

## STANDARD BRIDGE & CULVERT COMPONENTS

## Alberta Bridge Inventory

In Alberta there are about 13,300 bridges.

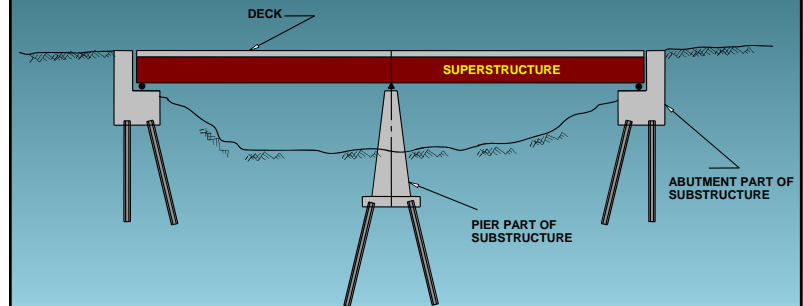
Types of bridges in Alberta:

- Standard bridges	3521	(26%)
- Bridge size culverts	8348	(63%)
- Major bridges	1435	(11%)

## Standard Bridges

- Any bridge which is built using standard components and according to standard drawings (plans).
- Exception is standard girder bridges with composite decks (e.g. – SMC, SCC, SLC) which are currently classified as major bridges
- For inspection purposes standard bridges are divided into two basic features:
  - Superstructure
  - Substructure

## Typical Bridge Components



## Typical Bridge Components

### Superstructure

- It carries the load applied to the deck and transfers it to bridge supports.

### Substructure

- It transfers load from the superstructure to the foundation soil or rock.
- It includes all elements below the bearings.

## Typical Bridge Components

### Deck

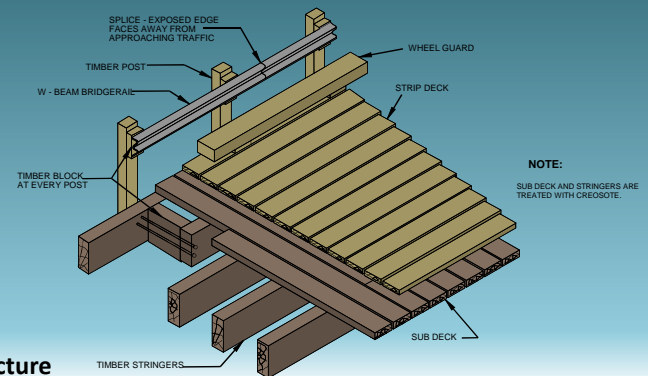
- Provides a smooth & safe riding surface
- Transfers load of the deck to other components.
- Three common material used for the deck:
  - Wood
  - Concrete
  - Steel

## Superstructure for Standard Bridges

Superstructure comprises of bearings and all elements above bearings, including:

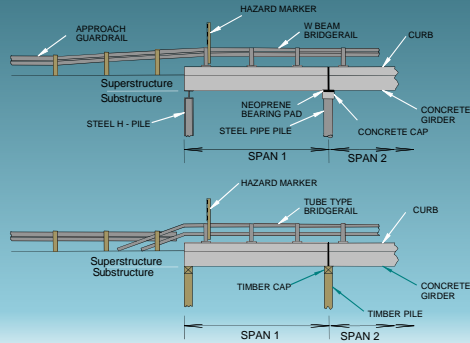
- Bridgerail.
- Hazard markers.
- Timber stringers with timber deck.
- Reinforced concrete girders.
- Prestressed concrete girders.
- Bearings.

