

Scope of Work

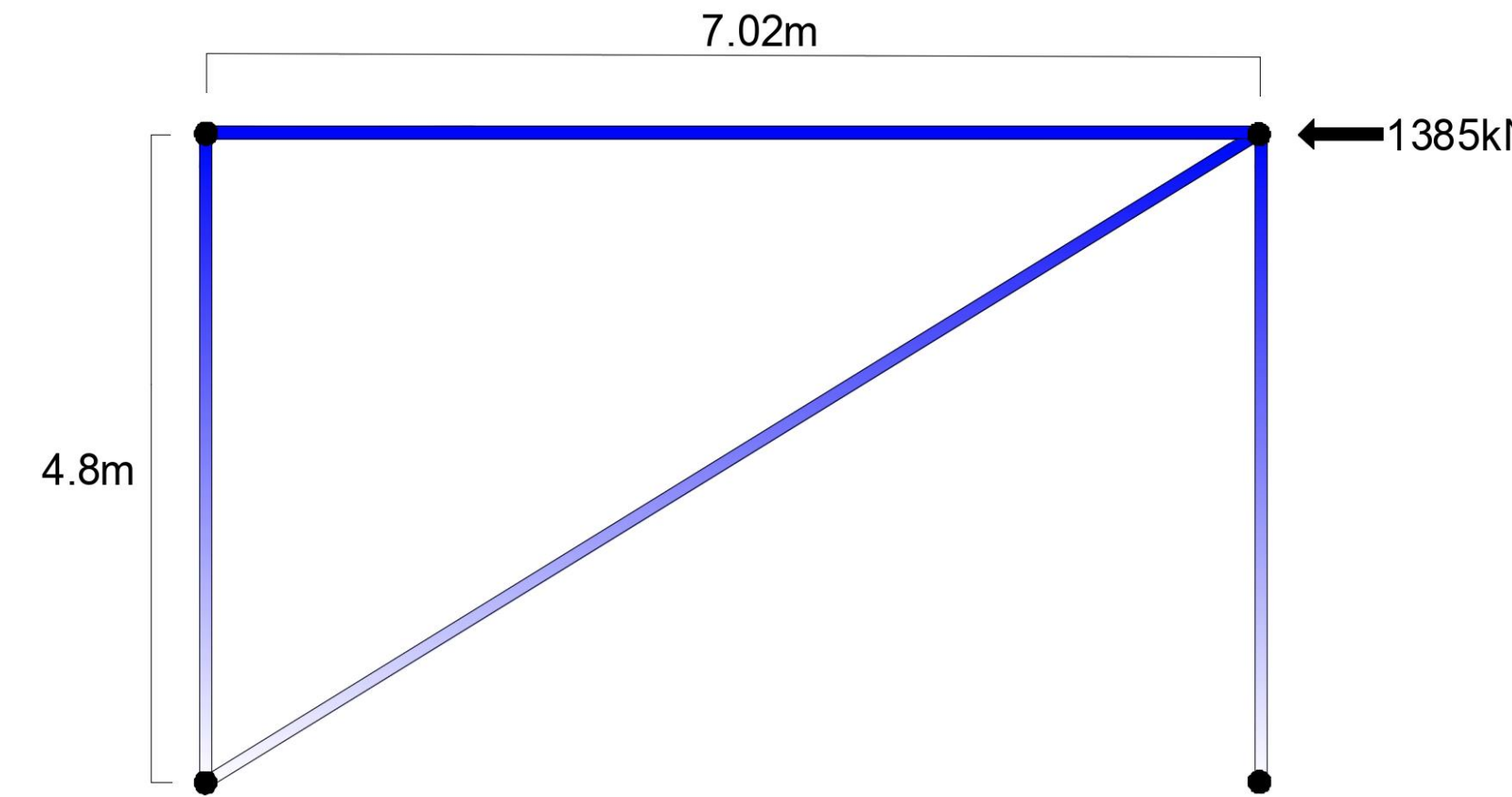
MJMA Architects and Blackwell Engineering selected Group 15 to design a unique and functional structural system for a new sports facility in St. Catharines, Ontario. The facility is intended to provide a venue for sports and entertainment, while presenting an aesthetically pleasing façade to the community. Key features of the building include a quadruple gymnasium, a 1,000-seat spectator arena, a practice arena, and a triangular canopy green roof.



