AASHTO Preservation Management - Local Agency Outreach Working Group

Bridge Joints

9/18/2024

Outline

- Joint Identification
- Joint Maintenance – Why Do It?
- Identify the Problem – Scope
- Simple Maintenance – Problem Prevention
- Advanced Maintenance – Strip Seal Replacement



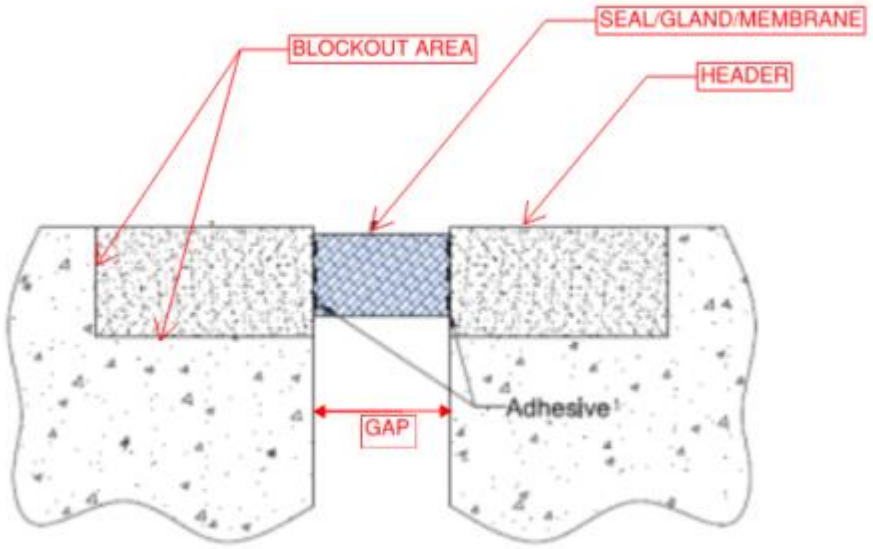

Joint Identification

- Guidelines for Maintaining Small Movement Bridge Expansion Joints – NCHRP 12-100

Joint Identification

- Definitions
  - Joint Movement – the opening and closing displacement caused by the change in temperature of the bridge.
  - Joint Gap – the nominal opening of the joint set at the time of construction.
  - Joint Seal – the flexible material that spans the joint gap. Also called membrane, gland or gasket.
  - Joint Blockout – the area adjacent to the joint that anchors the joint system.
  - Joint Header – the material placed in the blockout.

Joint Identification



Joint Identification

- Permit expansion, contraction, and/or rotational movement
- Located above piers, abutments, pin & hangers, or placed on a sleeper slab

Joint Identification

- Asphaltic Plug
  - Movement up to 1 inch

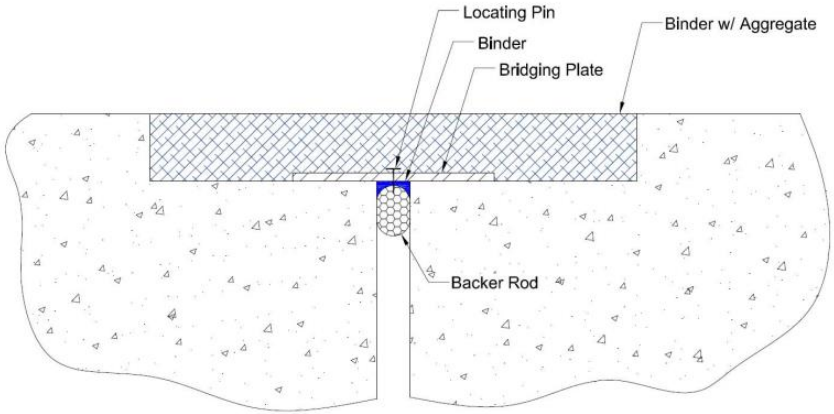
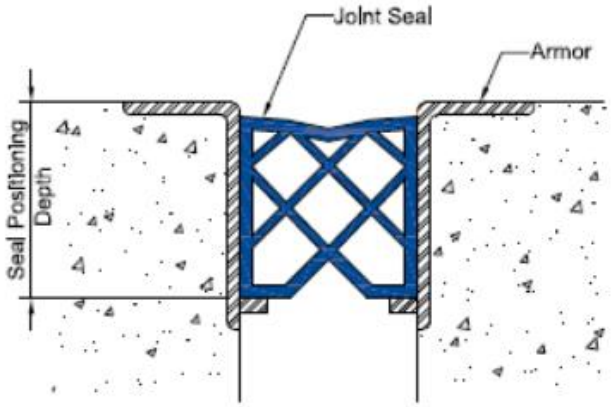
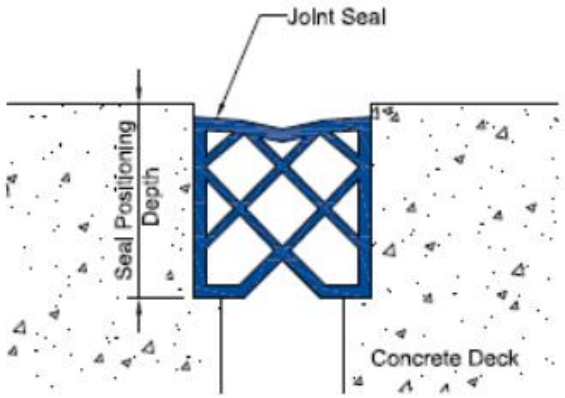


FIGURE 1.

