DECK JOINTS & BEARINGS

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Deck Joints (7.7 in Manual)

- Purpose is to:
  - bridge the gap between spans
  - protect the ends of the girders
  - allow for expansion, contraction and rotational movement
  - prevent water and salt from leakage
- Most important features are:
  - watertightness
  - proper anchorage
- Can be fixed or expansion
  - fixed are for rotational movement only
  - expansion accommodates translation in addition to rotation
  - located over fixed or expansion bearings

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Deck Joints

Several types of joints used on Alberta bridges:

- Buffer angles
- Waterstops
- Compression Seals
- Sliding Plates
- Open Finger Plates
- Closed Finger Plates with Troughs
- Modular Joint
- Gland Joints
  - Open
  - Cover plated / armored
- Thermoplastic Polymer Modified Asphalt
- Deck Joint Sealants
- Other Patented Devices/Processes
  - Fel Span
  - Interspan
  - Jeene

https://www.alberta.ca/assets/documents/trans-bridge-deck-joints-drawings.pdf

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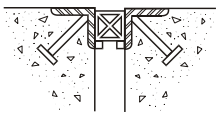
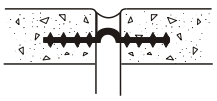
Deck Joints



Compression Seal



Waterstop

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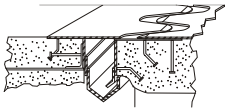
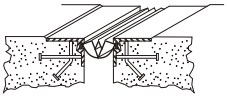
Deck Joints



Closed Finger Plates



Gland

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Buffer Angles for Fixed or Minor Expansion

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Individual Buffer Angles on Standard Girders

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Sliding Plate Expansion Joint

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Armored Gland Joint

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Armored Gland Joint

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Finger Plate Joint

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Finger Plate Joint Welds

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Strip Seal Joint

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Strip Seal Joint

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Strip Seal Joint with Plow Guards

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Gland Cross-Section

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"Honel" Gland Joint with Bolted Compression Connection

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16

"Modular Joint

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17

"Wabocrete" Joint

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18

Placing Wabocrete Two Component Elastomeric Material

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19

Completed Installation

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"Koch" Joint with Elastomeric Material

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Completed Koch Joint

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Waterstop Joint

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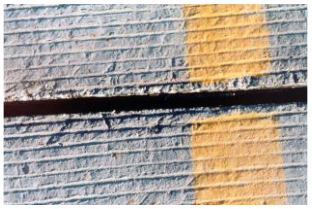
“Jeene” Joint Polymer Hot Pour



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RCS Dow Corning Epoxy Joint

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“Interspan” Joint

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Problems and Inspection Considerations

Check for:

- Watertightness of sealed joints
  - loose or torn seals
  - leakage or stains
- Freedom of movement
- Horizontal alignment
  - evenness of gap
  - fingers in alignment
- Vertical alignment
  - joint aligned with deck
  - both sides of joint in alignment

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- Corrosion
- Deteriorating concrete around anchorages, incomplete grout
- Loose or missing bolts, cover plates or curb plates
- Gouged, torn, cracked or broken
  - extrusions
  - angles
  - plates
  - fingers
  - welds

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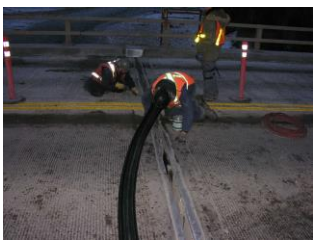
Problems and Inspection Considerations

- Observe traffic passing over joints
  - listen for unusual noises and watch for movement of the joint
- Check drainage system
  - plugging of joint opening, troughs and downpipes with debris
  - corrosion / perforations
  - cracks, breaks or tears in any component
  - Integrity of attachments and connections
    - loose or missing bolts
    - cracked or broken welds
    - loose or open connections
  - Check for:
    - signs of ponding on the deck
    - staining or deterioration on the deck, curbs, girders and substructure
    - erosion below downpipe

Hole in Gland Joint

Replace Joint Seal



Testing for Watertightness

Missing Plow Guards and Spalled Paving Lip

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Finger Plate Joint with Broken/Lifted Fingers Welds

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Finger Plate Joint with Broken/Missing Fingers

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Finger Plate Joint with no Remaining Expansion

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Armored Gland Joint - Missing Bolts

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Loose Buffer Angles

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Wabo-crete Joint with De-bonded Material and Exposed Bars

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Inspection Form and Rating

- Record temperature
- Verify joint type
- Verify joint function
  - fixed
  - expansion
- Measure and record average gap width in millimeters for each joint

