no less than seven (7) calendar days, or until the overlay is placed, by means of a double layer of wetted burlap or similar material. If the concrete surrounding a full depth concrete patch requires partial depth removal, then the full depth concrete patch shall be finished to an elevation corresponding to the bottom of the partial depth patch areas instead of the elevation of the original deck. After the concrete has hardened sufficiently to maintain the proper shape, all joint templates shall be removed in a manner to avoid chipping or breaking down the edges of the repaired joint. All forming material shall be removed prior to the completion of the project unless otherwise specified. The surfaces of all patched areas shall be blast cleaned to remove all laitance and all sand before the overlay is placed. All full depth patching in each lane shall be completed before beginning operations on another lane, unless otherwise permitted or directed.

The concrete overlay and Contractor's equipment will not be permitted on the full depth patches until the patches are at least seven (7) days old, or have developed a compressive strength of 3600 psi.

F. Partial Depth Patching. When a portland cement concrete is used for the overlay, areas of partial depth patches shall be filled with overlay material to the level of the existing deck. These areas shall be cured until the overlay is placed over the patch or the cure time expires. When latex concrete is used for the overlay, partial depth patches may be placed monolithically with the overlay.

G. Prohibited Field Welding. Except as approved on the plans, no welding of any nature shall be performed on the load carrying members of the bridge without the written consent of the Engineer, and then only in the manner and at the locations designated.

H. Mixing and Placing. Concrete for concrete overlays shall be mixed at the work site by two-batch or two continuous mixers approved by the Engineer. Drum-type transit truck mixers or rotating drum batch-type mixers shall not be used in any circumstance for portland cement concrete overlays. All batch mixers shall be equipped with rotating blades or paddles. The maximum time between completion of mixing and placement shall be 20 minutes.

Batch-type mixers shall be equipped with or accompanied by suitable devices for accurately measuring the weight of the cement, fine aggregate, and coarse aggregate for each batch. They shall also be able to accurately determining the volume or the weight of the water, the water reducing and air entraining admixtures, and latex admixture, as applicable, for each batch. Approved methods for adding the air-entraining admixture and the water reducing admixture shall be provided. The admixtures shall be kept separated, and shall be separately added to the mixture. Batch-type mixers that entrap unacceptable volumes of air in the mixture shall not be used.

Continuous type mixers shall be equipped so that the proportions of the latex admixture (when required), cement fine aggregate and coarse aggregate can be fixed by calibration of the mixer, and thereafter shall not be changed without approval by the Engineer. The latex admixture supply portion and the water supply portion of the mixer shall be equipped with a flow meter or other suitable device for calibrating the water supply, and a cumulative type water meter that can be read to the nearest 0.1 gallon or 1 pound. The latex and water meters shall be readily accessible, accurate to within $\pm 1\%$, and easy to read.

Approved methods for adding the air-entraining admixture and the water-reducing admixture shall be provided. The admixtures shall be added so as to be kept separated as far as is practicable. The continuous type mixer shall be calibrated in accordance with Department procedures before starting the work. It shall be re-calibrated thereafter at least once during each 50 cubic yards production if yield checks indicate re-calibration is necessary, and at any other time the Engineer deems necessary to ensure proper proportioning of the ingredients. Continuous type mixers that entrap unacceptable volumes of air in the mixture shall not be used.

The latex admixture supply lines and the water supply line shall be separate lines and shall be connected immediately before discharge into the hopper. Connected latex admixture and water lines discharging through a single valve will not be allowed even if check valves are incorporated in the supply lines.

The mixer, whether batch or continuous type shall be kept clean and free of partially dried or hardened materials at all times. All calibration valves shall be maintained as manufactured and all gauges and dials shall be accessible, clear, and legible. It shall consistently produce a uniform, thoroughly blended mixture within the specified air content and slump limits. Malfunctioning mixers shall be immediately repaired or replaced with acceptable units.

