



**CALIFORNIA STATE SCIENCE FAIR  
2004 PROJECT SUMMARY**

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| <b>Name(s)</b><br><b>Robert A. Carstens</b>  | <b>Project Number</b><br><b>J1803</b> |
| <b>Project Title</b><br><b>Concrete Breakers</b>   |                                       |
| <b>Objectives/Goals</b><br>The objective of my project was to find out if the ratio of sand to cement changes the strength of concrete. My hypothesis states that the ratios between 60% sand / 40% cement to 60% sand / 40% cement would be the strongest ratios.   |                                       |
| <b>Abstract</b><br><b>Methods/Materials</b><br>I tested 11 different ratios of sand to cement. I tested 100% sand / 0% cement, 90% sand / 10% cement etc. I made a form by taking two pieces of angle iron and put the bottoms together so that I had a small box. I taped a piece of expansive joint every eight inches to make nine sections. I then calculated the amount of sand and the amount of cement I needed for each ratio. I mixed up the first ratio and poured it into each section of the form. I took the bricks out of the form after twenty-four hours. After I took the bricks out I had nine 2x2x8 bricks of concrete. I then let the bricks cure for another two weeks. I did this for every ratio. To break the bricks, I supported the brick over two tables. I then centered the brick over the two tables and slid a metal bar, that had a half hook on the other side, over the brick. Then I centered that on the brick and between the two tables. After that I attached an 's' hook to the half hook on the bottom of the metal bar and attached a bucket to the other end. |                                       |
| <b>Results</b><br>After I broke all of the bricks I found that my hypothesis was wrong. I found that the strongest ratio was 30% sand / 70% cement, holding an average of 25.46 kilograms. I found that the more cement you add the stronger the concrete gets until it is over 70% cement, then the concrete gets cracks in it. As the amount of sand decreases, the concrete is stronger.  |                                       |
| <b>Conclusions/Discussion</b><br>In conclusion people should not use any ratio other than the ratio 30% sand / 70% cement if they want the strongest and the safest results. If you use a weak ratio in bridges or buildings, they could fall because the concrete is not strong enough to handle the weight.  |                                       |
| <b>Summary Statement</b><br>In my project, I determined if the ratio of sand to cement changes the strength of concrete.   |                                       |
| <b>Help Received</b><br>I received help from my science teacher on deciding how to break the concrete.   |                                       |