Innovation in Expansion Joints

Repair Methods and Materials

presented by

EMSEAL JOINT SYSTEMS

April 2017

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

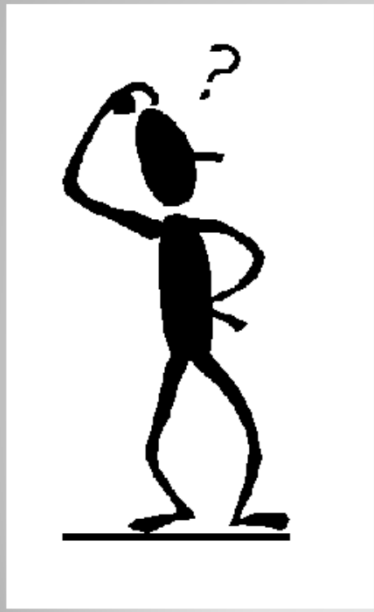
Provide **solutions** for bridge preservation problems

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

Wax emulsion bleeding during hot weather

- not suffer failure due to adhesive and cohesive tensile stresses

Identify and Diagnose Extent of Repair

Proper substrate preparation - a critical <u>first</u> 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.

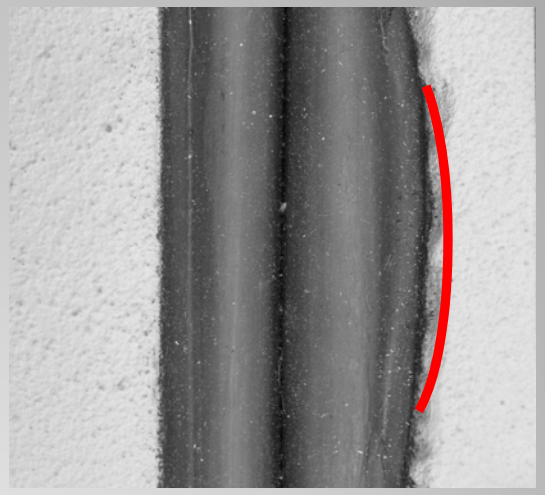
Metal substrates must be sandblasted and free of oxidation. Basic standards for preparing metal substrates are a joint effort between the Society for Protective Coatings (SSPC) and the National Association of Corrosion Engineers International (NACE).

Use a good quality elastomeric concrete header material with ratio of resin to aggregate by weight not to exceed 1:2.

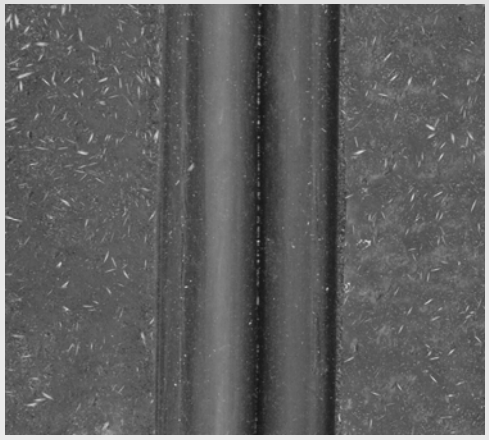
Look for a system that is adaptable to various substrates

