



**CALIFORNIA STATE SCIENCE FAIR  
2007 PROJECT SUMMARY**

<b>Name(s)</b> <b>Evelyn Chang</b>	<b>Project Number</b> <b>J0703</b>
<b>Project Title</b> <b>The Investigation of Different Earth Materials on the Seismic Response of a Building Structure</b>	
<b>Abstract</b> <b>Objectives/Goals</b> The main objectives of this project were to study 1) the structural response of a building when founded on different soil types under similar seismic loading and 2) the seismic performance of different soils when supporting similar building under similar seismic loading. My hypotheses are as follows: a) Buildings, in general, would show larger displacements when founded on medium dense sand and smaller displacements when put on rock, with the building on stiff clay showing displacements being somewhere in between the other two. b) The taller building will show larger displacements on soft soils than on rock, and the shorter building will show larger displacements on rock than on soft soils.	
<b>Methods/Materials</b> The model set-up consists of the model buildings, made of bamboo sticks tied with steel wire with bolts assigned to the joints in simulation of building mass; the three soil box each containing a different type of earth material(sand, clay, rock); and the shaking table. For each experiment, after affixing the soil box with the model building on the shaking table, a rotational speed ranging from 120 rpm to 150 rpm was applied to the shaking table for a period of five seconds. The movement of the soil box with model building was captured by digital camcorder positioned 500 mm away from the edge of the building. A cardboard with gridlines spaced at 12.7mm was placed 155 mm behind the building for the purpose of measuring displacement against its original position. The video clips of each experiment were analyzed to provide the basis of pinpointing the sequence, magnitude, and pattern of the building displacement.	
<b>Results</b> The buildings atop medium dense sand showed larger displacements, with the three-story building displaced and rotated more than the single-story one. The displacements were less when both the single-story building and the three-story building were founded on stiff clay. When placed upon rock, the buildings showed minimum or no displacement.	
<b>Conclusions/Discussion</b> In conclusion, buildings, especially high-rise buildings, built on sand site, will require special foundation design due to the relatively low rotational resistance and potentially large compaction of sand when subject to seismic shaking. The study of the effect of soil type and depth on ground shaking was inconclusive due to the design constraint of the shaking table and model set-up.	
<b>Summary Statement</b> The main objectives were to study 1) the structural response of a building on various soils under similar seismic shaking and 2) the seismic performance of different soils when supporting similar building under similar seismic loading.	
<b>Help Received</b> Father helped with the sawing and drilling of wood for the shake table; Used lab equipment at Associated Soils Engineering, Inc. under the supervision of the Senior Project Engineer, who is my father.	