Key Design Elements

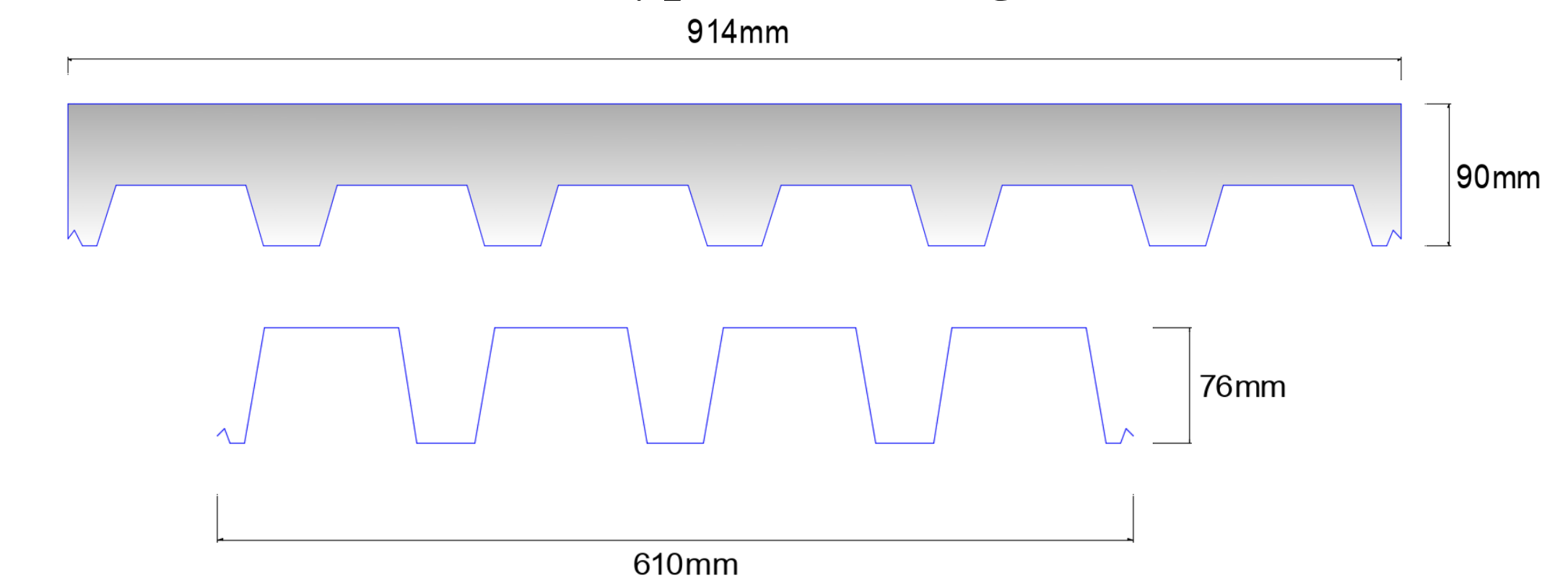
Braced Frames

Braced framed elements throughout the building include 2Lx127x127x13 hidden inside partition walls



