

Varner No.2 Bridge Replacement Project

INTRODUCTION

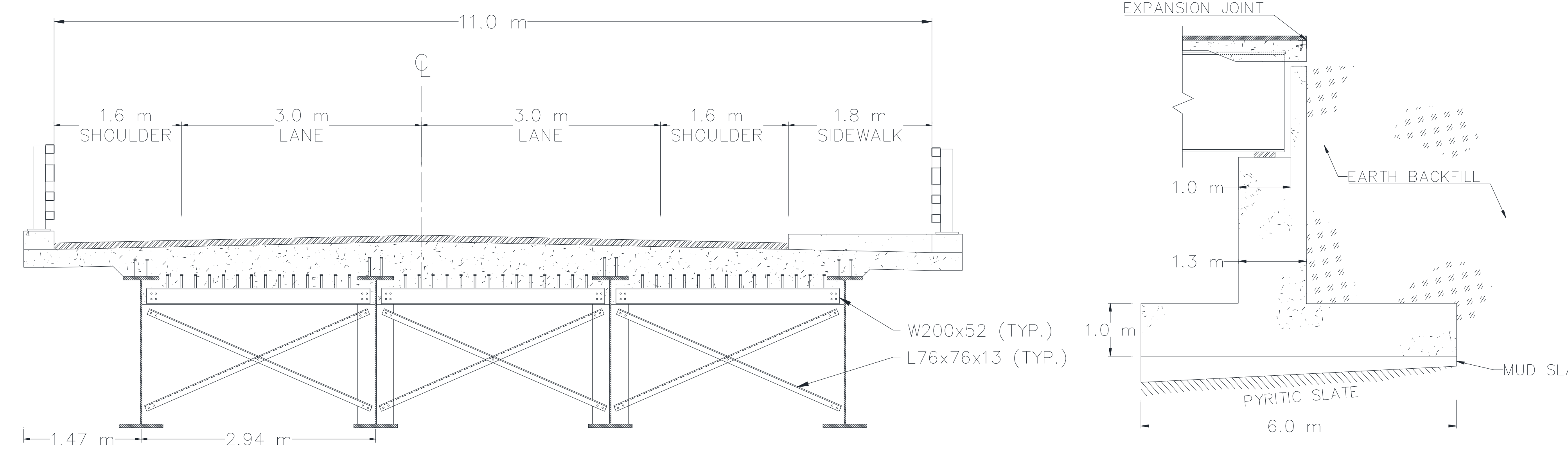
The existing Varner No.2 bridge is located in New Germany, Nova Scotia. The one-lane bridge spans 47.5-m across the LaHave River. The bridge structure consists of a steel truss superstructure which is supported on concrete abutments. There is also a three span pedestrian bridge located on the downstream side which is supported by two piers and the same abutment system used by the vehicle bridge.

