

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

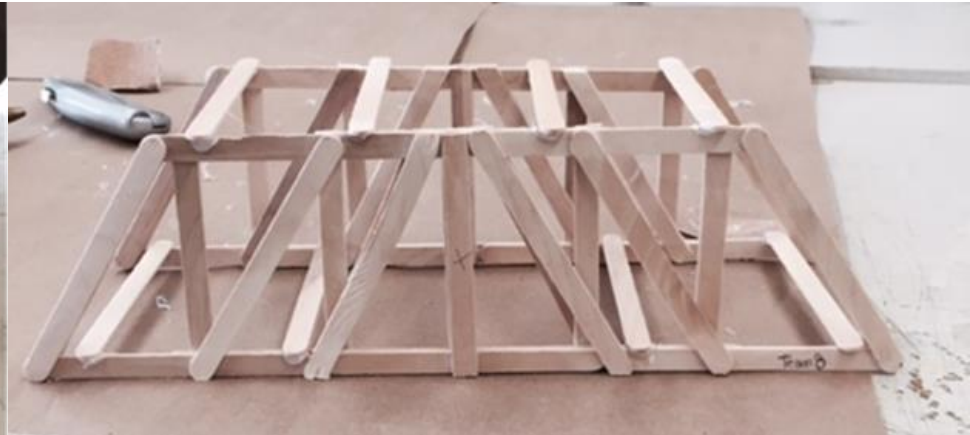
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Statement of Problem

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

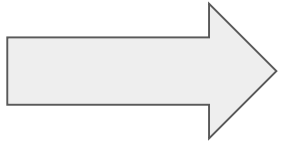
When: Too soon

Who: Design Team 8

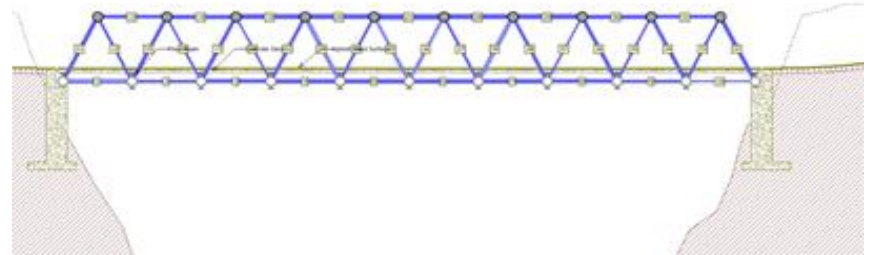
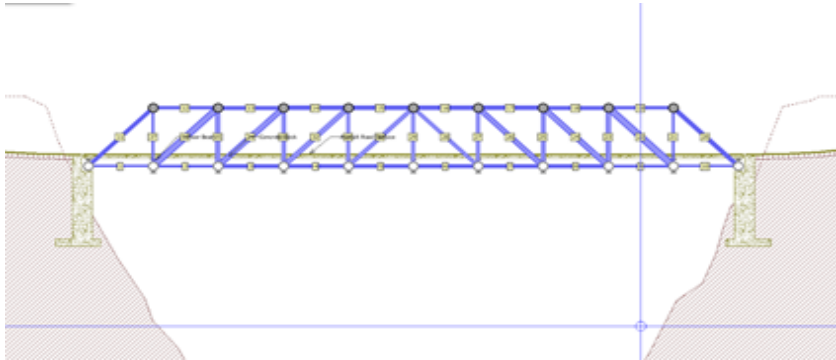
Cons of Collapse:

- 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)