The formation of longitudinal joints and transverse construction joints shall be held to the minimum number necessary, and both types of joints shall be thoroughly blast cleaned and coated with grout-bond coat material before fresh concrete is placed against the hardened

sides of the joints. When longitudinal joints are necessary, they shall be formed by use of a longitudinal header secured to the deck. The longitudinal header thickness shall be 1/4 inch less than the overlay. Longitudinal joints shall be located along lane lines unless otherwise permit-

ted. After removal of the header, the overlay shall be sawed longitudinally 3 inches or more inside the formed edge and the overlay outside the saw cut removed before the adjacent overlay is placed. The volume of the overlay removed will be deducted from the volume measured for payment. Alternate methods of constructing longitudinal joints may be used on latex concrete overlays if approved by the Engineer.

I. Placing and Finishing Equipment. Equipment shall include sufficient hand tools for placement of stiff, plastic Portland Cement Concrete or Latex Concrete and for working it down to approximately the correct elevation for striking off with a screed.

Supporting rails upon which the finishing machine travels shall be placed outside the area to be surfaced, and shall extend beyond each end of the bridge a sufficient distance to accommodate the finishing machine. Anchorage for the supporting rails shall be substantial enough to provide for rigid horizontal and vertical stability of the rails. Methods proposed for anchoring the supporting rails to the deck shall be submitted to the Engineer for approval before beginning the work.

The finishing machine shall be capable of forward and reverse motion under positive control. Provision shall be made for raising the screeds to clear the screeded surface for traveling in reverse.

Closely following the final pass of the screed, the surface shall be textured by use of a drag composed of two layers of wet burlap on a transverse screed or a Department approved broom on longitudinal screeds.

1. Portland Cement Concrete Overlays. The top surface of the overlay shall be uniform, smooth, and even textured after finishing by an approved finishing machine.

The finishing machine shall be equipped with a strike off to provide a uniform thickness of concrete in front of the screeds and with two oscillating screeds set accurately to the crown specified. The screeds of the finishing machine shall be metal.

The front oscillating screed shall be designed to thoroughly consolidate the concrete by vibration to the specified density for portland cement concrete. A sufficient number of identical vibrators shall be effectively installed on the screed so that at least one vibrator is provided for each 5 feet of screed length. The bottom face of this screed shall be at least 5 inches wide with a turned up or rounded leading edge to minimize tearing of the surface of the plastic concrete. Each screed shall have an effective weight of at least 75 pounds for each square yard of bottom face area. Each screed shall be provided with positive control of the vertical position, the angle of tilt and the slope of the crown. The final screed shall oscillate and finish without vibration.

Design of the finishing machine together with appurtenant equipment shall be such that positive machine screeding of the plastic concrete will be obtained within one inch of the face of the curbs or construction joint. The vibrating screed shall be of sufficient length to extend at least 6 inches beyond an intended longitudinal joint, and to extend at least 6 inches beyond the longitudinal edge of a previously placed section of overlay.

2. Latex Concrete Overlays. The top surface of the overlay shall be uniform, smooth, and even textured after finishing by an approved finishing machine. The latex concrete shall be thoroughly consolidated by vibration during the finishing operations.

The finishing machine shall be equipped with a strike off to provide a uniform thickness of concrete in

front of the screeds and with two oscillating rollers set accurately to the crown specified. The screeds of the finishing machine shall be metal.

Design of the finishing machine together with appurtenant equipment shall be such that positive machine screeding of the plastic concrete will be obtained.

The vibrating screed shall be of sufficient length to extend at least 6 inches beyond an intended longitudinal joint, and to extend at least 6 inches beyond the longitudinal edge of a previously placed section of overlay.

