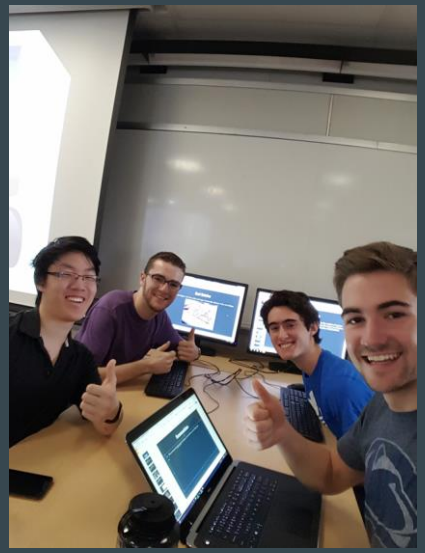
Replacement of Vehicle Bridge Over Spring Creek

Centre County, PA

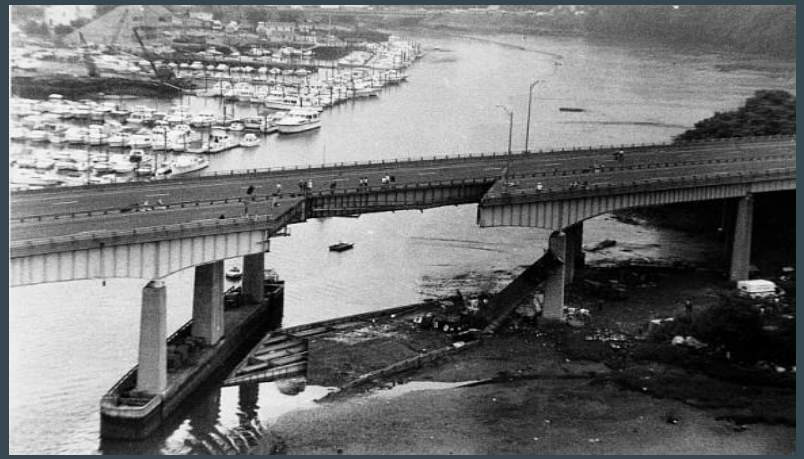


•••

Design Project #1
EDSG100 Section 002
Seal Team 6
Group 6

Ed Li, Chase Thatcher, Gordon Marron, Matt Schoffelmeer

Statement of Problem



The bridge over Spring Creek along Puddintown Road in College Township, Centre County, PA has been destroyed by flooding. As a result, traffic has had to be rerouted about ten miles out of the way of its original route and is therefore causing a great inconvenience as well as a great concern for safety. The bridge was of very significant importance to local and commercial traffic, and it provided crucial access to Mount Nittany Medical Center.

Objective

Objective - Create a prototype Warren and a Howe bridge out of popsicle sticks to replace the Spring Creek bridge so that traffic may resume

A new bridge must be designed and implemented as quickly as possible.

Design Criteria

The bridge is to include:

- standard abutments, no piers
- medium strength concrete with a thickness of 0.23 meters
- no cables
- support a load of 225kN or two AASHTO H20-44 trucks
- deck span will be 40 meters and the elevation should be 20 meters

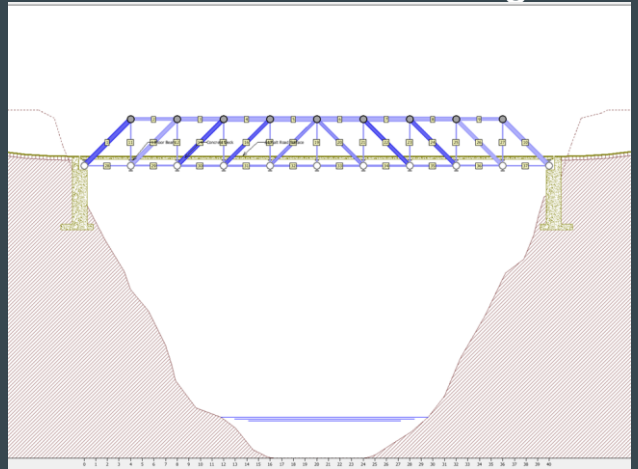
Technical Approach (Phase 1:Economic Efficiency)

Software template used from the Engineering Encounters Bridge Designer 2015 (EEBD 2015) which calculated the total cost after the design.

Size and material of all members could be manipulated

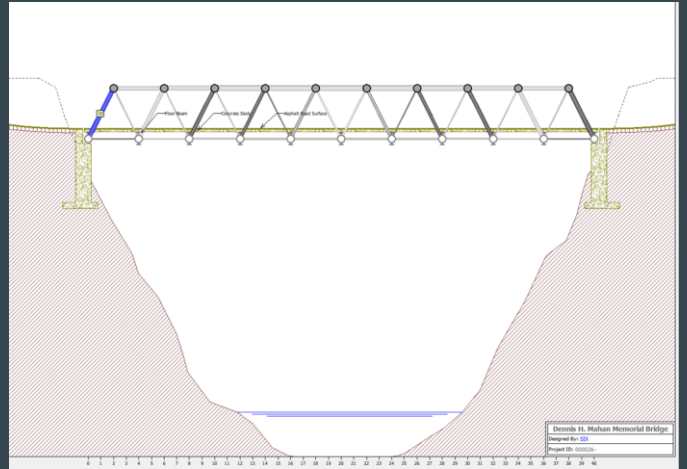
Process of trial and error to try different material and thickness combinations

The lowest cost bridge that met requirements was born



Howe

Warren



Technical Approach (Phase 2)

Prototypes of the bridges were constructed using a maximum of 60 popsicle sticks and Elmer’s glue.