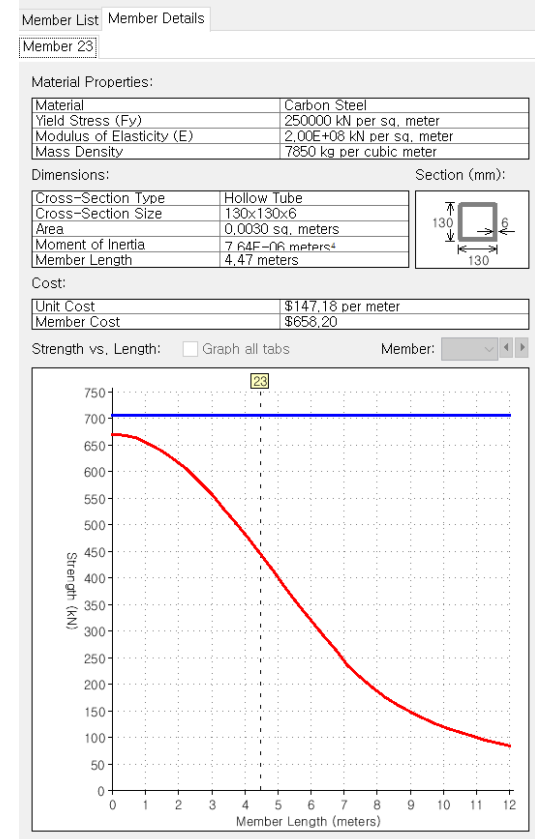
Technical Approach

Phase 1: Economic Efficiency

Make the cost as low as possible

Compression force / Strength,

Tension force / Strength as close to 1 as possible



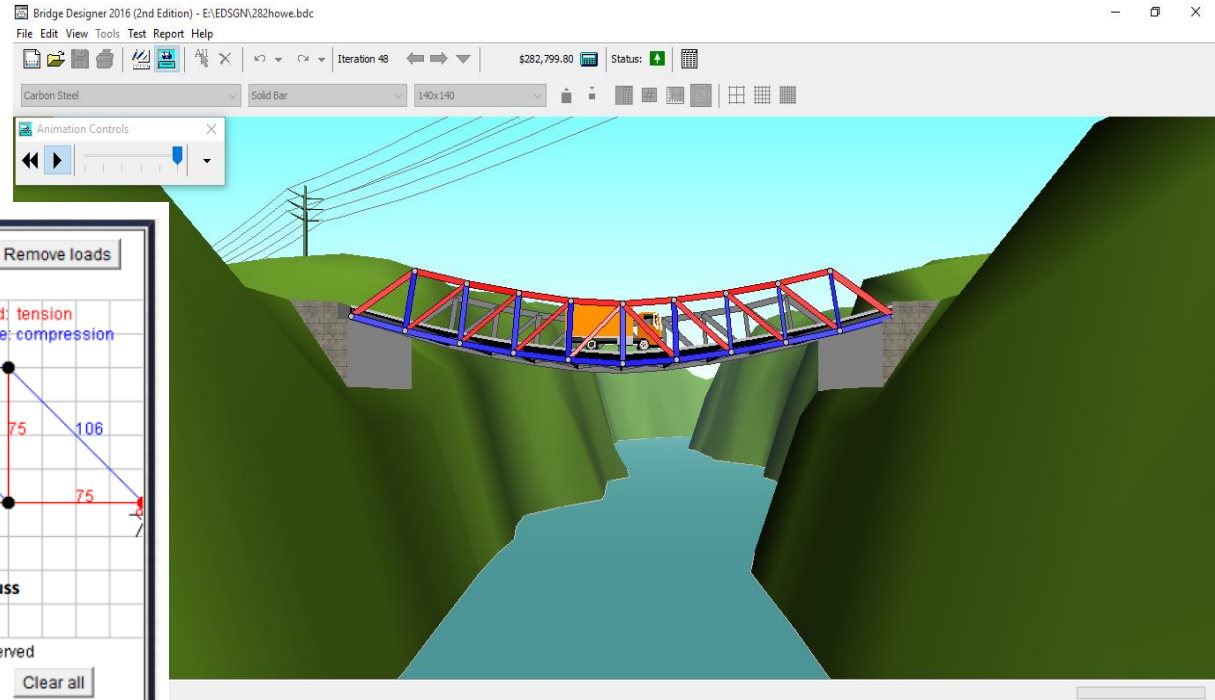
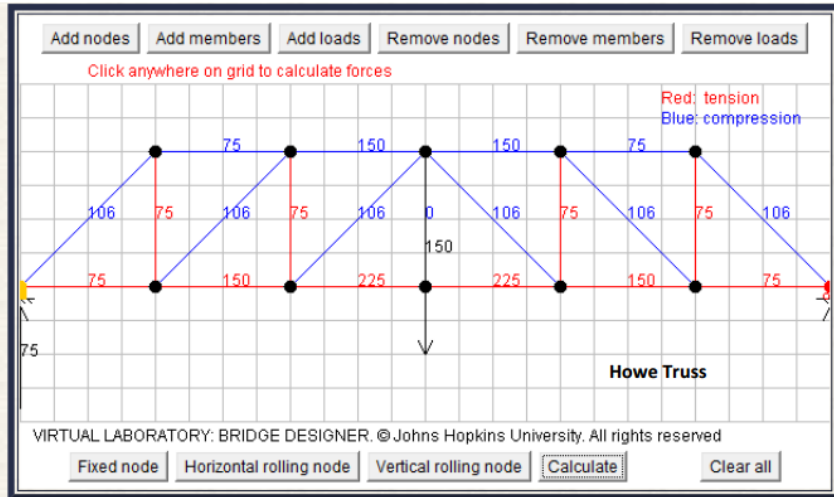
Technical Approach

