



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

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Project Title
Can the Strength of Concrete Be Increased Without Adding Cement?

Abstract

Objectives/Goals
My goal was to increase the final strength of concrete by adding aggregates. I had no objectives.

Methods/Materials
The experimenter mixed pre-packaged concrete mix with water and filled three plastic test cylinders for the control group. Steel fibers were added to an identical batch of concrete at 2% of cement volume weight. Three cylinders were filled with this concrete referred to as the steel batch. Fibermesh was added to a second variable batch, and an additional three cylinders were filled. These cylinders are referred to as the fibermesh batch. A third variable batch was mixed, adding plastic at 2% the cement volume weight, and three more cylinders were filled. This batch is referred to as the plastic batch. All the cylinders were allowed to damp cure at a temperature of 22.2C.

1. Eight 40.5 Kg bags of pre-mixed Quikrete concrete mix
2. Three plastic test cylinders
3. Fifty-six grams of fibermesh.
4. Three kilograms of steel fibers.
5. Three kilograms of high impact plastic particles.
6. One Imer cement mixer.

Results
The concrete batch produced three cylinders that tested 31.50 MPa or higher at twenty-eight days of curing. This exceeds the manufacturer's design for strength. The plastic batch produced one cylinder at 31.33 MPa, one cylinder at 31.50 MPa, and one cylinder at 31.67 MPa. The fibermesh batch cylinders were all above the control batch average. They tested at 32.29 MPa, 32.15 MPa, and 32.22 MPa. The steel batch was the strongest concrete, testing at 32.91 MPa, 34.00 MPa, and 32.74 MPa. Eight of the nine variable cylinders equaled or exceeded the strength of the standard concrete cylinders.

Conclusions/Discussion
The fibermesh and steel batches all produced concrete that exceeded the strength of standard concrete. Two of the three plastic batch cylinders met or exceeded the strength of standard concrete. Inert materials can be added to standard concrete to increase the final strength of the mix.

Summary Statement
My project is to see if concrete can be strengthened without adding extra cement.

Help Received
Father helped in experiments; John Johnson provided lab and equipment; John Rodriguez gave mixed designs and suggested ratios; Tyler Collins provided capping compounds and other testing materials; Al White cut finished test cylinders for display; Paz Espinosa provided plastic cylinders and cement mixer