## Superstructure Elements

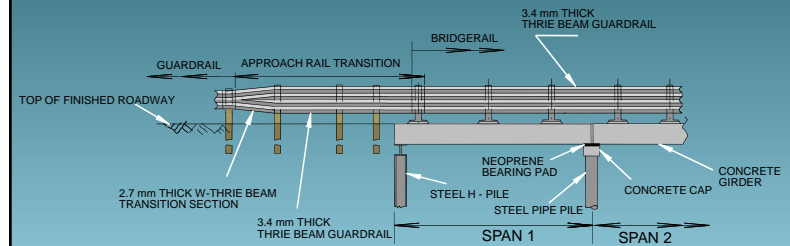


### Timber Superstructure

## Superstructure Elements



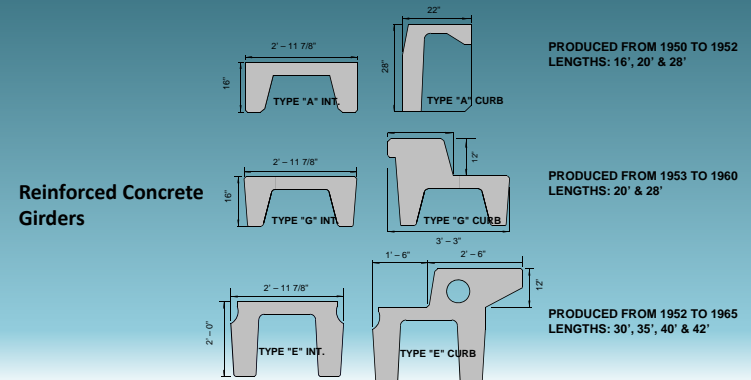
## Superstructure Elements



## Superstructure Elements

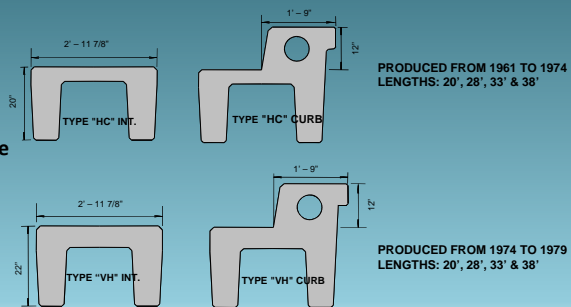
- Reinforced Concrete Girders
  - Concrete is strong in compression and weak in tension.
  - Concrete bending members are reinforced with mild reinforcing steel to produce reinforced concrete girders.
- Prestressed Concrete Girders
  - Girders are reinforced with high strength steel under tension.
  - Girders are designed not to crack.
  - Generally more economical.

## Superstructure Elements



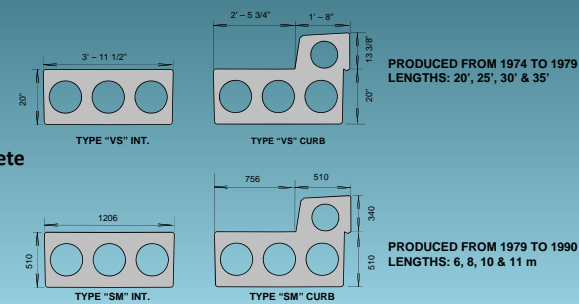
## Superstructure Elements

### Reinforced Concrete Girders



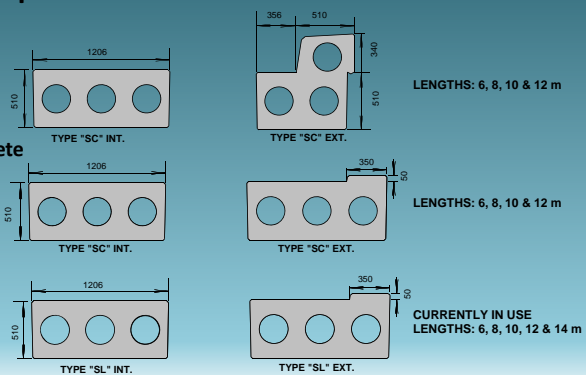
## Superstructure Elements

### Prestressed Concrete Girders



## Superstructure Elements

### Prestressed Concrete Girders



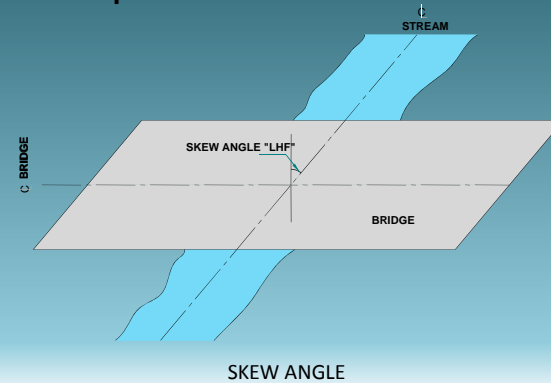
## Superstructure Elements



## Superstructure Elements



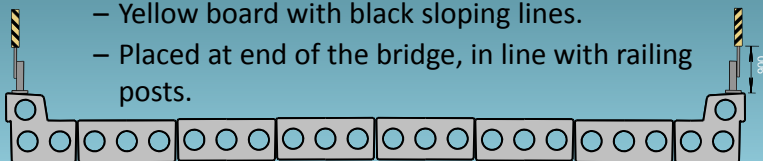
## Superstructure Elements



## Superstructure Elements

### Hazard Marker

- Warning sign at bridge approaches.
- Yellow board with black sloping lines.
- Placed at end of the bridge, in line with railing posts.



