

Design Project #1

Replacement of Vehicle Bridge over Spring Creek

Centre County, PA

Introduction to Engineering Design
EDGSN 100 Section 001

Design Team 007

Aashish Nair

Hyeokjun Choi

Tanner Quiggle

Han Gia Tran



Presented to:
Prof. Berezniak
Spring 2016



Statement of Problem

- Bridge over Spring Creek collapsed due to local flood
- Hinder local traffic flow
- Residents of State College are now under several difficulties
- Reduce accessibility to necessities, including Mount Nittany Medical Center

➔ NEED A RELACING BRIDGE

Objective

- To create an effective replacement for the bridge quickly and efficiently
- To restore normal traffic flow & access to necessities

Design Criteria

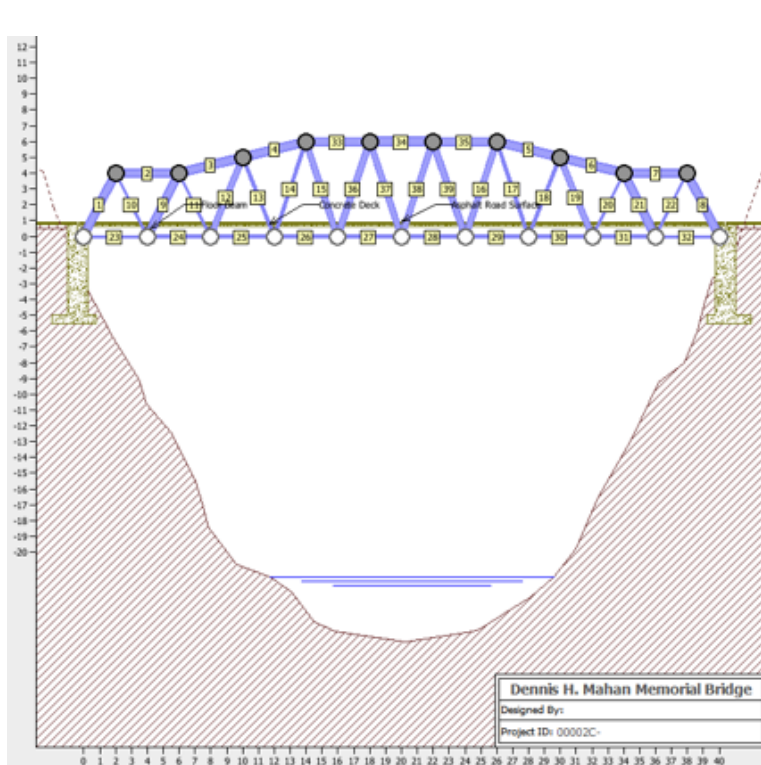
- Both bridges require:
 - Standard abutments
 - No piers, one span
 - Medium strength concrete for deck
 - No cable anchorages
- Must be able to support two AASHTO H20-44 trucks, one per lane
- Deck elevation: 20 meters
- Bridge span: 40 meters.

Technical Approach

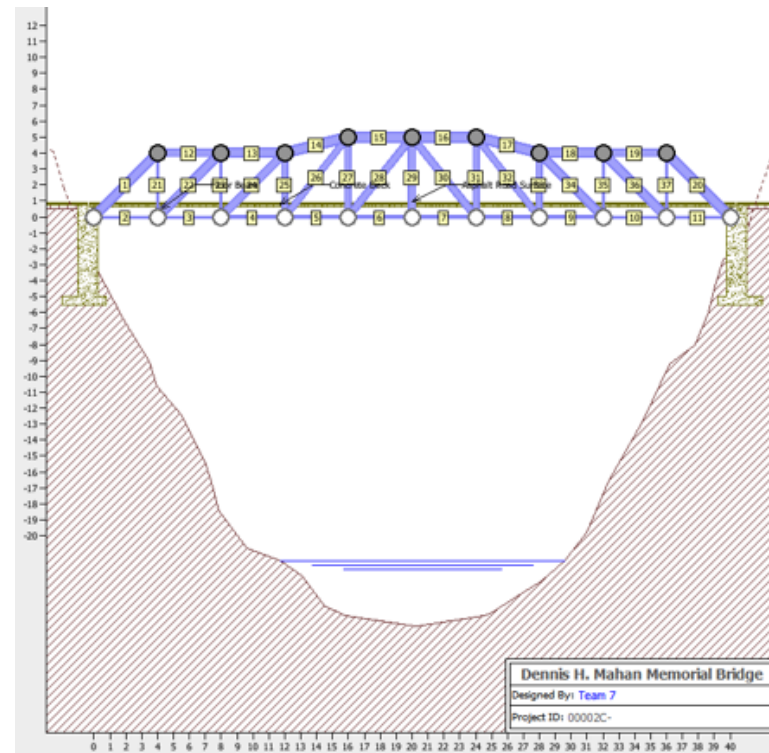
Phase 1: Economic Efficiency

- Determine Cost by Bridge Designer 2016 Software
- Maximize structural integrity + minimize cost

