



# CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

<b>Name(s)</b> <b>Kai T. Narum</b>	<b>Project Number</b> <b>J0810</b>
<b>Project Title</b> <b>Saturday Night Shake Down: Earthquakes and Soil Stability</b>	
<b>Abstract</b> <b>Objectives/Goals</b> The objective of my project was to find what soil (cat litter, dirt, sand) protected Lego towers the best against earthquakes on a shake table with varying voltage, building size and shape, and soils. <b>Methods/Materials</b> I built a shake table in which I placed three different soils (cat litter, dirt, and sand) and connected the shake table to a motor that spun a counterweight to simulate an earthquake. Cat litter was used as a substitute for unconsolidated gravel. I placed Lego towers with base to height ratios that ranged from 1.6 to 20 on the shake table, three at a time. Then I ran the shake table at 1.5 V and 3 V for 20 seconds and recorded the movement of the Lego towers and the time to fall of each tower. I repeated each experiment 4 times for a total of 120 trials. <b>Results</b> The cat litter was definitely the least stable. However dirt and sand had mixed results. The average time to fall for a 1.5 V earthquake was 19.3 seconds for cat litter, 25.5 seconds for dirt and 26.9 seconds for sand. The average time to fall for a 3 V earthquake was 9.9 seconds for cat litter, 15.1 seconds for dirt and 19.5 seconds for sand. Sand kept the Lego towers from falling the most but when the shake table shook the Lego towers would sink into the sand instead of falling over. Also the dirt was in the middle of the cat litter and sand in the protection factor. On all three soils, when the base to height ratio increased the Lego towers became more stable. Lego towers with a base to height ratio of over ten very rarely fell down. This occurred only twice over 120 trials. <b>Conclusions/Discussion</b> My results did not clearly support my hypothesis, which was that dirt would protect the Lego towers the best against the 1.5 V and 3 V earthquakes. I can conclude that cat litter was the least stable. Although sand kept the Lego towers from falling better than dirt it is on such a small scale and I could not measure the damage done to the Lego towers. So I can conclude that sand kept the Lego towers the best from falling but I could not measure damage so I would further this project by making a bigger scale and use real building codes to make it more realistic. The base to height ratio played a big part in my project, and a base to height ratio of ten marked a threshold for not falling down.	
<b>Summary Statement</b> The purpose of my project was to investigate which soils provided the most stability for Lego towers in simulated earthquakes.	
<b>Help Received</b> I received help building my shake table from my dad (with power tools) and my neighbor (with a power saw). I received help from my dad also with running my shake table because it is a two person job. I received help from my mom with my backboard layout.	