Las Trancas Bridge Project

Trancas Associates
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Michigan Technological University - International Senior Design
CE4915 / CE4916 - Summer / Fall 2016
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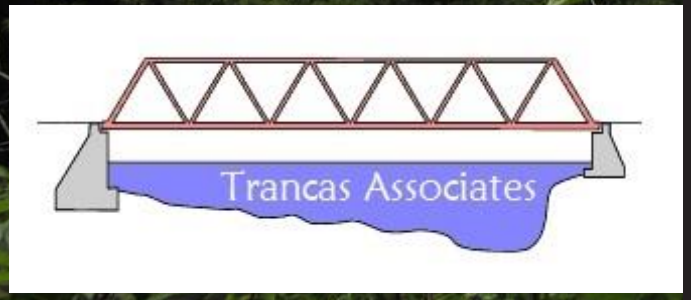


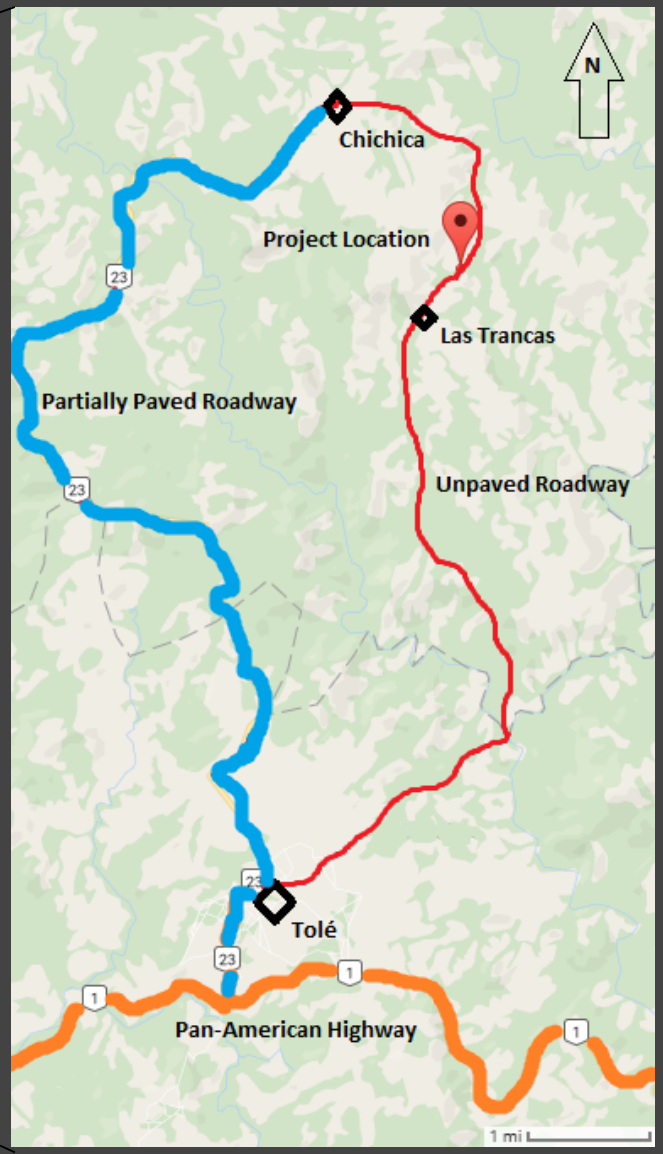
Outline

- Community Overview
- Current Conditions of Roadway and Project Site
- Data Acquisition and Analysis
- Design Constraints and Alternatives
- Final Design Selection and Detailing
- Cost Estimate and Project Schedule

Comarca Ngäbe-Buglé

Las Trancas Location & Transportation Routes

(via Google Maps)



Poor Road Conditions

Steep Road Grades

Previous Bridge Attempts

Current Conditions

Ford Crossing

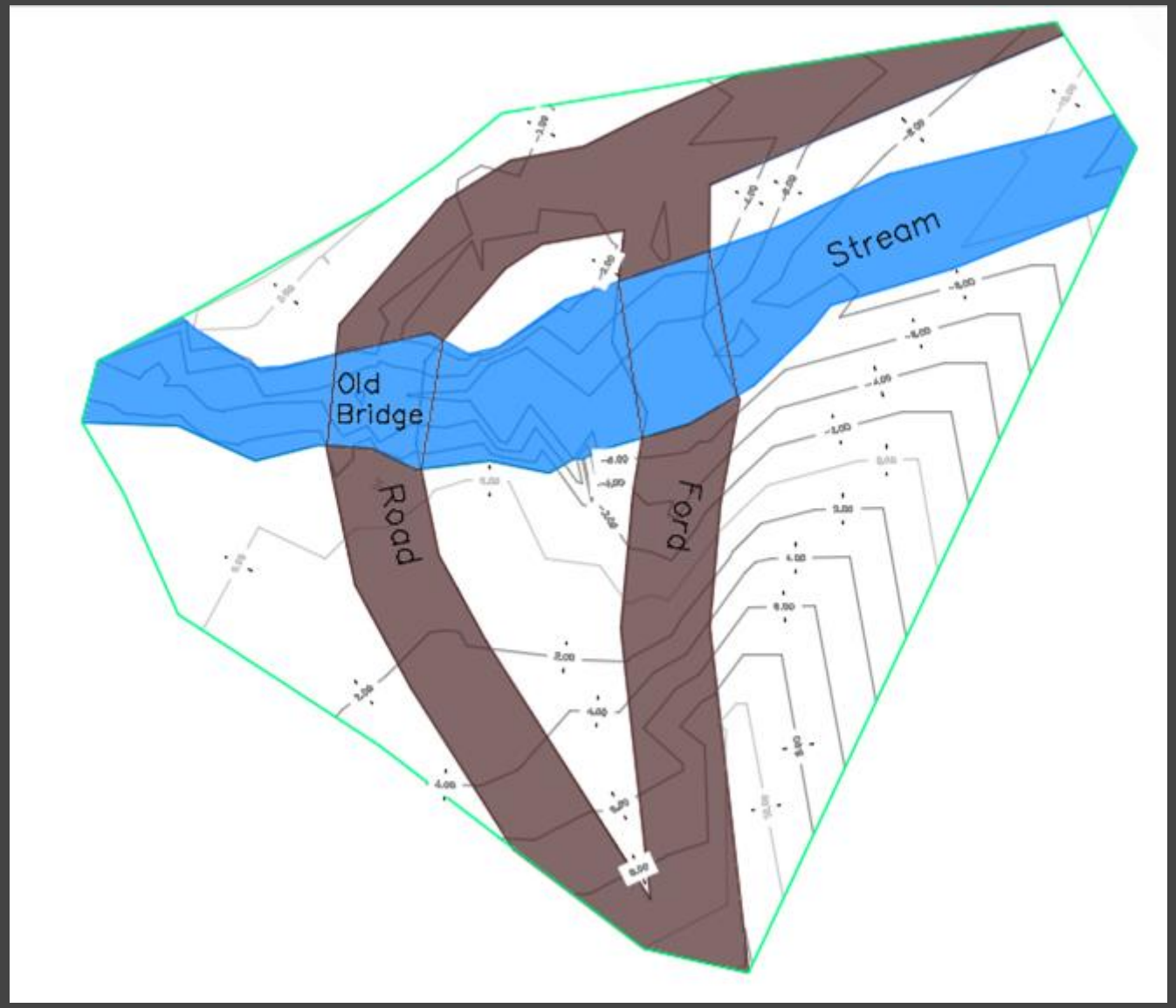
Las Trancas Center

Las Trancas Community

Site Layout

Site Surveying

Contour Map



Soil Conditions

Soil Classification

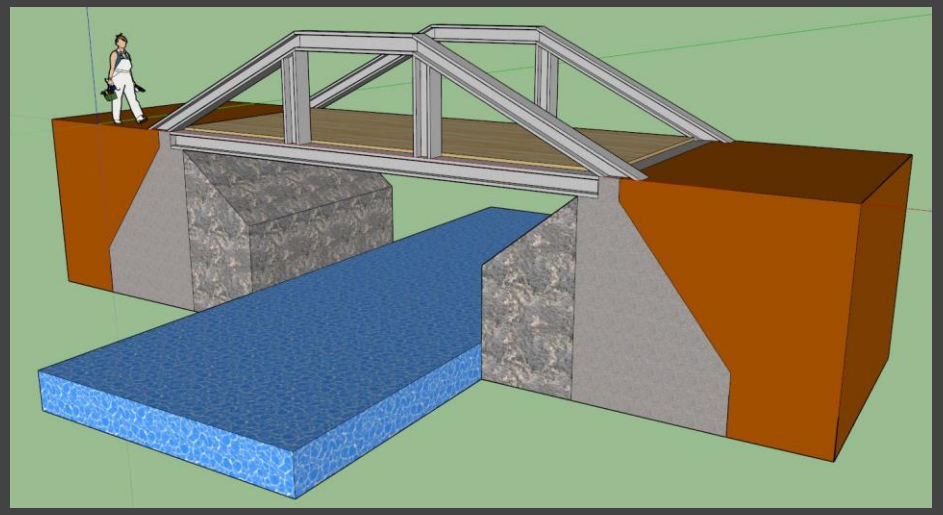
- Brown red fat clay
- High Plasticity
- CH on ASTM Scale

