



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

Name(s) Martin R. Geier	Project Number J1807
Project Title Architecture vs. Liquefaction: Will Braces Ensure a Building's Survival During Liquefaction?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My objective is to determine if a brace added to the structural design of a building will keep it from falling during liquefaction. I believe a brace is needed.</p> <p>Methods/Materials Twenty-five different structural designs were drawn and used to construct models of buildings, after interviewing three geologists and a civil engineer. Each design for the model was tested three times. The designs for the models were: seven with no brace; eight of my own made-up designs; one cross-brace; two moment frames; four brace frames; and three pyramids. Each model was constructed of miniature marshmallows and round toothpicks, placed on a 3.78 liter Ziploc plastic bag filled with two liters of water on a cookie sheet, and tested by dropping a book from three centimeters at two-second intervals 15 times on the bag to simulate liquefaction.</p> <p>Results Of the un-braced models only 14% succeeded. Fifty percent of the braced models were successful and are categorized as follows: 100% of the pyramids, 100% of the cross-braces, 50% of the moment frames, 50% of the brace frames, and 25% of the made-up designs.</p> <p>Conclusions/Discussion In conclusion, the braced models successfully withstood liquefaction in significantly higher numbers than did the un-braced models. My hypothesis was incorrect because not every braced model succeeded; one un-braced model succeeded due to its large base size. Only the pyramid design was completely successful through three stories. This data is applicable to architects and civil engineers in designing structures able to withstand liquefaction.</p>	
Summary Statement My project determined if a brace added to the structural design of a building kept it from falling during liquefaction.	
Help Received Aunt helped with idea, oversaw project, and proofread my work; Uncle helped build display board; Mr. Dee Jasper, civil engineer, gave me brace ideas; Mr. Karl Gross, Mr. Michael, and Mrs. Darlene Mercer, geologists, gave me information on liquefaction.	