BRIDGE JOINT PERFORMANCE IN CALIFORNIA

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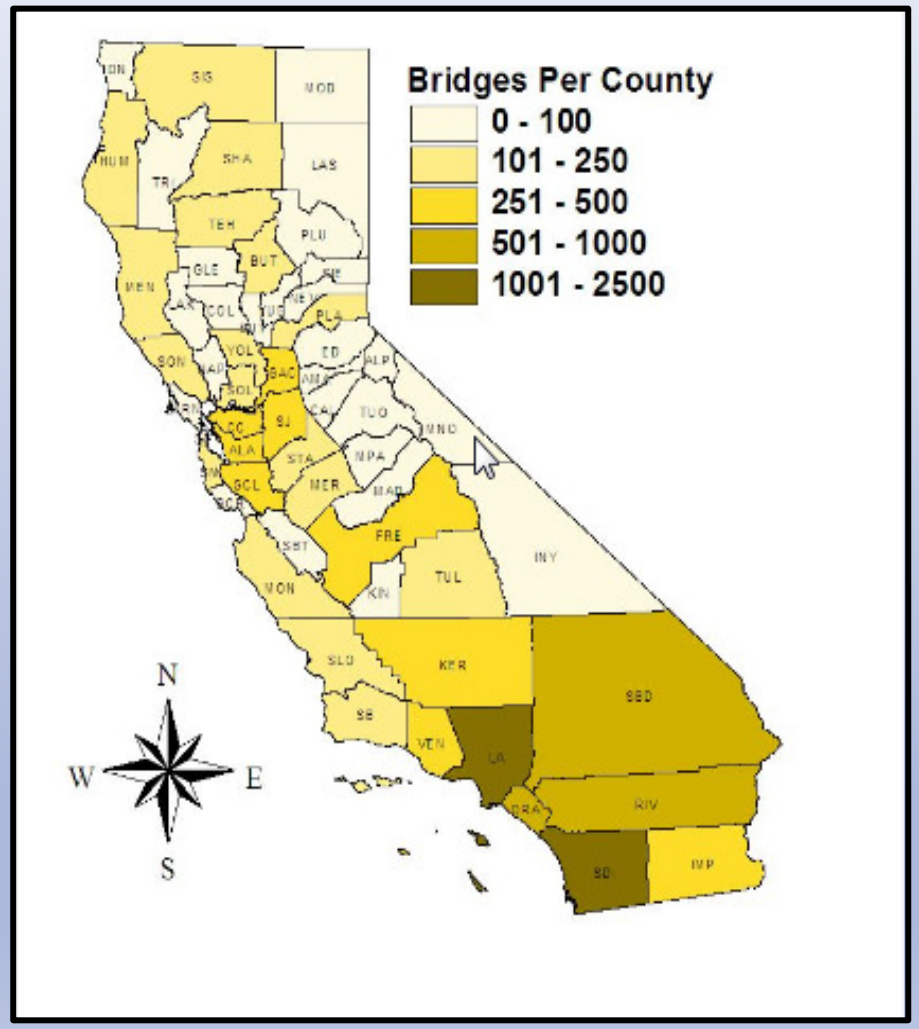
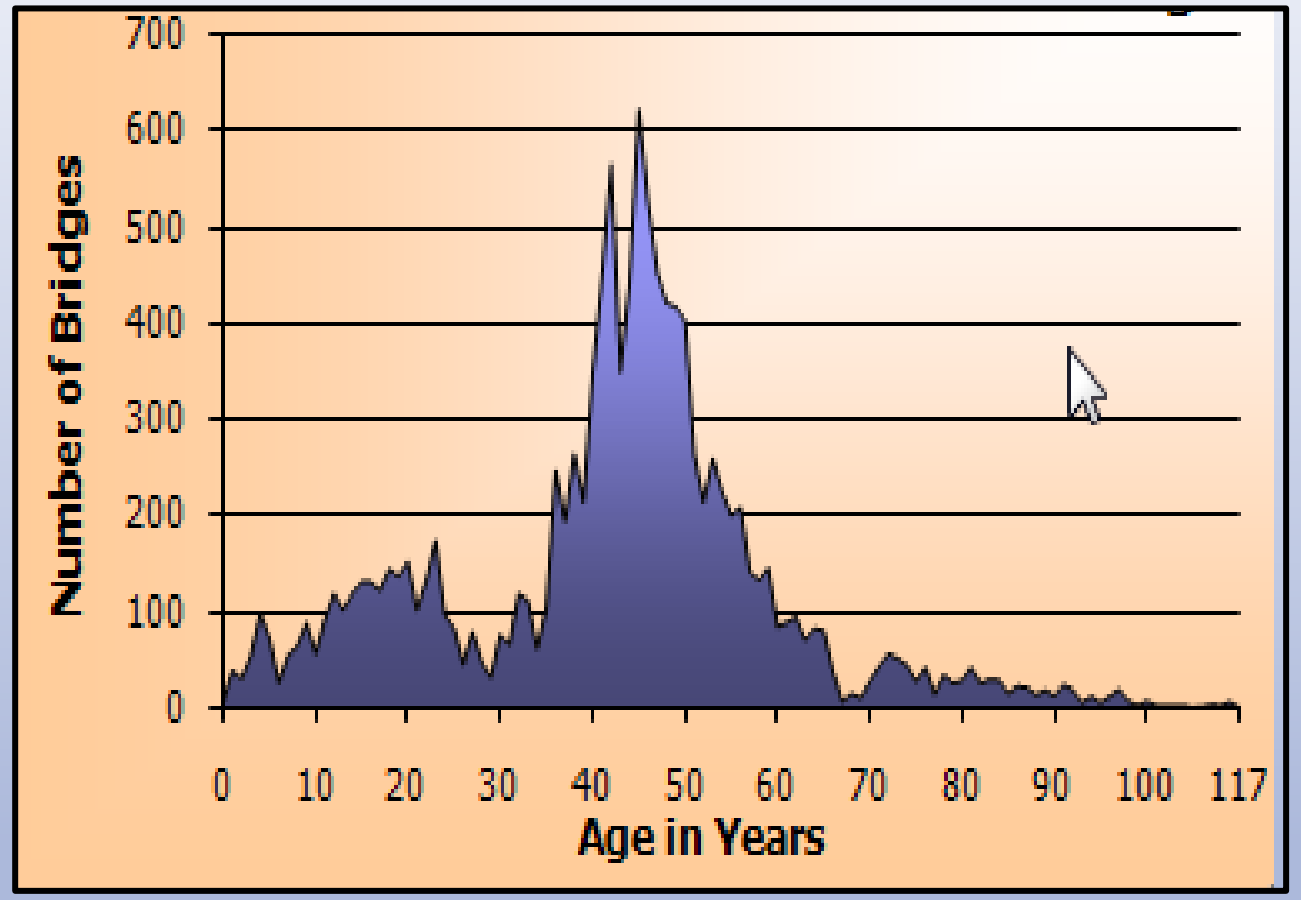
CALTRANS DISTRICTS AND BRIDGES PER COUNTY

