CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
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Project Number
S0223

Project Title
A Bridge to Safety: Changing Bridge Frequencies to Reduce Resonance

Abstract

Objectives/Goals

Problem Statement:
Will changing the stiffness of steel cables that run through a bridge deck cause the frequency to change, and thus make it more resistant to resonant frequencies prevalent in earthquakes? My objective is to test a scale concrete bridge, measure its displacement with a set amount of weight, and determine if the frequency can be changed by the stiffness of the bridge.

Methods/Materials

Materials:
1Concrete Bridge (70cm x 6cm x 1.4cm); 1 Bridge Stand (75cm high); 2 Turnbuckles 2 lengths of steel cable (95cm minimum)1 Motion Detector; Bucket of Weight
Procedure:
1. Build concrete bridge with tubular holes to run cables through and tensioning device with turnbuckles.
2. Create stand for bridge, leaving enough room for bucket to hang as well as a stand for the motion detector.
3. Set bridge into place on the stand with the bucket hook in the middle of the bridge.
4. Attach necessary equipment to LoggerPro system on computer, and test the bridge displacement with the weight attached.
5. Repeat tests for 20 trials for every tension of the bridge.
6. Record displacement and use in frequency formula to determine changing frequencies of the bridge.
7. Draw conclusions.

Results

It was clear that the changing of the bridge stiffness altered the frequency. At the first stiffness, the bridge had a frequency of 98.3 Hz, while the second stiffness had a frequency of 342.4 Hz. This definitively proves that the frequency can be changed solely based upon the stiffness of a structure

Conclusions/Discussion

In conclusion, when a bridge#s stiffness can be changed through tensioned steel cables, then the frequency of the bridge will also change. I achieve a standard deviation of 0.004, proving that this experiment was not only accurate, but precise. Actual concrete bridges in the world can utilize this technique to prepare against resonance during large earthquakes.

Summary Statement

My project proves that changing the stiffness of the bridge in turns changes its frequency, and it is thus able to activly resist resonance during earthquakes.

Help Received

Father helped cut wood and use Excel; Mother helped on backboard