

DEVELOPMENT OF FLOWABLE SLURRY UTILIZING MIXED GLASS

By Tarun R. Naik, Rudolph N. Kraus

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ABSTRACT

Flowable slurry utilizing mixed glass developed by the UW-Milwaukee Center for By-Products Utilization is a innovative and unique product. The objective of this project was to develop a flowable slurry for use in Wisconsin, using mixed broken glass and coal ash as main components, meeting Wisconsin regulations, for use by state and other government units, as well as for private construction projects. An engineer, architect, owner, or contractor, given a "new" material for use in construction, would likely hesitate to use it without knowing the performance of the material, including its environmental impact. For this reason not only physical characteristics and mechanical properties of the flowable controlled low strength material (CLSM) mixed glass were tested, but also environmental impact was evaluated as part of this project. The coal ash material used for this project was a low-lime ash (ASTM Class F).

Two different types of CLSM were developed. A standard CLSM material contained fly ash, cement, and water (Type I); and, another CLSM contained clean concrete sand, cement, and water (Type II). CLSM mixtures without fly ash were developed to accommodate producers that do not have the facilities to handle and batch fly ash in bulk. This would encourage additional utilization of glass in CLSM. A total of six different mixtures were developed for Type I CLSM, one control mixture without glass, and five mixtures containing glass as a replacement of fly ash at 20 to 80% by weight. Three different mixtures of CLSM were developed for Type II CLSM, one control mixture and two mixtures with glass used as a replacement of sand at 30 and 75% by weight. All mixtures were proportioned to achieve a flow in the range of 12 to 15 inches and compressive strength not to exceed 100 psi at the age of 28 days.

For all CLSM mixtures, test specimens were evaluated for compressive strength and water permeability as a function of age. Selected samples of CLSM were evaluated for water leach (TCLP) and elemental characterization at the age of 28 days. Test results indicate that as the quantity of glass is increased in the mixtures, less water is required to maintain the desired flow for the CLSM. The unit weight of the mixtures increased with increased percentages of glass. Decreasing the amount of fly ash and increasing glass lead to increased bleeding and segregation at high replacement levels of 60% and 80%. This was attributed to the decreased cohesiveness due to decreased fly ash contents and subsequently increased flows. A lower fly ash replacement rate or decreasing the flow should be considered to avoid the undesirable segregation and bleeding. Permeability of the CLSM was very low, approximately 10 to 100 times lower than that of compacted sand. Permeability decreased for CLSM mixtures containing glass. The compressive strength of all mixtures were considered acceptable for future excavatability. Wisconsin DNR Chapter NR 538 Standards ("Beneficial Use of Industrial Byproducts") were used for determining environmental compliance and potential uses of the CLSM produced in this project. When the results of the NR 538 are compared to the actual leachate and elemental results combined, the CLSM mixtures developed for this project are classified

as "allowable" for use in an unconfined geotechnical fill. This has been a primary use of CLSM.