metal angles

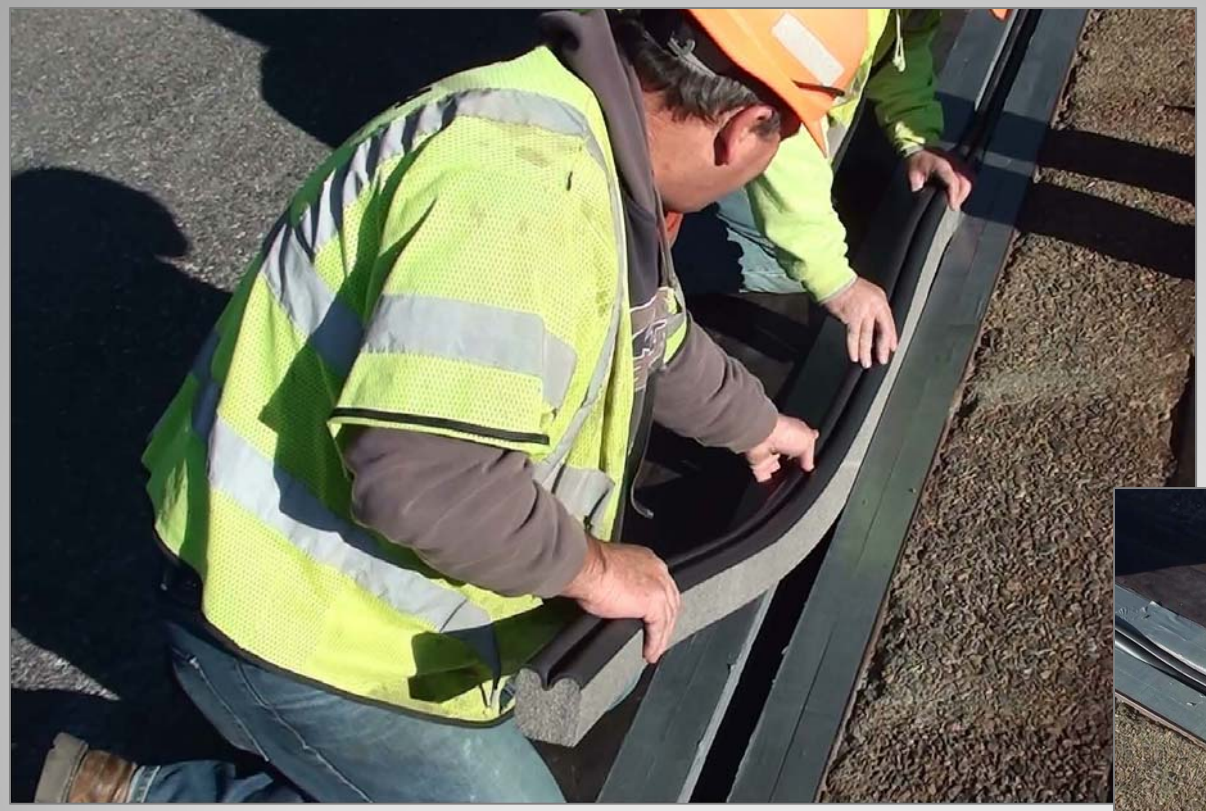
Small spalls or irregular concrete



header material



Look for a system that is easy to install and repair



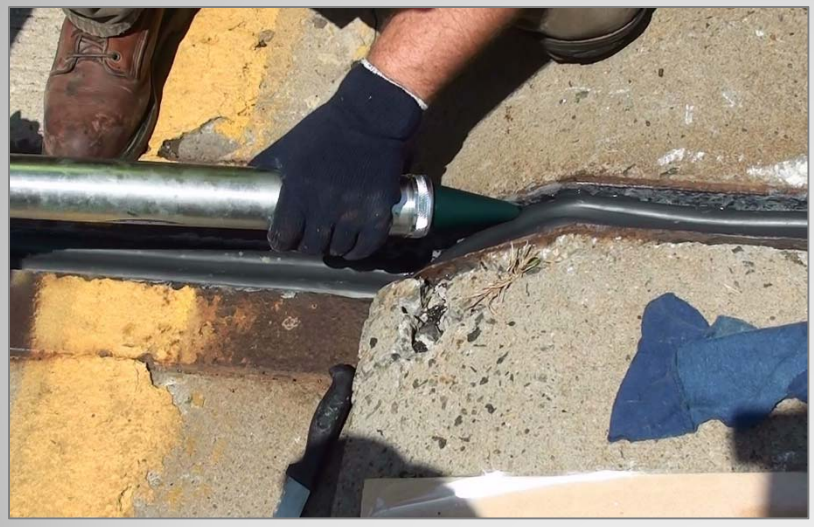
Inserting Stick

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.

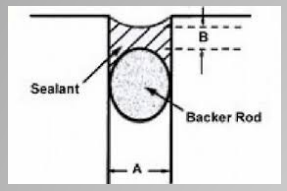


The number one enemy of expansion joints is... the Snow Plow!

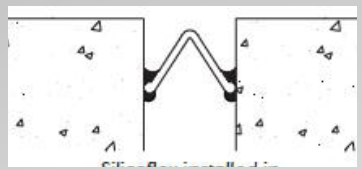
Any type of joint installed too high is vulnerable to snow plows and other road hazards.

Ask if the manufacturer provides tools to ensure the joint material is installed at a proper depth to survive plows and other road hazards.

