SPECIAL PROVISIONS

to

KTU CONSTRUCTORS STANDARD SPECIFICATIONS FOR CONSTRUCTION

SPECIAL PROVISION #1 - DEFINITIONS

For the purposes of the KTU Constructors Standard Specifications for Construction the following definitions shall apply:

Commission. The Missouri Highways and Transportation Commission.

Contractor. For the purposes of Standard Specifications and Special Provisions the term "contractor" shall be replaced with "subcontractor".

Engineer. KTU Constructors or its Designer.

SPECIAL PROVISION #2 - SECTION 202, REMOVAL OF ROADWAYS AND BUILDING

After the last sentence of Paragraph 202.30.1.1, add the following text: *All signs identified as removals will be removed by the Commission.*

SPECIAL PROVISION #3 - SECTION 216, REMOVALS FOR BRIDGE STRUCTURES

After the last sentence of Paragraph 216.10.1, add the following text: *All painted steel contains lead paint. The contractor shall submit a demolition plan prior to start of bridge removal detailing means and methods for:*

(a) Protecting existing waterways

(b) Abatement of lead based paint

(c) Abatement of asbestos containing materials

SPECIAL PROVISION #4 - SECTION 403, ASHPALTIC CONCRETE PAVEMENT

After the last sentence of Paragraph 403.1, add the following text: *At the contractor's option, if the project bridge is not on a major route and if the ADT is less than 2,000, cold mixed bituminous pavement mixture may be substituted for hot bituminous pavement mixture at bridge approaches.*

SPECIAL PROVISION #5 - SECTION 616, TEMPORARY TRAFFIC CONTROL

Add the following subsection:

616.1.1 Requirements. *The contractor shall develop, install, maintain and remove temporary traffic control for all:*

(a) Project Bridges on or over divided highways;

(b) Project Bridges constructed with staged construction;

(c) Project Bridges constructed using a bypass;

(d) All roadways under a Project Bridge;

(e) Work which is not continuous with the removal and replacement of a Project Bridge, such as core drilling and completion of punch list items; and

(f) All warranty work.

The Commission shall be responsible for Maintenance of Traffic for all road closures for the removal and replacement of the remaining Project Bridges. The contractor will cooperate with Commission to ensure that all traffic control devices are protected and not disturbed. The contractor will coordinate access to the project bridge through the temporary traffic control with the engineer. The Commission will be responsible for all detour routes, with the reasonable cooperation of the contractor for implementing any necessary adjustments to the operations to prevent disruption of the traffic flow resulting in unreasonable traffic delays.

When traffic control plans are the responsibility of the contractor, the contractor shall develop and submit, for Approval, Traffic Control Plans for each stage of construction on each Project Bridge that shows the contractor's proposed construction staging and proposed traffic control devices consistent with the MOT Plan. Revisions to a TCP shall also be submitted to the engineer for review and Approval. The TCPs shall include, at a minimum, a detailed diagram of the work zone that shows the location of all traffic control devices, lane widths, work zone speed limits, temporary bypasses and detour routing. The contractor shall provide Traffic Control Plans (TCP) and bypass detail sheets, if applicable, 120 Days prior to start of construction for each Project Bridge that the Contractor is responsible for developing TCP. Any contractor provided MOT Plan shall identify the contractor's strategy to provide for the safe and efficient movement of people, goods and services through and around each Project Bridge while minimizing impacts to local residents, business and commuters; such MOT Plan shall include:

(a) Traffic Control Plans (TCP);

(b) Plan to maintain resident, business and school access to emergency and other service providers;

(c) Plan to minimize traffic impacts to school districts, businesses, farmers and local residents;

(d) Plan to maintain and control pedestrian, bicycle and other non-vehicular traffic.

(e) Public information plan to share information about the Project Bridge, including but not limited to construction schedule and potential traffic impacts, with those potentially affected.

Access to all parcels within each improvement limit shall be maintained or the contractor shall provide alternative access. Contractor shall describe the MOT Plan with reasonable, measurable tasks and milestones. The contractor shall conform to the following:

(a) The contractor shall notify the engineer of any lane and road closures necessary to perform work on each Project Bridge by submitting a Notice of Intent to Perform Work form prior to instituting or changing such traffic control measures. This form shall be submitted at least 2 Business Days prior to start of construction or impact to traffic and should include the state bridge number, date and time of day, which must be within regular business hours, the Project Bridge closure is being requested. The Notice of Intent to Perform Work form is located at http://www.modot.org/asp/intentToWork.shtml.

(b) The contractor shall notify the engineer 17 Business Days prior to any vertical clearance reduction that provides less than 18 foot clearance, any load capacity reductions or any width reduction that results in a restriction of less than 20 feet, which includes road closures. Notification shall be in the form of the Overdimension/Overweight Workzone Restriction Request Form.

(c) Any Project Bridge that is or has an overhead obstruction shall have a MoDOT's motor carrier services Bridge Clearance Report completed and submitted to the engineer before the over-dimension/overweight work zone restriction is removed. This submittal should be prior to the bridge opening and as close as reasonably practical.

(d) The contractor's placement of construction equipment, materials and vehicles shall comply with AASHTO policies and guidelines.

The contractor shall be responsible for maintaining the existing traffic flow through the job site. If disruption of the traffic flow occurs with unreasonable traffic delays, the contractor shall review the construction operations that directly contributed to the disruption of the traffic flow and make any limited adjustments to the operations to reduce or prevent the queues from reoccurring. Limited adjustments to stage or bypass traffic control would include such actions as pothole patching in the travel lane(s), adjustment of traffic tapers or other temporary and moveable traffic control devices, or movement/addition of advance signing.

