Innovation in Expansion Joints

Repair Methods and Materials

presented by

EMSEAL JOINT SYSTEMS

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What should an expansion joint do?

**Seal** and span the gap between structurally moving elements on a bridge.

Provide **watertightness** to protect vulnerable working mechanisms and concrete below.

- Rebuilt header
- Existing metal angles
- Parapet wall
Performance requirements:

Handle the extreme **movement** of thermal cycling

Withstand **temperature variations** – not become too soft in summer or too brittle in winter

Be easy to **install**

Handle many types of **imperfect substrate conditions**

Provide **continuity** of seal

Provide **solutions** for bridge preservation problems

Be easy to **repair**
Insanity: doing the same thing over and over again and expecting different results.

Attributed to Albert Einstein

Before replacing any joint it is important to determine why the system failed.

Why doesn’t it work?

Innovation: The act or process of introducing new ideas, devices, or methods
Composition of the material is critical as it must remain flexible throughout extremes of temperature ranges:

- not suffer compression set
- not fail at the bondline in cold temps
- not release impregnation chemicals in warm temps
• not suffer failure due to adhesive and cohesive tensile stresses
Identify and Diagnose Extent of Repair

Proper substrate preparation - a critical first step

Refer to best practice for substrate repair.

The concrete surface should be prepared to a minimum concrete surface profile (CSP) 2 as defined by the ICRI surface-profile chips or (CSP) 1 assuming the substrate is moisture free and has been solvent wiped.

Metal substrates must be sandblasted and free of oxidation. Basic standards for preparing metal substrates are a joint effort between the Society for Protective Coatings (SSPC) and the National Association of Corrosion Engineers International (NACE).

Use a good quality elastomeric concrete header material with ratio of resin to aggregate by weight not to exceed 1:2.
Look for a system that is adaptable to various substrates

metal angles

Small spalls or irregular concrete

header material
Look for a system that is easy to install and repair

Inserting Stick

Inserting factory fabricated transitions

Pushing ends together

Material is factory-precompressed ensuring easy install
The system should be flexible to adapt to **angled curbs** and fill irregular gap edges and **small spalls** which will reduce the high cost of substrate repair.
The number one enemy of expansion joints is…
the Snow Plow!

Any type of joint installed too high is vulnerable to
snow plows and other road hazards.
Ask if the manufacturer provides tools to ensure the joint material is installed at a proper depth to survive plows and other road hazards.
Typical Expansion Joint Types

- Liquid sealant and backerod
- Extruded silicone seal
- Compression seal
- Asphalitic plug
- Strip seal
- Modular Joint
- EVA – Closed cell foam
- Bolt down molded rubber
- Neoprene inflatable seal
- Open cell precompressed silicone coated foam
Considerations in choosing a joint system:

- **Movement requirement** - will the system handle required movement - thermal, deflection, even shear (skew)

- Is the **substrate** in good condition with parallel sides or is there some spalling and imperfections.

- Ease and speed of **installation**

- How does the system handle **transitions** at curbs and parapet walls - likely leak points. Does the manufacturer provide warranted **factory fabricated transitions** or do they rely on workmanship in the field with a glued upturn.

- **Reparability** of the system. For example does the entire length of the joint need to be removed or can a section be repaired to save time and money?
Example of a simple to repair system - section only
Silicone Coated Precompressed Open Cell Foam

Measure damaged area

Cut on either side of damaged area

Cut along substrate
Loosen damaged material

Remove damaged material

Grind substrate to remove remaining materials
Measure the opening and add extra 3/8” to ensure a tight fit.

Cut new material including the extra 3/8”

Material cuts with a bread knife
Check that the piece is correct (slightly oversized) Solvent wipe substraight before installation.

Insert silicone bead to the profile of existing bellows. Do not apply silicone directly to the foam.

Apply epoxy (not shown)
Insert new piece and push – due to oversizing note the pressure fit
Use trowels for final placement

Insert gun tip between edge and substrate and insert a ¾” corner band of silicone

Tool away any excess sealant and at the joins and tool corner bands to the substrate
Finished watertight repair

...total time approximately 15 minutes - 30 minutes
Open to traffic immediately
Tools Required for Repair
Sizing Tools to ensure proper selection

Each type of system must be properly sized to handle all movement expectations on each bridge.

Checklist - custom select size for each bridge

Chart - select size on day of install

Does the manufacturer provide tools to help size their material properly?
Sizing Matters - Example of Extreme Skew

In a skew joint total movement includes both thermal and shear occurring simultaneously.

Is the joint material capable of being “pulled” in multiple directions without adhesive or cohesive failure? The manufacturer should be an active participant to determine size and proper application.

Successful retrofit of extreme skew joint in Illinois

No leaks after 2 ½ years
Provide Continuity of Seal

**Factory-Fabricated Terminations and Transitions** ensure continuity of seal through changes in plane and direction at curbs and parapet wall and is an essential performance differentiator.

*Silicone coated in the factory on both sides*
**Before** - No continuity of seal

**After** - Using factory fabricated transition pieces
3 years later and holding up well!

5 years later and holding up well!
Parapet Wall Repair
Factory fabricated assemblies provide continuity of seal.
Custom factory fabricated transitions provide continuity

Saves time, money and provides watertightness

Costommed manufactured in one drop in piece.
Provide **continuity** during repair at the curbs and **watertightness** in an asphaltic plug joint.

“Changes in plane and direction shall be executed using factory-fabricated or custom transition assemblies supplied by the same manufacturer of the pre-compressed polyurethane silicone coated foam seal…”
Provide **Solutions** for Bridge Preservation

*Repair of existing systems*

It is costly to remove cast in place systems like old strip seals.

If the metal rails are still in good condition including the surrounding substrates, but the membrane is no longer manufactured or is unable to be snapped in due to damage in the knuckle area there are options.
Replacement of failed seals in **strip seal** configurations

Field applied non sag epoxy fills void
Tip - Choose a joint material capable of adapting to upturns in strip seal retrofit
Failed elastomeric seals in modular joints

Rubber Seals have failed or no longer available
Replacement for failed seals in a modular joint

* Modular Joints have many moving parts. Repair may not provide watertightness but can function to prevent debris from falling through to roadway below.
A flexible solution for repairing *reoccurring failed liquid sealants* that is **cost effective** for small joint gaps in **transverse** and **longitudinal** joints.

Manufactured in 12 foot reels for lane by lane staged install.

Not dependent on correct application of backerod and liquid sealant. Able to open to traffic immediately.
Innovation in Bridge Expansion Joints

Look for new ways of solving problems and new products that deliver the following:

- Long-lasting watertight solution
- Handles extreme thermal movement
- Simple to install
- Fills imperfect substrate conditions
- Easy to repair
- Continuity of seal at curbs and parapets
- Cost effective

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Questions?