CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
S0322

Project Title
Feasibility of Recycling Scrapped Tires and Silica Fume into Super-Duper Concrete

Abstract

Objectives/Goals
The objective is to evaluate the dynamic properties of the proposed rubberized silica fume concrete, which includes the damping ratio, seismic response, compressive strength, and Young's modulus.

Methods/Materials
Material for preparing normal, rubberized silica fume concrete specimen includes cement, sand, 10 mesh recycled rubber crumbs, 5 mm diameter steel bars, silica fume, and tap water. Experiments on compressive strength and deformation, free vibration, shaking table tests, and ductility of rubberized concrete structural samples were conducted.

Results
The results show that the average damping ratio of the rubberized concrete columns is 7.7 compared with 4.7 for the normal concrete columns. The peak response acceleration of the rubberized concrete columns in shaking table tests is 26% less than those of the normal concrete columns. However, the rubberized concrete dropped as many as 57% of the compressive strength for the 20% rubber replacement specimen. Introducing silica fume on the aggregate's surface is an effective way to improve interface bondings. Results from the rubberized silica fume concrete show the significant improvement in the compressive strength and Young's module of elasticity.

Conclusions/Discussion
The rubberized concrete structure suffers less seismic force than a normal concrete structure. This is because rubber can absorb the kinetic energy caused by the earthquake and transfer it into thermal energy. At the same time, coating the crumb rubber with silica fume will improve the bonding between crumb rubber and cement. This will mitigate the side effect of a decrease in compressive strength. In conclusion, the proposed rubberized silica fume concrete is promising. As a new construction material, it has its niche because of the superior performance in absorbing kinetic energy. Furthermore, the super-duper rubberized silica fume concrete is a future green material.

Summary Statement
Proposed rubberized silica fume concrete is feasible for a new type of green construction material

Help Received
Used lab equipment at UC Irvine with helps from lab technical assistants