

SCOPE OF WORK

The City of Calgary requires the design and construction of a replacement to the existing Jaipur Bridge. The bridge must have a 100-year design life and must satisfy the CSA S6-19 bridge design code along with Alberta bridge design criteria. Jaipur Bridge must be designed to accommodate for emergency vehicles such as a fire truck or a CL-625 vehicle. The construction must be limited to one year and must reflect some sort of cultural aesthetic in relation to Jaipur, India.

PROJECT LOCATION



Above: Project Site, Jaipur Bridge, Calgary AB (Orange)

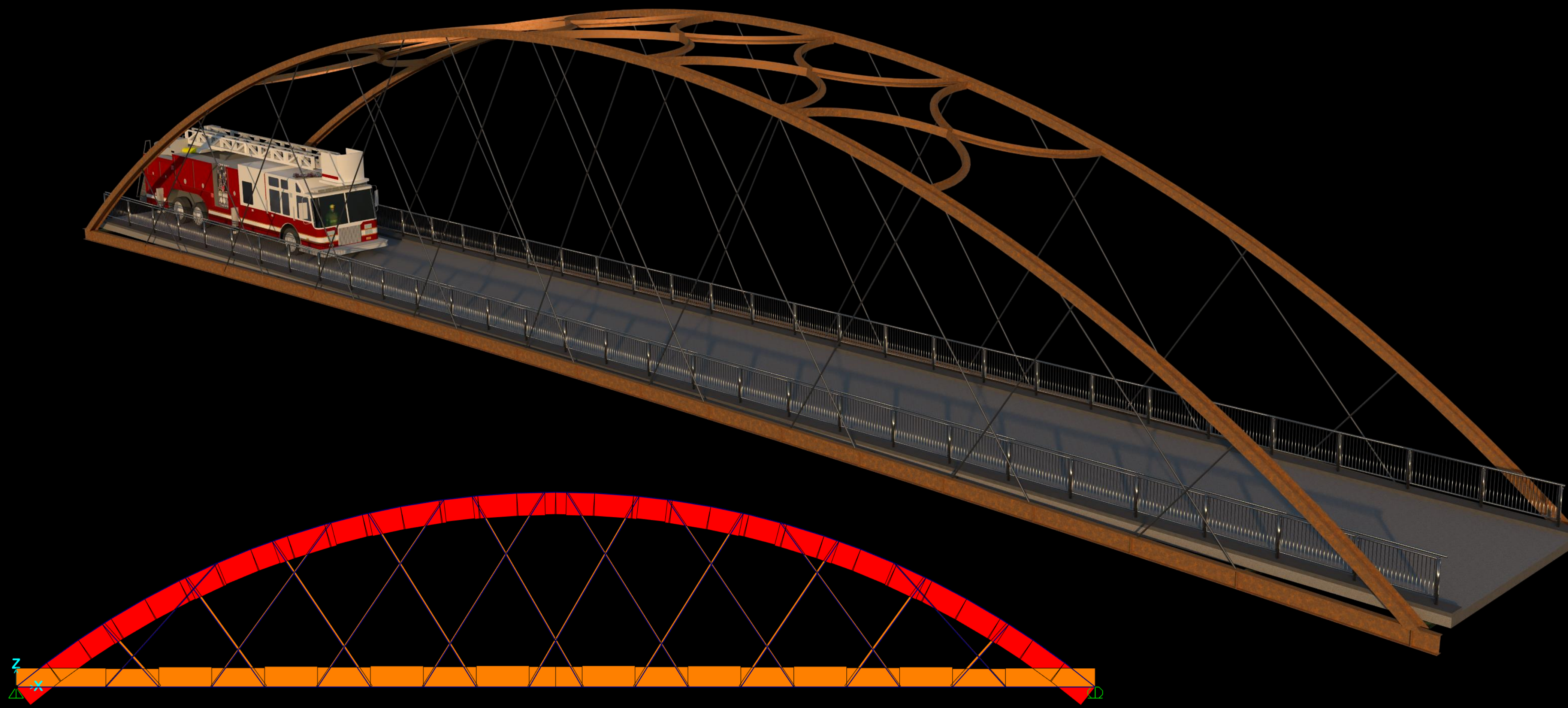
INITIAL CONDITIONS



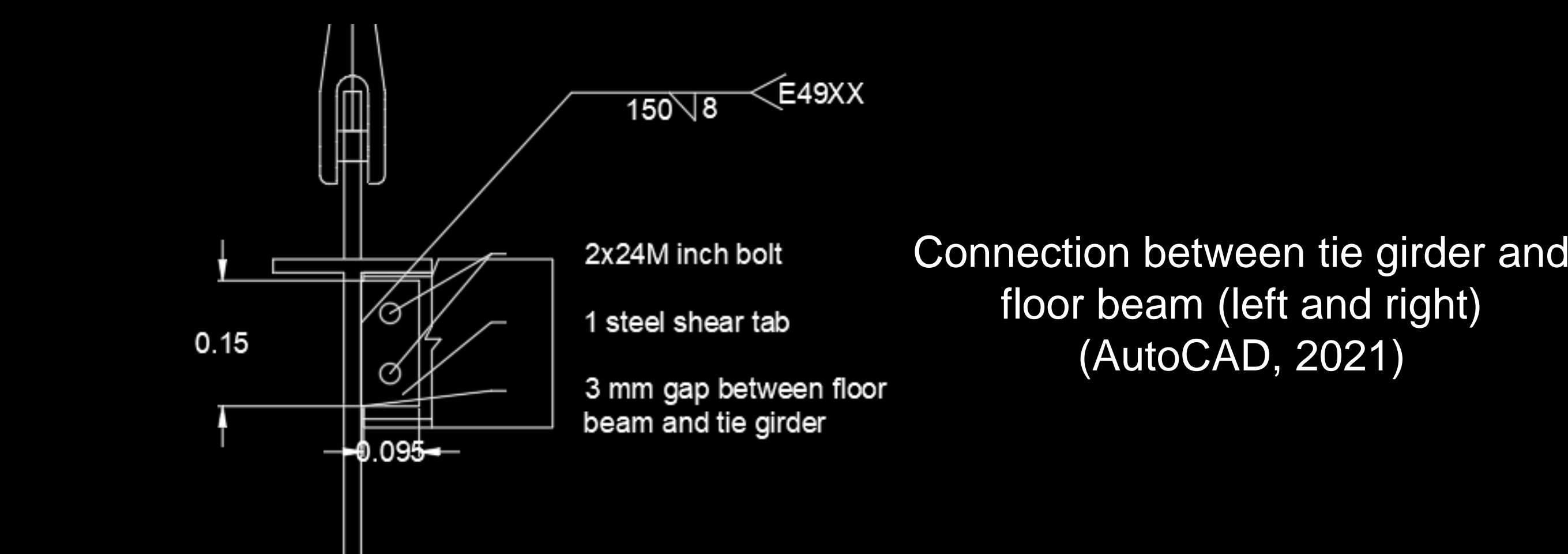
The existing Jaipur Bridge is located in Calgary, Alberta. The bridge spans 61 metres across the Bow River. The bridge superstructure consists of multiple concrete girders that are supported on concrete abutments at either side of the bridge and intermediate piers. The bridge mainly rests on native gravel and bedrock.

