



# CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

<b>Name(s)</b> <b>Ethan D. Maahs</b>	<b>Project Number</b> <b>J0319</b>
<b>Project Title</b> <b>A Study of How Different Forms of Base Isolation Affect the Maximum Acceleration of a Structure during Seismic Activity</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> My objective was to determine the most effective material at reducing maximum acceleration and vibrations during an earthquake. The secondary objective was to use materials that may be applicable to residential use.</p> <p><b>Methods/Materials</b> A shake table was constructed that was capable of multiple acceleration settings using a standard drill. A 1/20 building was constructed based on my own home. A 3-axis accelerometer was purchased and from Vernier and used with a Vernier LabQuest data logger with LoggerPro software borrowed from Fairmont Private Schools-Edgewood Campus. The accelerometer was attached to the shake table. A variable autotransformer was used to adjust the drill speeds to achieve accelerations equivalent to earthquakes with magnitudes of 7.0 # 9.7 on the Richter scale. Six (6) materials were tested 3 times at each drill speed setting. The peak acceleration was determined by reviewing the graphs generated by LabQuest and five (5) peak data points from each run were averaged to determine the average peak acceleration. Additional statistical tests were performed between all the materials to determine if there was a statically significant differences between the averages existed.</p> <p><b>Results</b> Tennis balls and carpet sliders were the most effective because the reduced the friction between the shake table and the house. Golf balls were not as effective as tennis balls because the house bounced up and down and the momentum of the golf balls increased the acceleration of the house causing the house to be destroyed. The other base isolation methods were ineffective and sometimes increased the acceleration of the building rather than reducing it.</p> <p><b>Conclusions/Discussion</b> The friction between the building and the ground causes seismic energy to travel throughout the building and damage it. Tennis ball were the most effective because they completely isolated the house from the shake table, but also prevented the building from bouncing up and down. Isolating the building from the shake table was not only factor that contributed to reducing the maximum acceleration, it was also important not to increase the momentum of the house because increased momentum increases the maximum acceleration. This was the case in with the golf balls.</p>	
<b>Summary Statement</b> The project was conducted to find forms of base isolation that effectively reduce the acceleration of buildings and homes during seismic activity.	
<b>Help Received</b> Father helped build shake table; Mother helped construct the house; Mark Hobbs helped revise my report; Amy Hoffman gave me the necessary materials for my board	