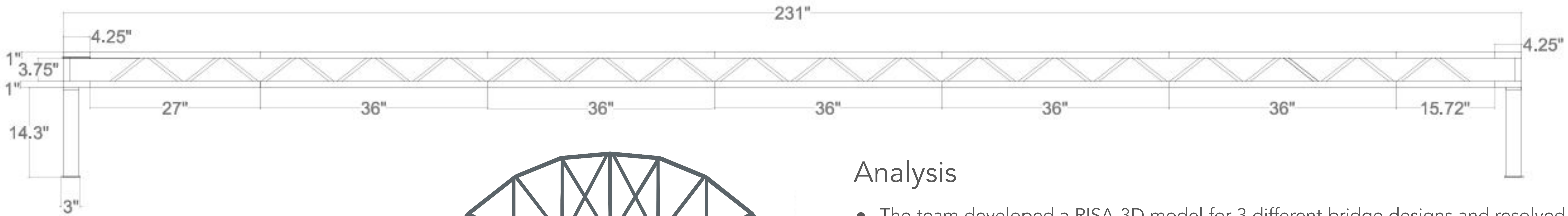
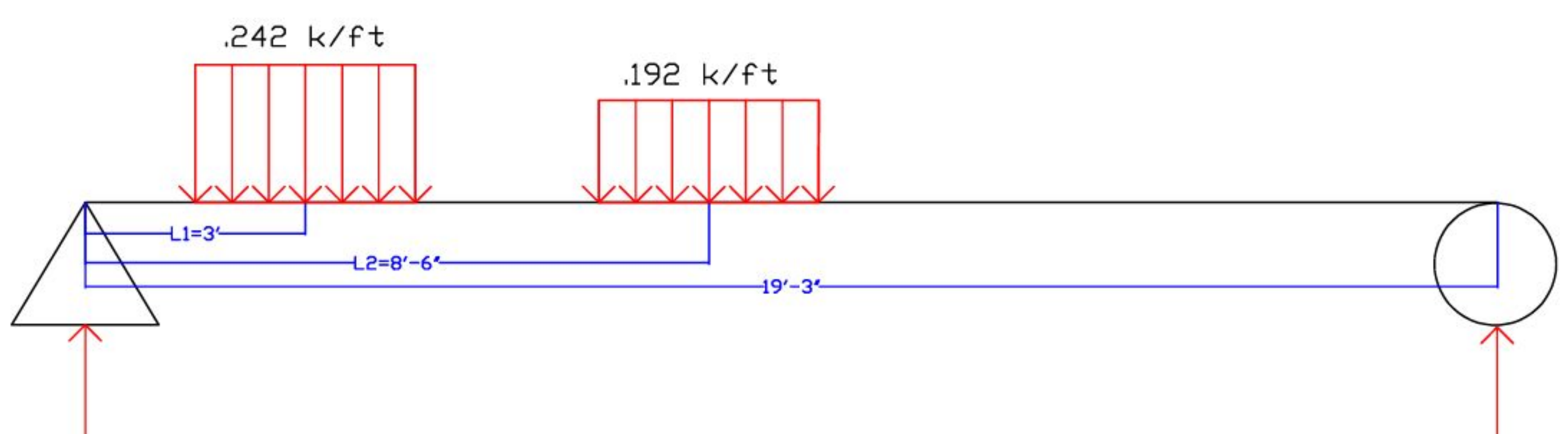