Joint Identification

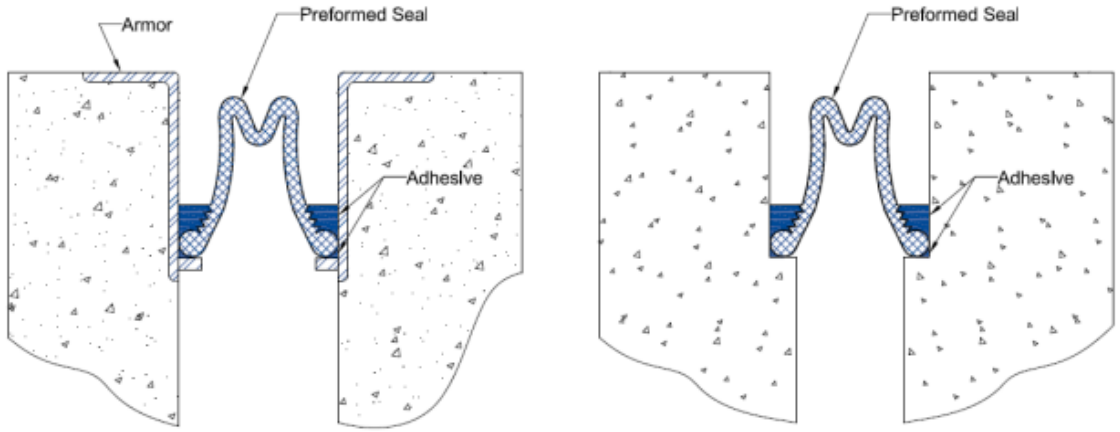
- Open Cellular Compression Seal –
  - Seal is compressed prior to placement in gap.
  - Movement up to 2-1/2 inch.





Joint Identification

- Bonded Seal –
  - Seal is bonded to concrete with adhesive.
  - Movement up to 2-1/2 inch.



Joint Identification

- Bonded & Compressed –
  - Seal is compressed prior to placement in gap.
  - Seal is bonded with adhesive.
  - Material is purchased 50% wider than joint opening.
  - Movement up to 2-1/2 inch.

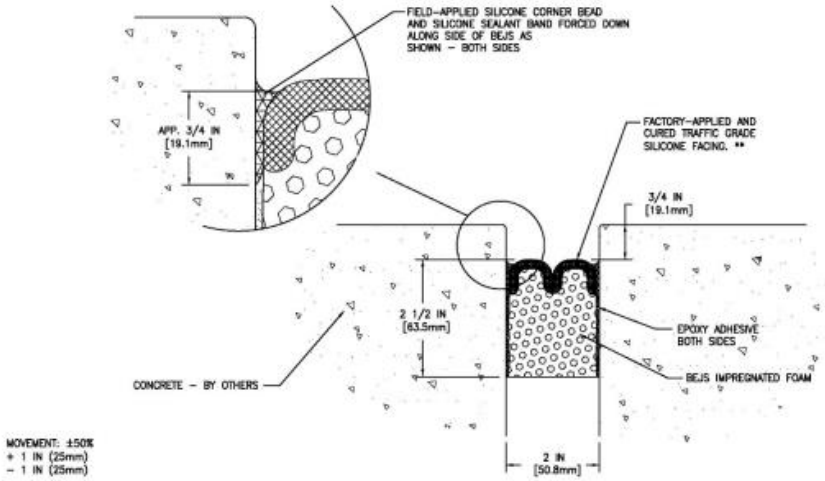
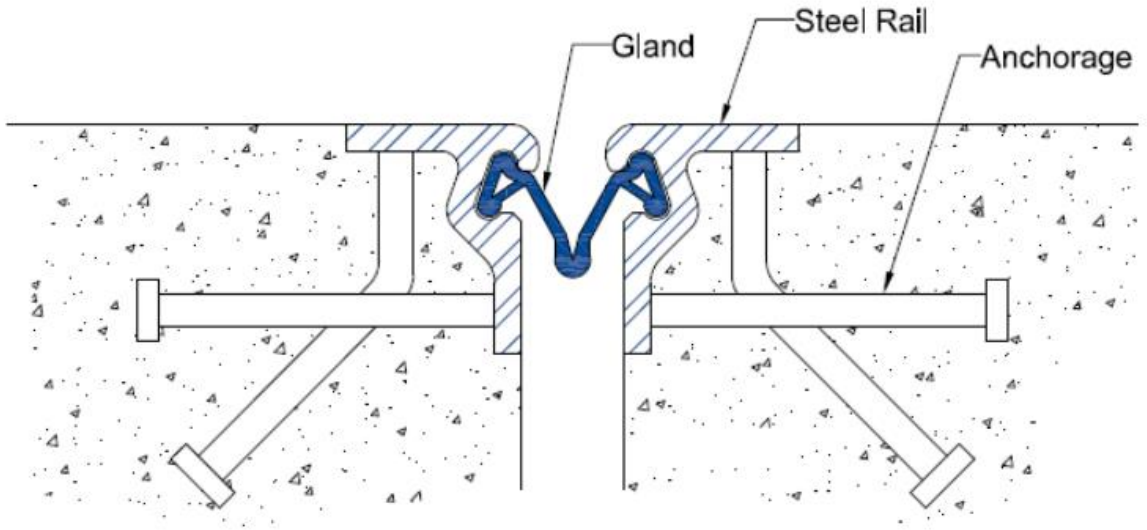


