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4.440 / 4.462 Basic Structural Design
Spring 2009

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Structural Design Project

You will design a long span roof to serve as an open market and pavilion. A successful design will require minimal structural supports to avoid obstructing the interior views. You must provide at least 30,000 square feet of enclosed space on the ground level (about half the size of a football field). No other floors are allowed, though you may alter the elevations of the ground level as you like. At least one long span is required, with a minimum span of 100 feet. Your structure must provide a means for natural lighting as well as natural ventilation.

Loads

Your structure must support its own self-weight (dead load), plus a uniform live load of 30 psf for snow/wind. The structure must be able to support asymmetrical loads, such as the snow/wind load applied over one half of the roof. You must also propose a lateral load system. Detailed design calculations are not required for lateral loads, but you must have a strategy for resisting lateral loads due to wind and earthquake loading. You may use metric units throughout if you prefer.

Allowable Design Stresses

You should size the elements of your structure so that the axial stresses under all loading conditions do not exceed the allowable stress given below. Use the material density to compute the dead load.

<u>Material</u>	<u>Allowable Stress</u>	<u>Material Density</u>
Masonry (compression)	0.5 ksi	150 pcf
Concrete (compression)	1.5 ksi	150 pcf
Steel	15 ksi	490 pcf
Steel cable (tension)	30 ksi	490 pcf
Timber (tens. or comp.)	1.0 ksi	60 pcf

Deliverables

Your final project must include design drawings and supporting calculations. Your drawings should illustrate the plan and elevation of your structure, together with the cross-sectional properties of at least two key structural members. One critical structural detail must be designed and presented as part of the drawings.

Your design should include sufficient calculations to illustrate the structural action and the safety of your proposal. You may demonstrate safety with a graphical analysis or other equilibrium methods. Your calculations should include an estimate of the weight of the structure and the maximum vertical loads for design. Be sure to include the approximate weight of roofing or other external finishes. Your calculations should not exceed five pages of 8.5" x 11" and above all you should seek clarity in your design and analysis. Your complete proposal should be presented on a maximum of eight total pages of 8.5" x 11", or the equivalent sized poster. **Each design must provide the self-weight and embodied CO₂ emissions in pounds per square foot for your structure.**

Project Schedule

Week 11	Turn in preliminary calculations for project
Week 13	Final review