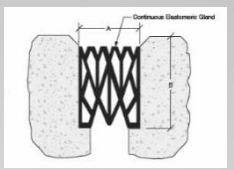
Typical Expansion Joint Types



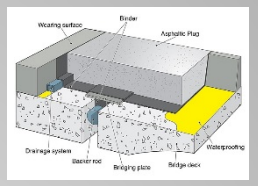
Liquid sealant and backerod



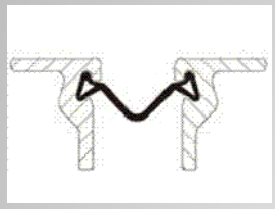
Extruded silicone seal



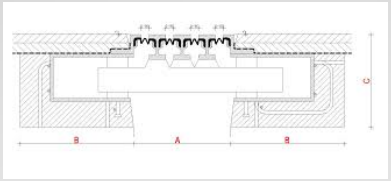
Compression seal



Asphaltic plug



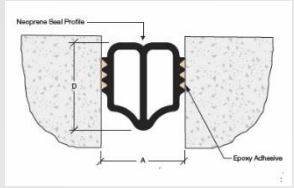
Strip seal



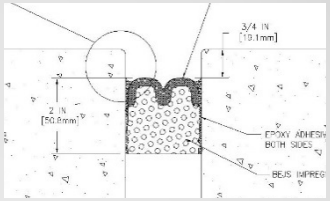
Modular Joint

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

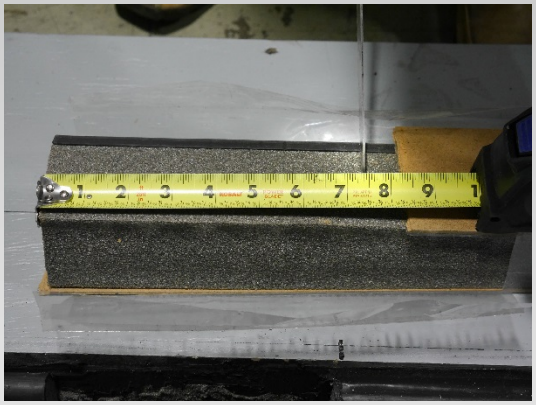
Cut along substrate

Loosen damaged material

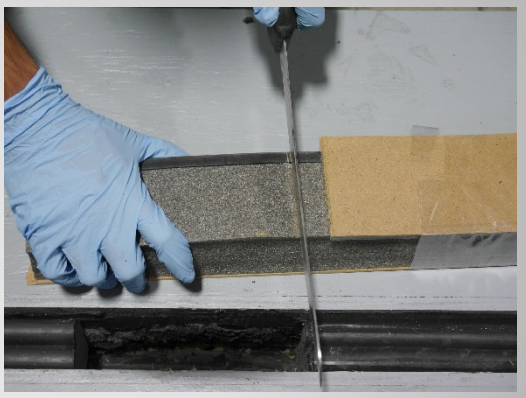
Remove damaged material

Grind substrate to remove remaining materials

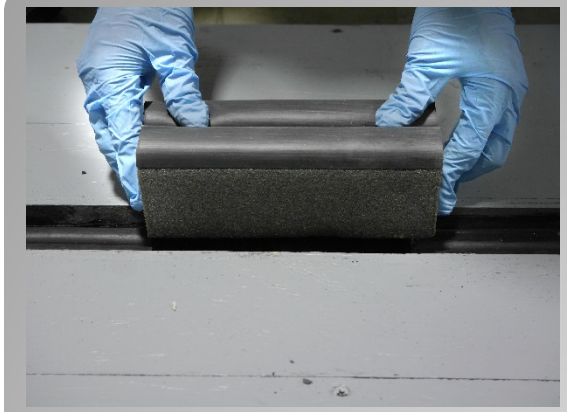
Measure the opening and add extra 3/8” to ensure a tight fit.



Cut new material including the extra 3/8”