Figure 5 Precompressed, self-expanding open cell foam bonded joint seal

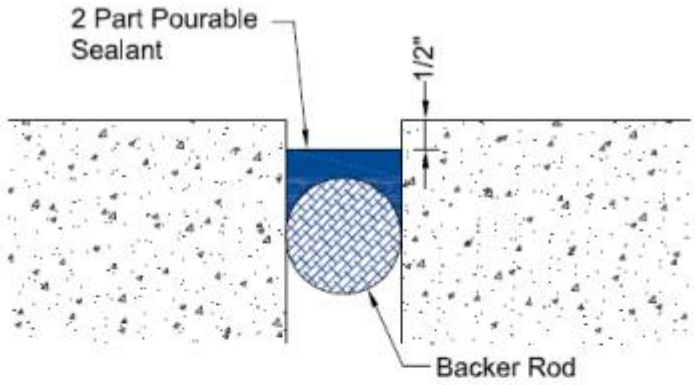
Joint Identification

- Strip Seal
  - Movement up to 4 inches



Joint Identification

- Pourable
  - Movement up to 1 inch



Joint Identification

- How much movement did you say?

Joint Identification

- Pourable
  - Movement up to 1 inch

STRUCTURE NUMBER	ANGLE OF CROSSING TO NEAREST 10°	LOCATION OF JOINT	MIN. TOT. TRAVEL ALONG CENTERLINE OF BRIDGE *	REQUIRED LENGTH OF EXPANSION JOINT DEVICE

Joint Maintenance – Why Do It?

- Damaged joints will leak resulting in deterioration of superstructure elements below.

Joint Maintenance – Why Do It?

- Damaged joints will leak resulting in deterioration of substructure elements below.

Joint Maintenance – Why Do It?

- Damaged joints will leak resulting in deterioration of bearing elements below.

Joint Maintenance – Why Do It?

- Damaged bearings restrict thermal movement, causing substructure and superstructure damage. Lather, Rinse, Repeat

