Design Project #1

Replacement of Vehicle Bridge over Spring Creek

Centre County, PA

Introduction to Engineering Design

EDGSN 100 Section 002

4 Girls 1 Guy

Design Team 8

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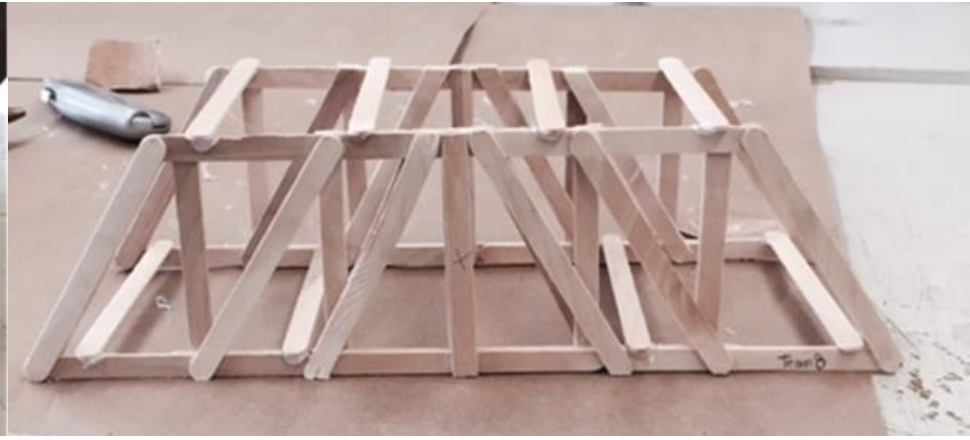


Statement of Problem

A structurally deficient vehicle bridge has collapsed due to extreme flooding.

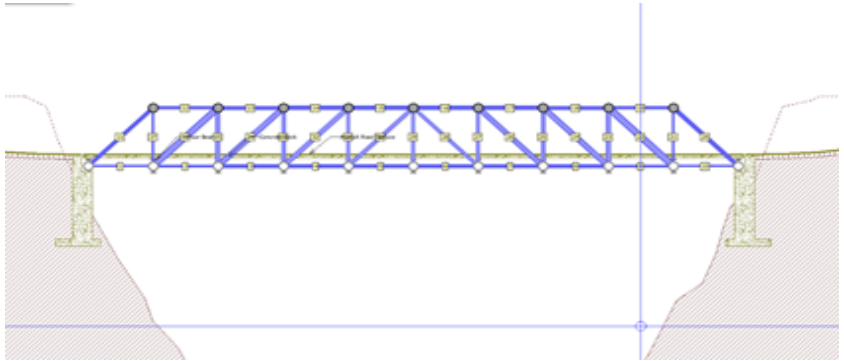
What: Bridge collapse
Where: Over Spring Creek on Puddington Road in Centre County, PA
Why: Extreme flooding
How: Collapse of main pier due to scour of its foundation
When: Too soon
Who: Design Team 8

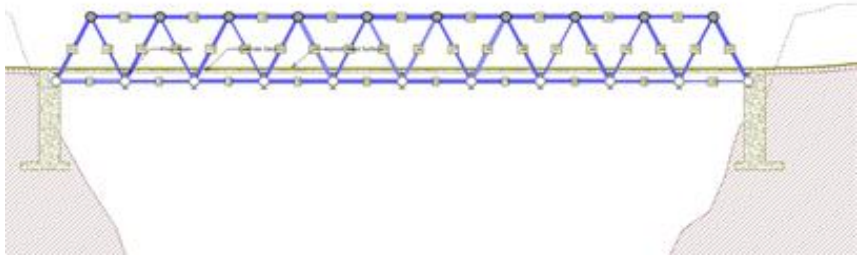
Cons of Collapse:

- Was a vital lifeline to Mt. Nittany Medical Center
- Heavy traffic needs rerouted 10 extra miles
- Emergency responders will take longer to reach and react to disasters

Objective

To design and replace new vehicle bridge design over Spring Creek due to the extreme flood





Design Criteria

- Standard abutments
- No piers (one span)
- Medium strength concrete (0.23 m)
- No cable anchorages
- Load of AASHTO H20-44 trucks (225kN)
- Bridge deck elevation at 20 meters
- Deck span is 40 meters

Howe Truss Bridge

- Carbon Steel
- Carbon Steel Bar
  - (110x110 mm - 160x160mm)
- Carbon Steel Tube
  - (120x120x6 mm - 240x240x12 mm)