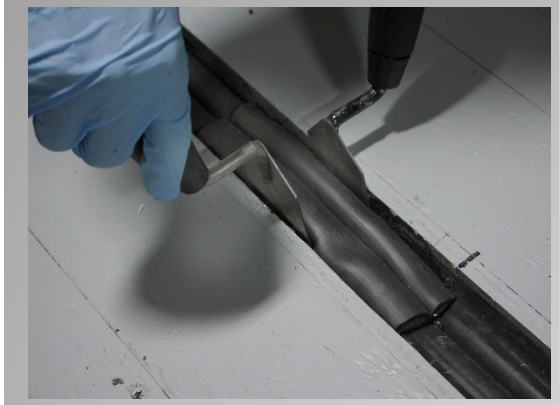
Material cuts with a bread knife



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

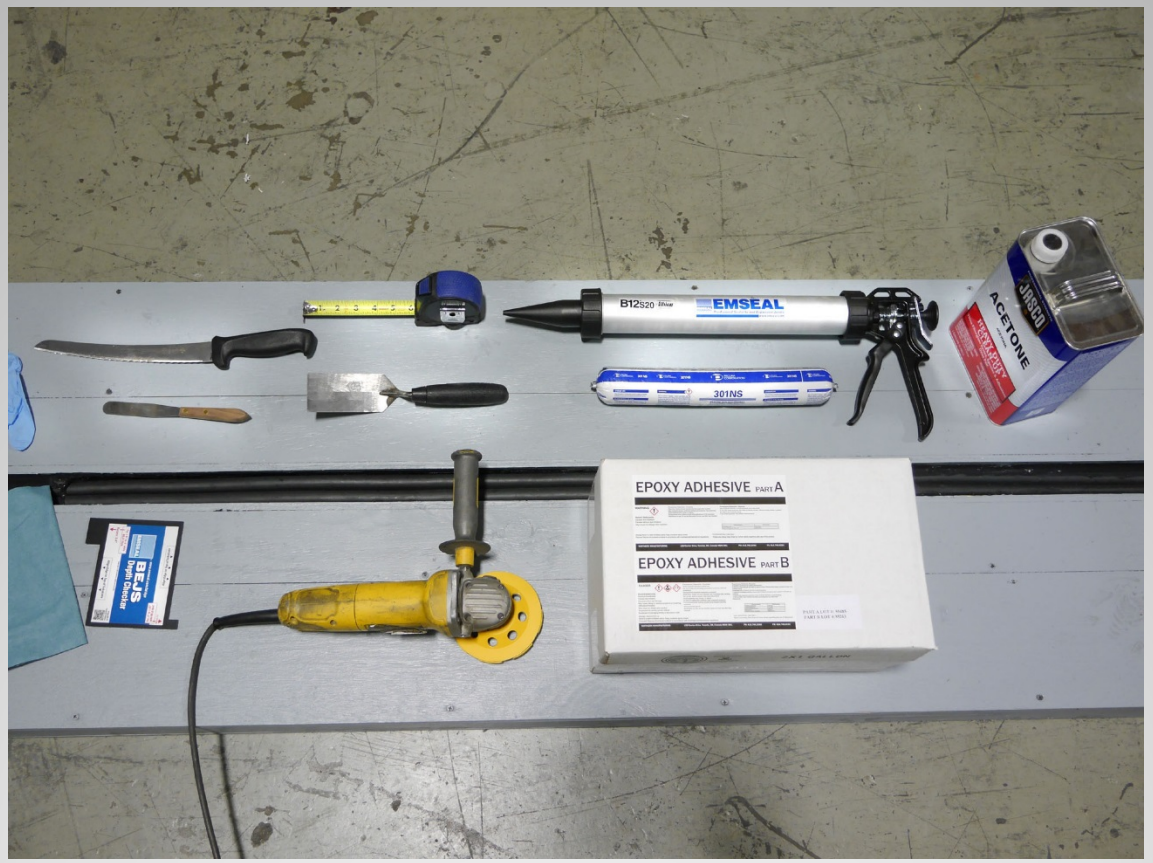
Insert gun tip between edge and substrate and insert a ¾” corner band of silicone

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

Finished watertight repair

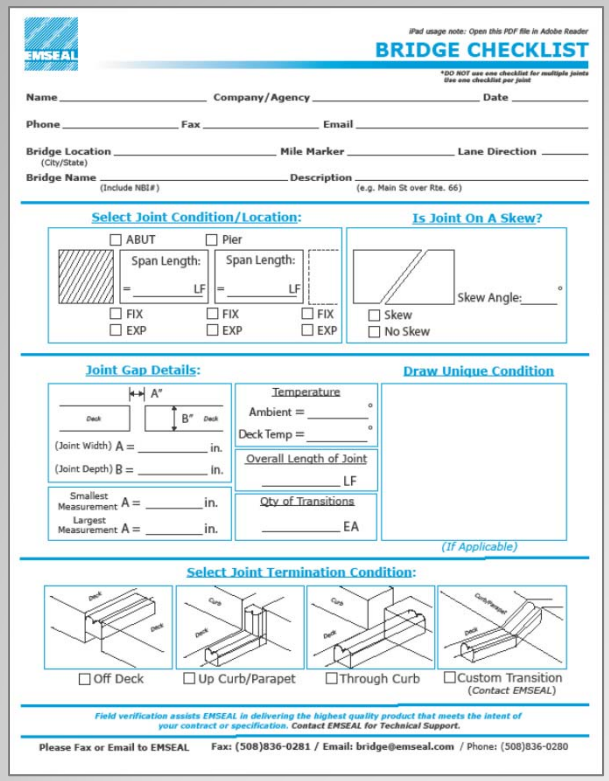
.....total time approximately 15 minutes – 30 minutes
Open to traffic immediately

Tools Required for Repair



Sizing Tools to ensure proper selection

Each type of system must be *properly sized* to handle <u>all</u> movement expectations on each bridge.



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iPad usage note: Open this PDF file in Adobe Reader

BRIDGE CHECKLIST

*DO NOT use one checklist for multiple joints Use one checklist per joint

Name _____ Company/Agency _____ Date _____

Phone _____ Fax _____ Email _____

Bridge Location _____ Mile Marker _____ Lane Direction _____
(City/State)

Bridge Name _____ Description _____
(Include NBI#) (e.g. Main St over Rte. 66)

Select Joint Condition/Location:

☐ ABUT ☐ Pier

Span Length: = _____ LF

Span Length: = _____ LF

☐ FIX ☐ EXP ☐ FIX ☐ EXP ☐ FIX ☐ EXP

Is Joint On A Skew?

Skew Angle: ____°

☐ Skew ☐ No Skew

Joint Gap Details:

A" B" Deck

(Joint Width) A = _____ in.

(Joint Depth) B = _____ in.

Smallest Measurement A = _____ in.

Largest Measurement A = _____ in.