Phase 2: Structural Efficiency

Diagonals didn't bear as much of the load

Middle portion - most flexible

Verticles - hollow tubes



Results

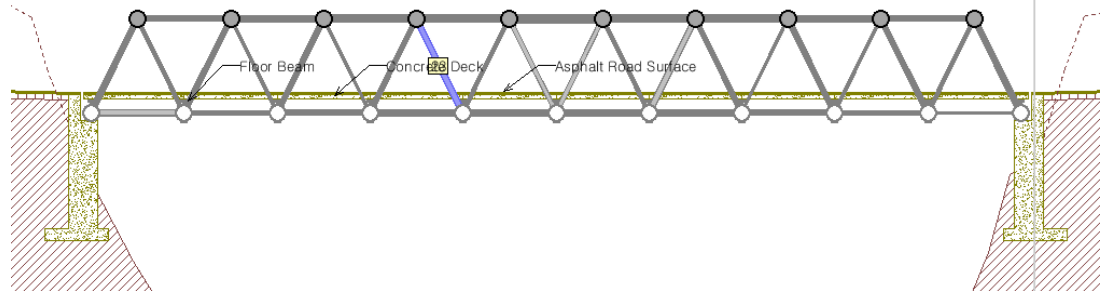
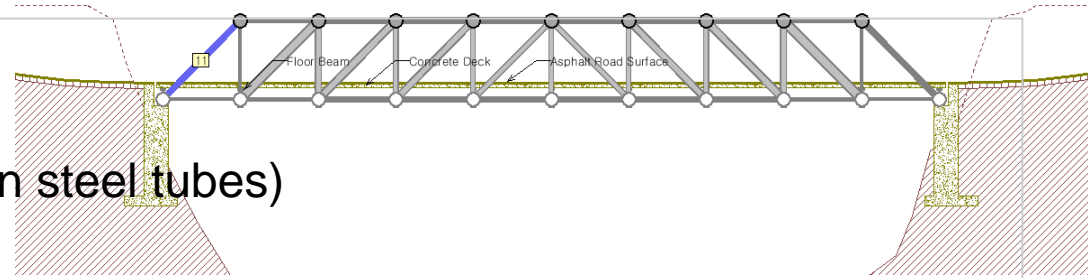
Phase 1: Economic Efficiency

Howe : \$256,465.20

(21 carbon steel bars and 16 carbon steel tubes)

