JOB SPECIAL PROVISIONS TABLE OF CONTENTS (BRIDGES)

(Job Special Provisions shall prevail over General Special Provisions whenever in conflict therewith)

GENERAL SPECIAL PROVISIONS (BRIDGES)

A. WORK SCHEDULE

1. GENERAL

The construction requirements as shown on the plans shall be strictly adhered to unless otherwise approved by the Engineer.

The Contractor shall replace the rivets at the designated field splices, in accordance with the plans and special provisions, prior to starting the bridge deck removal and replacement. The sequence and order of any other work in this contract may be as proposed by the Contractor, but must be approved by the Engineer.

As part of the work schedule, the Contractor shall specify locations and times for restriction of boat traffic below the bridge. See Special Provision “WATER CRAFT CONTROL PLAN”.

Temporary lane closures shall only be permitted with prior approval of the Engineer. All temporary lane closures shall be in accordance with the *Manual of Uniform Traffic Control Devices (MUTCD)*.

2. CONTRACTOR’S PROPOSED WORK SCHEDULE

The Contractor shall submit a detailed work schedule to the Engineer for approval within 30 days after award of the contract, and preferably at the Pre-construction meeting. The bar graph method shall be used and scheduling shall be accurate to one-half month. The work schedule shall be realistic and shall provide for completion of the work within the contract allotted time. As part of the work schedule, the Contractor shall submit a detailed schedule for each type of bridge closure (ie. two panels per night, three panels per night, four panels per night, substructure work, placing silica fume overlay). For each type of bridge closure period the submittal shall include a schedule of operations performed, completion time of each operation, and the methods and equipment used for each operation.

The Contractor shall meet bi-weekly or at some other time interval as required by the Engineer to review the work schedule and to make such changes as necessary to reflect the current conditions. If conditions warrant the Contractor shall revise the work schedule and resubmit it to the Engineer for approval.

3. PAYMENT

All costs incurred by the Contractor in complying with the above requirements will be considered to be included in and completely covered by the unit prices bid and the amount paid for the various items of work in the contract.

B. CONSTRUCTION REQUIREMENTS

The Contractor shall be responsible for field verifying the existing conditions including field measuring all dimensions necessary to complete the work. All field verified dimensions shall be made prior to fabrication of any new components to be installed. All field verified dimensions shall be indicated on the shop drawings. The Contractor shall submit a letter with each shop drawing submittal stating that all dimensions encompassed in the submittal have been field verified.

Shop drawing and calculation submittals shall include, but are not limited to, temporary bridges, temporary barrier for exposed existing bridge curb, temporary thrie beams guard rails at closure pours, methods and equipment used for deck removal, methods and equipment used to transport and place slab panels, and loads for construction equipment. All shop drawings and calculations shall be sealed by a Professional Engineer registered in the State of Missouri. The Contractor shall review the calculations and shop drawings of all subcontractors and shall apply a stamp indicating Contractor approval prior to presenting the calculations and shop drawings to the Engineer for review.

The bridge shall remain open to traffic between the hours specified in the Roadway Special Provisions. All work including removal of the existing bridge rail, removal of the existing bridge deck, removal of the existing shear connectors, cleaning the stringer top flange, welding the new shear connectors, coating the stringer top flange, installation of the precast deck panel(s), grouting, and bridging over any construction openings, shall be completed and the bridge re-opened to traffic prior to the time specified in the Roadway Special Provisions. The grouting shall be completed with adequate time to achieve the required strength prior to opening the bridge to traffic. No traffic, either construction or public, will be permitted on the bridge after grouting until the grout has achieved the required strength of 2500 psi. The Contractor shall hire the services of an independent testing laboratory, approved by the Engineer, to sample and test the grout to verify the grout strengths for re-opening the bridge to traffic. With the Engineer’s approval, a strength curve chart may be established to determine the time necessary for achieving the required design strength.

The Contractor shall have all necessary back-up equipment on site and ready for use so that any equipment failure shall not delay the opening of the bridge.

Deck removal shall be limited to no more than two deck panels per night until the Engineer is satisfied that the Contractor has demonstrated his ability to replace additional amounts. After the first two panels are placed, the Engineer will inspect the finished installed deck panels. Items of inspection will include, but are not limited to, the grout between the stringer top flange and bottom of panel, shear connector pockets, and post-tensioning bar anchorages. Any repairs to the installed deck panels or modifications to the construction method requested by the Engineer shall be at no additional cost to the Owner.

In the event the Contractor is unable to complete a stage of deck replacement, the Contractor shall be prepared with whatever equipment and bridging necessary to open the bridge to traffic at the time specified in the Roadway Special Provisions at no additional cost to the Owner.

All construction loads including Contractor's equipment and vehicular traffic on the bridge shall not exceed legal limits without permission from the Engineer. To aid in the contractor's evaluation of construction equipment allowed on the bridge, the following design loads are provided for the AASHTO HS15-44 design loading:

(1) The HS15-44 truck has one 6000 pound axle and two 24,000 pound axles. The spacing between axles is 14 feet and the wheel spacing along the axle is 6 feet.
(2) The HS15-44 lane load is 40 pounds per square foot and a concentrated load of 27,000 pounds (distributed over the entire deck width) in one span.

C. PARTIAL REMOVAL OF SUBSTRUCTURE CONCRETE

This work shall consist of the following work and procedures:

1. General

Remove the existing wings, end posts, and backwall to the lines shown on the bridge plans at End Bent No. 1 and End Bent No. 20.

2. Limits of Concrete Removal

The existing wings, end posts and backwall shall be removed to the lines shown on the bridge plans. Any excavation required during the removal of the backwall concrete shall be backfilled after the new concrete in the backwall is poured and cured. Any part of the approach roadway that is removed or damaged during the removal of the existing concrete in the backwall shall be repaired or the material replaced as determined by the Engineer.

3. Concrete Removal

A continuous groove, one inch (25 mm) deep (plus or minus), shall be sawed in the faces of existing concrete as a guide for the line of break. In no case shall reinforcement that is to remain in place be cut by the sawing operation. The removal of existing concrete shall be in accordance with Section 703.3.21 of the Missouri Standard Specifications for Highway Construction except that the old concrete may be cleaned by bush hammering or another approved method.

Pavement breakers of the 35-pound (15.88 kg) class may be used for concrete removal and chipping hammers of the 15-pound (6.8 kg) class shall be used to remove concrete from any reinforcing bars where required unless in the opinion of the Engineer another method would be

less damaging to the concrete or reinforcement to remain in place. The bits shall be sharp in order to reduce pounding.

The existing reinforcing steel shall be stripped, cleaned, straightened and extended into or utilized in the new concrete as noted on the bridge plans. Extreme care shall be taken to prevent damage to the reinforcement or its bond in the concrete to remain in place. If any reinforcement is damaged or deteriorated it shall be called to the attention of the Engineer.

Backwall removal shall be completed prior to installation of precast deck panels at end bents. During and after completion of backwall removal, a temporary bridge will be required for maintenance of traffic. See Special Provision “TEMPORARY BRIDGE”.

4. Basis of Payment

Payment for the above described work including all materials, labor, equipment, and all incidentals necessary to complete this item shall be included under the contract lump sum price for “Partial Removal of Substructure Concrete”.

D. REMOVAL OF EXISTING BRIDGE DECK

1. GENERAL

This work shall consist of removing the existing bridge curbs, bridge rail, slab, expansion devices and any other items necessary to reconstruct the concrete deck in accordance with the stage construction shown on the bridge plans.

The existing bridge was constructed as a composite structure.

The amount of bridge deck to be removed shall not exceed that which can be replaced and bridge re-opened to traffic at the time specified in the roadway portion of Special Provisions. The Contractor shall remove the existing bridge rail in stages with the bridge deck removal. The existing bridge rail removal shall be limited to but not including the nearest post beyond the removal limit of the existing bridge deck. The remaining bridge rail shall be left in place until the next stage of bridge deck removal.

The Contractor shall take all necessary care and precautions so as to not damage any of the structural components to remain in place. Transverse and longitudinal saw cuts in the deck shall not be permitted within six inches of the existing stringer flanges. For the deck removal directly above the existing stringer top flange, pavement breakers of the 35-pound (15.88 kg) class may be used for concrete deck removal and chipping hammers of the 15-pound (6.8 kg) class shall be used to remove concrete from any shear connectors or structural steel, unless in the opinion of the Engineer another method would be less damaging to the concrete or reinforcement to remain in place. The bits shall be sharp in order to reduce pounding.

The Contractor’s equipment shall be limited to type and size necessary to assure adequate control of the removal operation. The Contractor shall provide adequate netting, platforms, and baskets to catch and retain any falling debris during the removal operation. The existing bridge deck and debris shall be removed from the job site and disposed of in a manner and at a site approved by the Engineer.

Any damage resulting from the Contractor’s operations during the removal of the existing bridge deck shall be repaired by the Contractor, to the satisfaction of the Engineer, at no additional cost to the Owner.

After removal of the concrete deck, the top surfaces of old structural steel shall be cleaned of all concrete, rust, scale or other extraneous material which will be in contact with the new deck.

The top surface and the sides of the top flanges of existing stringers exposed by removal of the concrete deck shall be cleaned with a minimum of SSPC-SP-6 surface preparation and according to the manufacturer’s recommendation and coated with one coat of Organic Zinc Primer to produce a dry film thickness of not less than 3.0 mils [75 micrometers] that is compatible with concrete.

2. MEASUREMENT AND PAYMENT

The area of removal has been computed to the nearest square foot based on measurement longitudinally from fill face to fill face of the end bents and transversely from out to out of the bridge deck.

Final measurement will not be made except for authorized changes during construction or where appreciable errors are found in this contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

Payment for the work described above including all materials, equipment, labor, and all incidental work necessary to complete this item shall be made and considered completely covered under the contract unit price bid per square foot for “Removal of Existing Bridge Deck”.

E. SHEAR CONNECTORS

1. GENERAL

This work shall consist of furnishing all labor, materials, equipment, and incidentals necessary for the removal and disposal of existing shear connectors and installation of new shear connectors.

2. REMOVAL OF THE EXISTING SHEAR CONNECTOR

The existing shear connectors shall be removed in a manner that shall not damage the existing stringer top flange. Any existing stud locations that interfere with new shear connectors or joint filler material or polystyrene bedding material shall be made smooth and flush by grinding. Where the base metal has been pulled out during the

removal, SMAW with low-hydrogen electrodes, in conformance with AWS BRIDGE WELDING CODE D1.5, shall be used to fill the pocket and the weld surface ground smooth and flush. All grinding shall be performed in the direction of stress.

3. WELDING SHEAR CONNECTORS

This work shall consist of furnishing and installing new shear connector studs on existing stringers as shown and noted on the bridge plans and shall be in accordance with Section 712.3.4 of the Missouri Standard Specifications for Highway Construction. Before any welding of new shear connectors is performed, the top surface of the top flange to which shear connectors are to be welded shall be thoroughly cleaned of scale, rust, oils, paint, and other foreign substances. Cleaning shall be to the extent necessary to obtain satisfactory welds. Prior to installing new shear connectors each workday, the Contractor shall prove to the Engineer that all equipment is functioning correctly by installing shear connectors on a test plate. The number and manner of installing shear connectors onto the test plate will be as proscribed by the Engineer.

The Contractor may elect to weld the shear connectors before the precast panel has been installed or afterwards through the open pockets provided in the precast panel. However, if the shear connectors are welded prior to installing the precast panel, the Contractor shall assure that the shear connector clusters shall be adequately located within the open pockets without the need to bend the connectors.

The shear connectors will be inspected and testing in accordance with the requirements of AWS D1.5, Section 7.8. If a shear connector weld does not exhibit a full 360 degree flash, and cannot be bend tested the full 15 degrees in the direction opposite the missing portion of the flash, the Contractor may elect to do one of the following:

(1) Complete the weld by adding a 5/16 inch fillet weld in place of the missing flash. If the Contractor elects to complete the weld, the weld shall extend at least 3/8 inches beyond each end of the discontinuity being repaired.

(2) Remove and weld a new shear connector in its place.

(3) Weld an additional shear connector meeting the requirements herein specified.

If the shear connectors are welded after the top flange has been coated the coating shall be removed prior to welding the shear connector and repaired after the shear connectors have been welded.

4. MEASUREMENT AND PAYMENT

Measurement for “REMOVAL OF EXISTING SHEAR CONNECTORS” shall be made per lump sum completed and accepted.

The accepted “REMOVAL OF EXISTING SHEAR CONNECTORS” will be paid for at the contract unit price lump sum which price shall include all

material, labor, equipment, testing, and incidentals necessary to complete the work.

Measurement for “INSTALLATION OF SHEAR CONNECTORS” shall be made per each installed and accepted. Additional studs welded at the option of the Contractor as substitutes for those not passing inspection will not be included in the quantity of accepted and completed work.

The accepted quantity of “INSTALLATION OF SHEAR CONNECTORS” will be paid for at the contract unit price per each which price shall include all materials, labor, equipment, and incidentals necessary to complete the work.

F. POST-TENSION SYSTEM

1. GENERAL

The post-tensioning system shall be approved by the Engineer. The Contractor shall furnish details from the Manufacturer for the proposed materials and equipment with the shop drawing submittal for approval.

Except as noted otherwise on the approved shop drawings or as approved by the Engineer, permanent post-tensioning bars must be stressed from the leading end of the sequentially erected slab panels.

2. POST-TENSIONING BARS

The post-tensioning bars shall be 1″ diameter epoxy coated, high strength bars meeting the requirements of ASTM A 722, Type II, (Minimum yield point of 150 kips per square inch). Epoxy coating shall be in accordance with ASTM A 775.

3. POST-TENSIONING COUPLERS

Where bars are coupled, the assembled units shall develop at least 100% of the Manufacturer’s minimum specified ultimate tensile strength of the bar, tested in the unbonded state without exceeding the anticipated set. Bar couplers shall be epoxy coated per ASTM A 775. The Contractor shall verify that the coupled bars have been brought to the required engagement as specified by the Manufacturer of the post-tensioning system prior to beginning the post-tensioning operation.

4. POST-TENSIONING ANCHORING DEVICES

The post-tensioning anchoring device shall effectively distribute forces to the concrete and meet the following requirements:

(1) The average bearing stress in the concrete created by the bearing plate shall not exceed the values allowed by Chapter 9 of AASHTO Standard Specifications for Highway Bridges, 17TH Edition.

(2) Bending stresses in the plates or assemblies induced by the pull of the post-tensioning steel shall not exceed the yield point of the material or cause visible distortion of the anchorage plate when

100% of the ultimate strength of the bar is applied. Provide the Engineer certified test reports from an approved independent testing laboratory verifying compliance with this requirement for each type and/or size of anchoring device.

(3) The anchoring devices shall be epoxy coated.

5. POST-TENSIONING BAR DUCTS

Unless specifically noted on the plans or otherwise approved by the Engineer, use ducts for post-tensioning meeting the requirements of these Special Provisions.

For ducts embedded in the concrete for high strength post-tensioning bars use either galvanized ferrous metal or high density virgin polyethylene. All ducts shall be watertight.

Ducts for single bars shall have an inside diameter the greater of at least 3/8 inches larger than the nominal size of the bar or as specified in the plans.

Ferrous metal ducts shall be hot dip galvanized. Rigid metal ducts may be fabricated with either welded or interlocked seams. Ducts shall bend without crimping or flattening and shall have sufficient strength to maintain their alignment during placing of concrete. Joints between sections of ducts shall have positive metallic connections that do not result in angle changes at the joints.

Polyethylene ducts shall be sufficiently rigid to withstand concrete placement, grouting, and construction loads without damage or excessive deformation. Polyethylene ducts shall meet the requirements of ASTM D 3550 with a cell classification of 345433C and a minimum wall thickness of 1/16 inches ± 1/64 inches. Plastic material shall not react with concrete or enhance corrosion of the high strength bars and shall be free of water soluble chloride. Smooth pipes shall not be used.

Ducts shall be sealed within 4 hours of stressing until actual grouting is performed. No corrosion inhibitors shall be applied within the ducts. No flushing of ducts with water prior to grouting shall be done.