PROJECT SCOPE

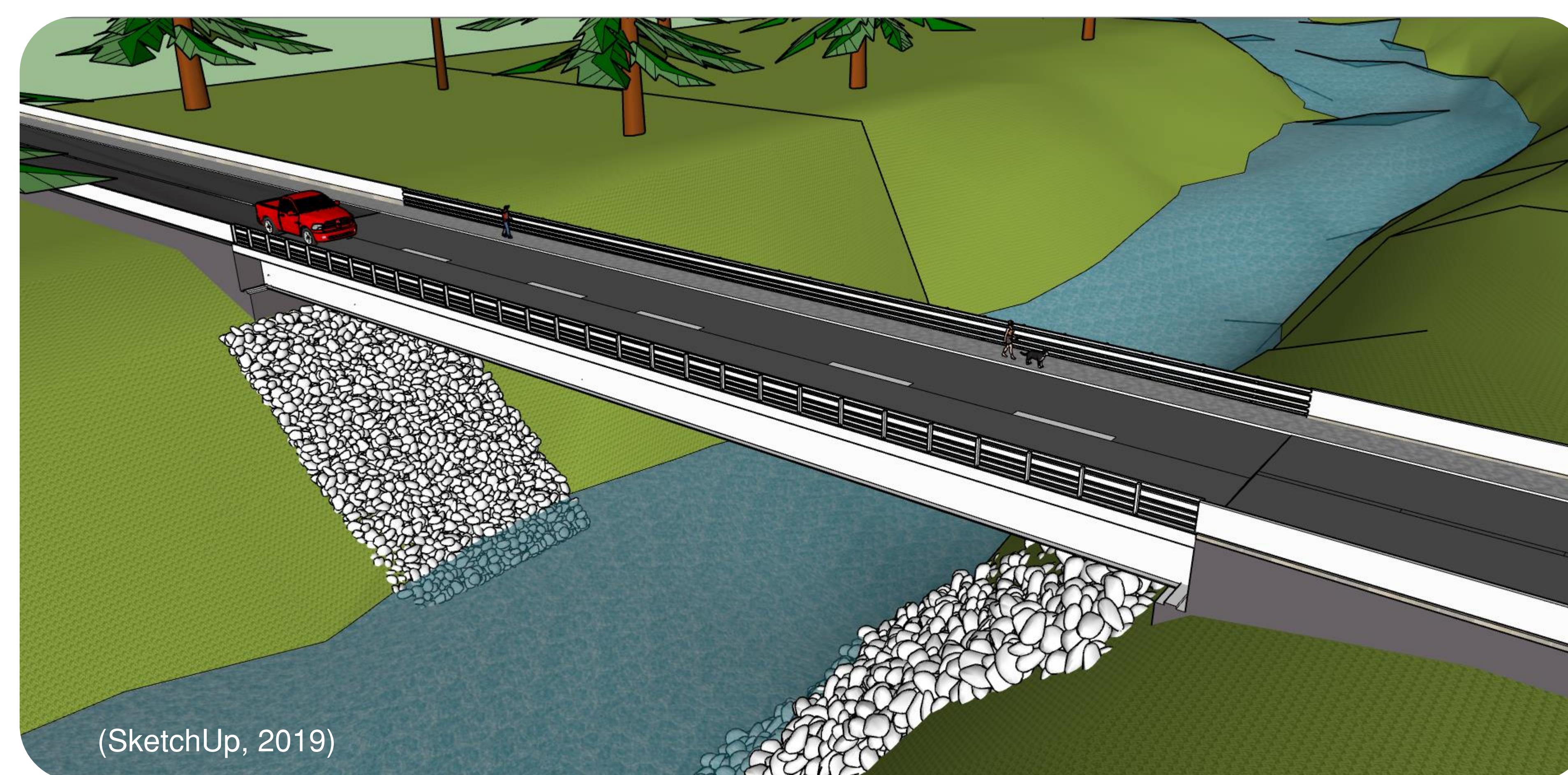
The project team was tasked to complete a full design of the planned replacement bridge. Base deliverables included: preliminary design, concept selection proposal, structural design, construction drawings, construction schedule and cost estimate.



