

14.5 BRIDGE JOINTS

Expansion joint devices are designed to accommodate structure movement, provide smooth and quiet passage of traffic, prevent water runoff (particularly deicing chemicals) from damaging the supporting structural elements, and provide a long service life.

The following selection criteria cover the expansion joint systems most commonly used in Idaho:

SMALL MOVEMENT JOINTS

Small movement joints can be utilized where the total movement is approximately 1"-2" and the skew is less than 30°. Joint types include compression seals, silicone sealants, and asphalt plug joints. Compression Seals are the preferred joint type for new construction. Silicone Sealant joints should be limited to repair/rehabilitation projects.

- Compression Seals are continuous preformed elastomeric sections with extruded internal web systems and are held in place by mobilizing friction against adjacent vertical faces. They must be sized and installed to always be in a state of compression. The nominal uncompressed width of Compression seals should not exceed 4" and the skew should not exceed 30°.

Seals should be designed according to the Selection Criteria for Compression Seals in A14.6.

The following is a list of approved joints:

<u>MANUFACTURER</u>	<u>STYLE</u>
WATSON BOWMAN & ACME	WA Series
D.S. BROWN	CV Series

- Silicone sealants are poured in place directly over a foam backer rod placed in the expansion gap. The cured silicone sealant joint can accommodate tensile movements of up to 100% and compressive movements of up to 50% of the sealant width at installation. A minimum recess is required from the top of the pavement to the top of the silicone sealant in order to prevent tire traffic from contacting and debonding the sealant from the substrate.

The following is a list of approved joints:

<u>MANUFACTURER</u>	<u>STYLE</u>
DOW CORNING	Dow 902 RCS

- Asphaltic plug joints consist of polymer modified asphalt (PMA) installed within a blockout over a steel plate. The steel plate spans across the expansion gap to retain the PMA during its installation. Application guidelines must be carefully followed to assure successful performance. They should not be used for joints having large skew angles, joints subjected to large rotations, joints subjected to differential vertical movements (for example, longitudinal separation joints), or in situations where the total height of the PMA above the steel plate is less than 2". Asphaltic plug joints should not be used in situations where the adjacent pavement is subjected to significant acceleration or deceleration (off ramps, traffic signals) because the PMA has a tendency to creep out of the blockout and this tendency is amplified by any horizontal loading.

The following is a list of approved joints:

<u>MANUFACTURER</u>	<u>STYLE</u>
LINEAR DYNAMICS	BRIDGE JOINT SYSTEM (BJS)
D.S. BROWN	MATRIX 502 ASPHALTIC EXPANSION JOINT
WATSON BOWMAN ACME	WABO EXPANDEX JOINT SYSTEM
DEERY AMERICAN CORP	DEERY FLEXIBLE JOINT SYSTEM

Polymer concrete headers are recommended at compression seal and silicone sealant joints. Polymer concrete provides tensile strength and toughness to resist traffic impact. Proprietary elastomeric concretes can also be used to further enhance impact resistance. Patent infringement issues may result when generic polymer concrete is used in combination with a Dow Corning silicone sealant.

MEDIUM MOVEMENT JOINTS

Strip Seals are the preferred system for medium movement joints. Maximum allowable joint opening, measured in the direction of traffic, is 4". This is to improve ride and reduce hazard to motorcycles and bicycles.

Strip Seals should be designed according to the Selection Criteria For Strip Seals in A14.6.

The following factors that affect movement should be considered in determining the joint size:

- Creep
- Construction tolerances
- Temperature range
- Bearing type and direction of allowed movements
- Skew
- External restraints

Movement from earthquake is not generally considered.

When designing joint modifications, review past inspection reports for recorded joint movement history. Adjustment of the expansion device to compensate for bridge temperature at time of installation must be possible.

The majority of joint failures have been due to failure of the anchorage system.

Complete full-width units should be shipped to the job site. Lengths up to 60' can normally be shipped without difficulty. No joints in the continuous rubber seal should be allowed. One pre-approved manufacturer's shop vulcanized splice per seal is permitted.

Closely analyze joints at sidewalks and parapets with respect to leakage, constructibility, and maintenance.

At highly skewed locations, an effort should be made to reduce skew to diminish joint complexity.

Structural steel extruded shapes with a minimum thickness of 1" should be used. Aluminum extruded shapes should not be used.

The following is a list of approved joints:

<u>MANUFACTURER</u>	<u>STYLE</u>	<u>EXTRUSION TYPE</u>
WATSON BOWMAN & ACME	SE Series	E or A
D.S. BROWN	A2R Series	SSA2

LARGE MOVEMENT JOINTS

Modular Expansion devices are the preferred system for movements in excess of 4". The skew angle should be less than 30° and the movement per sealing element should not exceed 3". The same criteria for Medium Movement Joints apply to modular joints, in addition to the following.