SPECIAL PROVISION #6 - SECTION 620, PAVEMENT MARKING

After the last sentence of Paragraph 620.1, add the following text: *The contractor shall provide all temporary pavement markings. If pavement markings are to be relocated during construction, temporary marking shall be provided. Conflicting pavement markings, either temporary or permanent, shall be removed. Permanent pavement marking will be installed by the Commission upon completion of the Project Bridge. The contractor will be responsible all temporary and permanent pavement markings on Project Bridges that are not closed.*

SPECIAL PROVISION #7 - SECTION 627, CONTRACTOR SURVEYING AND STAKING

After the last sentence of Paragraph 627.2.1 add the following text: *The engineer will provide two control points at each project bridge.*

SPECIAL PROVISION #8 - SECTION 702, LOAD BEARING PILES

Add the following subsection:

***702.2.7 Owner/Contractor Furnishing Piling**. All piling for use in the work shall be furnished by KTU Constructors. Piling will be furnished in standard lengths of between forty (40) and sixty (60) feet. The contractor shall provide the engineer a Pile Order Request indicating the number of each length requested and the requested delivery date for a project bridge within five (5) days of receiving Notice to Proceed 1 (NTP1).*

SPECIAL PROVISION #9 - SECTION 903, HIGHWAY SIGNING

After the last sentence of Paragraph 903.1, add the following text: *The Commission will install new signing as required, except for any signs that are damaged or unnecessarily removed by the contractor and delineation at bridge ends.*

SPECIAL PROVISION #10 - UNIT PRICES

Where unit prices are indicated in the Proposal Submittal Documents (General Requirements - Division I, Article C), the work will be measured in the field an paid on a unit price basis. This Special Provision will govern over any lump sum measurement and payment provisions found in the Standard Specifications (Division II, Article A).

SPECIAL PROVISION #11 - ADDITIONAL APPLICABLE STANDARDS

The following Additional Applicable Standards (AAS) that were submitted with KTU's Final Technical Proposal and approved by the Commission are included with the Special Provision and supplement or replace the Standard Specifications as described therein:

(a) AAS 2.1 - Prestressed concrete cored slabs

(b) AAS 2.2 - Prestressed concrete box beams

(c) AAS 2.3 - Testing concrete strength using maturity method

(d) AAS 2.4 - Removal of forms and falsework

(e) AAS 2.13 - Load bearing piles

(f) AAS 2.16 - Evazote joint

(g) AAS 2.17 - Waterproofing membrane

(h) AAS 2.18 - Concrete placement temperature

AAS 2.1
PRESTRESSED CONCRETE CORED SLABS

2.1.1 General. Prestressed concrete cored slab units similar to those in use by the North Carolina DOT will be used on the project as appropriate according to the following. This specification was developed from the following documents, available in KTU's Final Technical Proposal:

(a) Sample drawings showing details of the adjacent and spread cored slabs.

(b) NCDOT specifications 430 and 1078 for cored slabs.

(c) NCDOT Structure Design Manual Section 6-4 discussing cored slab use.

2.1.1.1 Transverse Connection of Units. Bridges will be joined together transversely with post tensioning strand or post-tensioning bars located at the interior diaphragms as shown on the Released for Construction drawings.

2.1.1.2 Skew. Girders shall be fabricated and erected on the skews shown in the Released for Construction drawings.

2.1.1.3 Allowable Stresses. Allowable stresses will be in accordance with the AASHTO Standard Specifications for Highway Bridges, 17th Edition.

2.1.2 Fabrication. Place concrete in accordance with Section 1029 and the additional requirements of this article. Place concrete for cored slabs in 2 or more horizontal layers. Place and compact each layer before the preceding layer takes initial set so that there is no surface or separation between layers. Should shrinkage or settlement cracks occur, the engineer reserves the right to require additional layers and/or vibration. These requirements may be waived with the permission of the engineer if self consolidating concrete is used.

When box beams are cast, a positive hold-down system shall be employed to prevent voids from moving. Design the system to be left in place until the concrete has reached the release strength. At least six weeks prior to casting box beams, the manufacturer shall submit to the engineer for review and comment, detailed drawings of the proposed void material and hold-down system. In addition to structural details, location and spacing of the hold-downs shall be indicated. The manufacturer shall also submit his proposed method of concrete placement and of consolidating the concrete under the void.

2.1.2.1 Finish. This special provision replaces 1029.6.14 and 1029.6.15 in it's entirety. The top surface of the cored slab sections shall be as shown on the Released for Construction drawings..

Surface finish shall be in accordance with Sec 703.3.5.8, except that no cracks of any kind in post-tensioned members shall be filled before the stressing is completed. The engineer will determine the kind, type and extent of cracks and surface defects, such as honeycomb and chipped edges or corners, that will be tolerated. Repairs may be permitted with mortar in accordance with Sec 703.3.2.9. Commercially available patching material may be used if approved by the engineer.

For cored slabs that will carry a concrete deck or overlay, the top surface of members shall be scored transversely to a depth of approximately 1/4 inch (6 mm) with a wire brush, stiff broom or other approved method. A 3-inch (75 mm) wide strip across the top flange of the member shall be smooth finished to accurate top flange depth at each point designated on the plans. No laitance shall remain on surfaces to be embedded in concrete.

For cored slabs that will carry a waterproofing membrane and asphalt overlay, the top surface of members shall be broom finished with a stiff broom or other approved method. A 3-inch (75 mm) wide strip across the top flange of the member shall be smooth finished to accurate top flange depth at each point designated on the plans. No laitance shall remain on surfaces.

After removal of hold-down devices, holes shall be plugged. If the method for plugging these holes is not shown on the shop drawings, written approval of the proposed method shall be obtained from the engineer. Exposed reinforcing steel shall be thoroughly cleaned of all concrete before delivery of members. The portions of girders to be embedded in the diaphragms at supports shall be roughened by sandblasting or other approved methods to provide suitable bond between girder and diaphragm. Mechanical benders, without the use of heat, shall be used to bend the strands on girders.

No surface finish is required for sides and bottom of the cored slab sections except the exposed side of the exterior beam section as noted on the plans. Provide a resulting surface finish essentially the same color and surface finish as the surrounding concrete.