J. Epoxy-Sand Slurry. After the overlay has been completed and cured, a thin coat (approximately 1/16 inch) of an epoxy-sand slurry shall be applied to the 12 inches of the overlay adjacent to the curbs, concrete barrier walls or other vertical walls. Unless otherwise indicated on the plans, the epoxy-sand slurry mixture shall extend up the faces of the curbs and walls for 3 inches above the overlay. The areas to receive the epoxy-sand slurry shall be thoroughly blast cleaned to a clean, bright appearance and shall be thoroughly clean and dry before the slurry is applied. The deck must be dry when the epoxy-sand slurry is started, and the deck shall not have been subject to rain within 12 hours preceding the application of the slurry. Before applying the slurry, all joints in the area receiving the application shall be protected by placing strips of masking along the joints in a manner to exclude the slurry from the joints. Masking will also be required on the deck to ensure a straight line for applying the epoxy-sand slurry.

The epoxy-sand slurry mixture shall consist of:

1 gallon of Component A
1 gallon of Component B
2 gallons of dry, white, silica sand

The above quantities shall be considered as one standard batch for the purpose of measurement and payment. The Engineer may make minor adjustments in the quantity of sand, in order to produce a more workable mixture. The ingredient materials shall be thoroughly mixed from 3 to 5 minutes. The slurry shall then be spread as smoothly and uniformly as possible so as to completely fill the blast cleaned pitted areas, cracks and rough surfaces. The finished elevation of slurry shall be no more than 1/16 inch above the elevation of the deck. Silica sand shall be sprinkled very lightly over the slurry to prevent a slippery condition.

K. Cleaning and Sealing Joints. Joints shall be reworked as shown on the plans and in the special provisions.

L. Approach Roadway Sections. When the approach roadway sections at the bridge ends are indicated on the plans to receive an overlay, they shall be overlaid and finished dependent on the type of approach pavement present.

For rigid type (concrete) approaches, a latex or portland cement concrete overlay shall be placed as indicated on the plans. The existing concrete approach roadway shall be removed as necessary to maintain the minimum specification thickness of the overlay.

For non-rigid type (bituminous) approaches a bituminous overlay shall be used.

M. Material Hauling. The hauling of all materials for latex concrete or portland cement concrete overlays by trucks with continuous mixers or any other types of trucks shall be performed with vehicles that do not exceed the

regulation for either the legal axle weights or axle spacing contained in the appropriate sections of the most current publications of the *South Carolina Laws Covering Size, Weight, Load and Truck Operations*. Before doing any overlay work on a structure, the Contractor shall furnish to the Engineer a certified statement listing the empty weight of each hauling vehicle, the axle weights when empty, axle weights when fully loaded, the gross weight of each vehicle when loaded with a specified number of cubic yards, and the spacing of the axles. This information will be used by the Engineer for limiting the quantity of materials permitted to be hauled by the Contractor. This limitation shall be based on the capacity and condition of the bridge after unsound concrete has been removed and prior to placement of the overlay. Under no circumstances will loads that exceed legal gross or axle gross or axle load limits be permitted.

N. Damage to Structures The Contractor is responsible for any and all damage to the structure during construction until all the work is completed, even to the replacement of entire spans at his expense, should they fail as a result of this construction.

O. Unacceptable Work. The Department will determine the overlay thickness (any coring will be done in accordance with Department procedures). The Contractor shall fill any core holes in the overlay using concrete overlay materials, at no additional cost to the Department. Areas found to be deficient in thickness no more than 1/2 inch will be paid for as specified hereinafter. Areas found deficient by more than 1/2 inch shall be removed and replaced with concrete overlay of the specified thickness at no cost to the Department.

Any areas of the overlay displaying a significant number of cracks or are not intimately bonded to the underlying deck shall be removed and replaced with acceptable concrete at the Contractor's expense. Small cracks that exist but are not significant enough to require removal of

the overlay shall be thoroughly sealed using an low viscosity polymer sealant approved by the Engineer.

P. Compensation for Altered Quantities. As provided in Subsections **104.02** and **109.03** the following unit price adjustment formulas have been established and will be used for determining adjusted unit prices for concrete overlay when an underrun of more than 25%, or an overrun of more than 25% occurs in the quantity of this item.