Summary of Design Constraints

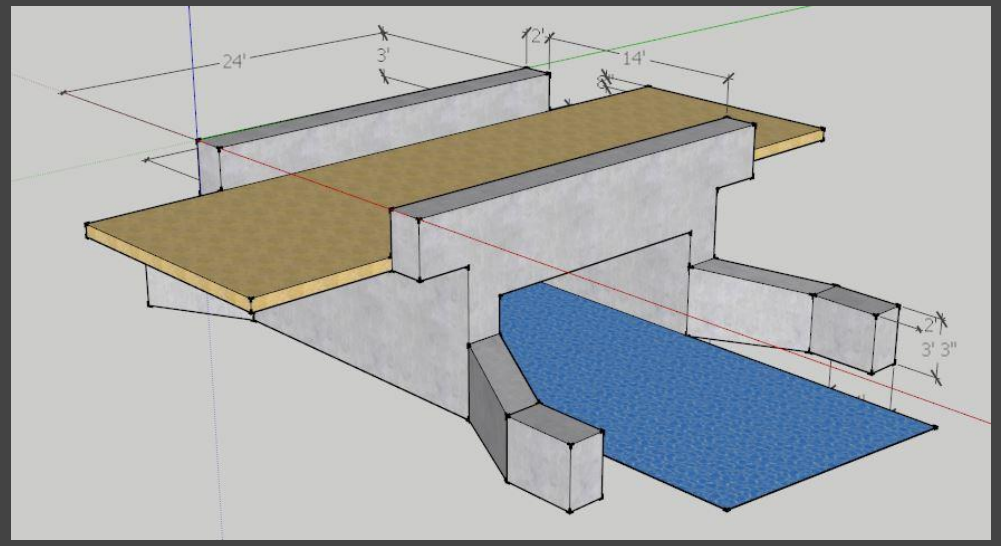
- Remote Location
- Poor Road Conditions
- Steep Elevations
- Budget
- Hydrology
- Soil Conditions

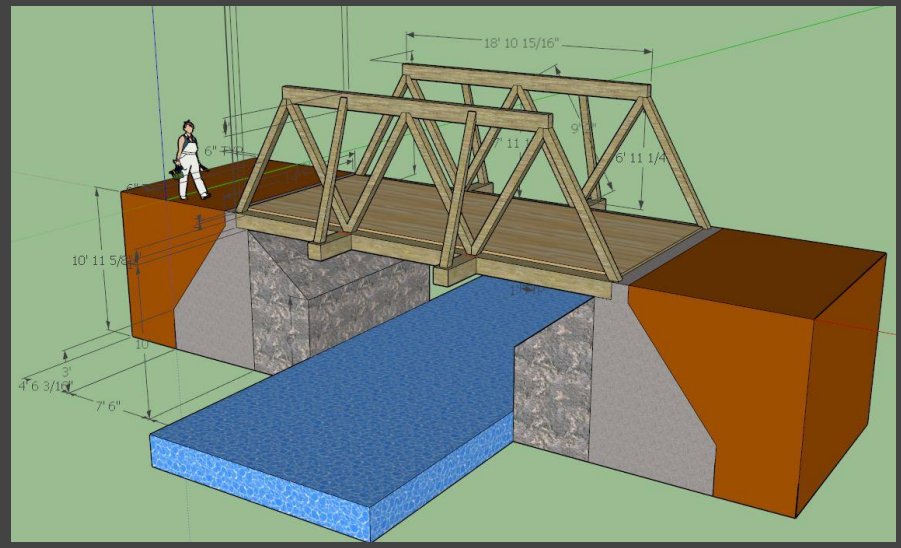
Design Alternatives

Box Culvert



Steel Truss





Wood Truss

Final Design

Flexible Steel Buried Bridge

- Reduces Live Loads
- Spread footings
- Natural river bottom
- Lightweight materials
- Low maintenance

Manko, Z.; Beben, D. 2008. Dynamic testing of a corrugated steel arch bridge, Canadian Journal of Civil Engineering 35(3): 246–257. DOI: 10.1139/L07-098 McCavour, T. C.; Byrne, P. M.; Morrison, T. D. 1998. Long span reinforced steel box culverts, Transportation Research Record 1624:184–195. DOI: 10.3141/1624-22

"Bridge-Plate Replaced Distressed Bridge While Keeping Highway Open." *Armtec*. Armtec, n.d. Web. 07 Dec. 2016.

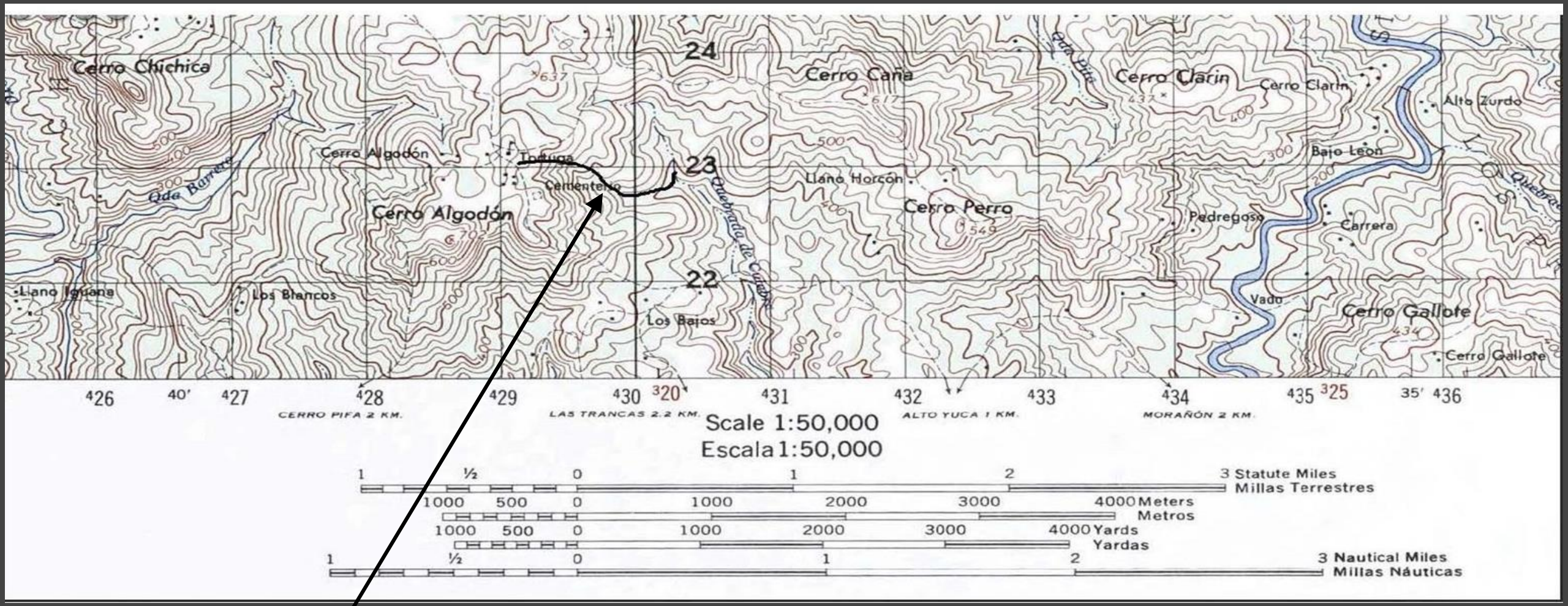
Solutions, Contech Engineered. "Aluminum Box Culvert." *Aluminum Box Culvert - Contech Engineered Solutions*. Contech, n.d. Web. 07 Dec. 2016.

Hydrology - Watershed

- *0.33 mi^2* approximated watershed area
- *~ 4300'* channel length leading into the site location
- NRCS Peak Discharge Method was used:

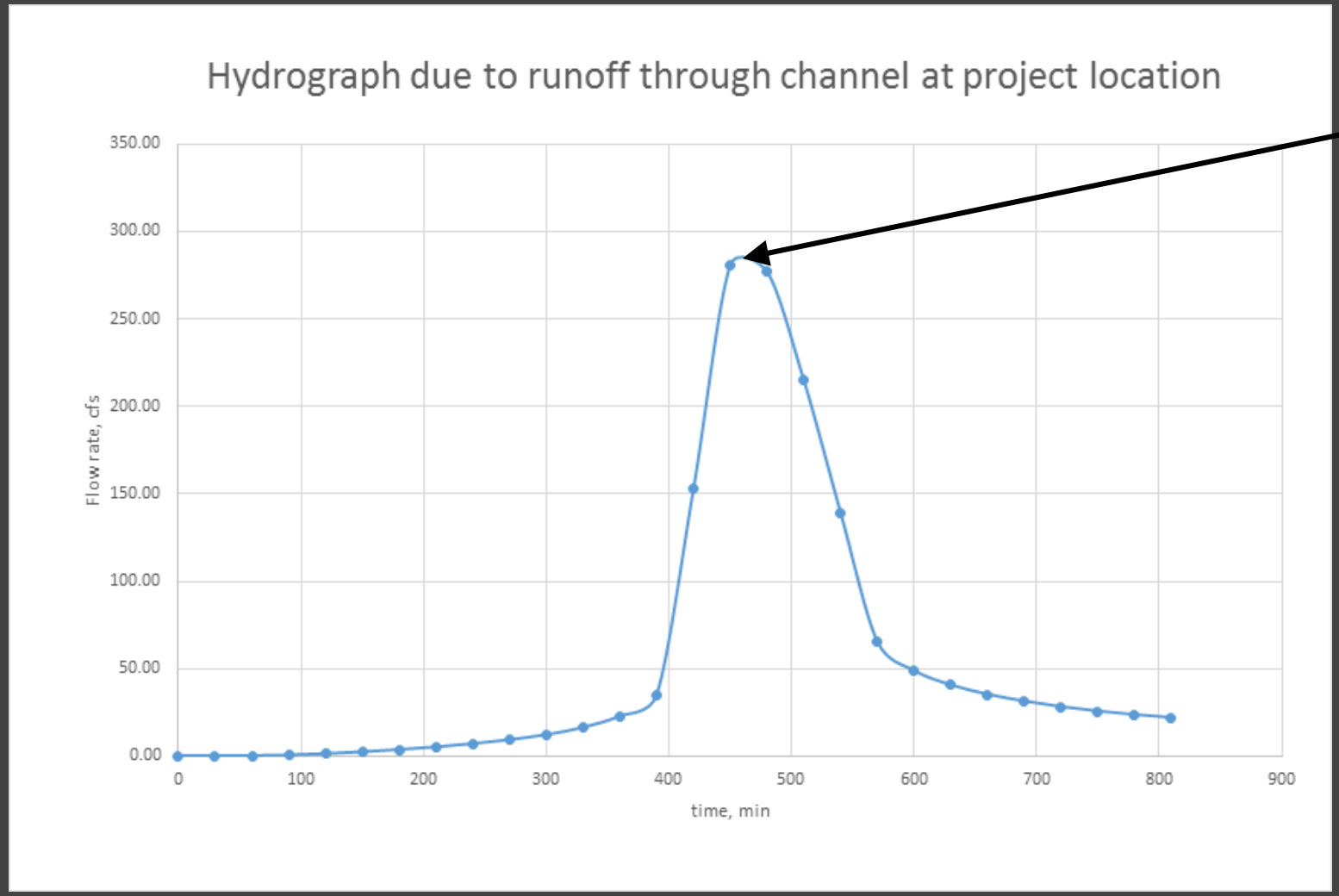
➢ Runoff Curve Number: *83*

Hydrology - Stream Channel Slope



- 5% Channel Slope

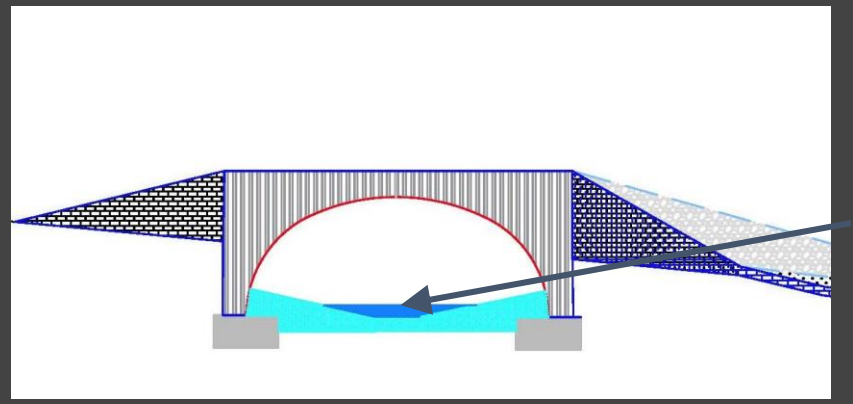
Hydrology - Hydrograph



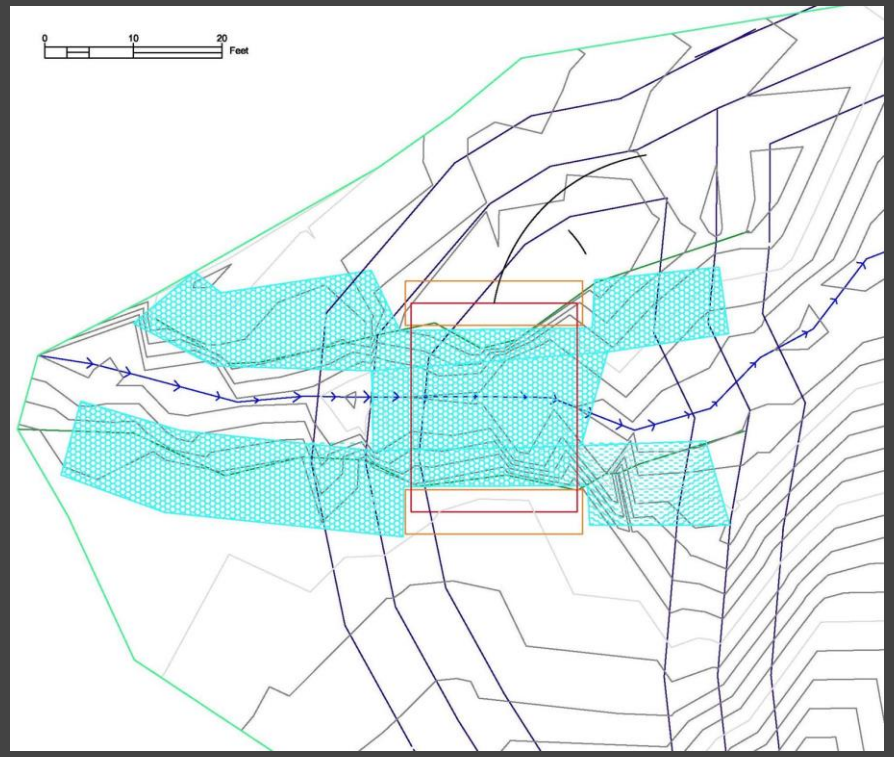
- 280 ft^3/s Max Flow Rate

Riprap Placement

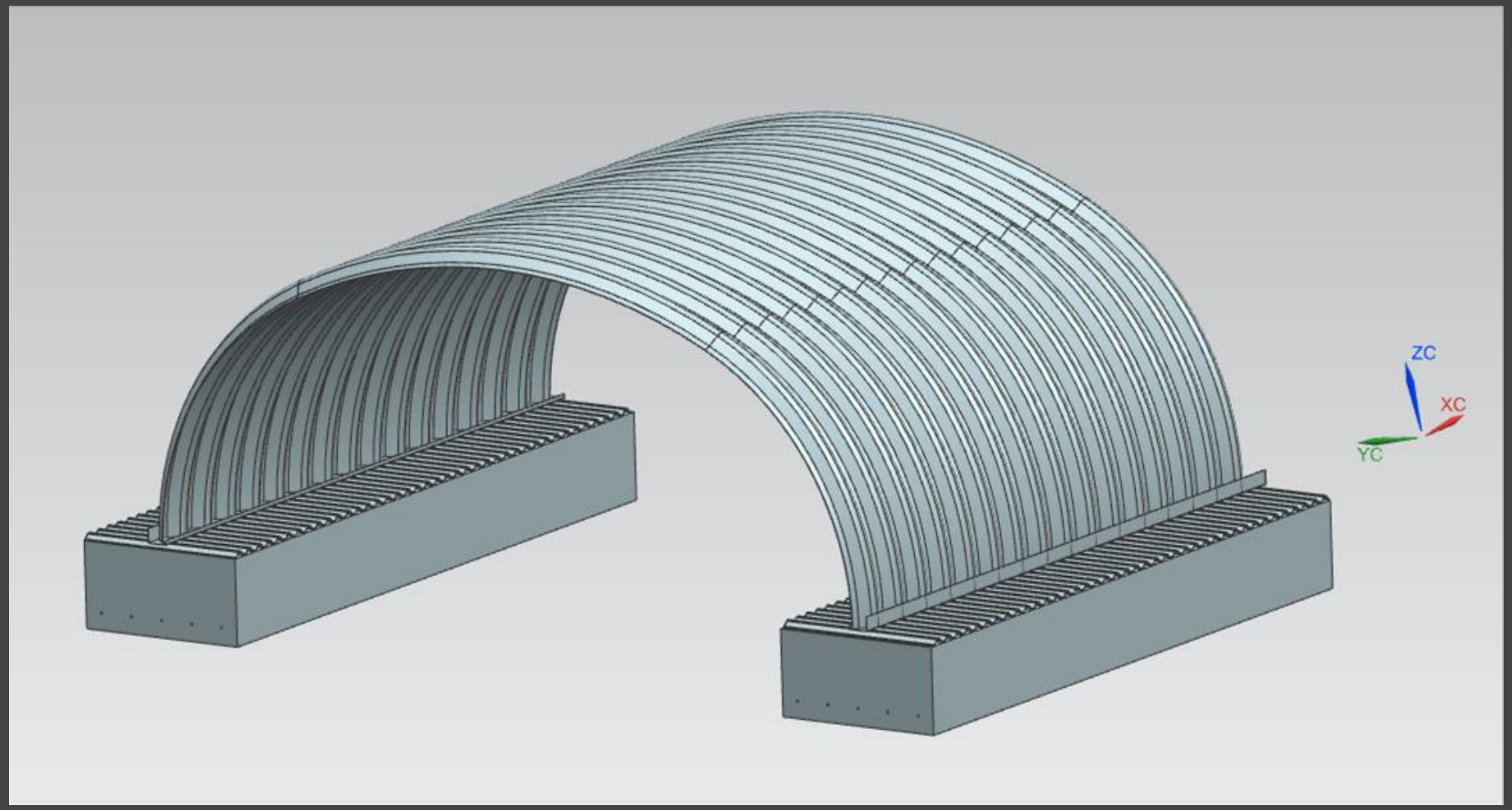
- Plan view of Riprap Placement
- Riprap to be Placed at 3:1 along River Channel



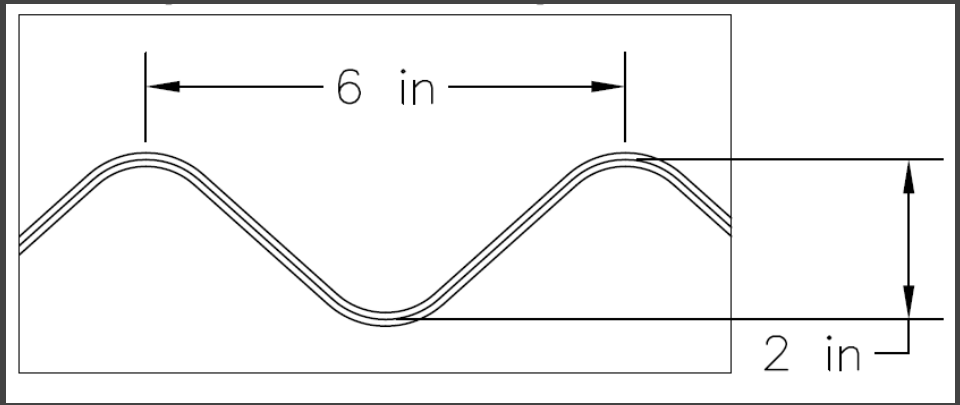
Max River Height: 30”
Max Velocity of 8.4 ft^3/s