## Superstructure Elements

- Bearings
  - Neoprene or rubber pads or strips.
  - Used over steel and concrete caps.
  - Transmit all loads from superstructure to substructure.
  - Permit longitudinal movement of the superstructure.
  - Allow rotation caused by deflection.

## Substructure Elements

Substructure comprises of all elements below bearings.

Major components:

- Abutments
- Pier or Pile Bent (H pile pier or Pipe pile pier)

## Substructure Elements

Other components:

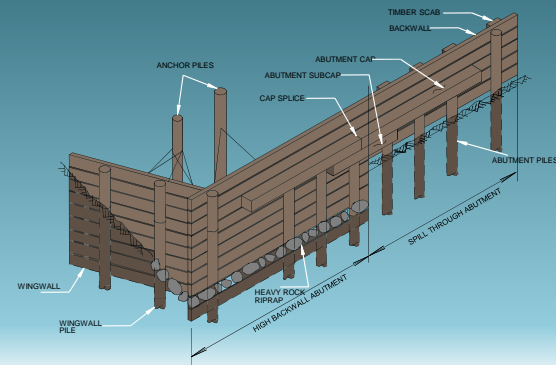
- Caps & Subcaps.
- Piles.
- Sheathing & Bracing.
- Wingwall
- Backwall
- Riprap

## Substructure Elements

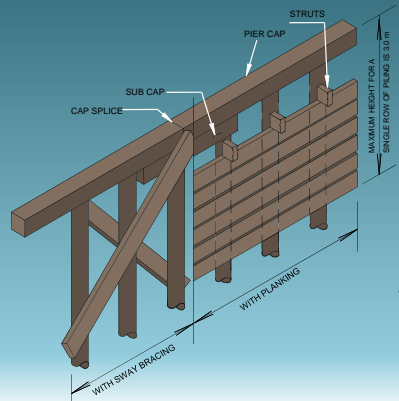
Substructures can be:

- Timber piles with timber cap
- Timber piles with steel cap
- Steel "H" piles with steel cap
- Steel "H" piles with concrete cap
- Steel pipe piles with concrete cap

## Substructure Elements

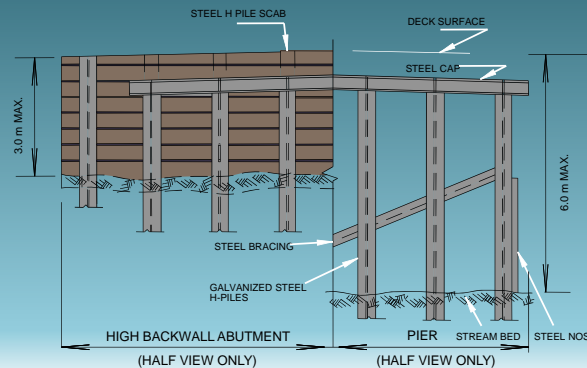


## Substructure Elements

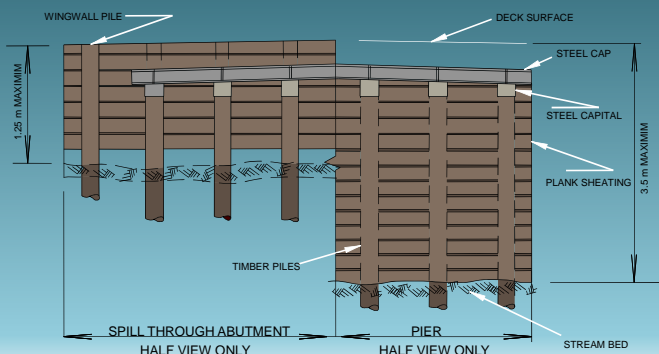


**Timber Piers ( 2 Types Of Bracing)**

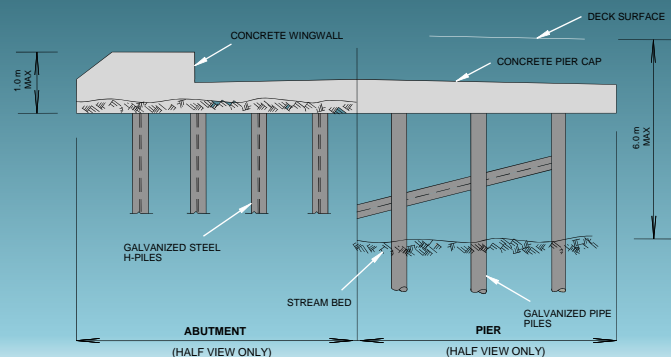
## Substructure Elements



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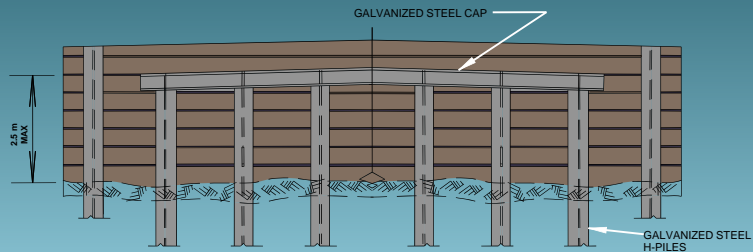