Identify the Problem - Scope

- Is the Joint Leaking?
  - Best time to inspect a bridge – right after it rains

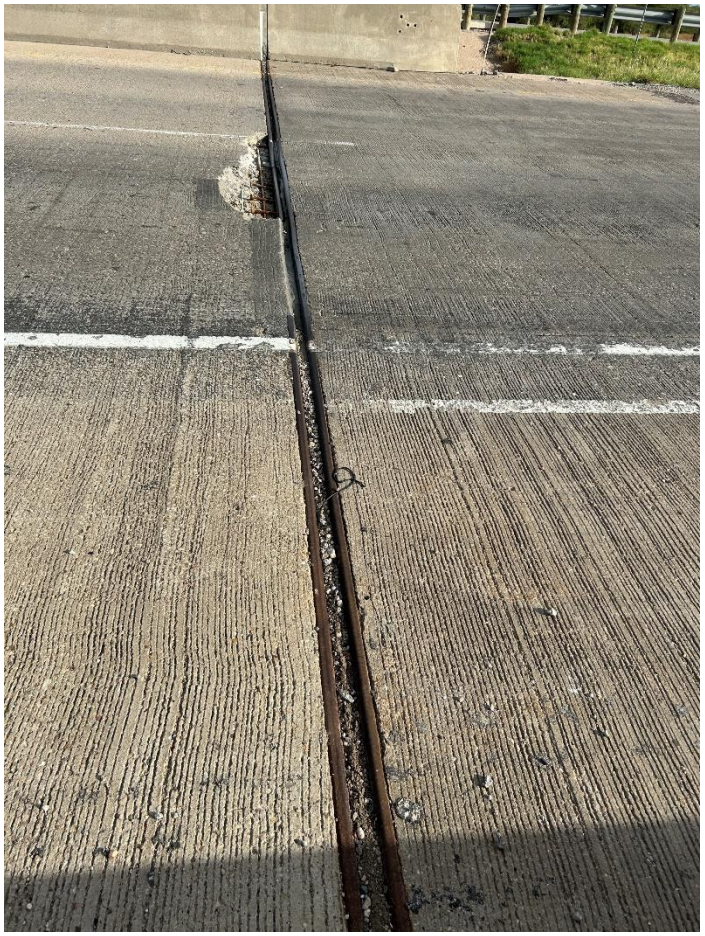
Identify the Problem - Scope

Plow Damage

Debris Impaction Gland Tear

Identify the Problem - Scope

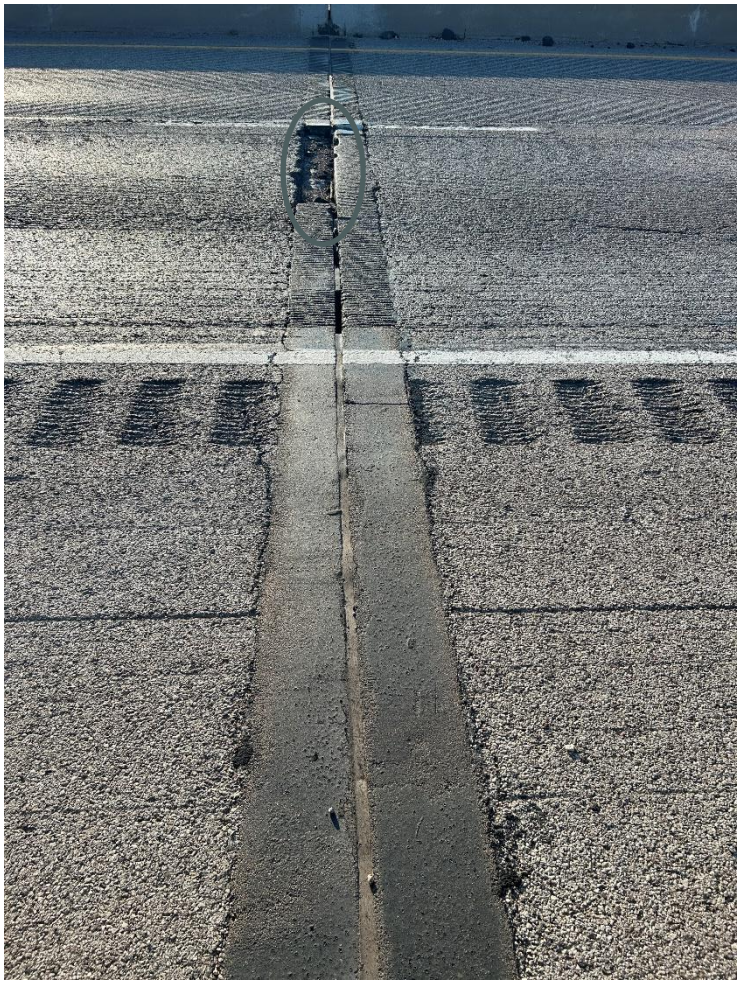
Improper Construction –
Expansion Rail Pulled Away



Adjacent Concrete Spall

Identify the Problem - Scope

Adhesion Failure – Missing Pourable Joint Material



Header Material Failure

Simple Maintenance – Problem Prevention

- Clean your joints

Simple Maintenance – Problem Prevention

- Clean your bridge and flush your drains – follow local environmental regulations

Simple Maintenance – Problem Prevention

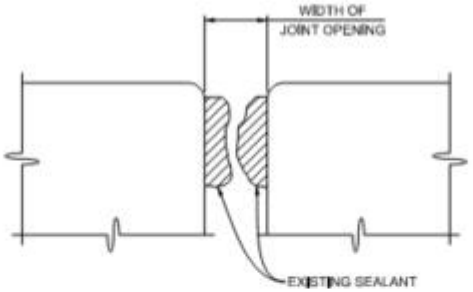
- Clean your bridge, clean your bridge, clean your bridge

The NTSB says corrosion and section loss resulted from clogged drains that caused water to run down bridge legs and accumulate along with debris at the bottom of the legs, which prevented the development of a protective rust layer.Although repeated maintenance and repair recommendations were documented in inspection reports, the agency said Pittsburgh failed to act on them, leading to the deterioration of the fracture-critical transverse tie plate and the structural failure of the bridge."The city of Pittsburgh was r...

- **Corrosion and section loss resulted from clogged drains**

Simple Maintenance – Problem Prevention

- Reseal pourable joint seals – Be Proactive!

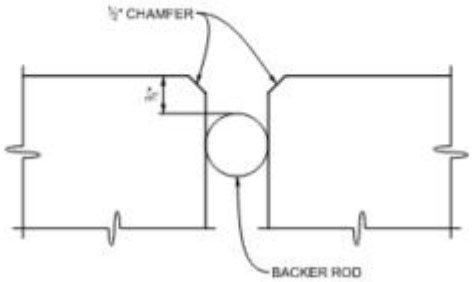


STEP 1

1. COMPLETELY REMOVE REMAINS OF EXISTING JOINT AND ALL SEALANT.
2. THOROUGHLY CLEAN THE EXISTING JOINT OPENING OF ALL MATERIAL AND DEBRIS BY SANDBLASTING, USING COMPRESSED AIR TO REMOVE DUST AND DIRT.
3. IF NECESSARY RE-SAW JOINT OPENING BETWEEN ⅜" AND ⅝".
4. USING AND ANGLE GRINDER, ROUND EDGES OF JOINT TO ½" CHAMFER.

Simple Maintenance – Problem Prevention

- Reseal pourable joint seals – Be Proactive!

