

## SECTION 458 BRIDGE DECK JOINTS

### 458-1 Description.

Furnish and install bridge deck joints of the types and at the locations shown in the Plans. This Section covers the following types of joints:

- Poured Joint
- Poured Joint with Backer Rod System
- Strip Seal Joint System
- Modular Joint

### 458-2 Materials.

**458-2.1 General:** Transport, store and prepare all joint materials and components for all joint types as per the manufacturer's recommendations.

**458-2.2 Poured Joint:** Furnish joint sealer or a Type A, B, or C silicone sealant material meeting the requirements of Section 932 that is listed on the Qualified Products List (QPL).

**458-2.3 Poured Joint with Backer Rod System:** Furnish poured joint with backer rod systems consisting of Type D silicone sealant material, foam backer rods, sidewalk cover plates (as required) and all associated miscellaneous components.

The Type D silicone sealant material used in the system shall be listed on the QPL and meet the requirements of Section 932.

**458-2.4 Strip Seal Joint System:** Furnish strip seal joint systems in accordance with ASTM D5973 and Design Standards, Index No. 21100 that are listed on the QPL. Manufacturers seeking evaluation of their product for the QPL shall submit an application in accordance with Section 6. Design documentation showing the expansion joint system shall include installation details and temporary or sacrificial support brackets, bolts, clamps, etc. that are compatible with decks constructed with or without block-outs. Furnish joint systems consisting of watertight steel edge rails, elastomeric strip seals, sidewalk cover plates (as required) and all associated miscellaneous components. Obtain the elastomeric strip seals from the edge rail manufacturer.

**458-2.5 Sidewalk Cover Plates:** Furnish slip resistant galvanized steel sidewalk cover plates in accordance with ASTM A36 or ASTM A709, Grade 36 or 50 and as shown in the Design Standards, Index Nos. 21100 and 21110 or in the Contract Documents. Sidewalk cover plates shall be an anti-slip steel surface consisting of a random hatch matrix or other suitable pattern. Do not use diamond plate or surface applied slip resistant tapes, films, nonmetallic coatings or other similar materials. Sidewalk cover plates shall have a minimum coefficient of friction on the top galvanized surface of 0.8 in dry condition, and 0.65 in a wet condition, as determined by FM 3-C1028. After shop fabrication, hot-dip galvanize in accordance with Section 962 and the cover plate manufacturer's recommendations. Furnish flat head stainless steel sleeve anchors in accordance with ASTM F593 Group 1 Alloy 304 for attaching sidewalk cover plates. Install sleeve anchors in accordance with the manufacturer's instructions.

**458-2.6 Modular Joint:** Furnish modular joints meeting the requirements of this Section. Provide manufacturer certification that modular joint components meet the following material requirements.

Table 2-6.1 Component Material Requirements	
Solid Separation Beams, Steel Extrusions, Support Bars, and	ASTM A588 or ASTM A572

Milled Steel Shapes	
Box Seals	ASTM D2628*
Adhesive	ASTM D4070
Stud Shear Connectors and Threaded Studs	ASTM A108
Connection Plates – 3/8 inch minimum thickness	ASTM A588 or ASTM A572
Sliding Plates - 3/8 inch minimum thickness	ASTM A240, Type 316
Sliding Plates - 3/8 inch minimum thickness	ASTM D4895-10
Railing and Sidewalk Cover Plates – 1/2 inch minimum thickness	ASTM A36**
*Provide seals with hardness Type A durometer equal to 55 (plus or minus 5) by ASTM D2240.	
**Hot-dip galvanize railing and sidewalk cover plates in accordance with Section 962.	

Supply test results from the manufacturer verifying the maximum coefficient of friction between mating surfaces. Testing must be performed by an independent testing laboratory according to the manufacturer's stated precompression values for the system to a minimum of two million cycles. Maximum allowed coefficient of friction is 0.10.

Provide PTFE bonded steel sliding plates using a heat cured, high temperature epoxy capable of withstanding temperatures of minus 40°F to plus 250°F.

Use preformed elastomeric joint seals of multiple-web design that comply with ASTM D3542. Use preformed elastomeric joint seals of the strip type that comply with ASTM D5973.