All large expansion devices should be designed for the movements required plus a safety factor of 15%. This excess allowance is intended to prevent destruction of the joint due to unpredictable movements at a given location. Consideration should be given to accommodating some earthquake movement.

All elastomeric sealing components shall be continuous full width of each roadway, including curb treatment. The entire joint device should be shipped completely assembled to the jobsite.

For large expansion joints specify all accepted name brands that provide good performance. Do not specify "OR APPROVED EQUAL".

The following is a list of approved joints:

<u>MANUFACTURER</u>	<u>STYLE</u>
WATSON BOWMAN & ACME	STM Series
D.S. BROWN	D Series

STANDARD DRAWINGS

The most current data for the RECOMMENDED MANUFACTURERS TABLE should be obtained from the manufacturer's web site.

<u>MANUFACTURER</u>	<u>WEB SITE</u>
WATSON BOWMAN & ACME	wbacorp.com
D.S. BROWN	dsbrown.com

The following Compression Seal Standard Drawings are located in the Bridge Design Manual:

SKEWS $\leq 10^\circ$
SKEWS $> 10^\circ$

The Strip Seal Standard Drawing is for a skewed bridge and the details should be modified for a square crossing. The adjustment for temperature change in Note 12 must be calculated.

The Modular Joint Standard Drawing is for a square bridge and the details should be modified for a skewed crossing.

Generic details are provided for both the Silicone Sealant and Asphaltic Plug joints.

MAINTENANCE

Consideration should be given to the maintainability of the joints (particularly for movements over 4"), availability and replaceability of parts, and provisions for access to reach these parts.

WIDENING AND REHABILITATION

During the rehabilitation of bridge decks, it is recommended that existing joints and structure layout be studied to determine which joints can be eliminated or what modifications are necessary to revamp those joints that remain to provide an adequate functional system. Some latitude will be necessary on joint type selection for rehabilitation projects.

SNOW PLOWS

Snow plows have a fixed blade angle between 28° - 35° (left-forward). To minimize the possibility of having a snowplow blade drop into a joint, joint skews between 25° - 38° (left-forward) should be avoided. If not avoidable, modify the joint so the blade can pass over the joint without snagging.

SUBSTRUCTURE PROTECTION

Concrete surfaces beneath expansion joints should be protected with a penetrating water repellent sealer that conforms to Section 511, Type C system. Faces of backwalls, beam seat surfaces, and exposed faces of the cap should be protected on abutments. Pier surfaces to be protected include the beam seat and pier cap. Areas to be protected should be shown on the contract plans.

SHOP DRAWINGS

Review the shop drawings in combination with the Plans and Special Provisions for the following information

- PLAN and ELEVATION of the expansion joint.
- Complete details of all components and sections showing all materials incorporated into the joint.
- All AASHTO or other material designations.
- Movement rating and load capacity.
- Installation procedures including services of a manufacturer's field representative if required.
- Treatment of sidewalks and parapets with respect to leakage and maintenance.
- Anchorage details including special reinforcement of blockouts.
- Considerations of weld details in areas of stress concentration.
- Opening dimensions at intermediate temperatures.

RECOMMENDATIONS

- Eliminate expansion joints where feasible.
 Use monolithic abutments on smaller bridges.
 Use continuity to reduce the number of joints on larger bridges.
- The following joint types should be used for the range of movement shown:

<u>JOINT TYPE</u>	<u>TOTAL MOVEMENT</u>
Compression Seal	1" - 2"
Silicone Sealant	1" - 2"
Asphaltic Plug	1" - 2"
Strip Seal	2" - 4"
Modular Joints	≥ 4"

- As a guideline, bridges with the following lengths may be designed continuous without expansion joints at end abutments if the skew is less than 30°.

<u>STRUCTURE TYPE</u>	<u>LENGTH</u>
Steel Structures	300'
Post-tensioned Concrete	400'
Cast-In-Place Concrete	400'
Prestressed Girder	400'

- Compression seals should not be used when the skew exceeds 30°. Joints with skews greater than 30° require special consideration - see "Selection Criteria for Strip Seals".
- To prevent snowplow blades from dropping into a joint, left-forward skews of 25°-38° should be avoided.

Commentary

As of October 2006, only two manufacturers of compression and strip seal joints could be found – D.S.Brown & WatsonBowmanAcme. Listing only two products on the plans in acceptable to FHWA Idaho Division Office.

Revisions:
April 2008 Added Commentary.