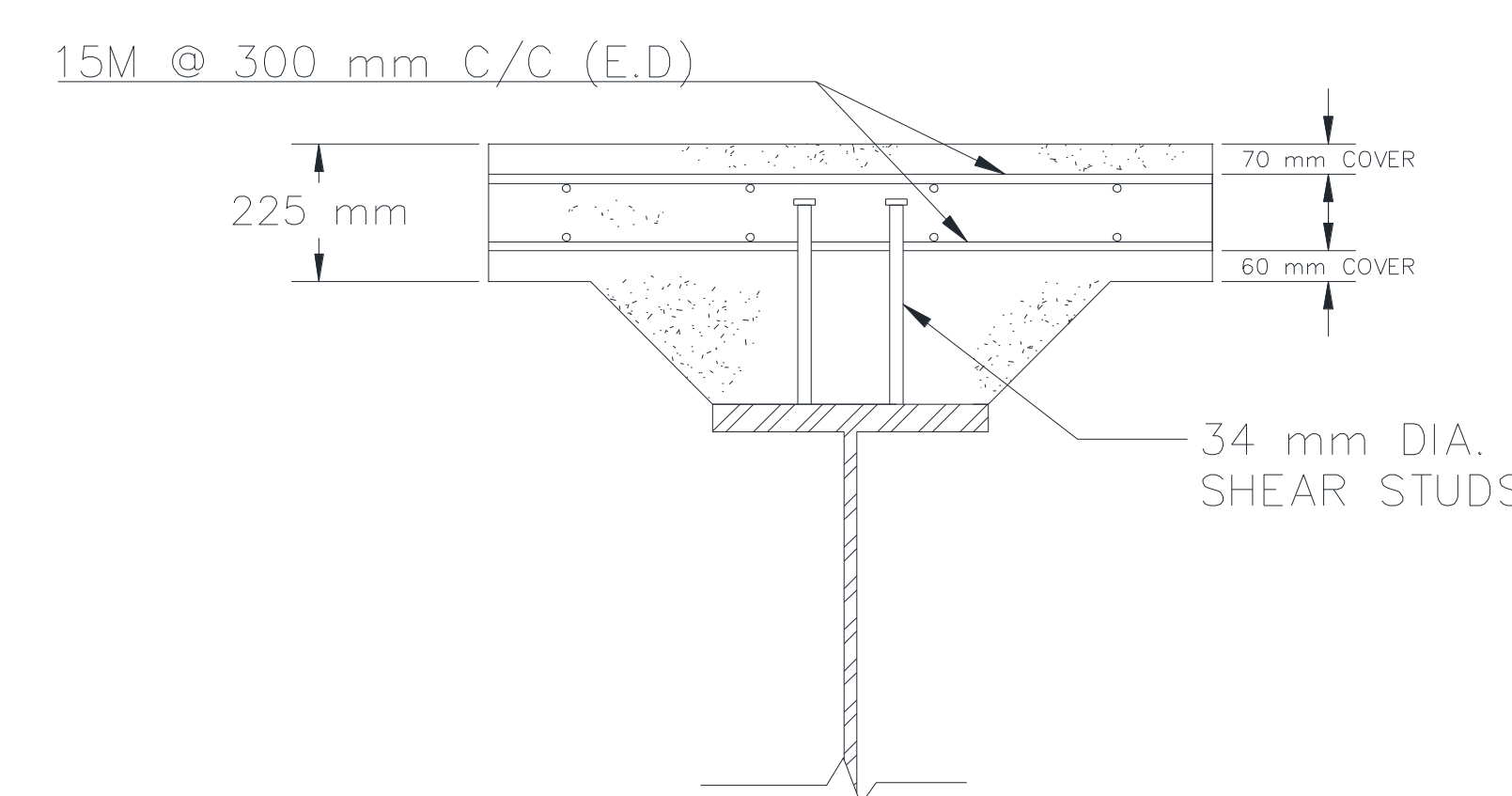
DETAILS OF DESIGN



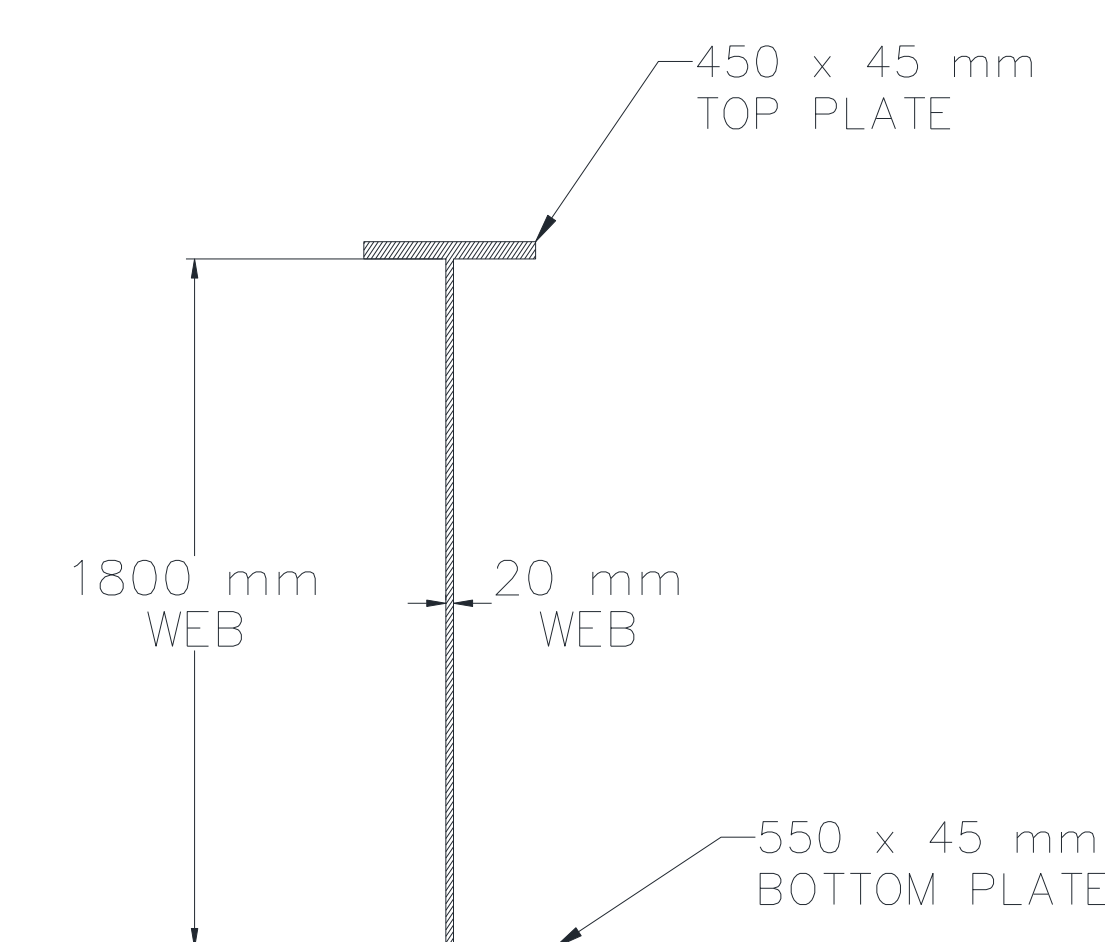
Above: Bridge cross section and abutment detail (AutoCAD Civil 3D, 2019).