Warren Truss Bridge

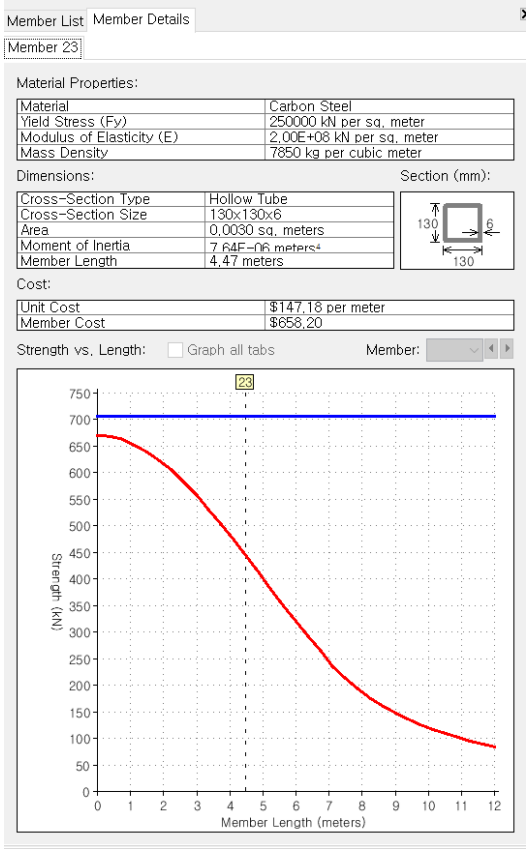
- Carbon Steel
- Carbon Steel Bar
  - (55x55 mm - 170x170mm)
- Carbon Steel Hollow
  - (100x100x5mm - 140x140x7mm)