Temperature

Ambient = _____°

Deck Temp = _____°

Overall Length of Joint

_____ LF

Qty of Transitions

_____ EA

Draw Unique Condition

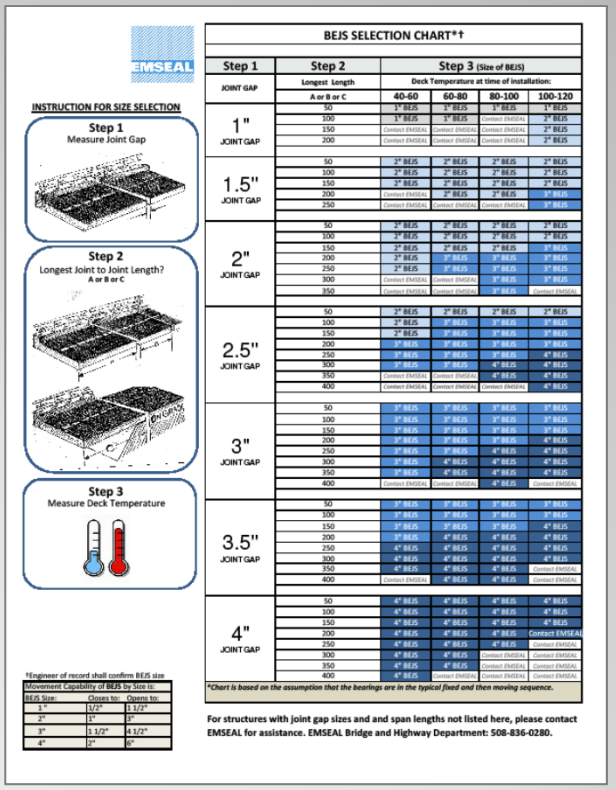
(If Applicable)

Select Joint Termination Condition:

☐ Off Deck ☐ Up Curb/Parapet ☐ Through Curb ☐ Custom Transition (Contact EMSEAL)

Field verification assists EMSEAL in delivering the highest quality product that meets the intent of your contract or specification. Contact EMSEAL for Technical Support.

Please Fax or Email to EMSEAL Fax: (508)836-0281 / Email: bridge@emseal.com / Phone: (508)836-0280



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BEJS SELECTION CHART*†

INSTRUCTION FOR SIZE SELECTION

Step 1 Measure Joint Gap

Step 2 Longest Joint to Joint Length? A or B or C

Step 3 Measure Deck Temperature

Step 1	Step 2	Step 3 (Size of BEJS)			
JOINT GAP	Longest Length A or B or C	Deck Temperature at time of installation: 40-60	60-80	80-100	100-120
1" JOINT GAP	50	1" BEJS	1" BEJS	1" BEJS	1" BEJS
	100	1" BEJS	1" BEJS	Contact EMSEAL	2" BEJS
	150	Contact EMSEAL	Contact EMSEAL	Contact EMSEAL	2" BEJS
	200	Contact EMSEAL	Contact EMSEAL	Contact EMSEAL	2" BEJS
1.5" JOINT GAP	50	2" BEJS	2" BEJS	2" BEJS	2" BEJS
	100	2" BEJS	2" BEJS	2" BEJS	2" BEJS
	150	2" BEJS	2" BEJS	2" BEJS	2" BEJS
	200	Contact EMSEAL	2" BEJS	2" BEJS	3" BEJS
	250	Contact EMSEAL	Contact EMSEAL	Contact EMSEAL	3" BEJS
2" JOINT GAP	50	2" BEJS	2" BEJS	2" BEJS	2" BEJS
	100	2" BEJS	2" BEJS	2" BEJS	2" BEJS
	150	2" BEJS	2" BEJS	2" BEJS	3" BEJS
	200	2" BEJS	3" BEJS	3" BEJS	3" BEJS
	250	2" BEJS	3" BEJS	3" BEJS	3" BEJS
	300	Contact EMSEAL	Contact EMSEAL	3" BEJS	3" BEJS
	350	Contact EMSEAL	Contact EMSEAL	3" BEJS	Contact EMSEAL
2.5" JOINT GAP	50	2" BEJS	2" BEJS	2" BEJS	2" BEJS
	100	2" BEJS	3" BEJS	3" BEJS	3" BEJS
	150	2" BEJS	3" BEJS	3" BEJS	3" BEJS
	200	3" BEJS	3" BEJS	3" BEJS	3" BEJS
	250	3" BEJS	3" BEJS	3" BEJS	4" BEJS
	300	3" BEJS	3" BEJS	4" BEJS	4" BEJS
	350	Contact EMSEAL	Contact EMSEAL	4" BEJS	4" BEJS
	400	Contact EMSEAL	Contact EMSEAL	Contact EMSEAL	4" BEJS
3" JOINT GAP	50	3" BEJS	3" BEJS	3" BEJS	3" BEJS
	100	3" BEJS	3" BEJS	3" BEJS	3" BEJS
	150	3" BEJS	3" BEJS	3" BEJS	3" BEJS
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	300	3" BEJS	4" BEJS	4" BEJS	4" BEJS
	350	3" BEJS	4" BEJS	4" BEJS	4" BEJS
	400	Contact EMSEAL	Contact EMSEAL	4" BEJS	Contact EMSEAL
3.5" JOINT GAP	50	3" BEJS	3" BEJS	3" BEJS	3" BEJS
	100	3" BEJS	3" BEJS	3" BEJS	3" BEJS
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	300	4" BEJS	4" BEJS	Contact EMSEAL	Contact EMSEAL
	350	4" BEJS	4" BEJS	Contact EMSEAL	Contact EMSEAL
	400	4" BEJS	Contact EMSEAL	Contact EMSEAL	Contact EMSEAL

*Chart is based on the assumption that the bearings are in the typical fixed and then moving sequence.