12 DISTRICTS

58 COUNTIES



STATEWIDE AGE OF BRIDGES

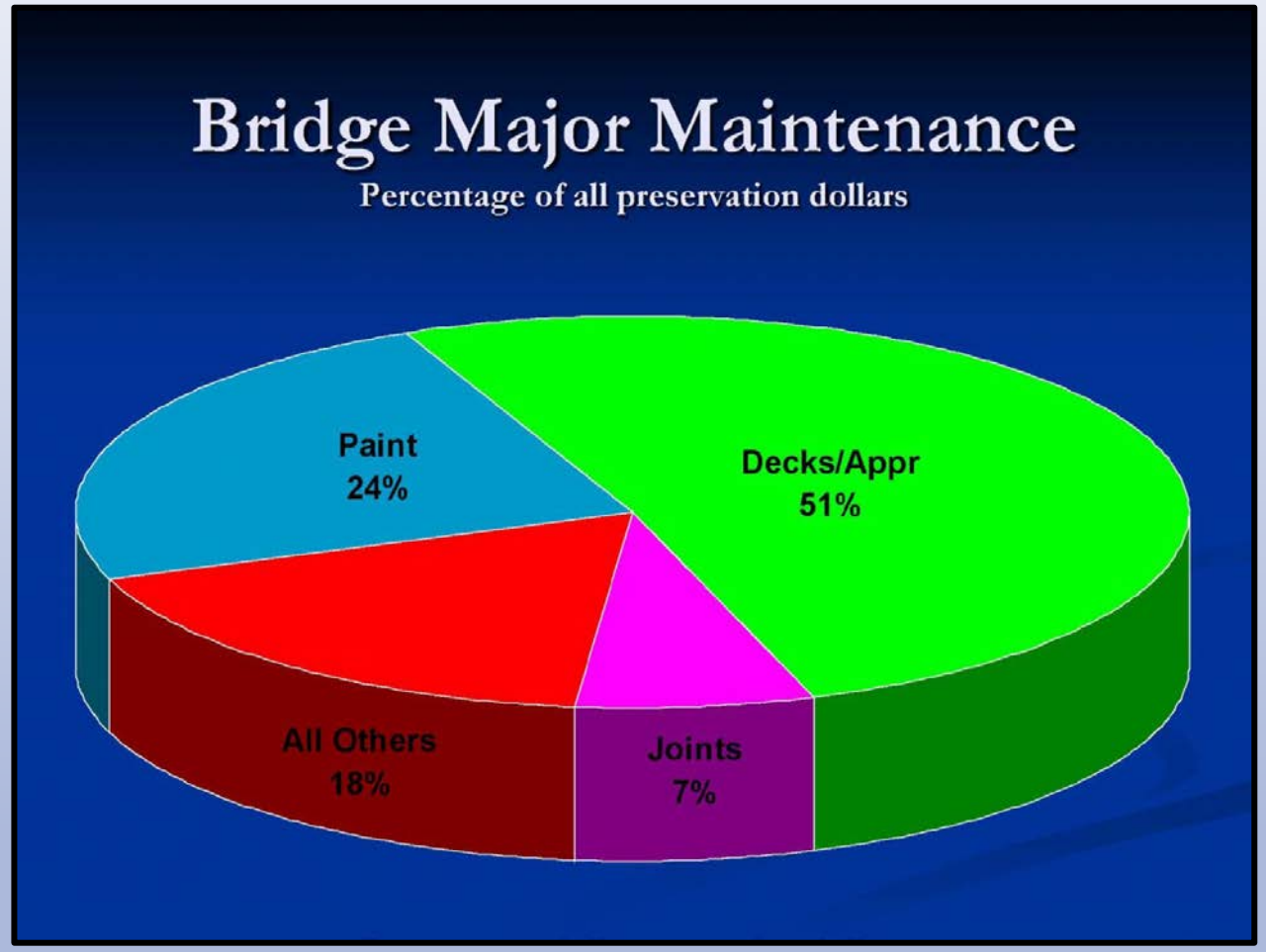


State Highway Bridges: 13,189

Local Agency Bridges: 13,140

Total Bridges: 26,329

CALTRANS BRIDGE MAINTENANCE EXPENDITURES



Highway Maintenance 315 Program:
≈$146 Million

State Highway Operation Protection Program:
≈300 Million

CALTRANS BRIDGE EXPANSION JOINTS - TYPES

- Non-Seismic (Conventional)
  - ❖C1. Type A & AL
  - ❖C2. Type B
  - ❖C3. Asphaltic Plug
  - ❖C4. Bonded
  - ❖C5. Strip Seal
  - ❖C6. Modular
  - ❖C7. Internal Box Girder Flume
  - ❖C8. Steel Sliding Plate
  - ❖C9. Steel Finger
- Seismic
  - ❖S1. Maurer Swivel Expansion Joint
  - ❖S2. Caltrans Designed Seismic Joint

CONVENTIONAL EXPANSION JOINTS

- A conventional expansion joint is usually a joint that accommodates longitudinal expansion and contraction movements for service demand conditions of bridge superstructures. (upwards of 15 inches)

- They are not designed for seismic demand conditions. During seismic events these joints are anticipated to sustain moderate to severe damage depending upon the magnitude of the earthquake.

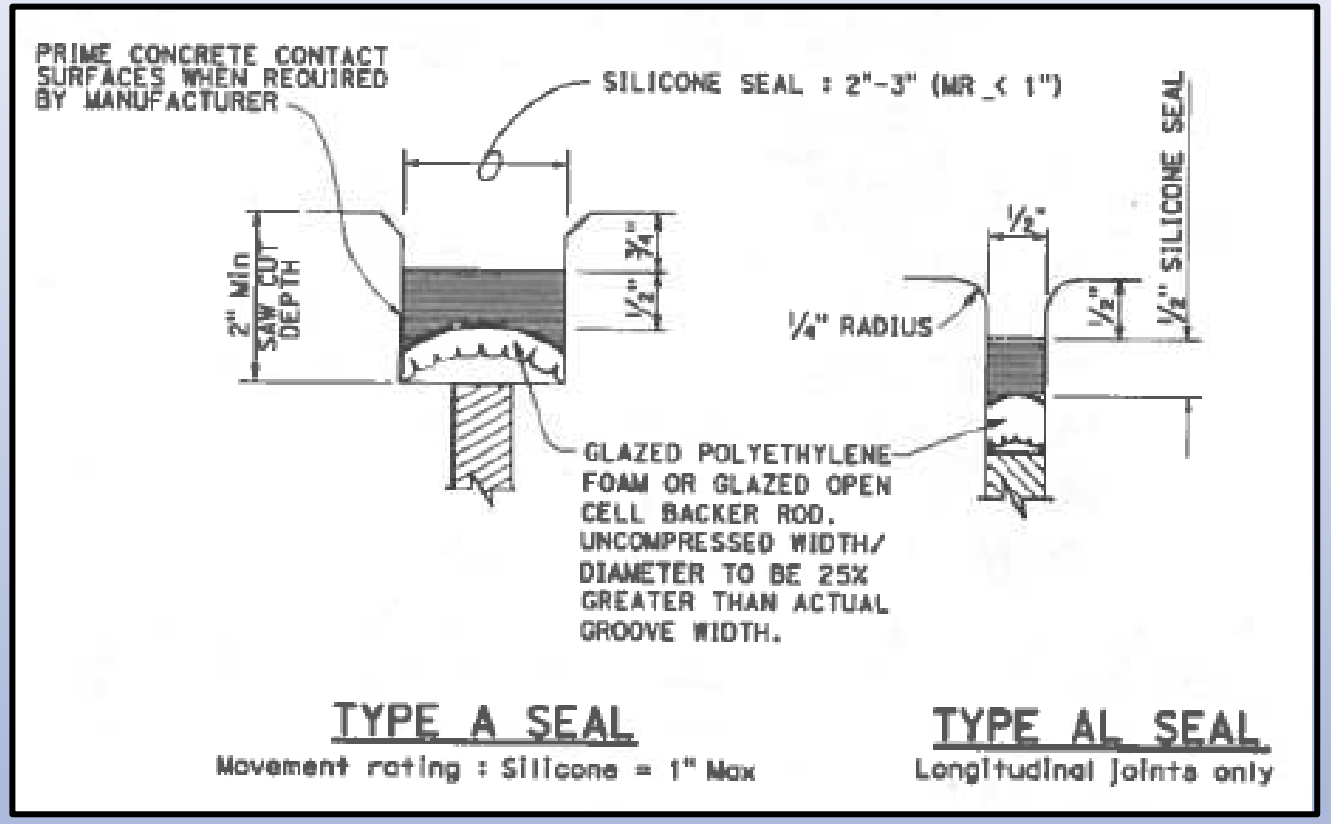
SEISMIC EXPANSION JOINTS

- An expansion joint that accommodates small to large movements during service demand conditions as well as seismic demand conditions. (upwards of 50 inches)

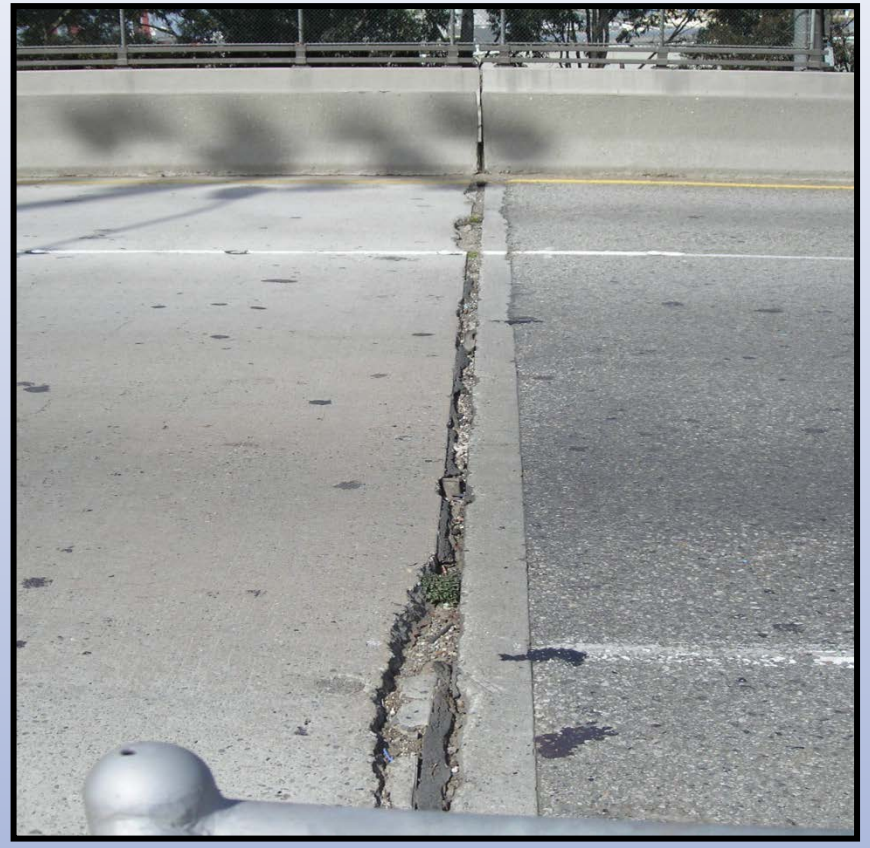
- The joint is expected to maintain it’s full functionality with zero to minor damage after a significant earthquake.