The ducts and connections shall be capable of withstanding the pressure required for flushing the ducts in the event of an aborted grouting operation.

Accurately and securely fasten all post-tensioning anchorages, ducts, vent pipes, miscellaneous hardware, reinforcing bars, and other embedments at the locations shown on the Plans or on the approved Shop Drawings or as otherwise approved by the Engineer. Exercise great care when placing and consolidating concrete so as not to displace or damage any of the post-tensioning ducts, anchorage assemblies, splices and connections, reinforcement or other embedments.

6. GROUT VENTS, INJECTION, AND EJECTION PIPES

Provide vents made of standard pipe or suitable plastic pipe with a minimum diameter of 3/8 inches. Neither metallic nor plastic components shall react with the concrete or enhance corrosion of the post-tensioning steel. Plastic components shall be free of water soluble chloride.

Grout injection pipe fittings shall be equipped with positive mechanical shut-off valves. All fittings, valves, and vents shall be capable of withstanding traffic loadings until grouting operations are completed.

Vents and ejection pipes fitted with valves or other devices shall be capable of withstanding the grout pump pressure.

7. STRESSING JACKS AND GAUGES

Each jack shall be equipped with a pressure gauge for determining the jacking pressure. The pressure gauge shall have an accurately reading dial at least six inches in diameter. Each jack and its gauge shall be calibrated as a unit with the cylinder extension in the approximate position it will be in at the final jacking force. Calibration shall be done when the jack is connected to the equipment (pumps and gauges) in the identical configuration as will be used on the job site, e.g. with the same length hydraulic lines. Initial calibration of the jacks and gauges shall be performed by an independent laboratory using a proven load cell. For each jack and gauge unit used on the project, furnish certified calibration charts from the independent laboratory prior to stressing the first bar.

Certified calibration shall be made at the start of the work, or as requested by the Engineer. Calibrations subsequent to the initial calibration with a load cell may be accomplished by the use of a master gauge. Supply the master gauge to the Engineer in a protective waterproof container capable of protecting the calibration of the master gauge during shipment to a laboratory. Provide a quick-attach coupler next to the permanent gauge in the hydraulic lines to enable quick and easy installation of the master gauge to verify the permanent gauge readings. The master gauge will be calibrated by and remain in the possession of the Engineer for the duration of the project.

Any jack repair, such as replacing seals or changing the length of the hydraulic lines, is cause for recalibration using a load cell.

No extra compensation will be allowed for the initial or subsequent calibrations or for the use and required calibrations of the master gauge.

8. STRESSING OPERATIONS

Cut post-tensioning steel by an abrasive saw within 20 to 40 mm away from the anchoring device. Flame cutting of post-tensioning steel is not allowed.

Keep a record of the following post-tensioning operations for each high strength bar installed:

(a) Project name, number.

(b) Contractor and/or Subcontractor.

(c) High strength bar location, size and type.

(d) Date high strength bar was first installed in ducts.

(e) Heat number for bars.

(f) Assumed and actual cross-sectional area.

(g) Assumed and actual Modulus of elasticity.

(h) Date Stressed.

(i) Jack and Gauge numbers per end of high strength bar.

(j) Required jacking force.

(k) Gauge pressures.

(l) Elongations (anticipated and actual).

(m) Anchor sets (anticipated and actual).

(n) Stressing sequence (i.e. bars before and after this).

(o) Witnesses to stressing operation (Contractor and inspector).

(p) Date grouted, days from stressing to grouting, grouting pressure applied and injection end.

Record any other relevant information and all repair procedures and details. Provide the Engineer with a complete copy of all stressing and grouting operations.

9. GROUTING OPERATIONS

All grouting operations shall be carried out by experienced superintendents and foremen that have received instructional training and have at least three years of experience on previous projects involving grouting of similar type and magnitude.

The Contractor shall submit a grouting operation plan for approval at least 30 days in advance of any scheduled grouting operations. Written approval of the grouting operation plan by the Engineer is required before any grouting of the permanent structure takes place.

At a minimum, the following items shall be provided in the grouting operation plan:

(a) Provide names, training and experience records for the grouting crew and the crew supervisor in conformance with this Specification.

(b) type, quantity, and brand of materials used in grouting including all certifications required.

(c) type of equipment furnished, including capacity in relation to demand and working condition, as well as back-up equipment and spare parts;

(d) general grouting procedure;

(e) duct repair procedures;

(f) method(s) for sealing ducts at all connections, vents, splices, etc.;

(g) method to be used to control the rate of flow within ducts;

(h) theoretical grout volume calculations;

(i) types and locations of inlet and outlet pipes;

(j) duct cleaning methods prior to grouting;

(k) mixing and pumping procedures;

(l) direction of grouting;

(m) sequence of use of the inlets and outlet pipes;

(n) procedures for handling blockages, including flushing of ducts;

(o) method(s) to inspect behind anchorages;

(p) procedures for post grouting repair of any grout voids detected in the post-tensioning system.

Before grouting operations begin, a joint meeting of the Contractor, grout manufacturer’s field representative and the Engineer will be conducted to discuss the grouting operation plan, required testing, corrective procedures and any other issues requested by the Engineer.

Within 30 calendar days after installation of the high strength post-tensioning bars, grout the ducts in accordance with these Specifications. Except when approved by the Engineer in writing, failure to grout high strength bars within 30 calendar days will result in stoppage of the affected work and no invoices will be processed for payment of that affected work. Have the grout manufacturer’s field representative on site to witness the initial grouting operation and to provide technical assistance to the grouting crew.

Within 4 hours after stressing and prior to grouting, protect bars against corrosion or harmful effects of debris, by temporarily plugging or sealing all openings and vents. Within this period, clean rust and other debris from all metal surfaces which will be covered by the grout cap and place the permanent non-metallic grout cap, including a seal, over the wedge plate until the bar is grouted.

When stressing has been completed and the stressed bars have been accepted by the Engineer, grout the annular space between the bars and the duct.

The Contractor shall use a colloidal grout mixer and pump capable of continuous mechanical mixing and producing a grout free of lumps and undispersed cement. The equipment used shall be able to pump mixed grout in a manner complying with all the provisions specified herein. The Contractor shall provide accessory equipment that will provide for accurate solid and liquid measures necessary to batch all materials.

Use positive displacement type grout pumps able to produce an outlet pressure of at least 150 psi, with seals adequate to prevent oil, air or other foreign substances entering into the grout and to prevent loss of grout or water. Place a pressure gauge having a full scale reading of no more than 300 psi at some point in the grout line between the pumping outlet and the duct inlet.

The grouting equipment must contain a screen having clear openings of 0.125 inch [3.35 mm] maximum size to screen the grout prior to its introduction into the grout pump. If using grout with an additive, a screen opening of 3/16 inch is satisfactory. Ensure that this screen is easily accessible for inspection and cleaning. Utilize a gravity feed to the pump inlet from a hopper attached to and directly over it. Keep the hopper at least partially full at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct. Under normal conditions, the grout equipment must be capable of continuously grouting in not more than 20 minutes.

The Contractor shall mix the grout in accordance with the manufacturer’s instructions using a colloidal mixer to obtain a homogeneous mixture. The Contractor shall perform a fluidity test on the mixed grout, in accordance with these Special Provisions, prior to beginning the injection process. Do not begin the grouting process until the proper grout properties have been obtained. Meet the specified target flow rates.

Open all grout vents and high point vent openings before grouting starts. Provide injection and ejection vents with positive shut-offs. Allow grout to flow from the first vent after the injection vent until any residual flushing water or entrapped air has been removed, then close that vent. Close remaining vents in sequence in the same manner. Maintain a continuous flow of grout at a rate not to exceed 10 meters of duct per minute.

The Contractor shall not allow the pumping pressure at the injection vent to exceed 150 psi for oval ducts nor 250 psi for circular ducts, however; normal operations shall be performed at approximately 75 psi. If the actual grouting pressure exceeds the maximum allowed, close the injection vent and inject the grout at the next vent which has been, or is ready to be, closed as long as a one way flow is maintained. Do not inject grout into a succeeding vent from which grout has not yet flowed.

Pump grout through the duct and continuously waste at the ejection vent until no visible slugs of water or air are ejected.

Perform a fluidity test on each bar measuring the grout discharged from the discharge outlet. The measured grout efflux time shall meet the requirements of the Fluidity Test listed in these Special Provisions. If the grout efflux time is not acceptable, discharge additional grout from the discharge outlet. Test grout efflux time. Continue this cycle until an acceptable grout fluidity is achieved. Ensure that the duct remains filled with grout, by closing the ejection and injection vents in sequence, respectively, under pressure when the duct is completely filled with grout. Do not remove the positive shut-offs at the injection and ejection vents or open until the grout has set.

The temperature of the concrete shall be 39°F or higher from the time of grouting until job cured 2 inch cubes of grout reach a minimum compressive strength of 800 psi. Grout shall not be above 90°F during mixing or pumping. If necessary, cool the mixing water.

Do not remove or open valves, caps and vent pipes until the grout has set. Remove the ends of steel vents at least one inch below the concrete surface after the grout has set. Remove ends of plastic vents to the surface of the concrete after the grout has set.

10. GROUT

Grouts shall be prepackaged in plastic lined or coated bags. Grout bags shall indicate date of manufacture, lot number, and mixing instructions. Any change of materials or material sources requires retesting and certification of the conformance of the grout with these Special Provisions. A copy of the Quality Control Data Sheet for each lot number and shipment sent to the job site shall be provided to the Contractor by the grout supplier and furnished to the Engineer. Materials with a total time from manufacture to usage in excess of 6 months shall be retested and recertified by the supplier before use or the material shall be removed and replaced.

The material shall be mixed in strict accordance with the Manufacturer’s written instructions.

The grout shall not contain aluminum powder or components, which produce hydrogen gas, carbon dioxide, or oxygen.

The grout shall meet or exceed the specified physical properties stated herein as determined by the standard and modified ASTM test method shown in Table A.

TABLE A

Properties	**Test Value**	**Test Method**
Total Chloride Ions	Max. 0.08% by mass of cementitious material	ASTM C 1152
Volume Change @ 24 Hours and 28 days	0.0% to +0.3%	ASTM C 1090*
Expansion	2.0% for up to 3 hours	ASTM C 940

Compressive Strength 28 day (Average of 3 cubes)	7000 psi	ASTM C 953
Initial Set of Grout	****	ASTM C 953
Fluidity Test** Efflux Time from Flow Cone		
(a) Immediately after mixing	Min. 20 Seconds Max. 30 Seconds	ASTM C 939***
	Or Min. 9 Seconds Max. 20 Seconds	
(b) 30 minutes after mixing with remixing for 30 seconds.	Max. 30 Seconds	ASTM C 939
	Or Max. 30 Seconds	ASTM C 939***
Bleeding @ 3 Hours	Max. 0.0 Percent	ASTM C 940
Permeability @ 28 Days	Max. 2500 Coulombs at 30V for 6 hours	ASTM C 1202

* Modified ASTM C 1090 to include verification at both 24 hours and 28 days.

**Adjustments to flow rates will be achieved by strict compliance with the Manufacturer's recommendations.

***Grout fluidity shall meet either the standard ASTM C 939 flow cone test or the modified test described herein. Modify the ASTM C 939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a 1 liter container placed directly under the flow cone.

****Initial set of grout shall be such that set time meets the specified construction requirements.

11. SIMULATED FIELD HIGH TEMPERATURE FLUIDITY TEST

Perform a conditioned laboratory high temperature grout fluidity test as described below using production grouting equipment utilizing both mixing and storage tanks. For the test to be successful, the grout meeting the requirements herein specified must have efflux time of not greater than 30 seconds at the end of the 1 hour test period. Efflux time may be determined by either ASTM C 939 or the modified ASTM C 939 as herein described.

Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer, and all other

equipment to be used to 90°F temperature for a minimum of 12 hours prior to the test.

Use 10 feet of duct tube for the test. Use a duct with an inside diameter of 1 inch ± 1/4 inch.

Mix the grout to the specified water content and pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

Start the 1 hour test period after the duct is completely filled with grout.

Record the time to circulate the grout through the duct. Constantly pump and re-circulate the grout into the commercial grout mixer storage tank.

Pump and re-circulate the grout for a minimum of 1 hour.

At 10 minute intervals throughout the test period record the pumping pressure at the inlet and test the grout and record the temperature and fluidity at the discharge outlet.

12. ACCELERATED CORROSION TEST METHOD (ACTM)

Perform the ACTM as outlined in Appendix B of the Specification for Grouting of Post-Tensioned Structures published by the Post-Tensioning Institute. Report the time to corrode for both the grout being tested and the control sample using neat grout.

A grout that shows a longer average time to corrode in the ACTM than the control sample is considered satisfactory.

13. SAMPLES FOR TESTING

Testing shall conform to the applicable ASTM Specifications for the post-tensioning material used. The Contractor shall furnish all material samples for testing at no cost to the Owner. The Contractor shall furnish samples for testing as described below for each manufacturer of high strength bar, bar couplers, and anchorage assemblies to be used on the project. With each sample of bars furnished for testing submit a certification stating the manufacturer’s minimum guaranteed ultimate tensile strength of the sample furnished.

The Contractor shall allow the Engineer to sample the following materials, selected by the Engineer at the plant or jobsite, from the steel used for post-tensioning operations well in advance of anticipated use:

(a) For bars: Three randomly selected samples, 1.5 m long, per manufacturer, per size of bar, per heat of steel, with a minimum of one sample per shipment.

(b) For permanent couplers: Three units of 0.5 m lengths of bar, each equipped with one coupler and fabricated to fit the coupler, per manufacturer, per heat of coupler steel.

(c) For anchorage assemblies: Two samples of each size, per manufacturer, per heat of steel.

One of each of the samples furnished to represent a lot will be tested. The remaining sample(s), properly identified and tagged, will be stored by the Engineer for future testing in the event of loss or failure of the component represented to meet minimum strength requirements. For acceptance of the lot represented, test results must show that 100% of the guaranteed ultimate tensile strength has been met.

A lot is that parcel of components as described herein. All bars, anchorage assemblies and couplers of each size from each mill heat of steel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each such lot can be accurately identified at the job site. The Contractor shall submit records to the Engineer identifying assigned lot numbers with the heat, coil or reel of material represented. All unidentified high strength post-tensioning bar steel, anchorage assemblies or bar couplers received at the site will be rejected. Also, loss of positive identification of these items at any time will be cause for rejection.

The release of any material by the Engineer shall not preclude subsequent rejection if the material is damaged in transit or later damaged or found to be defective.

14. MEASUREMENT AND PAYMENT

Measurement for “POST-TENSION SYSTEM” shall be made per lump sum completed and accepted.

The accepted “POST-TENSION SYSTEM” will be paid for at the contract unit price lump sum which price shall include all post-tensioning bars, post-tensioning bar couplers, post-tensioning anchoring devices, ducts, grouting, all other materials, labor, equipment, testing, and incidentals necessary to complete the work.

G. FABRICATION OF PRECAST SLAB PANELS

1. GENERAL

The concrete for the precast slab panels shall meet the requirements of Section 501 of the *Missouri Standard Specifications for Highway Construction* for Class B1 concrete.

Forms and formwork, placing and tying of reinforcing bars, and placing and vibrating of concrete, and curing shall conform to the applicable requirements of Section 703 and 706 of the *Missouri Standard Specifications for Highway Construction.*

Precast post-tensioned slab panel construction shall consist of fabrication, storage, transporting and erecting the precast slab panels that are post-tensioned together. All slab panels shall be placed and post-tensioned together in accordance with the design, dimensions,

details and requirements shown on the plans and in accordance with the Standard Specifications and these Special Provisions.

All fabricated slab panels shall meet the following tolerance requirement:

Flat Surface (deviation from a plane at any location)

±1/4 inch per 10 feet

The Contractor shall control dimensions from panel to panel and compensate for any deviations within a single panel or series of panels so that the overall dimensions of the completed structure meet the dimensions and overall erection tolerances shown on the plans and allowed by this Section.