726.05 Special Requirements for Latex Concrete Overlays. In addition to the requirements in Subsection **726.04**, the latex concrete overlay shall conform to the following:

A. Pre-wetting and Grout-Bond Coat. The blast cleaned areas to receive the overlay shall be thoroughly and continuously wetted with water at least one hour before placement of the overlay is to start. The areas shall be kept wet and cooled with the water until the overlay is placed. Any accumulations of water shall be dispersed and/or removed before applying the grout-bond coat. Immediately before placing the overlay mixture, a thin coating of the latex concrete mixture to be used for the overlay shall be thoroughly brushed and scrubbed onto the wetted surface as a grout-bond coat. Accumulations of coarser particles of the mixture that cannot be scrubbed into intimate contact with the surface will not be permitted.

The grout-bond coat shall be applied only for a short distance in advance of the placement of the overlay and shall not be allowed to show any signs of drying before being covered with the overlay.

B. Proportioning. The latex concrete shall be accurately proportioned as follows and shall contain no less than 7 bags of cement nor less than 24.5 gallons of latex admixture per cubic yard.

Mix Proportions for Latex Concrete Overlay

Type I Portland Cement	94 pounds
Latex Admixture	3.5 gallons
Fine Aggregate	210 to 250 pounds*
Coarse Aggregate	140 to 180 pounds*
Water(including free moisture on the fine and coarse aggregates)	22 pounds max.**

Notes:

*The Research and Materials Engineer will design the mixture, and will determine the actual quantity of this ingredient to be used.

**The actual quantity of water to be used within this limit shall be determined by the Contractor and shall be subject to the approval of the Engineer.

The properties of the latex concrete shall be as follows when determined by the Department's current methods:

Property	Value
Slump (Slump shall be measured 4 to 5 minutes after discharged from the mixer)	4 to 6 inches
Air Content	No more than 6 1/2%
Water Cement Ratio (Considering all the non-solids in the Latex Admixture as part of the total water)	No more than 0.40
Expected Compressive Strength at 7 calendar days	3000 psi

Table (Continued)

Property	Value
Minimum Compressive strength at 28 calendar days	4000 psi
Maximum Mix Temperature	85°F

C. Placing, Consolidating, and Finishing Overlays. The latex concrete for the overlay shall be placed on the blast cleaned and pre-wetted deck immediately after the grout-bond coat has been applied. The finishing machine shall be passed over the existing deck before placing the overlay so that measurements can be made to ensure that the proper cross slope and thickness will be achieved.

D. Curing. Immediately following the finishing operation and as soon as the overlay will not be deformed by the added weight, the overlay shall be covered with a curing blanket that shall be left in place for at least 24 hours, and shall be re-wetted if any signs of drying appear.

After the 24 hour period has ended, curing blanket shall be removed, and the overlay shall be allowed to air cure for at least 72 hours.

After the curing of the overlay has been completed, the tops of all longitudinal and transverse construction joints shall be given a thorough coating of a Department approved low viscosity polymer sealant. The coating shall be at least 2 inches wide, and shall be neatly and uniformly applied. This coating is intended to seal any minute cracks that may have developed at these locations. Use of epoxy-sand slurry to seal construction joints instead of the low viscosity polymer sealant will not be permitted. The overlay may be opened to traffic as soon as all curing is completed and a compressive strength of 3000 psi has been obtained, all joints and cracks have been sealed as specified above, and the bridge deck grooved in accordance with these specifications.

