

## CSEF Official Abstract and Certification

Word Count

246

Fair Category

PST

Project  
Number

6502

**Title:** The Effect of Altering The Material Composition in Ultra High-Performance Concrete (UHPC) With Regional Materials On Compressive Strength

**Student Name(s):** J. Ho, N. Magold

### Abstract:

Ultra High-Performance Concrete (UHPC) is a modified concrete mixture with higher compressive strength and durability than standard concrete. UHPC exhibits stronger performance due to a blend of fine aggregates, cement powder, and water, which form a dense matrix. This study investigates the task of developing cost-efficient and environmentally conscious concrete with regional materials.

The first phase of the investigation created a new UHPC mixture utilizing Holcim IL (10) MS, a cement powder with higher calcium carbonate levels, a cheaper and environmentally friendly material. A control mixture utilizing Holcim II/V was developed conforming to standard UHPC mixtures. Mixtures were poured into cubic molds then left to cure in a controlled environment or a steam curer. Cubes were then tested for ultimate compressive strength at different time intervals after pouring.

When cured in standard conditions, the new mixture had a compressive strength 86% as strong as the control and nearly 7 times stronger than traditional concrete. When cured in a steam curer, the new mixture had a compressive strength 83% as strong as the control and over 8 times stronger than standard concrete. The increase in compressive strength of the new mixture compared to standard concrete allows for infrastructure to be developed with higher peak loads in a cheaper and eco-friendly manner. Increases in compressive strength indicate an increased lifespan of structures. This means that infrastructure can be built to last longer at cost-efficient rates. Ongoing experiments will provide stronger solutions to infrastructure.

### Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- |                                             |                                                                  |
|---------------------------------------------|------------------------------------------------------------------|
| <input type="checkbox"/> human subjects     | <input type="checkbox"/> potentially hazardous biological agents |
| <input type="checkbox"/> vertebrate animals | <input type="checkbox"/> controlled substances                   |

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No

3. This project was conducted at a Registered Research Institution. ☒ Yes ☐ No

4. Is this project a continuation? ☐ Yes ☒ No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No