The Contractor shall repair minor breakage, spalling, or honeycomb not over one inch deep by a method approved by the Engineer. Major breakage, spalling, or honeycomb in excess of one inch deep is subject to the Engineer's structural review. If found to be satisfactory, repair these areas using a method approved by the Engineer. Do not perform surface finishing or repairs on the matching joint surfaces of precast slab panels until after final erection of the slab panel, except as herein noted. All repairs shall be at no additional cost to the Owner.

If more than 20%, but less than 40% of the total contact surface of all shear keys in any single slab panel is broken, spalled or honeycombed, grind the damaged areas to produce a cylindrical depression into sound concrete to a depth and width approximately equal to the shear key dimensions. Complete necessary repairs to shear keys damaged at the casting site prior to shipping the slab panel to the erection site. After erection of the slab panels adjacent to the damaged keys and prior to erection of additional slab panels, carefully pack the voids left by the depressions with an epoxy mortar as approved by the Engineer. With the Engineer's approval, an alternate method of repair may be used. The Engineer will consider the slab panel unsatisfactory for use if more than 40% of the total contact surface of all shear keys in any single end is broken, spalled or honeycombed. The Engineer will consider a slab panel unsatisfactory for use if more than 50% of the total contact surface of all alignment keys in any element of the slab is broken, spalled or honeycombed. The Contractor shall remove and dispose slab panels found to be unsatisfactory and not repairable after structural review and cast a new slab panel at no expense to the Owner.

Precast panels shall not be erected until they have reached the age of 14 days.

2. SHOP DRAWINGS

The Contractor shall submit to the Engineer for review, all details, calculations, information and applicable drawings of the methods, materials, equipment, and procedures proposed for use in

constructing and erecting the precast concrete slab panels at proper grade and alignment in the finished structure. Included shall be calculations and details showing locations and number of lifting points and methods and equipment for handling the precast slab panels. Tensile stresses in the concrete panels due to handling shall not exceed 3 times the square root of the compressive strength of the concrete at the time of lifting. A 20 percent impact factor shall be used in these computations and the slab reinforcing steel shall be neglected.

The Contractor’s submittal shall include:

(1) A schedule of the timing and sequence of slab panel casting and erection.

(2) Details of the forms and casting cells for the manufacture of the slab panels.

(3) Layout of the casting yard showing operational features, casting cells, rebar fabrication and material storage areas, movable rain and sun sheds, geometry control stations, slab panel handling and storage facilities and the like.

(4) Calculations and details for lifting, storage or stacking of the slab panels. (Note: any additional strengthening of the slab panels to accommodate stacking will be at no expense to the Owner).

(5) Details of inserts or lifting holes including any necessary localized strengthening and the materials and methods to fill and finish such holes.

(6) Details and calculations for any localized strengthening for concentrated supports, loads or reactions from any special erection equipment.

(7) Details and complete description of post-tensioning hardware components and any other embedments to be cast into the slab panels.

(8) Details of all embedded items and all appurtenant items.

(9) Fully and accurately dimensioned views showing the geometry of the slab panels including projections, recesses, notches, opening and blockouts.

(10) Appropriate details of changes from dimensions shown on the plans where variations are made to slab panels, including any special reinforcing required but not shown on the Contract plans, with clear and concise cross-reference to the appropriate Contract plans to which the variations apply.

(11) Details of and supporting calculations for any modifications to reinforcement at anchorages, made necessary for accommodating the elected post-tensioning system hardware.

(12) Casting curves and erection elevations, prepared in accordance with chosen construction methods, sequence and schedule.

(13) A procedure for the casting and geometry control of the slab panels in accordance with the information provided in the Contract Documents or as required by this Specification.

(14) Method of mixing and placing grout; equipment capacity; mix design.

(15) The volume of concrete, the weight of reinforcement and weight of post-tensioning in each precast slab panel and the totals of these for the superstructure summarized and tabulated on the shop drawings.

In general, any revision to materials, components, erection methods or erection sequencing indicated on the plans and/or previously approved shop drawings shall require submittals prepared and sealed by a Professional Engineer registered in the State of Missouri.

3. MATCH CASTING REQUIREMENTS

The Contractor shall use a precast concrete fabrication process whereby a slab panel is cast against the preceding slab panel producing a matching interface which permits the re-establishment of the cast geometry at erection time. Match casting is accomplished by either the short line or long line casting method.

(a) Short Line Casting:

Casting slab panels one at a time in a casting cell between a bulkhead at one end and a previously cast slab panel at the other. The first slab panel is cast between the bulkhead and another, temporary bulkhead.

(b) Long Line Casting:

Casting slab panels on a casting bed of sufficient length to permit the cumulative casting of slab panels for the entire length of a span without repositioning the slab panels on the casting bed. With this method, the first slab panel is cast between bulkheads and successive slab panels are cast between a movable bulkhead on one end and the previously cast slab panel on the other.

All materials, details, and procedures shall be as specified herein, as noted on the plans, or as directed by the Engineer. The Contractor shall not begin casting slab panels until the Engineer approves the relevant shop drawings, calculations, casting manuals, concrete forms, concreting operations and the post-tensioning system components and layout if different from that on the Contract Plans. (Approval of post-tensioning stressing forces for field erection operations is not required at this stage but is required prior to erection.)

The Contractor shall give each slab panel an erection mark indicating its location, orientation and order in the erection

sequence. Match mark abutting edges of adjacent slab panels. Show erection marks on the erection plans or in the erection manual.

The Contractor shall take responsibility for the design and engineering of the forms as well as their construction. Form all exposed formed surfaces of each element of the structure with the same material to produce similar concrete surface textures, color, and appearance. Obtain the Engineer's approval of forms prior to initiating casting operations. Build the details shown on the Contract Plans or as amended by approved Shop Drawings into the forms. Repair worn, damaged, or otherwise unacceptable forms and obtain the Engineer's approval before casting any slab panel.

Where sections of forms are joined, ensure that offsets in flat surfaces do not exceed 1/16 inch and that offsets with corners and bends do not exceed 1/8 inch.

Ensure that all joints in the forms and contact points with bulkheads and existing panels have good fitting seals to prevent loss of fine material and cement grout. Check and inspect forms on a regular basis as frequently as necessary to ensure proper alignment and geometric accuracy. Do not use forms which fail to meet the specified casting tolerances until such corrections are made to produce slab panels within the specified tolerances.

Before commencing the casting operation, the Contractor shall submit the proposed method of geometry control for all slab panel casting operations to the Engineer for approval. This submittal shall include but not necessarily be limited to:

(1) All measuring equipment, procedures and the location of control points to be established on each slab panel.

(2) The location and values of all permanent benchmarks and reference points in the precasting yard.

(3) A geometry control procedure for the vertical and horizontal alignment control for the precasting of slab panels; including survey controls and procedures, observations, checks, computational and/or graphical methods and correction techniques.

The Contractor shall not begin casting without the Engineer's approval of the geometry control method.

In the precasting yard, instruments for the geometry control which are mounted on a permanent platform of sufficient height to sight on all control points shall be used. In addition, the Contractor shall establish and maintain permanent benchmarks and reference points throughout the casting operations.

During casting, make all corrections required in the geometry of the slab panels from the control points established on each slab panel.

With a match cast system, after casting and before bond breaking to separate the slab panels, check the position of the new cast and match cast slab panels again. If positions are not as desired, make

corrections in the next slab panel. In general, and unless otherwise approved by the Engineer, make observations on the geometry control reference hardware cast into the slab panels (i.e. elevation bolts, alignment offsets and lengths) to a measurement precision of ±0.001 feet.

During casting operations, the Contractor shall produce and maintain on a daily basis a graphical plot of the vertical and horizontal "as cast" alignments along each vertical and horizontal control line to an exaggerated scale in order to clearly highlight variations. Depict these against the theoretical geometric profile grade casting curves on a continuous layout of the entire superstructure. Maintain this plot in good condition so that it may be used and referenced during erection.

The Contractor shall keep all geometry control hardware cast into any panels, such as elevation bolts and alignment hairpins, in place during erection for reference and checking purposes. Remove the hardware after completion of erection of the superstructure.

The Contractor shall use experienced personnel to operate the instruments and supervise the casting operation. Prior to the commencement of casting, the Contractor shall obtain the Engineer’s approval of the experience and/or qualifications of the supervisory and instrument operating personnel, particularly with regard to the observational precision required.

When match casting, the Contractor shall take precautions in positioning of the match cast (previously cast) slab panel in relation to the slab panel to be cast. Ensure that the match cast slab panel is not twisted.

Ensure that all materials to be embedded in the concrete of the new cast slab panel are properly positioned and supported in order to maintain their position and withstand concrete placement and consolidation without damage. Make provisions for all projections, recesses, notches, openings, blockouts and the like in accordance with the plans and approved shop drawings.

Cover the abutting surface of the match cast slab panel with a thin film of a bond breaker consisting of flax soap and talc, or other material approved by the Engineer. The soap and talc mixture shall be five parts flax soap to one part talc. The Engineer will base acceptance of a material other than soap and talc prior to casting any slab panels by demonstration on a large specimen consisting of a precast piece and a new cast piece with a contact facial area of at least four square feet.

4. CONCRETE PLACEMENT

The Contractor shall not deposit concrete into the forms until the entire set-up of the forms, reinforcement, ducts, anchorages and embedded items have been thoroughly inspected and checked.

The Contractor shall not place concrete until the Engineer is satisfied that all the above items have been properly inspected and checked, and the rate of producing and placing the concrete will be sufficient to complete the casting and finishing operations within the scheduled time, that experienced concrete finishers are available where required for finish work and that all necessary finishing tools and equipment are on hand at the site of the work and are in satisfactory condition for use.

During conveying and placement, concrete shall be protected against undue drying or rise in temperature and inclement weather.

Discharge individual loads of concrete into the forms, and place and consolidate in the required locations. After discharge into the forms, do not bodily move concrete from place to place within the forms by mechanical vibrators or other similar equipment. Place and consolidate concrete with care so that post-tensioning ducts, anchorages and any other embedded items are maintained in their proper positions and are not damaged.

Consolidate all concrete using approved vibrators together with any other equipment necessary to perform the work as specified. When consolidating concrete reinforced with epoxy coated bars, vibrator heads covered with rubber or other resilient material approved for consolidation shall be used. Vibrate concrete in a manner which avoids displacement or damage to reinforcement, post-tensioning ducts, anchorages and other embedded items.

No construction joints are allowed within a slab panel.

5. FINISHING

Promptly after the concrete has been placed and vibrated, it shall be struck off to the proper profile. The area to be textured shall then be floated a minimum amount to close the surface. The surface shall be checked with a straight edge at least two feet longer than the slab panel, and the surface shall not deviate from a straight line by more than 3/16 inch in 10 feet. Use the straightedge approximately parallel to the centerline of the slab panel to strike an accurate surface between the bulkhead and the top of the match cast slab panel at all positions across the panel width. After any irregularities are corrected, the surface shall be grooved.

The top surface of the panel shall receive a grooved finish to facilitate bond with micro-silica concrete overlay. The scoring shall be perpendicular to the centerline of the bridge. The grooves shall be approximately 3/16 inch wide, be on 3/4 inch centers and be approximately 1/8 inch in depth.

6. DUCTS AND ANCHORAGES

Accurately align ducts and position at the locations shown on the Plans or according to the approved Shop Drawings or as otherwise approved by the Engineer. The Contractor shall securely fasten all internal ducts in position at regular intervals not exceeding 2.50 feet (Small ducts and very flexible ducts may require closer supports) to prevent movement, displacement or damage from concrete placement and consolidation operations. Any auxiliary ties and support bars needed for these purposes shall be considered incidental and at no extra cost to the project. Prevent the concrete cover requirements from being violated by any auxiliary ties and support bars.

Show the method and spacing of duct supports on appropriate Shop Drawings.

Ensure that all alignments are smooth and continuous with no lips, kinks or dents. Carefully check and repair all ducts as necessary before placing any further concrete.

After installing the forms, the Contractor shall ensure that all ends of ducts, connections to anchorages, splices, vents and the like are sealed water-tight at all times to prevent the entry of water and debris.

At splices and joints, and connections to anchorages, smoothly align and secure ducts with no lips or kinks. Join them in a way that positively prevents the entrance of cement paste and water from the concrete or unwanted leakage of grout during subsequent grouting operations.

Provide all ducts or anchorage assemblies for permanent post-tensioning with pipes or other suitable connections at each end of the tendon for the injection of grout after prestressing.

Make all connections to ducts with metallic or plastic structural fasteners. Use waterproof tape at all connections to include vent and grouting pipes. Ensure that vents are water tight, taped as necessary, and provide means for injection of grout through the vents and for sealing the vents. Fit grout injection pipes with positive mechanical shut-off valves. Fit vents and ejection pipes with valves, caps or other devices capable of withstanding the grout pumping pressures. Install all grout caps to prevent entrapment of air or water voids and to provide 100% coverage of all strands, wedges, and anchor plates in the post-tensioning anchorage.

Ensure that post-tensioning ducts are positioned within 1/4 inch vertically and 1/2 inch laterally. Ensure entrance and exit angles of tendon paths at anchorages and/or at faces of concrete are within ±3 degrees (±5%) of desired angle measured in any direction. Locate anchorages within ±1/4 inch [±6 mm] of desired position laterally.

If conflicts exist between the reinforcement and post-tensioning duct, in general, the position of the post-tensioning duct shall prevail and the reinforcement shall be adjusted locally to the Engineer’s approval.

Prior to placing concrete in the forms, fix all anchor plates and anchor castings in their respective position in the forms, connected to their duct and sealed to prevent mortar intrusion. Ensure that anchor plates and castings are rigidly fixed in the forms to maintain their correct alignment and position during concrete placement and consolidation.

Do not cut out or remove reinforcing steel to permit proper alignment of post-tensioning ducts. Replace any bar that cannot be fabricated to clear the ducts by additional bars with adequate lap lengths and submit the details to the Engineer for approval.

Upon completion of concrete placement, the Contractor shall prove that the post-tensioning ducts are free and clear of any obstructions or damage and are able to accept the intended post-tensioning tendons by passing a torpedo through the ducts. Use a torpedo having the same cross-sectional shape as the duct, and be 6 mm smaller all around than the clear, nominal inside dimensions of the duct. Make no deductions to the torpedo section dimensions for tolerances allowed in the manufacture or fixing of the ducts. For straight ducts, use a torpedo at least two feet long. If the torpedo will not travel completely through the duct, the Engineer will reject the member, unless a workable repair can be made to clear the duct, all to the satisfaction of the Engineer. Pass the torpedo through the duct easily, by hand, without resorting to excessive effort or mechanical assistance.

7. CURING

Where casting cells are intended to operate on a short (daily) cycle and it can be demonstrated to the satisfaction of the Engineer that the required initial concrete strengths for the removal of the forms, moving and handling of the slab panels and that the final concrete strength can be achieved in a timely and consistent manner, then steam curing will not be required. However, the Contractor shall take precautions to promote proper curing by methods approved by the Engineer and in accordance with the Standard Specifications. Such precautions shall meet or exceed the following:

(a) To prevent moisture loss, cover all exposed surfaces (those not in contact with a form or match cast panel) as soon as possible after casting with a moisture tight covering (wet curing blankets or other approved equal systems). Avoid spoiling the deck surface finish. Keep the cover on or within one foot of the deck surface.

(b) Keep the moisture-tight covering substantially in place throughout succeeding operations such as geometry control survey, stripping of internal forms, wing forms and shifting of and working with a slab panel in a match cast position. Keep the concrete surface wet throughout these operations.

(c) After stripping of the side and core forms, continue curing of the precast concrete by the application of a Type 2 (white pigmented) membrane curing compound conforming to AASHTO M148 to all exposed surfaces (including panel exterior once exposed by removal

from the form). Apply an approved debonding compound to match cast surfaces to serve both as a bond breaker and seal for curing.

(d) Maintain the moisture tight covering for at least 7 days. As an alternative, steam curing may be used.

(e) While the new cast slab panel is in contact with the match cast slab panel, cover the match cast slab panel with curing blankets, or other approved equal system, to minimize the effects of differential temperature between the panels.

