



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Garrett M. Warner	Project Number J0335
Project Title Effects of Base Isolators on Building Stability	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Because I live in southern California near the San Andreas Fault, earthquakes are a problem for my community. Due to this threat, I researched different technologies that improve the stability of buildings during earthquakes. I learned about some structural innovations known as base isolators. I designed an experiment to compare two of the most common techniques: the ball bearing base isolators versus the rubber technique. I hypothesized that the rubber base isolators that dampen the energy would provide more effective protection than the ball bearing isolators that reroute the energy into the motion of the balls.</p> <p>Methods/Materials For my project, I performed a total of 60 tests using 11mm and 6mm glass balls and 2mm and 5mm thick rubber pads. I created a model building from 150 Lego bricks, making sure it was strong enough to not collapse instantly, while weak enough so that it could eventually break apart under stress. I placed my structure on a shaker table on top of one of the test base isolators, or no base for the control. I started the shaking at 120 rpm and increased the speed in increments of 20 rpm every 10 seconds. I timed each test and recorded how long the structure remained intact. I performed 12 tests for each of the five base conditions and averaged the results.</p> <p>Results To my surprise, only in the ball bearings tests did the structure stand for the full 60 seconds. Overall, the structures on ball bearings remained intact 6.8 times longer on average than structures on rubber and 7.7 times longer than the control. In contrast, the structures on rubber remained intact an average of 1.9 times longer than in the control test.</p> <p>Conclusions/Discussion Both techniques improved the time the structure remained intact, but contrary to my hypothesis, the ball bearings were more effective. Although rubber base isolators provided nearly twice the stability as the control, the structure on ball bearings never collapsed, nor had any dangerous movement. My project confirms that use of base isolators could be helpful in preventing structural damage due to earthquakes. Based on my results, I would recommend that architects and engineers emphasize using ball bearing base isolators versus rubber base isolators for structures in earthquake areas.</p>	
Summary Statement The goal of this project was to compare the effects of ball bearing and rubber base isolators on the stability of buildings during earthquakes.	
Help Received My parents drove me to numerous stores so that I could purchase my materials, and also supervised my experiment. My science teacher loaned me a shaker table which I used in my tests. I completed all of the testing and analyzing of the data myself.	