For springs, bearing, and equidistance devices (i.e. control springs), use the same material composition and formulation, manufacturer, fabrication procedure and configuration as those used in the prequalification test.

### **458-3 Calculations and Shop Drawings.**

**458-3.1 All Joint Types (with the exception of Poured Joints):** Submit shop drawings in accordance with Section 5 for any applicable joint system supplied. For format and required details, follow the AASHTO/NSBA Steel Bridge Collaboration "Guideline for Shop Detail Drawing Presentation". The following information must be included on the shop drawings:

1. The name and address of the joint system manufacturer, including the physical address where the fabrication is performed.
2. The joint manufacturer's instructions for proper installation, including the proper width settings for a minimum 100°F temperature range. Shop drawings that are submitted without this information will be returned without review.
3. Show all materials including project specific details and dimensions. Include the joint model number and joint movement range.

**458-3.2 Sidewalk Cover Plates:** Submit shop drawings for sidewalk cover plates showing all materials, project specific details and dimensions. The submittal must include a certification from the manufacturer that the sidewalk cover plates meet the minimum coefficient of friction requirements.

**458-3.3 Strip Seals:** Provide the QPL number in the shop drawings.

**458-3.4 Modular Joints:** When support boxes are supported by the deck or abutment, detail in the shop drawings a minimum of 2 inches between the bottom surfaces of the joint elements and the deck blockouts to allow easy placement of concrete and allow for proper consolidation of concrete under and around all parts of the joints.

Detail in the shop drawings at least 6 inches of clear space between the support boxes or anchorages on the ends of support boxes and the periphery of the blockout to permit placing of concrete.

Submittal of shop drawings must include a manufacturer's installation manual in accordance with this Section.

Include design calculations, signed and sealed by a Professional Engineer licensed in the State of Florida, confirming that all load bearing components are in conformance with the requirements of this Section.

#### **458-4 Fabrication and Installation.**

**458-4.1 General:** Install the joint in accordance with the specific requirements of this Section, the plan details, the Design Standards, and the manufacturer's installation instructions for the particular type of expansion joint to be installed.

**458-4.2 Poured Joint:** Install the joint at the locations and in accordance with the details shown in the Plans and the manufacturer's recommendations.

##### **458-4.3 Poured Joint with Backer Rod System:**

**458-4.3.1 Casting Joint Opening:** When casting the bridge deck, approach slab or raised sidewalk adjacent to the expansion joint at temperatures other than 70°F, adjust the joint opening (Dim. A as shown in the Design Standards, Index No. 21110) at 70°F by the amount of the adjustment per 10°F shown in the Structures Plans, Poured Expansion Joint Data Table. For temperatures above 70°F, decrease the opening. For temperatures below 70°F, increase the opening.

**458-4.3.2 Installation of Poured Joint System:** After deck profiling, grinding, and grooving operations are complete, install poured joint with backer rod in accordance with the manufacturer's recommendations, when the joint opening is plus or minus 1/4 inch of the design joint opening (Dim A at 70°F) shown in the Structures Plans, Poured Expansion Joint Data Table. The minimum opening must not be less than 1 inch at the time of installation. Place poured joint material only when the ambient temperature is between 55°F and 85°F and is expected to rise for the next three hours minimum to provide for adequate joint opening and compression of the poured joint material during curing.

##### **458-4.4 Strip Seal System:**

**458-4.4.1 Elastomeric Seal Fabrication:** Furnish continuous heavy duty bridge deck elastomeric seals sized in accordance with the manufacturer's recommendations, to perform satisfactorily for the opening range shown. Minimum movement classification is 4 inches. Shop vulcanization is restricted to use on horizontal turns on skewed bridges at upturn ends where the horizontal turn angle is greater than 35 degrees. Field vulcanization is not permitted.

##### **458-4.4.2 Edge Rail Fabrication:**

(a) Furnish extruded, hot rolled or machined solid steel edge rails in accordance with ASTM A709, Grade 36, 50 or 50(W). Furnish edge rails with a minimum mass of 19.2 lb/ft excluding studs, a minimum height of 8 inches, a minimum thickness of 1/2 inch and a maximum top surface (riding surface) width of 2 inches. Edge rails manufactured from bent plate or built up pieces are not acceptable.

