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

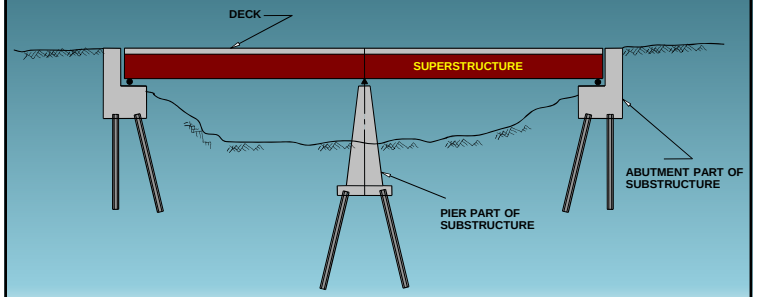
-Any bridge which is built using standard components and according to standard drawings (plans).

-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.

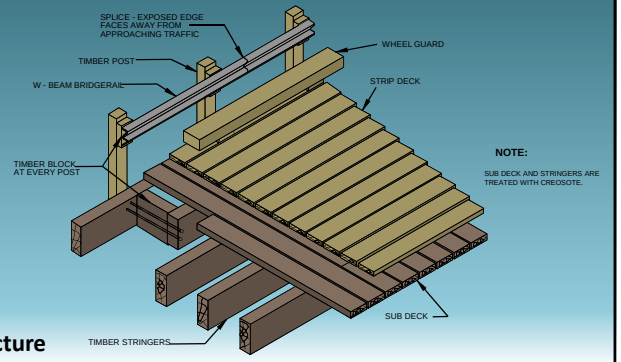
Typical Bridge Components

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

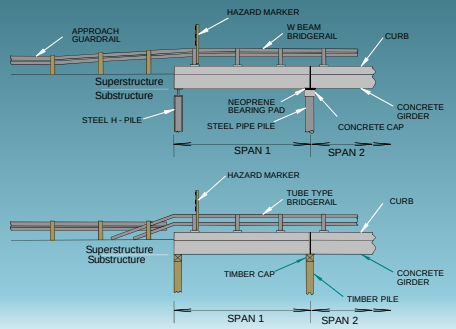
Superstructure comprises of bearings and all elements above bearings, including:
- Bridgerail.
- Hazard markers.
- Timber stringers with timber deck.
- Reinforced concrete girders.
- Prestressed concrete girders.
- Bearings.

Superstructure Elements

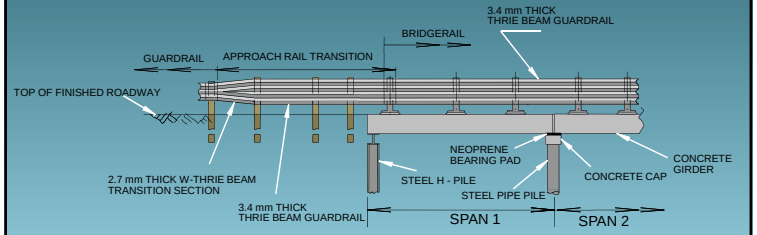


Timber Superstructure

Superstructure Elements



Superstructure Elements

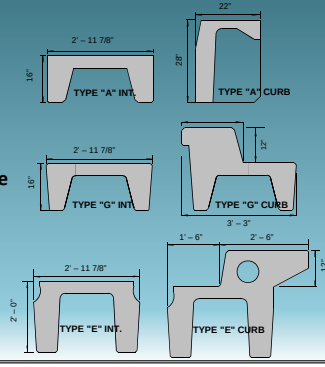


Superstructure Elements

- 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

Reinforced Concrete Girders



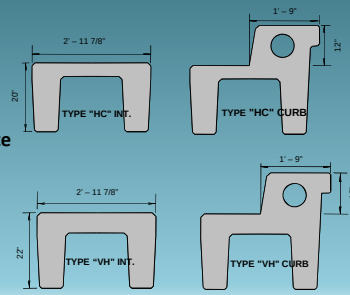
PRODUCED FROM 1950 TO 1952
LENGTHS: 16', 20' & 28'

PRODUCED FROM 1953 TO 1960
LENGTHS: 20' & 28'

PRODUCED FROM 1952 TO 1965
LENGTHS: 30', 35', 40' & 42'

Superstructure Elements

Reinforced Concrete Girders

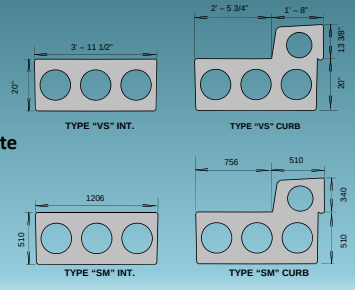


PRODUCED FROM 1961 TO 1974
LENGTHS: 20', 28', 33' & 38'

