Make the following Section a part of the Standard Specifications:

"SECTION 682 – DEFECTIVE CONCRETE REPAIRS

682.01 Description. This section is for locating and confirming the size of defective areas in the concrete deck and other concrete surfaces and repairing of all concrete spalls, delaminations, honeycombing, and other defective concrete as shown in the contract plans. This section applies to the locations as designated on the plans as well as all other locations encountered by the Contractor and Engineer.

682.02 Materials. The Contractor shall use a polymer modified repair mortar of which shall herein be referred to as a "VESLMC" for all existing concrete deck repairs.

(A) VESLMC:

(1) A factory blended cementitious patching material (containing no gypsum) combined with a polymer type admixture, water, and a corrosion inhibitor. The 3-hour and 28-day compressive strength shall be at least 3,000 psi and 6,000 psi respectively. The 28-day bond strength shall be at least 2000 psi.

(2) Repair materials shall consist of:

(a) Western Materials FASTRAC 246 Concrete o approved equal

(b) Western Materials Ready-To-Use FASTRAC Polyme or approved equal

(c) 1½ pints per cubic yard of CORTEC MCI 2005 NS o approved equal

(d) 5 lbs of ¾ inch long Forta Ferro macrofibers o approved equal

(B) Water. Shall comply with Subsection 712.01 Water.

(C) Curing Compound. For curing of VESLMC, cover with wet burlap or approved equal. Leave wet burlap on until opening to traffic.

(D) Other Materials: All other materials, not specifically described but required for the successful completion and installation of the work shall be as selected by the Engineer.

(E) Substitution of Materials.

(1) Use only materials specified herein. Other materials of the same manufacturer or of other manufacturers may not be substituted for those specified without written approval of the Engineer. This is not to be construed as to limit competition but to establish a standard of quality. Other manufacturers of equal or better system of products may be considered as a substitution to the system of products specified herein. However, complete documentation proving that the substituted product meets or exceeds the performance of the specified product shall be provided in order to provide a basis for evaluation and comparison. Submission of incomplete, inadequate, incongruous, vague material and installation data will be grounds for disapproval without review.

682.03 Construction.

(A) Submittals. Submit a minimum of 30 days prior to the start of this work and providing a minimum of ten complete sets consisting of copies of the following submittals for acceptance. Clearly indicate the name of the product and its manufacturer on pertinent submittals as well as what portion of the Contract Document it is being submitted for, e.g., subsection, line number. No work that is related to these submittals shall be performed until written acceptance has been received by the Contractor. Sets that are not complete in the sole opinion of the Engineer shall be rejected and no review will take place. The Contractor shall resubmit required sets to start the review process again.

(1) Material Safety Data Sheets: Furnish the manufacturer's Material Safety Data Sheets for each of the materials present at any time on the job site.

(2) Manufacturer's data sheets and certificates of compliance signed by the manufacturer for the following:

(a) Pre-packaged polymer modified repair mortar.

(b) Ready-to-use liquid polymer admixture.

(c) Fibers.

(d) Materials for curing VESLMC.

(e) Equipment: Submit descriptive literature describing the kinds, types, model numbers and operational features of the mixing and application proposed for use on this project.

(3) Detailed plans and procedures to be in compliance with the requirements of Section 107 – Legal Relations and Responsibility to the Public and Section 620 – Dust Control including complying to noise variances, and controlling of work to appropriately minimize dust and air borne debris from concrete demolition, abrasive blasting, mixing and placing concrete, and cleaning operations, and to prevent water runoffs.

(6) Planned procedures for concrete repair areas and emergency work that cannot be appropriately constructed within the allotted closure hours or if work results in a complete depth penetration of the deck.

(7) Planned procedures to maintain adherence to limitations and requirements of ambient air temperature, wind speed, temperature of plastic concrete, relative humidity, evaporation rate of concrete, and rain.

(8) Procedures for documentation of all aspects of repair work including the measurement and locations of repair areas.

(B) Quality Assurance.