C1: TYPE A & AL EXPANSION JOINT SEALS

Movement Rating ≤ 1 inch



TYPE A & AL EXPANSION JOINT SEALS, Maintenance



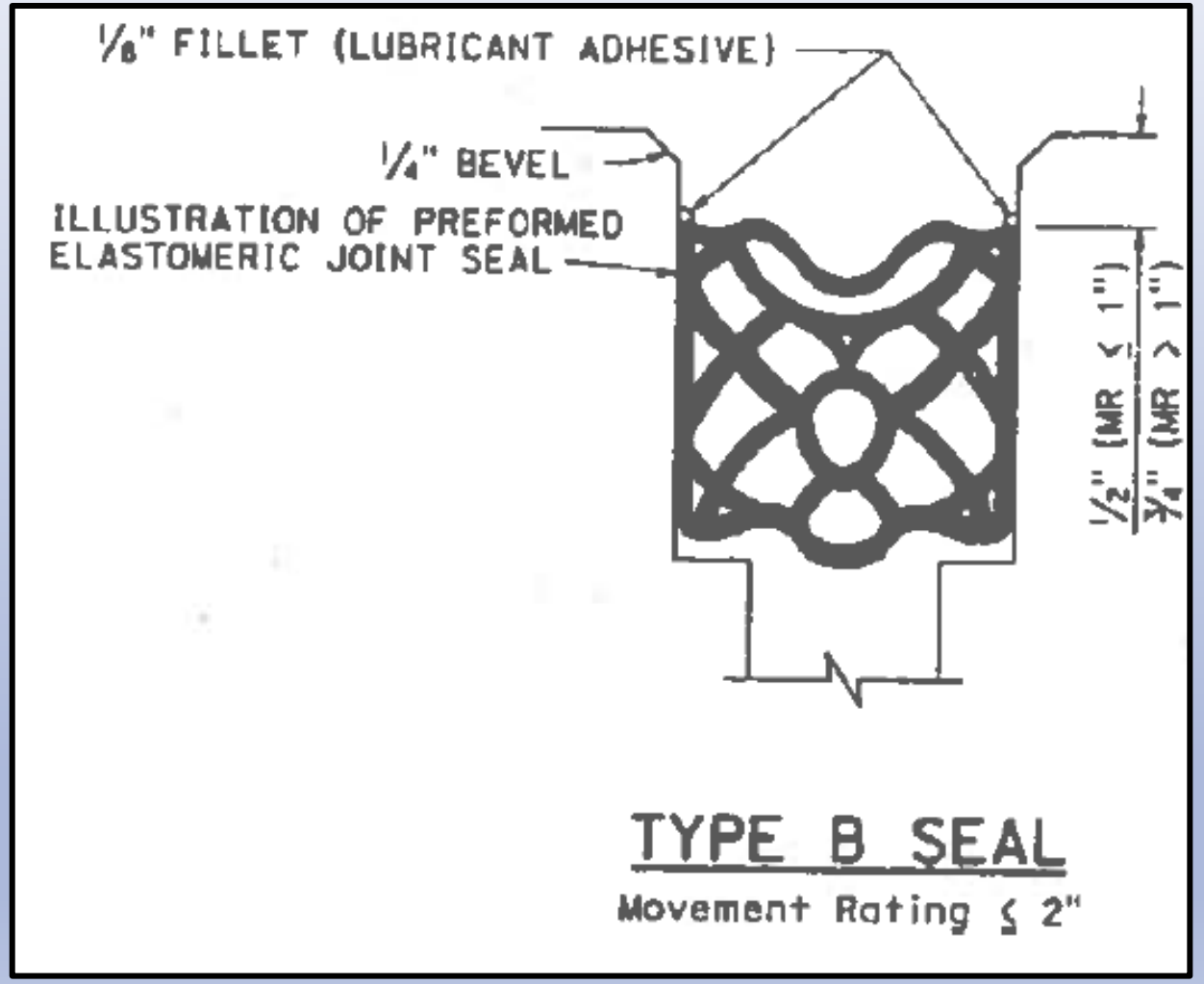
Spall repairs: sometimes the repair has failed after in-place for a few months. This is common for Type A, Type B, and Bonded Joint Seals.

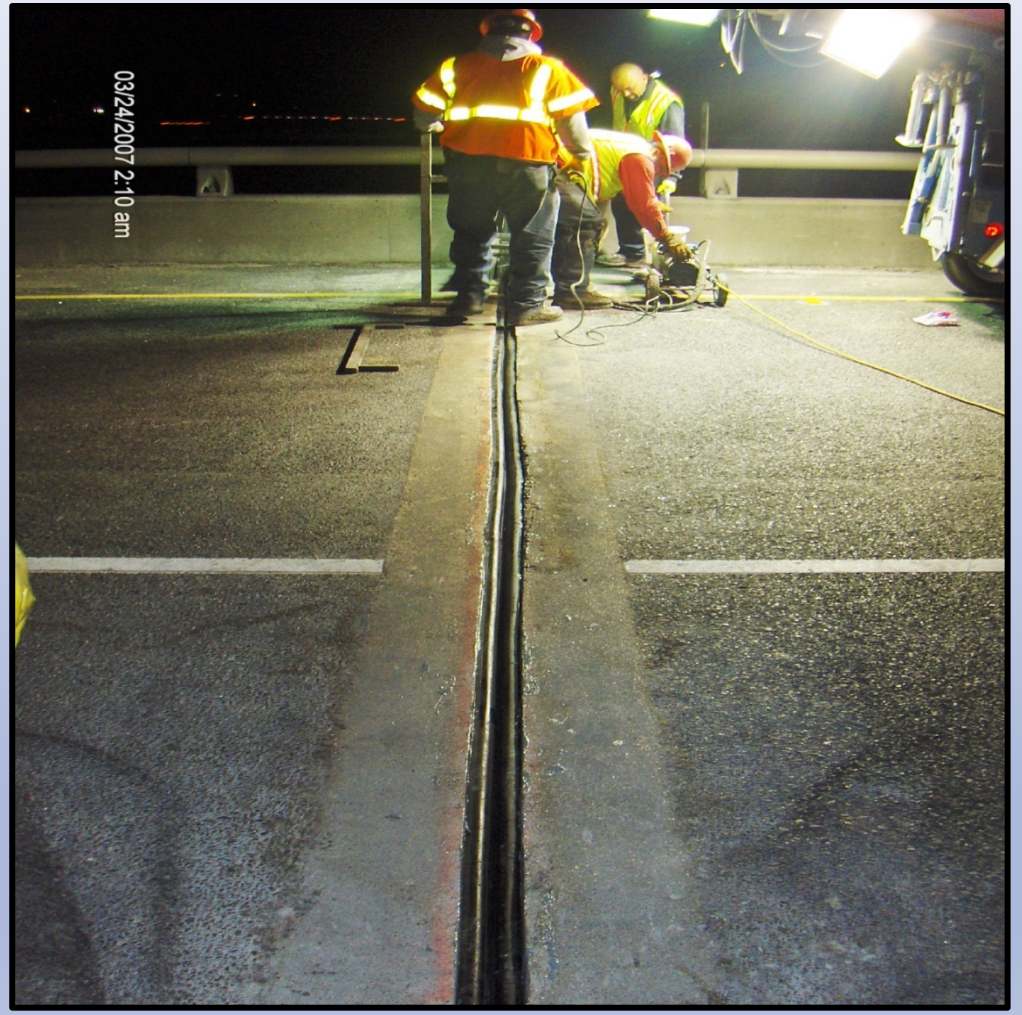
TYPE A & AL EXPANSION JOINT SEALS, Maintenance

New joint only 1 year old, failure due to lack of adhesion. Hinge reconstruction.