726.06 Special Requirements for Portland Cement Con-

crete Overlays. In addition to the requirements of Subsection **726.04**, the portland cement concrete overlay shall conform to the following:

A. Grout-bond Coat. After the concrete surface has been blast cleaned and accepted, and immediately before placing the concrete overlay mixture on the deck, a thin coating of bonding grout shall be vigorously scrubbed into the dry, clean surface areas. The surface areas shall not be wetted before applying the grout. When the bridge deck is exposed to rain before application of the grout, application shall be delayed until the bridge deck has dried sufficiently to proceed. The length of the delay will be determined by the Engineer, but a minimum drying time of 4 hours will be required. The grout shall consist of equal parts, by weight, of portland cement and mortar sand, mixed with sufficient water to form a wet slurry. The consistency of the grout shall be such that it can be applied with a stiff brush or broom in a thin, even coating which will not run or puddle in low spots. Care shall be exercised to ensure that all areas of the blast cleaned deck receive a thorough even coating of the grout and that no excess grout is permitted to collect in any areas. The grout shall be applied only for a short distance in advance of the placement of the overlay and shall not be allowed to show any signs of drying prior to being covered with the overlay. Any areas that show any signs of drying shall be thoroughly re-coated with fresh grout.

B. Proportioning the Overlay Mix. The concrete for the overlay shall be accurately proportioned to contain 8.75 bags of cement per cubic yard and no more than 35 gallons of water per cubic yard, including free moisture on the aggregates. The Contractor shall determine the amount of water to be added to the mixture to maintain the proper slump, except that the limit of 35 gallons per cubic yard shall not be exceeded. The expected compressive strength, at seven (7) calendar days shall be 3000 psi. The minimum compressive strength at 28 calendar days shall be 4000 psi.

The amount of fine aggregate and coarse aggregate for the concrete will be determined by the Engineer on an approximately 1:1 proportion by volume and shall be incorporated into the concrete mixture as directed by the Engineer.

The water-reducing admixture shall be added to the concrete in accordance with the manufacturer's recommendations, or as otherwise approved in writing by the Engineer.

The Contractor shall determine the amount of air-entraining mixture to be added to the concrete mixture. The air content of the concrete as determined by the pressure meter shall be 4 1/2%. A tolerance of plus or minus 1 1/2% from the specified air content will be allowed in occasional samples.

The slump of the concrete determined by the SC-T-42 procedure shall be consistently maintained at 3/4 inch. Slump shall be measured 4 to 5 minutes after discharge from the mixer. A tolerance of plus or minus 1/4 inch will be permitted for occasional samples. Concrete with a slump of more than one inch shall not be used in any circumstances and shall be wasted at the Contractor's expense. Concrete with a slump less than 1/2 inch shall not be used unless the finishing machine can finish and consolidate the concrete in accordance with requirements specified herein. Slump requirements shall be met, both at the site of mixing and at the time of placing.

C. Placing, Consolidating and Finishing the Overlay. The finishing machine shall be passed over the existing deck before placing the concrete overlay in order that measurements can be made to ensure that proper cross slope and thickness will be achieved. Promptly after the grout-bond coat has been applied, the concrete shall be deposited on the deck, struck off and consolidated with

the finishing machine.

Consolidation using hand-held vibrators may be required when placing the mixture around steel reinforcement or structural steel members.

The concrete shall first be struck off at 1/4 inch or more above the specified final thickness and then consolidated by vigorous mechanical vibration. The in-place density of the consolidated mixture will be determined by use of a nuclear gauge immediately following the screeding operation.

Areas of concrete of deficient density shall be immediately corrected by additional passes of the finishing machine. When any concrete cannot be consolidated to the specified density, it shall be removed and replaced with acceptable concrete at the Contractor's expense. Hand finishing of the consolidated concrete with a float may be required in order to produce a tight uniform surface.

The top surface of the consolidated and finished concrete overlay shall be smooth, uniform, and tight and the surface will be checked with a 10 foot straightedge and a profilograph.

D. Use of Nuclear Gauge In Determining Overlay Density. The in-place density of the consolidated portland cement concrete overlay mixture will be determined by use of a nuclear gauge immediately following the screeding operation.

All operations of the nuclear gauge shall be carried out by personnel certified in the use of a nuclear gauge.