PRODUCED FROM 1974 TO 1979
LENGTHS: 20', 28', 33' & 38'

Superstructure Elements

Prestressed Concrete Girders

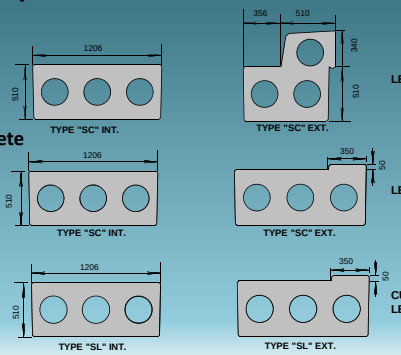


PRODUCED FROM 1974 TO 1979
LENGTHS: 20', 25', 30' & 35'

PRODUCED FROM 1979 TO 1990
LENGTHS: 6, 8, 10 & 11 m

Superstructure Elements

Prestressed Concrete Girders



LENGTHS: 6, 8, 10 & 12 m

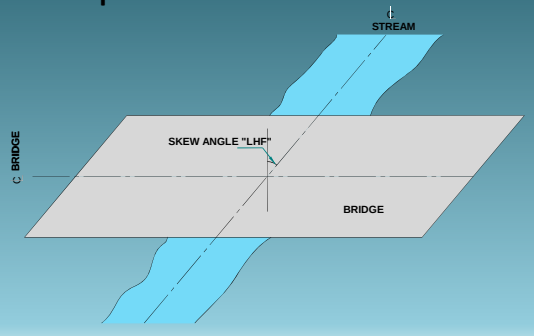
LENGTHS: 6, 8, 10 & 12 m

CURRENTLY IN USE
LENGTHS: 6, 8, 10, 12 & 14 m

Superstructure Elements

Superstructure Elements

Superstructure Elements

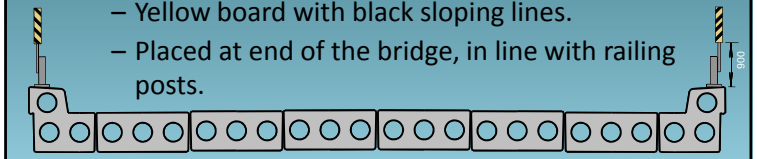


SKEW ANGLE

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:

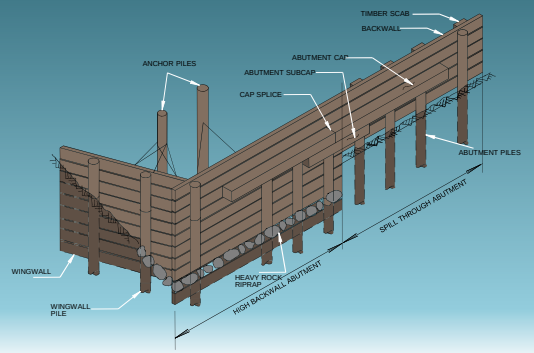
- Caps & Subcaps.
- Piles.
- Sheathing & Bracing.
- Wingwall
- Backwall
- Riprap

Substructure Elements

Substructures can be:

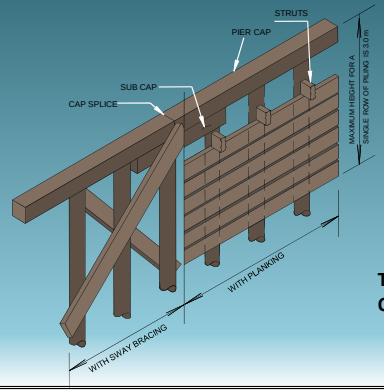
- Timber piles with timber cap
- Timber piles with steel cap
- Steel “H” piles with steel cap
- Steel “H” piles with concrete cap
- Steel pipe piles with concrete cap

Substructure Elements



Standard Bridge & Culvert Components

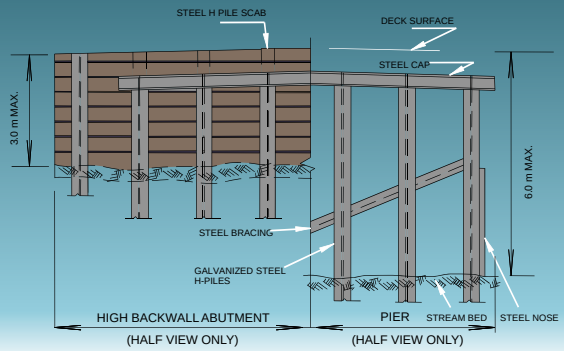
Substructure Elements



Timber Piers (2 Types Of Bracing)