*Engineer of record shall confirm BEJS size

Movement Capability of BEJS by Size is:		
BEJS Size:	Closes to:	Opens to:
1"	1/2"	1 1/2"
2"	1"	3"
3"	1 1/2"	4 1/2"
4"	2"	6"

For structures with joint gap sizes and and span lengths not listed here, please contact EMSEAL for assistance. EMSEAL Bridge and Highway Department: 508-836-0280.

<u>Checklist</u> – custom select size for each bridge

<u>Chart</u> - 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.

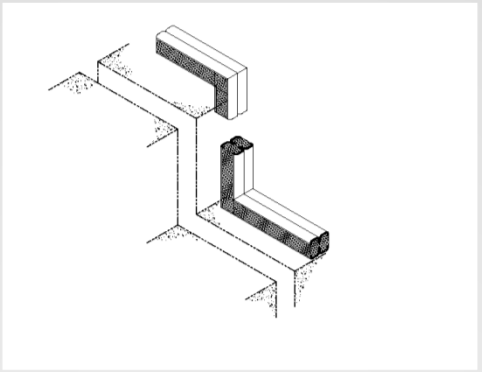
Is the joint material capable of being “pulled” in multiple directions without adhesive or cohesive failure? The manufacturer should be an active participant to deterime size and proper application.

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!

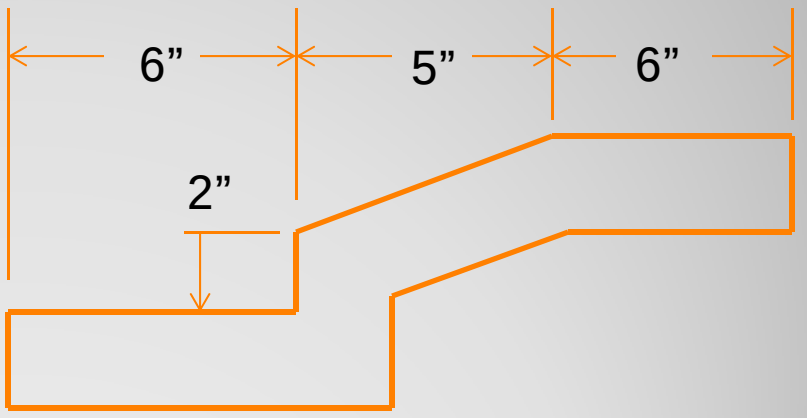
5 years later and holding up well!

Parapet Wall Repair

Factory fabricated assemblies provide continuity of seal.

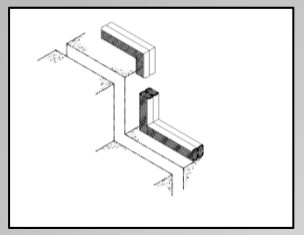
Custom factory fabricated transitions provide continuity