Warren : \$251,890.30

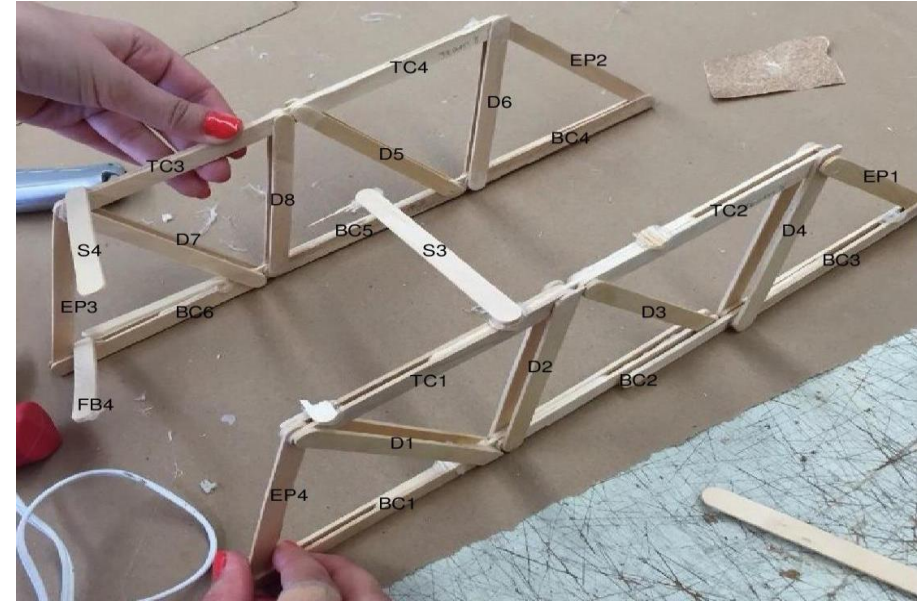
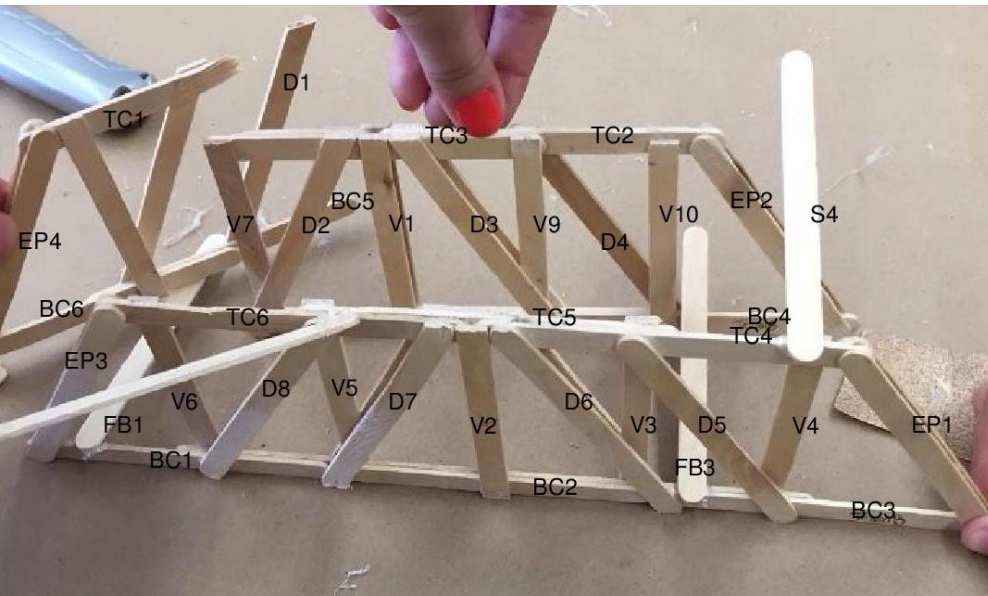
(34 carbon steel bars and 5 carbon steel tubes)



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.