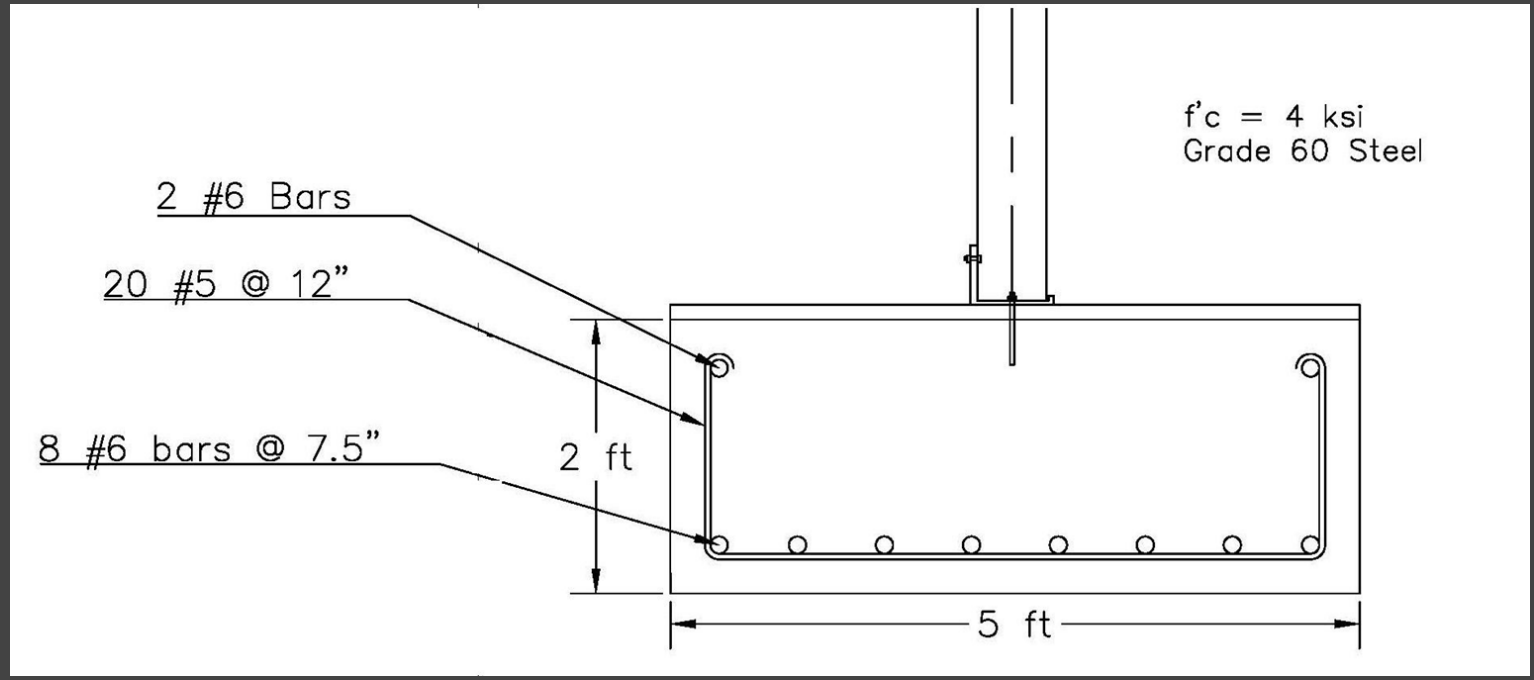


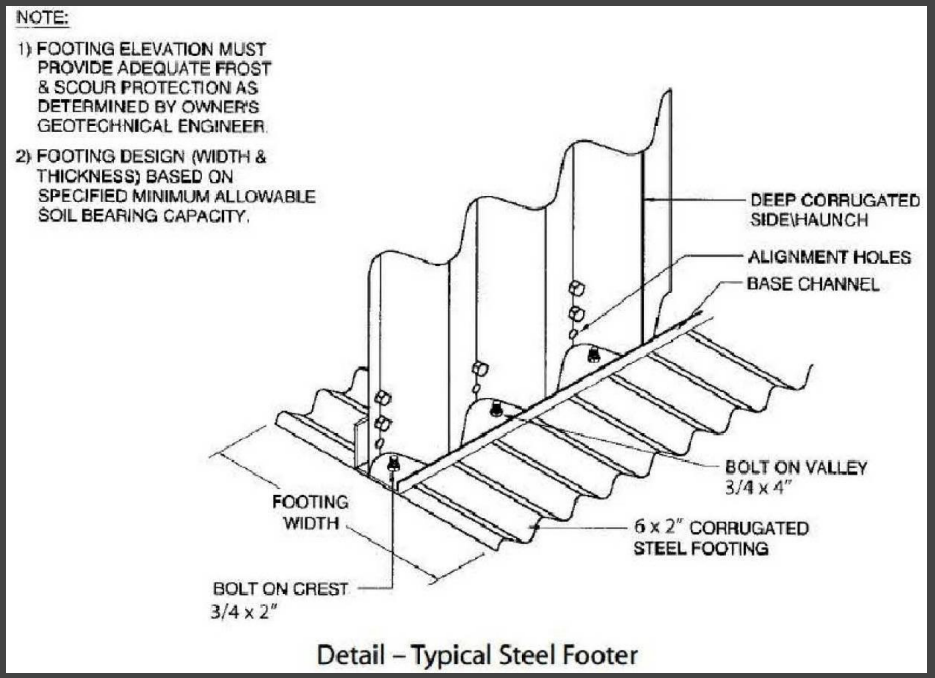
Crown Plate and Footing on 3D model



Footing Design





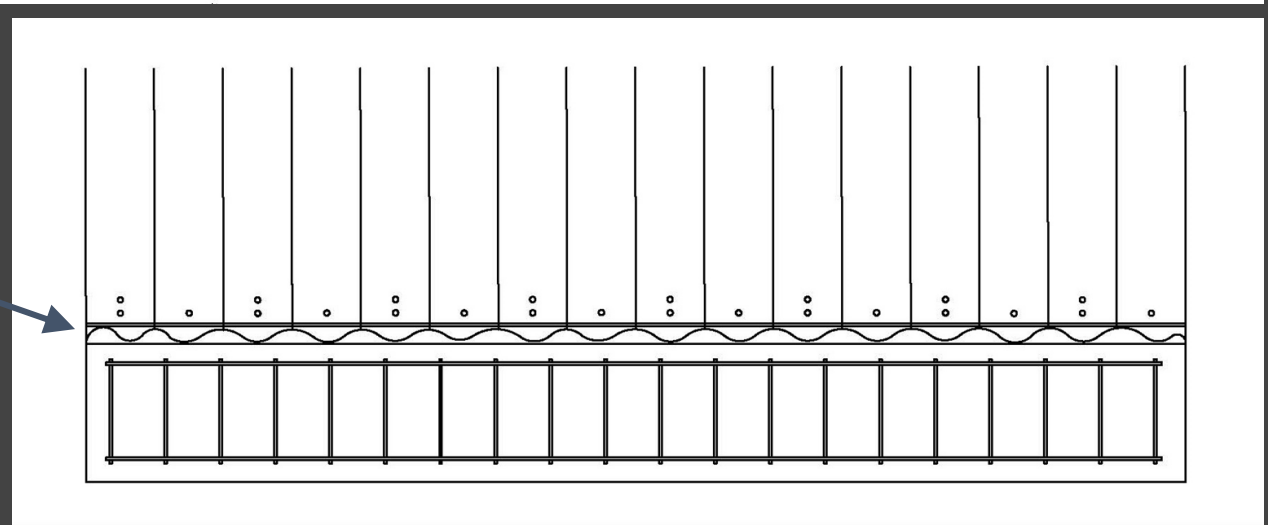


Detail – Typical Steel Footer

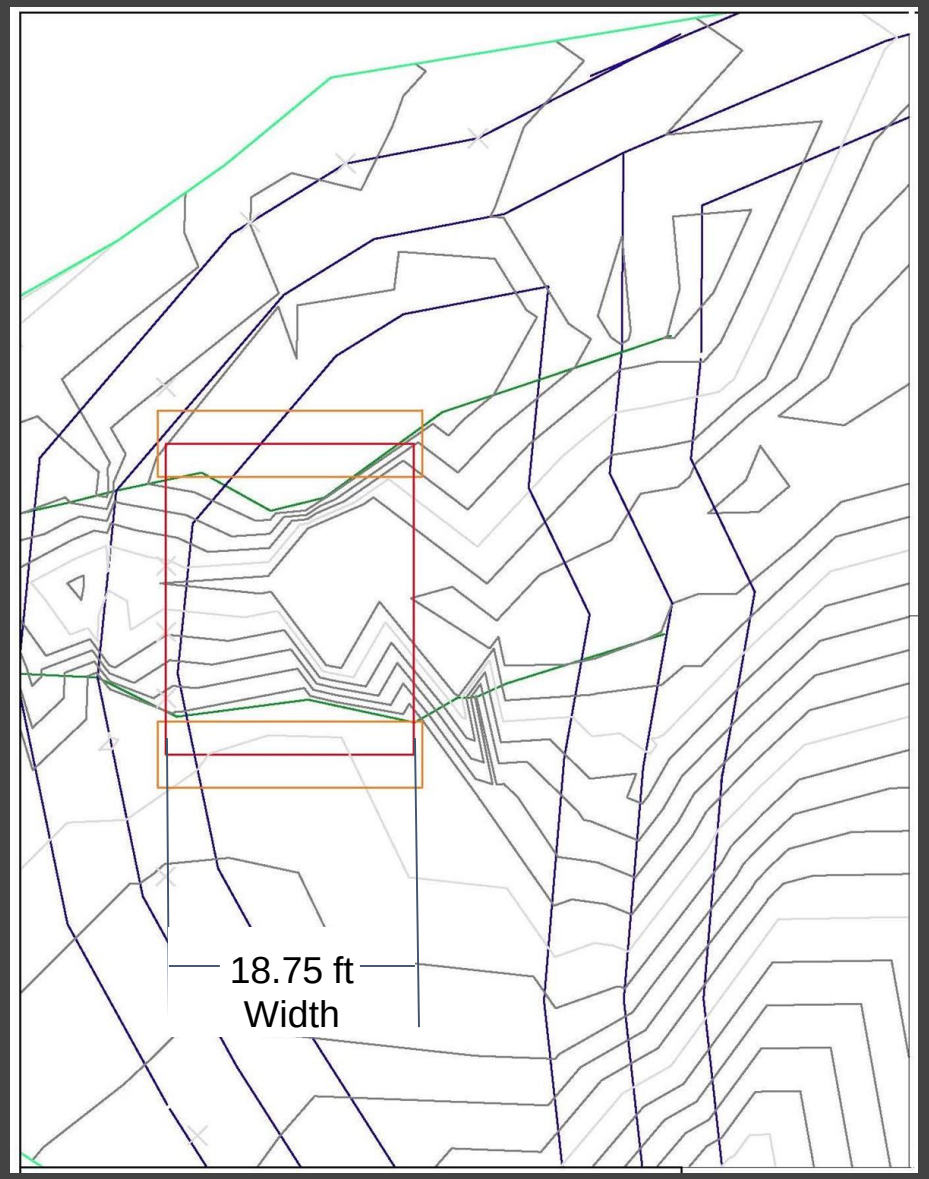
6" x 2" Steel Footing