Meet the requirements of the Standard Specifications modified by the following requirements when steam curing is used:

(1) Provide a device or devices for simultaneously recording the temperature of three widely separated locations per casting cell. Locate the three temperature sensors near the top, middle and bottom of the enclosure or as otherwise approved by the Engineer. Identify the charts with the hours, dates and slab panel number and deliver to the Engineer immediately after steam curing is completed unless otherwise approved.

(2) Apply an approved debonding compound to match cast surfaces to serve both as a bond breaker and seal for curing.

(3) Expose match cast slab panels to the same curing environment (temperature and humidity) as the new cast slab panel until the new slab panel reaches the required strength to allow the removal of the forms.

Prior to removing the forms, protect the plastic concrete from adverse weather effects. Keep supporting forms in place until the concrete has reached the required strength for form removal as specified on the plans, in this Section, or as approved by the Engineer. The Contractor shall avoid cracking or damaging the slab panel when removing the forms, especially match cast surfaces and shear keys. Notify the Engineer of any damage which occurs and repair in an approved manner.

Test cylinders shall be made and cured in the same manner as the slab panel, to confirm the form release strength prior to removing form. With the Engineer’s approval, a strength curve chart may be established to determine the time necessary for achieving the required form release strength, in accordance with the specifications for form removal. Provide additional test samples and testing for compressive strength on precast slab panels to control the construction activities and to ensure adequate strength of these components at various stages of their manufacture and assembly.

The Contractor shall make test cylinders in accordance with the Standard Specifications, cured in the same manner as the structural components to ensure adequate compressive strength has been achieved in accordance with the plan requirements for the following conditions:

(a) Prior to form release and/or moving the components to storage.

(b) Prior to placing a component into position in the structure and/or stressing of longitudinal post-tensioning tendons if the component is less than 28 days old.

Determine the number of cylinders in accordance with the proposed method for casting, transporting and erecting the various components.

Provide the results of the compression testing of one or more test cylinders for controlling the time of execution of the various construction operations. Obtain the Engineer's approval for meeting the Specification requirements on casting, curing and testing of concrete test cylinders.

No direct payment will be made for the concrete testing. All costs for such testing will be included in the bid items for the various precast structural components.

8. OVERLAY

Just prior to placing concrete the panels shall be cleaned by high pressure water. There shall be no free water standing on the panels when concrete is placed. If this method of cleaning does not appear sufficient to remove laitance or other foreign matter, sandblasting these areas will be required followed again by high pressure water cleaning prior to concrete placement.

9. HANDLING, STORAGE AND SHIPMENT

The Contractor shall handle slab panels with care to prevent damage and shall use only the devices shown on the shop drawings for this purpose. The Contractor shall store all precast slab panels level in the upright position and shall firmly support all precast slab panels for storage and shipment on an approved three point bearing system which does not introduce a twist under self weight.

Prior to shipment the Engineer will thoroughly inspect each segment for damage. Thoroughly clean the faces of all joints of laitance, bond breaking compound and any other foreign material by light sand blasting prior to shipment. Make no repairs of minor spalls or chipped areas on the joint surfaces until after erection of the slab panel. Upon arrival at the bridge site the Engineer will inspect each slab panel again.

If in the Engineer's opinion, any damage has occurred during shipment that will impair the function of the slab panel (structurally, aesthetically, etc.), the slab panel shall be rejected. Replace any rejected slab panel with an approved slab panel at no cost to the Owner. At Contractor's option, the replacement panel may be constructed cast-in-place at no additional cost to the Owner. Provide firm support at bearing locations noted above.

The Contractor shall fully secure the slab panels against shifting during transport and shall provide a storage area of suitable stability for the slab panels to prevent differential settlement of the slab panel supports during the entire period of storage.

10. MEASUREMENT AND PAYMENT

No direct payment will be made for handling, storage and shipment of the precast panels.

H. INSTALLATION OF PRECAST SLAB PANELS

1. GENERAL

This work shall consist of furnishing all labor, equipment, materials, and incidentals necessary to fabricate, transport, and install the precast deck panels.

2. JOINT FILLER

The joint filler shall be a one piece thickness up to 3 inches thick, cut to the required haunch above top of flange. After removal of the existing bridge deck, the top of flange elevations shall be surveyed and the joint filler thickness (haunch) determined to maintain the top of slab profile elevation, provide uniform bearing of the precast panel on each stringer, and provide the cross-slope shown in the plans. The minimum thickness of the joint filler shall be 1 inch except over field splices where it may be reduced to 3/4 inches. Adjustment of the profile grade may be necessary to provide the required minimum haunch thicknesses. The thickness of the joint filler material shall be adjusted as required to provide the minimum haunch thicknesses specified after the panel has been placed. The thickness shall account for any crush in the joint material due to the weight of the precast panel. The joint filler shall be glued to stringer flange and a bead of glue shall be placed on top of the joint filler just prior to placing the deck panel. The joint filler shall be placed grout-tight to keep grout from leaking through any seams or joints in the filler material. Any joint filler damaged while placing the precast deck panel shall be replaced. To evenly distribute the precast slab panel load to the stringers, additional joint filler shall be added to the interior stringers only. This additional joint filler thickness at the interior stringers only shall be a maximum of 1/4″ at midspan and taper to 0″ at centerline of bents, and shall be in addition to the joint filler thicknesses determined from the Contractor’s erection analysis. At Contractor’s option, dry pack grout may be used in place of joint filler material at no additional cost to the Owner.

At all locations where joint filler thickness exceeds 2 inches, joint filler material shall be removed and replaced with dry pack grout after installation of panels within a span is completed. Dry pack grout shall be non-shrink, specifically designed for mixing and placing at a damp pack consistency, and meet the strength requirements of Concrete

Class B-1. The Contractor shall submit the dry pack grout product information, including application methods, to the Engineer for review.

3. EPOXY BONDING AGENT

Mix and apply an approved epoxy bonding agent in strict conformance with the Manufacturer's instructions. Ensure that the application surfaces are free from oil, form release agent, laitance, dirt, or any other deleterious material that would prevent the epoxy bonding agent from bonding to the concrete surface. Remove the laitance by light sandblasting, wire brushing, or high pressure water blast. However, do not destroy or damage the surface shape and profile of the mating surfaces. The surfaces shall be free of moisture at the time the epoxy bonding agent is applied.

Apply the epoxy bonding agent only when the substrate temperature of both surfaces to be joined is between 40°F and 115°F. The formulation of the epoxy bonding agent shall have an application temperature range between 40°F and 115°F. If the mating surfaces have different substrate temperatures, then use the formulation for the higher temperature in hot weather periods, and in cold weather periods use the formulation for the lower temperature.

Plan erection and post-tensioning operations so that the time elapsing between mixing components of the first batch of epoxy bonding agent applied to the match-cast joining surfaces of precast concrete panels and the application of a compressive contact pressure across the joint does not exceed 70% of the open time for the particular formulation of epoxy bonding agent used.

If the time between combining the components of the epoxy bonding agent and applying the compressive contact pressure exceeds 70% of the minimum open time, move the precast slab panels apart, remove all epoxy bonding agent from both surfaces in a manner recommended by the Manufacturer and that will not damage the precast panel, and then reapply a new batch of the epoxy bonding agent.

4. HANDLING AND PLACING

The precast deck panels shall not be transported or erected until the concrete strength has reached the specified design unit strength. If in the Engineer's opinion, any damage has occurred during handling that will impair the function of the slab panel (structurally, aesthetically, etc.), the slab panel shall be rejected.

The precast deck panels shall be lifted only from the pick points provided in the panel. Other methods of handling the panels may be used provided they have been approved by the Engineer. The Contractor's shop drawings shall show any lifting devices used in the panels.

Just prior to placing the precast panel in its final position, the match-cast surfaces of the precast panels being joined shall be coated with an approved epoxy bonding agent in accordance with the Manufacturer's recommendations. The Contractor shall make provisions to ensure that the epoxy bonding agent does not enter the post-tensioning ducts.

The precast deck panels shall be lifted and lowered vertically when being placed on the joint filler without sliding or adjusting the panels laterally while resting on the joint filler material. The panels shall be placed as near as practicable to its final position and aligned to assure that the match cast surfaces mate with minimum effort. Any damage to the joint filler or deck panel shall be repaired to the satisfaction of the Engineer.

Begin applying the epoxy bonding agent immediately after it has been mixed. Apply the epoxy bonding agent in accordance with the Manufacturer's recommendations. Apply a complete and uniform layer of epoxy on both mating surfaces to a nominal thickness of 1/16 inches. The amount of epoxy may be required to be adjusted as necessary to completely fill the interstitial space in the joint and to extrude a small bead from the joint after application of the compressive contact pressure.

Any joints not extruding a small bead or open after the contact surfaces have been stressed may be required to be epoxy injected after the joint epoxy has set as determined by the Engineer. Any epoxy injection required to completely fill the joint will be performed at no additional cost to the Owner.

5. POST-TENSIONING

The compressive contact pressure across the joint shall be accomplished through the use of the permanent post-tensioning bars. After all post-tensioning bars have been installed the final post-tensioning force shall be applied. Continuous uniform pressure shall be maintained across the entire joint during the post-tensioning operation. The post-tensioning shall be performed symmetrically about the centerline of the panel. The final contact pressure between the panels shall be at least 250 pounds per square inch. Each post-tensioning bar shall be stressed to a final load of 89.3 kips per bar (70% of the guaranteed ultimate strength (GUTS) of the bar). The post-tensioning jacking force shall not exceed 95.7 kips per bar (75% of the guaranteed ultimate strength (GUTS) of the bar) at any time during the stressing operation.

After all post-tensioning bars have been stressed the final post-tensioning force shall be verified by the Contractor by performing lift-offs.

After the post-tensioning forces have been verified the excessive bead of epoxy shall be wiped from the joint and roadway surface.

6. GROUTING

After the post-tension has been completed the open pockets and deck haunch shall be filled with a shrinkage compensating grout. The grout shall be compatible with the zinc-rich epoxy primer applied to the top flange. The grouting operation shall start at the open pocket nearest the joint and progress from pocket to pocket to the end of the deck panel. The grout shall flow freely to the next open pocket and

fill completely the haunch area between the stringer top flange and bottom of deck panel. Grout tubes and vent holes may be incorporated into the deck panels to assure the completeness of the grouting operation. After the haunch area is completely filled, the open pockets shall be filled flush with the top of the panel with a high-early strength, shrinkage compensating concrete meeting the strength requirements of Concrete Class B1.

7. MEASUREMENT AND PAYMENT

Measurement for "PRECAST CONCRETE SLAB PANELS (WITH INTEGRAL BARRIER CURBS)" shall be made per square yard installed and accepted.

The accepted quantity of "PRECAST CONCRETE SLAB PANELS (WITH INTEGRAL BARRIER CURBS)" will be paid for at the contract unit price per square yard which price shall include all grout, joint filler, epoxy bonding agents, other materials, labor, equipment, and incidentals necessary to complete the work.

No direct payment will be made for handling, storage and shipment of the precast panels.

If necessary, adjustment of the profile grade to meet the minimum haunch requirement will not be paid as an extra cost to the Owner.

I. HANGER RETROFIT AT HINGES

1. GENERAL

This work shall consist of furnishing all materials, labor, equipment, and incidentals necessary to remove the existing pin and hanger assemblies and replace with new hinge retrofit assemblies as shown in the plans.

The Contractor shall submit detailed plans for the temporary support of the stringers and the proposed sequence of operation for review by the Engineer. Longitudinal movement at the hinge by the stringers, due to expansion and contraction, shall be accommodated by the Contractor at all times. The method of accommodating this movement shall be shown in the Contractor's submittal.

The Contractor shall take all necessary precautions during the entire operation to protect the portions of the bridge to remain in place from damage. Any damage to the existing structure to remain in place shall be repaired or replace by the Contractor, to the satisfaction of the Engineer, at the Contractor's expense. During the removal of the individual hangers at each joint location, there shall be no construction equipment located within that span. The Contractor shall provide the sequence of jacking and hanger removal in the shop drawings.

Structural steel construction shall conform to the requirements of Section 712 of the *Missouri Standard Specifications for Highway Construction*.

Prior to any fabrication of new metalwork the Contractor shall make the necessary measurements in the field to verify dimensions of the existing structure where new members are to be erected. All field verified dimensions shall be indicated as such on the shop drawing. Any deviations of the dimensions shown in the plans from the field measurements shall be called to the Engineer's attention. The Contractor shall be required to coordinate all field verified dimension and make all necessary adjustments involving fabrication and erection of the hanger assemblies. No payment or adjustment will be made where new members are affected due to any deviations of the dimensions shown in the plans against the dimensions verified in the field.

Holes in the new hinge bracket may be used as a template for drilling the holes in the existing stringers. A minimum edge distance shall be maintained for all field drilled bolt holes. The edge distance for 7/8 inch diameter H.S. bolts shall be 1 1/2 inches measured to the center of the hole.

All surfaces of the existing steel which will become faying surfaces and the inside of the drilled holes shall be cleaned and coated with one prime coat of Inorganic Zinc Primer to produce a dry film thickness on not less than 3.0 mils [75 micrometers].

Prior to erection of the new structural steel, the existing structural members that are to remain in place shall be carefully inspected by the Contractor for irregularities. If such irregularities are found they shall be brought to the attention of the Engineer.

After the hanger retrofits have been installed all structural steel shall be coated in accordance with the finish field coat specified in the contract.

2. MEASUREMENT AND PAYMENT

Measurement for HANGER RETROFIT AT HINGES shall be made per each installed and accepted.

The accepted quantity of HANGER RETROFIT AT HINGES will be paid for at the contract unit price per each which shall include all material, labor, equipment, and incidentals necessary to complete the work.

J. TEMPORARY BRIDGE

1. GENERAL

The Contractor shall provide temporary bridges to span the deck openings and closure pours during the construction of the bridge deck and end bent backwalls. The maximum ramping slope of the approaches shall not exceed 2%. The design speed during construction shall be 25

mph. The temporary bridge shall be wide enough to carry both lanes of two-way traffic and the riding surface shall be textured to provide traction to traffic. At closure pour locations, the temporary bridge shall be designed so that traffic loads will not be transferred to green concrete.

The Contractor shall provide temporary barriers for the opening between the existing bridge guardrail and the precast panel safety barrier curb.

The Contractor shall submit for approval design calculations and details for all temporary bridges and temporary barriers provided. The shop drawings for the temporary barrier shall indicate any straps and anchors required to secure the temporary barrier to the superstructure. All shop drawings and calculations shall be sealed by a Professional Engineer registered in the State of Missouri.

A thrie beam guard rail or other appropriate device approved by the Engineer shall be used between safety barrier curbs at the closure pours. The size of guard rail and method of attaching the guard rail to the precast safety barrier curbs shall be shown in the shop drawings.

The temporary bridge, temporary barrier, and thrie beam guard rail shall be designed for HS20-44 live load and include impact in accordance with the AASHTO *Standard Specifications for Highway Bridges, 17th Edition*.

2. MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for any temporary bridges, temporary barriers and attachments, and guardrails used during the construction. Payment will be considered subsidiary to other items of work.

K. STRIP SEAL EXPANSION DEVICE

1. GENERAL

This item shall consist of the following work and procedures:

a. Furnish all materials and the necessary labor to fabricate, assemble, construct and install a watertight neoprene strip seal expansion joint system, the type and size specified on the bridge plans. The joint shall be fabricated to match the cross-slope of the bridge.

b. Furnish and install the closure pour concrete adjacent to the new expansion device to the top of the riding surface in accordance with the plans.

2. DESCRIPTION

The expansion joint assembly in this contract shall be one of the following or an approved equal:

1) Wabo-Maurer Strip Seal as manufactured by Watson-Bowman & Acme Corporation, 95 Pineview Drive, Amherst, New York 14228. Ph. No. 716-691-8162.

2) Steelflex Strip Seal as manufactured by D. S. Brown Company, 300 E. Cherry Street, North Baltimore, Ohio 45872.

Ph No.419-257-3561.

3) RJ SERIES Strip Seal as manufactured by R.J. Watson, Inc. 78 John Glenn Drive East Amherst, NY 14051.

Ph No. 716-691-3301.