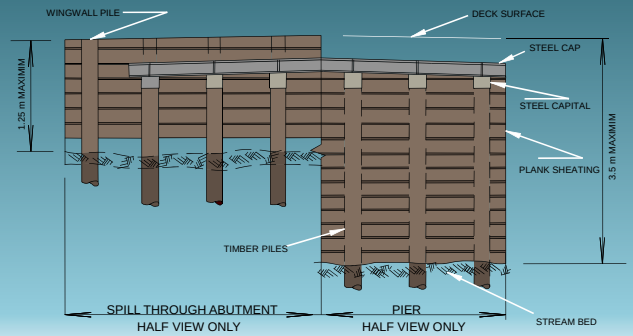
Standard Bridge & Culvert Components

Substructure Elements



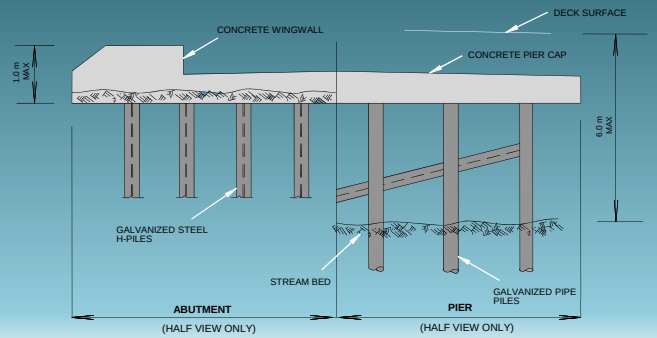
Standard Bridge & Culvert Components

Substructure Elements



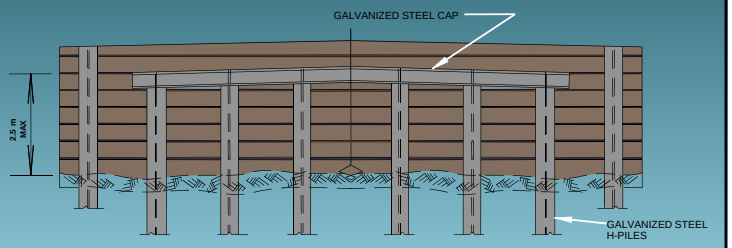
Standard Bridge & Culvert Components

Substructure Elements



Standard Bridge & Culvert Components

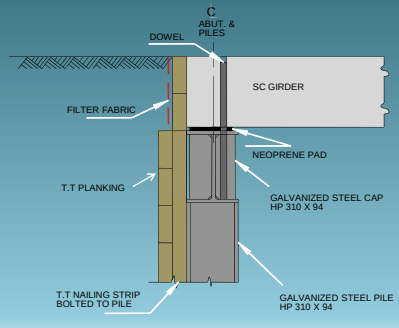
Substructure Elements



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

Standard Bridge & Culvert Components

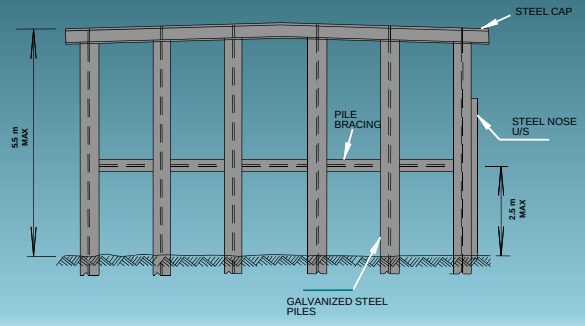
Substructure Elements



SC PRECAST GIRDER BRIDGE WITH STEEL SUBSTRUCTURE (SECTION)

Standard Bridge & Culvert Components

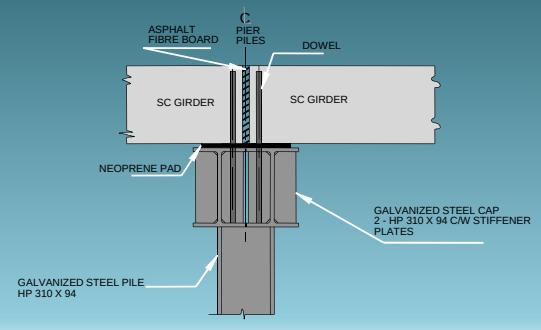
Substructure Elements



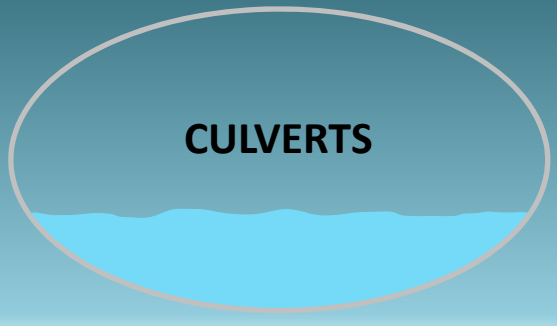
SC PRECAST GIRDER BRIDGE WITH STEEL SUBSTRUCTURE PIER (ELEVATION)

