STANDARD BRIDGE & CULVERT COMPONENTS

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Alberta Bridge Inventory

In Alberta, there are about 13,405 bridges.

Types of bridges in Alberta:

- Standard bridges 3223 (24%)
- Bridge size culverts 8515 (63%) of which (>95% flexible)
- Major bridges 1667 (12%)

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Standard Bridges

- Any bridge which is built using standard components and according to standard drawings.
- Exception is standard girder bridges with composite decks (e.g. – SMC, SCC, SLC) or pre-stressed girders with overlays (SMO, VSO) which are currently classified as major bridges and must be inspected by a Cl. A.
- For inspection purposes standard bridges are divided into two distinct categories:
  - Superstructure
  - Substructure

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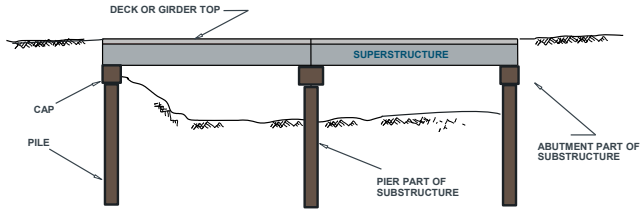
Basic Bridge Components



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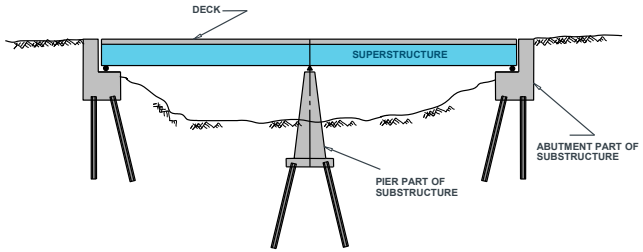
Basic Bridge Components



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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.

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SUPERSTRUCTURE

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Superstructure for Standard Bridges

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

- Deck / wearing surface
- Curbs
- Bridgerail
- Girders / stringers
  - Timber stringers with timber stripdeck and subdeck.
  - Conventionally Reinforced concrete girders.
  - Prestressed concrete girders.
- Bearings

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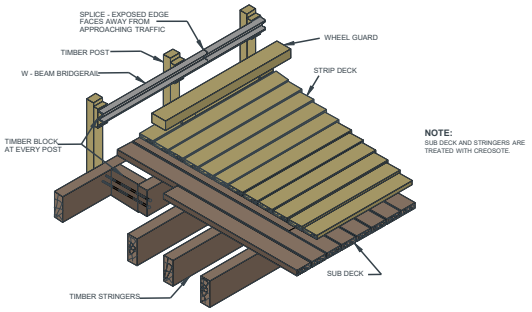
Superstructure Elements

Timber Superstructure



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Superstructure Elements

Deck

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

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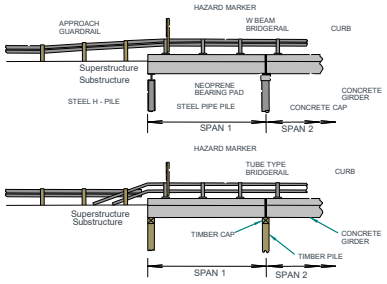
Superstructure Elements



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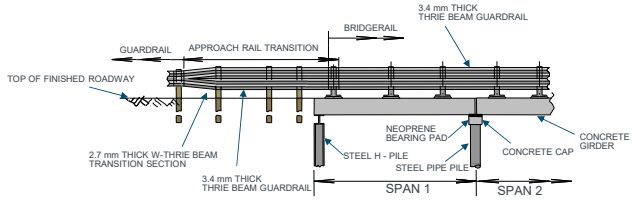
Superstructure Elements



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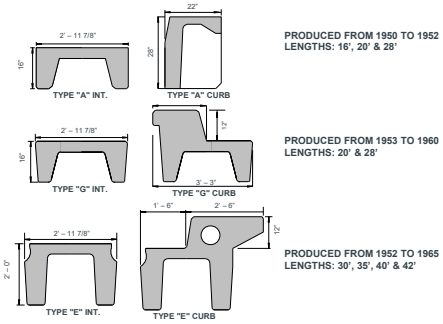
Superstructure Elements

- Conventionally Reinforced Concrete Girders
  - Concrete is strong in compression and weak in tension.
  - Concrete bending members are reinforced with mild reinforcing steel (rebar) to produce reinforced concrete girders.
- Prestressed Concrete Girders
  - Girders are reinforced with a combination of high-strength steel strand under tension and conventional rebar.
  - Girders are designed not to crack.
  - Generally, more economical.