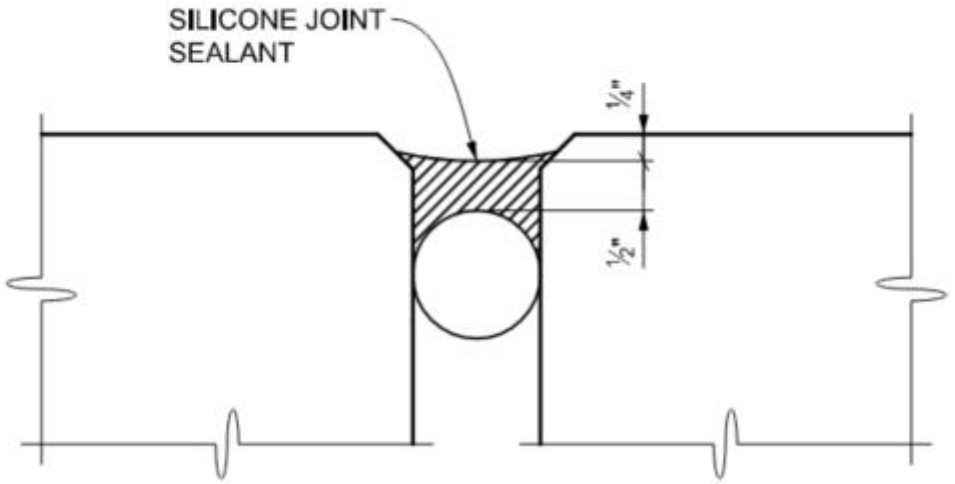


STEP 2

1. INSTALL FOAM BACKER ROD INTO JOINT APPROXIMATELY ¾" BELOW THE SURFACE OF THE CONCRETE. THE BACKING MATERIAL SHOULD BE ⅛" WIDER THAN THE JOINT TO BE SEALED.

Simple Maintenance – Problem Prevention

- Reseal pourable joint seals – Be Proactive!
- Key Observations – Thicker at edge for adhesion – Hourglass shape (thinner in the middle) for joint expansion and contraction.



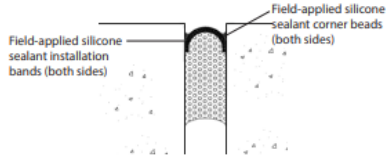
Simple Maintenance – Problem Prevention

- Reseal pourable joint seals – Be Proactive!
- Key observation – remove pourable joint seal and replace with bonded precompressed at skewed bridges.

- Highly skewed bridges move normal and transverse to joint

Fig.2: BEJS-ON-A-REEL for Joints 1/2" (12mm) – 1 1/4" (30mm)

Note: Material sizes less than 1 1/4" (30mm) are supplied on 12-LF long reels with a smooth, convex single bellows as shown.



20TM602(A405)

Designer: Use SP for self-expanding pavement joints when expected forces are normal and transverse to joint. Use SP for Polyurethane Joint Material when expected forces are normal/perpendicular to the joint. Use SP on pavement joints equal to or greater than 1/2 inch. Add proper source code. Add/Remove/Edit pay item shown in red according to project specific needs. Once that is done, ensure there is no remaining red text and delete this note. Submit for review and approval.

SPECIAL PROVISION
FOR
SELF-EXPANDING PAVEMENT JOINTS

Source Code 1 of 2 APPR:ARB:JAB:08-11-23

a. Description. This work consists of constructing and sealing pavement joints with an open cell, self-expanding, silicone pre-coated joint filler material at the locations shown on the plans, or as directed by the Engineer. Perform all work in accordance with the standard specifications and standard plans, except as modified in this special provision.

b. Materials. Furnish the open cell, self-expanding, silicone pre-coated joint filler material from the following list, or equal, as approved by the Engineer. Ensure furnished material is capable of plus-50 percent and minus-50 percent movement. Size joint filler material to accommodate the nominal constructed joint width as measured in the field.

Company	Product Name
LymTal International, Inc.	Iso-Flex SILFAST XL
Watson Bowman Acme Corp.	Wabo®FS Bridge Seal
EMSEAL Joint Systems Ltd.	BEJS System

Simple Maintenance – Problem Prevention

- Replace leaking bonded seal joints

- Remove old bonded seal, and sand blast joint face.

- Locking Adhesive Bead Applied 1 Inch Below the Surface

Simple Maintenance – Problem Prevention

- Replace leaking bonded seal joints

- Press Gland into opening and locking adhesive

- Locking Adhesive Bead Applied to the top of the gland at the joint edge

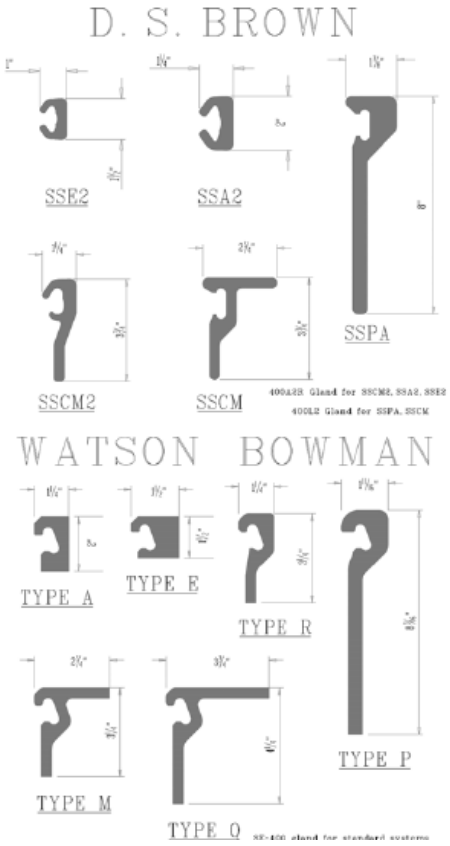
Simple Maintenance – Problem Prevention

- An entire expansion joint may not require replacement if adjacent concrete is sound and rail is intact.