(b) Furnish anchor studs in accordance with ASTM A108, and electric arc end-weld anchor studs with complete fusion. Anchor studs may be piggy backed to achieve required lengths.

(c) Perform all shop welding in accordance with the Bridge Welding Code ANSI/AASHTO/AWS D1.5. Do not weld to surfaces in contact with the elastomeric seal or the

top surface (riding surface) except as shown in the shop splice detail. Do not weld inside seal cavity.

(d) Fabricate edge rail assemblies in one piece including upturns. Splices in an individual joint are only permitted where (1) a construction joint is specifically required by the Plans, (2) joint segment length exceeds 50 feet, or (3) approved by the Engineer in writing. Shop splice sections of edge rail to obtain the required length by partial penetration double V-groove welds on prepared beveled edges and seal welds as shown in the shop splice detail. Weld all around the joint as far as practical to achieve a watertight seal. Do not use short pieces of edge rail less than 6 feet 0 inches long unless required at curbs, sidewalks or phase construction locations.

(e) After shop fabrication, hot-dip galvanize edge rail in accordance with Section 962 and the manufacturer's recommendations.

(f) Furnish temporary or sacrificial support brackets, bolts, clamps, etc. that are capable of resisting shipping, handling and construction forces without damage to the edge rail assemblies or galvanized coating and are adjustable to account for variable temperature settings. Do not use temporary or sacrificial support brackets, bolts, clamps, etc. between the faces of the edge rails.

(g) Clearly match mark corresponding edge rail assemblies with joint location and direction of stationing.

#### **458-4.4.3 Installation:**

(a) Install the edge rail assemblies at proper grade and alignment before or after deck planing in accordance with the manufacturer's instructions. When installed after deck planing and grinding, install the edge rail assemblies in the block-outs on a profile tangent between the ends of the deck and/or approach slab to within a plus 0 inch and minus 1/4 inch variation. When installed before deck planing, install the edge rail assemblies 3/8 inches, plus or minus 1/16 inch, below the top surface of the deck or approach slab to compensate for concrete removal during planing and grinding.

(b) Bolt, weld or clamp edge rail assemblies in position using temporary or sacrificial brackets as required. For phased construction, install edge rail assemblies in a given subsequent phase to align with those installed in an adjacent prior phase after deflection and rotation due to deck casting of adjoining spans has occurred.

(c) For installation of edge rail assemblies at temperatures other than 70°F, adjust the opening of the joint (Dim. A as shown in the Design Standards, Index No. 21100) by the amount of the adjustment per 10°F shown in the Structures Plans, Strip Seal Expansion Joint Data Table. For temperatures above 70°F, decrease the opening. For temperatures below 70°F, increase the opening.

(d) After galvanizing, do not weld within 2 inches of edge rail surfaces exposed in the completed structure. Do not weld expansion joint components to or electrically ground to reinforcing steel or structural steel. Seal field butt joints and empty shipping and erection holes with caulk before placing deck concrete.

(e) Protect galvanized edge rail assemblies during screeding operations per the manufacturer's recommendations. Provide temporary blocking material in the edge rail seal cavities to prevent concrete intrusion during deck pour and finishing.

(f) Loosen any temporary or sacrificial support brackets, bolts, clamps, etc. that span across the joint after initial set of concrete, but not more than two hours after conclusion of concrete placement.

(g) Install elastomeric seal after completion of deck casting. Remove all joint form material and blocking material prior to installing elastomeric seal. Field install elastomeric seal in accordance with manufacturer's recommendations. Thoroughly coat all contact surfaces between the elastomeric seal and the edge rail seal cavities with an adhesive lubricant before setting elastomeric seal in place.

#### **458-4.5 Modular Joints**

**458-4.5.1 Fabrication:** Perform all steel fabrication in accordance with the requirements of Section 460.

After fabrication, hot-dip galvanize all non-stainless steel metal surfaces in accordance with Section 962.

Joint systems must be designed in accordance with the latest edition of AASHTO LRFD Bridge Design Specifications or as required by the Contract Documents. Supply joint systems for which identical full-size specimens have been subjected to full life-cycle fatigue testing. Obtain all joint system components from the same manufacturer, fabricated at their approved corporate facilities, using subcomponents meeting the testing requirements of this Section.

