AN ABSTRACT OF A THESIS

HIGH FINES LIMESTONE SCREENINGS AS FINE AGGREGATE FOR PRECAST PORTLAND CEMENT CONCRETE

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Byproduct usage is becoming necessary due to the increasing emphasis on environmental stewardship. Quarry byproducts like screenings are being produced much faster than the demand. Because limestone screenings are angular and have a high fines content, they require a high paste content which makes them impracticable for standard concrete. However, precast/prestressed concretes already have a high paste content making the union of limestone screenings and precast/prestressed logical. The purpose of the research was not to prove limestone screenings are a superior fine aggregate, but to show limestone screenings as a fine aggregate can meet precast/prestressed specifications.

Four mixes were tested; two contained limestone screenings as a fine aggregate and two contained river sand as a fine aggregate. The mixes were tested for plastic, structural, and durability properties. The test specimens were cured in a way that simulated the curing precast members undergo. The results of the testing were compared to TDOT Class P and other precast concrete criteria.

PCC mixtures can be proportioned meeting TDOT Class P utilizing limestone screenings as a fine aggregate. Precast concrete with good workability and durability can be made with screenings as a fine aggregate. Because screenings are angular and have high fines contents, the workability suffered. The loss in workability was mitigated with an increase in the water to cementitious ratio. The increase in the water to cementitious ratio led to a decrease in compressive strength and tensile strength and an increase in shrinkage and absorption. It was found that the Ahmad and Shaw tensile strength prediction equation worked well for mixes that included limestone screenings as a fine aggregate. The ACI 318, ACI 363, and Ahmad and Shaw modulus of elasticity prediction equations over-predicted the modulus of mixes that incorporated limestone screenings. The ACI 209 shrinkage prediction equation under predicted shrinkage for mixes incorporating screenings.