DETAILS OF FINAL DESIGN

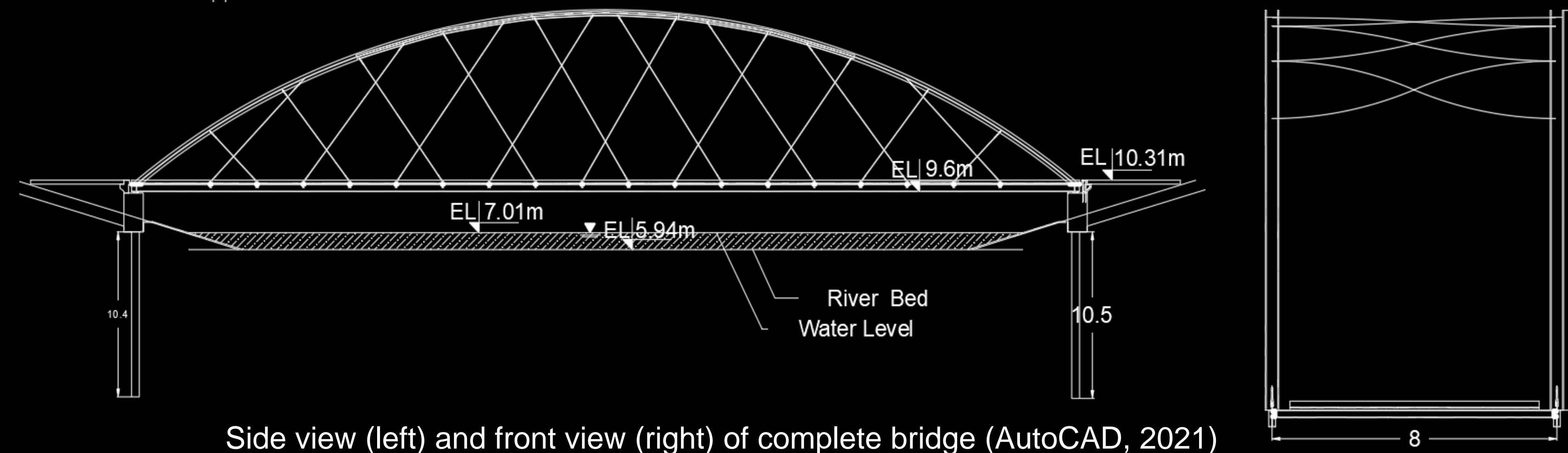
Isometric rendering of proposed Network Arch Bridge design (SketchUp, 2021)



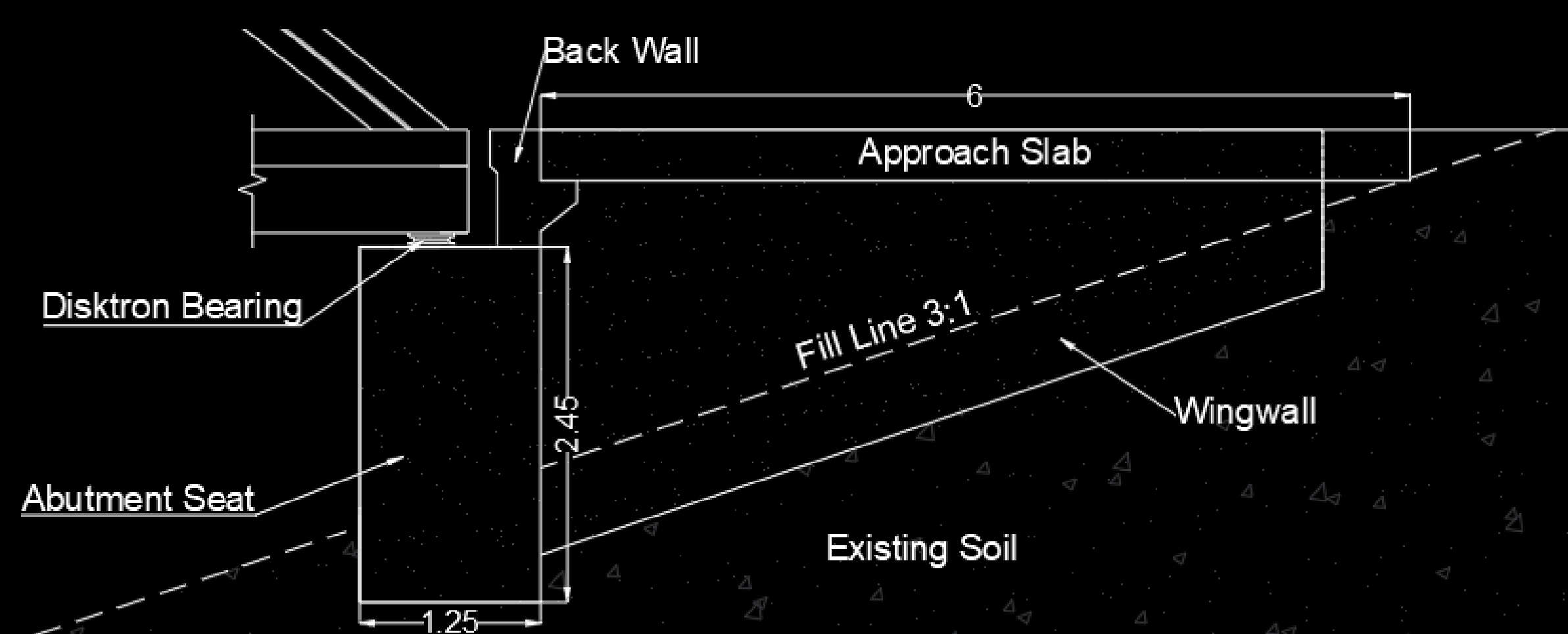
Axial Force Diagram under Full Pedestrian Loading (SAP2000, 2021)