(1) The Contractor shall be experienced (5 years or more) and have expertise in the field of repairs of reinforced concrete structures, proper application of corrosion inhibiting admixtures, and be familiar with the type of materials specified for this project. The Contractor will employ and provide a full-time supervisor to be on site at all times during the duration of the work covered in this Section. This person will work very closely with the manufacturer of the repair systems, the Engineer and the State's representative.

(2) Codes and Standards: Comply with all locally applicable codes, regulations and requirements pertaining to this work.

(3) Rejection of Installed Work: The Engineer shall have the right to reject all work which is not in compliance with the requirements of the drawings and specifications.

(4) Indication of lack of skill on the part of installation and application mechanics shall be sufficient grounds for the Engineer to reject applied products and to require their immediate removal and complete reinstallation and application until the Engineer accepts the work at no additional cost to the State. Mechanics lacking skill shall be replaced. Method to fix the Contractor's non-compliant repair shall be submitted to the Engineer for review and acceptance before the reconstruction of the remedial surface prep is started.

(5) Replacement of rejected work may require that the materials in place in the rejected areas be entirely removed to the solid concrete deck. Use methods that shall produce acceptable work. Additional surface preparation and a change of surface preparation or primer materials may be required. The Contractor shall research and define these procedures and complete the additional surface preparation and reapplication of the VESLMC at no extra cost to the State or additional contract time.

(C) Delivery, Handling, and Storage.

(1) Delivery of Materials: Deliver all materials in original tightly sealed containers or unopened packages, clearly labeled and containing manufacturer's name, labels, date of manufacture, lot number, product identification, manufacturer's instructions for mixing, and warning for handling and toxicity.

(2) Storage: Store materials at the Contractor's place of business in cool, dry and safe location out of weather in original containers or unopened packages as recommended by the manufacturer. Temperature and humidity requirements of the manufacturer are to be adhered to at all times. No storage of material or debris shall be allowed other than material needed for the shift's work or debris created during the shift.

(3) Handling: Handle all materials in a safe manner and in a way to avoid breaking container seals.

(4) Environmental Requirements: Container shall comply with manufacturer's recommendations as to environmental conditions under which the materials may be applied.

(D) Job Conditions.

(1) Adhere to the manufacturer's printed instructions regarding weather and climate condition restrictions on the use of all materials supplied in this section.

(2) Do not apply the materials if it is raining or if rain is imminent. Take proper precautions to protect newly placed and completed repairs from weather conditions such as strong wind or rain.

(3) Do not man scaffolds or lift equipment in wind or rain conditions that makes working dangerous.

(4) Protection: Precautions shall be taken to avoid damage to any surface near the work area due to spillage.

(5) Barricades: Erect temporary barricades and railings, to

prevent people from entering the project area. Coordinate with the State's representative on final location and placement. The extent of barricade and railings may be adjusted by HIOSH requirements at no extra cost to the State.

(E) Protection of the Work.

Use all means necessary to protect the materials of this section before and during installation and to protect this work and the work of all other trades. In the event of damage during installation, immediately make repairs and replacements necessary to the approval of the State's representative at no additional cost to the State.

(F) Execution.

(1) All repairs shall be made in accordance with the specifications, appropriate Repair Application Procedures (RAP) publications by the American Concrete Institute (ACI), recommendations by the International Concrete Repair Institute (ICRI), and the manufacturer's recommendations.

(2) The Contractor shall inspect all areas of the concrete deck in question and all concrete surfaces surrounding the repair area for spalling and/or other deterioration. Contractor shall utilize the contract documents, visual inspection, an auditory hammer sounding, and exploratory removal methods. Areas identified for repair shall be marked on the surface, and marked on the project as-built plans.

(3) Defective Concrete Removal:

(a) General: Execute all work in an orderly and careful manner. Protect all surfaces and items to remain. The Contractor is responsible for any and all damages, repairs or replacement of existing surfaces and items to remain. Carefully cut and remove defective materials indicated or found without damaging adjacent material surfaces or items that are to remain. Provide catchment device or platform to collect all concrete chips and other debris for proper disposal offsite.