3. IDENTIFICATION MARKING

The seals shall be marked with the name, or a suitable trademark of the manufacturer, date of production, and lot number, at intervals of not more than 4 feet [1.2 meters]. It will not be required to date the material if the lot number certification shows the date of manufacture.

4. MATERIALS

All materials shall meet the following requirements:

a. Steel extrusions shall conform to requirements of ASTM A709 Grade 50W [ASTM A709M Grade 345W] or ASTM A709 Grade 36 [ASTM A709M Grade 250]. Gland retainers made from rolled plates will not be permitted. The upper lip of extrusion must extend over the bottom lip to avoid pinching of gland when device is in closed position

c. Neoprene strip seal shall be an extruded neoprene material meeting the requirements of ASTM D2628. The gland lugs which fasten into the steel extrusion shall be of a type which exerts pressure to the contact surfaces. Glands with snap or “arrowhead” type lugs will not be permitted.

d. Lubricant Adhesive: The strip seal shall be made watertight with a lubricant adhesive for bonding the neoprene gland to the steel extrusion as recommended by the manufacturer of the expansion joint assembly.

5. ACCEPTANCE OF EXPANSION JOINT ASSEMBLY MATERIALS

The Contractor shall furnish manufacturer’s certification in triplicate for production of neoprene strip seal represented, showing results of tests for the cured material supplied and certifying that it meets all requirements specified.

Manufacturer’s certifications for lubricant adhesive and steel shall attest that the material meets the specification requirements.

The expansion joint seal manufacturer shall furnish a letter of recommendation specifically listing recommended adhesive and elastomer concrete materials.

No materials shall be installed until the requirements of this section have been satisfactorily furnished and until the proper representation are present.

6. SHOP DRAWINGS

Complete working drawings of the expansion joint system shall be submitted to the Engineer for approval before installation of the seal. The drawings shall show in detail the type, size, location of anchors and method of installation.

7. COATING

The structural steel plates if required by the bridge plans and steel extrusions shall be cleaned and coated in the shop using two coats of inorganic zinc primer to provide a minimum dry film thickness of 5 mils [125 micrometers] in accordance with Sec 712.12 of the *Missouri Standard Specifications for Highway Construction*.

8. CLEANING AND INSTALLATION

The areas of steel extrusion to come in contact with strip seal gland shall be sandblasted prior to bonding of seal.

Structural steel plates used for shimming shall be as shown on plans for the attachment of the steel extrusion to existing expansion device armor. Connection of the extrusion to the structural steel plate may be shop or field welded. Field welding of the extrusion to the structural steel plate may be permitted by approval of the Engineer if the Contractor verifies prior to submittal of shop drawings that the existing expansion device armor is not soundly attached to the concrete.

9. METHOD OF MEASUREMENT

The expansion joints system will be measured between bridge fascias to the nearest linear foot [half meter] for each joint.

10. BASIS OF PAYMENT

Payment for the above described work including all materials, welding, coating (including touch-up), equipment, labor, furnishing, fabrication, and any other incidental work necessary to complete this item shall be considered as completely covered by the contract unit price for “STRIP SEAL EXPANSION DEVICE” per linear foot [meter].

L. PTFE BEARING ASSEMBLY (TYPE “N”)

1. GENERAL

This item shall include furnishing and installing complete factory produced bearings in accordance with the details shown on the plans and as specified in Section 1038 of the *Missouri Standard Specifications for Highway Construction* and the requirements of these

special provisions. The bearings shall be either fixed units or expansion units having sliding surfaces of mirror stainless steel against Polytetrafluoroethylene (PTFE) materials.

PTFE sliding bearings shall consist of a steel sole plate with a welded 1/8 inch [3 mm] stainless steel facing (top element) bearing on a lower element consisting of a layer of Polytetrafluorethylene (PTFE) material bonded to a 1/8 inch [3mm] stainless steel plate which is then bonded to the neoprene elastomeric pad.

2. MATERIALS

a. Structural steel sole plates shall be fabricated from steel meeting the requirements of ASTM A709 Grade 36 [ASTM A709M Grade 250] unless otherwise specified on the bridge plans. When ASTM A709 Grade 50W [ASTM A709M Grade 345W] uncoated steel is specified, the anchor bolts and welds shall have corrosion resistance and weathering characteristics compatible with the base material.

b. The stainless steel sheet for the top element of sliding bearings shall be Type 304 conforming to ASTM A240 and shall be 1/8 [3 mm] inch in thickness. The finished stainless surface shall be a plane within a tolerance of one thirty-second of an inch [0.8 mm] and shall be polished sufficiently to meet the friction requirements of this item and in addition shall be comparable to a No. 8 finish as established by the American Iron and Steel Institute Committee of Stainless Steel Producers “Finishes for Stainless Steel”.

c. The stainless steel sheet for the bottom element of sliding bearings shall be Type 304 conforming to ASTM A240 and shall be 1/8 inch [3 mm] in thickness.

d. Neoprene elastomeric pads shall be 70 durometer meeting the requirements of Section 1038 of the *Missouri Standard Specifications for Highway Construction* and dimensions as noted on the bridge plans. The shim plates within the pads shall be 11 gage or 1/8 inch [3 mm] rolled mild steel sheets conforming to ASTM A569 [ASTM A569M], A570 Grade 36 [A570M Grade 250], A611 Grade D or A607 Grade 50[Grade 345].

e. The PTFE materials shall be pure virgin polytetrafluoroethylene fluorocarbon resin, unfilled, or filled with a suitable inert filler and/or reinforcement to minimize the cold flow tendencies while maintaining the friction properties of the PTFE fluorocarbon resin. The amount of filler by weight of filled PTFE sheet shall be no less than 10 percent nor more than 35 percent. The finished materials shall exhibit the following physical properties:

		Filled	Unfilled
Requirement	Test Method	Value	Value
Hardness at 78°F [25.6°C]	ASTM D2240, Shore “D”	50-60	50-65

Tensile Strength psi	ASTM D 4895	2,000 min	2,800 min
[MPa]		[13.8] min	[19.3]min
Elongation, Percent	ASTM D 4895	150 min	200 min
Deformation Under Load	ASTM D621		10 max 15 max
Percent-73.4° F-2,000 psi			
[23°C-13.8 MPa]	Method A		
Specified Gravity	ASTM D 4895	2.16 min	2.14 min

The thickness of the finished PTFE sheet shall not be less than one-sixteenth of an inch [1.5 mm] nor more than one-eighth of an inch [3 mm].

f. Top Element: The stainless steel sheet shall be attached to the steel plate by continuous fillet welding all around the edges.

g. Bottom Element: The PTFE sheet shall be bonded to the 1/8 inch [3 mm] stainless steel with extreme care using high temperature resistant epoxy bonding material proven adequate for the purpose. The stainless steel shall then be bonded (vulcanized) to the neoprene elastomer at a high temperature and pressure controlled condition to give a homogenous type bond free of air or moisture pockets.

h. The neoprene pad shall be bonded to the base plate with an epoxy adhesive as approved by the bearing manufacturer for bonding neoprene to steel. Caution shall be taken so that the top and bottom plates are aligned properly before gluing pads.

3. SHOP DRAWINGS

Shop drawings shall be prepared in accordance with the general requirements of Section 712.3.2 of the *Missouri Standard Specifications for Highway Construction*.

4. FABRICATION

Fabrication of all parts of the bearing shall be carefully done in strict accordance with the approved shop drawings.

a. Welding of stainless plate.

During the welding procedure the surface of the stainless steel plate shall be protected from weld splatter.

At the completion of fabrication the surface of the stainless steel plate shall either have a mirror finish or be polished to such a finish.

5. TESTING AND ACCEPTANCE

One load specimen from the sliding bearing is to be tested by the manufacturer and shall consist of a bottom element at least 4 by 4 inches [101 mm x 101 mm], but preferably the length of the actual pad in the direction parallel to the stringer and at least 4 inches [101 mm] wide with a compatible size of top element. This specimen shall be loaded to 800 psi [5.51 MPa] compression and subjected to 100 slow cycles of one inch [26 mm] horizontal movement each way from center. The average coefficient of friction shall be .06 or less and the bearing shall show no signs of bond failure or other defect.

The minimum rate of testing for sliding bearings as described above shall be the greater of the following:

a. One test per year per manufacturer.

b. One test per 100 bearings furnished in a year.

The manufacturer shall proof load each laminated neoprene bearing with a compressive load of 1500 psi [10.34 MPa] on the bearing area. If bulging patterns imply laminate placement which does not satisfy design criteria and manufacturing tolerances or if bulging suggests poor laminate bond, the bearing shall be rejected. If there are 3 separate surface cracks which are greater than 0.08 inches [2 mm] wide and 0.08 inches [2 mm] deep, the bearings shall be rejected.

The Contractor shall furnish a manufacturer’s certification certifying that each bearing has passed the required proof loading.

Each manufacturer’s lot of bearing assemblies shall be accompanied by a manufacturer’s certification stating that the steel, neoprene elastomer and PTFE material meet the requirements of Section 2, Material above, showing actual test results for the materials used in the manufacture of the bearings.

Acceptance of bearing assemblies will be based on satisfactory manufacturer’s certification and inspection at the time of installation.

At the time of installation the stainless steel sliding face of the upper element and the PTFE sliding face of the lower element shall have the surface finish herein specified and shall be cleaned, free of all dust, dirt, moisture, or any other foreign matter.

6. COATING OF SOLE PLATES

The sole plates shall be cleaned and coated in the shop using two coats of inorganic zinc primer to provide a minimum dry film thickness of 5 mils [125 micrometers] in accordance with Section 712.12 of the *Missouri Standard Specifications for Highway Construction*. Care shall be taken to prevent any coating of the stainless steel plates.

7. METHOD OF MEASUREMENT

No separate measurement will be made for bearing assemblies but bearing assemblies will be included with item “HANGER RETROFIT AT HINGES” for payment.

8. BASIS OF PAYMENT

The accepted quantity of elastomeric bearing assemblies, complete in place, will be included for payment with item “HANGER RETROFIT AT HINGES”, per each.

M. SILICA FUME CONCRETE WEARING SURFACE

1.0 Description. This specification covers the production and placement of silica fume concrete for bridge deck overlays.

1.1 All material and construction procedures shall be in accordance with MoDOT specifications and specifically the applicable requirements listed in Sec 505 and Sec 505.30, except as noted herein.

1.2 Final design strength shall be as indicated on the plans.

2.0 Materials. All material used in the concrete mix shall be in accordance with Sec 501 except as noted herein.

2.1 Coarse and fine aggregates shall be in accordance with the requirements of Sec 1005 for pavement aggregate quality and gradation. Coarse aggregate shall meet Gradation D or E as outlined in Sec 1005.1.3.

2.1.1 With approval of the engineer, optimized gradations may be used, however all quality requirements, including a maximum of 2.0 percent passing the No. 200 (75 m) for fine and coarse aggregate, shall apply and the nominal maximum aggregate size shall not exceed ¾ inch. If optimized gradations are utilized, the contractor shall designate the intended gradation range for use during the inspection and quality control of the aggregates.

3.0 Concrete Mix Design. The contractor shall submit the concrete mix design for approval by Construction and Materials. The concrete mix design shall include the specific materials proposed for use, mix proportions, designated slump, air content and water/cementitious ratio. The contractor shall also submit a batching sequence of the mix design, in which the location of the plant in relation to the job site is identified, and the sequencing and place of addition of the high range water reducer is specified in accordance with the recommendations of the admixture manufacturer.

3.1 The minimum cementitious amount and maximum water/cementitious

material ratio by weight, including all cementitious material (such as cement, fly ash, ground granulated blast furnace slag, silica fume, and water components) shall meet the following requirements:

Cementitious Requirements	
Class of Sand	Minimum Total Cementitious Materials (lb/yd^3)
A	600
B	620
C	640
D	660

Maximum Water/Cementitious Material Ratio	0.40 (28.8 gal/yd^3)

3.2 Silica fume shall be used in the mix design in accordance with this specification. Contents shall be limited to the following requirements:

Silica Fume	Range: Min. 6% - Max. 8 %

3.3 A Type F or Type G high range water-reducing admixture in accordance with AASHTO M194 and Sec 1054 shall be used in the concrete mix.

3.4 A Type B retarding admixture in accordance with AASHTO M194 and Sec 1054 may be used in conjunction with a Type F water reducer.

3.5 Type III cement, admixtures containing calcium chloride, and admixtures with accelerating characteristics shall not be used.

3.6 The air content shall be 6.5 percent, plus or minus 1.5 percent.

3.7 Slump shall not exceed 6.00 inches.

4.0 Construction Requirements.

4.1 Trial batching consisting of at least 3 yd^3 per batch shall be conducted prior to the pour to ensure the mix is in accordance with this special provision. The trial batches shall be mixed and transported to the job site in the same manner as the contractor's batching sequence plan. Trial batching shall continue until the slump, air content, and water/cementitious measurements conducted at the job site are in accordance with this specification.

4.2 The high range water reducer may be added and mixed at the plant or at the jobsite in accordance with the recommendation of the admixture manufacturer. No water shall be added after the high range water reducer is incorporated into the mix. Additional high range water reducer may be added only once after the initial mixing process, but redosage shall be limited up to 50% of original dosage and total dosage shall not exceed manufacturer's recommendations. Concrete in a particular load not meeting the air, slump, or other requirements shall be rejected and the load shall be discarded.

4.3 An admixture representative shall direct the addition of the high range water reducer and document the dosage rate. The admixture shall be measured in a calibrated container and shall be added at a consistent dosage rate recommended by the manufacturer. Additional mix time and revolutions shall be conducted in accordance with the admixture manufacturer's recommendations.

4.3.1 If the entire dosage of high range water reducer is added at the jobsite, additional mixing water may be added only once prior to the addition of the high range water-reducing admixture, in which case an additional thirty revolutions at full mixing speed is required.

4.4 Slump and air content shall not deviate by more than the allowable tolerance from the mix design.

4.5 Placing and curing shall be conducted in accordance with MoDOT Specifications and specifically Sec 505.30.8, except as noted herein.

4.6 A fogging system shall be in-place prior to concrete placement. The fogging system shall consist of pressurized equipment that distributes at least 0.10 gallons of water/hour/square foot. The fogging system shall apply the fog uniformly over the entire surface of the bridge deck. The fogging system shall produce atomized water that has a droplet diameter of 80 microns (.003 inches) or less and which keeps the finished deck surface saturated without producing standing water. The contractor must submit a letter certifying that their fogging system is in accordance with this Special Provision.

4.6.1 The fogging system shall be started progressively along the length of the deck, during or immediately after floating.

4.6.2 Saturated curing mats shall be in-place prior to the fogging operation being stopped.

4.7 No water shall be added to the surface during finishing, other than from the approved fogging system.

4.8 The continuous wet cure shall be maintained a minimum of seven days and the concrete has attained a minimum compressive strength of 3000 psi.

4.9 When the weather forecast predicts a daily high temperature of 85 F or higher, the contractor shall schedule, place, and finish the entire pour with no sunlight.

5.0 Surface Texturing. Texturing of the deck surface shall be conducted in accordance with Section 703.3.14.5 unless specified otherwise in the contract.

5.1 The finished deck will be examined for cracking. If cracking is found, the engineer will determine whether cracking is detrimental, whether remedial surface repairs are needed, or whether the overlay in the cracked area should be removed and replaced. All remedial surface repairs removal or replacement shall be done at the contractor's expense.

5.2 After placement and cure of the silica fume concrete, the finished deck will be tested to detect unbonded areas.

5.3 No surface sealing shall be applied to the silica fume concrete wearing surface.

6.0 Removal. Material removal and disposal shall be in accordance with MoDOT Specification Sec 505.10.10.

7.0 Repair. Repair shall be in accordance with MODOT Specification Sec 505.10.12.

8.0 Method of Measurement. All labor, materials, and other work needed for the silica fume concrete wearing surface, in place, shall be included in the contract price for the "SILICA FUME CONCRETE WEARING SURFACE", per square yard.

