

Basic Structural Considerations

Culverts - Basic Structural Considerations

<https://m.youtube.com/watch?v=NTbhyHNA1Vc>



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Basic Structural Considerations

Introduction

- Currently approx. 8350 bridge size culverts in Alberta
- Two types of culverts:
 - 1) Rigid Structures (concrete or timber)
 - 2) Flexible Structures (corrugated metal)

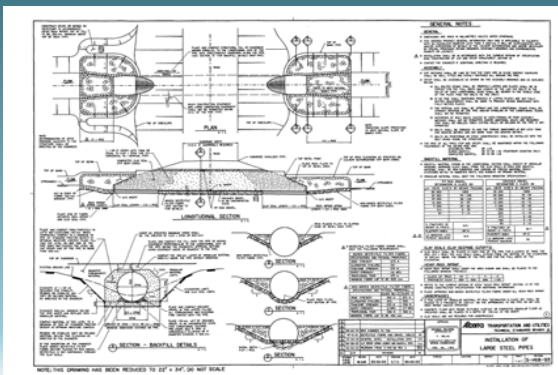


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Basic Structural Considerations

Standard Drawing S-1418-03



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Rigid Structures

- Concrete (~4%) – either box or pipe
- Timber (0.1%) - no longer being built
- No noticeable deflection under loads
- Concrete is a durable material
- Concrete is relatively expensive

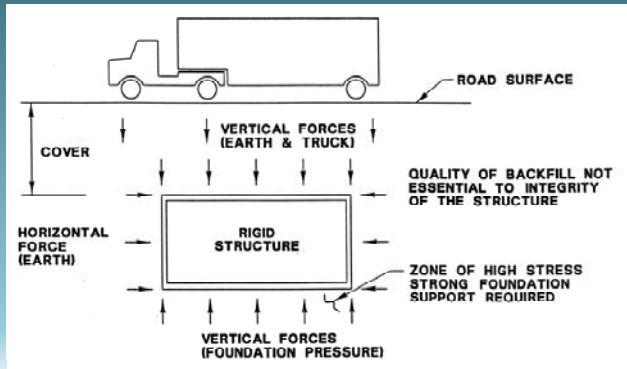


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Rigid Structures



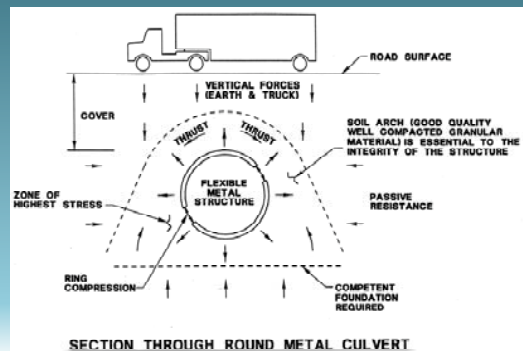
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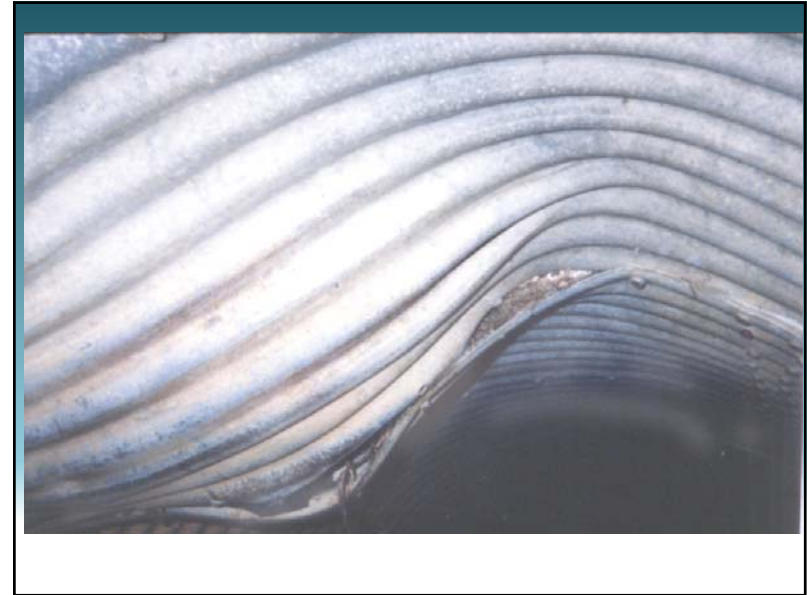
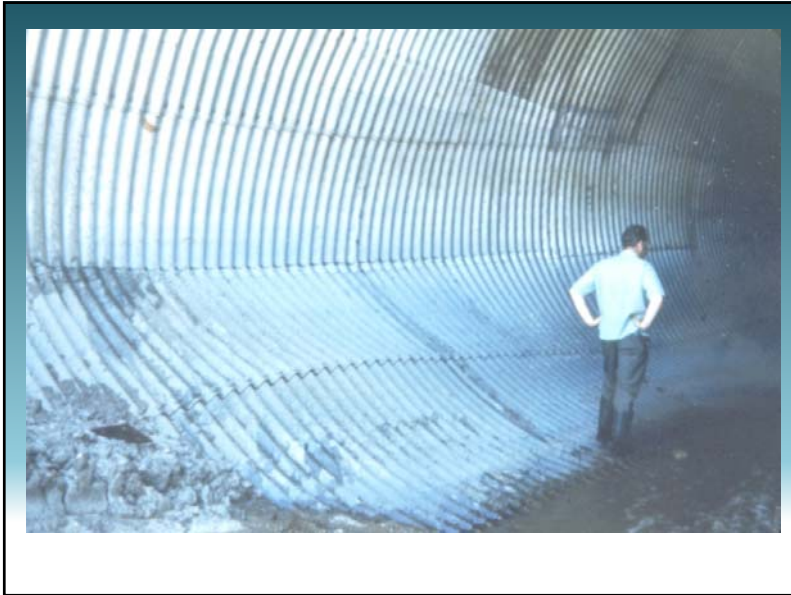
Flexible Structures

