Introduction

In the Bridge Design Module, my group is presented with a scenario to design, build and test a truss bridge system that would maximize the external loading efficiency of the bridge; likewise minimize the total cost of the building materials. When building the bridge, one of the design constraints associated with the bridge design was that it could only be constructed using K’Nex pieces provided to each group. No other stronger materials, or bonding agents were to be used to strengthen the bridge beyond the strength of the K’Nex pieces. When building the bridge, another design constraints associated with the bridge design was for the bridge to span a minimum distance of 30 inches, which meant the bridge needed to be longer than 30 inches in order for the bridge to rest on the platforms on each side of the gap. In addition, the bridge could not be built wider than 9 inches. When designing the bridge, the vertical center of the bridge needed to be engineered so that there were no obstructions blocking the loading apparatus. In addition, the bridge design needed to hold a minimum of 20 pounds in order for the design to be valid. When designing the bridge, the final constraint was for the bridge to be assembled into prefabricated, 10.5 inch by 8 inch by 6 inch sections before the actual competition.

Our group found this design module very crucial because it simulated a real world design project with specific due dates the research and design needed to be completed by. This simulated what it would feel like to work on an actual design project for a real client who expects result on a timely manner. The Bridge design module taught our group how to meet all of the client’s requirements by researching the strengths and weaknesses of three common truss types: Howe, Pratt and Warren trusses. The Howe truss is designed with diagonal members in compression and vertical members in tension. The Pratt truss is designed with diagonal members in tension and vertical members in compression. The Warren truss is designed with a diagonal compression member in every other panel of the truss. With many tests and simulations using the computer program Visual Analysis, the theoretical failure loads and failure locations were determined for each of the three types of trusses. This was calculated algebraically by the method of joints. This method consists of isolating a joint as a free body and then summing the forces at the joint in both the x-axis and y-directions. The forces in each member were calculated using the equation for static equilibrium, which is the sum of the forces in any direction must equal zero.

Utilizing the information we found, our group created a preliminary bridge design attempting to maximize the amount of weight the bridge could carry. Our group faced many challenges along the way as bridge designs were tested and thrown out because they failed to improve the performance of the original bridge design. With many tweaks and modifications, the bridge design had to also be mindful to minimize the cost for the preliminary competition. For the final bridge design, our group focused on further reducing the weight to cost ratio without scarifying the bridges loading efficacy and preparing the Final Competition in Week 10.