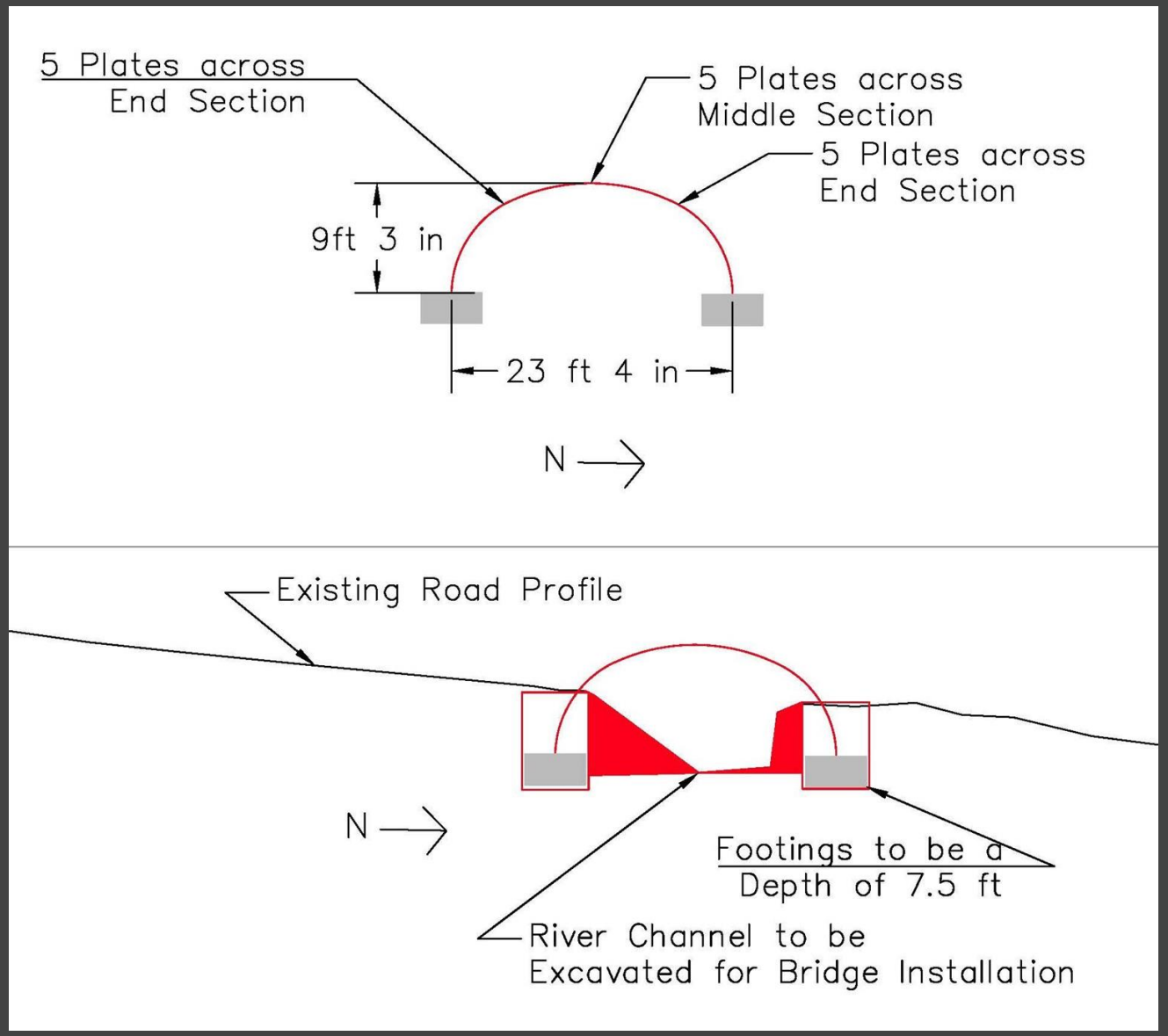
18.75 ft Length

5 ft Width

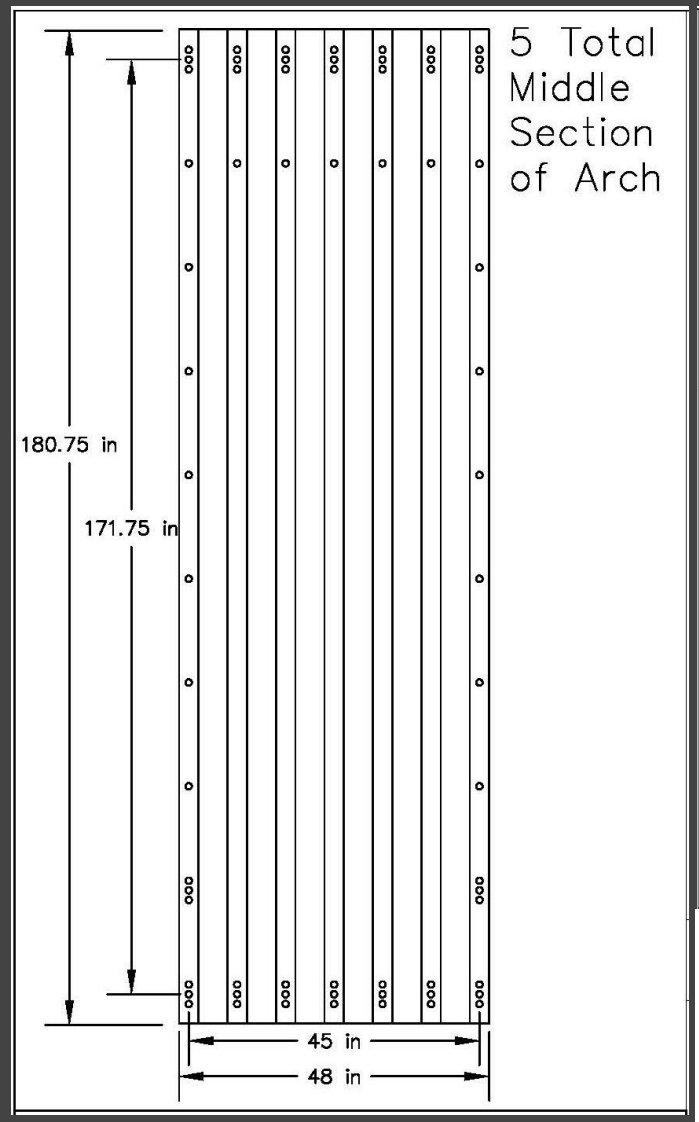


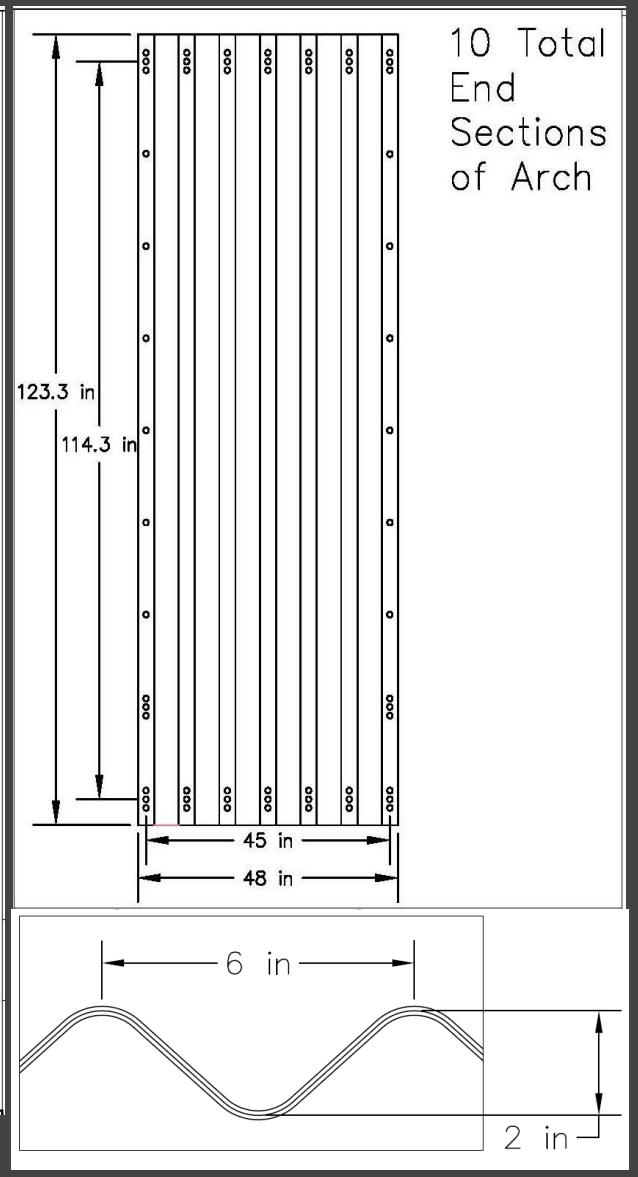
Bridge Dimensions





Bridge Plates



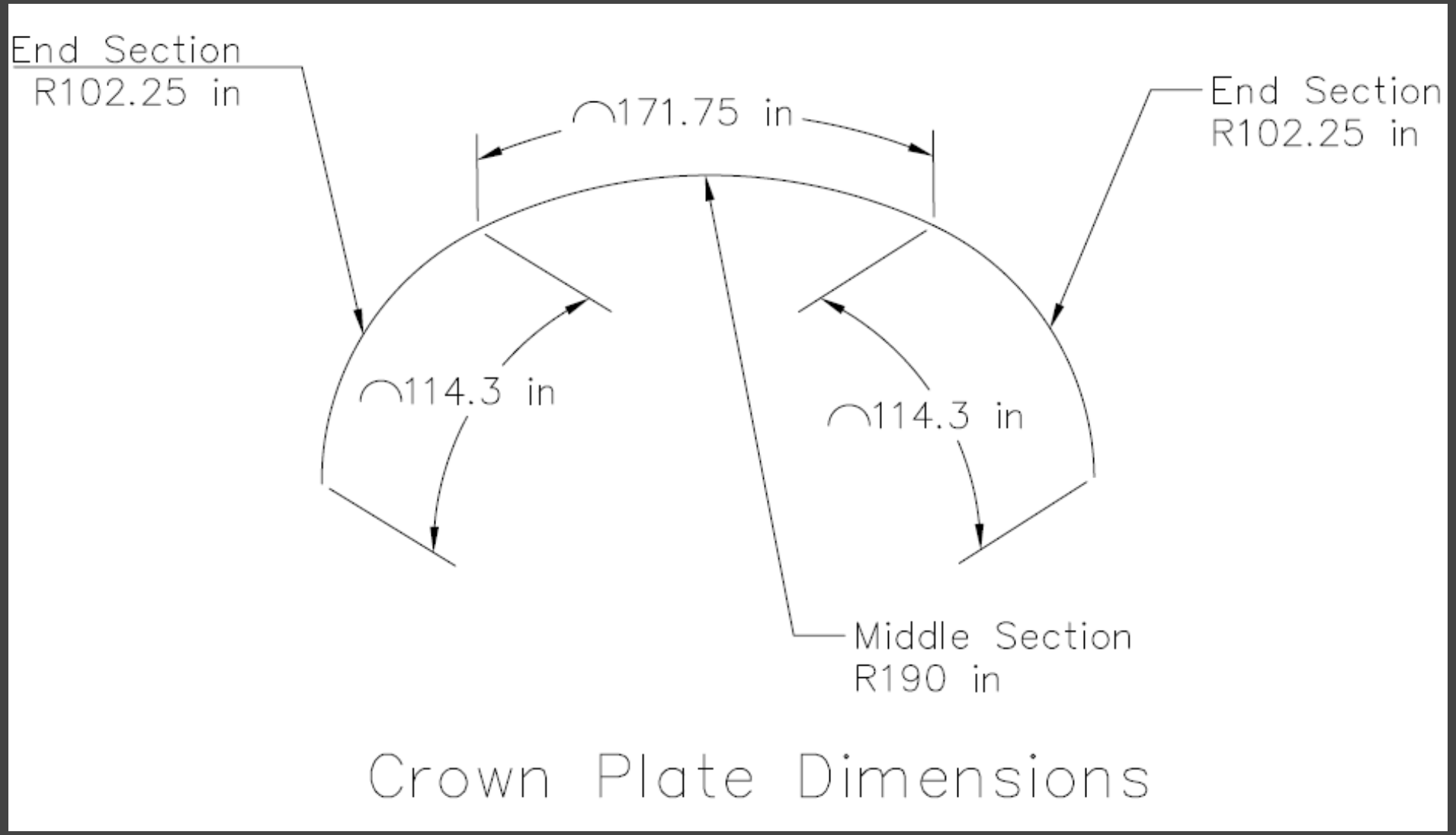


Corrugated Steel Plate
(15 in x 5.5 in)

