

2021 Steel Bridge

Team members:

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Abstract

As a part of the Bachelor of Civil Engineering Degree, undergraduate students at the New Mexico Institute of Mining and Technology (NMT) complete a Senior Design project. Five undergraduates chose to participate in the American Institute of Steel Construction (AISC) Student Steel Bridge Competition (SSBC). This project focused on the design of a steel bridge, analyzing it under lateral and vertical loads, and sequencing it for construction.

The AISC SSBC coincides with the American Society of Civil Engineers (ASCE) Rocky Mountain Regional Conference, which hosts the ASCE Concrete Canoe competition. Traditionally, both of these events are held in person at the same region-specific host school, and competing teams travel to participate in various conference events and festivities. Historically, participants in the SSBC physically construct their bridge on-site, where it is rated according to aesthetics, construction speed, lightness, stiffness, construction economy, structural efficiency, and cost estimation. The teams with the highest overall performance go on to compete in the AISC National Competition.

The impacts of the COVID-19 pandemic led AISC and ASCE officials to cancel all in-person events for the 2021 Rocky Mountain Regional Conference in order to preserve the safety and welfare of all participants. This decision was made after many competing teams, including that from NMT, had already begun planning and scheduling bridge designs. In lieu of an in-person competition, AISC provided students with the option to either compete from campus or participate in a supplemental competition. The former option was very similar to the traditional in-person competition, with trained faculty members from each respective university acting as competition judges. The latter option was an entirely novel competition and involved the design and analysis of a bridge that complied with the same structural specifications as those followed by the “compete from campus” option. Rather than physically constructing a bridge, teams competing in the supplemental competition were required to create a detailed, step-by-step construction procedure. The supplemental competition also required a comprehensive paper outlining the methods and techniques used for design, analysis, and construction.

Bridge Specifications:

The 2021 AISC SSBC Rules outline all specifications for the bridge. This section outlines the critical stipulations defined by AISC. Non-compliance with these requirements results in immediate disqualification from the competition. The bridge must be constructed of only magnetically attractive steel nuts, bolts, and members. Each member must be completely rigid and may have dimensions no larger than 3'-6" x 6" x 4". Bolts cannot exceed 3" in length and nuts must be hexagonal. The bridge may have only two stringers, each with a length of at least 20'. The top chord of the stringers may not have any large gaps or elevation changes and must be between 1'-7" and 1'-11" above the ground surface at all locations along the span of the bridge. The bridge is to be constructed with the stringers at a prescribed 1'-6" offset, as shown in Figure 1. Each of the four footings shall be 1'x1' and are considered fixed connections. The floor space within these footings is the only place in which any bridge component may touch the ground, and the length of the bridge must be confined within the footing areas. The width and height of the bridge may not exceed 5' and the total length of the bridge must be less than 22'-6". The bottom of the stringers must also be no lower than 7-1/2" above the surface of the ground. The decking of the bridge must be wide enough to accommodate a 3'-6" decking plate at any point between the two footings and must provide a straight clear passageway.