CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)

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Project Number

S0224

Project Title

The Effect of the Placement of Support Columns on the Structural Integrity of the World Trade Center

Abstract

Objectives/Goals

This expirement will acertain if the spread out placement of the support columns was a factor in the World Trade Center collapses

Methods/Materials

150 5"x0.75"x0.125" pine strips; 10.1' of 0.25"x0.25" wood dowel; 48 twist ties; 1 box cutter; 1 hack saw; 2 5"x5"x0.5" wood squares; 1 hot glue gun; 1 pair of shears; 1 drill; 1 8" inch drill bit (diameter doesn't matter); 1 0.31" drill bit; 1 ruler ; 1 stress anaylzer.

To summarize the procedures, two, 18" high, model towers were constructed out of the materials above. One tower, representing a twin tower, will have its support columns near the perimenter while the second tower will have it columns equidistant from the center and the corner. Both towers were placed into a stress analyzer which applied a compresion force from the top.

Results

The first tower, which represents the World Trade Center, was able to hold 662 pounds of force with 0.235 inches of displacement, while the second tower with the normal column placement was able to hold 894 pounds of force at 0.355 inches of displacement.

Conclusions/Discussion

When placed in the stress analyzer, The first tower, which represents the World Trade Center, was able to hold 662 pounds of force with 0.235 inches of displacement, while the second tower with the normal column placement was able to hold 894 pounds of force at 0.355 inches of displacement. The results are do to a difference of force vectors, which are the measure of a forces magnitude and force. During the stress test, the Newtons exerted on the towers, create two resultant vectors acting against each other. Each resultant vector consists od two, non-colinear, forces applied at one point, which, in this case, represents the support column. The first vector is the result of the two wood planks pushing against the column to secure it in place. The second resultant vector is the force of the two perimeter walls acting against the aforementioned wooden planks. The normal tower was able to carry more weight because the first and second vector were near equilibrium. For the spread-out design, the second vector is much small than in the normal tower as a result of the columns shorter distance from the wall. Since the first vector is disproportionally larger than the second vector, it means that there is more force pushing the column towards the corner than is pushing the column towards the center, causing quicker structural failure.

Summary Statement

This project is about anaylzing any possible defects in the current structure of our skyscrapers to avoid any future collapse and loss of life

Help Received

Used stress analyzer under supervision of Mr. Martin , my engineering teacher