The weight of each bridge was measured and recorded.

Bridges were tested for the load at failure by hanging a bucket from the bridge and adding weight to it.

The bucket with the weight was then placed on a scale to measure the total load at failure.

Structural efficiency of each bridge was calculated.

Results (Phase 1: Economic Efficiency)

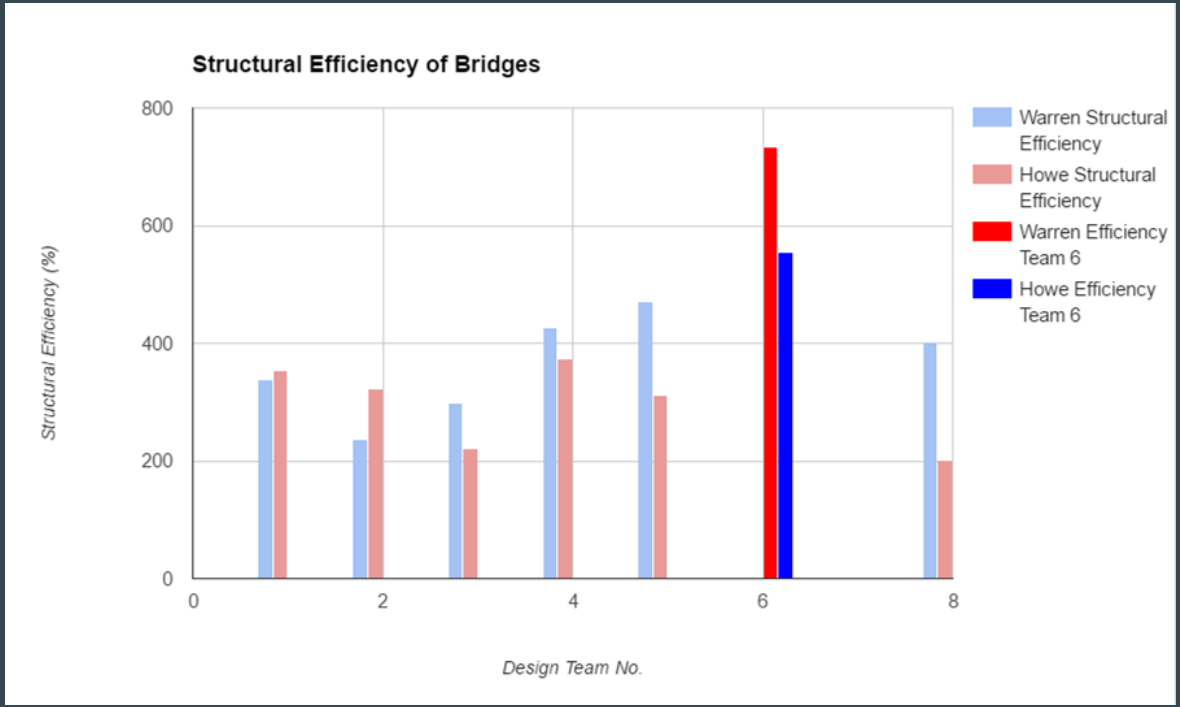
Both bridges were designed member by member by the analysis of tension and compression forces to produce a bridge that was the most cost efficient.

The Warren truss bridge was less costly with a final value of $203,843.22.

The Howe truss bridge came in at $214,354.93.

Results (Phase 2)

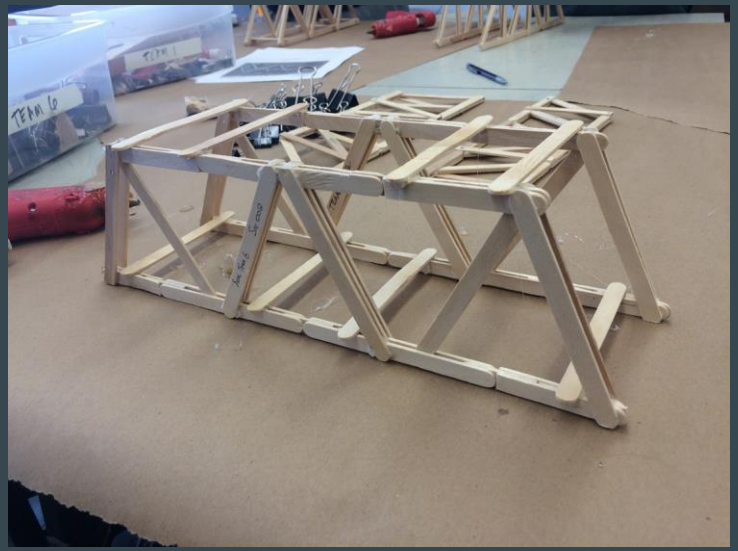
The Warren Bridge had a higher structural efficiency than the Howe in Team Six



Best Solution

The Warren Bridge is the less costly and more structurally efficient of the two bridges tested.

The design efficiency for the Howe according to the geomean SE is $674.07 /SE whereas the Warren is $520.01/SE



Conclusions

The new bridge spanning over Spring Creek along Puddintown Road in College Township, Centre County, PA should be the Warren Truss Bridge type because of it’s cost and structural efficiency advantages over the Howe Truss Bridge.

Recommendations

We recommend replacing the bridge with the Warren truss bridge type

We also do not recommend building the actual bridge out of Popsicle Sticks.

Also, we recommend hiring a geotechnical engineer to test the soil in the area to ensure that the design will not fail in future flooding events.