N. CLEANING, LUBRICATING, AND COATING BEARING

1. GENERAL

During stages of construction in which the existing concrete deck over the existing stringers is removed, the existing stringers shall be raised and supported as required to inspect, clean, lubricate, and coat existing bearings as directed by the Engineer. The masonry plate at each bearing shall be replaced.

2. RAISING AND SUPPORTING THE SUPERSTRUCTURE

The Contractor shall exercise caution when supporting the structural steel and shall raise the stringers the minimum extent necessary to perform this work. Raising the stringers at the end bents

shall be done simultaneously to prevent any damage to the adjoining steel. The Contractor shall ensure that any elevation differences between adjacent stringers due to the Contractor's raising or lowering of the stringers are less than 1/8 inch.

Before commencing operations, the Contractor shall submit to the Engineer for review the method and sequence of operation he/she proposes to use in performing this work. The lifting operation shall be done only when authorized, but such authorization shall not relieve the Contractor of responsibility for the safety of the operation or for damage to the structure. All shop drawings and calculations shall be sealed by a Professional Engineer registered in the State of Missouri.

3. BEARING INSPECTION AND REPAIR

After the structural members are supported, the Engineer will inspect each bearing for deterioration and when indicated, the Contractor shall replace any or all portions of the deteriorated bearings.

If it is necessary to remove a bearing, the Contractor shall exercise special care to prevent any damage to the existing anchor bolts in the concrete beam. Prior to removal or disassembly all bearings shall be match-marked for re-erection at ends of each piece by stamping an identification number in the metal with a steel stencil. All existing bearing material deemed necessary to be replaced shall be disposed of by the Contractor in accordance with applicable requirements of Section 202 of the *Missouri Standard Specifications for Highway Construction*.

4. CLEANING, LUBRICATING, AND COATING

Bearings shall be cleaned in accordance with Section 712.13 of the *Missouri Standard Specifications for Highway Construction* and as specified in the special provision "RECOATING EXISTING STEEL". After cleaning and just prior to resetting the bearings, contact surfaces between the bearing pin and cradle shall be given a heavy coat of graphite and oil.

After bearings are reset they shall receive a final cleaning and a prime coat. The final coat shall be applied when the existing structural steel is coated. Coating of bearings shall be as indicated for coating existing steel outlined elsewhere in this contract.

5. BASIS OF PAYMENT

Payment for furnishing new bearing material including rocker bearing replacement, if required, shall be paid for as extra work in accordance with Section 109 of the *Missouri Standard Specifications for Highway Construction*.

Payment for the remaining items as outlined herein including all materials, labor, tools, equipment and all incidentals necessary to complete this item shall be made and considered completely covered under the contract unit price, per each, for "CLEANING, LUBRICATING, AND COATING BEARING".

O. RIVET REPLACEMENT AT FIELD SPLICES

1. DESCRIPTION

The rivets in the existing bottom flange field splices located 36 feet back-station of the hinges (Total of 16 field splices), shall be replaced with 7/8 inch diameter ASTM A325 High Strength bolts.

2. CONSTRUCTION REQUIRMENTS

PRIOR TO REMOVAL OF ANY EXISTING BRIDGE DECK, THE RIVETS SHALL BE REMOVED AND REPLACED WITH 7/8 INCH DIAMETER HIGH STRENGTH BOLTS AS SPECIFIED HEREIN.

The Contractor shall obtain approval from the Engineer for the method of removing the rivets. Any damage to the existing steel as a result of rivet removal and replacement shall be repaired at the Contractor's expense and to the satisfaction of the Engineer.

The rivets shall be replaced with 7/8" diameter ASTM A325 high strength bolts with washer under both head and nut. All surfaces of the existing steel which will become faying surfaces and the inside of the drilled holes shall be cleaned and coated with one prime coat of Inorganic Zinc Primer to produce a dry film thickness on not less than 3.0 mils [75 micrometers].

3. SEQUENCE OF CONSTRUCTION

The Contractor shall remove and replace the rivets in pairs starting with the pair nearest the centerline of the field splice and alternating from one side of centerline of field splice to the other side, working toward the splice plate ends. After any pair of rivets is removed, the faying surfaces shall be cleaned and coated with inorganic zinc primer. The rivets shall be immediately replaced with bolts and tightened to the required bolt torque before proceeding to the next rivet pair in the sequence of removal.

NO MORE THAN TWO RIVETS ON EACH SIDE OF THE FIELD SPLICE CENTERLINE SHALL BE REMOVED AT ANY TIME DURING THE REMOVAL AND REPLACEMENT OF THE RIVETS.

4. METHOD OF MEASUREMENT

The "RIVET REPLACEMENT AT FIELD SPLICES" will be measured per each rivet replaced and accepted.

5. BASIS OF PAYMENT

Payment for "RIVET REPLACEMENT AT FIELD SPLICES" will be made per each rivet replaced which price shall include all materials, equipment, and incidentals necessary to complete the above described work.

P. CLOSURE POUR

1. GENERAL

The closure pours indicated on the plans shall be Class B1 Concrete.

The slab area to be in contact with the closure pour shall be sandblasted to remove all foreign matter and shall be cleaned to remove all dirt and loose material. After the slab area has been cleaned and any damaged epoxy coating on the reinforcing bars, exposed post-tensioning bars, or post-tensioning anchorages repaired, an epoxy bonding compound shall be applied to the slab area to be in contact with the closure pour. The concrete bonding compound and application shall be in accordance with Section 623 of the *Missouri Standard Specifications for Highway Construction*.

Immediately following application and before the concrete bonding compound has set, the closure concrete shall be placed.

2. MEASUREMENT AND PAYMENT

Any cost of furnishing and mixing the concrete shall be included in the contract unit price bid for "CLASS B1 CONCRETE (CLOSURE POUR AND BARRIER CURB)" per cubic yard.

Payment for the above described work including all materials, labor, tools, equipment and all incidentals necessary to complete this item shall be made and considered completely covered under the contract unit price for "CLASS B1 CONCRETE (CLOSURE POUR AND BARRIER CURB)" per cubic yard.

Q. RECOATING EXISTING STEEL

1. General

All exposed and accessible surfaces of the existing structural steel and bearings shall be cleaned and coated.

The existing bridge is presently painted with a lead base paint and shall be cleaned and coated in accordance with these special provisions. The state estimates that there is approximately 65,700 square feet of existing steel to be coated.

Plans for the existing structure are included in the contract drawings and may be used by bidders in determining for themselves the amount of metal to be cleaned and coated with the full understanding that the State accepts no responsibility for accuracy of its approximate estimate and that the bidder's acceptance and use of this estimate shall be no cause for claim for any final adjustment in the contract price on this work. Each bidder is urged to personally view

the structure, investigate the condition of existing paint, and to prepare an estimate of quantities involved before submitting a bid.

The Contractor shall clean and coat in areas or sections as may be approved by the Engineer, usually consisting of one or more complete spans. The cleaning and application of each coat for each specified section shall be entirely completed and accepted before proceeding with any of the succeeding coats. When a span or section is cleaned and ready for coating, or when a coat has been applied, the Contractor shall notify the Engineer, and permission will be given for coating to proceed when the Engineer is satisfied that previous work is complete and acceptable.

2. Paint Removal

The existing paint shall be removed by sandblasting, by recyclable blast abrasives, or any method that meets the surface preparation requirements specified herein and the residue generated shall be collected and stored in containers furnished by the Contractor. However, if the Contractor removes the existing paint by methods other than blasting with sand and/or steel grit, the lead contaminated residue shall be considered to be hazardous waste and shall be hauled to a certified resource recovery or permitted hazardous waste facility. The use of a blast media other than silica sand or steel abrasive must be approved by the lead smelter prior to use to determine if the lead smelter can utilize the blast media as a substitute for fluxing material.

The paint removal operation shall be in such a manner to comply with all local, state and federal regulations, including but not limited to:

ENVIRONMENTAL PROTECTION AGENCY

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION STANDARDS:

29 CFR 1910 and 1926.62: Stringent air monitoring, worker protection, hygiene.

MISSOURI CODE OF STATE REGULATIONS:

10 CSR 10 Air Conservation Commission

Prohibits emissions to ambient air. Special requirements in non-attainment or maintenance areas.

Defines the need for containment of blast residue.

10 CSR 20 Clean Water Commission

Requires permits for discharge of water or solids to waters of the state.

10 CSR 25 Hazardous Waste Commission

Requires capture, containment, and proper management of lead contaminated residue.

Prohibits deposition of residue on ground.

May require compliance with 10 CSR 25-5.262 “Generator Requirements” if the TCLP (Toxic Concentration Leaching Procedure specified in 40 CSR 261) test for lead is greater than 5 ppm.

10 CSR 80 Solid Waste Management

Defines special waste disposal considerations for non-hazardous waste.

The Contractor shall have all necessary licenses and certifications as required by the Missouri Department of Health (phone 573/751-6102) including necessary licenses and certification for lead abatement/removal workers prior to commencement of the cleaning operation.

The bidder shall comply with all requirements of any local, state, and federal permits issued to the Missouri Highway and Transportation Commission for the activities associated with this project.

The bidder is encouraged to contact the appropriate regulatory agencies prior to the submission of a bid in order to ensure knowledge of any and all regulations. By the submission of a bid, the bidder affirms knowledge of all local, state, and federal regulations regarding safe removal, collection, and disposal of lead contaminated residue and that the cost of compliance of such regulations has been included in the appropriate bid items for this work.

The lead contaminated residue from the cleaning operation shall be collected and the collected residue shall be stored in containers furnished by the Contractor.

All of the containers furnished by the Contractor for storage of the lead contaminated residue shall be in good condition, free from rust, leakage and structural defects. They shall remain closed during storage except when necessary to add additional residue. Each container shall be labeled only with the labels provided by MoDOT. When the container is filled, the Contractor shall permanently and legibly record the required information on the label.

Acceptable containers for storage of the residue are:

a. Fifty-five (55) gallon open head steel drums with removable lids complete with a bolt ring, bolt and nut;

b. Covered steel roll off bulk material containers;

c. Other containers approved on a case by case basis by the Engineer.

The lead contaminated residue shall be collected, and after each day's work the Contractor shall deliver full containers to an area out of the 100 year flood plain and away from general access to the public at Preston, MO. or another location specified by the Engineer within the same hauling distance. The Commission shall be responsible for providing a storage area reasonably secure and out of the flood plain. At the end of each day's work, partially filled containers shall be stored temporarily in a secure area out of the flood plain at or near the bridge site as approved by the Engineer.

The lead contaminated residue shall be transported to an approved lead smelter. The approved lead smelters are:

a. Doe Run Company-Resource Recycling Division-Buick

Facility

Highway KK

Boss, Mo. 65440

Telephone (573) 626-4813

b. Doe Run Company-Herculaneum Smelter

881 Main Street

Herculaneum, Mo. 63048

Telephone (314) 993-3164

For more information concerning the approved smelters contact the Environmental Compliance Section at Missouri Department of Transportation telephone (573) 526-4530.

The Contractor is responsible for the shipping but shall contact the Engineer to coordinate the shipment of the lead contaminated residue to the lead smelter. The Contractor shall obtain from MoDOT the appropriate shipping papers required by MoDOT and the lead smelter. These shipping forms shall be completed prior to shipping the blast residue to the lead smelter. Any shipment received at the lead smelter without the proper shipping papers shall be rejected by the smelter.

The residue shall consist of collected media no larger than one inch [25 mm] and/or paint chips that were removed during these operations. Material other than the lead contaminated residue from the cleaning operation shall not be placed in the containers. All lead contaminated clothing, tarps, hoses and other waste material that is generated during the cleaning operation shall be tested according to all applicable state and federal regulations for determining hazardous wastes. These waste materials if determined not to be hazardous shall be disposed of at a permitted sanitary landfill, if waste materials are determined to be hazardous the waste shall be delivered by a licensed hazardous waste transporter from the designated storage area to the Doe Run Company-Resource Recycling Division-Buick Facility at Boss Missouri.

If the Contractor removes the existing paint by blasting with sand and/or steel grit, the blast residue shall be used as a fluxing material for the lead smelting process. As a substitute for a raw material requiring no additional treatment or processing, the material is no longer considered to be a solid or hazardous waste in accordance with 40 CFR 261.2(e) (1) (ii).

If the Contractor removes the existing paint by methods other than blasting with sand and/or steel grit, the lead contaminated residue shall be considered to be hazardous waste and shall be hauled to a certified resource recovery or permitted hazardous waste facility. The Contractor shall arrange for the waste to be transported by a Missouri licensed hazardous waste transporter. The Contractor is responsible for applying for a hazardous waste generator number for the project and is responsible for all waste tracking and reporting required by applicable local, state and federal regulations.

The Contractor shall maintain an inventory of the quantity of lead contaminated residue delivered to the storage site and the smelter plant.

The Commission will maintain documentation which satisfies the requirements of 40 CRF 261.2 (f).

3. Method of Measurement

Measurement of existing metal work will not be made for determining the quantity of coated material.

4. Basis of Payment

Payment for the above-described work of removing the existing paint, collecting residue, and surface preparation including all materials, equipment, labor, and any other incidental work necessary to complete this item, shall be considered as completely covered by the contract unit price for “SURFACE PREPARTATION FOR RECOATING STRUCTURAL STEEL” per square foot [square meter] or per lump sum as shown on the plans.

Payment for applying the field coat of inorganic zinc primer including all materials, equipment, labor, and any other incidental work necessary to complete this item, shall be considered as completely covered by the contract unit price for “FIELD APPLICATION OF INORGANIC ZINC PRIMER” per square foot [square meter] or per lump sum as shown on the plans.

Payment for applying the intermediate and finish coats including all materials, equipment, labor, and any other incidental work necessary to complete this item, shall be considered as completely covered by the contract unit price for “INTERMEDIATE FIELD COAT (SYSTEM G) GRAY” and “FINISH FIELD COAT (SYSTEM G) GRAY” per square foot [square meter] or per ton [megagram] as shown on the plans.

No direct payment will be made for stencils, paint, and painting specified to indicate the paint system type and date painted.

Any costs for storage and transportation of the lead contaminated residue from the bridge to the storage area including all labor, materials, equipment and all incidentals necessary to complete this work shall be included in the contract unit price per lump sum for “TRANSPORTING LEAD CONTAMINATED RESIDUE TO STORAGE AREA”.

Any costs for storage and transportation of the lead contaminated residue from the storage area to the lead smelter including all labor, materials, equipment and all incidentals necessary to complete this work shall be included in the contract unit price per lump sum for “TRANSPORTING LEAD CONTAMINATED RESIDUE TO THE SMELTER”. In the event that no lead smelter will accept the lead contaminated residue, the Contractor shall haul the lead contaminated waste to a hazardous waste disposal facility designated by the Engineer. Transportation costs for any additional mileage will be according to Section 104 of the *Missouri Standard Specifications for Highway Construction*.

Any costs for the disposal of the lead contaminated residue including all labor, materials, equipment and all incidentals necessary to complete this work shall be included in the contract unit price per lump sum for “DISPOSAL OF LEAD CONTAMINATED RESIDUE”. The lead smelter or other disposal facility will submit an invoice to MoDOT for the disposal costs of the lead contaminated residue based on the gross weight or number of 55 gallon drums of material received at the lead smelter. MoDOT will forward the invoices to the Contractor. The Contractor shall pay the lead smelter for disposal of residues within thirty (30) days of receipt of invoices by the Contractor.

R. ADDITIONAL INTERMEDIATE COATING REQUIREMENTS FOR BRIDGES

Delete Section 712.12.3.1 and replace with the following:

712.12.3.1 Unless otherwise indicated on the plans or specified herein, the application of the intermediate and finish coats (defined as field coats) for System G shall be applied per 1999 Standard Specifications to the structures and within the following limits:

BRIDGES OVER ROADWAYS AND STREAMS:(does not include "Bridges over Railroads")

(a) The field intermediate coat for beam and girder spans shall be applied to surfaces of all structural steel except as specified herein, and except that areas of steel to be in contact with concrete shall not receive the intermediate coat. The intermediate coat shall also be applied to the bearings, except where bearings will be encased in concrete.