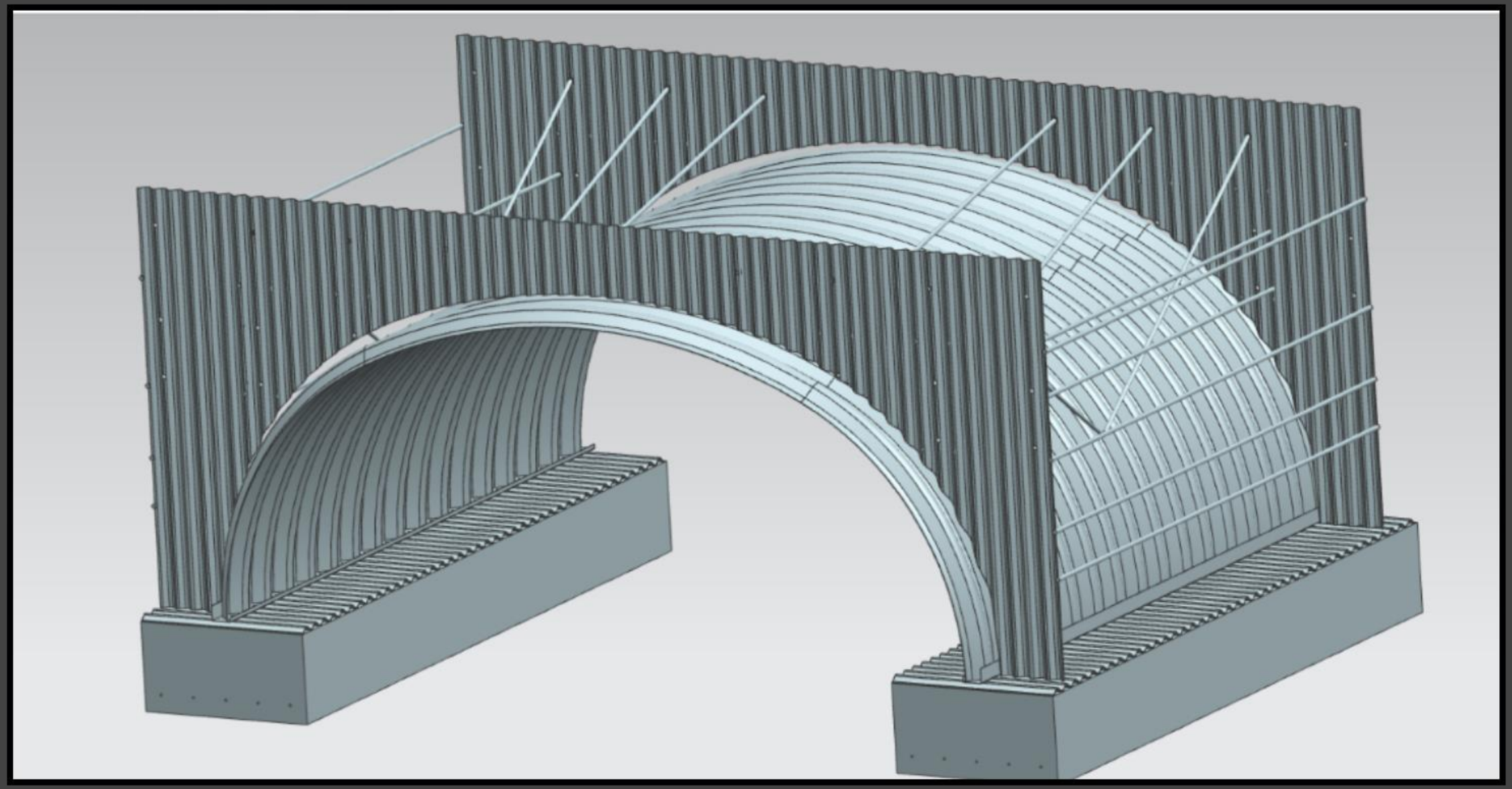
HS-20 Loading

"Galvanized Corrugated Metal Roofing and Corrugated Siding Panels." *Corrugated Metal Roofing Panels - Galvanized Corrugated Metal Roof and Corrugated Steel Siding Panels - Union Corrugating*. N.p., n.d. Web. 08 Dec. 2016.