## Substructure Elements



Standard Bridge & Culvert Components

### Substructure Elements



**SC PRESTRESSED CONCRETE GIRDER BRIDGE WITH STEEL SUBSTRUCTURE  
HIGH ABUTMENT BACKWALL (ELEVATION)**

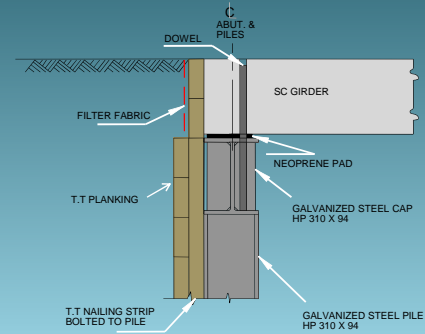


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Standard Bridge & Culvert Components

### Substructure Elements



**SC PRECAST GIRDER BRIDGE WITH STEEL SUBSTRUCTURE (SECTION)**

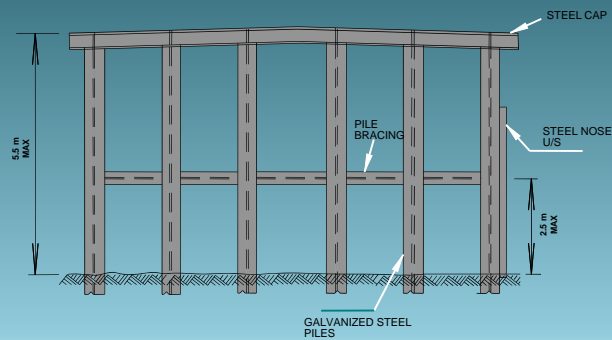


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Standard Bridge & Culvert Components

### Substructure Elements



**SC PRECAST GIRDER BRIDGE WITH STEEL SUBSTRUCTURE PIER (ELEVATION)**

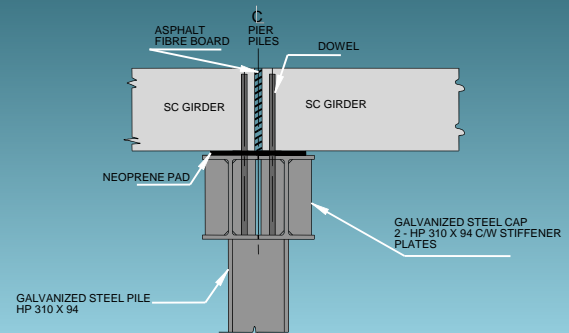


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Standard Bridge & Culvert Components

### Substructure Elements



**SC PRECAST GIRDER BRIDGE WITH STEEL SUBSTRUCTURE PIER (ELEVATION)**

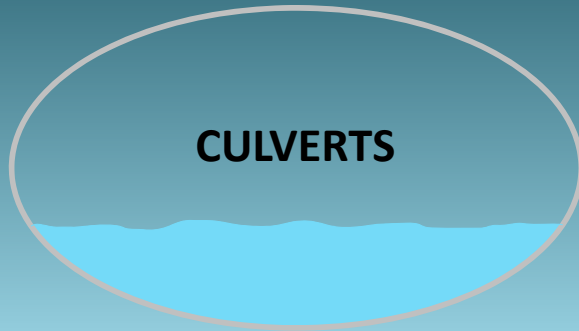


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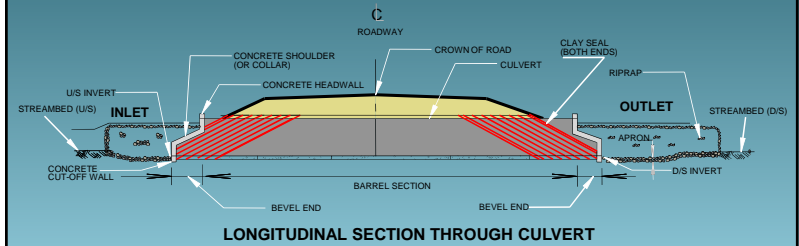


