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4.440 / 4.462 Basic Structural Design
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Beam Design Project

Working in teams of two, you will design a simply-supported beam to carry a heavy load at the center. The beam must span a clear distance of 24" and must support a 4" square loading plate at the center. The goal is to design a minimum weight structure which will support 100 pounds at the center. Though it should fail at 100 pounds, the structure should support 50 pounds with no visible deflection. A load plate (4"x4") must be supported at the center of the beam. Your beam must be less than 4" deep and less than 4" wide throughout.

Materials: You may use balsa wood and dental floss. Suggested properties of balsa wood:

Modulus of Elasticity, $E = 100,000$ psi

Failure Stress, $f_{cr} = 800$ psi (in both tension and compression, parallel to grain)

These properties vary substantially for balsa wood of differing density and quality. Similarly, the mechanical properties of dental floss vary.

You may use smaller balsa wood elements to build up larger sections, but no single component may have a cross-sectional area greater than 0.125 square inches ($1/8$ in²). (For example, you may use thin strips of balsa $1/4$ " x $1/2$ " to build up sections with an area greater than 0.125 square inches, but you may not use solid balsa pieces which are $1/2$ " x $1/2$ ".) No more than *four* pieces of wood may be glued together to make a built-up member. There are no restrictions on the type of glue used. If you are unsure about whether your proposed design is acceptable, please see your TA or the professor with questions.

Deliverables

Your final project must include a report with design drawings and supporting calculations. You should justify the failure mode with calculations. You should illustrate the plan and elevation of your structure with drawings or pictures, together with the cross-sectional properties of at least two key structural members. Your calculations should not exceed two letter size pages and the entire report must not exceed four pages.

Project Schedule

Week 5	Project assigned
Week 6	Form teams in lab
Week 8	Load testing of structures
Week 9	Project report due

Grading: Your project will be evaluated on the clarity and accuracy of your final report.