2.1.2.2 Alignment and Dimensional Tolerances. Ensure that pieces fit together neatly and in a workmanlike manner. Manufacture box beams within the tolerances indicated in Section 1029.7, Table I.

2.1.3 Erection. Erect Cored Slabs in accordance with Section 705.4.2 and the additional requirements of this article. Post-tensioning of cored slabs shall be in accordance with 1029.6.9. After erecting prestressed cored slabs, place the transverse post tensioning strands and tension to the jacking force specified on the plans. The transverse strands shall be greased and placed in a noncorrosive 1/16" minimum wall thickness black polyethylene pipe meeting the requirements of ASTM D2239. Do not apply grease or extend the pipe in the area of the recesses at the ends of the tensioning strands where grout is applied. If tie rods are specified on the plans, tighten the tie rods to the torque specified on the plans. After stressing the transverse post tensioning strands or tightening tie rods, fill the shear key, dowel holes, and recesses at the ends of transverse strands with an approved non-metallic, non-shrink grout and cure until the grout reaches a minimum compressive strength of 3000 psi.

After tensioning and curing, obtain approval prior to placing material and equipment on the cored slab spans. Place support cranes or other equipment exceeding the legal load limit on mats. Submit for review a detailed drawing for the mats that are intended for use on the cored slabs. Provide a complete description of the equipment that is intended for placement on the mats. Supply and construct mats at no additional cost to the engineer.

2.2.4 Payment. Payment for cored slabs shall be made in accordance with Section 705.

AAS 2.2
PRESTRESSED CONCRETE BOX BEAMS

2.2.1 General. Prestressed concrete box beam units similar to those in use by the North Carolina DOT will be used on the project as appropriate according to the following. This specification was developed from the following documents, available in KTU's Final Technical Proposal:

(a) Sample drawings showing details of the adjacent and spread box beams.

(b) Original NCDOT specifications 430 and 1078 for box beams.

(c) Original NCDOT Structure Design Manual Section 6-4 discussing box beam use.

2.2.1.1 Transverse Connection of Units. Bridges will be joined together transversely with post-tensioning strand or post-tensioning bars located at the interior diaphragms as shown on the Released for Construction drawings. Bridges with concrete overlay will be joined together with a combination of the composite overlay and 1" diameter Grade A36 tie rods. Transverse connection of box beam units will only be required for bridges with adjacent box beam units.

2.2.1.2 Skew: Girders shall be fabricated and erected on the skews shown in the Released for Construction drawings..

2.2.1.3 Allowable Stresses. Allowable stresses will be in accordance with the AASHTO Standard Specifications for Highway Bridges, 17th Edition.

2.2.2 Fabrication. Place concrete for box beams in 2 or more horizontal layers. Place and compact each layer before the preceding layer takes initial set so that there is no surface or separation between layers. Should shrinkage or settlement cracks occur, the engineer reserves the right to require additional layers and/or vibration. These requirements may be waived with the permission of the engineer if self consolidating concrete is used.

When box beams are cast, a positive hold-down system shall be employed to prevent voids from moving. Design the system to be left in place until the concrete has reached the release strength. At least six weeks prior to casting box beams, the manufacturer shall submit to the engineer for review and comment, detailed drawings of the proposed void material and hold-down system. In addition to structural details, location and spacing of the hold-downs shall be indicated. The manufacturer shall also submit his proposed method of concrete placement and of consolidating the concrete under the void.

2.2.2.1 Finish. This special provision replaces 1029.6.14 and 1029.6.15 in it's entirety. The top surface of the box beam sections shall be as shown on the Released for Construction drawings.

Surface finish shall be in accordance with Sec 703.3.5.8, except that no cracks of any kind in post-tensioned members shall be filled before the stressing is completed. The engineer will determine the kind, type and extent of cracks and surface defects, such as honeycomb and chipped edges or corners, that will be tolerated. Repairs may be permitted with mortar in accordance with Sec 703.3.2.9. Commercially available patching material may be used if approved by the engineer.

For box beams that will carry a concrete deck or overlay, the top surface of members shall be scored transversely to a depth of approximately 1/4 inch (6 mm) with a wire brush, stiff broom or other approved method. A 3-inch (75 mm) wide strip across the top flange of the member shall be smooth finished to accurate top flange depth at each point designated on the plans. No laitance shall remain on surfaces to be embedded in concrete.

For box beams that will carry a waterproofing membrane and asphalt overlay, the top surface of members shall be broom finished with a stiff broom or other approved method. A 3-inch (75 mm) wide strip across the top flange of the member shall be smooth finished to accurate top flange depth at each point designated on the plans. No laitance shall remain on surfaces.

After removal of hold-down devices, holes shall be plugged. If the method for plugging these holes is not shown on the shop drawings, written approval of the proposed method shall be obtained from the engineer. Exposed reinforcing steel shall be thoroughly cleaned of all concrete before delivery of members. The portions of girders to be embedded in the diaphragms at supports shall be roughened by sandblasting or other approved methods to provide suitable bond between girder and diaphragm. Mechanical benders, without the use of heat, shall be used to bend the strands on girders.

No surface finish is required for sides and bottom of the box beam sections except the exposed side of the exterior beam section as noted on the plans. Provide a resulting surface finish essentially the same color and surface finish as the surrounding concrete.

2.2.2.2 Alignment and Dimensional Tolerances. Ensure that pieces fit together neatly and in a workmanlike manner.

Manufacture box beams within the tolerances indicated in Section 1029.7, Table I.

