OKLAHOMA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION
FOR
BRIDGE DECKS, APPROACHES, RAILS AND PARAPETS
PROJECT NUMBER, JP NO. 00000(04), COUNTY

These Special Provisions amend and where in conflict, supersede applicable sections of the 2009 Standard Specifications for Highway Construction, English and Metric.

(Add the following:)

504.01 DESCRIPTION

This item of work consists of furnishing materials, services, labor, tools, equipment, and incidentals necessary to design, fabricate, inspect, test, and install the expansion joint system as specified. The supervision of installation and incidental visits of a manufacturer's representative are also included in this work.

The expansion joint assembly consists of a modular, multiple seal joint system that will allow movements as shown and noted in the Plans. The configuration of the expansion joint system shall consist of preformed neoprene strip seals mechanically held in place by steel edge and separation beams. Each separation beam shall be supported by an independent support bar which is welded to the separation beam. The support bars shall be suspended over the joint opening by sliding elastomeric bearings. An equidistant control system shall be incorporated which develops its maximum compressive force when the joint is at its maximum opening. The expansion joint system shall not incorporate any bolted connections between the separator beams and support bars.

The expansion joint system shall be continuous across the full width of the roadway and continue into the traffic barriers as shown in the Plans.

The design of the expansion joint system is according to the AASHTO LRFD Specification, 2nd Edition, using HS 20 truck loading plus Impact, and appropriate load and distribution factors.

504.02 MATERIALS

(A) Acceptable Manufacturers

Only manufacturers who have successfully completed the fatigue testing requirements described later in this Special Provision will be permitted to design and supply bridge modular expansion joint assemblies. The following manufacturers have completed fatigue testing in accordance with the requirements of this Special Provision:

The D. S. Brown Company
P. O. Box 158
300 E. Cherry Street
North Baltimore, Ohio 45872-0158
Phone: 419-257-3561; FAX: 419-257-2200

Harris Speciality Chemicals, Inc.
Watson Bowman Acme Division
95 Pineview Drive
Amherst, New York 14228
Phone: 716/691-7566; FAX: 716/691-9239

It is the contractor's responsibility to ensure that any other manufacturer being considered to provide the joint assembly has completed fatigue testing in accordance with the requirements of "Fatigue Testing", stated below. The contractor is cautioned against selecting a modular expansion joint assembly manufacturer based solely on the lowest price. Carefully review the expansion joint manufacturer's experience in designing, fabricating, and installing modular expansion joint systems.

Fabricate the expansion joints at facilities owned and operated by the manufacturer; the manufacturer being the single entity that designs, fabricates, and installs (or supervises the installation of) the joint assemblies. Ensure that the fabrication shop is certified by the American Institute of Steel Construction as a Quality Certified Fabricator in the category of Simple Steel Bridge Structures (Sbr).

(B) Submittals

Select a manufacturer that has a minimum of three years experience in designing and fabricating modular bridge expansion joint systems of the type and size required by this project. Provide written certification of the manufacturer's experience and provide a list of a minimum of five expansion joint systems that have been installed with an owner and contact person for each system indicated.

Ensure that the shop plans and calculations are prepared, reviewed, and approved by a registered Professional Engineer and carry the Engineer's signature and seal. Ensure that the registered Professional Engineer is either a full-time employee of the manufacturer or has designed modular joint systems for a minimum of three years.

(C) Shop Plans

Submit details of the expansion joint system to be used together with installation and waterproofing plans to the Engineer for approval prior to fabrication of the joint assembly. Include but do not be limited to the following information on the drawings:

- Plans, elevations and sections of the joint system for each movement rating and roadway width showing dimensions and tolerances.
- All ASTM, AASHTO, or other material designations.
- Method of installation including but not limited to sequence, setting relative to temperature, anchorage during setting, and installation at curbs.
- Corrosion protection system.
- Details of temporary supports for shipping and handling.
- Design calculations for all structural elements. Include in the design calculations a fatigue design and a strength design for all structural elements, connections, and splices. Illustrate all welded centerbeam splices on the shop plans.
- Use welding procedures in accordance with AASHTO/AWS D1.5-95 Bridge Welding Code and interim supplements.

(D) Certificates of Compliance

Along with the shop plans, submit the following certifications, for review and approval:

- Manufacturer's certificate of compliance with the AISC Quality Certification Program.
- Certification that welding inspection personnel are qualified and certified as welding inspectors under AWS QC1, Standard for Qualification and Certification of Welding Inspectors.
- Record of previous completed projects with contact persons.

(E) Shipping and Handling

To avoid field splices in the modular expansion joint system, design, fabricate, and deliver each assembly to the job site as a continuous unit. The maximum length of completed expansion joint assemblies will be determined by practical shipping limitations. At the site, store the expansion joint system in accordance with the manufacturer's written recommendations and as approved by the engineer.

Indicate lifting locations and lifting mechanisms on the shop plans.

Damage to the joint system during shipping or handling will be cause for rejection of the joint system.

Damage to the corrosion protection system shall be repaired to the satisfaction of the Engineer.