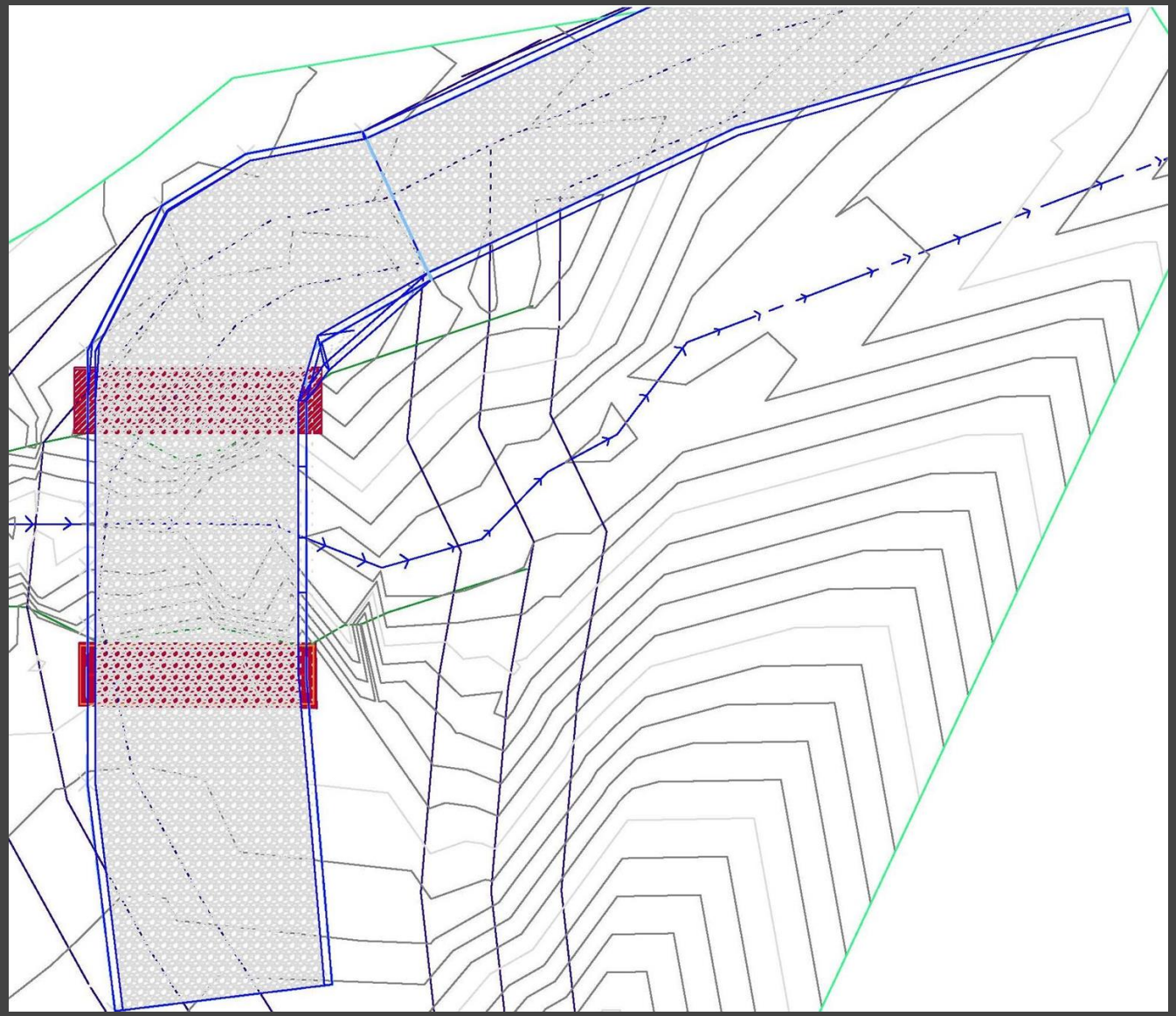
Crown Plate Dimensions



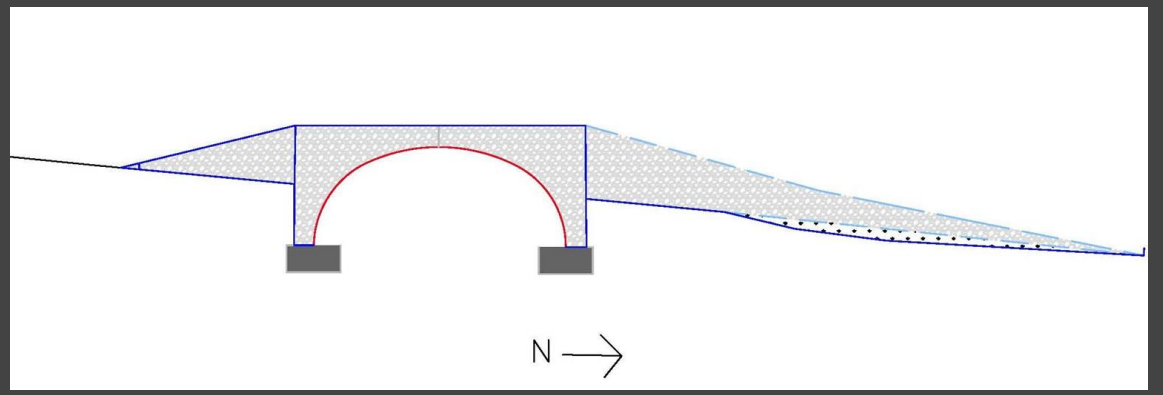
Headwall Plate on 3D Model



Gravel Placement

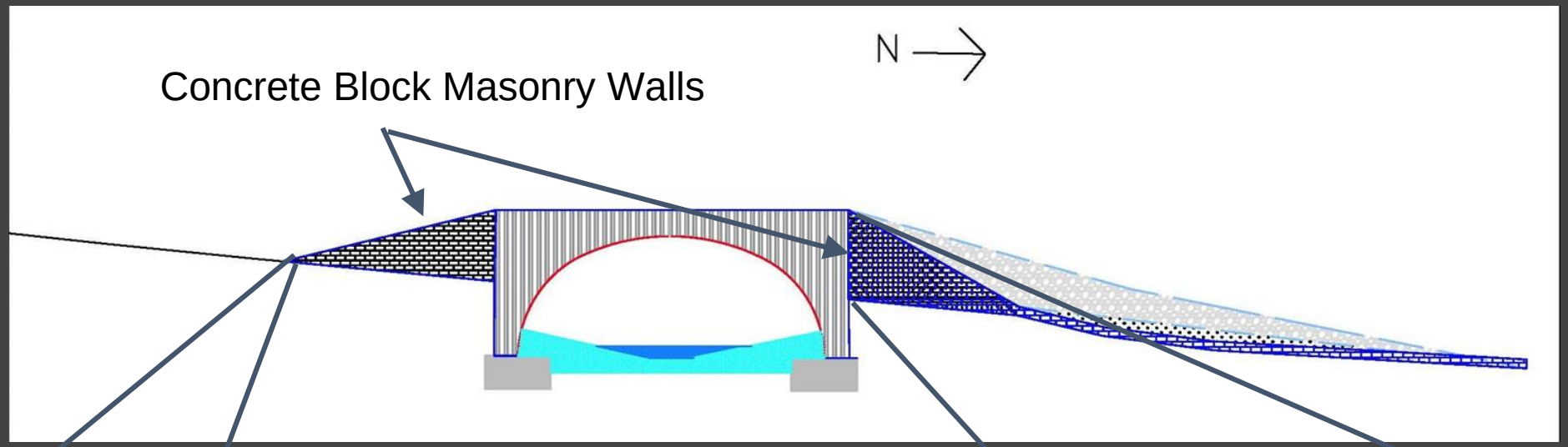


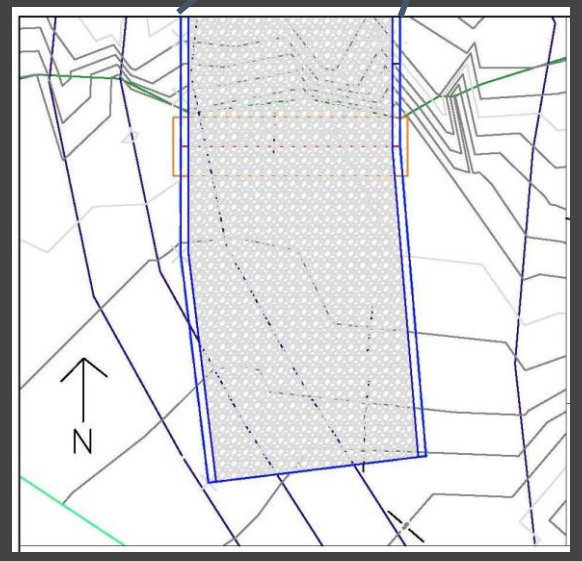
- 18 ft Road Width
- Minimum 2 ft of Gravel Cover
- Masonry Wall to Contain Gravel

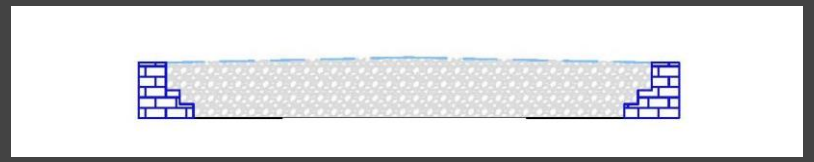


- 1 in Crushed, Angular Gravel
- 6” - 8” Lifts and Compacted to 90%
- Vertical Road Grades of 16% and 20%