(b) Where concrete work is to be repaired, make a 1/2 – inch deep square saw cut along straight lines at 90-degree angles, 2 inches beyond the edge of the damaged area or spall into sound concrete, unless noted otherwise.

Hydrodemolition, pneumatic tools weighing less than 15 pounds, or approved equal may be used to remove the remaining unsound concrete. When a saw-cut edge cannot be achieved because of tool interferences, face of the top edge of the patch shall be chipped out to provide a vertical face a minimum of 1/2-inch to 3/4-inch depth, unless shown otherwise. The remainder of the defective concrete shall be chipped out with a chipping gun to solid sound concrete.

Adjust saw-cut depth so as not to cut existing concealed reinforcing bars. Do not extend saw-cut beyond the limits of removal work. Contractor shall take extra care to minimize any "blow-outs" in the bridge deck. A "blow-out" is demolishing through the entire concrete bridge deck.

(c) Spalled and Loose Surfaces: Remove all loose concrete and check all spalled areas that are indicated or are obvious upon visual examination. Contractor shall remove a minimum of ¾ inch below the rebar for the VESLMC repair to ensure a sound repair. There shall be a minimum of 3/4-inch of space between the reinforcing bars and the concrete all around the bar. Do not vibrate the reinforcing bar when removing concrete.

(d) Sounding: Inspect the remaining exterior concrete surfaces around the repair area for the bridge span in question for any other defective concrete by utilizing non-destructive testing equipment approved by the Engineer.

(e) Remove deteriorated concrete, prepare and clean surfaces to be patched. Clean all chipped concrete surfaces to remove all foreign material and laitance before application of VESLMC.

(f) All concrete surfaces to receive repair material shall be roughened to a minimum of ¼ inch amplitude or a Concrete Surface Profile (CSP) of 7.

(h) No material is allowed to fall or flow into streams or drainage systems.

(4) Surface Preparation:

a) Cleaning: After removal of all defective concrete, remaining concrete surfaces to be patched shall be structurally sound, clean, free of dirt, powdered concrete,

loose mortar particles, paint, film, protective coatings, efflorescence, laitance, and other matter detrimental to proper adhesion of the new VESLMC. Contractor shall use methods such as pressure washing or approved equal to ensure proper cleanliness. Work surfaces must be free of ridges, fins or sharp projections. All reinforcing bars in the repair area shall be made free of all scale and loose rust by using either powered rotary wire bristle brush or abrasive blasting. Needle gunning may be used as preliminary step for removal of loose rust. Do not overly vibrate the reinforcing bars. Following all concrete removal and steel cleaning, the entire repair area shall be cleaned. Any areas not patched within the work shift shall be recleaned.

1. Immediately prior to placing VESLMC, the repair area shall be cleaned of all dust, debris, and other deleterious material with oil-free compressed air at a minimum of 100 psi with a Safety Air Blow Gun OSHA Compliant, with alloy nozzle and extension.

2. Certify that all of the manufacturer's recommendations for preparation, bonding and application have been followed.

(h) Formwork: All formwork, supports, and bracing shall be adequately designed to support the anticipated weight of the wet repair material. Caulk all edges to ensure forms are watertight. Set elevation of formwork such that the minimum concrete clear cover, as shown in the drawings, is provided.

(G) Application of VESLMC:

(a) Mix VESLMC and apply in strict conformance with the manufacturer's published instructions or job specific written instructions. If patch exceeds maximum thickness, extend with aggregate as recommended by manufacturer.

(b) Make batches large enough to assure continued placement of VESLMC within repair area prior to initial set.

(c) Finish: Finish all patch work to match existing surfaces in texture and appearance or as otherwise directed by the State's representative. Do not feather edge VESLMC onto adjacent surfaces. Grind any high spots, transition areas, or protrusions.