Technical Approach Phase 1: Economic Efficiency

Make the cost as low as possible

Compression force / Strength,

Tension force / Strength as close to 1 as possible

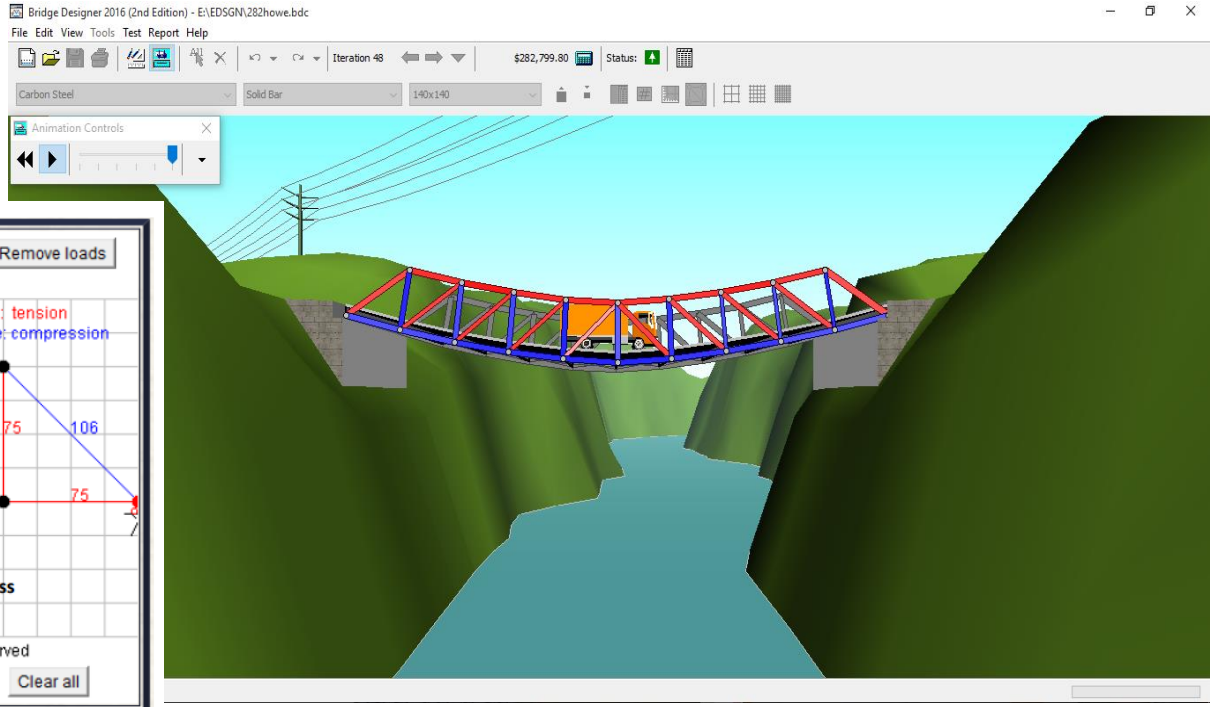


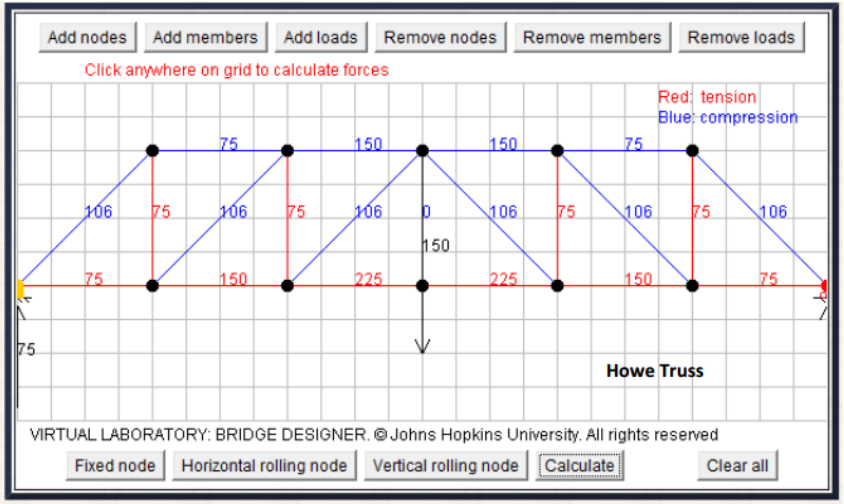
Technical Approach Phase 2: Structural Efficiency

Diagonals didn’t bear as much of the load

Middle portion - most flexible

Verticles - hollow tubes

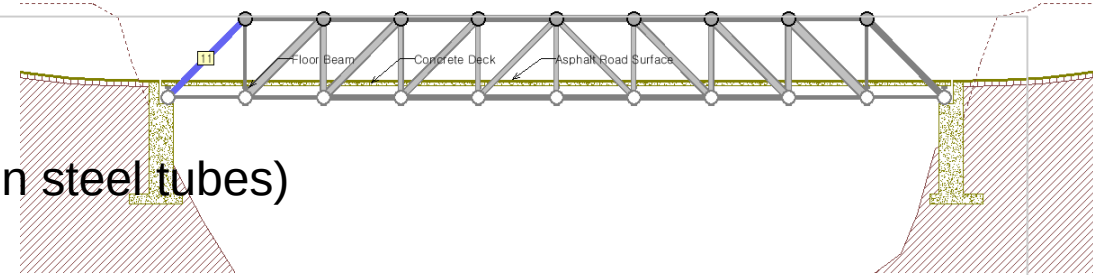




Results Phase 1: Economic Efficiency

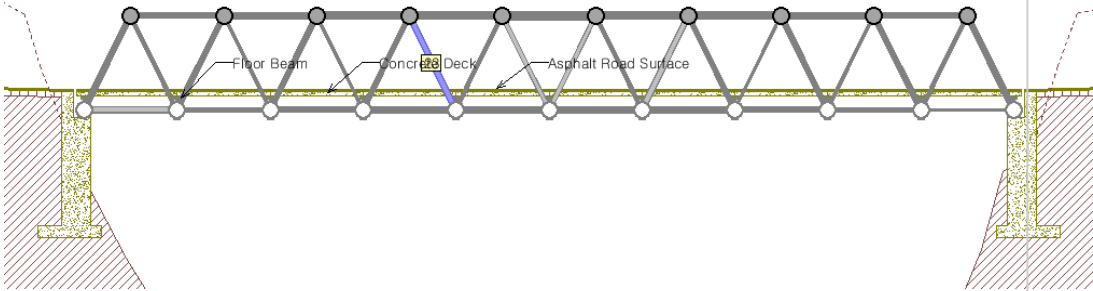
Howe : $256,465.20

(21 carbon steel bars and 16 carbon steel tubes)



Warren : $251,890.30

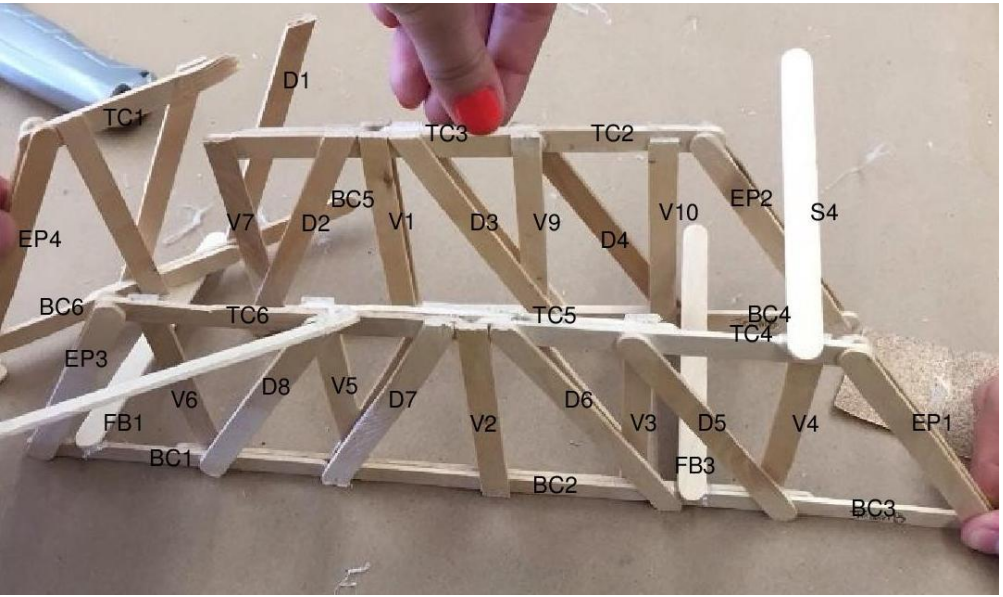
(34 carbon steel bars and 5 carbon steel tubes)