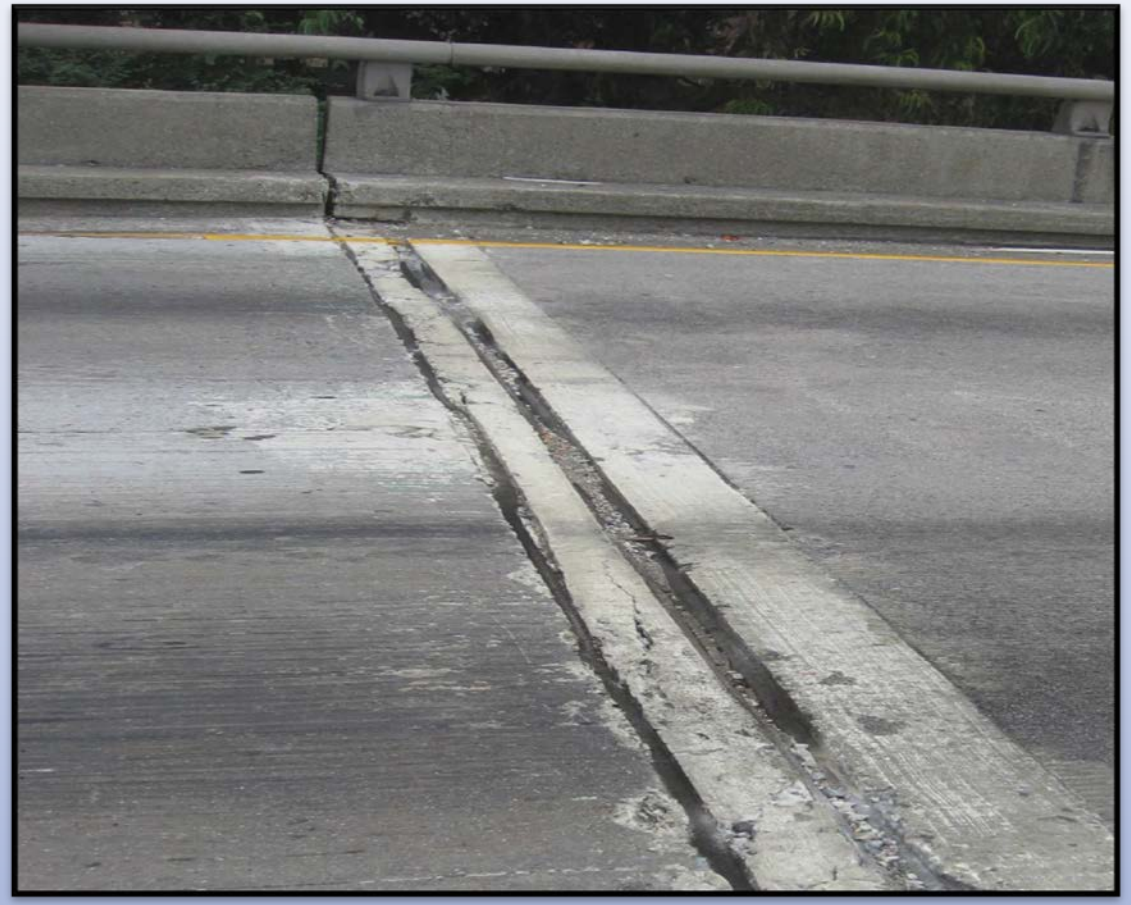
C2: TYPE B EXPANSION JOINT SEAL

1 inch < Movement Rating ≤ 2 inch





TYPE B EXPANSION JOINT SEAL, Maintenance



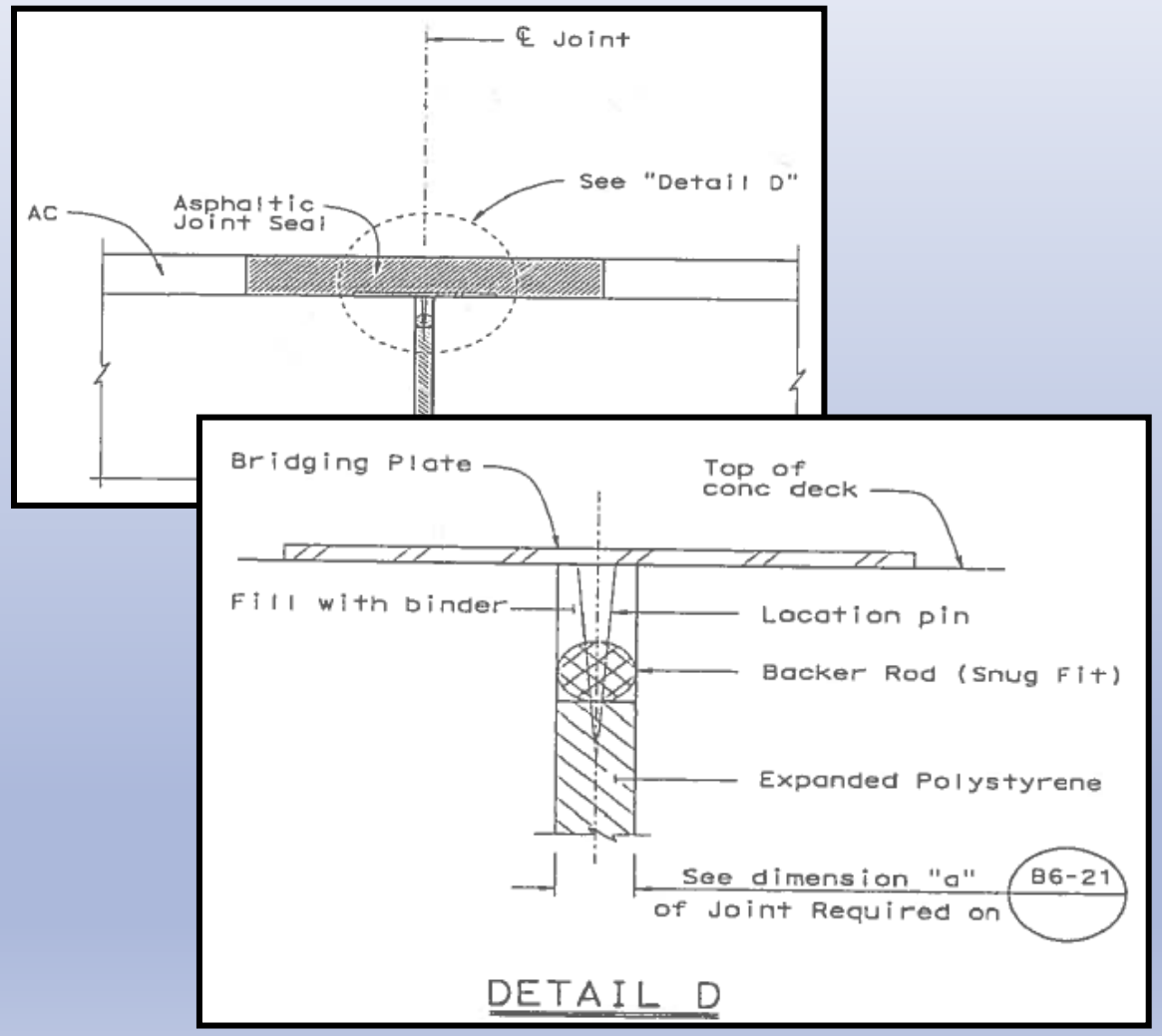
Backwall failure for seat abutments. Sometimes the new concrete fails after only a few months. Notice the armored angle failure due to breakage of anchors.

TYPE B EXPANSION JOINT SEAL, Maintenance

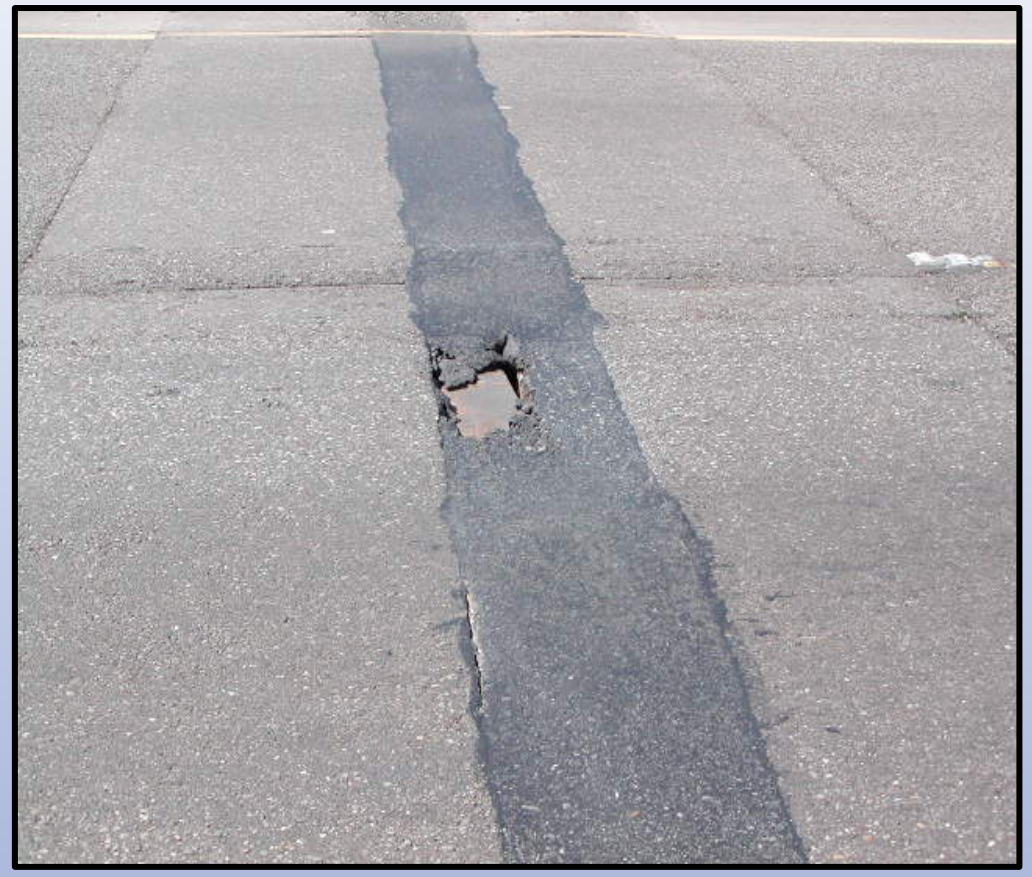
Age, crushing, bulging. Sometimes the joint gap is too large for the seal. Joint palls.

