

# Deck Joints and Bearings

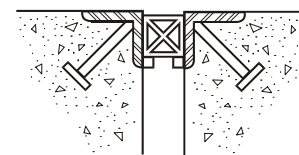
## Deck Joints

- 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 accommodate translation in addition to rotation

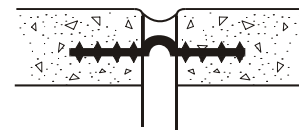
## Deck Joints

- The main types of joints used on Alberta bridges are:
  1. Buffer angles
  2. Waterstops
  3. Sliding Plates
  4. Open Finger Plates
  5. Compression Seals
  6. Closed Finger Plates with Troughs
  7. Gland Joints
    - Open
    - Coverplated
  8. Thermoplastic Polymer Modified Asphalt
  9. Deck Joint Sealants
  10. Other Patented Devices/Processes
    - Fel Span
    - Interspan
    - Jeene

## Deck Joints

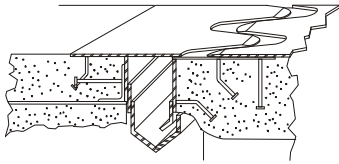


Compression Seal

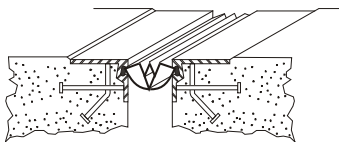


Waterstop

### Deck Joints



Closed Finger Plates



Gland

### Waterstop Joint



### Buffer Angles for Fixed or Minor Expansion



### Sliding Plate for Small Expansion Movements



### Finger Plate Joint



### Gland Cross-section



### Close-up View of Gland Joint



### “Honel” Gland Joint with Bolted Compression Connection



### Cover Plated Joint



### “Wabocrete” Joint



### Two Component Elastomeric Material



### Placing Wabocrete



### Completed Installation



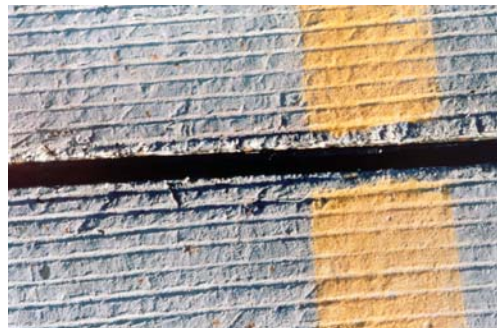
### “Koch” Joint with Elastomeric Material



### Complete Koch Joint



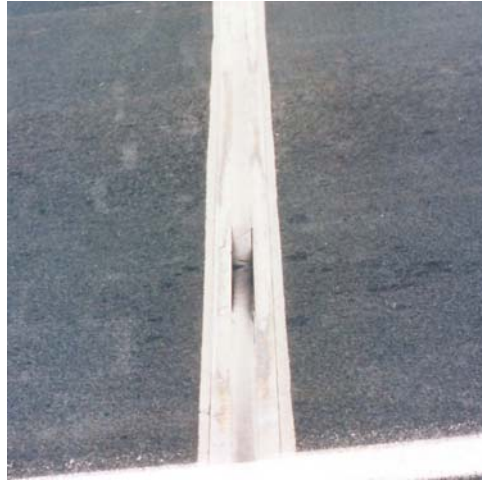
### “Jeene” Joint Polymer Hot Pour



### RCS Dow Corning Epoxy Joint



### “Interspan” Joint



### Transflex Joint



### 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
- corrosion
- deteriorating concrete around anchorages, incomplete grout
- loose or missing bolts, coverplates or curb plates
- gouged, torn, cracked or broken
  - extrusions
  - angles
  - plates
  - fingers
  - welds

### Finger Plate Joint with Broken Welds and Gap Under Fingers



### Unmatched Finger Plate Joint, Snow Plow Guards & Plug Welded Fingers



### Testing for Watertightness



### 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
  - 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

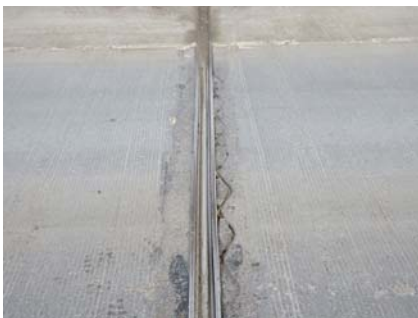
## Hole in Gland Joint



## Coverplate Missing Bolts



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



## Inspection Form and Rating

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



## 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
- 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 rate 3 or less
- Joints which are a hazard to traffic
  - rate 2

## Bearings

- Bearings must transfer loads from the superstructure to substructure.
- The bearings accommodate movement caused by temperature changes, deflection, earth pressures, etc.
- Bridge bearings are generally classified as fixed or expansion type.
- 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.