Warren Design



Howe Design



Technical Approach

Phase 2: Structural Efficiency

- Prototype built on:
 - At most 60 Wooden Popsicle Sticks as members
 - Elmer's Glue for joint connection
 - Hot Glue for floor beams and struts
- Load Testing:
 - Loading block hanged on the top center chords
 - Load sand and hammers until failure
 - Failure load measured
- Investigate the failed positions and the causes
 - Photographs before and after testing
 - Thorough analyses
 - Recommendation

Results

Phase 1: Economic Efficiency

- **Howe Bridge:**
 - Only Quenched and Tempered Steel
 - Higher Production cost (by \$1,000) for 8 types of members
 - Higher Material cost (by \$7,000)
 - Lower Connection cost (by \$800)
 - Same Site cost
 - Total: \$214,000
- **Warren Bridge:**
 - Only Quenched and Tempered Steel
 - Lower Production cost (by \$1,000) for 7 types of members
 - Lower Material cost (by \$7,000)
 - Higher Connection cost (by \$800)
 - Same Site cost
 - Total: \$207,000

Bridge Cost Analysis

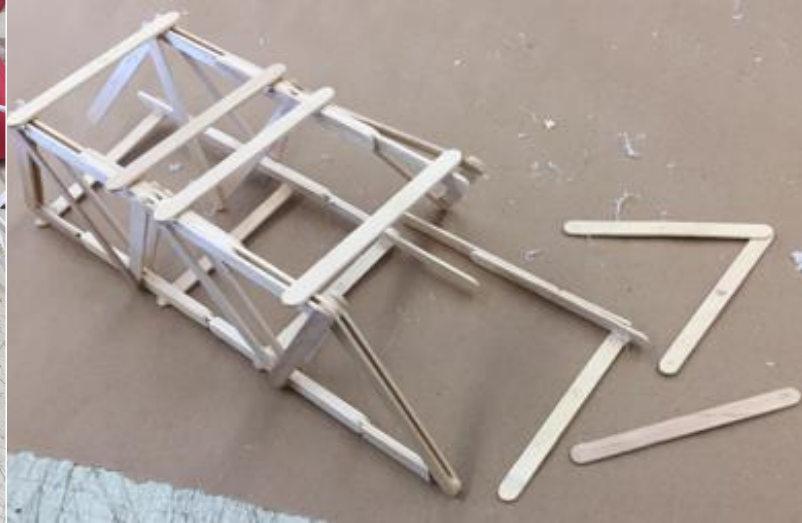
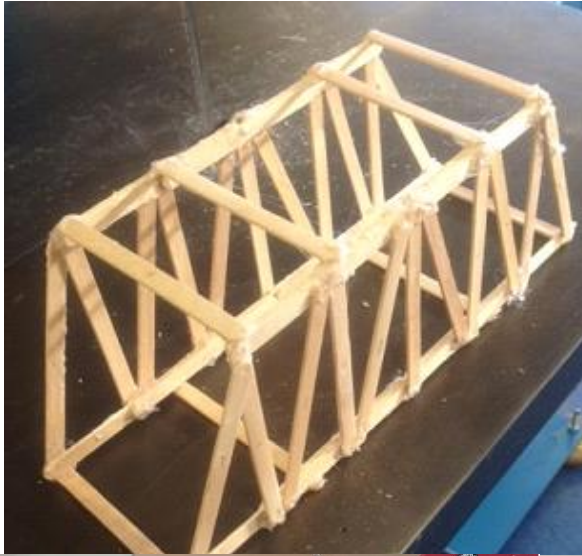
Costs	Howe	Warren
<i>Material</i>	\$108,634	\$101,693
<i>Connection</i>	\$16,000	\$16,800
<i>Product</i>	\$8,000	\$7,000
<i>Site</i>	\$81,400	\$81,400
TOTAL	\$214,034	\$206,893

➔➔ **Warren Bridge is more economically efficient**

Results

Phase 2: Structural Efficiency

Howe
Bridge



Warren
Bridge

➔➔ **Warren Bridge is more structurally efficient**

Best Solution

- **Warren Bridge**

- Lower production cost
- Structurally more efficient
- Lower design efficiency
- Higher constructability



VS



Conclusions

- The Warren bridge is better than the Howe bridge in terms of:
 - Economic Efficiency
 - Structural Efficiency
 - Design efficiency
 - Constructability

Recommendations

- Warren Bridge is highly recommended
- A professional engineer should review and adjust the design