Simple Maintenance – Problem Prevention

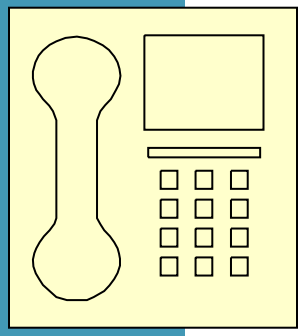
- Step 1 – Ensure Rail is Secure

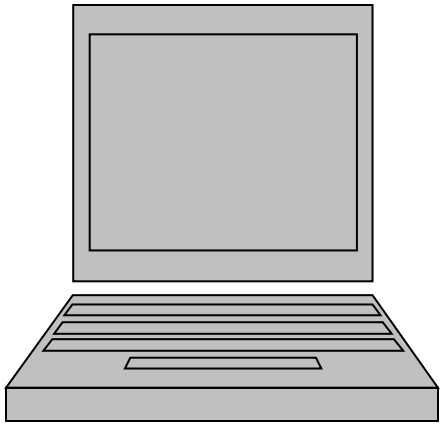
- Step 2 - Determine Joint Profile



Simple Maintenance – Problem Prevention

- Step 3 – Order Gland and Lubricant





- Step 4 - Determine Replacement Limits

Simple Maintenance – Problem Prevention

D.S. BROWN

Online Store

EXPANSION JOINT SYSTEMS

Strip Seal Removal Kit

DESCRIPTION

- Hand-held mechanical tools used for the removal of strip seal glands from steel retaining rails.
- Tools minimize the need for sand blasting to remove seal and/or glue residue.
- View full list of included products and components.
- Removal Kit is packaged in an 27 x 21 x 9” box.

ONLINE STORE PRICE

$775.00

Simple Maintenance – Problem Prevention

Product Description

- The Strip Seal Removal Kit consists of the following components:
  1. Oscillating Tool
  2. Oscillating Blades
  3. Grabber Tool
  4. Air Hammer with quick change retainer
  5. Clean Out Tool Bar
  6. Clean Out Tool Head
  7. Button Cutter Inserts
  8. Insert Screws
  9. Insert Screw Allen Wrench
  10. Kit Bag
  11. Small Parts Container

- Other tools that may be required, but are not in the kit:
  - Screwdriver
  - Pry Bar
  - Hammer
  - Hand Saw
  - Knife
  - Sandblasting Equipment
  - Air Compressor