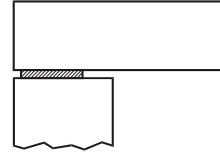
## Bearings

- There are usually three distinct components in a bearing:
  - Sole plate
    - steel plate welded, bolted, riveted or cast to bottom of girders
  - Masonry plate
    - similar to sole plate except located on top of substructure element and usually anchored by bolts into concrete
  - Bearing
    - assembly between sole plate and masonry plate that permits movement of the bridge

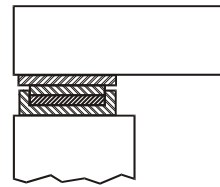
## Bearings

- The main types of bearings used on Alberta bridges are:
  1. **Elastomeric pads**  
Usually neoprene (reinforced or plain) and sometimes incorporating stainless steel and teflon for expansion
  2. **Rockers**  
Massive steel "pie-shaped" bearings designed for large movements
  3. **Pot**  
Consists of an elastomeric pad confined by a heavy steel ring and loaded vertically by a cover component. Pot bearings can allow movement in one or more directions, can be fixed and can be designed to resist uplift.
  4. **Spherical bearings**  
Made of spherical machined steel plates that nest together to allow rotation and may have allowance for horizontal translation
  5. **Rollers**  
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. **Others**
    - steel sliding plates (sometimes with a bronze insert)
    - disc bearings (round, confined polyurethane pad)

## Bearings

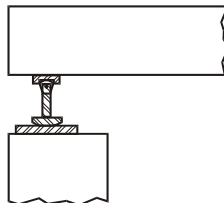


ELASTOMERIC PAD

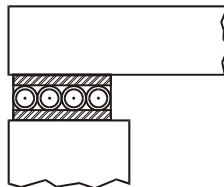


POT BEARING

## Bearings

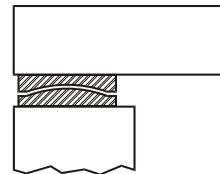


ROCKER BEARING

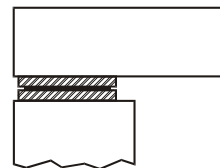


ROLLER BEARING

## Bearings



SPHERICAL BEARING



BEARING WITH SLIDING SURFACE

### Elastomeric Bearing Showing Pintel, Anchor Bolts, Sole and Masonry Plates



### Elastomeric Expansion Bearing with Teflon & Stainless Steel



### Pot Bearing



### Sliding Plate Under Truss



### Rocker Bearing Under Girder



### Expansion Rocker Bearings



### Roller Bearing Under Concrete Girder



### Three Roller System Under Concrete Girder



## Rocker/Roller Bearing Under Truss



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



## Bearings

### Problems and Inspection Considerations

- Dirt or debris
  - may inhibit movement
  - promotes corrosion
- Corrosion
  - “frozen” bearing (2016 bulletin regarding “Type O” bearings)
  - deterioration of bearing
  - especially under leaking joints
- 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
- 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

### Inspection Form and Rating

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

## Bearings

### Inspection Form and Rating

- If bearings are functioning properly and are in excellent condition but have inadequate coating
  - rate 7 or 8
- Bearings require resetting
  - rate 4 or less
- Bearings movement inhibited by dirt, debris or corrosion
  - rate 4 or less
- Concrete elements with wide cracks or visual signs of damage (not accessible for sounding) at bearing locations
  - Rate 3 or less (from 2016 Bulletin)
- Cracked hanger bearings
  - rate 2

## Displaced Neoprene Pad



### Extended Rocker Bearing



### Failed Rocker/Roller Bearing



### Displaced Roller Nest



### Failed Sliding Plate with Self-Lubricating Bronze Plate Bearing



## Failed Sliding Plate with Self-Lubricating Bronze Plate Bearing



## BIM Advisory Bulletin #3

- 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.
- Inspectors should be completely familiar with the details of this recent bulletin. Refer to the following link:

<http://www.transportation.alberta.ca/4827.htm>

# Questions??