C3: ASPHALTIC PLUG EXPANSION JOINT SEAL

Movement Rating ≤ 1.5 inch



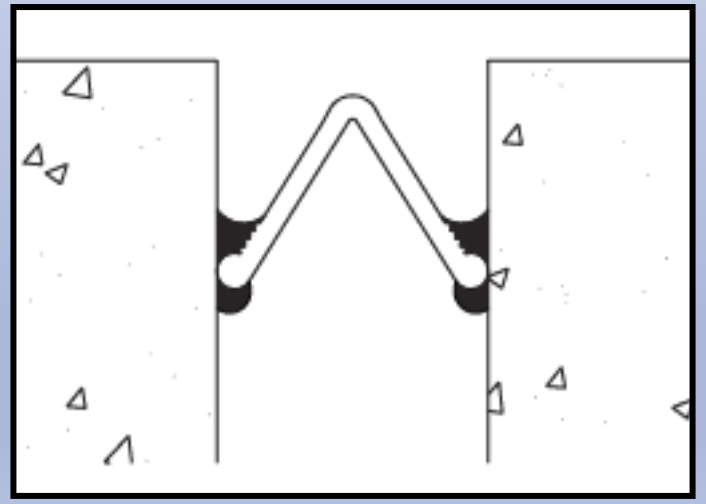
ASPHALTIC PLUG EXPANSION JOINT SEAL, Maintenance

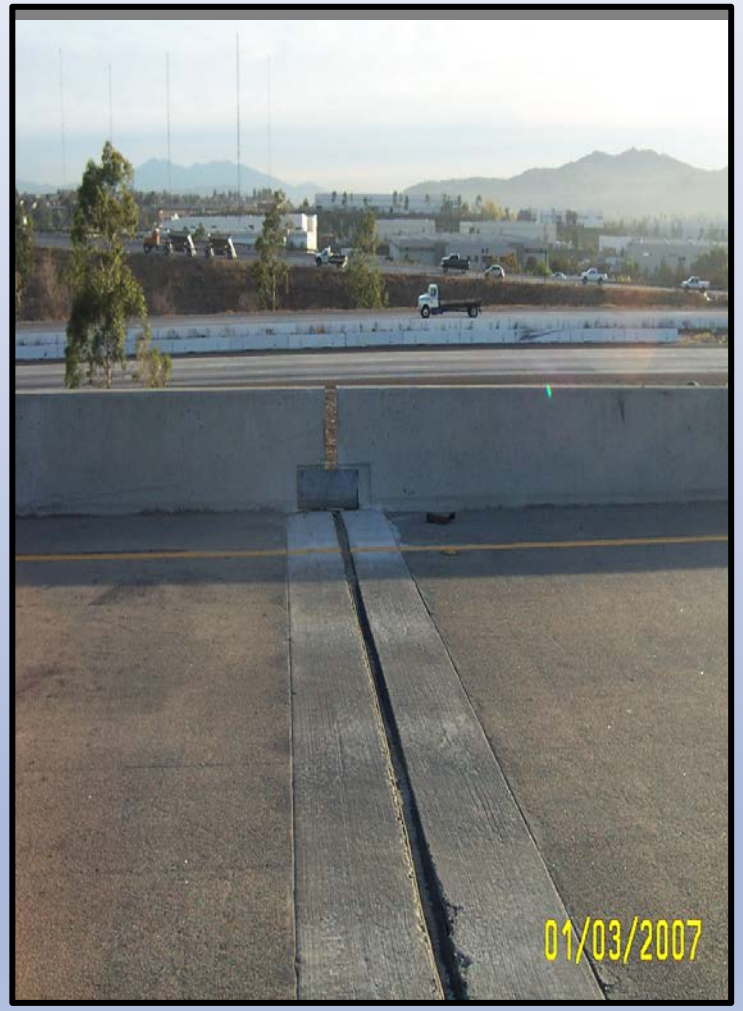


Deterioration of elastic expansion material. Transverse failure at AC interface.

C4: BONDED EXPANSION JOINT SEAL

1 inch < Movement Rating ≤ 4 inch





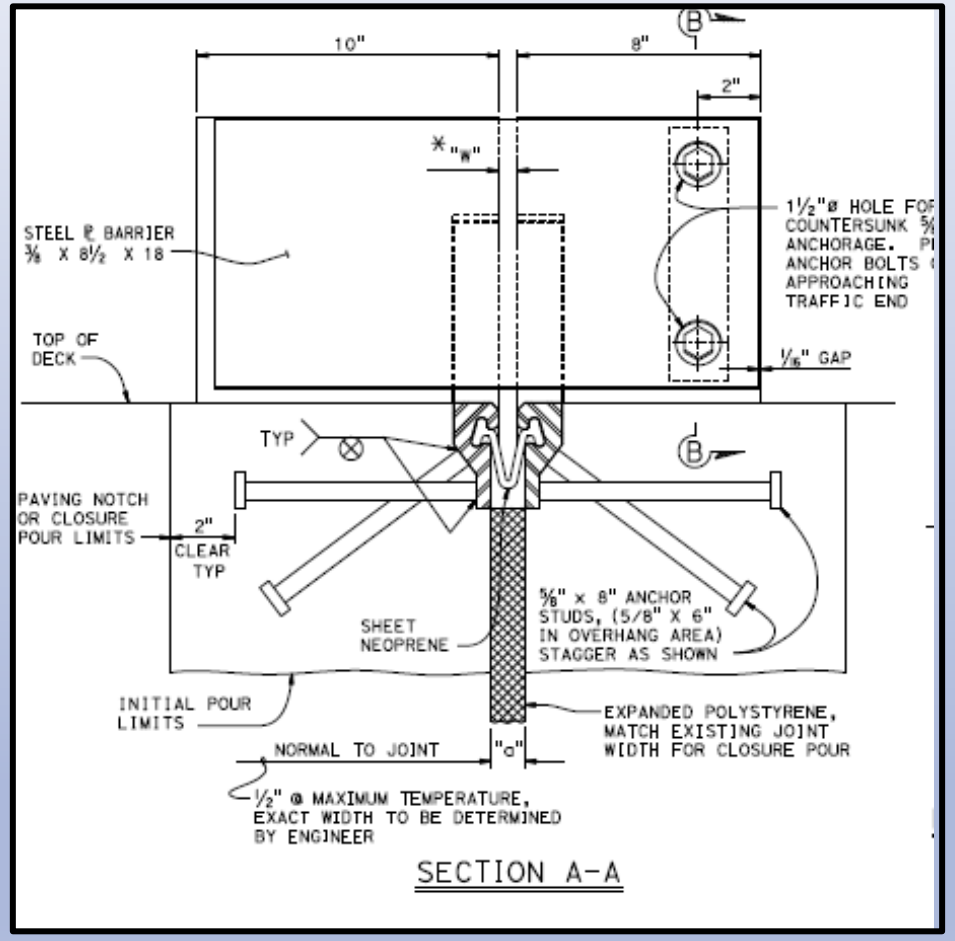
BONDED EXPANSION JOINT SEAL, Maintenance

Issues and Concerns:

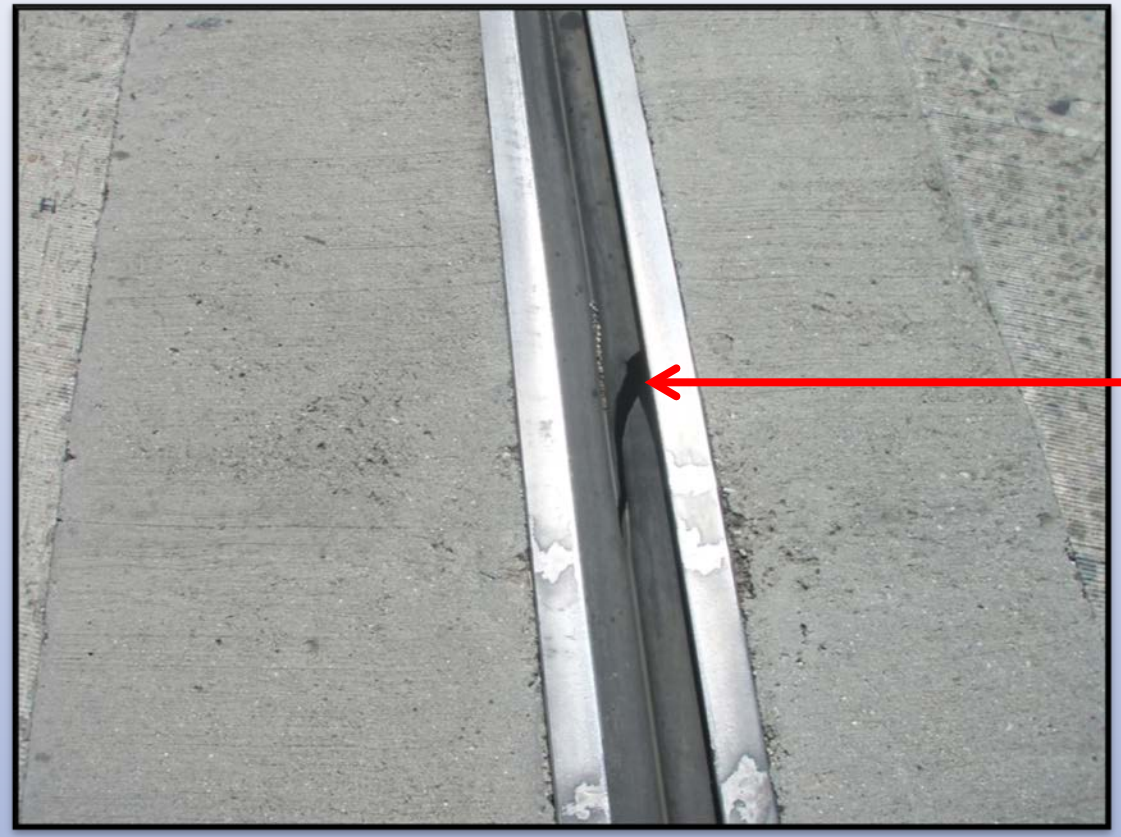
- First use in Southern CA was 2006.
- For joints with skews ≥ 20 degrees.
- Adhesive bonded to the sides of the joint opening.
- Have identified 1 joint with a partial length that did not receive proper amount of adhesive bond thus resulting in a joint that was not fully sealed.