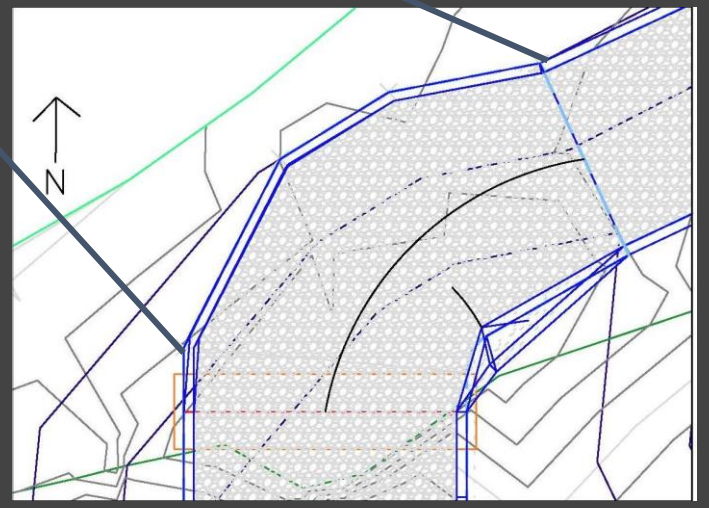
Masonry Wing Walls



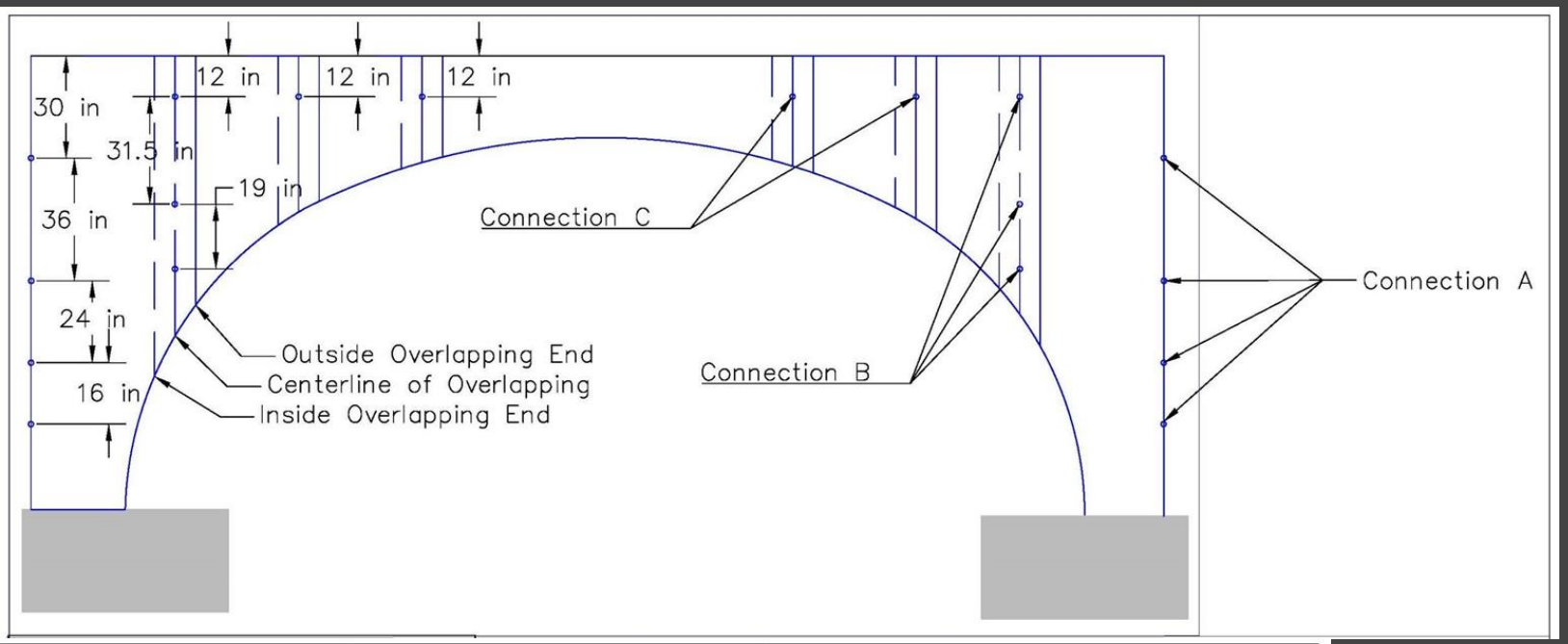


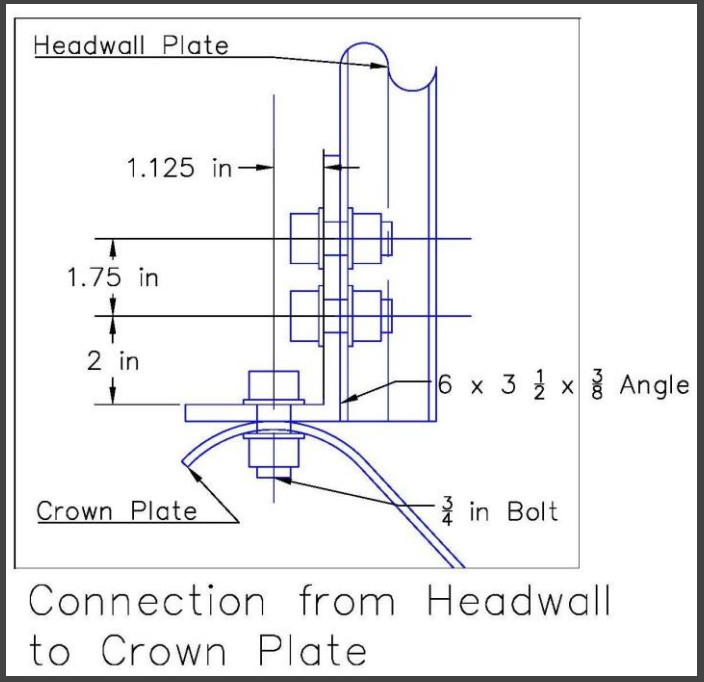


Cross Section
5% Crown

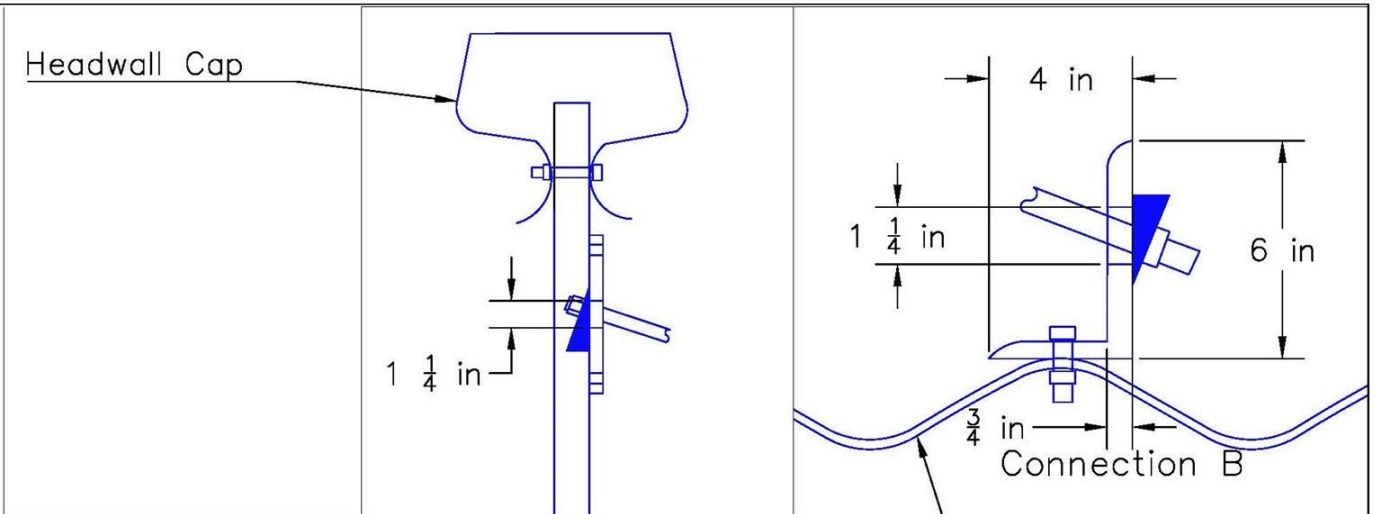


Steel Headwall



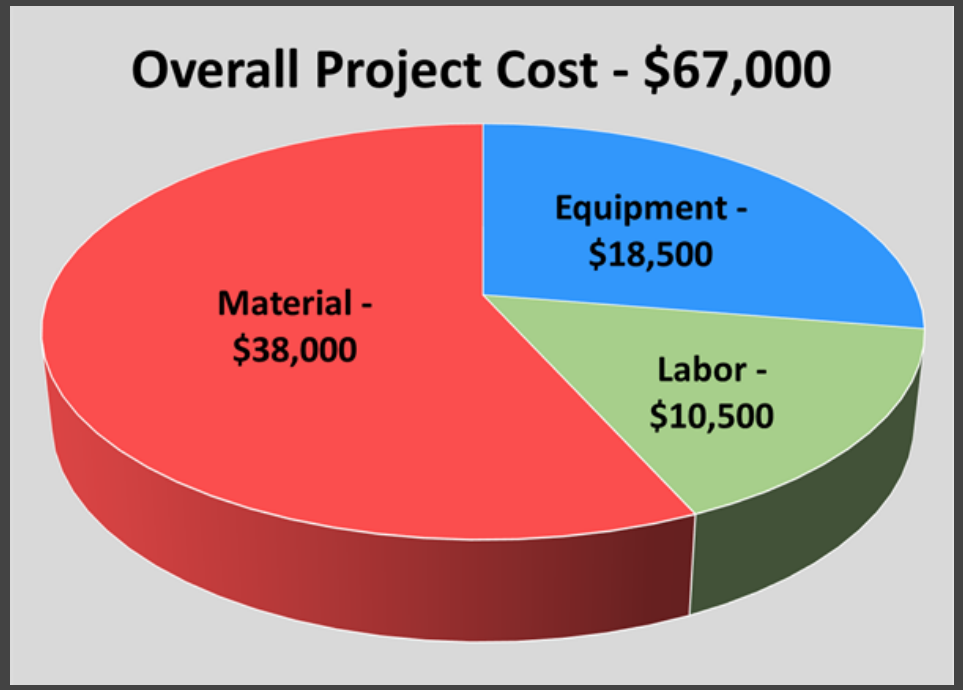


Connection from Headwall to Crown Plate

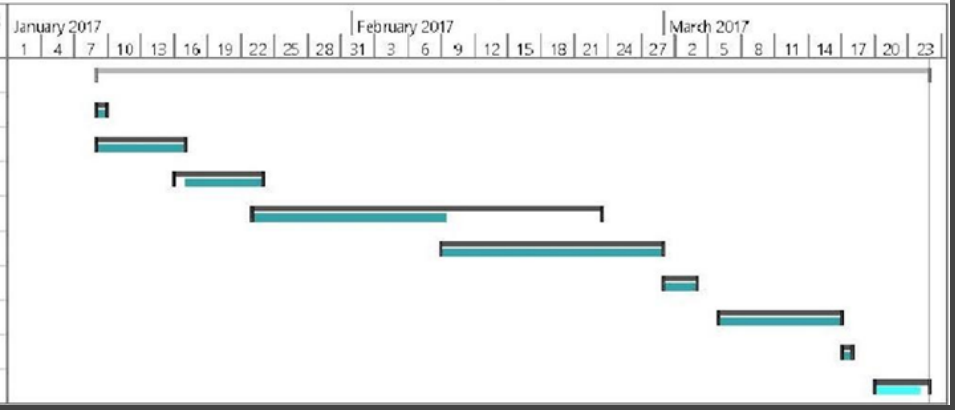


Connection A rods run to opposite side Headwall. Connection B & C rods connect to Crown Plate

Cost Estimation and Project Schedule



Task Name	Duration	Start	Finish	Predecessors
Project Schedule	55 days	Mon 1/9/17	Fri 3/24/17	
Material Preparation	1 day	Mon 1/9/17	Mon 1/9/17	
Mobilization	6 days	Mon 1/9/17	Mon 1/16/17	
Site Preparation	6 days	Mon 1/16/17	Mon 1/23/17	
Footings	23.5 days	Mon 1/23/17	Thu 2/23/17	
Steel Plate Assembly	14 days	Thu 2/9/17	Tue 2/28/17	
Rip Rap Backfilling	3 days	Wed 3/1/17	Fri 3/3/17	
Roadbed Creation	9 days	Mon 3/6/17	Thu 3/16/17	
Site Repair	1 day	Fri 3/17/17	Fri 3/17/17	
Cleanup / Demobilization	5 days	Mon 3/20/17	Fri 3/24/17	



Conclusion

- Las Trancas needs a reliable structure over this stream crossing to keep transportation route open year-round
- Analyzed data collected on assessment trip, formed design constraints
- Flexible buried steel bridge best meets design constraints
- Detailed final design
  - Channel Design
  - Footing Design
  - Roadbed Design
  - Steel Structure Design
- Cost Estimate Project Schedule

Thank You!