2.2.3 Erection. Erect Box Beams in accordance with Section 705.4.2 and the additional requirements of this article. Post-tensioning of box beams shall be in accordance with 1029.6.9.After erecting prestressed box beams, place the transverse post tensioning strands and tension to the jacking force specified on the plans. The transverse strands shall be greased and placed in a noncorrosive 1/16" minimum wall thickness black polyethylene pipe meeting the requirements of ASTM D2239. Do not apply grease or extend the pipe in the area of the recesses at the ends of the tensioning strands where grout is applied. If tie rods are specified on the plans, tighten the tie rods to the torque specified on the plans. After stressing the transverse post tensioning strands or tightening tie rods, fill the shear key, dowel holes, and recesses at the ends of transverse strands with an approved non-metallic, non-shrink grout and cure until the grout reaches a minimum compressive strength of 3000 psi.

After tensioning and curing, obtain approval prior to placing material and equipment on the box beam spans. Place support cranes or other equipment exceeding the legal load limit on mats. Submit for review a detailed drawing for the mats that are intended for use on the box beams. Provide a complete description of the equipment that is intended for placement on the mats. Supply and construct mats at no additional cost to the engineer.

2.2.4 Payment. Payment for Box Beams shall be made in accordance with Section 705.

AAS 2.3
TESTING CONCRETE STRENGTH USING MATURITY METHOD

2.3.1 Description. When approved in writing by the engineer, this maturity method, similar that in use by the Iowa DOT, may be used on the project as appropriate according to the following. This specification was developed from Iowa DOT Material IM 383, available in KTU's Final Technical Proposal:

2.3.2 General. Measuring the strength of Portland Cement Concrete using the Maturity Method is a two-step procedure. First, a relationship must be established between the maturity values and the concrete strength as measured by destructive methods (that is, through testing of beams or cylinders). The development of the maturity-strength curve shall be done in the field at the beginning of construction using project materials and the project proportioning and mixing equipment. The second step is the instrumentation of the concrete to be measured. Temperature probes are installed in the concrete and the temperature is measured. From those measurements, along with the age at which the measurements were taken, maturity values are determined. A maturity meter of temperature-measuring device and a computer or calculator may also be used to determine the maturity values.

2.3.2.1 The contractor shall develop a plan for performing the maturity testing. The plan shall include:

(a) The contractor shall be responsible for the development of the maturity curve. The curve development shall be monitored by the engineer.

(b) The temperature monitoring process of the constructed pavement or structure shall be the responsibility of the contractor and shall be monitored by the engineer. Determining that sufficient strength has been achieved shall remain the responsibility of the engineer. The contractor shall provide documentation of maturity testing before a pavement section may be opened to traffic, a structure may be loaded, or the forms may be removed.

2.3.2.2 For concrete furnished from a construction or stationary mixer, which is in place prior to construction of the specified project, a maturity curve may be established ahead of actual construction of the specified project. The test specimens shall be cast with concrete made from the same plant and using the same materials source as will be used in the specific project. The engineer shall be informed and have an opportunity to observe the development of the maturity curve.

2.3.3 Implementation. For pavements, when used at the contractor's option with the approval of the engineer, it is the intent of the procedure to use the maturity method to open the pavement to traffic from the very first day of paving, including the days of development of new curves. Pavement

2.3.3.1 Placed on the first day during development of the strength-maturity curve may be opened when either of the following criteria has been met:

(a) The TTF of the slab, or structure, meets or exceed the opening TTF as determined by the strength-maturity curve being developed.

(b) At a particular test age, the average strength of the three beams used for development of the strength-maturity curve meets or exceeds the required opening strength.

2.3.3.2 For structures, since maturity is to be used on units exposed to flexural loading, the maturity curve should be developed early in the project during placement of concrete exposed to compressive stress. If this is not possible, concrete placed on the same day as development of the strength-maturity curve may be loaded at a particular age using either of the first day placement criteria required for pavements.

2.3.4 Validation. Once per month, or as directed by the engineer, validation tests shall be conducted to determine if concrete strength is being represented by the current maturity curve. Cast and cure three (3) beams using the same procedure and manner as used to develop the current maturity curve. Test all three beams as close as possible to the maturity value determined to represent the opening strength of the pavement or the flexural loading strength or form removal strength of the structure.

2.3.4.1 For pavements, if the average calculated strength value at the TTF the validation beams were tested is within the range of ±50 psi (0.34 MPa) of the original curve, the original curve shall be considered validated. If the average calculated strength at the TTF the validation beams were tested is lower than the minimum range (-50 psi (-0.34 MPa)) of the original maturity curve, a new maturity curve shall be developed. If the average calculated strength at the TTF the validation beams were tested is greater than the maximum range (+50 psi (+0.34 MPa)) of the original maturity curve, a new maturity curve may be developed at the contractor's option with the approval of the engineer.

2.3.4.2 For structures, if the average calculated strength is greater than the original curve at the TTF the validation beams were tested, the original curve shall be considered validated. If the average calculated strength is less than the original maturity curve

at the TTF the validation beams were tested, a new maturity curve shall be developed.

2.3.5 Factors Requiring a New Curve. Changes in material sources, proportions, and mixing equipment all affect the maturity value of a given concrete mixture. Development of a new maturity curve due to material source or proportion changes in a concrete mix may be waived by use of the validation procedure. The following will require a new curve to be developed:

(a) The average calculated strength at the TTF the validation beams were tested is lower than the minimum range (-50 psi (-0.34 MPa)) of the original maturity curve (pavements only).

(b) The w/c ratio of the production concrete exceeds the w/c ratio of the concrete used to develop the strength maturity curve by more than 0.02.

AAS 2.4
REMOVAL OF FORMS AND FALSEWORK

2.4.1 Description. When approved in writing by the engineer, this method for the removal of forms and falsework, similar that in use by the Texas DOT, may be used on the project as appropriate according to the following. This specification was developed from Texas DOT 410S, available in KTU's Final Technical Proposal:

2.4.2 General. Unless otherwise indicated on the drawing, forms for vertical surfaces may be removed when the concrete has aged 12 hours after initial set, provided it can be done without damage to the concrete. Forms for mass concrete placements shall be maintained in place for 4-days following concrete placement. Mass placements are defined as concrete placements with a least dimension greater than equal to 5 ft. (1.575 meters), or those designated as such on the drawings.