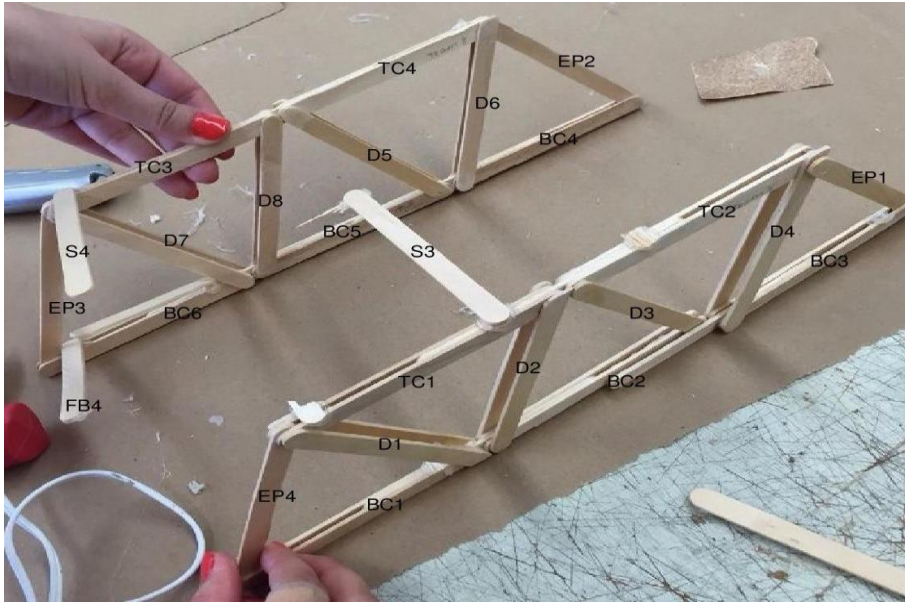


Results Phase 2: Structural Efficiency

Howe: 201 Average: 335

Warren: 405 Average: 411





Best Solution

Economic Efficiency

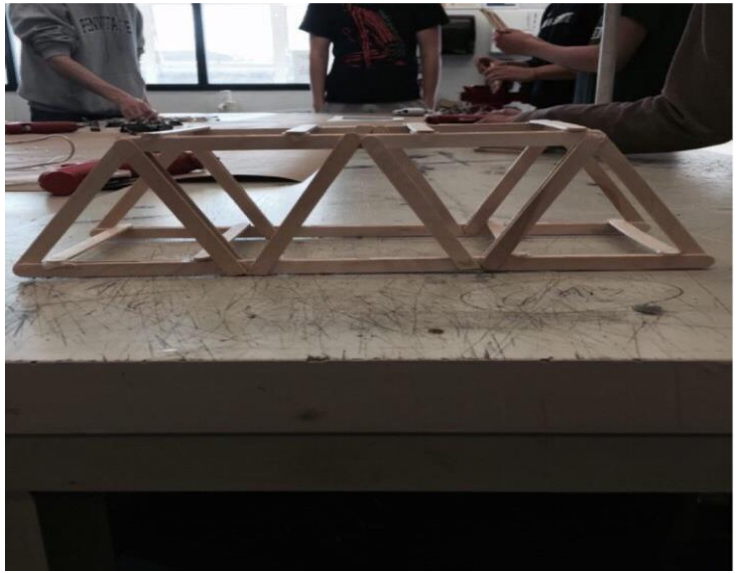
- **Howe: $256,465.20**
- **Warren: $251,890.30**

Structural Efficiency

- **Howe: 201**
- **Warren: 405**

Design Efficiency

- **Howe: $1276/one unit of structural efficiency**
- **Warren: $622/one unit of structural efficiency**

Conclusions

When comparing the two bridges, the Warren bridge proved to be less expensive to build and has a higher structural efficiency than the Howe bridge. Team 8 recommends that the Warren Bridge be built to replace the bridge over Spring Creek.