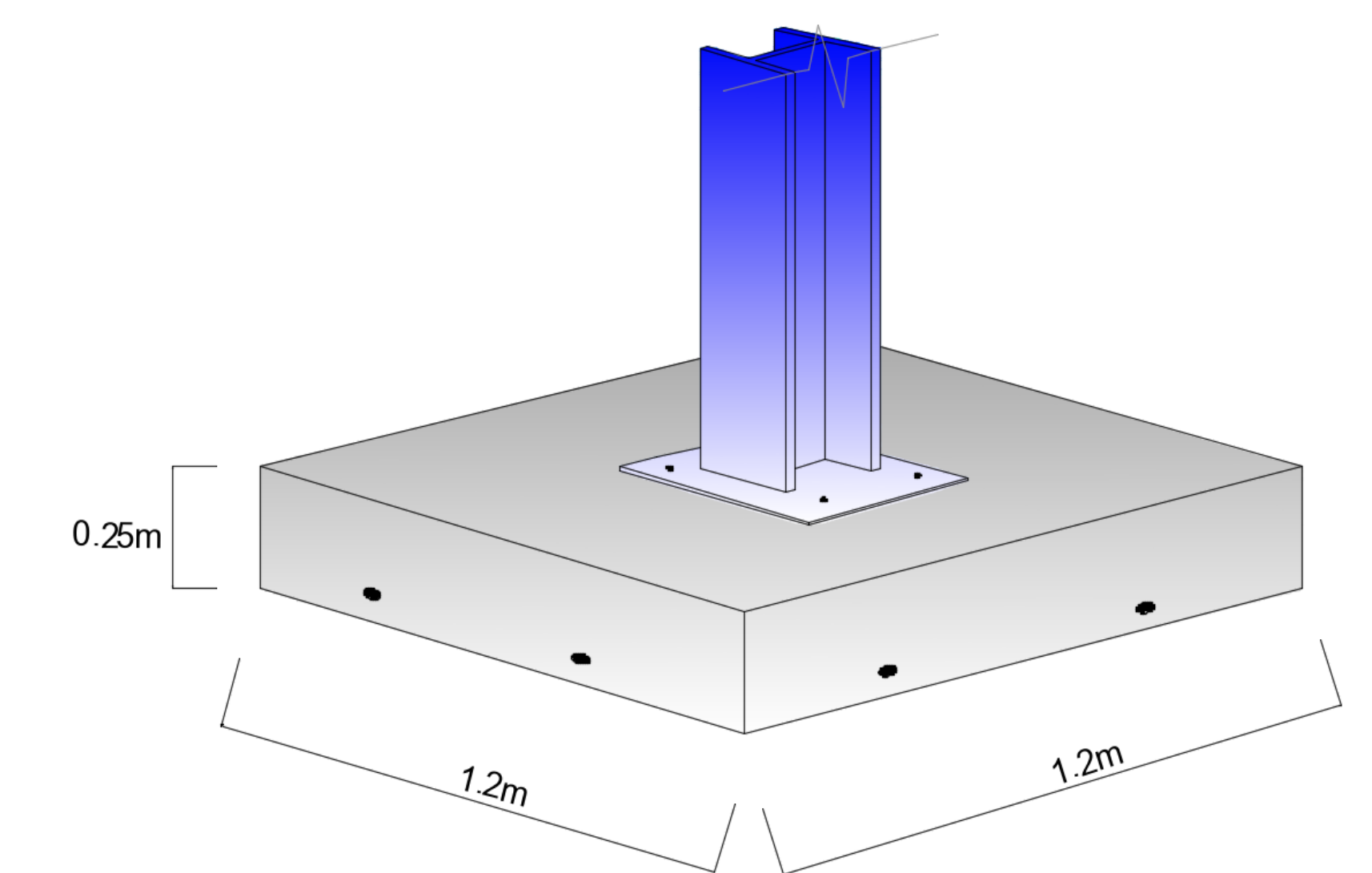
Steel Deck

Second Level: P-3615 Type 20 composite deck
Roof level: P-2436 Type 18 corrugated steel deck