2.4.2.1 Forms for inside curb faces may be removed in approximately 3 hours provided it can be done without damage to the curb. Unless indicated otherwise on the drawings weight supporting forms and falsework spanning more than 1 ft. (300 mm) for structures, bridge components and culvert slabs shall remain in place until the concrete has attained a minimum compressive strength of 2500 psi (17.25 MPa). Forms for other structural components may be removed as approved by the engineer.

2.4.2.2 Inside forms (walls and top slabs) for inlets, box culverts and sewers may be removed after the concrete has attained a minimum compressive strength of 1800 psi (12.4 MPa), provided an overhead support system, approved by the engineer, is used to transfer the weight (mass) of the top slab to the walls of the box culvert or sewer before the support provided by the forms is removed.

2.4.2.3 If all test cylinders made for the purpose of form removal have been broken without attaining the required strength, forms shall remain in place for a total of 14 curing days.

2.4.2.4 The above provisions relative to form removal shall apply only to forms or parts thereof which are constructed to permit removal without disturbing forms or falsework required to be left in place for a longer period on other portions of the structure.

2.4.2.5 Remove all metal appliances used inside forms for alignment shall be removed to a depth of at least ½ in. (13 mm) from the concrete surface. The appliances shall be manufactured to allow the removal without undue chipping or spalling of the concrete, and so that it leaves a smooth opening in the concrete surface when removed. Rods, bolts and ties shall not be burned-off.

2.4.2.6 Backfilling against walls of Type I or Type II cement shall not take place for a minimum of 7 days. Backfilling against walls of Type III cement shall not take place until the cylinder compressive strength has reached 3000 psi (20.7 MPa) or the wall has cured for 5 days.

2.4.2.7 All forms and falsework shall be removed unless indicated otherwise on the drawings.

AAS 2.13
LOAD BEARING PILES

2.13.1 Description. With the approval of the engineer, modified hammer energies, similar those in use by the Iowa DOT, will be used for driving piles when larger energies are considered appropriate at a particular site. Larger hammer energies are permitted by the Iowa DOT's current standard specifications. Steel H-piles will be considered for use as either end bearing piles or friction piles. This specification was developed from the following documents, available in KTU's Final Technical Proposal:

(a) Proposed special provision for the use of larger hammer energies and for the use of H-piles as friction piles.

(b) Original Iowa DOT specification section 2501 for piling.

2.13.2 Hammer Energies. Section 702.3.5 of the Standard Specifications will be modified as follows:

2.13.2.1 Maximum hammer energies of 60,000 foot-pounds (for steel piles) and 40,000 foot-pounds (for concrete piles) will be used for pile installation. The increased maximum hammer energies do not relieve the contractor of the responsibility to provide equipment suitable for driving the specified pile(s) to the required bearing value and /or pile tip elevation without inducing unacceptable stresses and/or damage to the pile(s).

2.13.2.2 Structural steel piles (H-piles) will be considered for use as either friction piles or bearing piles. When used as friction piles, the practical refusal criteria of a pile bearing value equal to 1.9 times the design bearing value (as stipulated in Sec. 702.4.11 of the *Missouri Standard Specifications*) will not be applicable.

AAS 2.16
EVAZOTE JOINT

SECTION 2.16.10 DESCRIPTION AND CLARIFICATIONS

2.16.10.1 Description. As directed by the engineer and indicated on the plans, Evazote Joint Seals, similar those in use by the North Carolina DOT will be used as an expansion seal for bridges requiring an expansion joint device. The NCDOT Evazote joint specification included below is approved for use on this project with the following exceptions:

(a) Range of allowable movement is between 0 and 4 inches.

(b) No limit on maximum skew.

(c) Maximum compression in seal is 60% of the nominal seal width.

(d) Maximum tension in seal is 30% of the nominal seal width.

(e) Maximum shearing movement 120% of the nominal seal width.

(f) Armoring of Evazote expansion joints is not required.

(g) The use of an "elastomeric concrete filled" blockout is not required. The seal will be attached directly to the sides of the formed opening.

SECTION 2.16.20 NCDOT EVAZOTE JOINT SEALS SPECIFICATION (8-13-04)

1.0 Seals.

Use preformed seals compatible with concrete and resistant to abrasion, oxidation, oils, gasoline, salt and other materials that are spilled on or applied to the surface. Use a low-density closed cell, cross-linked ethylene vinyl acetate polyethylene copolymer nitrogen blown material for the seal.

Use seals manufactured with grooves 1/8" (3 mm) ± wide by 1/8" (3 mm) ± deep and spaced between 1/4 (6 mm) and 1/2 inch (13 mm) apart along the bond surface running the length of the joint. Use seals sized so that the depth of the seal meets the manufacturer's recommendation, but is not less than 70% of the uncompressed width. Provide a seal designed so that, when compressed, the center portion of the top does not extend upward above the original height of the seal by more than 1/4 inch (6 mm). Splice the seal using the heat welding method by placing the joint material ends against a Teflon heating iron of 350°F (177°C) for 7 - 10 seconds, then pressing the ends together tightly. Do not test the welding until the material has completely cooled. Use material that resists weathering and ultraviolet rays. Provide a seal that has a working range of 30% tension and 60% compression and is watertight along its entire length including the ends.

Provide seals that meet the requirements given below.

TEST	TEST METHOD	REQUIREMENT
Elongation at break	ASTM D3575	210 ± 15%
Tensile strength, psi (kPa)	ASTM D3575	110 ± 15 (755 ± 100)
Compression Recovery (% of original width)	AASHTO T42 50% compr. for 22 hr. @ 73°F (23°C) 1/2 hr. recovery	87 ± 3
Weather/Deterioration	AASHTO T42 Accelerated Weathering	No deterioration for 10 years min.
Compression/Deflection	@ 50% deflection of original width @ 50% deflection of original width	10 psi (69 kPa) min. 60 psi (414 kPa) max.
Tear Strength, psi (kPa)	ASTM D624	16 ± 3 (110 ± 20)
Density	ASTM D545	2.8 to 3.4
Water Absorption (% vol/vol)	ASTM D3575 Total immersion for 3 months	3

Have the top of the evazote seal clearly shop marked. Inspect the evazote seals upon receipt to ensure that the marks are clearly visible upon installation.