TRUSS-TY ENGINEERING

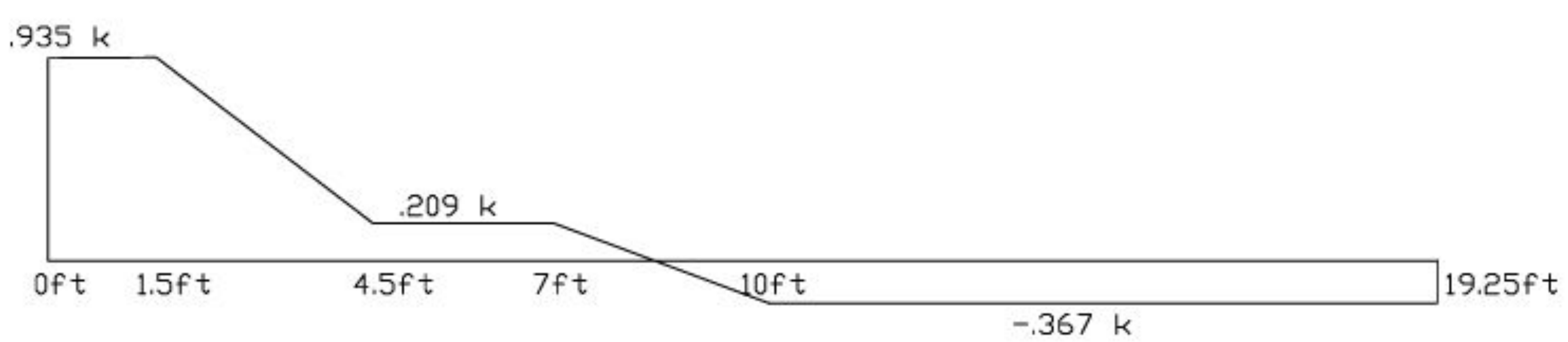
Bridge Design Selection

This bridge design was selected because its RISA-3D model had the fewest pieces and lowest weight compared to the team's other two models that were developed while remaining within the allowable deflection limits. The weight and number of pieces were minimized in order to reduce the amount of materials needed, overall cost, and construction time.

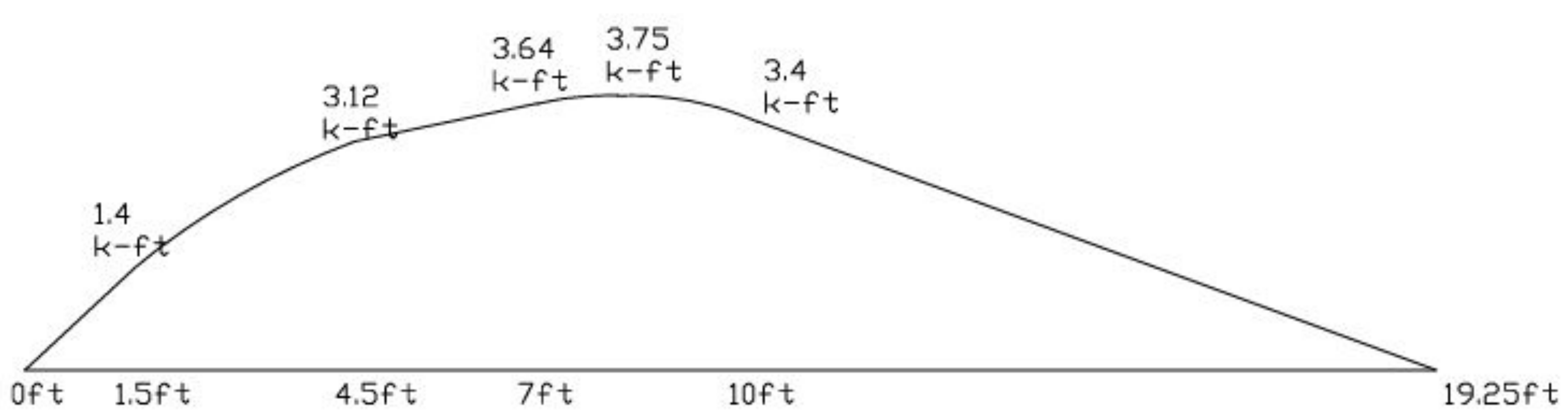
Member	Limit States Checked
Abutment	Tensile & shear yielding and rupture, block shear
Truss	Tensile & shear yielding and rupture, block shear
Cross-brace	Tensile & shear yielding and rupture, block shear