Column Footings

1.2m x 1.2m x 0.25m concrete footing supporting steel columns



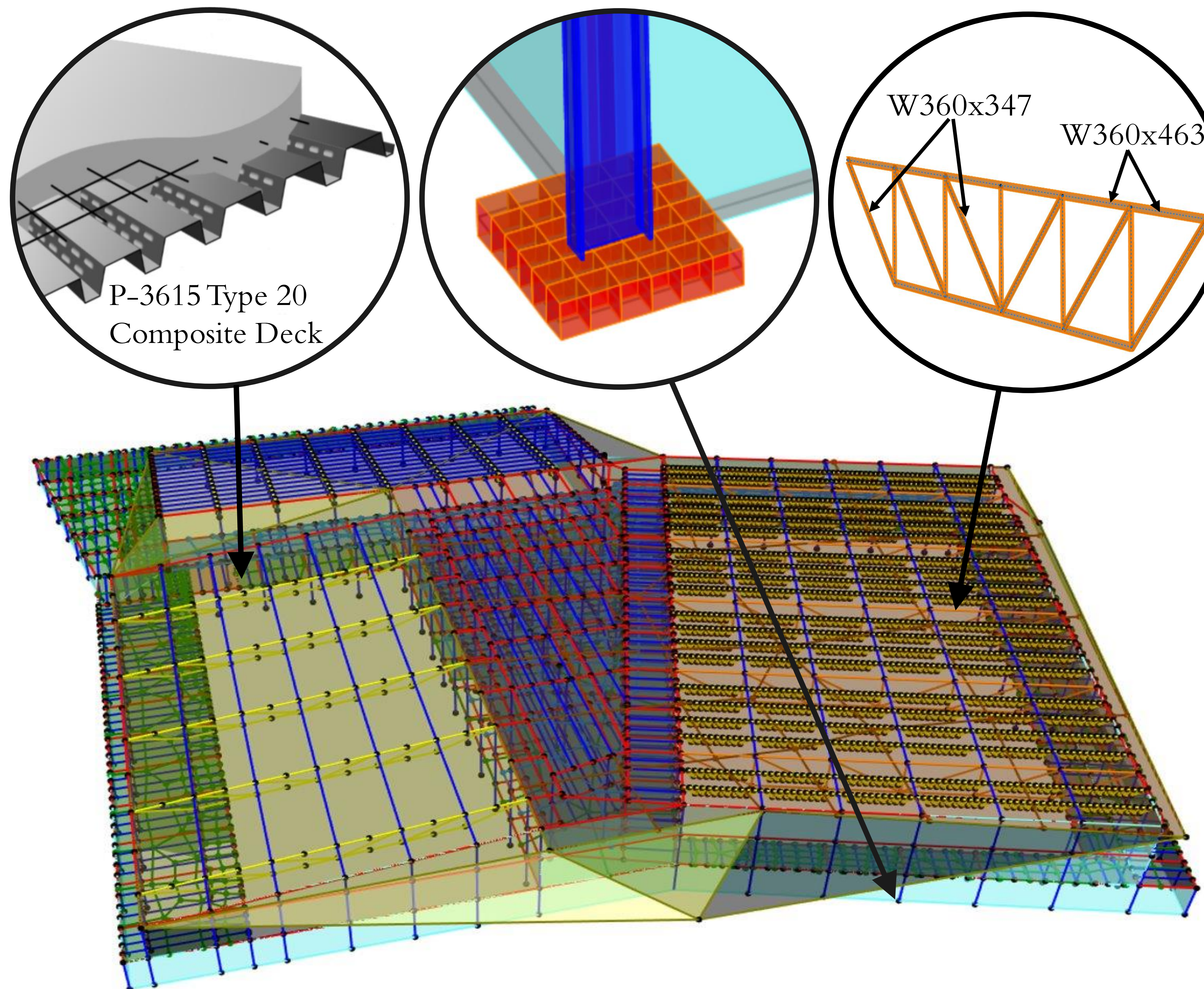
Project Location

The project is situated in St. Catharines, Ontario. The site is located on competent soil with allowable bearing capacity of 300 kPa at ULS. The region is very open with minimal trees or buildings to obstruct wind.



Design Process

Select Material	Steel was selected as the main structural material.
Calculate Design Loads	The applied dead, live, wind, and seismic loads were calculated.
Model Building	Structural members were placed and the building was modeled in SAP2000.
Analyze Structure	The model was analyzed and reaction moments/forces were obtained.
Design Elements	Structural members were designed based on the calculated reactions.



Cost Estimate

Building Cost:	Location:
\$29.5 million	St. Catharines, Ontario
Cost per Square Foot:	Floor Area:
\$140	210,000 ft ²

Final Design

The final design for the building contains large steel trusses that span over the arenas and gymnasium areas. Steel tension members and concrete shear walls were utilized for the lateral resisting systems and hidden in partition walls. The foundation is a four-inch-thick concrete slab that includes thickened strip and pad footings under load bearing walls and columns.

Conclusions & Recommendations

The building was designed using predominantly steel construction with a concrete foundation. It includes unique features such as a large green roof and long truss spans over the arenas and gym. The trusses, which span a maximum distance of 51m, are designed to withstand the load from the green roof and are supported by columns that load into concrete footings. The total cost using a type D cost estimate based on the dimensions of the building is approximately \$29,500,000.

References

- Autodesk: AutoCAD LT 2021 [Computer software]. San Rafael, CA, USA.
- Google Maps, 2021. St. Catharines, ON. Retrieved March 2, 2021
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- Steel Deck [Catalogue]. (2006). *Canam*, 2-38.