Design Project #1

Replacement of Vehicle Bridge over Spring Creek

Centre County, PA

Introduction to Engineering Design

EDGSN 100 Section 002

Team Purple Cobras

Design Team 3

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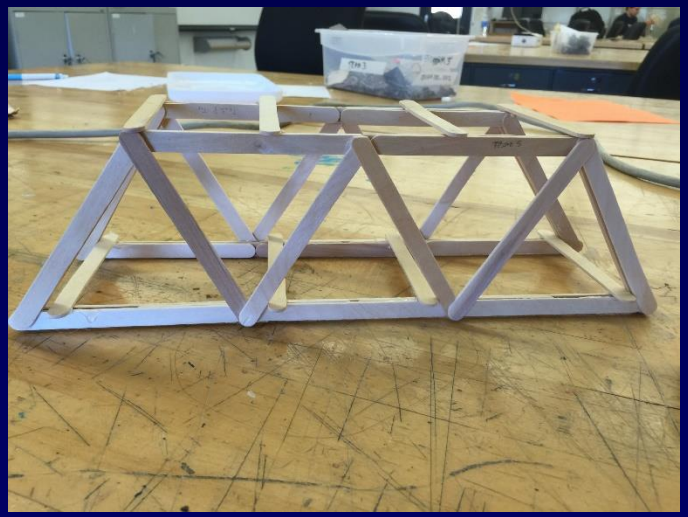
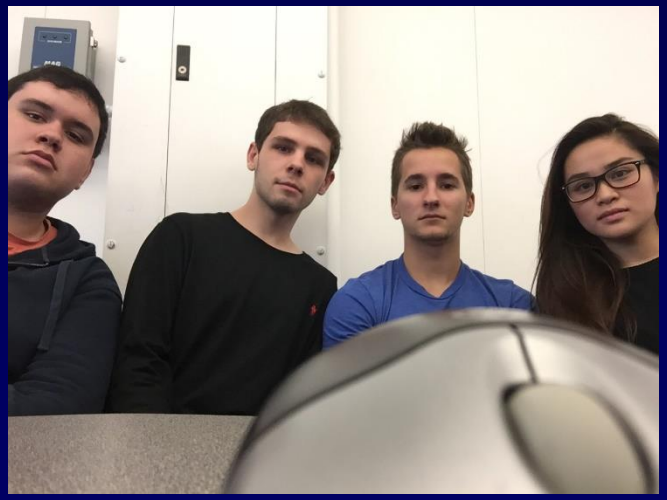




Presented to:

Prof. Berezniak

Fall 2015

PENNSTATE

Statement of Problem

Flooding in the area has caused a bridge to collapse. This bridge over Spring Creek took much of the traffic going into Mount Nittany Medical Center. The traffic now has to take a detour 10 miles around bridge. The detour creates an issue when emergency crews need to make it to the Medical Center.

Objective

A new bridge must be built in place of the destroyed bridge so that traffic can resume normal routes. The bridge should be built to the standards of the old one at the lowest cost.

Design Criteria

A few criteria were followed when building the bridge. The bridge must include: standard abutments, no piers (one span), 0.23 meter thick medium strength concrete for the deck material, no cable anchorages. It must be strong enough to hold two AASHTO H20-44 trucks (225kN) with one in each lane, with a 20-m deck elevation and 40-m deck span. Warren through truss and Howe through truss bridge shall be analyzed for use. Member and cross section materials shall be decided by the design team.

