

AN ABSTRACT OF A THESIS

VERY EARLY STRENGTH NON-EXCAVATABLE CLSM

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Highways, interstates, and other roadways are constantly under repair. Roadway repairs can stem from subgrade and base issues or from the maintenance of underground utilities. These repairs cause temporary lane closures and therefore are directly responsible for traffic congestion, user delays, worker safety issues, and possibly monetary penalties issued to contractors. In this study, four categories of very early strength non-excavatable CLSM were developed. The four categories of TTU Lightning CLSM would allow for much quicker roadway repairs than typical backfill methods.

The four categories of TTU Lightning CLSM used three different cementitious materials, three different fine aggregates, and one coarse aggregate. Twelve total mix designs were produced and tested for plastic properties of flow and unit weight as well as the hardened properties of California Bearing Ratio (CBR), compressive strength, and static modulus of elasticity.

Each category of TTU Lightning CLSM had at least one advantage when compared to the other categories of Lightning CLSM. Some categories were produced with more common materials while others were produced with more environmentally-friendly materials. One category contained coarse aggregate, making it stiffer and more likely to be used as a base repair material. Another category was produced with Type III portland cement, allowing it to gain strength quickly even in cold weather applications.

All mix designs had adequate plastic properties: flow greater than or equal to 8 inches and if applicable, entrained air content less than or equal to 30 percent. The hardened properties also met all project requirements. All four hour and six hour compressive strengths were at least 10 psi and 30 psi, respectively. The 24 hour strengths were in the range of 224-831 psi. The 6.5 hour CBR values were in the range of 19-142 percent, with 24 hour CBR values in the range of 89-880 percent. The 24 hour static modulus of elasticity values ranged from 700 – 1950 ksi and 28 day values ranged from 1600-5100 ksi.

The relationship between static modulus of elasticity and CBR was found to be good. The relationship between the compressive strength and static modulus of elasticity was determined to be fair at 24 hours and good at 28 days. The ACI 318 and Ahmad and Shah static modulus of elasticity prediction equations proved to be good conservative equations for predicting TTU Lightning CLSM static modulus of elasticity.