Standard Bridge & Culvert Components



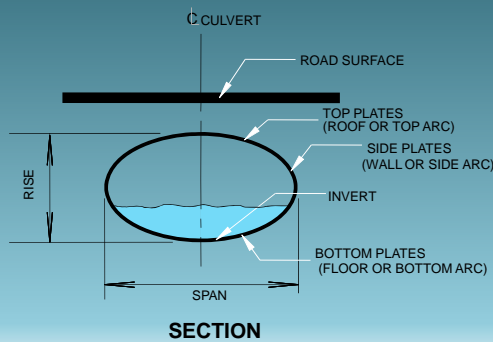
Standard Bridge & Culvert Components

Culvert Components



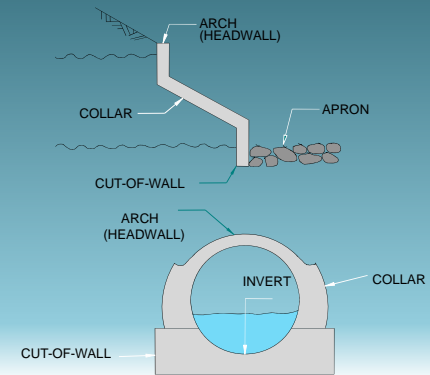
Standard Bridge & Culvert Components

Culvert Components

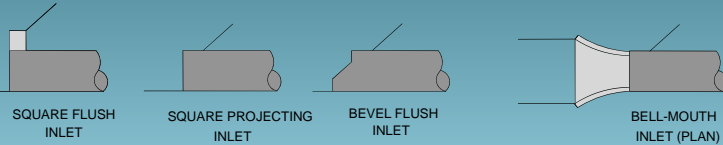


Standard Bridge & Culvert Components

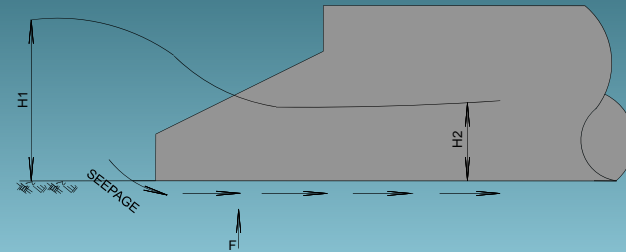
Culvert Components



## Typical Inlet Configurations

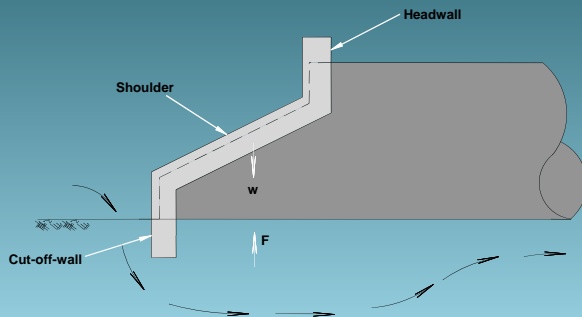


## Concrete End Treatment



Uplift force,  $F$  is proportional to  $H1 - H2$   
Seepage is proportional to  $H1 - H2$

## Concrete End Treatment



## Concrete End Treatment

Concrete end treatment has five important functions:

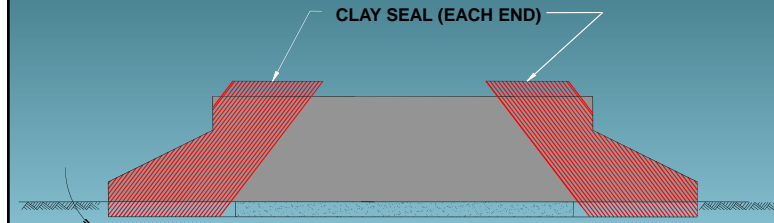
1. Weight provides downward force to resist uplift.
2. Cut-off wall lengthens the seepage path.
3. Shoulder strengthens the bevel edges.
4. Enhances the inlet transition.
5. Aesthetics.

## Clay Seals

### Problems due to seepage:

- Fine material is removed from the granular backfill.
  - Loss of material creates voids.
  - Support length of the backfill is reduced.
  - Culvert can deform.
- Uplift forces are increased.

## Clay Seals



## Scour Protection - Aprons



### Flowing water causes shear forces on the bed.

- Shear force is proportional to velocity.
- High shear forces will erode bed and bank material.
  - Causes fill stability problems at inlet and outlet.
  - Causes structural deformation.

## Scour Protection - Aprons



- Riprap is placed to protect the end of culverts.
- Larger and heavier riprap provides higher shear resistance.
- Cut-off wall helps anchor riprap.

## Culvert (SPCSP) Installation



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# END