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Deck Joint Inspection and Rating

- Rate according to existing condition and functionality
- Includes condition and functionality of drainage system
- Leakage of sealed joints is reflected in both the deck joint rating and the deck drainage rating

- Defects in open joints with plumbing features are also reflected in both the deck joint rating and the deck drainage rating
- Leakage problems with open joints without plumbing are rated under deck drainage only
- Curb cover plates are rated with the deck joint and not the curb rating

Deck Joint Inspection and Rating

- Joints that are not fully free to move - Rate 4 or less
- Joints designed to be watertight joints which allow leakage of water onto girders, bearings or substructure - Rate 4 or less
- Open (non-watertight) joints should not be down rated because of leakage
- Joint defects causing problems with structure (e.g. frozen bearings causing pier cap delams) - Rate 3 or less
- Joints which are a hazard to traffic - Rate 2 or less

Bearings (7.20)

- Bearings must transfer loads from the superstructure to substructure.
- Bearings accommodate movement caused by temperature changes, deflection, earth pressures, etc.

- Bridge bearings are generally classified as fixed or expansion type and located under corresponding joints.
- Fixed bearings allow rotation but no vertical or horizontal movement.
- Expansion bearings allow both rotation and longitudinal movement of the superstructure. Expansion bearings sometimes also permit transverse movement.

Bearings

There are usually three distinct components in a bearing:

1. Sole plate - Steel plate welded, bolted, riveted or cast to bottom of girders
2. Masonry plate - Similar to sole plate except located on top of substructure element and usually anchored by bolts into concrete
3. Bearing - Assembly between sole plate and masonry plate that permits movement of the bridge

Bearings

The common types of bearings used on Alberta bridges are:

1. Elastomeric pads
   - Usually neoprene – newer are reinforced with steel shims, older are plain/un-reinforced
   - Often include stainless steel and teflon for expansion of longer span girders
2. Rockers
   - Large steel "pie-shaped" bearings designed for large movements
3. Rocker Plates
   - Steel plate with cylindrical side - accommodate rotation only–fixed so no thermal movement
4. Pot
   - Elastomeric pad confined by heavy steel ring & loaded vertically by cover component. Can allow movement in one or more directions, be fixed, and be designed to resist uplift.

Bearings cont'd.

The common types of bearings used on Alberta bridges (continued):

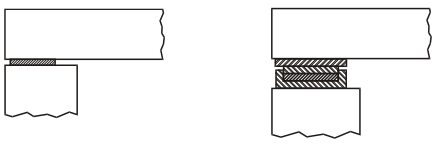
5. Roller/Roller Nest
   - Cylindrical steel bearings either in the form of a single roller or in a group (nest). Rollers allow rotation and horizontal movement in one direction.
6. Neoprene Strip Bearing
   - Fixed bearing used under short span standard girders not requiring movement
7. Steel Sliding Plate w/Self Lubricating Bronze Plate
   - Steel plates with bronze plate between – used primarily under Type O girders (1955-19650
   - Problems with freezing and inducing stresses to substructure

Bearings cont'd.

The common types of bearings used on Alberta bridges (continued):

8. Spherical bearings
   - Made of spherical machined steel plates that nest together to allow rotation and may have an allowance for horizontal movement
10. Sliding Plates
   - steel sliding expansion plates commonly used under pony trusses – simple and no problems
11. Disc/Disc and Dome
   - disc bearings (round, confined polyurethane pad)
12. Others
   - Rotation Pins - allows truss rotation of fixed bearings
   - Pinned – fixed stacked plates (opposite of sliding plates)
   - Pedestal

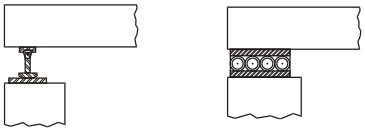
Bearings



ELASTOMERIC PAD

POT BEARING

Bearings



ROCKER BEARING ROLLER BEARING

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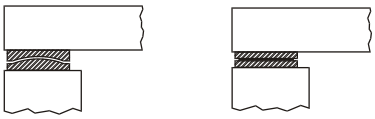
Bearings



SPHERICAL BEARING BEARING WITH SLIDING SURFACE

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Elastomeric Bearing Showing Pintel, Anchor, Bolts, Sole and Masonry Plates (before grouting)

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Reinforced Neoprene Expansion Bearing with Teflon & Stainless Steel

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Reinforced Neoprene Bearing without Teflon & Stainless Steel

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Pot Bearing - Expansion

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Multi Pot Bearings - Expansion