2.0 Adhesives.

Use a two component, 100% solid, modified epoxy adhesive with the seal that meets the requirements of ASTM C881, Type 1, Grade 3, Class B & C and has the following physical properties:

Tensile strength	3500 psi (24.1 MPa) min.
Compressive strength	7000 psi (48.3 MPa) min.
Shore D Hardness	75 psi (0.5 MPa) min.
Water Absorption	0.25% by weight

Use an adhesive that is workable to 40°F (4°C). When installing in temperatures below 40°F (4°C) or for application on moist, difficult to dry concrete surfaces, use an adhesive specified by the manufacturer of the joint material.

3.0 Sawing The Joints.

When the plans call for sawing the joints, the joints shall be initially formed to a width as shown on the plans including the blockout for the elastomeric concrete. Complete placement of the elastomeric concrete after the reinforced concrete deck slab has cured for seven full days and reached a minimum strength of 3000 psi (20.7 Mpa).

Cure the elastomeric concrete for a minimum of 2 days prior to sawing the elastomeric concrete to the final width and depth as specified in the plans.

When sawing the joint to receive the evazote seal, always use a rigid guide to control the saw in the desired direction. To control the saw and to produce a straight line as indicated on the plans, anchor and positively connect a template or a track to the bridge deck. Do not saw the joint by visual means such as a chalk line. Fill the holes used for holding the template or track to the deck with an approved, flowable non-shrink, non-metallic grout.

Saw cut to the desired width and depth in one or two passes of the saw by placing and spacing two metal blades on the saw shaft to the desired width for compression seals.

The desired depth is the depth of the seal plus 1/4 inch (6 mm) above the top of the seal plus approximately 1 inch (25 mm) below the bottom of the seal. An irregular bottom of sawed joint is permitted as indicated on the plans. Grind exposed corners on saw cut edges to a 1/4" (6 mm) chamfer.

Remove any staining or deposited material resulting from sawing with a wet blade to the satisfaction of the engineer.

Use extreme care to saw the joint straight to the desired width and to prevent any chipping or damage to sawed edges of the joint.

4.0 Preparations For Sawed Joints.

When the plans call for sawing the joint, the engineer thoroughly inspects the sawed joint opening for spalls, popouts, cracks, etc. Make all necessary repairs prior to blast cleaning and installing the seal.

Immediately before sealing, clean the joints by sandblasting with clean dry sand. Sandblast to provide a firm, clean joint surface free of curing compound, loose material and any foreign matter. Sandblast without causing pitting or uneven surfaces. The aggregate in the elastomeric concrete may be exposed after sandblasting.

After blasting, either brush the surface with clean brushes made of hair, bristle or fiber, blow the surface with compressed air, or vacuum the surface until all traces of blast products and abrasives are removed from the surface, pockets, and corners.

If nozzle blasting, use compressed air that does not contain detrimental amounts of water or oil.

Examine the blast cleaned surface and remove any traces of oil, grease or smudge deposited in the cleaning operations.

Bond the seal to the blast cleaned surface on the same day the surface is blast cleaned.

5.0 Preparations For Armored Joints

When the plans call for armored joints, form the joint and blockout openings in accordance with the plans. If preferred, wrap the

temporary form with polyethylene sheets to allow for easier removal. Do not use form release agents.

(a) Submittals. Submitting detailed working drawings is not required; however, submitting catalog cuts of the proposed material is required. In addition, direct the joint supplier to provide an angle segment placing plan.

(b) Surface Preparation. Prepare the surface within the 48 hours prior to placing the elastomeric concrete. Do not place the elastomeric concrete until the surface preparation is completed and approved.

(1) Angle Assembly. Clean and free metalized steel of all foreign contaminants and blast the non-metalized steel surfaces to SSPC SP-10. Blast-cleaning anchor studs is not required.

(2) Concrete. Prior to placing the elastomeric concrete, thoroughly clean and dry all concrete surfaces. Sandblast the concrete surface in the blockout and clear the surface of all loose debris.

(c) Elastomeric Concrete Placement. Make sure that a manufacturer's representative is present when placing elastomeric concrete. Do not place elastomeric concrete if the ambient air temperature is below 45°F (7°C). Prepare and apply a primer, as per manufacturer's recommendations, to all vertical concrete faces, all steel components to be in contact with elastomeric concrete, and to areas specified by the manufacturer. Align the angles with the joint opening. Prepare, batch, and place the elastomeric concrete in accordance with the manufacturer's instructions. Place the elastomeric concrete in the areas specified on the plans while the primer is still tacky and within 2 hours after applying the primer. Pay careful attention to properly consolidate the concrete around the steel and anchors. Trowel the elastomeric concrete to a smooth finish.

(d) Joint Preparation. Prior to installing the seal, the engineer thoroughly inspects the armored joint opening for proper alignment and full consolidation of elastomeric concrete under the angle assemblies. Make all necessary repairs prior to cleaning the joint opening and installing the seal. Clean the armored joint opening with a pressure washer rated at 3000 psi (20.7 MPa) minimum at least 24 hours after placing the elastomeric concrete. Dry the cleaned surface prior to installing the seal. Examine the cleaned surface and remove traces of oil, grease or smudge deposited during the cleaning operations. Bond the seal to the cleaned surface on the same day the surface is cleaned.

6.0 Seal Installation.

Install the joint seal according to the manufacturer's procedures and recommendations and as recommended below. Do not install the joint seal if the ambient air temperature is below 45°F (7°C). Have a manufacturer's representative present during the installation of the first seal of the project.