Load Combination N=2, South Stringer

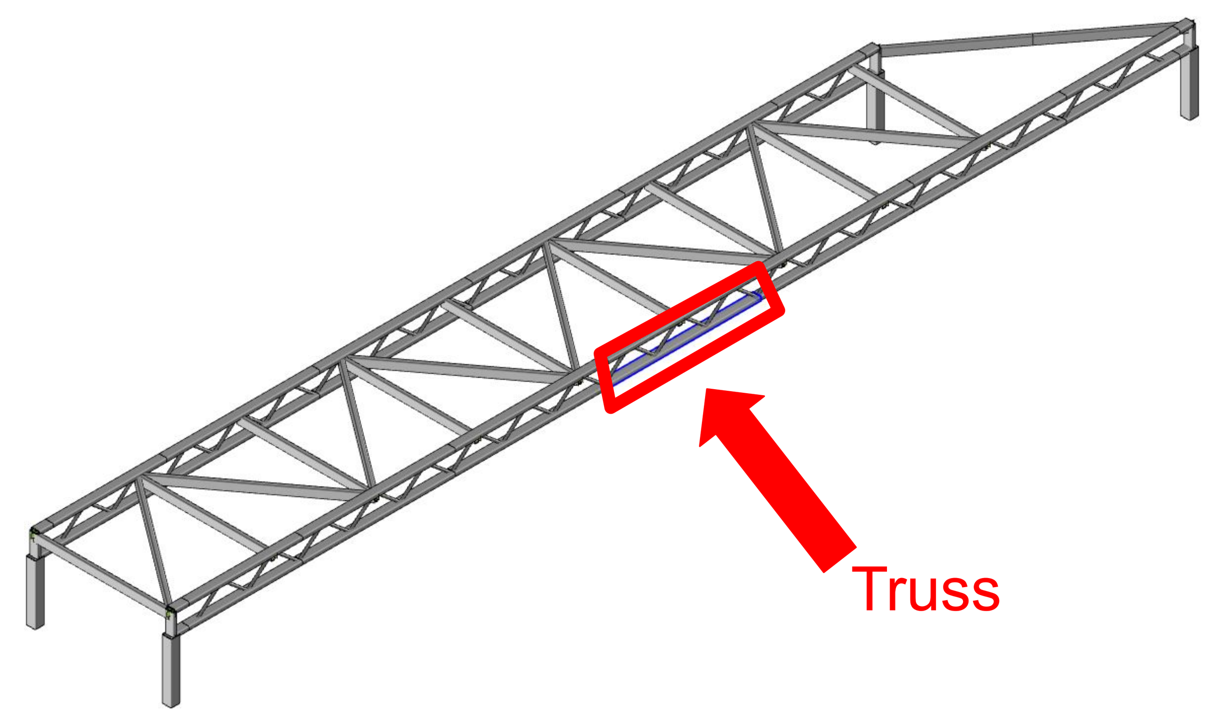


SFD, Load Combination N=2, South Stringer



BMD, Load Combination N=2, South Stringer

Critical Member Calculation Example



Controlling Limit State: Tensile Rupture

$\varphi P_n = .75F_uA_e = .75(58\ ksi)((.686\ in^2 - (2)(.125")(9/16")) = 23.7\ k$

$P_u = 13.7\ k$

$P_u < \varphi P_n$, $13.7k < 23.7k$ (OK)

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Presented by Alexa Godkin, Sydney Juve, Kyler Wilkens, and Lilly Zelenka

Analysis

- The team developed a RISA-3D model for 3 different bridge designs and resolved any issues that prevented the models from successfully solving (P-delta diverging, model was unstable, etc.)
- Once the three models solved successfully, the team verified that all code checks displayed in the results table were met (i.e. all demand to capacity ratios for all failure modes were less than 1)
- The team then sorted the lateral and vertical deflection values of all locations along the bridge in the results table from absolute maximum to absolute minimum, then noted the largest values and determined whether these were within the allowable deflection limits (.75" lateral and 2" vertical)
- The team continued to refine the three models to make them as light as possible and have as few pieces as possible while remaining within the deflection limits
- Using a decision matrix, the bridge models were scored in categories that were weighted, which were lateral deflection, vertical deflection, bridge weight, and number of pieces to determine which model would be selected for fabrication
- To be conservative, the forces used to design the bridge's welded and bolted connections were taken as the largest internal member forces developed in that connection type (see distinct connection types below) from the final RISA-3D model. That is, each connection is designed to resist that connection type's worst-case force.

Selection of Connections

Connection 1: Truss members connect on the bottom by resting on top of angles with 2 bolts through them to primarily resist tension, which is dominant in the bottom truss chord.

Connection 2: Connects the tops of truss members together. Since the top chord of the truss is primarily in compression, these members are not at risk of pulling away from each other, so the bolts here primarily resist shear from the vertical loads.

Connection 3: Connects the non-diagonal individual cross braces to the truss pieces. Tabs were welded to the bottom chord to prevent stringer template interference. Bolts are installed vertically to primarily resist shear.

Connection 4: Connects the diagonal cross braces to the truss pieces. Tabs were welded to the bottom chord to prevent stringer template interference. Bolts are installed vertically to primarily resist shear.

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