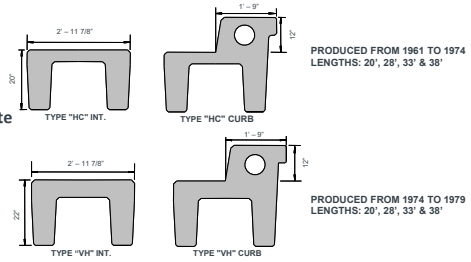
Superstructure Elements

Reinforced Concrete Girders



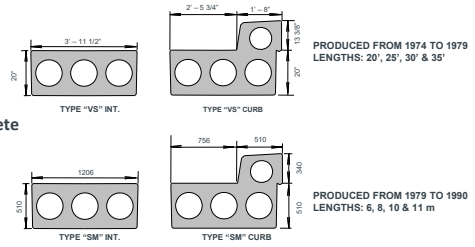
Superstructure Elements

Reinforced Concrete Girders



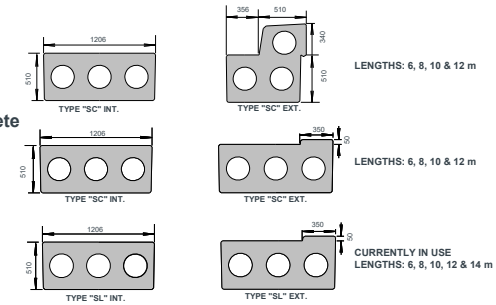
Superstructure Elements

Prestressed Concrete Girders



Superstructure Elements

Prestressed Concrete Girders



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Superstructure Elements

SLW-510 Curb Unit

SLW-510 Curb and Interior Girders

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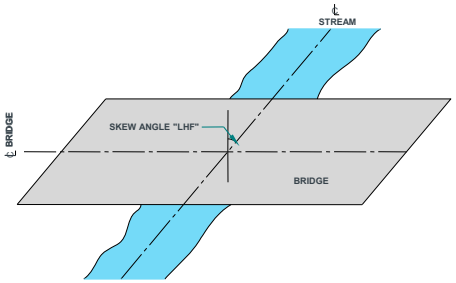
Superstructure Elements



SKEW ANGLE

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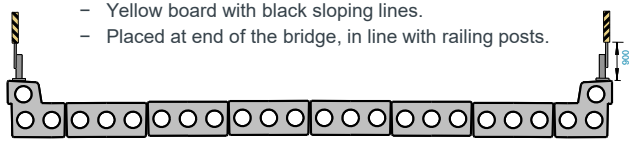
Superstructure Elements

Hazard Marker

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



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Superstructure Elements

Bearings

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

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SUBSTRUCTURE

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Substructure Elements

Substructure comprises of all elements below bearings.

Main components:

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

Other components:

- Caps & Subcaps
- Piles
- Sheathing & Bracing
- Wingwall
- Backwall
- Riprap or other scour protection

22

22

Substructure Elements

Substructures can be:

- Timber piles with timber cap

23

23

Substructure Elements

Substructures can be:

- Timber piles with steel cap

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24

Substructure Elements

Substructures can be:

- Steel “H” piles with steel cap

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Substructure Elements

Substructures can be:

- Steel “H” piles with concrete cap
- Steel pipe piles with concrete cap

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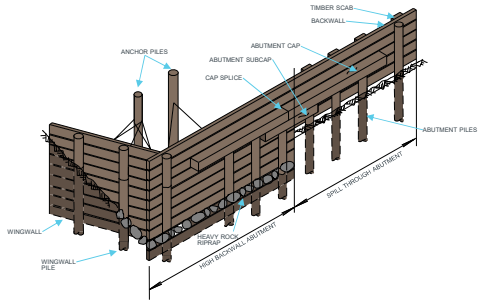
Substructure Elements



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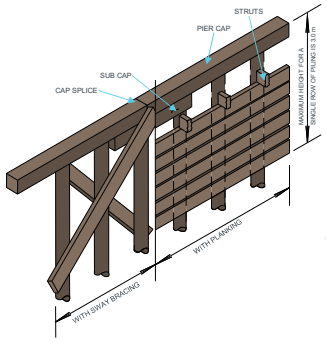
Substructure Elements