The procedure for determining the density of an overlay provided in the instrument's instruction manual shall be followed along with appropriate nomographs or formulas for the nuclear gauges used by the Department. These procedures call for taking reading of the existing concrete,

and the overlay, and then calculating the density of the overlay based on a nomograph or appropriate formula.

The Contractor shall cooperate in preparing sections of the existing deck for density measurements to be obtained. Preparations may include cutting and removing steel reinforcing bars in the vicinity of the density determination area. Preparations may also include adequate leveling of rough areas after the milling operation to allow density determinations to be carried out.

The density of the overlay as determined by use of the nuclear gauge will be adjusted according to the hardened concrete density by use of a nomograph or appropriate formula as supplied by nuclear gauge manufacture/supplier.

This adjusted density shall equal or exceed the target density, where the target density shall be 100% of the maximum theoretical density calculated assuming an entrained air content of 4.5%. Areas of deficient density shall be immediately corrected by additional passes of the finishing machine. When any concrete cannot be consolidated to the specified density, it shall be removed and replaced with acceptable overlay material at the Contractor's expense. Hand finishing of the consolidated concrete with a float may be required to produce a tight uniform surface.

E. Curing. Curing of the overlay shall be initiated immediately after texturing. Curing shall be accomplished by use of a curing blanket that shall be continuously and thoroughly wetted by automatic fogging or sprinkling equipment for at least 96 hours after the curing is started. Improper curing will be a basis for rejection of the concrete and non-payment for the total cost of the rejected concrete. Curing compound will not be permitted on the overlay. After the curing of the overlay has been completed, the tops of all longitudinal and transverse construction joints shall be given a thorough coating of an approved low viscosity polymer sealant approved by the En-

gineer. The coating shall be neatly and uniformly applied. This coating is intended to seal any minute cracks that may have developed at these locations. Use of epoxy-sand slurry to seal construction joints instead of a Department approved low viscosity polymer sealant will not be permitted. The overlay may be opened to traffic as soon as all curing is completed, a compressive strength of 3000 psi has been obtained, all cracks and joints have been sealed with a low viscosity polymer sealant, and the specified surface texture treatment has been applied.

726.07 Method of Measurement. The quantities to be paid for will be measured in units of completed and accepted work, as hereinafter specified. In computing quantities, all dimensions used shall be those measured by the Engineer.

A. Removal and Disposal of Existing Overlays. The epoxy, bituminous and foreign overlays removed as specified, complete, and accepted shall be measured in square yards. This item will not be measured when a bid item for the removal of the epoxy, bituminous and foreign overlays is not included in the contract, but will be considered incidental to the installation of the new overlay.

B. Machine Preparation of Existing Surface. The total deck area prepared as specified, complete, and accepted shall be measured in square yards.

C. Partial Depth Removal of Unsound Concrete. The area of removal of partial depth unsound concrete as specified, complete, and accepted shall be measured in square yards. The range of this partial depth removal shall be from the upper portion of the top layer of reinforcing steel to the mid-depth of the slab.

D. Concrete Class 4000 for Full-depth Patching. The quantity to be measured for payment under this item shall be the number of cubic yards necessary to complete the work and shall be calculated from the dimensions of the areas patched, as measured by the Engineer.

E. Reinforcing Steel. Reinforcing Steel shall be measured in accordance with Section **703.11**.

F. Blast Cleaning. The area of the deck blast cleaned complete and accepted, including the 12 inches adjacent to the curb and the 3 inches of the vertical face of the curb to receive the epoxy-sand slurry, shall be measured in square yards. The blast cleaning of any longitudinal and transverse construction joints will not be measured for payment.

G. Concrete Overlay (Latex). The volumes of latex concrete in the completed and accepted overlay shall be measured in cubic yards. In computing the volume for payment, the dimensions used shall be those shown on the plans or as ordered by the Engineer. The volume of patches cast monolithically with the overlay shall be included in this quantity and shall be based on measurements of the patched area taken by the Engineer. The volume of material wasted or not incorporated in the finished work shall not be included in the measured quantity. Grout used for the bond coat and crack sealing is considered incidental to the latex concrete overlay and shall not be measured for separate payment.