Do not cut seals except as recommended by the manufacturer and approved by the Engineer. Perform all splices to the seal in the shop using methods approved by the seal manufacturer. Splices to the seal are not permitted in the field.

(F) Structural Steel

Provide all structural steel conforming to the requirements of AASHTO M 270 (ASTM A709), Grade 50W or AASHTO M 222 (ASTM A588). Do not use aluminum components.

Provide Charpy V-Notch testing for structural steel that is used to fabricate the following main components: edge beams, center beams and support bars. Perform the CVN testing on the H (heat, i.e. one test per each heat from which these three major joint components are fabricated) basis at a 70 degree F testing temperature. The minimum average energy is 20 foot-pounds. Ensure that weathering-type steel is used for all other components of the joint system, unless noted.

Provide parapet and median barrier overlapping plates - ASTM A 588 or ASTM A 572.

Provided galvanize structural steel ASTM A 123 (AASHTO M 111).

(G) Stainless Steel

Provide ASTM A 240, Type 304, with 2B finish.

Provide SS flat headed bolts into concrete inserts - Type 304 or other approved alloy.

Provide Anti-Seize Lubricant. Submit product literature to the Engineer for approval prior to use.

(H) Polytetrafluorethylene (PTFE)

Provide 100% virgin Teflon(PTFE), woven PTFE fabric, or dimpled PTFE conforming to the requirements of Section 18.8.2, AASHTO LRFD Bridge Construction Specifications, First Edition, 1998.

(I) Expansion Joint Seals

The maximum movement range of the expansion joint strip seals shall be 3.15 inches. "Box" seals or seals utilizing double webs will not be acceptable.

Material Tests Physical Properties	Test Method	Range of Values
Hardness, Durometer A	ASTM D 2240	50-70
Tensile Strength	ASTM D 412	2000 psi [13.8 mPa](Min)
Elongation at break	ASTM D 412	250% (Min)
Compression Set		
Set at 72 hr. @ 212°F	ASTM D 395	40% (Max)
Oven Aging - 70 hours @ 212°F		
Tensile Strength, max, % loss	ASTM D 573	20
Elongation, max, % loss	ASTM D 573	20
Hardness, Type A Durometer, points change	ASTM D 573	0 to +10
Oil Swell, ASTM Oil #3, 70 hours @ 212°F		
Weight change, max, %	ASTM D 471	45
Ozone Resistance, 20% Strain		
300pphm in air 70 hours @ 104°F(40°C)	ASTM D 1149 modified	No cracks
Low Temperature Stiffening 7 days @ 14°F(-10°C)		
Hardness, Type A Durometer, points change	ASTM D 2240	0 to +15

(J) Lubricant Adhesive

Provide material to bond the polychloroprene seal to the steel shapes that is one part moisture curing polyurethane and hydrocarbon solvent mixture meeting the requirements of ASTM D 4070.

(K) Headed Studs

Provide headed studs meeting the requirements of ASTM A 108 (uncoated).

(L) Hardware (Bolts, Nuts, Washers)

Provide hardware conforming to the following requirements:

- Bolts - AASHTO M 164, Type 3
- Nuts - AASHTO M 291, Type C3
- Hardened Washers, Type 3
- Galvanize in accordance with AASHTO M298

504.04 CONSTRUCTION METHODS

(C) Expansion Joints

(1) Modular Expansion Joints

(a) General

Design and fabricate the expansion joint systems as one continuous unit without field splices.

Design the expansion joint system to accommodate all expected longitudinal movements (i.e. thermal, creep, shrinkage, elastic shortening, etc.) as well as vertical and horizontal rotations. Incorporate the design strip seal glands with a maximum movement range of 3.15 inches (80 mm)per seal.

Ensure that the expansion joint assembly seals do not protrude above the top of the joint into the level of the roadway.

Design the elastomeric springs and bearings so that they are removable and replaceable. Ensure that the removal and reinstallation of the strip seal can be easily accomplished from above the joint with a 1.25 inch (32 mm)minimum gap width. These operations would be performed with partial closure of the roadway.

Ensure that the expansion joint system is water tight.

1) Fatigue Limit State Wheel Loads

Design the transverse separation beams, support bars, bearings and other structural elements for the simultaneous application of the vertical and horizontal fatigue limit state wheel load ranges shown below:

Vertical Wheel Load Range (Normal to the Roadway Surface)	Horizontal Wheel Load Range (Parallel to the Roadway)
26.0 kips(9072 kg)/wheel	8.0 kips(3629 kg)/wheel

Include impact with these fatigue limit state wheel ranges.

Alternate wheel load ranges may be used providing that the absolute magnitude of the wheel load ranges (e.g. sum of positive and negative loads along the same axis) is not less than the total wheel load ranges shown above.

2) Application of Fatigue Limit State Wheel Load Ranges.

For design of the separation beams, space two vertical and horizontal load ranges described above six feet apart and apply at the roadway surface as a rectangular patch loading. Use a rectangular patch with a 9 inch (230 mm) length in the direction of traffic and a 20 inch (500 mm) width perpendicular to the direction of traffic.