Provide all load bearing structural steel components with a 1/4 inch minimum thickness in any direction. Construct edge rails consisting of a monolithic steel shape with a machined or extruded retainer cavity. Multiple component welded steel shapes to achieve a final member cross section or seal retainer cavity are not permitted. Attach separation beams to individual support bars with a complete joint penetration weld.

Support each separation beam with a dedicated support bar connected by a complete joint penetration welded connection. Use of bolted connections, yokes, or other means to directly attach separation beams to support bars is not permitted. Maintain equal spacing between separation beams at all stages of movement.

Contain support bars with bearings capable of transferring all imposed loads to the structure and allow the support bar to freely move within the limits of the expansion joint.

Fabricate a full length modular joint system as one piece. Only a minimal number of splices in an individual joint may be permitted where (1) a construction joint is specifically required by the Plans, (2) joint segment length exceeds 50 feet, or (3) approved by the Engineer in writing.

When phased construction is permitted or required by the Contract Documents, fabricate each segment to exactly fit that portion of superstructure, including sidewalks, under construction in each specific phase. Connect segments with a bolted splice to ensure continuity. Fit segments with temporary seals. Lubricant adhesive is not required for temporary seals. Submit watertight seal details for the splice. Shop inspection will be conducted at the discretion of the Engineer in accordance with Article 5-6.

Fabricate final seal assembly as one single, continuous component. Splicing of seals in the field is not permitted.

Provide lifting devices and devices to maintain the preset opening of the joint at a uniform spacing of not greater than 15 feet along the length of the joint. Provide at least three of these preset opening devices per joint segment.

Direct the manufacturer to preset the joint opening in accordance with joint opening as shown in the Plans at 70°F, prior to shipment.

Prior to installation, place the centerbeam/support bar assembly on a flat surface to verify the support bars lay in a single plane, with no part of the bottom of any support bar exceeding 0.25 inches off the surface. The subassembly may be straightened. No more than three attempts may be made to heat-straighten the subassembly.

Polish stainless steel sliding surfaces to an 8  $\mu$ -inch mirror finish.

**458-4.5.2 Installation:** Clean any metal surface component exhibiting surface rust and field metalize in accordance with Section 562. Replace any component exhibiting pitting and/or section loss with a new component.

Install the joint system in strict compliance with the manufacturer's instructions in the shop drawings and as directed by the manufacturer's installation technician.

**458-4.5.2.1 Manufacturer's Installation Manual:** Submit two copies of the manufacturer's installation manual at least two weeks prior to installation activities, containing complete and detailed installation instructions for the modular expansion joint supplied by the Contractor. The manual must include step-by-step installation instructions and all related manufacturer's recommendations, including bridge deck pouring sequence, restraints, finishing, etc., for successful installation and long term operation and serviceability of the joint.

**458-4.5.2.2 Manufacturer's Installation Technician:** Provide for a manufacturer's installation technician, under the direct employ of the manufacturer, to be on the jobsite prior to the first joint installation and in sufficient time to train the Contractor's joint installation crews using the shop drawings and the manufacturer's installation manual. The manufacturer's installation technician must remain on the jobsite and be present for all modular joint installation activities for a minimum of the first two joints for each of the Contractor's installation crews. The manufacturer's installation technician will provide written certification to the Engineer that the Contractor's installation process follows the requirements outlined in the manufacturer's installation manual.

**458-4.5.2.3 Field Inspection:** The Engineer will inspect the joint system for proper alignment, complete bond between neoprene gland seal and steel, and proper stud placement and effectiveness.

Bends or kinks in the joint system steel are not allowed except as necessary to follow roadway grades. Straightening of any bends or kinks in the steel, whether intentional or inadvertent, is not allowed. Any joint system exhibiting bends or kinks will be rejected, removed from the jobsite, and replaced by a new joint system. Match joint system to the finished roadway profile and grades before final acceptance.

Restore bond of any neoprene gland seal found not fully bonded to steel.

