CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

J0322

Project Title

Bridge Strength: Truss vs. Arch vs. Beam

Abstract

Objectives/Goals

The objective of this experiment was to determine which bridge design is the strongest against heavy loads through deflection testing on three bridge models. Also the goal was to understand and analyze how much greater the strength would be between the three models and plausibly why their strengths differ.

Methods/Materials

The project began with the design and then construction of the bridge models that were 0.75 meters long, out of glue and wooden popsicle sticks. Before deflection testing occurred, supplies need were a bucket, bag of sand, string, scale, caliber, construction paper, and a testing stand to stabilize the bridge models before loads were attached. Finally deflection testing initiated by loading each bridge model with 1 # 7 pounds of sand, with 1 pound increments. For each load the deflection was measured and recorded.

Results

For cumulative deflection, the truss bridge under 7 pounds of load deflected 0.2 cm. The arch bridge under 7 pounds achieved 0.69 cm. While the span/beam bridge deflected by 2.01 cm under the same 7 pound load. The deflection for each 1 pound load increment was also measured and recorded. This deflection is referred as incremental deflection. The average incremental deflection for the truss bridge was 0.0285 cm. For the arch bridge, the average is 0.0985 cm and the span/beam bridge#s average is 0.2871 cm.

Conclusions/Discussion

With the bridge#s designs researched and tested, it was determined that the truss is the strongest bridge, with arch the second, and span/beam dramatically weaker than the other two. Based on the incremental deflection averages, the truss bridge is 10.0736 stronger than the span/beam bridge and 3.4561 stronger than the arch bridge. While the arch bridge is 2.9147 stronger than the span/beam bridge. It is concluded that the truss bridge was the strongest from its increased weight and its geometric design of spreading the compression with a triangular design. Though the arch#s geometry also supports and spreads the compression placed on the bridge by loads, it lacked the efficient ability of the truss#s design.

Summary Statement

This project utilizes bridge deflection to test and compare the strength of three different bridge designs: Truss, arch, and beam.

Help Received

Parents helped with retrieving the supplies and building the stand for the bridge deflection testing.