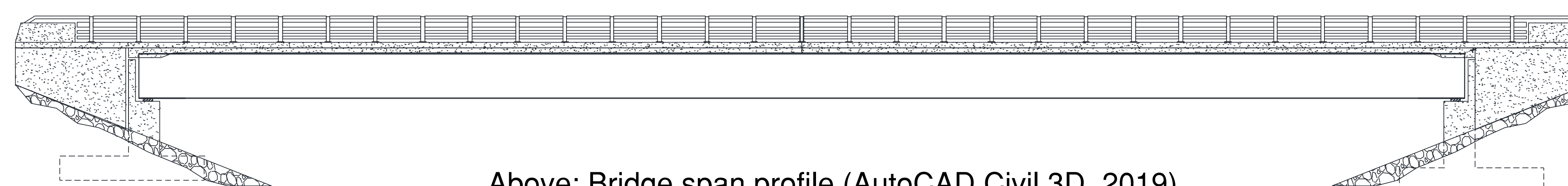
(SketchUp, 2019)



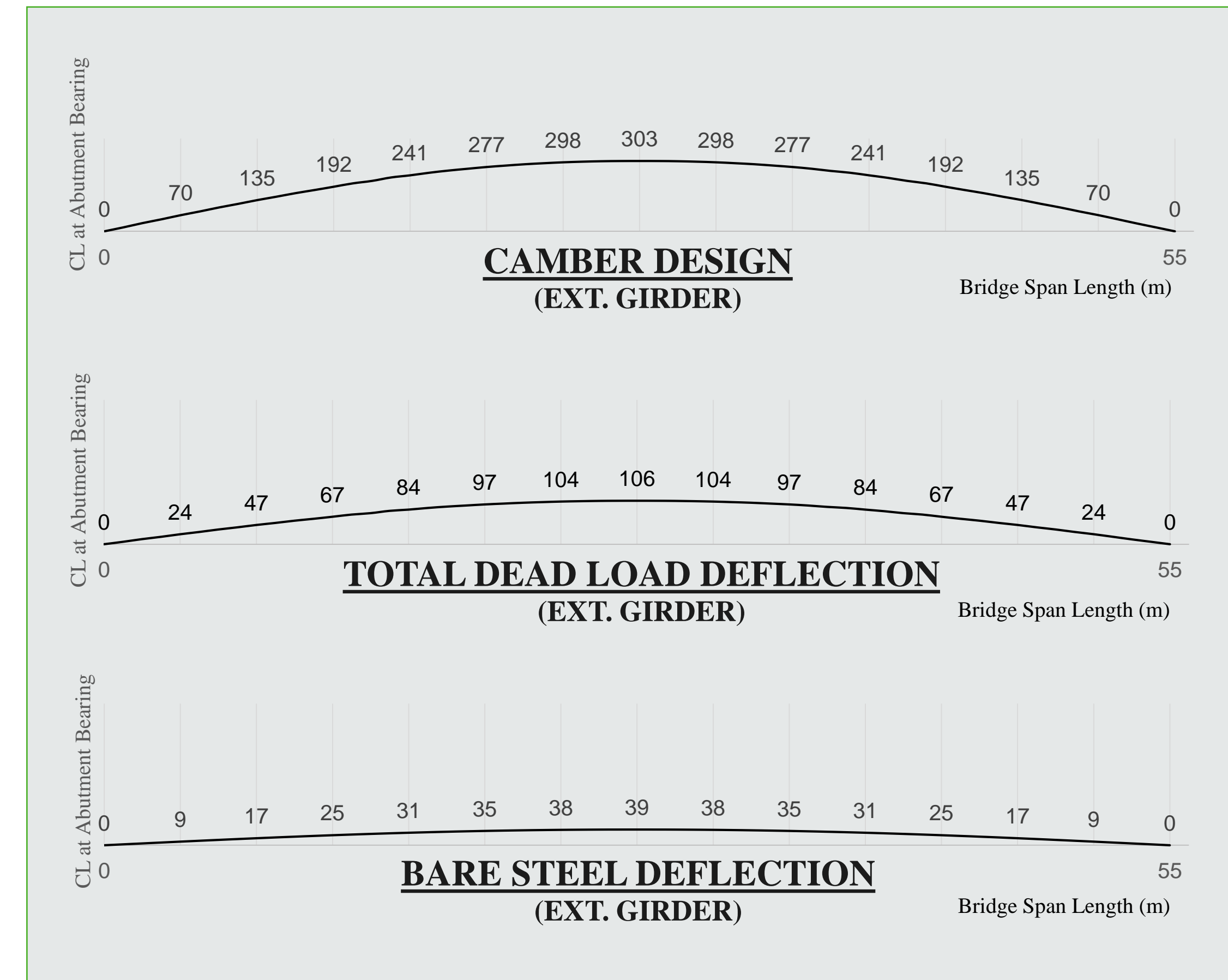
Above: Deck slab and shear connector detail (AutoCAD Civil 3D, 2019).