H. Concrete Overlay (Portland Cement). The volume of portland cement concrete in the completed and accepted overlay shall be measured in cubic yards. In computing the volume for payment, the dimensions used shall be those shown on the plans or as ordered by the Engineer. The volume of patches cast monolithically with the overlay shall be included in this quantity and shall be based on measurements of the patched area taken by the Engineer. The volume of material wasted or not incorporated in the finished work shall not be included in the measured quantity. Grout used for the bond coat and crack sealing is considered incidental to the concrete

overlay and shall not be measured for separate payment.

I. Epoxy-Sand Slurry. The accepted epoxy-sand slurry will be measured by the square feet of area covered by a 1/16 inch coating of the epoxy-sand slurry.

J. Repair or Rehabilitation of Expansion Joints and Bridge Ends. Unless stated otherwise in the special provisions, the rehabilitation or repair of expansion joints and bridge ends shall be considered incidental to the work of providing the overlay and shall not be measured for payment.

K. Dust Control. All drilling, grinding and sawing of rock, shale, concrete and other similar dust-producing materials shall be performed by equipment provided with water sprays, fabric filtered collection systems or other suitable devices to prevent excessive dust from becoming airborne. Dust control shall be considered incidental to the other items of work and shall not be measured for separate payment.

726.08 Basis Of Payment.

A. Removal and Disposal of Existing Overlays. The satisfactory removal and disposal of existing overlays will be paid for at the contract unit price for Removal of Epoxy, Bituminous, and Foreign Overlay which price and payment shall be full compensation for the complete removal and disposal of the overlay as specified, including all material, equipment, tools, labor, and incidentals necessary to satisfactorily complete the work.

When a bid item for this work is not included in the bid proposal, satisfactory removal and disposal of existing overlays will be incidental to the overlay installation item.

B. Machine Preparation of Existing Surface. The deck area prepared as specified, complete and accepted, will

be paid for at the contract unit price for Machine Preparation of Existing Deck, which price and payment shall be full compensation for all expenses associated with machine preparation operation, including all material, equipment, tools, labor, and incidentals necessary to satisfactorily complete the work.

C. Partial Depth Removal of Unsound Concrete. The measured quantity of the areas of partial deck removal will be paid for at the contract unit price for Partial Depth Removal of Unsound Concrete, which price and payment shall be full compensation for all expenses associated with the satisfactory removal of all partial depth unsound concrete including all material, equipment, tools, labor, and incidentals necessary to satisfactorily complete the work.

The estimated quantities shown in the proposal for Partial Depth Removal of Unsound Concrete is for bid purposes only. The actual amount of quantities will be determined in the field by the Engineer after completing the removal of unsound concrete. The unit price bid will be adjusted by the formula shown in Subsection **726.04P**.

D. Concrete for Full-depth Patching. The measured volume of concrete used in full depth patches will be paid for at the contract unit price for Concrete, Class 4000 for Full Depth Patching, which price and payment shall be full compensation for all expenses including all materials, equipment, tools, labor, and incidentals necessary to satisfactorily complete the work.

E. Reinforcing Steel. Reinforcing Steel will be paid for in accordance with Section **703.12**.

F. Blast Cleaning. The measured areas of blast cleaning will be paid for at the contract unit price for Blast Cleaning, which price and payment shall be full compensation for all expenses associated with the blast cleaning operation, including all material, equipment, tools, labor, and incidentals necessary to satisfactorily complete the

work.

G. Concrete Overlay, (Latex) or (Portland Cement). The area of a latex concrete or portland cement concrete overlay meeting the specifications will be paid for at the contract unit price for Concrete Overlay (Latex) or Concrete Overlay (Portland Cement) as applicable, which price and payment shall be full compensation for furnishing, placing, finishing, curing, and texturing of the overlay, including all material, equipment, tools, labor, and incidentals necessary to satisfactorily complete the work.