Standard Bridge & Culvert Components

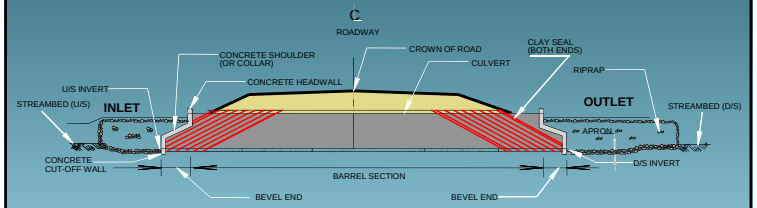
Substructure Elements



SC PRECAST GIRDER BRIDGE WITH STEEL SUBSTRUCTURE PIER (ELEVATION)

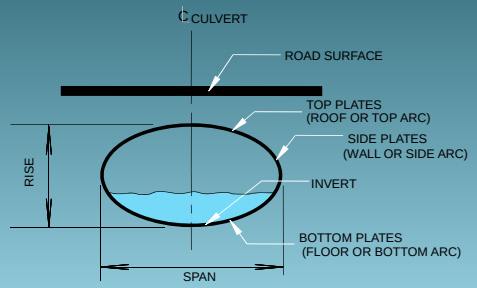


Culvert Components



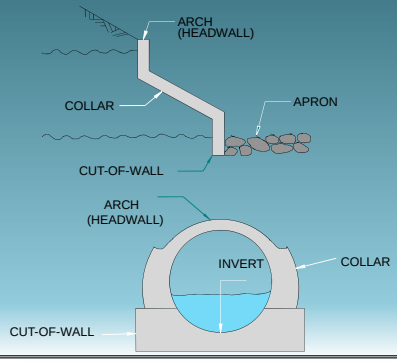
LONGITUDINAL SECTION THROUGH CULVERT

Culvert Components

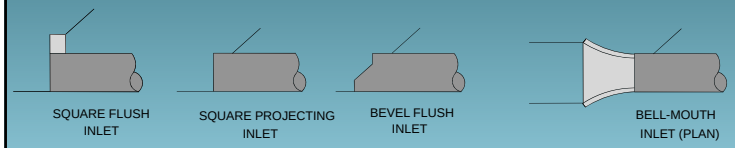


SECTION

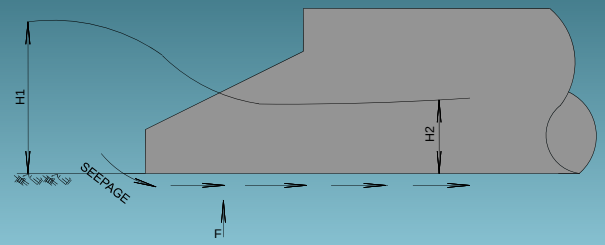
Culvert Components



Typical Inlet Configurations

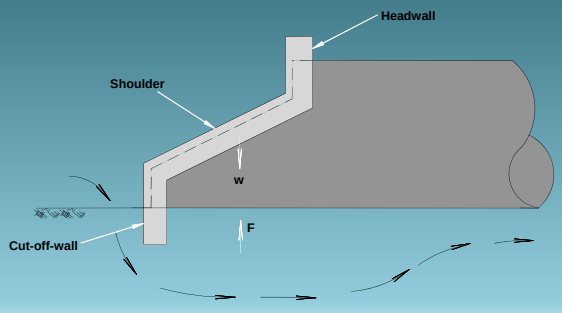


Concrete End Treatment



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:

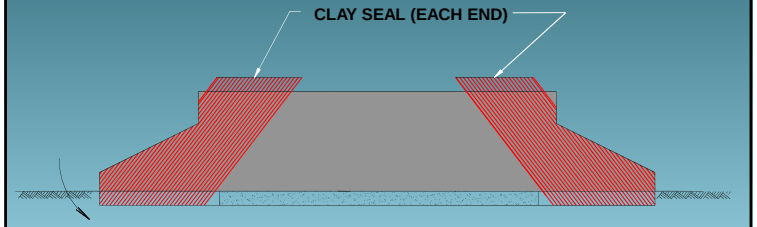
1. Weight provides downward force to resist uplift.
2. Cut-off wall lengthens the seepage path.
3. Shoulder strengthens the bevel edges.
4. Enhances the inlet transition.
5. Aesthetics.

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

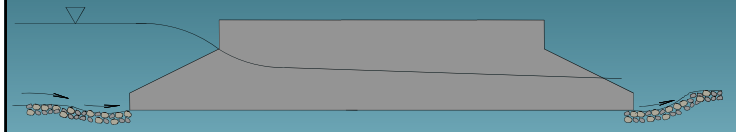


Scour Protection - Aprons

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

Culvert (SPCSP) Installation

END