Timber Piers (2 Types Of Bracing)

28

Alberta

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Substructure Elements

Substructures Pier Supports:

- Timber Sway bracing
- Full Timber Sheathing

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Alberta

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Substructure Elements

Substructures Pier Supports:

- Steel Bracing

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Alberta

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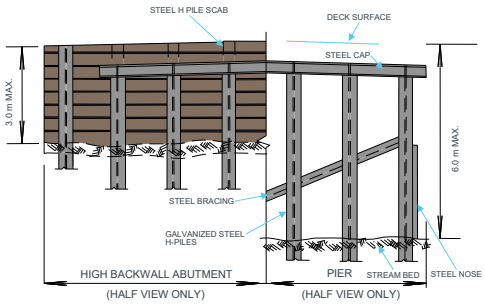
Substructure Elements



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Alberta

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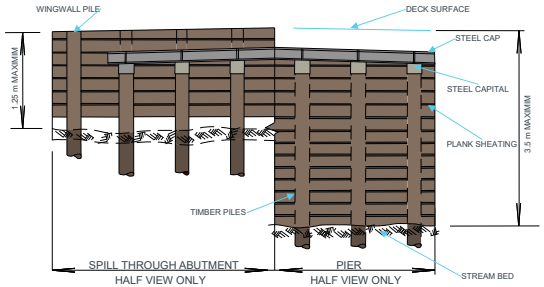
Substructure Elements



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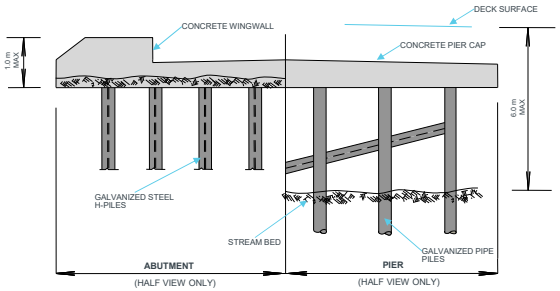
Substructure Elements



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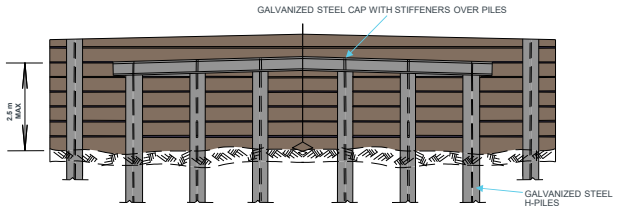
Substructure Elements



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

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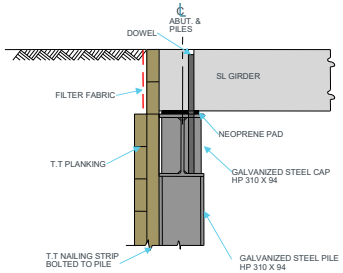
Substructure Elements



SL PRECAST GIRDER BRIDGE WITH STEEL SUBSTRUCTURE (SECTION)

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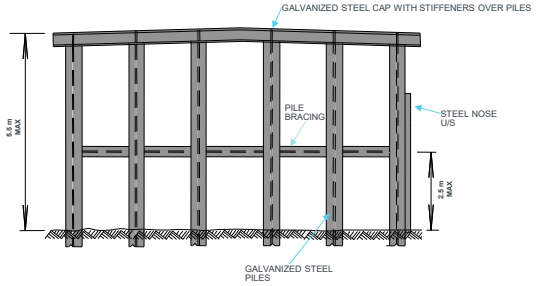
Substructure Elements



SL PRECAST GIRDER BRIDGE WITH STEEL SUBSTRUCTURE PIER (ELEVATION)

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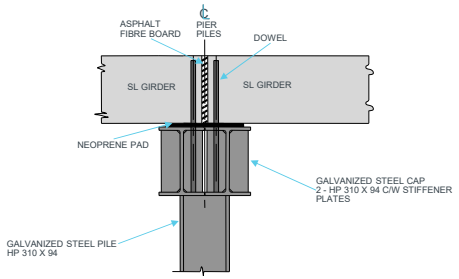
Substructure Elements



