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Truss Bridge Project

Description

This project gives students the chance to apply concepts learned in truss analysis to the design of a small road bridge. The project also introduces techniques for design and testing of structural models. Work is to be conducted in groups of up to four people. The project is divided into three parts: 1) initial conceptual design and analysis, 2) design development and testing, 3) post analysis and documentation.

Objectives

- to explore the geometric design parameters of a structural truss through bridge design.
- to perform quantitative analysis as a means of testing and evaluating a design.
- to test a design concept using a 1:64 (3/16" = 1') scale structural model.
- to document the results in a clear, well organized report.

Procedure

1) Develop a structural concept for a 2-lane vehicular bridge meeting the following criteria:
   - Function: accommodate a flat roadway to carry 2-lane traffic (10ft lane width)
   - Loads: each lane to carry 640 PLF (HS20 truck loading)
   - Geometry: 160 ft span, 52 ft maximum depth (below supports), unlimited height
   - Materials: wood, glue (no strength modifying of wood, i.e., coating in glue or other material)
   - Efficiency: maximize the load capacity to bridge weight ratio.
2) Analyze the design concept using either manual calculations or computer software:
   - Determine the magnitude and sign (tension or compression) of the force within each truss member.
   - Determine the cross-sectional sizing for each member based on the force calculations and the allowable material stress (**F = P/A** or **A = P/F**). See attached table for material properties of basswood.
3) Document initial design concept and quantitative analysis in a preliminary report.
4) Construct a structural test model (scale: 3/16" = 1'-0"). The model will be tested in class to determine its maximum load capacity. Load is applied with 5 lb. steel bars measuring 1 ½" x 2" x 5 7/8".
5) Produce a final report (see scoring rubric for more details) to include:
   - Explanation of the structural concept
   - Design and analysis with drawings
   - Test documentation and results
   - Discussion of results and possible improvements

Model Criteria

- Models are to be made entirely of basswood and glue. Additional basswood gusset plates at member connections are allowed. No steel pins or fasteners are allowed for the joining of members.
- Trusses must be constructed of individual members. That is, you may not laser cut a truss from a flat sheet of basswood. Based on the grain of wood, this would be counterproductive anyway.
- Maximum member cross-sectional dimension = ¼". If two pieces of wood are laminated together, the maximum thickness may not exceed ¼".
- Strength modifying of basswood (coating in glue or other material) is not allowed.
- Models must span a 30" gap (an exactly 30" long bridge will fall through), hang no further than 10" below the supports, and have a 1/8" maximum deck thickness.
- Models may bear only on the top surfaces of the support frame.
- Models must have a **FLAT,** continuous deck with a minimum of 4" width. It cannot be perforated.
- The models will be loaded on the roadway deck using 1 ½" x 2" x 5 7/8" steel bars.
- Bridge decks must be loadable, and able to accommodate the placement of steel weights.
- Models (wood + glue) may not weigh more than **4 ounces.**
- Models must carry a **minimum load of 50 lbs**. (10 steel bars)
- Ranking score is based on the ratio of load capacity to the weight of the bridge.
- Some points will be awarded based on class ranking of load-to-weight ratio.

Part	Due Dates	points
Preliminary Report	10.16.26	40
Model Testing	11.09.26	60
Final Report	12.07.26	150