Saves time, money and provides watertightness

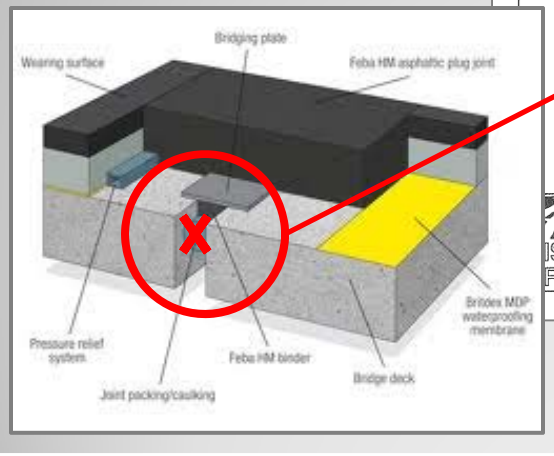


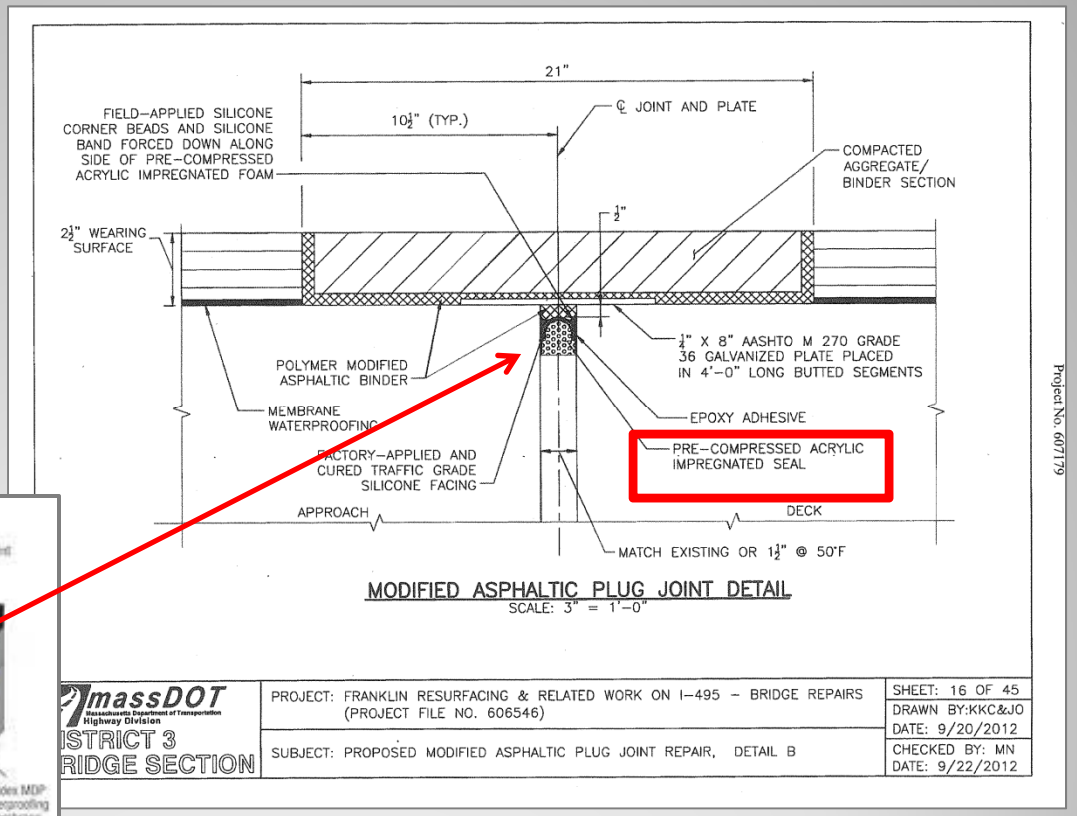
Costomed manufactured in one drop in piece.

Provide **continuity** during repair at the curbs and **watertightness** in an asphaltic plug joint



New detail at the curb





"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

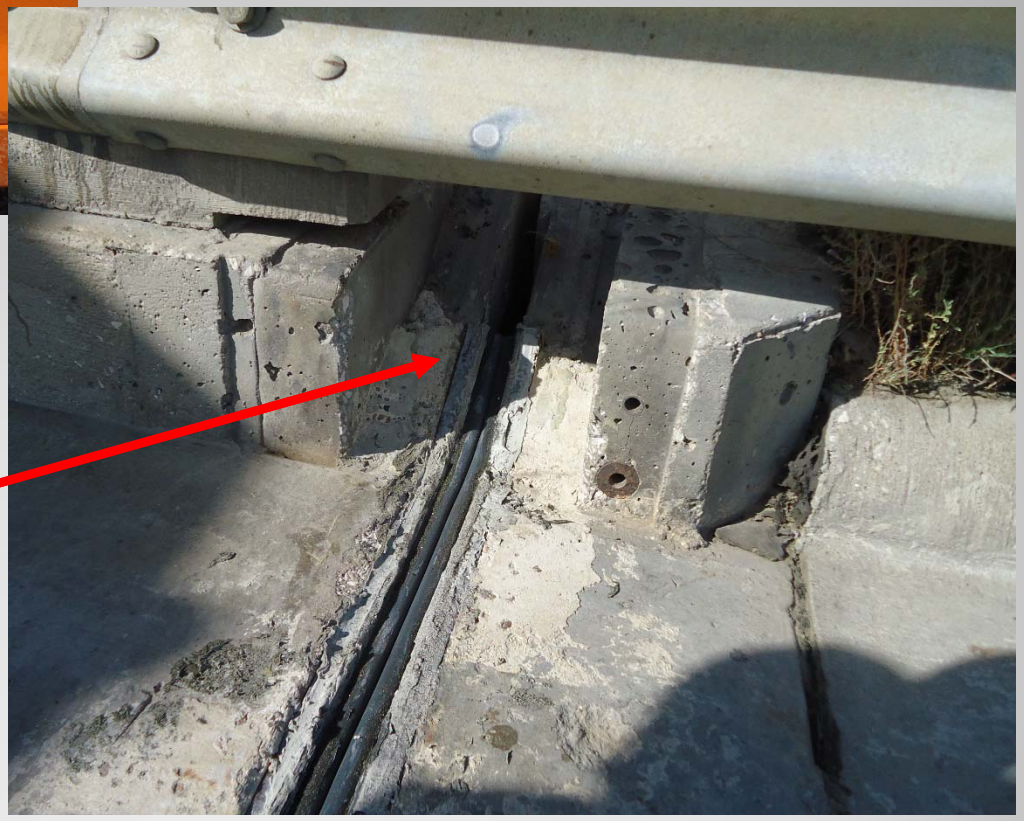
Repair of existing systems

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.