Connection between tie girder and floor beam (left and right) (AutoCAD, 2021)



Side view (left) and front view (right) of complete bridge (AutoCAD, 2021)



Side view of conventional abutment design (AutoCAD, 2021)

DESIGN PROCESS

PRELIMINARY ANALYSIS

- Literature Review
- Options Analysis
- Preliminary Designs

LOADING ANALYSIS

- Load Calculations
- Finite Element Model Development

SUPERSTRUCTURE DESIGN

- Member selection (Arch, Tie, Deck, etc.)
- Strength (ULS) check
- Deflection (SLS) check
- Connection Design

SUBSTRUCTURE DESIGN

- Bearing Reactions
- Abutment Design
- Pile Design
- Approach Slab Design

PROJECT FINALIZATION

- Engineering Design Drawings
- Construction Schedule
- Cost Estimate

CONCLUSIONS AND RECOMMENDATIONS

The new design of the Jaipur Bridge is a network arch bridge that has a total width of 8 m, with a 7 m wide deck and a span of 61 m. The superstructure is composed of two arches with a height of 11 m and a radius of 47.6 m. There are two tie girders connected with the arch by full penetration welding at the ends. There are 18 floor beams (W200x36) that are connected to the tie-girder with a bolted connection. The slab has a 250 mm thickness with 20M at 300 mm spacing in the longitudinal and transverse directions. Each arch (W360x237) has 18 steel cables with \varnothing 26M and connected with tie girder (W460x74). There are 12 braces connecting the arches at the top and they are WT205x57 sections. The abutments on both sides of the bridge were designed with a seat that has a height of 2.45m and a backwall that has a total height of 3.25 m. Additionally, the abutments are supported on 10 piles with depths of 10.4 m on the north side and 10.5 m on the south side. The total project cost, according to a Class A cost estimate, was about \$6.45 million.

COST ESTIMATE

Earthworks	\$774,300.00
Bridge Structure	\$2,191,300.00
Other	\$1,808,200.00
SUB TOTAL	\$4,773,800.00
Contingency (20%)	\$954,800.00
Mobilization (10%)	\$477,400.00
Inflation (5%)	\$238,700.00
Total Bridge Cost	\$6,444,700.00

REFERENCES

- Alberta Bridge Structures Design Criteria, Version 8.0, 2017. Alberta Government. Calgary, AB, Canada
- Autodesk, AutoCAD 2021 [Computer Software]. Autodesk, Inc. San Rafael, CA, USA.
- CSA S6-19, 2019. Canadian Highway Bridge Design Code. Edition 11. CSA Group. Mississauga, ON, Canada.
- Google Earth, 2021. Jaipur Bridge, Calgary AB. Retrieved March 28, 2021.
- SAP2000, 2021 [Computer Software]. Computers and Structures Inc. Berkeley, CA, USA.
- SketchUp 2021 [Computer Software]. Trimble Inc. Sunnyvale, CA, USA.