C5: STRIP SEAL EXPANSION JOINT SEAL

2 inch < Movement Rating ≤ 4 inch



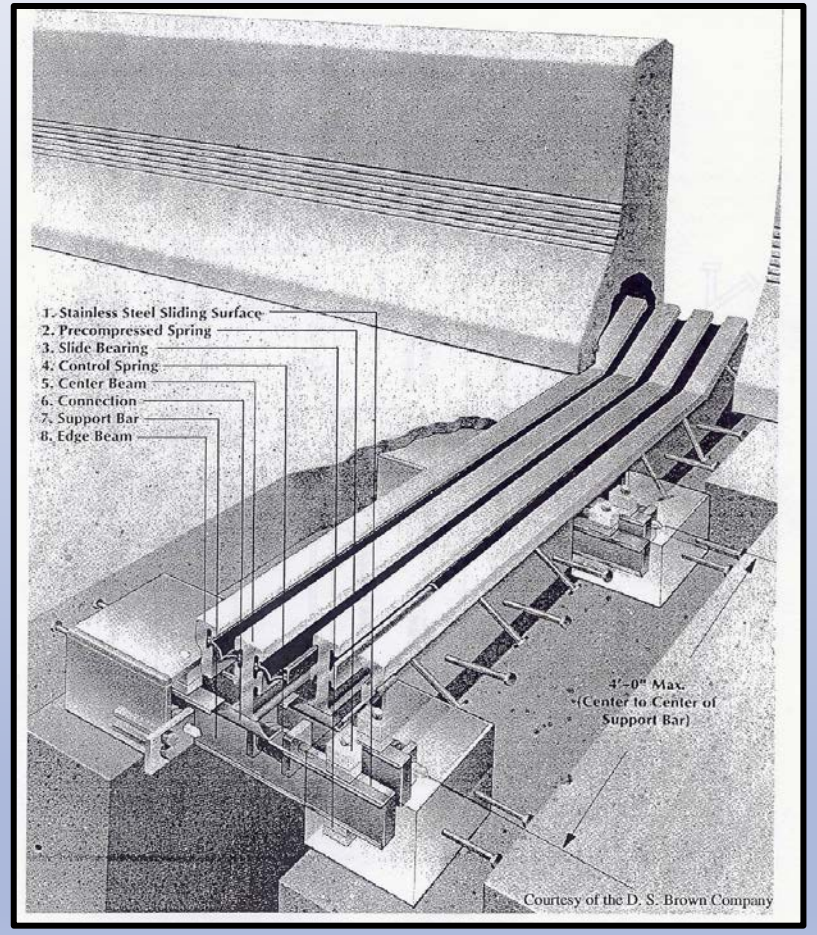
STRIP SEAL EXPANSION JOINT SEAL, Maintenance



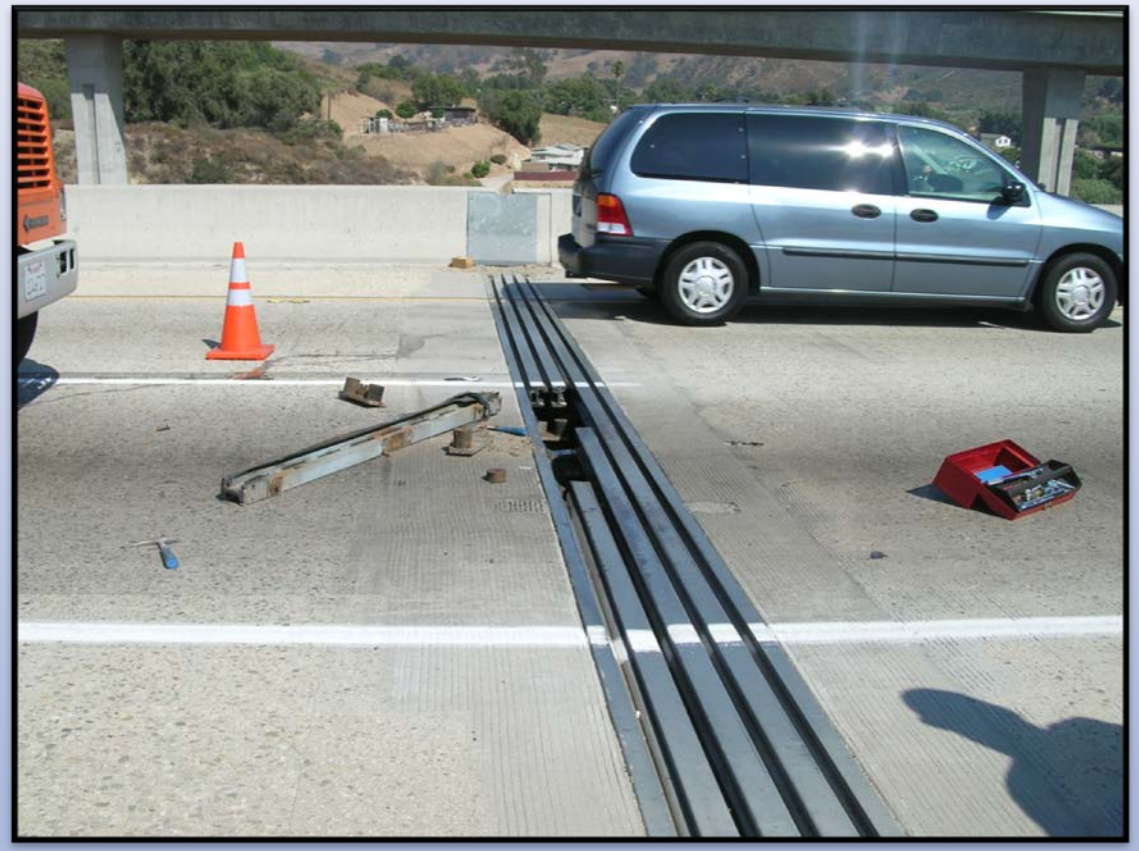
Torn neoprene gland. Also applies for the Modular Joint Seal Assembly. Neoprene glands are proprietary to the manufacturer of the joint.

C6: MODULAR EXPANSION JOINT SEAL

Movement Rating > 4 inch



MODULAR EXPANSION JOINT SEAL, Maintenance



Broken center transverse beams.

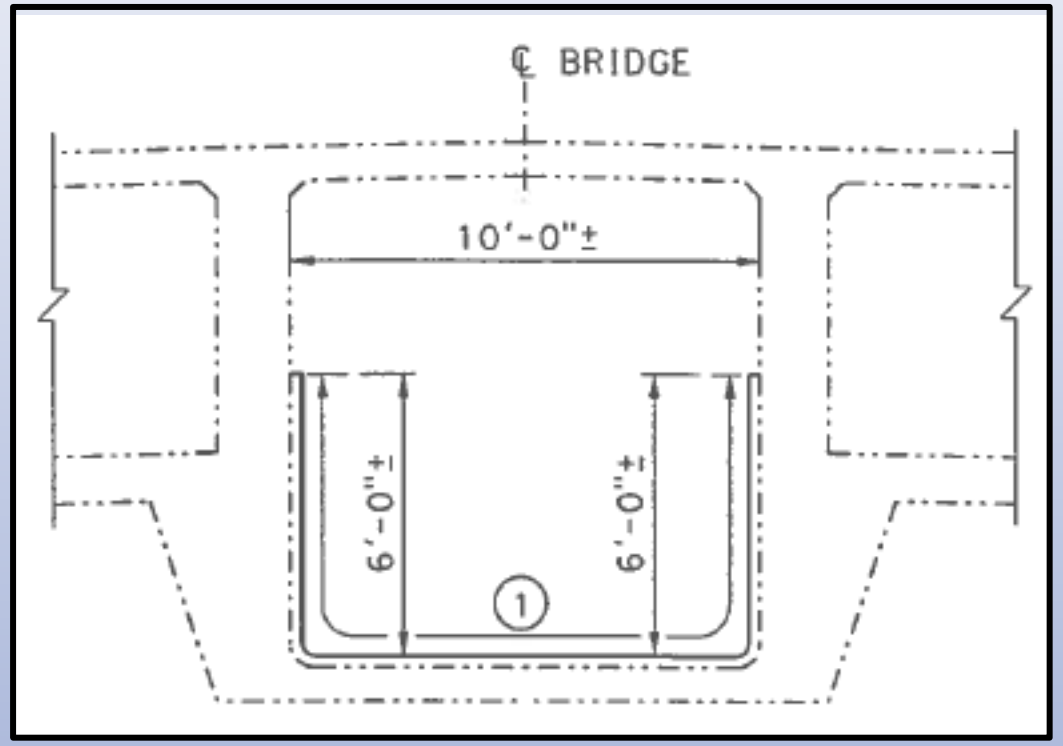
MODULAR EXPANSION JOINT SEAL, Maintenance

Some Failure Modes

- Spall & failure of concrete headers
- Fatigue of welded connections
- Shop & field splice of center beams
- Control spring failure
- Poor workmanship
- Excess concrete in the joint opening
- Poor joint connection to the main deck reinforcement
- Joint is placed too high or too low in the deck
- Incorrect joint seal alignment
- Design error ….. Incorrect joint type selection

C7: INTERNAL BOX GIRDER FLUME JOINT SEAL

(Storm Drain Channel within a Cell of Box Girder Superstructure)