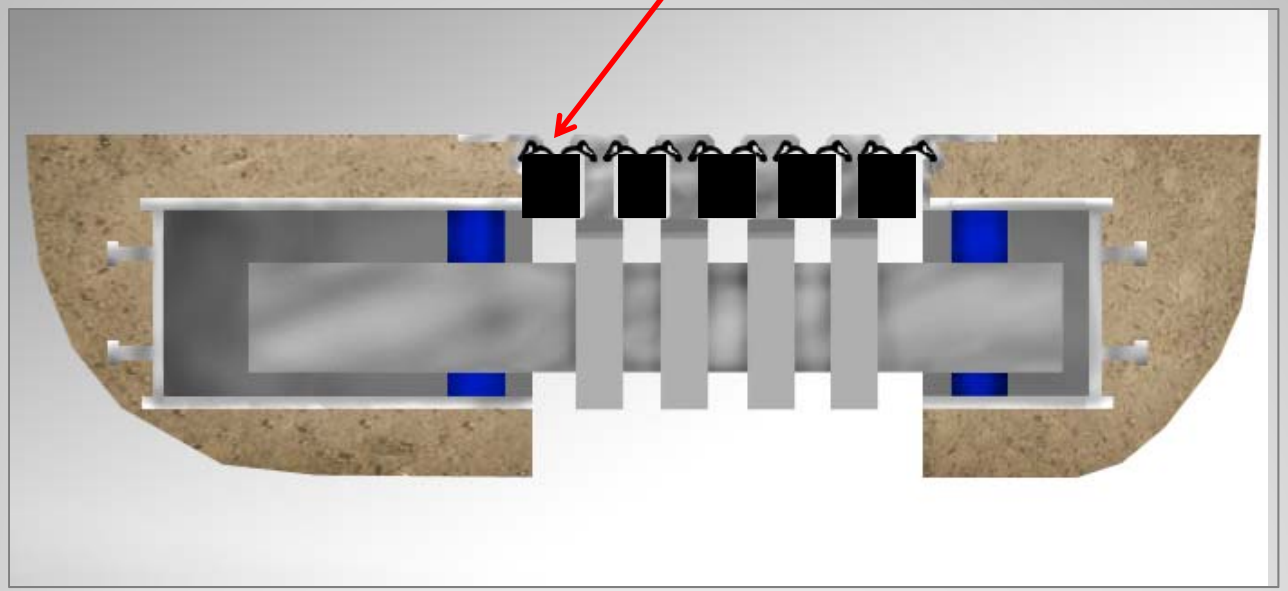
Replacement of failed seals in **strip seal** configurations

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



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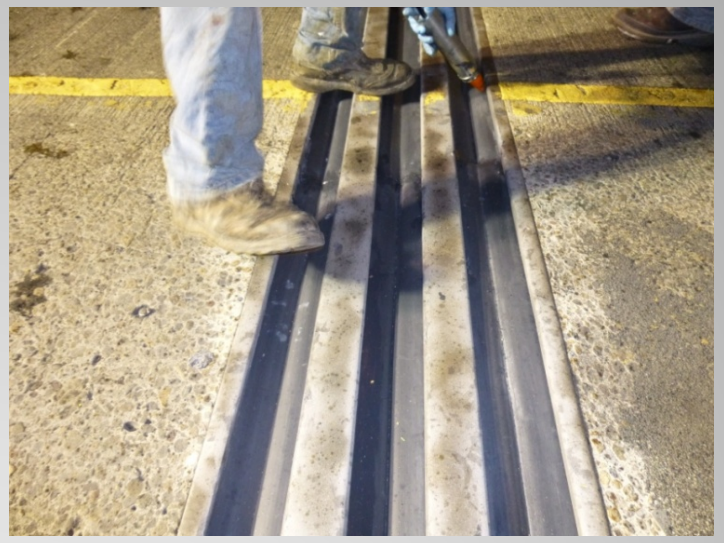
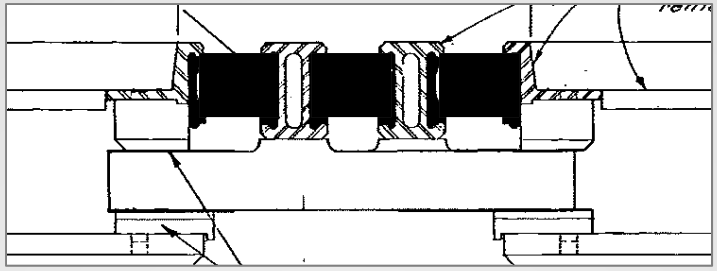
Replacement for failed seals in a modular joint

Before



After



* Modular Joints have many moving parts. Repair may not provide watertightness but can function to prevent debris from falling though to roadway below.

A flexible solution for repairing *reoccurring failed liquid sealants* that is **cost effective** for small joint gaps in <u>transverse</u> and <u>longitudinal</u> 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
EMSEAL
EMSEAL Joint Systems, Ltd. (508) 836-0280 / www.emseal.com/bridge

Questions?