- Metal culverts comprise approx. 96% of culvert inventory
- Fabricate to almost any shape
- Relatively cheap
- Backfill & Installation CRITICAL
- Susceptible to structural problems
- Prone to corrosion, abrasion

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Flexible Structures





Basic Structural Considerations

CSP (field jointing)

The diagram illustrates the field jointing of Corrugated Steel Pipe (CSP). It shows two cross-sectional views of the pipe. The top view shows a single ring with labels for 'Re-rolled End' at the left edge, 'Spiral Corrugation' along the length, and 'Ring Length' indicated by a double-headed arrow. The bottom view shows two rings joined together, with labels for 'Coupler' at the joint, 'Circumferential Seam' where the rings meet, and 'Ring Length' for one of the rings.

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Flexible Culverts

- Two Types:
 - Corrugated Steel Pipe (CSP)
 - Structural Plate Corrugated Steel Pipe (SPCSP)

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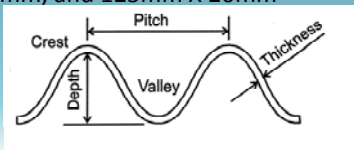
Corrugated Steel Pipe (CSP)

- Complete rings fabricated in plant
- Rolled helical sections, re-rolled ends
- Joined by couplers
- Bridge sizes range from 1500 to 3600
- Common sizes 1800 to 3000 (in 200mm increments)
- Length to suit transportation (2.5 to 15.0m)

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CSP Properties

- Common Thickness
 - 2.8mm, 3.5mm, 4.2mm
- Common Profiles
 - 68mm (Pitch) x 13mm (depth)
 - 76mm X 25mm, and 125mm X 26mm



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Structural Plate Corrugated Steel Pipe (SPCSP)

- Flat plate is corrugated & punched
- HD galv. then curved to shape
- Five thickness – 3, 4, 5, 6, and 7mm
- Profiles - pitch x depth
 - 152 x 51
 - 380 x 140
 - 400 x 150
- Plates bolted together

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SPCSP (cont.)

- Plate lengths
 - 3050mm (10 ft)
 - 3670mm (12 ft)
- Plate width 5N, 6N, and 9N

N is the circumferential bolt spacing

$N = 3\pi$ (244mm or 9.6")

$N/\text{ring} = 4(\text{dia. in feet})$

(i.e. 10ft dia = 40N)

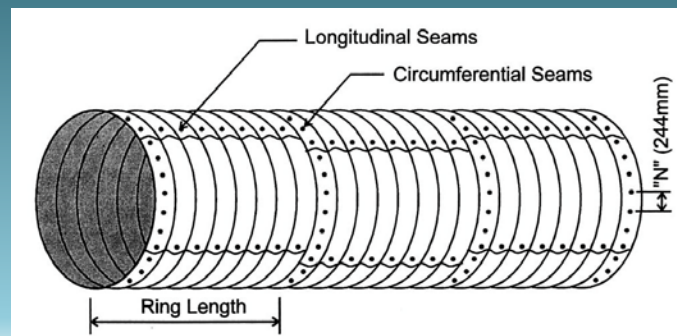
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SPCSP - some recent products

- Atlantic Industry's 'Bolt-a-Plate'
width 1067, length 3N to 16N
- Twister Pipe's 'MP 200'
pitch 200, depth 55mm
- SuperCor, and Bridge Plate
(pitch 380, depth 140)
- New coating systems

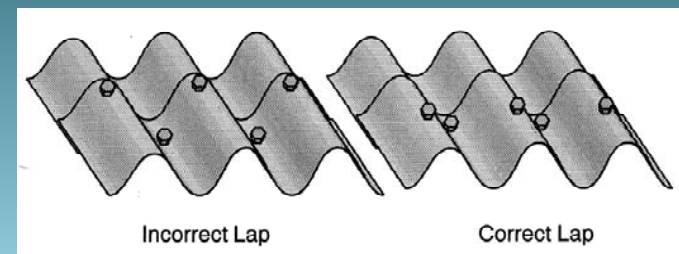
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SPCSP (field bolting)



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SPCSP (longitudinal lapping)



Basic Structural Considerations

Properly Lapped Seam

Bolt in valley is nearest visible edge



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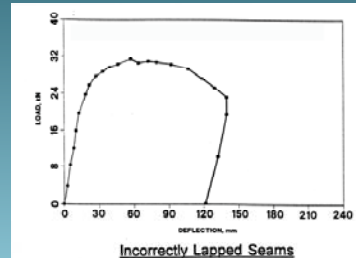
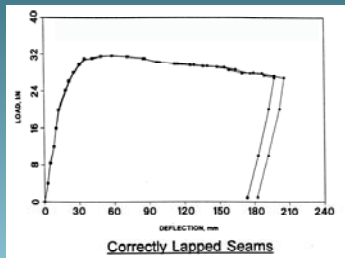
Improperly Lapped Seam

Bolt in valley is farthest from visible edge



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SPCSP (seam strength tests)



Both types of laps can carry about the same load
 Correctly lapped seams are more ductile - don't normally develop cracks

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Bridge Construction Inspection Manual

<http://www.transportation.alberta.ca/Content/docType30/Production/BridgeConstructionManualDec2015.pdf>

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Questions??



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