



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Chad J. Wakamiya	Project Number J0327
Project Title The Best Semicircle Arch Design: What Angle Voussoirs Are the Strongest?	
Abstract Objectives/Goals The objective is to determine if the angle and number of voussoirs have an effect on the pressure a model semicircle arch can hold before collapsing. I predicted that a semicircle arch with more voussoirs at smaller angles would hold more pressure. Methods/Materials Five model semicircle arches were constructed with the same span and height. Each arch had a different number of voussoirs at corresponding angles. One arch had 7 voussoirs; another had 9, and so on until reaching an arch with 15 voussoirs. The angles corresponded with the number of voussoirs so that each arch had a total of 180 degrees. The arches were each tested 10 times by applying mass blocks to the keystone to test how much pressure the structure could hold before collapsing. Results The semicircle arch with 11 voussoirs at 16 degree angles held the most pressure and proved to be the strongest design. The arches with voussoir angles greater or less than 16 degrees held less pressure. Conclusions/Discussion The angle and the number of voussoirs contribute to the strength of a semicircle arch. The keystone falls easily if the angle is too small, so a large enough angle is necessary for the stability of the arch. If there are too few voussoirs, each voussoir is put under great pressure and the sides of the arch slide outward, so multiple voussoirs are important. The semicircle arch with 11 voussoirs at about 15 to 17 degrees proves to be the strongest design.	
Summary Statement My project found the strongest semicircle arch design based on the angle and the number of voussoirs.	
Help Received Mother and Father helped me edit report. Teacher, Mr. Miller helped mentor me throughout the project.	