(d) Curing:

1. Allow VESLMC to cure for a minimum 3-hours prior to opening to traffic. Cover with wet burlap or approved equal and remove prior to opening to traffic.

2. Immediately following formwork removal, cure VESLMC as recommended by the manufacturer.

(e) Falsework: Any falsework and formwork required shall be considered incidental to this work.

(H) In-Place Test of Repairs:

1. Utilizing a 2-pound hammer, test all completed concrete spall repairs to locate hollow or ringing sounding areas. A hollow sound generally will indicate that either the repair material has not completely filled the space from which the damaged concrete was removed or that it has not adequately bonded to the concrete substrate. Submit revised method of installation to prevent the non-compliant work from happening again.

2. The Contractor shall remove the VESLMC from those hollow or ringing sounding areas, prepare the surfaces of the exposed reinforcing bars and the sound concrete substrate, if necessary, form and then place, cure and finish the new VESLMC at no additional cost to the State. Upon completion, the repairs will be retested by the State's representative.

(I) Cleaning:

(a) Surfaces Not Involved in the Repairs: Adjacent surfaces damaged by staining left by concrete work, or other concrete materials shall be completely restored to the original new condition with respect to color and texture to the acceptance by the State's representative.

(b) Uncured VESLMC can be cleaned from tools with water. Cured VESLMC can only be removed mechanically.

(c) Removal:

1. Remove debris and rubbish from the site daily.

Prevent debris and rubbish from entering the waterway. Debris and rubbish shall not be allowed to accumulate on the site. Debris shall be removed and transported in a manner that will prevent spillage into the open channel, onto the adjacent ground and streets.

2. Upon completion of the work, remove all materials, tools, forming materials, catchments, work platforms, refuse and debris generated by the work specified in this section.

(J) Traffic and Equipment Control on Bridge.

(1) Construction vehicles shall not exceed a 15-mph speed limit within 200 feet of the placement area in both directions during VESLMC placement and curing.

(2) Equipment and vehicles shall not contaminate the prepared deck surface.

(3) The Contractor shall not permit compressors or other equipment that produce vibrations on the span undergoing deck VESLMC work. Equipment shall not be located on spans undergoing deck VESLMC unless approved by the Engineer.

(4) Vehicular traffic shall not exceed a 35-mph speed limit on the bridge span during VESLMC pour and cure.

(5) The VESLMC shall have a minimum compressive strength of 3000 psi according to manufacturer's recommendations prior to opening the bridge to traffic.

(6) The bridge deck shall not be used as a storage area for equipment or for stockpiling materials. Loads exceeding eight tons shall not be used on the bridge unless approved by the Engineer.

(7) The contractor shall not allow any equipment or vehicles within 4 feet laterally from any repair for the duration of traffic control.

(M) Documentation of Repairs. Include in the preparation of posted drawing as required in Section 648, records of each repaired concrete area.

The documentation shall include the following:

(1) The replacement concrete pour date.

(2) The location of the center of each repair rectangle as indicated by:

(a) The transverse offset from the baseline with offset direction information.

(b) The dimensions of the rectangle in the following directions:

(c) Longitudinally in the direction of traffic flow.

(d) Transversely perpendicular to the direction of traffic flow.

(e) The Contractor shall also prepare a spread sheet tabulation of the above information.

682.04 Measurement. The Engineer will measure the Defective Concrete Repair per square foot of repaired and accepted section.

682.05 Payment. The Engineer will pay for the accepted quantities of Defective Concrete Repair at the contract unit price per cubic foot, complete in place.

The payment will be full compensation for chipping, removing and disposing of defective concrete found within the limits of the spall and patch repair work; locating existing reinforcing steel bars, extending the probing to beyond the end of corrosion and removing concrete around the corroded reinforcing steel; cleaning and preparing concrete surfaces; removing corrosion damage from reinforcing steel; providing forms and falsework; placing, finishing and curing concrete repair materials; repairing defects; sampling and testing concrete; for clean-up; and for furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

Pay Item	**Pay Unit**
Concrete Repair Type _____	**Square Foot**