Above: Girder detail (AutoCAD Civil 3D, 2019).



Above: Bridge span profile (AutoCAD Civil 3D, 2019).



COST ESTIMATE

Earthworks	\$ 1,000,000
Bridge Structure	\$ 2,520,000
Asphalt Surface	\$ 28,000
SUBTOTAL	\$ 3,548,000
Design Development Contingency (5%)	\$ 180,000
Construction Contingency (10%)	\$ 350,000
TOTAL BUDGET AMOUNT	\$ 4,078,000

CONCLUSION AND RECOMMENDATIONS

The Varner No.2 bridge replacement is a two-lane highway bridge with pedestrian access designed in compliance with the CSA S6-14 standard. The slab-on-girder system spans 55-m over the LaHave River. The superstructure consists of four steel plate girders and is structurally composite with the 225-mm reinforced concrete deck. The lateral load resisting system is comprised of steel angles arranged in a cross pattern located every 7.85-m along the span. The substructure is a semi-integral abutment system with wingwalls arranged in a U-pattern. The abutment and wingwall units are designed to rest on the in-situ pyritic slate bedrock. A detailed quantity take-off was completed to support the development of a Class A cost estimate which indicated a \$4.1M construction cost.

REFERENCES

- CBCL Ltd. 2018. Varner #2 Bridge Replacement Project Scope. 1489 Hollis St, Halifax, NS, 4pp.
- CHBDC CSA S6-14. 2014. Canadian Highway Bridge Design Code. The 11th edition. Published in December 2014 by CSA Group. 5060 Spectrum Way, Suite 100, Mississauga, ON, 894 pp.
- Civil 3D 2016 Metric [Computer Software]. Autodesk, Inc. San Rafael, CA, USA.
- Google Maps. 2019. HWY 208, New Germany, NS. Retrieved March 20, 2018.
- SketchUp. 2019 [Computer Software]. Trimble Inc. Sunnyvale, CA, USA.

DESIGN PROCESS

CONCEPT SELECTION

- Research design proposals
- Develop preliminary designs
- Prepare formal options analysis report

LOADING ANALYSIS

- Identify loading sources
- Research geographic parameters
- Determine governing load cases

SUPERSTRUCTURE DESIGN

- Design girder elements for construction loading
- Design bridge deck for composite action
- Design lateral load resisting system

SUBSTRUCTURE DESIGN

- Design bridge abutments
- Design wingwalls
- Design approach slab

CONSTRUCTION WORK PACKAGE

- Draft construction drawings
- Complete quantity take-off & Class A cost estimate
- Develop construction schedule