Visually inspect all stud welds. Test a minimum of 10% of the total number of stud welds at the discretion and direction of the Engineer. Any stud found to not have a complete end weld (as evidenced by a ringing sound when struck by a hammer) will require replacement. Any stud located more than one inch in any direction from location shown in the shop drawings will require removal and a new stud placed in the proper location.

**458-4.5.2.4 Width:** For installation at temperatures other than 70°F, adjust opening of the joint as shown in the Contract Documents by amount of adjustment per 10°F shown in the Contract Documents. For temperatures above 70°F, decrease the opening. For temperatures below 70°F, increase the opening. Release all support brackets as the concrete is being placed and no later than when the concrete takes initial set.

Remove opening devices immediately after the concrete is placed.

**458-4.5.2.5 Permanent Seals:** When phased construction is necessary, remove temporary neoprene seals and replace with full width permanent seals after joint system is completely installed over full width of structure, including sidewalks.

Clean (SSPC-SP6) all metal surfaces which will be in contact with permanent seals to visual standard CSP6 as defined by SSPC Vis 1-89.

**458-4.5.2.6 Final Placement:** After modular joint system has been set to its final line and grade, fill any deck joint blockouts with Class II (Bridge Deck) concrete or as specified in the Plans. Prepare contact surfaces in accordance with the same procedure described in this Section. Finish the uppermost surface of concrete placement in accordance with requirements of 400-15, except that machine finishing is not required. Unless otherwise noted in the Plans, include the cost of the pourback in the unit bid price of superstructure concrete.

Construction loads are not allowed on the modular joint for 72 hours after complete installation unless approved by the Engineer. In the event it is necessary to cross the modular joint before the 72 hour prohibition, bridge over the joint in a manner approved by the Engineer.

**458-4.5.3 Acceptance:** Acceptance of fabricated joint systems will be based on the Engineer's visual inspection at the jobsite and in accordance with requirements of this Section.

Provide a certified copy of all mill test reports to the Engineer for all steel used to fabricate the joint system.

**458-4.5.3.1 Watertight Integrity Test:** Test full length of joint system for watertight integrity in accordance with this Section, no more than five working days after each joint system installation is completed. In case of phased construction, perform this test after the full length of joint is installed (after all applicable phases). For the first two joints, perform the watertight integrity test and inspection in the presence of the manufacturer's installation technician and the Engineer. For all remaining joints, perform the watertight integrity test and inspection in the presence of the Engineer.

Cover full length of joint with either water ponded to a minimum 1/2 inch depth, or continuously flowing water directly over full plan area of joint for a 15 minute minimum duration. Inspect underdeck surfaces beneath the joint for any evidence of dripping water or moisture for the 15 minute duration of water application and for 45 minutes after water supply is removed. Watertight integrity of joint system is interpreted as absolutely no free dripping water or moisture on underdeck surfaces beneath joint. Document date, time, and location of joint inspections and submit the report to the Engineer.

Repair joint integrity at every location exhibiting free dripping water or moisture identified during the watertight integrity test and subsequently retest, subject to same conditions and consequences as the initial test. Retest and repair until joints pass the watertight integrity test.

#### **458-5 Method of Measurement.**

The poured joint without backer rod will be incidental to the concrete work and included in the cost of the concrete. Poured joints with backer rod, strip seal joints, and modular expansion joints will be the plan quantity length of each type of joint constructed and accepted.

**458-6 Basis of Payment.**

**458-6.1 Basic Items of Joints.** The Contract unit price per foot for joints will be full compensation for all work and materials necessary for the complete installation. Such price and payment will include, but not be limited to, the following specific incidental work:

(a) Any work required to clean and prepare the adjacent bridge deck, deck block out or deck joint gap.

(b) Any work to replace any rejected joints.

(c) Any repairs to the galvanizing on metallic joint components.

(d) Any additional work or materials required for non-standardized or special construction or installation techniques.

(e) Any cost of erection and removal of any temporary supports which may be necessary for ensuring proper alignment and positioning of the joint relative to the bridge deck.

(f) Any sidewalk cover plates required.

(g) All costs associated with the manufacturer's installation technician.

(h) All work related to performance of the watertight integrity test and any necessary repairs and retesting.

**458-6.2 Payment Items:** Payment shall be made under:

Item No. 458 - 1- Bridge Deck Expansion Joint - per foot.