Technical Approach Phase 1: Economic Efficiency

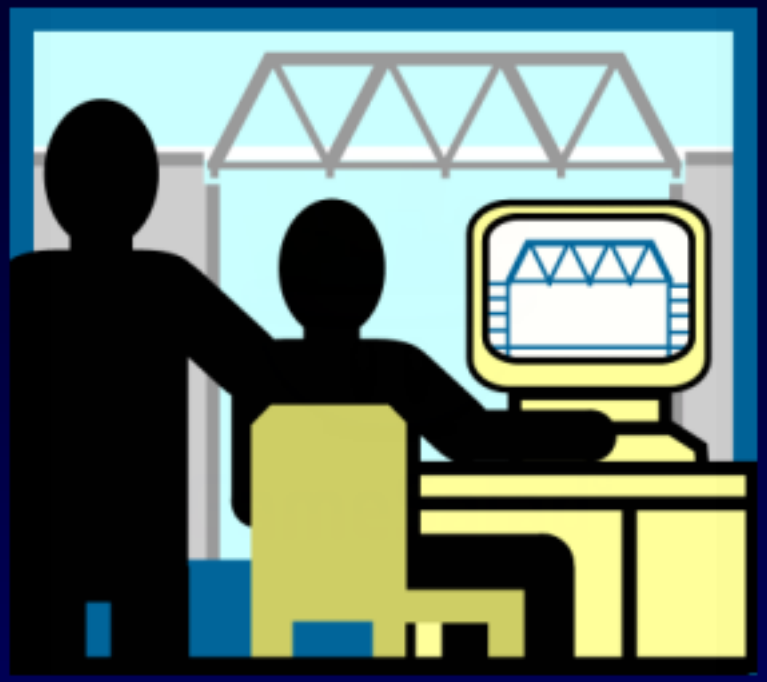
A few steps were taken to ensure it's economically efficient. Similar material of similar size were used to reduce cost. The Howe bridge was constructed out of only QTS tubes to reduced the cost greatly. The Warren bridge used two different materials, but it was made solely out of tubes as well.

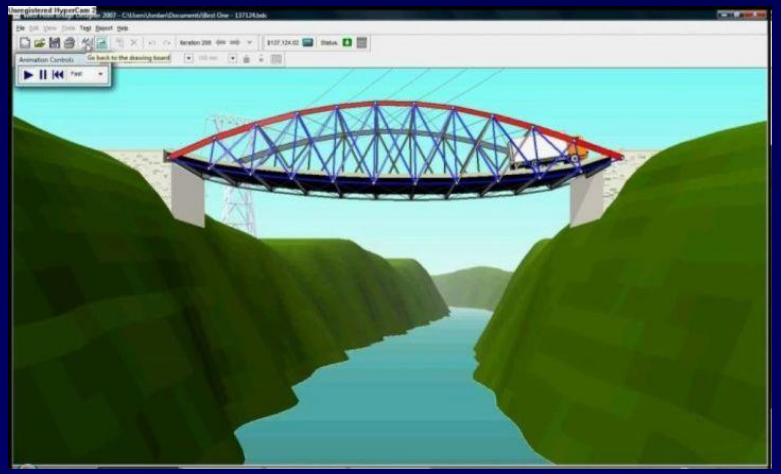
Technical Approach Phase 2: Structural Efficiency

Structural efficiency was calculated using the formula: load held divided by weight of the bridge. The structural efficiency for the Howe truss bridge was 282.46 307.88 for warren truss

Results Phase 1: Economic Efficiency

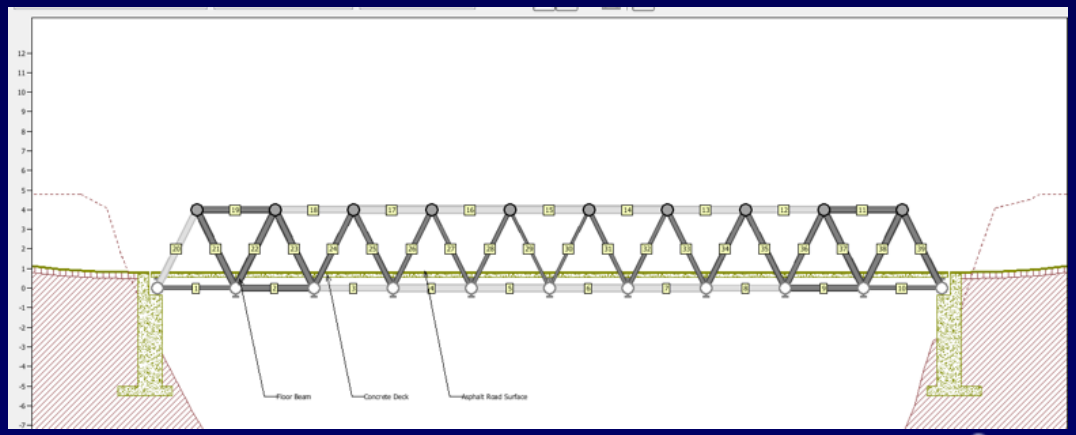
Using the Engineering Encounters Bridge Design 2015 (EEBD 2015), a Warren and Howe through truss bridge will be built to the lowest cost while performing to the standards of holding its own weight plus the weight of the live trucks.





