Bridge Deck Joint Replacement Practices

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Topics

• Why do we need joints?
• Texas’ Design Philosophy: Minimize Joints
• Joint Types in Use
• Common Failure Modes and Replacement Practices
• Future Directions
Why do we need joints?

- Allow thermal expansion and contraction
- Allow translation & rotation of the deck
Why do we need joints?

- Keep water, … off of substructure
- Protect exposed concrete edges
Minimizing Joints – the Texas Way

• Joints and the “90% Rule”
• 90% of new bridges use PS beams
• “Poor-Boy” Continuous slabs
• Don’t eliminate joints completely
• Joint “failure” is inevitable
Fully Continuous Units
“Poor-Boy” Continuous

400’ maximum unit length
Controlled Joint

3/4” Chamfer or Steel Angle

“Zip-strip”

4”
Minimizing Joints – What we don’t do:

• Don’t eliminate joints completely
  – Change the way we build foundations
  – Moves the maintenance problem

• Don’t make prestressed beams continuous over the bents
  – Not worth the trouble
Joint Types

- Armor Joint (AJ)
- Sealed Expansion Joints (SEJ)
- Fabric Joint Underseal
- Header Type Joint
- Asphalt Plug
- Finger Joint
- Modular Joint
Joint Types

- Armor Joint
- SEJ
- Fabric Joint Underseal
- Header Type Joint
- Asphalt Plug
- Finger Joint
- Modular Joint
Armor Joint

• With or without overlay & Seal
Sealed Expansion Joint
Steel section

Conforms to slab surface

See table for joint opening at 70°

5/8" Dia x 0'-6"
Stud Anchors at 0'-6" C.C. Max
(Alternate Location)

6 9/16" Dia Holes for 1/2" Dia Erection Bolts at 4'-0" C.C. Max

D S BROWN COMPANY
Steel section 1
Conforms to slab surface
See table for joint opening at 70°

Center on surface (Typ)
Min

2 1/4 (Typ)

5/8" Dia x 0'-6" Stud Anchors at 1'-0" C.C. Max

5/8" (Typ)

5/8"

5/8" Dia x 0'-10" Stud Anchors at 1'-0" C.C. Max

2 1/4 (Typ)

5/8"

5/8"

5/8"

5/8"


6 5/8" Dia Holes for 1/2" Dia Erection Bolts at 4'-0" C.C. Max

1/4" (Typ)
Steel Section

Surface Treatment and ACP Overlay

See table for joint opening at 70°

1. 2

3/4" required

5/8" Dia x 0'-8" Stud Anchors at 1'-0" C.C. Max

7/8" Dia Air Holes in angles at 9" C.C. Max

7/8" Dia Holes for 1/2" Dia Erection Bolts at 4'-0" C.C. Max

L 4 x 3 x 3/8
Joint Types

- Armor Joint
- SEJ
- Fabric Joint Underseal
- Header Type Joint
- Asphalt Plug
- Finger Joint
- Modular Joint
Fabric Joint Underseal (FJU) - Features

- Use with ACP overlays for small joint movements

Center fabric @ Jt

1” sawed opening

18” wide fabric underseal

HMACP
Surface Treatment
Concrete Deck

Hot poured rubber
Backer rod
Header-Type Joints
Header-Type Joints with Overlay

- Wearing Surface
- Header
- Silicone Seal
- Concrete
- Existing Angle or Rail
Header-Type Joints Repairs

Header

Silicone Seal

Concrete

Concrete
Asphalt Plug Joints
Asphalt Plug Joints

- Wearing Surface
- Blended Polymer Modified Asphalt with Aggregate
- Bridging Plate
- Seal & Backer Rod
Joint Types

- Armor Joint
- SEJ
- Fabric Joint Underseal
- Header Type Joint
- Asphalt Plug
- Finger Joint
- Modular Joint

Specialized New Construction
Finger Joints
Modular Joints
Failure Modes

• SEJ’s and Armor Joints
  ➢ Damaged concrete deck edge or approach slab edge
  ➢ Disengaged stud anchors of the steel section from the concrete deck
  ➢ Damaged strip or silicone seal
  ➢ Joint is locked together
SEJ-Armor Joint Failures/Repairs

Damaged Slab Edge
- poor installation
- material failure

Partial depth slab repair
SEJ-Armor Joint Failures/Repairs

Damaged Slab Edge
- poor installation
- material failure

Full depth repair
Partial depth repair
Belzona repair
Remove top plate
Repair with Belzona
SEJ-Armor Joint Failures/Repairs

Steel is disengaged - fatigue

Full depth repair
Reset joint
SEJ-Armor Joint Failures/Repairs

Joint is locked together during hot weather - service limit

Full depth repair
Reset joint
SEJ-Armor Joint Failures/Repairs

Seals broken or leaking
Failure Modes

- **Header and Asphalt Plug Joints**
  - Header material delaminates
  - Header material has cracks
  - The deck concrete fails and the header fails
  - Header material expands due to moisture during installation
  - Excessively wide header joint
  - Sealant fails
Delamination of Header Material
- incorrect application
- material failure
- poor installation
Header and Plug Joint Failures

Cracking of Header Material
-material failure
Header and Plug Joint Failures

Deck concrete failure
-header material failure

Partial deck repair with Belzona
Header and Plug Joint Failures

Header bubbled from excess moisture - material failure
Header and Plug Joint Failures

Excessively Wide Header Joint - service limit
Header and Plug Joint Failures
Future Directions

• Stay with current design practices
• Warranty specs for header joints
• Evaluation of new header “systems”
  – One year trial installation
• Always looking for the perfect joint
  – Smooth ride
  – Stays sealed
  – Low maintenance