(b) The finish coating for beam and girder spans shall include the fascia girder or beams. The limits of the fascia girders or beams shall include the bottom of the top exterior flanges, top of the bottom exterior flanges, the exterior web area, the exterior face of the top and bottom flange and the bottom of the bottom flange. Areas of steel to be in contact with concrete shall not receive the finish coat. The finish coat shall also be applied to the end bent bearings.

(c) The surfaces of all structural steel located under expansion joints of beam and girder spans shall be field coated for a distance of 1-1/2 times the girder depth, but not less than 10 feet [3 meters], from the center line of the joint. Within this limit, the items to be field coated shall include all surfaces of beams, girders, bearing, diaphragms, stiffeners and miscellaneous structural steel items. Areas of steel to be in contact with concrete shall not receive the field coats. The limits of the field coatings shall be masked to provide crisp, straight lines and to prevent overspray on adjacent areas.

(d) For all truss or steel box girder spans, the above limits shall not apply and all structural steel for these span types shall be field coated, except the areas of steel to be in contact with concrete.

(e) Where bridges are over both roadways and streams, the requirements for bridges over roadways shall be used.

Delete Section 712.12.6.1 and replace with the following:

712.12.6.1 For partial application of intermediate and finish coats for Systems G and H as outlined in Sec 712.12.3.1, the tint of the prime coat shall be similar to the color of the field coat to be used. If the field intermediate coat is the final coat on interior girders or beams then it should be similar in color to the finish coat on the fascia girders or beams.

S. NON-DESTRUCTIVE TESTING (NDT) OF EXISTING STEEL

1. General

After the concrete deck is removed, the steel that is to remain will be inspected by department personnel. In addition to this inspection, non-destructive (magnetic particle) testing of welds and adjacent base metal at ends of top cover plates at Bents 2 through 19 and at the post-tensioning plate connections to the top flange of the stringers at Bents 2 through 19 shall be performed by the Contractor. Inspection shall be done by an approved testing agency. The Contractor shall provide the Engineer with documentation of the testing agency and the qualifications of personnel performing the testing. The documentation and qualifications shall be submitted to the State Bridge Engineer for approval. Personnel performing the tests shall be qualified for SNT-TC-1A Level II. The length of weld to be tested and the base metal one inch [26 mm] either side of the weld shall be cleaned of all rust prior to the testing. If fatigue cracks are found, it is expected that some will be very small and may be located in the base metal at the toe of the welds. Any crack discovered by testing, regardless of length, shall be marked and reported to the Engineer. Any repair work and retesting required as a result of this inspection will be paid for in accordance with Section 109.4 of the *Missouri Standard Specifications for Highway Construction*. This does not relieve the Contractor from responsibility to repair any damage caused by this work at the Contractor’s expense. Any delay or inconvenience caused by this inspection requirement shall not be considered cause for

additional payment. All repairs shall be made by a MoDOT certified welder.

2. Method of Measurement

The area of weld to be tested for cover plates shall be the one inch [26 mm] returns across the ends of the cover plate plus six inches [152 mm] back along the side from each corner of the plate. On tapered ends, the weld shall be tested along the end of the cover plate, along tapered edges and 6″ back along the cover plate from end of taper.

The area of weld to be tested for the pier post-tensioning connection shall be the 7″ width of each anchor plate.

The Department has estimated that there will be 420 linear feet of top cover plate weld and anchor plate weld to be tested. Final measurements will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

3. Basis of Payment

Payment for the testing work described above including all materials, equipment, labor and all incidental work necessary to complete this item shall be made and considered completely covered under the contract unit price bid per linear foot [meter] for “Non-Destructive Testing”.

T. MECHANICAL BAR SPLICE

Mechanical bar splice systems, as shown on the plans, shall be capable of developing 125% of the specified yield strength of the bar being spliced and shall be installed in accordance with the manufacturer’s specifications and as modified by this special provision.

The Contractor shall furnish to the Engineer a manufacturer’s certification stating that mechanical bar splice systems meet all requirements of this specification. The certification shall include or have attached specific results of tests showing yield and ultimate tensile load capacities.

The splicing system may attach directly to the bars being coupled or may be of a type that provides reinforcing bars of like size that laps with the bars being joined. A threaded type splice system will be required where clearance considerations require the splicing device to be placed flush to the face of the construction joint for the initial concrete placement.

Reinforcing bar lengths shown in the Bill of Reinforcing Steel may require modification to accommodate the specific mechanical bar splice system that will be used. The Contractor shall determine the

actual rebar lengths to accommodate the manufacturer's recommendations for installation of the mechanical bar splices.

For mechanical bar splice systems that require laps with the reinforcement, the minimum lap length on each side of the joint shall be as shown in the tables below. Mechanical bar splice systems that required laps with the reinforcement shall not be used for voided slabs and solid slabs bridges. Systems that require laps shall be grade 60 [420] deformed bars in accordance with Section 1036 of the *Missouri Standard Specifications for Highway Construction*. Epoxy coated bars shall have epoxy coated mechanical bar splices.

Bar Size	Required Lap Length – Top Bars equal or greater than 12″ (300 mm) of concrete below bar			
	Plain Reinforcing		Epoxy Coated Reinforcing	
	Bar Spacing Less Than 6″ (150 mm) on Center	Bar Spacing More Than or Equal to 6″ (150 mm) on Center	Bar Spacing Less Than 6″ (150 mm) on Center	Bar Spacing More Than or Equal to 6″ (150 mm) on Center
	Inches (mm)	Inches (mm)	Inches (mm)	Inches (mm)
f′c = 3 ksi (21 MPa)				
4 (13)	29 (760)	23 (610)	35 (925)	28 (740)
5 (16)	36 (955)	29 (765)	44 (1160)	35 (925)
6 (19)	47 (1235)	37 (990)	56 (1500)	45 (1200)
7 (22)	63 (1690)	51 (1350)	77 (2050)	61 (1640)
8 (25)	82 (2225)	66 (1780)	100 (2700)	80 (2160)
9 (29)	105 (2815)	84 (2250)	127 (3415)	102 (2735)
10 (32)	133 (3575)	106 (2860)	161 (4340)	129 (3475)
11 (36)	163 (4385)	131 (3510)	198 (5325)	159 (4260)
f′c = 4 ksi (28 MPa)				
4 (13)	29 (760)	23 (610)	35 (925)	28 (740)
5 (16)	36 (955)	29 (765)	44 (1160)	35 (925)
6 (19)	43 (1145)	35 (915)	53 (1390)	42 (1115)

7 (22)	55 (1460)	44 (1170)	66 (1775)	53 (1420)
8 (25)	71 (1925)	57 (1540)	87 (2340)	69 (1870)
9 (29)	91 (2435)	73 (1950)	110 (2960)	88 (2365)
10 (32)	115 (3095)	92 (2475)	139 (3760)	112 (3005)
11 (36)	142 (3800)	113 (3040)	172 (4615)	137 (3690)

Bar Size	Required Lap Length – Other than Top Bars less than 12″ (300 mm) of concrete below bar			
	Plain Reinforcing		Epoxy Coated Reinforcing	
	Bar Spacing Less Than 6″ (150 mm) on Center	Bar Spacing More Than or Equal to 6″ (150 mm) on Center	Bar Spacing Less Than 6″ (150 mm) on Center	Bar Spacing More Than or Equal to 6″ (150 mm) on Center
	Inches (mm)	Inches (mm)	Inches (mm)	Inches (mm)
f′c = 3 ksi (21 MPa)				
4 (13)	21(545)	17 (435)	31 (815)	25 (655)
5 (16)	26 (680)	21 (545)	39 (1020)	31 (815)
6 (19)	33 (885)	27 (705)	50 (1325)	40 (1060)
7 (22)	45 (1205)	36 (965)	68 (1810)	54 (1445)
8 (25)	59 (1590)	47 (1270)	88 (2380)	71 (1905)
9 (29)	75 (2010)	60 (1610)	112 (3015)	90 (2410)
10 (32)	95 (2555)	76 (2045)	142 (3830)	114 (3065)
11 (36)	117 (3135)	94 (2505)	175 (4700)	140 (3760)
f′c = 4 ksi (28 MPa)				
4 (13)	21 (545)	17 (435)	31 (815)	25 (655)
5 (16)	26 (680)	21 (545)	39 (1020)	31 (815)
6 (19)	31 (820)	25 (655)	46 (1225)	37 (980)

7 (22)	39 (1045)	32 (835)	59 (1565)	47 (1255)
8 (25)	51 (1375)	41 (1100)	76 (2065)	61 (1650)
9 (29)	65 (1740)	52 (1390)	97 (2610)	78 (2090)
10 (32)	82 (2210)	66 (1770)	123 (3315)	99 (2655)
11 (36)	101 (2715)	81 (2170)	152 (4070)	121 (3255)

The accepted mechanical bar splice systems, complete in place, will be paid for at the contract unit price for Mechanical Bar Splice, per each. No adjustment of the estimate quantity for reinforcing steel for payment will be allowed for those bars coupled with mechanical bar splices.

U. POTENTIAL COST UNDERRUN IF REQUESTED BY THE MISSOURI DEPARTMENT OF TRANSPORTATION

The following work pay items to be paid for by the Missouri Department of Transportation may be subject to a complete or partial underrun as directed by the Engineer.

206-55.00 Temporary Shoring - per Lump Sum

611-99.03 Rock Fill (Special) - per cubic yard

V. SILICONE JOINT SEALANT FOR SAFETY BARRIER CURBS AND BETWEEN APPROACH SLAB AND WINGS

The sealing of the joints in the safety barrier curb shall consist of forming a joint configuration to the size and shape indicated on the plan details, installation of backup material, and sealing the joint with a one part ultralow modulus silicone sealant.

The sealing of the joints adjacent to wings and approach slab as shown on plans shall consist of cleaning, preparing and installation of backup material, and sealing the joint with a one part ultralow modulus silicone sealant.

1. Joint Surface Preparation

All joints shall be formed to the required dimension and cleaned of possible contaminants by sandblasting, wire brushing or other approved method. The joint interfaces must be fully cured, and dry or free of moisture at the time of installation. Remove all loose

particles by oil free compressed air or vacuum of at least 90 psi [620 kPa] before the application of the backer rod and sealant.

Any joints between the wings and approach slab 1/4 inch [6 mm] or greater shall be cleaned and packed with backing rod and silicone joint sealant. All joints less than 1/4 inch [6 mm] shall be cleaned and caulked only with the silicone joint sealant. All joint interfaces shall be cleaned of possible contaminants by grinding, saw cutting, sandblasting, wire brushing or other methods approved by the engineer. The joint interfaces must be fully cured, and dry or free of moisture at the time of installation. Remove all loose particles by oil free compressed air or vacuum of at least 90 psi [620 kPa] before the application of the backer rod and sealant.

2. Joint Backing Material

All joint areas shall be packed with a backer rod closed cell, expanded polyethylene foam to obtain the appropriate depth of the sealant and that is somewhat slightly oversized in the joint. The backer rod shall be resilient, compressible in nature, nonabsorbent, nonshrinking and compatible with the sealant.

For joint areas between the approach slab and the wings, a backer rod shall be used in the bottom of the joint slot to ensure that the sealant adheres to the sidewalls or interface of the joint.

Physical Properties of Closed-Cell Resilient Foam

Density	1.8 lbs./cu. ft. [28.8 kg/cu. m], min.
Water Absorption	(immersed in water 48 days) approx. 4% by volume
Compression	(50% deflection) approx. 15 psi [100kPa]
Recovery	(7 days after being held 7 days at 50% deflection) approx. 90% of original thickness
Tensile Strength	Approximately 25 psi [170 kPa]
Softening Point	Approximately 160°F [71°C]

3. Silicone Sealant

The sealant shall be a one component, cold applied, ultralow modulus silicone sealant with +100% elongation and -50% compressive

joint movement capability. The sealant shall meet the following requirements:

PROPERTIES	LIMITS	REFERENCE
Appearance	Smooth, uniform, gray	Visual
Flow, inches [mm]	0.2 [5.1] maximum	MIL S 8802
Extrusion rate, gms/min	90 - 250	MIL S 8802
Tack free time, minutes	35 - 75	
Cure time	7 days @ 75°-90° F [24°-32°C] and 45-55% R.H.	
Specific Gravity	1.450 - 1.515	ASTM D792
Durometer, Shore A	15 - 25	ASTM D2240
Tensile stress @ 150% elongation, psi [kPa]	45 [310] maximum	ASTM D412, Die C
Elongation, %	1200 minimum	ASTM D412, Die C

4. Sealant Placement

The sealant shall be placed to the proper configuration as shown on the plans. Joint sealer shall be protected from dust and other foreign matter until cured to a tack-free condition.

The sealant for joints between wings and approach slab should be pumped directly from the original container into the joint by the use of an air powered pump. The nozzle should be moved slightly along the joint, pushing the sealant ahead to form a uniform head. The sealant should fill the joint from the bottom to slightly below the pavement surface.

Immediately after placement and before a skin forms, the sealant shall be tooled to force it against the joint face and recess the bead approximately 1/8 inch [3 mm].

5. Packaging

The container for the joint sealant shall be labeled showing the material contained, the date manufactured, and the shelf life.

6. Approval

The contractor shall furnish manufacturer's certification attesting that the materials supplied conform to the requirements of these specifications.

Application instructions supplementing those specified herein shall be given in detail by the supplier of the joint sealer prior to start of job.

7. Basis of Payment for Joints in Barrier Curbs

Payment for forming, cleaning, back-up material, furnishing and applying the joint sealer and other incidental work items shall be considered as completely covered by the contract unit price for "PRECAST CONCRETE SLAB PANELS (WITH INTEGRAL BARRIER CURBS)", per square yard.

8. Basis of Payment for Joints Between Wings and Approach Slab

Payment for cleaning, preparing joint, back-up material, furnishing and applying the joint sealer and other incidental work items shall be considered as completely covered by the contract unit price for "BRIDGE APPROACH SLAB (BRIDGE)", per square yard [square meter].

W. COATING TOP FLANGE OF EXISTING STRINGER

1. GENERAL

The top surface of the existing stringer top flanges shall be coated with an organic zinc-rich epoxy primer prior to placement of precast deck panels. The top surface of the existing stringers shall be cleaned per the coating manufacturer’s recommendations. The Contractor shall submit the organic zinc-rich epoxy primer product information, including application methods and cure times, to the Engineer for review.

2. MEASUREMENT AND PAYMENT

Payment for applying the field coat of zinc-rich epoxy primer to the top surface of the existing stringer top flanges including all materials, equipment, labor, and any other incidental work necessary to complete this item, shall be considered as completely covered by the contract unit price for “FIELD APPLICATION OF INORGANIC ZINC PRIMER” per square foot as shown on the plans.

X. TEMPORARY SHORING

If the Contractor elects to build the temporary workpad, temporary shoring shall be required to retain the rock fill as indicated on the plans. The Contractor shall submit drawings showing the limits of temporary shoring to the Engineer and to U.S. Army Corps of Engineers (USACE) for approval. The type of shoring selected and installed shall consider the subsurface materials to be penetrated and retained.

The responsibility for the design and construction of the shoring rests solely with the Contractor. The design shall insure that the shoring is braced or substantially secured to prevent movement. The type of shoring used shall be determined by the Contractor and the Contractor shall furnish design calculations and plans for review by the Engineer. Both the design calculations and plans shall be sealed by a Professional Engineer registered in the State of Missouri.

The Contractor shall remove all shoring at the end of the project and the shoring shall become the property of the Contractor.

Payment for shoring at the locations shown on the plans including all materials, equipment, tools, labor, placing the shoring and any work incidental thereto shall be made and considered completely covered by the contract unit price for "TEMPORARY SHORING" per lump sum.

The Contractor may choose to use shoring at other locations than those indicated on the plans. No separate payment will be made for shoring used at locations other than those indicated on the plans; payment shall be included in the price bid for other items. This shoring shall become the property of the Contractor.

Y. ROCK FILL (SPECIAL)

If the Contractor elects to build the temporary workpad area, clean quarry rock containing less than 15% fines shall be placed behind the temporary shoring. If the Contractor elects to construct a temporary access pad for Spans 17-18 and 18-19 as shown in the plans, clean quarry rock containing less than 15% fines shall be used. Upon completion of the project, all rock fill shall be completely removed and all areas restored and reseeded.