As shown below, the percentage of the loads applied to the seal separation beams and edge beams is based on the midrange position of the seals and the width of the seal separation beams.

Width of Seal Separation or Edge Beams	Percentage
2.25 inch (57 mm) or less	40%
3.125 inch (79 mm)	50%
4.0 inch (102 mm)	60%

3) Fatigue Limit State Design

By performing a structural analysis of the modular expansion joint assembly using the fatigue limit state load ranges specified above in subsection 504.04.C.(1).*(a).2)*, "Fatigue Limit State Wheel Loads", obtain nominal stress ranges ($f_{SR\ Calc}$) at all fatigue critical details. To ensure an infinite fatigue life, ensure that all modular expansionjoint assembly structural steel members, welded connections, splices, and miscellaneous steel attachments satisfy the following:

	$f_{SR\ Calc} \leq F_{SR\ Test}$	Fatigue Limit State Equation
where		
$f_{SR\ Calc}$ =	Calculated stress range based on the simultaneous application of the vertical and horizontal fatigue limit state wheel ranges.	
$F_{SR\ Test}$ =	Constant-amplitude fatigue limit of component as determined from testing.	

4) Fatigue Testing

Perform constant-amplitude fatigue testing on multiple spans of one or more full-scale separation beams with load applied near the center of the spans and the support bars supported only at the ends. Ensure that the tests determine the lower-bound AASHTO Category ($F_{SR\ Test}$) for all modular expansion joint assembly structural steel members, welded connections, shop splices, and miscellaneous steel attachments. Obtain at least 10 data points for each detail and that no data points fall below the AASHTO Category. Do not take the welded separator beam to support bar connections as having a fatigue strength greater than Category C.

Apply the test loading so that a vertical and horizontal loading are applied simultaneously. Perform the testing so that the horizontal load shall be 20% of the vertical load.

Conduct fatigue testing by an independent testing laboratory.

(b) Fabrication

1) General

Fabricate the expansion joint system in accordance with the dimensions, shapes, designs, and details shown in the approved shop plans and in conformance with the Standard Specifications and the Special Provisions.

Fabricate all expansion joint assemblies by the same AISC Certified manufacturer.

2) PTFE Sliding Surface

Bond the PTFE under controlled conditions and in accordance with the written instructions of the manufacturer of the PTFE.

After completion of the bonding operation, ensure that the PTFE surface is smooth and free from bubbles.

3) Corrosion Protection

Hot-dip galvanize all structural steel components of the expansion joint and overlapping parapet and median barrier plates.

Portions of the expansion joint may be masked as required by the joint manufacturer.

4) Installation

To aid in assuring proper installation of each expansion joint system in the field, provide the services of a qualified installation technician who is employed full-time by the manufacturer of the expansion system to be installed in this project. Adhere to the recommendations made by the expansion joint manufacturer's installation technician, on or off the job site, and approved by the Engineer.

The expansion joint manufacturer's installation technician shall advise the contractor and certify to the Engineer that the proper installation procedures are being followed. All certifications to the Engineer shall be in writing, signed and dated by the manufacturer's installation technician.

Install the modular expansion joint system in strict accordance with the manufacturer's instructions, and the advice of the manufacturer's installation technician. Provide to the Engineer, two weeks prior to the intended installation, with two copies of the written instructions. Ensure that the permanently installed expansion joint system matches the finished roadway profile and grades.

Water test the expansion joint system after installation. Repair any leaks to the satisfaction of the Engineer.

Take precautions to protect the expansion joint system from damage. Exercise special care at all times to ensure protection of the expansion joint system. Prior to installation of the expansion joint assembly, protect the blockout and supporting system from damage and construction traffic. After installation of the joint system, do not permit construction loads on the expansion joint device. Provide a temporary bridge over the expansion joint assembly in a manner approved by the Engineer.

Set the modular expansion joint system to the proper width for the ambient temperature at the time of setting. Indicate this information on the shop plans.

Remove all forms and debris that tend to interfere with the free action of the expansion joint system.

5) Watertightness

After the expansion joint system has been completely installed, flood for a minimum of one hour to a minimum depth of 3 inches (75 mm). If leakage is observed, repair the

expansion joint system at the contractor's expense. Use the repair procedure that is recommended by the manufacturer and approved by the Engineer.

504.05 METHOD OF MEASUREMENT

The *Modular Expansion Joints* will be measured by the linear foot along the centerline of joint (at the top of the joint cross-section) from end to end of the joint. Modular expansion joint assemblies at both locations on the structure will be included in this payment item. Parapet and median barrier plates, as well as deck haunch plates, will not be measured for payment.

504.06 BASIS OF PAYMENT

The contract price per linear foot for *Modular Expansion Joints* is full compensation for all materials, labor, tools, equipment, testing, inspection, services, and incidentals necessary to furnish and install the expansion joint systems as specified. The detailing and fabrication of any miscellaneous steel components (i.e., parapet plates and median barrier plates, and deck haunch forming plates) are included in this pay item.

Pay Item:	**Pay Unit:**
(I) MODULAR EXPANSION JOINT	LF [M]