

Structural Stability

Introduction:

We have been involved with the process of structural design and analysis. This assignment will take the process to the next level of construction and testing. The class will be divided into groups that will build small, 4 sided structures. The structures will be required to support the gravity load supplied by students as well as a lateral load applied by a student. The purpose is to be able to think creatively about the means required to give the form stability and to be able to visually demonstrate the consequences when those elements are removed.

Objectives:

- To be able to analyze a structural problem
- To be able to generate alternative design concepts to solve the structural problem
- To be able to work with a group to select and develop a design concept
- To be able to solve a structural problem for vertical and lateral loads
- To be able to develop multiple systems to resist lateral loads
- To be able to construct a sound and stable structure
- To be able to document the design solution graphically
- To be able to work within a budget of money and time

Problem:

You will build a rectangular structural frame of 4 sides and a floor that will:

- Define a space large enough to contain one team member rotating 360° with arms outstretched in any direction when standing on the floor.
- Support 3 students at a level no less than 1' above grade on platform(s) attached to the structure. Members may not touch each other or any vertical support and must be able to remain standing while the initial lateral load is applied
- Contains at least 3 types of moment resisting elements. Different types of rigid connections will be counted as separate types of elements but the design must use at least one moment resisting element other than a rigid connection
- Allows you to easily remove or detach moment resisting elements to exhibit instability/racking, in at least 2 orthogonal directions and rotation in a horizontal plane. Connections must be removed in 30 seconds.
- You may not spend more than \$60, look for salvageable, recyclable materials
- No screws, nails or similar connectors may be used

Process:

1. Develop multiple design concepts
2. Review, as group alternate concepts for the success of the solution.
3. Review, as a group alternate concepts for cost and ease of construction
4. Select a design(s) to develop
5. Revise and refine design
6. Test design-make sure connections can be removed in 30 seconds. This will be timed.
7. Prepare a graphic representation of your project, sketch, photograph or drafted drawing showing and describing moment resisting elements
8. Construct your structure on the site, the concrete platforms of the courtyard.
9. Remove your structure by Friday afternoon

Requirements:

Structure

- Construct a sound and stable object capable of meeting the defined requirements
- Include moment resisting elements that can be easily removed or detached

Graphics

- Present in any media a representation of your structure identifying the moment resisting elements.

Data Sheet

- Show cost or origin of all materials. Attach receipts.
- **Donations of new materials are not allowed.**

	EXCELLENT	VERY GOOD	GOOD	AVERAGE	FAIR	POOR	INCOMPLETE
4 sides	10	9	8	7	6	5	2.5
Defines sufficient volume	10	9	8	7	6	5	2.5
Supports 3 team members without touching	10	9	8	7	6	5	2.5
3 or more moment resisting elements	10	9	8	7	6	5	2.5
Supports members at least one foot above grade	10	9	8	7	6	5	2.5
Creativity of removable/detachable elements	20	18	16	14	12	10	5
Connections are disconnected within 30 seconds	10	9	8	7	6	5	2.5
Demonstrates instability in vertical plane	10	9	8	7	6	5	2.5
Demonstrates rotation in horizontal plane	10	9	8	7	6	5	2.5
Craftsmanship	10	9	8	7	6	5	2.5
Creativity of stability systems	20	18	16	14	12	10	5
Efficient use of materials	20	18	16	14	12	10	5
Use of sustainable/recyclable materials	20	18	16	14	12	10	5
Complete, accurate and well drawn documentation	10	9	8	7	6	5	2.5
Complete receipts within budget	10	9	8	7	6	5	2.5
Aesthetic Qualities	10	9	8	7	6	5	2.5
TOTAL							