The volumes of rock fill placed below the multi-purpose pool elevation shall meet the requirements of the USACE 404 permit. The USACE 404 permit information is available upon request from the Project Contact.

Payment for rock fill to construct the temporary workpad and temporary access pad including all materials, equipment, tools, labor, restoring, reseeding and any work incidental thereto shall be made and considered completely covered by the contract unit price for "ROCK FILL (SPECIAL)" per cubic yard.

Z. SUBSTRUCTURE REPAIR

1. General

This work consists of repairing the deteriorated concrete in the areas shown on the bridge plans and any other areas designated by the Engineer.

This work consists of two types.

a. Substructure Repair (Formed)

b. Substructure Repair (Unformed)

2. Construction Requirements

a. General

A one inch (25 mm) saw cut shall be made along the boundary perimeter of the deteriorated area. The area of repair shall be made approximately rectangular. Concrete within the boundary of repairs shall be removed a minimum of 1 inch (25 mm) beyond the inside edge of the reinforcing bars so exposed. The exposed reinforcing shall be thoroughly cleaned by sandblasting. If any reinforcement is extensively deteriorated it shall be replaced with a bar of like size and with adequate bond. Loose particles and dust shall be vacuumed or blown out so that only sound concrete remains. No more than 1/4 of the column perimeter shall be removed at any one time and no more than 1/8 of the column perimeter if repair is completed under live load. That portion removed shall be repaired before any further removal shall be done.

Pavement breakers of the 35-pound (15.9 kilogram) class may be used for concrete removal and chipping hammers of the 15-pound (6.8 kilogram) class shall be used to remove concrete from beneath any reinforcing bars where required, unless in the opinion of the engineer, another method would be less damaging to the concrete to remain in place. The bits shall be sharp in order to reduce pounding.

Dispose of all material as approved by the engineer.

b. Substructure Repair (Formed)

After the deteriorated concrete has been removed and the area cleaned, an epoxy bonding compound in accordance with Sec 623 shall be applied to the old concrete to remain in place and be in contact with the new concrete.

Immediately following application, but before the epoxy compound has set, Class B-l Concrete with coarse aggregate meeting the requirements of Sec 1005.1.3 (Gradation E) shall be placed and finished to match the existing concrete.

c. Substructure Repair (Unformed)

After the deteriorated concrete has been removed, the area shall be cleaned and washed with water and repaired with qualified special mortar to match the existing concrete. The qualified special mortar shall be from the qualified rapid set concrete patching material listing available from Construction and Materials or MoDOT's web site.

3. Method of Measurement

When areas of substructure repair on different planes intersect at a common corner, the computed area of repair on each plane will be measured to the original common corner.

The substructure repair will be measured to the nearest square foot (0.1 square meter). The extent of substructure repair may vary from the estimated quantities but the contract unit price shall prevail regardless of the variation.

4. Basis of Payment

Payment for the above described work including all materials, equipment, labor and any other incidental work necessary to complete the item shall be considered as completely covered by the contract unit prices for "Substructure Repair (Formed)", per square foot (square meter) and "Substructure Repair (Unformed)", per square foot (square meter).

AA. Possible Research Investigation Work

1.0 Since a unique construction method is being used to replace the deck, MoDOT Research, Development and Technology (RDT) personnel may be present to document placement of the deck panels.

2.0 Additionally, if available, RDT personnel may install some sensors in the deck. During the grouting of the shear connector holes in the precast slab panels or right before the silica fume concrete overlay is poured, MoDOT RDT personnel shall be allowed to install RFID (Radio Frequency ID) sensors. The locations and types of sensors, if available, will be determined, paid for and placed by MoDOT personnel so as not to inconvenience the contractor's schedule.

3.0 If these sensors are installed, the contractor is to exercise caution around sensors, so as not to damage them. If the sensors are damaged by the contractor's construction activity, the contractor is responsible for the cost of replacing any damaged sensors.

4.0 No direct payment will be made to the contractor for allowing the above mentioned work.

1. RESIN ANCHOR SYSTEMS (BRIDGES)

The following are the approved resin anchor systems which will be accepted, except that the system used shall also meet any additional requirements as shown on the bridge plans. The manufacturer shall certify the minimum ultimate pullout strengths. Reinforcing bars or threaded rods used with these systems shall be as specified on the bridge plans.

1. Hilti HVA and HEA Adhesive Anchor System, Hilti Hit Doweling (C-10), Hit HY-150 Anchor Systems and HSE-2411 as manufactured by Hilti, Inc., P. 0. Box 21148, Tulsa, Oklahoma 74121

2. Molly Parabond Capsule and Paramount Pour Anchor Systems as manufactured by Molly Division, USM Corp., 504 Mt. Laurel Ave., Temple, Pennsylvania 19560

3. Sup-R-Set Synthetic Resin Capsule Anchor System as manufactured by U.S.E. Diamond, Inc., P. 0. Box 1589, 500 State Street, York, Pennsylvania 17405

4. Ramset Chemset Anchor System as manufactured by Ramset Fastening System, Shamrock Ave., East Alton, Illinois 62024

5. ESSVE Chemical Anchor UKA 3 System as manufactured by ESSVE OF NORTH AMERICA, INC., 8825 Roswell Road, Suite 600, Dunwoody, Georgia 30338

6. Redi-Chem Anchor System as manufactured by ITT Phillips Drill Division (Red Head), P. 0. Box 364, Michigan City, Indiana 46360

7. Moore Adhesive Capsule Anchor System as manufactured by Moore Construction Products, Inc., 429 Boston Turnpike, Shrewsbury, MA 01545

8. Sure Chemical Anchor System as manufactured by AMCA International, 2701 Industrial Drive, Bowling Green, KY 42101

9. Sikadur 31 Hi-Mod Gel and Injection Gel Anchor Systems as manufactured by Sika Corporation, P. 0. Box 297, Lyndhurst, New Jersey 07071

10. Anchor-It Bolt Grout Anchor System used with Solid Bond 200 epoxy groutas manufactured by Adhesive Technology Corporation, 21850 88th Pl. S., Kent, WA 98031

11. Kelken Construction Systems as manufactured by Kelken-Gold, Inc., 3220 Bordentown Ave, Parlin, NJ 08859

12. Sup-R-Resin 392 High Strength Polyester Grout Anchor System as manufactured by U.S.E. Diamond, Inc., P. 0. Box 1589, 500 State Street, York, PA 17405

13. Poly-Carb Mark-198 Epoxy Grout Anchor System as manufactured by Poly-Carb, 33095 Bainbridge Road, Cleveland, Ohio 44139

14. Poly-All Anchoring System as manufactured by Ackerman Johnson Fastening Systems, Inc., 327 Factory Road, Addison, Illinois 60101

15. Permagile 1-215 HM Gel and Permagile Bond-l Gel Anchoring Systems both manufactured by Permagile Industries, Inc., 101 Commercial Street, Plainview, New York 11803

16. Powers Rawl Chem-Stud Anchor System and Powers Rawl Hammer-Capsule as manufactured by Powers Fastening, Inc., 2 Powers Square, New Rochelle, New York 10801

17. MP-3 Polyester Anchoring System as manufactured by Energy Absorption System, Inc., One East Wacker Drive, Chicago, Illinois 60601

18. Celtite 21-24 TX Grout, 21-30 Anchortite and Anchor Bond Anchor Systems all manufactured by Celtite, Inc., 13670 York Road, Cleveland, Ohio 44133

19. Moore HAC Hammer Capsules as manufactured by Moore Construction Products, 250 Barber Avenue, Worcester, MA 01606, Tel. (508) 853-3991

20. Pro-Poxy 400, Pro-Poxy 300 and Pro-Poxy 300 Fast as manufactured by Unitex, 3101 Gardner, Kansas City, MO. 64120

21. R-304 as manufactured by Richmond Screw Anchor Co., 417 Main Street, Fenton, MO 63026

22. Ankr-tite and Slam-tite as manufactured by Ankrtite Fastening Systems, 2415 E. 13th Place, Tulsa, OK 74104.

23. Spec Bond 201 as manufactured by Conspec Marketing and Manufacturing Co., Inc., 636 South 66th Terrace, Kansas City, KS 66111

24. Ramset Maxima 7, Ramset Impact glass capsule, Epcon Acrylic 7 Adhesive and Epcon Ceramic 6 Epoxy Adhesive as manufactured by ITW Ramset/Red Head, 1300 North Michael Dr., Wood Dale, IL 60191

25. Ultrabond 1300, Ultrabond EZ-Set Capsules, Ultrabond Glass Capsules and Ultrabond Speed Set-2 as manufactured by US Anchor Corp., 450 E. Copans Rd., Pompano Beach, FL 33064

26. Inject-Tite Fast Set and Inject-Tite Standard Set as marketed by Ankr-Tite Fastening System, 2415 E. 13th Place, Tulsa, OK 74104

27. Polyject #1257 as manufactured by Polygem, Inc., P.O. Box 609, West Chicago, IL 60185

28. Rezi-Weld Gel Paste-State Unitized Cartridge as marketed by W. R. Meadows, P.O. Box 543, Elgin, IL 60121

29. ArrowBond 1300 and ArrowBond 1300 Fast as marketed by Fenton Supply Inc., 983 Gravois Road, Fenton, MO 63026

30. R-304 as marketed by Symons Corporation, 200 E. Touhy Ave., Des Plaines, IL 60018

31. HI-TECH Standard Gel and HI-TECH Structural Gel - Fast as marketed by HI-TECH Structural Epoxy Systems,9239 Utica Ave., Suite 150, Rancho Cucamonga, CA 91730

32. Anchor Gel - Two Hour Cure as marketed by CPR Products, Inc., 1250 Gravois Road, St. Louis, MO 63104

33. CWC 910 Epoxy - as marketed by Carter-Waters Corporation, 2440 West Pennway, Box 412676, Kansas City, MO 64141

34. Rapid Gel & Epogel - as marketed by ChemRex Inc., 889 Valley Park Drive, Shakopee, MN 55379

35. Acrylic Tie - as marketed by Simpson Strong Tie, 1720 Couch Dr., McKinney, TX 75069

These anchor systems shall be installed according to the manufacturer's specifications with the following exceptions:

1. Kelken Construction Systems shall have a minimum embedment of 6-1/2″ [170 mm] for 5/8″ [16 mm] diameter rods or reinforcing bars and a 8″ [205 mm] minimum embedment for 3/4″ [19.5 mm] or 7/8″ [22.2 mm] diameter rods or reinforcing bars.

2. Sikadur 31 Hi-Mod Gel and Injection Gel Anchor Systems and Sure Chemical Anchor System shall have a minimum embedment of 5″ [130 mm] for 5/8″ [16 mm] diameter rods or reinforcing bars and a 6 3/4″ [180 mm] minimum embedment for 3/4″ [19.5 mm] and 7/8″ [22.2 mm] diameter rods or reinforcing bars.

3. Anchor-It Bolt Grout Anchor System, Permagile 1-215 HM Gel Anchoring System, Permagile Bond-l Gel Anchoring System, Rawl Chem-Stud Anchor System, MP-3 Polyester Anchoring System, and Poly-Carb Mark-198 (Kelken-Gold Kelipoxy) Epoxy Grout Anchor System shall have a minimum embedment of 5″ [130 mm] for 5/8″ [16 mm] diameter rods or reinforcing bars and 7″ [180 mm] for 3/4″ [19.5 mm] and 7/8″ [22.2 mm] diameter rods or reinforcing bars.

4. Celtite 21-24 TX Grout, 21-30 Anchortite and Anchor Bond Anchor Systems shall have a minimum embedment of 6 1/2″ [170 mm] for 5/8″ [16 mm] diameter rods or reinforcing bars and a 8″ [205 mm]minimum embedment for 3/4″ [19.5 mm] and 7/8″ [22.2 mm] diameter rods or reinforcing bars.

2. PROTECTIVE COATING - CONCRETE BENTS (DELETERIOUS AGENTS

1. Description

This work shall consist of the surface preparation and the furnishing and application of modified urethane or polyurethane elastomeric protective coating to be used for sealing the top and all

sides of concrete bents, piers and abutments as noted on the bridge design plans.

Unless otherwise stated, ASTM specifications references are from the version in effect at the time of this contract.

2. Construction Procedure

New concrete shall have been cured a minimum of 28 days before application of protective coating. The application shall be in accordance with the manufacturer's instructions.

The surfaces to be sealed shall be cleaned by brush blasting or another approved method to remove all dirt, grease, loose concrete, loose coating, etc. that may be harmful to the adhesion of the protective coating to the concrete.

After the surface preparation is complete, the protective coating shall be applied to the surface of all concrete noted on the bridge design plans. The coating shall be applied as required to obtain a one coat thickness of at least 40 mils [1 mm], dry film. Any uneven surface which would allow ponding of water shall be given additional coats as required by the engineer.

3. Materials

The mixed material shall conform to the following requirements:

(a) Mixed Material:

% Solids Content, by weight	80 min. ASTM D 1644, Method A.
Pot Life @ 75° F [24°C]	45 minutes, min.

(b) Cured Materials:

Shore A Hardness	15 min., ASTM D 2240, material shall be cured in 40 mil [1mm] thick film for 7 days at 75°±2°F [24°±1°C] with 50% relative humidity. Test specimen shall be composed of plied pieces, to a minimum thickness of 1/4 inch [6 mm].

Tensile Strength 45psi [310kPa], min ASTM D412*

Elongation 400 percent, min ASTM D 412*

Water Vapor permeability 0.8 perms, Max.; ASTM D 1653 or ASTM E 96, Method BW 40 mil [1 mm] film thickness.

*Method and time of cure may be modified as recommended by the manufacturer.

The materials, as manufactured, shall be for outdoor exposure and shall be resistant to deterioration by ultra violet light. Additives for ultra violet stabilization to the material after the original manufacturing process will not be allowed.

The material shall be applicable to concrete surfaces which have received a sandblast cleaning as a maximum surface preparation. Materials which require other surface preparation such as acid etching, scrabbling, priming, etc., will not be allowed.

The material shall be capable of being applied by roller, squeegee, or brush to obtain a one-coat thickness of 40 mils [1 mm], dry film. The material shall not excessively run or sag when applied to a vertical concrete surface.

The material shall have a minimum shelf life, in unopened containers, of at least 6 months from the date of delivery.

Packaging. Two component materials shall be prepackaged to exact mixing quantities.

4. Prequalification

Prior to approval and use, the manufacturer shall submit a representative one-gallon [3.8 liter] sample to the Project Operations 2211 St. Mary's Blvd., Jefferson City, Missouri, 65109. The sample shall be clearly identified as to brand name, manufacturer's name and address, and accompanied with the following information:

(a) Manufacturer's complete material data showing typical test results for the properties herein specified, generic name of the major components of the materials, mixing instructions, surface preparation, application instructions, any modification to the standard tests herein specified, and intended use.

(b) Test results after 1000 hours exposure in a weatherometer, in accordance with ASTM D 822, Procedure B. Test specimens film thickness shall be 40 mils [1 mm] and shall show no cracking, flaking, or blistering after exposure. Slight discoloration will be allowed.

(c) In lieu of the weatherometer test results required in paragraph 4(b), the manufacturer may submit a use history showing

satisfactory performance for 3 years in at least two exposed applications. Name, address, and telephone number of the users shall be included in the use history.

After a review of the above data and based on results of tests performed on the representative sample, the engineer will notify the manufacturer whether the material has been added to the list of prequalified materials.

5. Acceptance

The contractor shall furnish a manufacturer's certification, in triplicate, certifying that the material supplied conforms to all requirements specified and certifying the material furnished is of the same composition as originally prequalified.

The engineer reserves the right to sample and test any or all of the material supplied.

Nothing in this specification shall waive the requirements of Section 106.

6. Basis of Payment

Payment for the above described work including all materials, equipment, labor and any other incidental work necessary to complete this item of work shall be considered as completely covered by the contract unit price for "PROTECTIVE COATING – CONCRETE BENTS (DELETERIOUS AGENTS)", per lump sum.