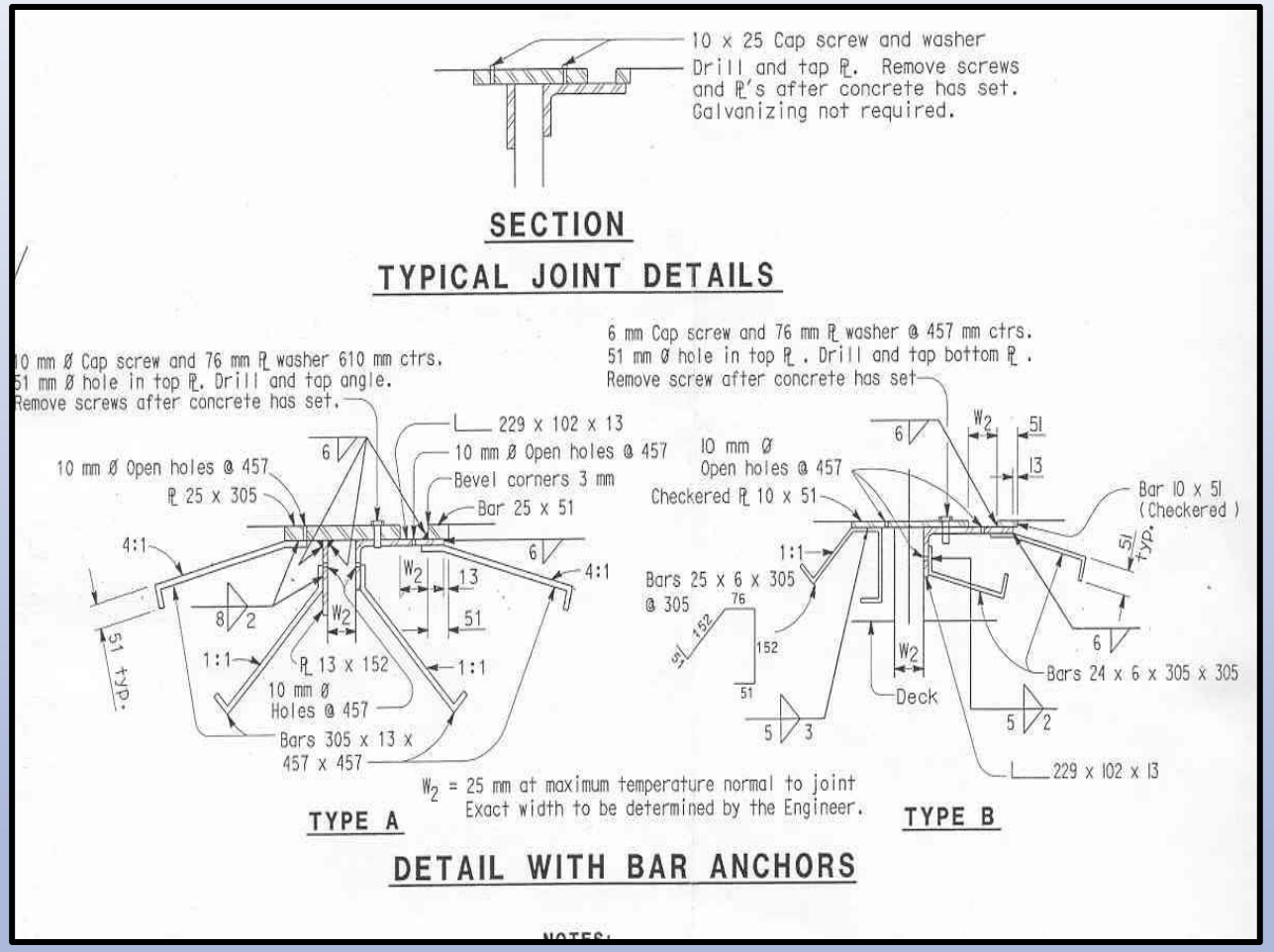


INTERNAL BOX GIRDER FLUME, Maintenance

Confined Space (Robotic Inspection)

Failed and Leaking Joint Seal

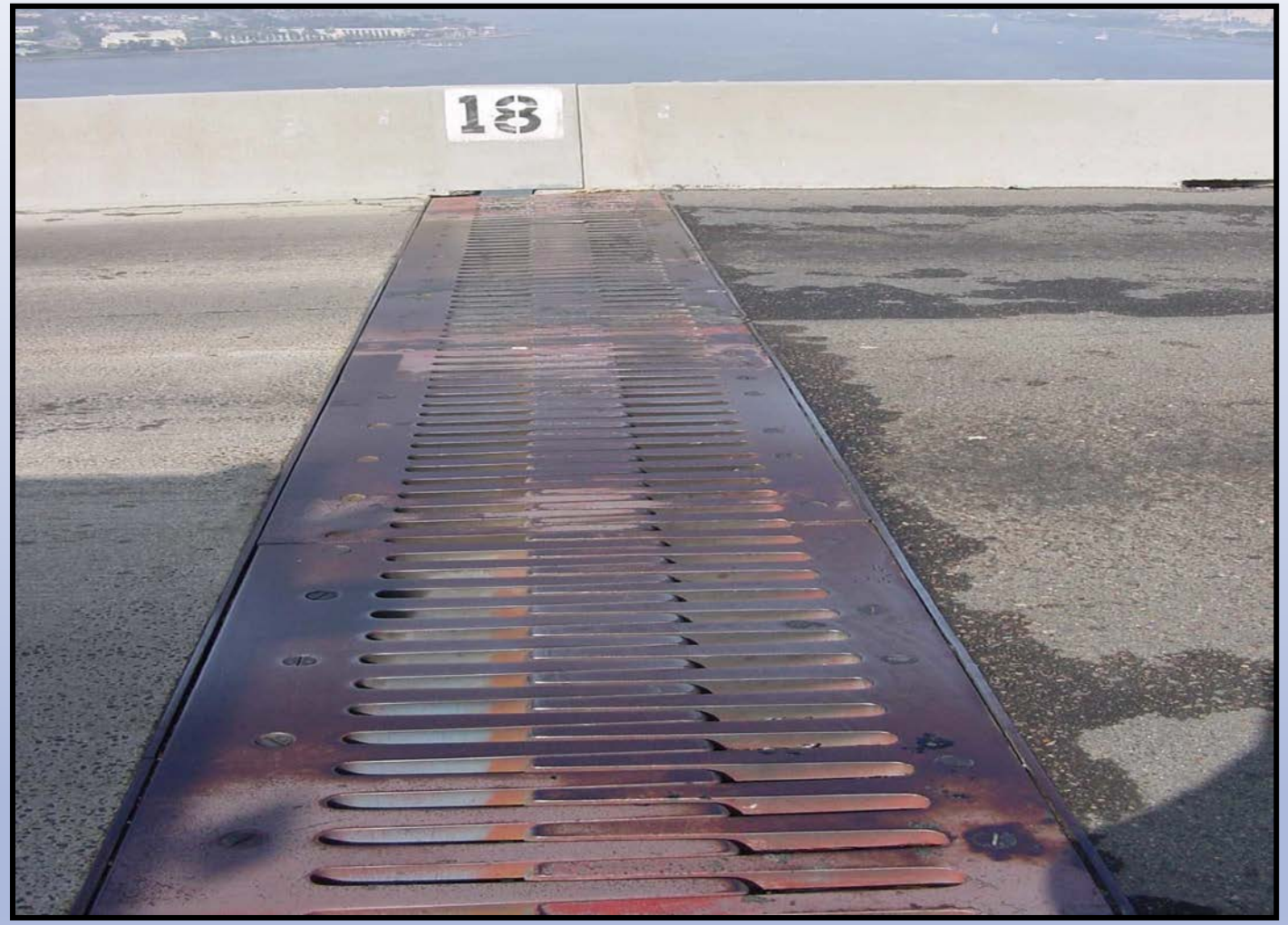
C8: STEEL SLIDING PLATE JOINT SEAL



STEEL SLIDING PLATE, Maintenance

Anchorage Breakage on the Steel Elements. Joint Closes Permanently or gets Paved Over

C9: STEEL FINGER JOINT SEAL

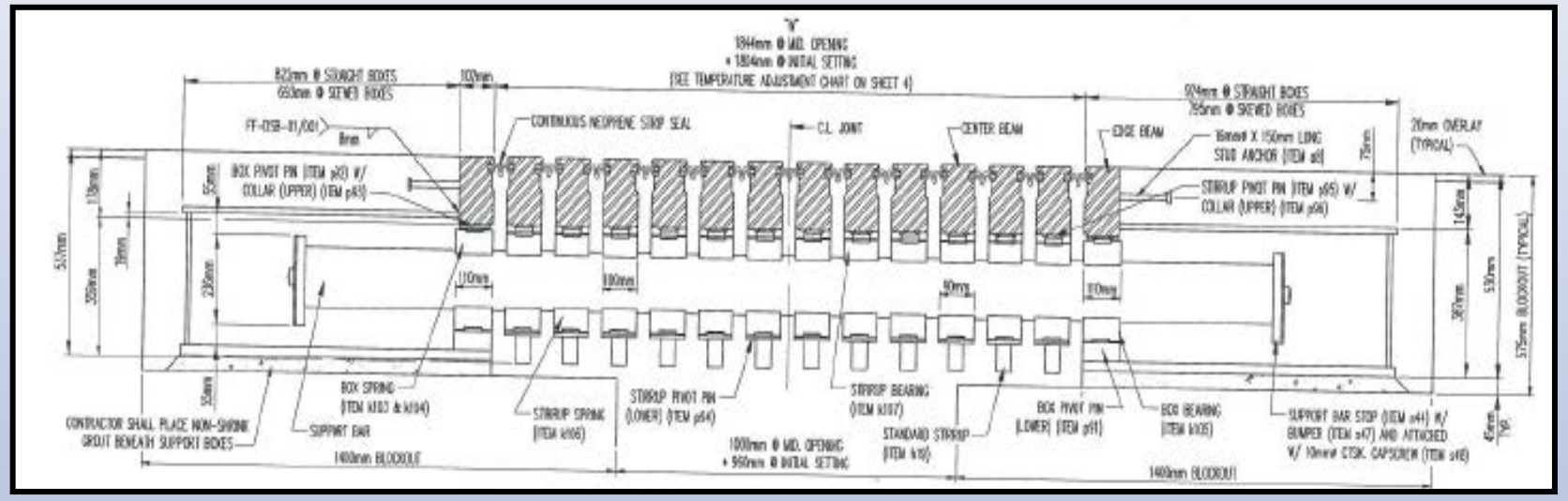


STEEL FINGER JOINT, Maintenance

Breakage of the Steel Finger Elements.

