

## **Section 21 - Bridge Deck Joints**

### **21.1 General Criteria**

Subsection 14.5.3.2 of the *AASHTO LRFD Bridge Design Specifications* provides criteria for surface gap tolerances. These criteria shall be followed for planning deck joint type selection.

1. Transverse deck joints on bridge decks shall consist of either preformed elastomeric joint assemblies or strip seal expansion joint assemblies. The use of bolt down type seal assemblies is restricted only to those locations where bolt down type assemblies currently exist.

Modular expansion joint systems are recommended for joint movements in excess of 4 inches. Joint system suppliers should be contacted to verify movement capabilities prior to specifying a joint assembly type for a project.

2. Standard Drawings provided within this Manual have been developed to facilitate the installation of strip seal joint assemblies and preformed elastomeric joint assemblies. Designers and suppliers are advised that these Standard Drawings should be followed in developing working drawings for the provision of these type joint assemblies.

Typical details for preformed elastomeric joint and strip seal expansion joint assemblies are shown on Bridge Construction Details. The details shown thereon are for typical installations on "new" construction or deck slab replacement projects. The illustrated concepts on the Bridge Construction Details may be used to facilitate the Working Drawing review.

3. Generally, for expected movements of less than or equal to 4 inches, preformed elastomeric or strip seal joint assemblies may be used. However, strip seal assemblies have shown to be more durable from a maintenance perspective. Therefore, strip seal assemblies can be assumed to be the preferred type for Department projects.

### **21.2 Preformed Elastomeric Joint Assembly**

1. Payment for structural steel shapes and plates used for Preformed Elastomeric Joint Assemblies will be included under the respective pay item. A separate item for this miscellaneous material is not required.
2. Preformed elastomeric seals smaller than 2½ inches are generally recommended only for fixed end joints. For skewed structures, seals shall be sized such that movements parallel to the joint caused by racking are not greater than 15% of the nominal compression seal width. This is a conservative value utilized by many seal manufacturers.

### **21.3 Longitudinal Deck Joints**

The location of longitudinal construction joints shall be provided where necessary for stage construction and for compatibility with a deck slab pouring sequence. When wide structures with many lanes are involved, the Designer should detail where Construction joints can be placed. This will address the potential of concrete placing delays and overall work stoppage. Longitudinal construction joints, if necessary, shall be located over a stringer.

Reference Guide Plate 3.8-1 for details concerning longitudinal construction joints in deck slabs.

## 21.4 Strip Seal Expansion Joint Assembly

1. Strip seal expansion dam assemblies shall consist of an extruded neoprene rubber gland locked in the cavities of two parallel steel rail sections. The steel rail material shall conform to AASHTO M 270 Grade 36 or AASHTO M270 Grade 50. The entire joint system shall be hot dipped galvanized after fabrication.

Any galvanized coating of the deck joint system which is damaged during field welding or from other causes shall be repaired by methods outlined in ASTM A780. The damaged area shall be repaired prior to installing the neoprene gland. The neoprene gland shall be continuous for the full bridge width including sidewalks, parapets and median barriers.

Payment for structural steel rails, plates, etc. will be included under the item 'Strip Seal Expansion Joint Assembly'.

2. Strip seal expansion joint assemblies may be used for all bridge applications. However, the following conditions warrant the primary use of Strip Seal Assemblies.
  - a. When the length contributing to expansion is less than 70 feet, and the skew is greater than 35 degrees.
  - b. When the length contributing to expansion is greater than or equal to 70 feet and less than or equal to 250 feet, and the skew is greater than 25 degrees.
3. When a transverse strip seal assembly intersects with a preformed elastomeric seal that is used in a longitudinal joint, the joint subjected to the larger movement shall remain continuous and the other seal shall butt up against it. When longitudinal and transverse strip seals intersect, various factory molded intersections are available as needed. It is recommended that strip seal manufacturers be contacted in order that the most effective details can be specified for these situations.
4. It is essential to the operation of the strip seal that no form of hot or cold applied joint filler be placed over the top of the rubber gland. All sidewalk joints must have steel cover plates. Joints in parapets and median barriers should preferably, if possible, be designed without steel cover plates. In these cases the steel rail sections shall be angled up into the parapet or median barrier and the concrete tapered to the edge of the rail as required.

When approved, steel cover plates may be used if required on highly skewed structures or for specific project requirements.

5. The maximum allowable joint width measured in the direction of travel shall be 4 inches, with 3 inches preferred. The minimum joint widths shown on the construction plans for the superstructure shall be set at 70° F. They shall be set, based upon the project requirements and the minimum installation width of the seal, normal to the steel rail sections.

The minimum joint installation width is generally equal to 1½ inches for smaller size strip seals.

Strip seals with a 5 inch classification are available. However, their use must be carefully evaluated against the AASHTO LRFD Uniform Temperature factoring.

6. The designer should closely analyze and provide details and configurations in problematic areas; such as, sidewalks and parapets. The potential for joint leakage is usually greater in these areas, and they are often difficult to construct and maintain.

Joint details at sidewalks, parapets and median barriers shall be shown on the plans.

### **21.5 Modular Bridge Joint Systems (MBJS)**

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

The expansion joint system is continuous across the full width of the roadway and continues into traffic barriers.

2. Working drawings shall include but not be limited to the following:
  - a. Plans, elevation and section of the joint system for each movement rating and roadway width showing dimensions and tolerances.
  - b. All ASTM, AASHTO or other material designations.
  - c. Method of installation including but not limited to sequence, setting relative to temperature, anchorage during setting, and installation at curbs.
  - d. Galvanizing of steel members.
  - e. Details of temporary supports for shipping and handling.
  - f. Design calculations for all structural elements. The design calculations shall include a fatigue design and a strength design (when appropriate) for all structural elements, connections, and splices. All welded centerbeam splices shall be shown on the shop plans.
3. The design of MBJS shall generally conform to the following design parameters and to criteria stated in Subsection 14.5.6.9 of the *AASHTO LRFD Bridge Design Specifications*:
  - a. It is preferred that the system be designed and fabricated as one continuous unit without field splices. The maximum expansion joint assembly length will be controlled by practical shipping limits. If site and/or construction requirements dictate the need for field splices, the splices shall be located in areas outside the main traffic lanes and consist of a bolted separator beam.
  - b. The expansion joint system shall be appropriately designed to accommodate all expected longitudinal movements (i.e. thermal, creep, shrinkage, elastic shortening, etc.) as well as vertical and horizontal rotations.
  - c. Verify by fatigue testing the fatigue resistance of transverse separation beams, support bars, and other structural elements. Design these elements according to the guidelines provided in NCHRP Report 402 – *Fatigue Design of Modular Bridge Expansion Joints* as well as the provisions specified in Subsection 14.5.6.9 of the *AASHTO LRFD Bridge Design Specifications*.
  - d. The expansion joint assembly seals shall not protrude above the top of the joint.
  - e. The elastomeric springs, bearings and strip seals shall be designed so that they are removable and replaceable.