



CALIFORNIA STATE SCIENCE FAIR 2012 PROJECT SUMMARY

Name(s) James D. Arias	Project Number S0302
Project Title A Study of the Relative Effectiveness of Two Building Foundation Isolation Techniques in Response to Equal Vibrations	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This experiment compares two base isolation techniques [ball bearing and lead-rubber bearing] and documents their behavior during a simulated earthquake. Using a shake table and models of the two base isolation techniques, the tests document the relative effectiveness of the two systems in damping building motion during an earthquake.</p> <p>Methods/Materials The main components of the project were a shake table and three generic model buildings that each used a different base isolation method (ball bearing made from marbles and wood, rubber bearing made from corkboard and washers, and the control which had no base isolation device). First, the model is placed onto the shake platform. A 0.6 lb cement cone is fixed onto the top of the building. The shake table is turned on, and time is started. The building is subjected to the motion until it fails. When failure occurs, time is stopped and recorded. If the building survives past the point of one minute and thirty seconds, then the test is stopped and recorded as "90.0 sec." Each method undergoes 20 trials. An average survival time is calculated for every building. The greater survival time documents the base isolation technique's overall success in limiting the potential damage a building might receive during an earthquake.</p> <p>Results The method that exhibited the greatest survival time was the ball bearing isolation; it had an average survival time of 90.0 seconds. The lead-rubber bearing isolation system averaged a survival time of 47.9 seconds. The building with no base isolation technique had an average time of 19.4 seconds.</p> <p>Conclusions/Discussion The most effective technique to lessen the movement of a building during an earthquake according to these trials is a ball bearing approach. It provided less friction for the building to move upon so there was no transfer of movement from the shake platform to the building. The difference in survival time, between this and the building that used no method, supports the use of base isolation in actual buildings. To conclude, this study strongly suggests that base isolation and energy dissipation should be considered in the construction of buildings. The ongoing seismic activity and increasing population will reach a point where earthquakes could prove more disastrous to human life than the present, and methods such as base isolation will be an important contribution to overall safety in any populated area.</p>	
Summary Statement Through the recreation of an earthquake scenario, this project highlights the benefits of using base isolation techniques in the construction of buildings.	
Help Received Father used power tools to assist in the building of the project; Starting point for shake table taken from Casey Hagbo	