

# **USE OF GLASS CULLET AS AGGREGATES IN FLOWABLE CONCRETE WITH FLY ASH**

By Tarun R. Naik, Rudolph N. Kraus

Reference: CBU-1999-03

## **ABSTRACT**

The emphasis of this project was to develop a flowable concrete (slurry) utilizing post-consumer glass aggregate and fly ash. The flowable concrete developed in this project also met the ACI Committee 229 specifications for controlled low strength materials (CLSM). Approximately 170 thousand tons of glass by-products are generated each year in Wisconsin alone. Problems associated with glass recycling are breakage and mixing colors. Two types of flowable concrete were developed as part of this project. Flowable concrete consisting of fly ash, cement, and water, Type I, and a flowable concrete consisting of sand, cement, and water, Type II (used where fly ash is not available or if manufacturers do not have facilities for handling fly ash). For the Type I flowable concrete, a total of six different flowable slurry mixtures were developed. A control mixture containing no glass and five other mixtures were proportioned with glass as a replacement of fly ash in the range of 20 to 80 percent by weight. For Type II slurries, a total of three different slurry mixtures were developed. A control mixture and two mixtures proportioned with 30 to 75 percent replacement of sand with glass. All mixture components such as fly ash, glass, cement, and sand were characterized for their chemical and physical properties. Appropriate ASTM standards were followed for all testing. Rheological properties of the mixtures were tested. Hardened slurry properties tested including compressive strength, permeability, and density. The compressive strength of all mixtures were considered to be acceptable for future excavatability. Unit weight of the mixtures increased with increased percentages of glass. Decreasing the amount of fly ash and increasing the glass content lead to increased bleeding and segregation at high replacement levels of 60% and 80%. This was attributed to decreased cohesiveness due to the decreased fly ash contents and subsequently increased flows. Permeability of the flowable concrete also increased as the percentage of glass was increased in the mixture. Generally, glass cullet was found to be an acceptable aggregate source for use in a flowable concrete.