Large gap widths between the steel fingers.

S1: SEISMIC JOINT, MAURER SWIVAL EXPANSION JOINT

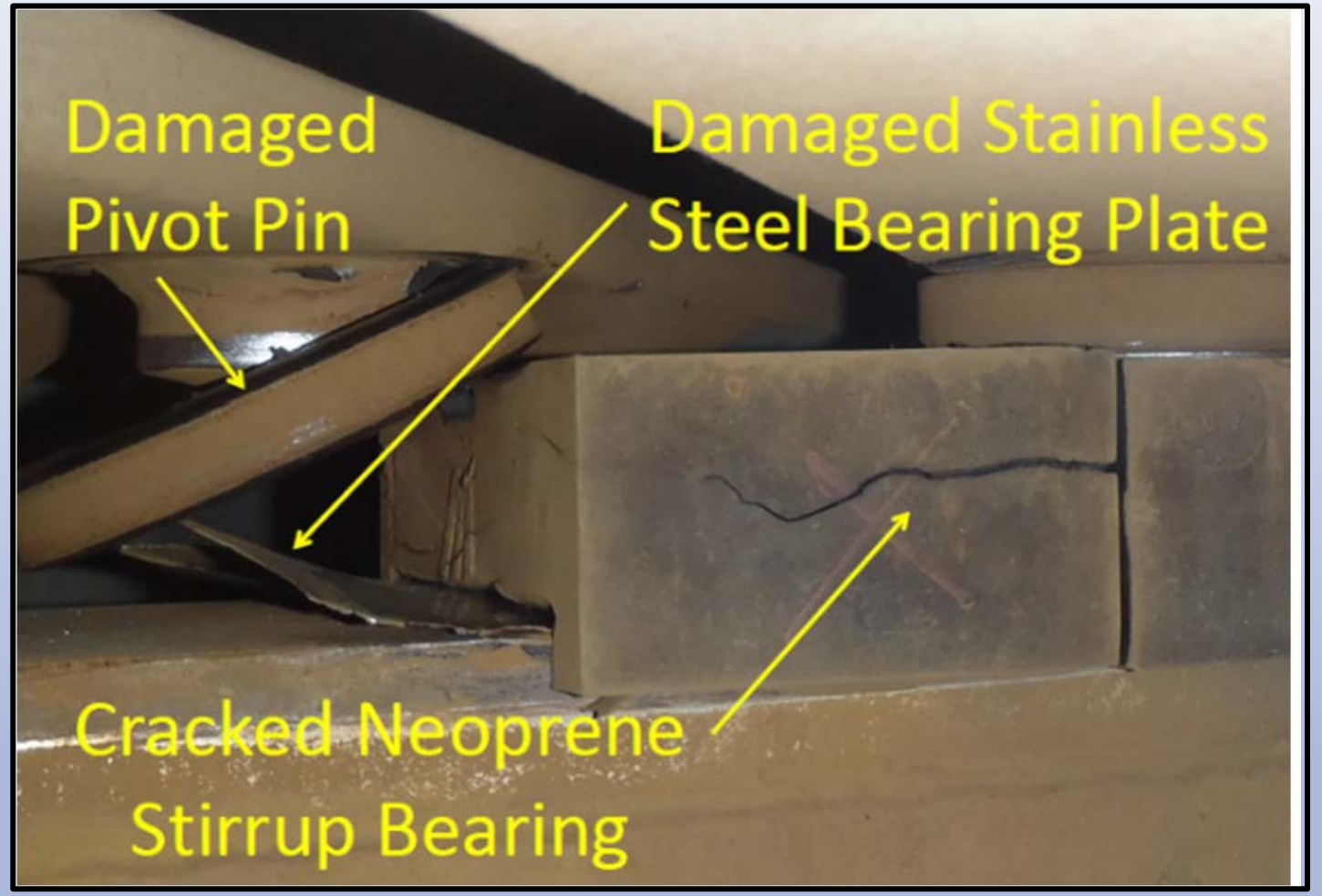


Bridges in California with this Joint Type:

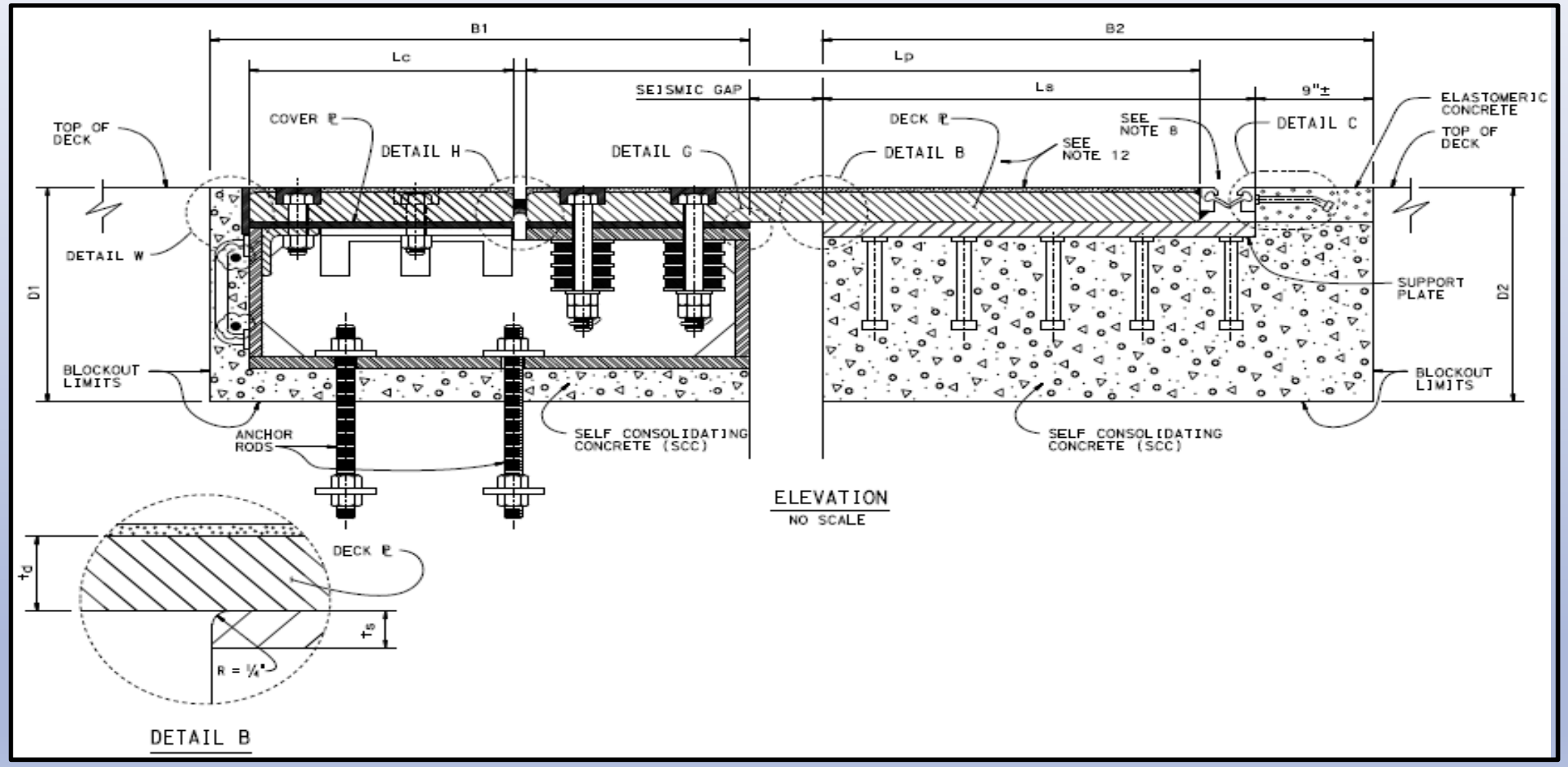
1. New Carquinez Suspension Bridge (50 inch total movement)
2. San Francisco Oakland Bay Bridge, Skyway
3. Hillery Drive OC, San Diego County

MAURER SWIVEL EXPANSION JOINT, Maintenance

2003 New Carquinez Suspension Bridge. Pier 1 & Abutment 4. Problems found 2012.



S2: SEISMIC JOINT, CALTRANS DESIGNED



SEISMIC JOINT, CALTRANS DESIGNED

CT Standard Drawings became available October 2014.
No known maintenance issues at this time.

GENERAL MAINTENANCE CONCERNS

1. Low Bidder Contract Award.
2. Time Permitted for Lane Closures.
3. Night Work by the Contractor.
4. Construction Inspection.
5. Materials.
6. Age of Infrastructure.
7. No Warranty.
8. Work Recommendations

   “Trust But Verify”

? QUESTIONS ?