SL PRECAST GIRDER BRIDGE WITH STEEL SUBSTRUCTURE PIER (ELEVATION)

37

37

CULVERTS

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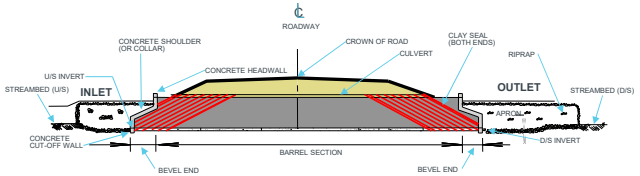
38

Culvert Components

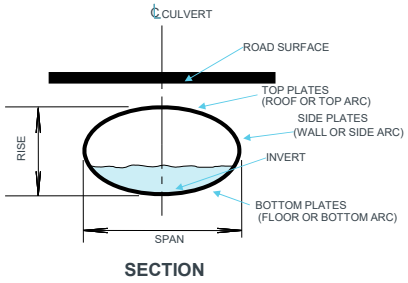


LONGITUDINAL SECTION THROUGH CULVERT

39

39

Culvert Components



SECTION

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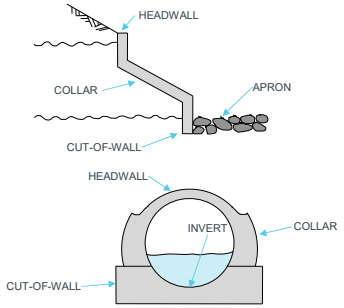
Culvert Components



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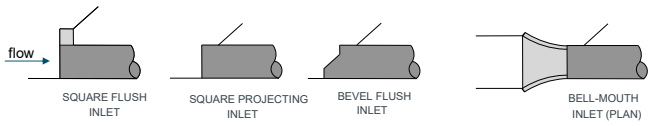
Typical Inlet Configurations



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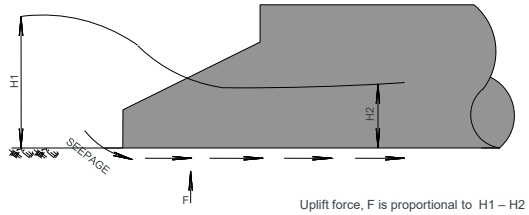
42

Concrete End Treatment

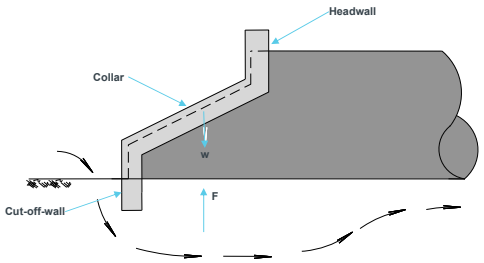


Uplift force, F is proportional to H1 – H2
Seepage is proportional to H1 – H2

43

43

Concrete End Treatment



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44

Concrete End Treatment

Concrete end treatment has five important functions:

- Weight provides downward force to resist uplift.
- Cut-off wall lengthens the seepage path.
- Collar strengthens the bevel edges.
- Enhances the inlet transition.
- Aesthetics.

45

45

Clay Seals

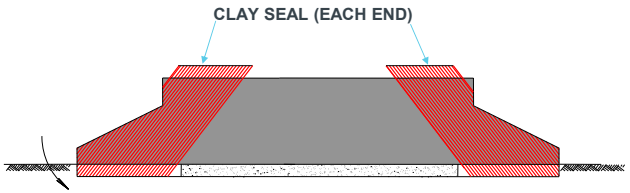
Problems due to seepage:

- 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.

46

46

Clay Seals



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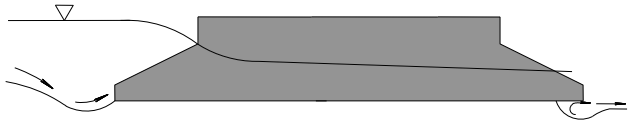
Scour Protection - Aprons



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.

48

48

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.

49

49

50

Culvert (CSP) Installation

51

Culvert (CSP) Installation

52

Culvert (CSP) Installation

53

SPCSP Culvert Grade Separation

54

SPCSP Arch Culvert – Wildlife Overpass

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SPCSP VE Arch Culvert – Pedestrian Underpass

56

Questions?

57