Begin installation at the low end of the joint after applying the mixed epoxy to the sides of both the joint material and both sides of the joint, making certain to completely fill the grooves with epoxy. With gloved hands, compress the material and with the help of a blunt probe, push it down into the joint until it is recessed approximately 1/4 inch (6 mm) below the surface. Do not push the seal at an angle that would stretch the material. Once work on a joint begins, do not stop until it is completed. Clean the excess epoxy off the surface of the joint material *quickly* and *thoroughly*. Do not use solvents to remove excess epoxy. Remove excess epoxy in accordance with the joint manufacturer's recommendations.

Install the seal so that it is watertight. Testing of the joint seal is not required, but it is observed until final inspection.

AAS 2.17
WATERPROOFING MEMBRANE

SECTION 217.10 DESCRIPTION AND CLARIFICATIONS

2.16.10.1 Description. As directed by the engineer and indicated on the plans, waterproofing membrane for bridges, similar that in use by the Colorado DOT, will be used on this project. CDOT Standard Specifications 515, 705.07, 705.08 and 705.09 included below are approved for use on this project.

A Waterproofing Membrane will be applied to the top of precast cored slab and box beam structures when the route 2012 Average Daily Traffic volume is 1000 vehicles per day or less. An asphalt overlay will be placed on top of the waterproofing membrane.

SECTION 217.20 CDOT STANDARD SPECIFICATION SECTION 515 WATERPROOFING MEMBRANE

Description

515.01 This work consists of furnishing and placing an approved waterproofing membrane and protective covering over a prepared concrete bridge deck surface or furnishing and placing an approved chemical concrete sealer (sealer) on the surface of a concrete bridge deck, approach slabs, and all adjacent sidewalk and curb, and other applications designated on the plans.

Materials

515.02 The waterproofing membrane shall consist of one of the following:

(1) A prefabricated reinforced membrane and primer or,

(2) A single component, hot applied, elastomeric membrane and primer if required.

Materials for the waterproofing membrane shall meet the requirements specified in the following subsections:

Protective Covering 705.07

Prefabricated, Reinforced Membrane and Primer 705.08

Single Component, Hot Applied, Elastomeric Membrane 705.09

515.03 Concrete sealer shall consist of an alkyl-alkoxy silane and shall be a penetrating type with 40 percent solids in water or a high flash organic solvent. The sealer shall be compatible with the curing compound used on the concrete and shall be one that is included on the approved products list of the Department. A certificate of compliance shall be provided with each shipment of sealer.

Construction Requirements

515.04 Waterproofing Membrane.

(a) *Condition of Concrete Deck for Application of Waterproofing Membrane.* The entire deck and the sides of the curbs for a height of 2 inches above the plan thickness of the hot mix asphalt shall be free of all foreign material such as dirt, grease, old pavement and primer. All decks shall be sand blasted or shot blasted. Immediately prior to the application of primer or any type of membrane, all dust and loose material shall be removed. The deck condition will be approved before application of the membrane.

(b) *Weather and Moisture Limitations for Application of Waterproofing Membrane.* Application of primer or membrane shall not be done during inclement weather conditions, or when deck and ambient air temperatures are below 50 F. The deck surface shall be dry at the time of application of primer and membrane.

(c) *Application, Prefabricated, Reinforced Membrane.* Primer shall be applied to the prepared concrete surface at the rate and according to the procedure recommended by the membrane manufacturer. Placement of the membrane shall not begin until the volatile material in the primer has dissipated. The membrane shall be placed in such a manner that a shingling effect will be achieved and any accumulation of water will be directed toward curbs and drains. Primer and membrane shall be placed on the curb faces for a height of 2 inches above the plan thickness of the hot mix asphalt. The entire membrane shall be

essentially free of wrinkles, air bubbles and other placement defects. Blisters or bubbles larger than 2 inches in diameter, which develop after placement of the membrane and before placement of protective covering, shall be punctured, the air expelled and membrane patched in a manner satisfactory to the Engineer. At all expansion joints, and other joints, membrane shall be flashed up to the top of the joint and secured with primer. At drain pipes, membrane shall be placed in such a manner that it extends down inside the drain and is secured with primer.

(d) *Application, Single Component, Hot Applied, Elastomeric Membrane*. Hot applied membrane shall be applied to the prepared deck surface at a uniform minimum rate of ½ gallon per square yard thickness of 90 to 110 mils, 1 mil = 0.001 inch. During application the thickness may be measured by the Engineer. Lack of uniform application shall be cause for termination of the work until remedial measures are taken. Primer, if required, and membrane shall be placed up the curb faces for a height of 2 inches above the plan thickness of hot mix
asphalt.

(e) *Application of Protective Covering*. As soon as practical, but in all cases the same day as membrane application, protective covering shall be placed from gutter line to gutter line. Protective covering shall be laid parallel to the
centerline of the bridge. The protective covering shall be butted together at longitudinal and transverse joints. Overlapping will not be permitted. The maximum allowable space between adjoining sections of protective covering
shall be 1 inch. Following placement of protective covering, a bead of compatible mastic or hot applied membrane shall be applied where the protective covering contacts the curbs, and in cracks between adjoining sections that are
apart by more than 3/8 inch. The bead shall fill the void preventing water from entering at this point.

(f) *Inspection.* Upon completion of the membrane and protective covering the Engineer will inspect the membrane system. Approval in writing from the Engineer shall be obtained before application of hot mix asphalt. The Contractor shall be responsible for maintaining the condition of the membrane system on the bridge deck until covered with hot mix asphalt to the thickness required by the Contract.

(g) *Overlay*. Hot mix asphalt shall be placed, spread and compacted, in accordance
with the specifications or as approved.