Simple Maintenance – Problem Prevention

- Step 5 – Cut Down Center

- Step 6- Remove from Rail

Simple Maintenance – Problem Prevention

- Step 7- Clean the Channels

- Step 8 – Unroll and Lubricate the Gland

Simple Maintenance – Problem Prevention

- Step 9 – Install Gland

Simple Maintenance – Problem Prevention

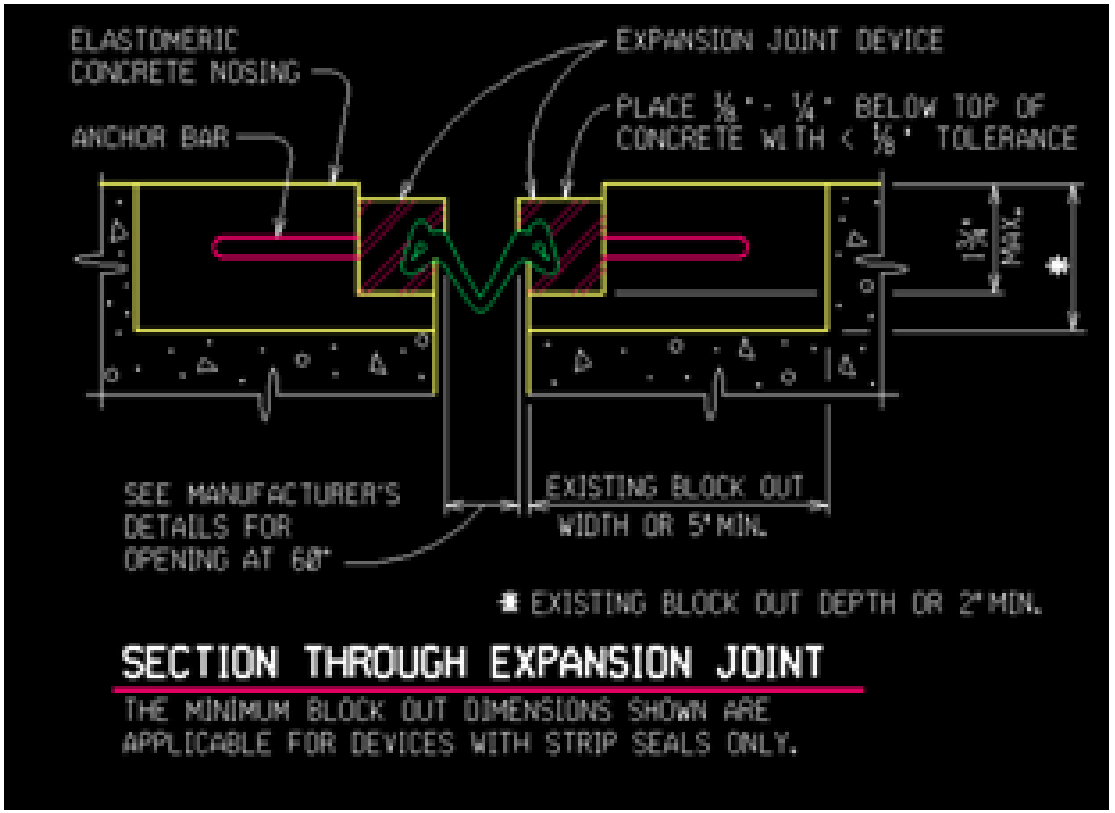
Gland Alternative

(Also works on bare concrete and armor plate joints)

Advanced Maintenance – Strip Seal Replacement

Partial Depth Option

- Strip seal with horizontal anchors
- Fast joint replacement
- Relies on chemical bond of elastomeric concrete to deck slab



Advanced Maintenance – Strip Seal Replacement

Partial Depth Option

- Chip out header material
- Place New Joint Rail
- Pour new non-cementitious proprietary concrete header.

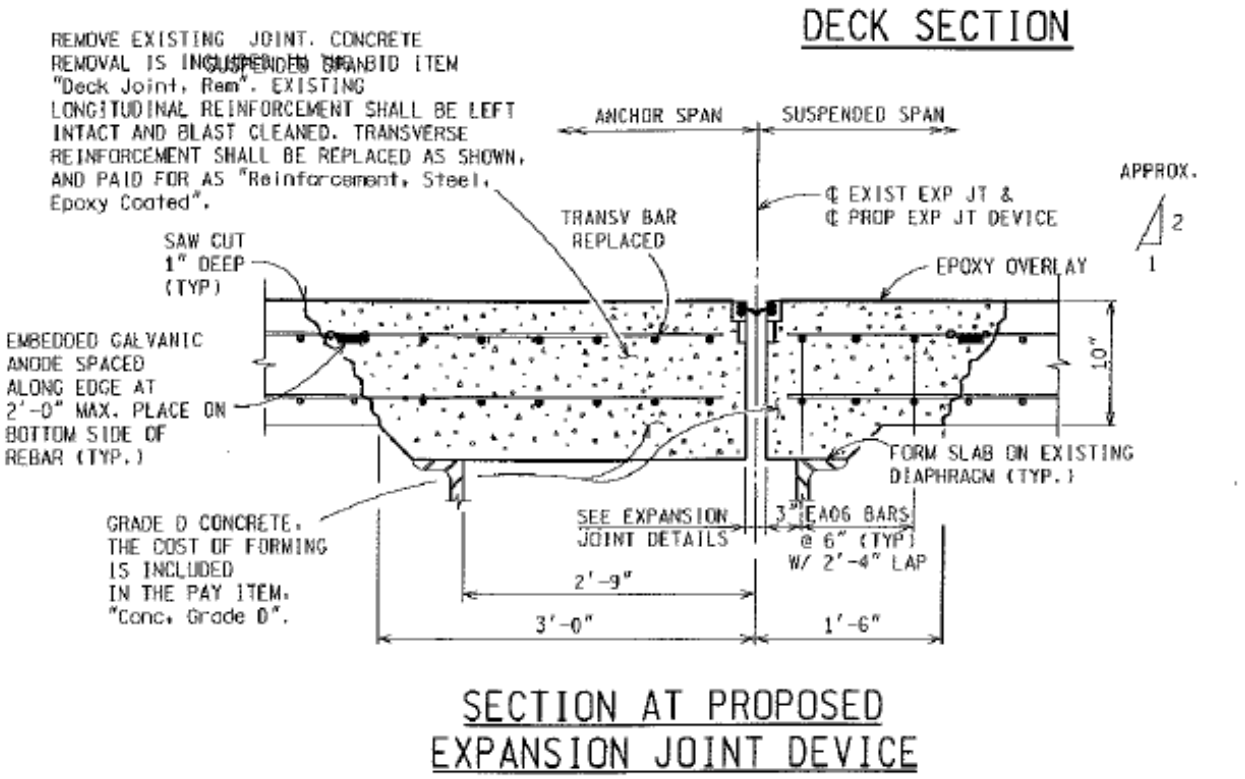
Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- 1” saw cut required a minimum of 1’-6” on either side of joint

Advanced Maintenance – Strip Seal Replacement

Full Depth Option



- Remove joint to width of deteriorated concrete or width of diaphragms

Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- Typical Concrete Removal
  - Do not use machine-mounted hydraulic or pneumatic equipment – prevent superstructure damage.
  - May use manual pneumatic hammers with 60 pound maximum rating – or whatever limitations your DOT recommends.

Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- Blast clean to remove scale or accumulated rust from exposed longitudinal reinforcement

Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- Replace exposed transverse bars
- Supplement broken or missing reinforcement and bars that have lost ¼ or more of original diameter

Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- The expansion joint shall be shop fabricated to conform to the contour of the bridge – Straight Line Crown? Parabolic Crown? Upturns?
- The steel anchorage for strip seal glands should be hot dip galvanized

Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- The top of the expansion joint shall be set 1/8” to 1/4” below the concrete slab with a tolerance of < 1/8”

Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- If device is not properly recessed it will be damaged by snowplows

- Damaged joint

- Properly Recessed

Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- Secure device anchors to deck reinforcement to maintain proper grade
- Remove shipping devices between rails (bolts). Or remove immediately after concrete pour.

Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- Part-width construction requires welding rails at stage interface.
- Blast clean or grind contact surfaces

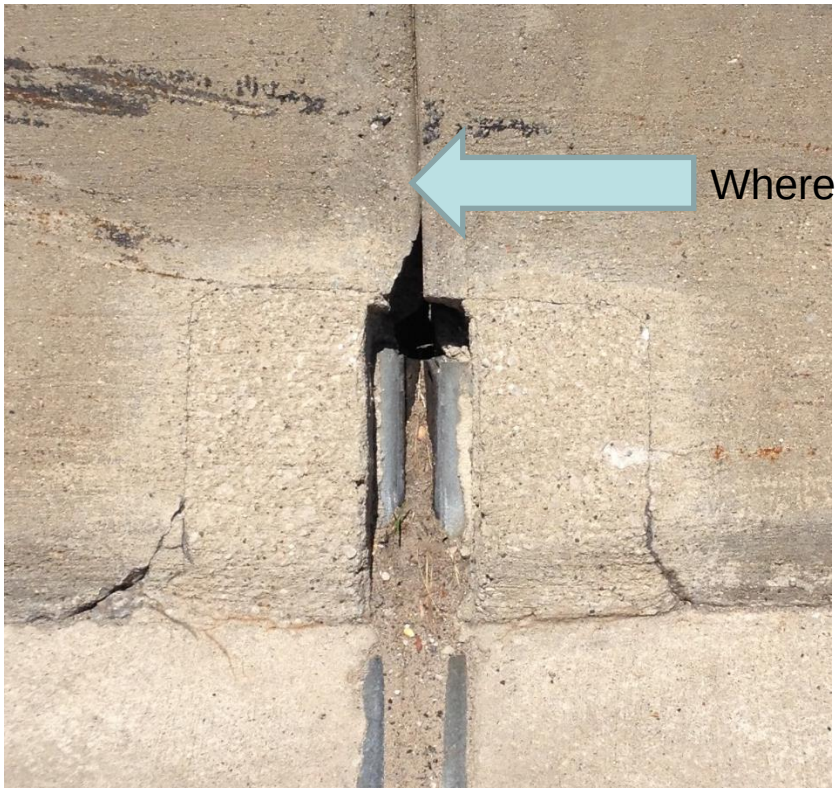
Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- Keep Concrete Out of your Joint

Advanced Maintenance – Strip Seal Replacement

Full Depth Option



Advanced Maintenance – Strip Seal Replacement

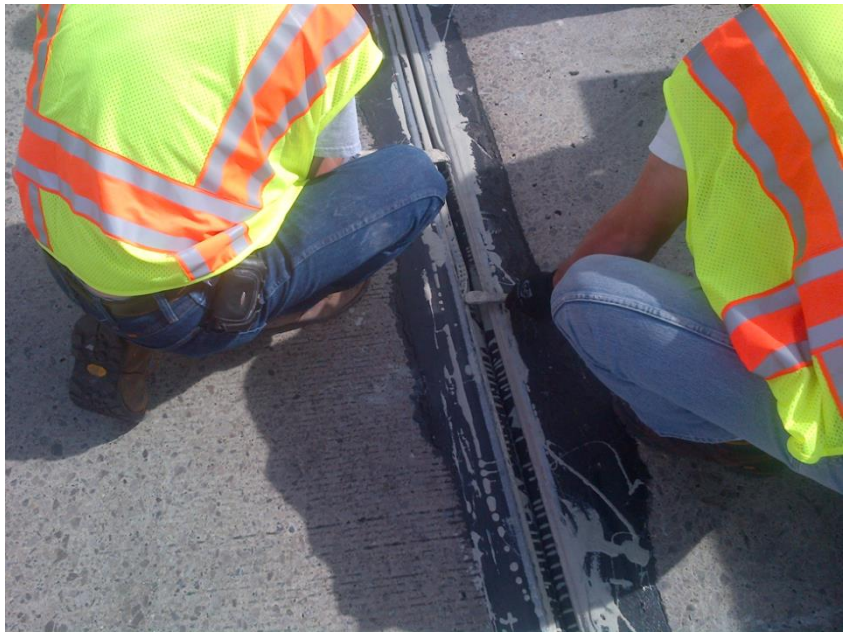
Full Depth Option

- Vibrate to consolidate concrete around anchors
- Cure in accordance with local DOT office requirements.

Advanced Maintenance – Strip Seal Replacement

Full Depth Option

- Install the gland in one continuous piece
- If the gland is not continuous and requires splicing use cold vulcanization or other approved means



Questions?

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