Results Phase 2: Structural Efficiency

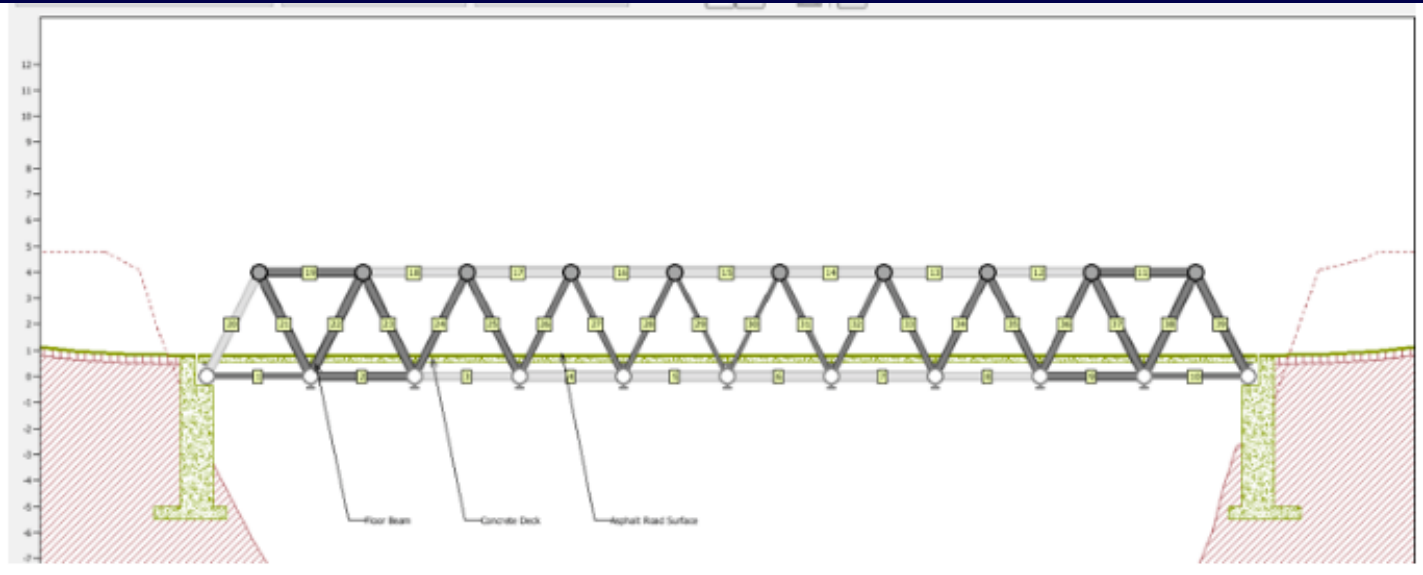
A prototype for each bridge shall be built and tested to catastrophic failure. The Structural Efficiency shall be measured by dividing the weight of the load supported by the bridge by the actual weight of the bridge.



Best Solution

The Warren Bridge

- More economically efficient
  - $223,400.49 compared to the Howe's cost of $229,839.09
- More structurally efficient
  - Looking at the average, maximum, and minimum structural efficiency, the Warren beats the Howe in each case
- Prototypes faired much better
  - In catastrophic failure less members and joints came apart.

Conclusions/Recommendations

The bridge that should replace the destroyed bridge should be a Warren through truss bridge because of its structural stability and low cost. The structural efficiency of this bridge was 308.29 compared to 282.46 produced by the Howe. The materials to build this bridge should be gathered and construction should start immediately. The online blueprint could be used directly to start the building of this bridge.