515.05 Concrete Sealer.

(a) *Condition of Surface for Application of Sealer.* The surface of bridge deck, approach slabs, sidewalks, and curbs and the interior concrete surface of drains shall be free of all residue and other surface contaminants. Within 48 hours prior to the application of the sealer these surfaces shall be cleaned with dustless abrasive shot blasting. Other methods of blasting, power washing, or cleaning may be used if approved. The amount of shot blasting or cleaning shall be sufficient to remove all visual evidence of curing compound residue, dirt, grease, and surface contaminants. When wet methods are used the surface shall be dried in accordance with subsection 515.04.

(b) *Weather and Moisture Limitations for Application of Sealer*. Sealer shall not be applied when the deck or ambient air temperature is below 40 F, above 90 F, or outside the manufacturer's recommended temperature range. The concrete shall have aged a minimum of 28 days and the surface shall be dry at the time of application of the sealer. When the surface is wet because of inclement weather, power washing, or other moisture it shall be permitted to dry at least 24 hours before the sealer is applied.

(c) *Application of Sealer.* Sealer shall be applied uniformly at a minimum rate of 1 gallon per 100 square feet of surface area. The sealer shall be applied to the surface of the concrete bridge deck, approach slabs, curbs including the face of concrete bridge rail for 6 inches above the bridge deck, sidewalks, and the interior concrete surface of drains. Two copies of the manufacturer's literature for the sealer including the recommended application procedure shall be provided to the Engineer prior to application. The literature shall include a product material safety data sheet. All solvents, coatings, or other chemical products, or solutions, shall be mixed, handled, applied, stored and disposed of in such a manner that spills, splashes, and drips shall be contained without contamination of the soil, vegetation, streams, or other water bodies. The Contractor shall provide two approved respirators for use by Department personnel. Traffic shall not be allowed on the treated surface until the sealer has penetrated the concrete and the liquid sealer is no longer visible on the surface. The Contractor shall follow all the manufacturer's recommendations, including penetration time, prior to opening to traffic.

Method of Measurement

515.06 No direct measurement for payment will be made for this item of work.

Basis of Payment

515.07 All work required and performed under this Section will be considered incidental to Section 711, Pay Item Number 35.

SECTION 217.30 CDOT STANDARD SPECIFICATION SECTION 705.07 PROTECTIVE COVERINGS

705.07 Protective Covering for Bridge Deck Waterproofing Membrane. The protective covering shall be composed of one or more layers of felt thoroughly bonded together and saturated with asphalt. Both exposed sides shall be asphalt coated. The density shall be 55 pounds per 100 square feet. The surfaces shall be coated with suitable mineral matter to prevent the material from sticking to itself. The covering may be furnished either in rolls or sheets. The covering shall be free of visible external defects, such as holes, ragged or untrue edges, breaks, cracks, tears, protuberances, and indentations. The covering furnished in rolls shall not crack nor be so sticky as to cause material damage upon being unrolled at atmospheric temperatures as low as 50 °F. The covering shall conform to the following requirements when tested in accordance with Colorado Procedure L-2202:

Property Determined	Specification
Width	Min. 35 ½", Max. 60 ½"
Pliability at 25 °C (77 °F)	At least 4 of 5 strips shall not crack when bent 90° over a rounded corner of 13 mm (½") radius.
Behavior on heating to 80 °C (176 °F)	Max. 1.5 percent volatile loss. No flowing, sagging or blistering.
Weight per square foot	0.5 lbs

Protective covering may be conditionally accepted in the field based on visual inspection for appearance, workmanship, and weight per square foot of a representative specimen.

SECTION 217.40 CDOT STANDARD SPECIFICATION SECTION 705.08 MEMBRANE AND PRIMER

705.08 Prefabricated, Reinforced Membrane and Primer. The membrane shall be a factory laminated sheet composed of either rubberized asphalt, bituminous mastic, or similar compounds reinforced with synthetic or fiberglass fabric. It shall be uniformly manufactured free from blemishes, discontinuities, and other defects. The membrane shall be supplied in rolls, having a minimum width of 30 inches and shall conform to the following requirements:

Property Determined	Test Procedure	Specification
Thickness		70 mils minimum
Pliability	CP L-2203	No cracks

The primer used to bond membrane to the deck and to seal seams and patches shall be a water resistant adhesive compatible with the membrane. The primer shall be of suitable consistency for application by brush, roller, or spray without further dilution.

SECTION 217.50 CDOT STANDARD SPECIFICATION SECTION 705.09 ELASTOMERIC MEMBRANE

705.09 Single Component, Hot Applied, Elastomeric Membrane. The membrane shall be capable of being sprayed or spread to a uniform thickness at the application temperature recommended by the manufacturer. After cooling it shall form a tough resilient membrane, well bonded to the concrete surface and shall conform to the requirements of ASTM D 6690 Type 2, except that blocks for the bond test shall be as described in ASTM D 1985.

The membrane material shall be pretested by the Department prior to use. The batch or lot of the product will be placed on the Department's Approved Product List.

AAS 2.18
CONCRETE PLACEMENT TEMPERATURE

2.16.10.1 Description. Cast-in-place structural concrete placement will be performed using temperature limitations similar to those used by the Texas Department of Transportation. Concrete placement temperatures will be limited by the following criteria:

(a) Maximum Cast-in-Place Placement Temperature: Drilled shaft foundations, substructure concrete and barriers will be placed at a temperature below 95 degrees.

(b) Maximum Precast Concrete Placement Temperature: Precast concrete beams and barriers will be placed at a temperature below 95 degrees.

(c) Maximum Bridge Deck Concrete Placement Temperature: Bridge deck concrete or concrete in the top slab of a direct-traffic culvert shall be placed at a temperature below 85 degrees.

The above temperature limitations have been developed from the following:

(a) TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, Section 420.4 discussing concrete placement temperatures. Particular attention is directed to section 420.4.G.1 which presents concrete placement temperature limitations.

(b) TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, Section 421.4.A, Table 5 which discusses the classes of structural concrete referenced in 420.4.G.1 discussing concrete placement temperatures.