Areas of concrete overlay found to be deficient in the attaining the minimum required compressive strength (4000 psi) by no more than 1000 psi will be paid at an adjusted unit price determined as follows:

$$AP = \underline{CP \times (ACS / RCS)^2}$$

Where

AP = Adjusted Unit Price
CP = Contract Unit Price
ACS = Actual Compressive Strength
RCS = Required Compressive Strength

The adjusted unit price as determined above shall be used as the contract unit price for further price adjustments due to deficiencies.

Areas of concrete overlay found to be deficient in the attaining the minimum required compressive strength by more than 1000 psi shall not be eligible for payment and shall be removed at the Contractor's expense.

If the average thickness of the concrete overlay is deficient in the required thickness by no more than 1/2 inch, the overlay will be paid for at an adjusted unit price determined by the following table:

Average Deficiency In Thickness (inches)	Adjusted Unit Price: Percent of Contract Unit Price
0	100.0
1/16	95.0
1/8	90.0
3/16	80.0
1/4	70.0
5/16	57.5
3/8	45.0
7/16	25.0
1/2	0.0

The adjusted unit price as determined above shall be used as the contract unit price for further price adjustments due to deficiencies.

In determining the average thickness, thickness greater than the required thickness will be entered as the required thickness, and thickness 1/2 inch less than the required thickness shall not be used, because those areas shall be removed by the Contractor at his expense. Areas of overlay that are monolithic with partial depth patches shall not be used in calculation of the average thickness.

At the Contractor's option, areas with a deficiency in compressive strength of less than 1000 psi or in average thickness of no more than 1/2 inch may be removed and replaced with concrete overlay conforming to the specifications at no cost to the Department. Payment at the contract unit price will be made for areas where the deficient overlay was removed and replaced with overlay meeting all requirements specified herein.

No additional payment will be made for concrete overlay in excess of the specified thickness except as required to fill areas where partial depth removal of unsound concrete has been performed.

When it is determined by analysis that the proportion of latex in the overlay mix when discharged from the mixer is less than the specified amount, payment for the batch will be made at an adjusted unit price determined by the following formula:

$$AP = CP \times \frac{(100 - 2 \times LD)}{100}$$

Where

AP = Final Adjusted Price
CP = Contract Unit Price
LD = Latex Deficiency (percentage)

If the proportion of latex in the overlay mix when discharged from the mixer is less than the specified amount by more than 20%, the batch shall be rejected for use. These provisions for a reduction in the unit price shall apply regardless of the readings of gauges or monitoring devices on the supply lines. No adjustment in the unit price will be made for latex in excess of the minimum specified.

Payment for the accepted quantity at the contract unit price, adjusted as required, shall be full compensation for all materials, equipment, labor and incidentals necessary to construct an acceptably textured concrete overlay on the prepared bridge deck.

H. Epoxy-Sand Slurry. The quantity of epoxy-sand slurry measured will be paid for at the contract unit price for Epoxy-Sand Slurry, which price and payment shall be full compensation for furnishing all materials, equipment, labor, tools and incidentals necessary to satisfactorily complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
7260100	Removal of Epoxy, Bituminous and Foreign Overlay	Square Yard

Pay Items (Continued)

Item No.	Pay Item	Pay Unit
7260200	Machine Preparation of Existing Surface	Square Yard
7260300	Blast Cleaning	Square Yard
7260400	Partial Depth Removal of Unsound Concrete	Square Yard
7260500	Concrete Overlay (Latex)	Cubic Yard
7260600	Concrete Overlay (Portland Cement)	Cubic Yard
7260700	Epoxy-Sand Slurry	Square Foot
7260800	Concrete Class 4000 for Full Depth Deck Patching	Cubic Yard