UTAH VALLEY UNIVERSITY: AISC BRIDGE DESIGN

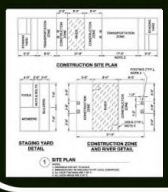
Jackson Anderson, Rod Martinez, Lauryn Crofts
Paul McMullin, SE, PhD

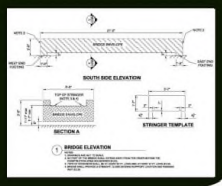
Project Statement

Teams are required to design a bridge for a disc golf course under construction in Ruston, Louisiana. It is to span a man-made river, be accessible to employees and maintenance vehicles, and must not disturb the scenery of the park. The park requests that the bridge be designed of steel because of its design versatility, ease of prefabrication, ability to rapidly erect, superior strength-to-weight ratio, durability, and high level of recycled content. The bridge must also be aesthetically pleasing to maintain the existing beauty of the park.

Design Background

The steel bridge team designed the 2023-2024 bridge after a warren truss bridge design. We opted to a low-profile bridge to not take away from the aesthetic of the course. Due the maximum height of the bridge and the height from the river to the bottom of the bridge limitations, our team engineered a solution that will overcome those constraints. With these considerations, the team decided on an inverted Warren truss bridge design.





Project Sponsors, Faculty, and Technicians

Capstone Instructor: Amanda Bordelon
Bridge Team Advisor: Paul McMullin

Bridge Team Designer: Lauryn Crofts
Bridge Team Designer: Rod Martinez
Bridge Team Designer: Jackson Anderson
Bridge Builder/Barge: Brayson Wilcox
Bridge Team Designer: Cody Gunn
Bridge Team Designer: Kaden Shepherd

A Special Thanks to our Fabrication Shop:
Keech Steel Corporation

Design Process

Before beginning the design process, because the loads that are supplied by AISC are "actual" loads that will be used in the competition, we can assume they are service loads. We are trying to design this bridge the lightest we can while still meeting the deflection criteria. therefore, our load combinations will not include any amplifying load factors. For the design process, we analyzed multiple different locations for each load case to find out the worst-case scenario for each. It should be noted that each load case is applied independently; the structure does not see both loading situations at the same time.

Once the stress demands were obtained, engineering programs like SkyCiv and RAM Elements were used to design the adequate steel member sizes and dimensions. In addition to load capacity checks, dimensional constraints set by the rules were also taken into account. After extensive analysis, rectangular hollow structural shape, HSS, were selected for the bridge stringers and decking.

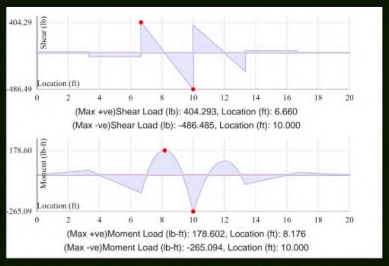


Figure 1: Illustrates the shear and moment diagrams

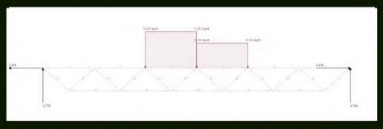


Figure 2: Illustrates the free-body diagram of a single beam that represents one of the decking support bridge stringers in kips/ft

Fabrication

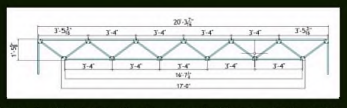


Figure 3: Illustrates the dimensioned side view of the bridge

All of our fabrications are completed by Keech Steel. For constructability during the build competition, the bridge will consist of bolts, nuts and double plate connections. Each member will have one end with two plates welded for a connection and the other end connected with bolts and nuts. Before the bridge is completed, all of the members will be tested in a right rectangular prism with dimensions of 3'-6" x 6" x 4" to ensure we met all of the dimensional requirements. Once complete, the designated build team will practice constructing the bridge in accordance to the rules.



Figure 4: Displays the structural representation of the 2023-2024 bridge in SkyCiv and Ram Elements. The coloration illustratees the stress experienced by each member