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Rocker Bearing Under Steel Girder

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Plate Rocker Bearing Under Truss

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Rocker & Plate Rocker Bearings

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Single Roller Bearing Under Concrete Girder

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Roller Nest Bearing Under Concrete Girder

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Roller Nest Bearing Under Truss

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Neoprene Strip Bearing Under Std. Girders

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Sliding Plate with Self-Lubricating Bronze Plate (Type PO Girders)

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Rotation Pin (Fixed) Bearing Under Truss

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Rotation Pin (Fixed) Bearing Under Acrow

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Sliding Plate Under Truss

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Steel Plate Pinned (Fixed) Bearing

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Bearings

Problems and Inspection Considerations

- Dirt or debris
  - may inhibit movement
  - promotes corrosion
- Corrosion
  - "frozen" bearing ("Type O" bearings most affected)
  - deterioration of bearing
    - especially under leaking joints

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Bearings

Problems and Inspection Considerations

- Loose or missing connections, cracked or broken welds
- Loss of bearing contact or uneven contact
  - rollers moved off masonry or sole plates
  - neoprene pads creeping out of position
  - can overstress steel or concrete members

Bearings

Problems and Inspection Considerations

- Wear
- Rocker alignment
  - overextension
  - should be approximately vertical at 0° Celsius
- Failure of elastomer
  - splitting, cracks, squeezing out, bulging
  - separation of the elastomer at reinforcing plates

Bearings

Problems and Inspection Considerations

- Anchor bolts
  - corrosion (strike with hammer)
  - bent
  - surrounding concrete cracked
  - nuts not properly secured (jam nut), nuts missing
  - binding on shoe plate or bearing device

Bearings

Problems and Inspection Considerations

- Indications of a non-functioning bearing
  - cracks in the bearing area of the substructure or superstructure
  - uneven gaps at expansion joints
    - bump at joint
    - variable gap in same joint
    - jammed joint
    - joint gap too wide
  - misalignment of superstructure at joint
  - unusual noise or movement under traffic

Bearings

Problems and Inspection Considerations

- Deterioration caused by leaking deck joints should be noted in Explanation of Condition.
  - Deck drainage also gets down-rated
  - If joint above was designed to be watertight then joint also gets down rated
- Cracks, delaminations or spalls in concrete abutment and pier's caps / seats / corbels emanating from bearing components should be noted and comments on reduced bearing functionality should be provided.

Bearings

Inspection Form and Rating

- Record temperature
- Record or verify bearing types and locations:
  - expansion
  - Fixed
- Record if coating intact and functioning to protect bearing from corrosion
- Record or verify whether the bearing is functioning as designed
  - proper bearing
  - proper movement

Bearings

Inspection Form and Rating

- Bearings functioning properly and in good condition but have inadequate coating
  - Rate 7 or 8
- Bearings require resetting
  - Rate 4 or less
- Bearing movement inhibited by dirt, debris or corrosion (frozen)
  - Rate 4 or less
- Concrete elements under bearings with wide cracks or visual signs of damage (not accessible for sounding)
  - Rate 3 or less
- Pin and Hanger bearings with cracked hanger
  - Rate 2 or less
  - Corrosion, frozen pins, missing windlocks – rate 3 or less

Displaced Neoprene Pad

Displaced Neoprene Pad - Over Keepers

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Torn Neoprene Pad Bearing

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Pot Bearing – Failed Keeper Plate

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Pot Bearing – Cracked

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Extended Rocker Bearing (rating dependent on temp)

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Failed Rocker/ Roller Bearing

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Displaced Roller Nest

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Pinned/Fixed Bearing with Corrosion & Failed Grout Pad

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Pinned Bearing with Sheared Anchor Bolt

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Sliding Plate Bearing Unsupported

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Sliding Plate Bearing Unsupported

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Type PO Girder Bearings

- Performance issues related to steel sliding plate bearings with self-lubricating bronze plates.
- Primarily found under Type “PO” girders between 1955 and 1965, and detailed on Standard Drawing S-701.
- Failed bearing at BF 1153 Hwy. 22 over Oldman River discovered during Level 1 BIM inspection. Near catastrophic and led to BIM Bulletin 3 Jan. 2016

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Failed Sliding Plate with Self-Lubricating Bronze Plate Bearing

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Failed Sliding Plate with Self-Lubricating Bronze Plate Bearing

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Failed Sliding Plate with Self-Lubricating Bronze Plate Bearing

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Failed Self-Lubricating Bearing Replaced with Neoprene Pad Bearings

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