

Abstract

"Glascrete" is known as a concrete in which the aggregates wholly or partially consist of crushed glass, where the glass is a unique material that could be recycled many times without changing its chemical or mechanical properties. It has been used for certain purposes where the aesthetical aspect is one of the main considerations. At the present time, numerous studies have been conducted to investigate the performance of concrete composites that contained waste glass, either as an aggregate substitution or as a pozzolanic material.

This study aims to evaluate the properties of concrete mixes containing different glass aggregate replacements up to 20% by volume of sand, with and without mineral and chemical admixtures, in order to investigate the incorporation of waste glass in some concrete applications. This study tends to provide a glass concrete with best possible properties with respect to strength and dimensional stability.

Through this work, fresh and hardened unit weight, compressive strength, splitting tensile strength, flexural strength, total absorption, ultrasonic pulse velocity and length change tests are investigated on 17 mixes at different ages. A total of 255 (100 mm) cubes, 204 (100*200 mm) cylinders, 204 (100*100*400 mm) prisms and 68 (25*25*285mm) prisms were prepared.

As an application, this study includes the possibility of incorporating waste glass into concrete tiles, and assesses the new product with regard to the requirements of the Iraqi Standard Specification.

The results indicate the possibility of incorporating crushed glass as partial fine aggregate replacement up to the specified level (20%) into concrete composites without seriously hindering the investigated properties. Although, slight reductions in compressive and splitting tensile strength are reported, results show that the addition of glass aggregate with replacement levels ranging from

(5-20%) by volume of sand, led to (4.3-14.6%) and (5.2-18.0%) decrement in compressive strength and splitting tensile strength respectively, relative to reference mix at 28-day age. However, the use of mineral and/ or chemical admixtures improved the mechanical properties of all mixes at all ages. On the other hand, the results show that the flexural strength of the glasscrete mixes is very comparable and sometimes greater than flexural strength of reference mix. Flexural strength improves significantly with the use of mineral and/ or chemical admixtures (up to 38.7% relative to reference mix at 28-day age).

The results also indicate that a significant dimensional stability could be obtained by using 1.2% water reducing admixture (Plastiment^R_PR400) especially if it is used in conjunction with the mineral admixtures at the specified limits in this study (12% of high reactivity metakaolin or 15% of glass powder as partial replacement by weight of cement) and thereby it confirmed their ability to serve as an effective alkali-silica reaction suppressant.

This study also proves that glasscrete tiles with 20% and 40% of glass aggregate as partial volume replacement of natural fine aggregate are found to be acceptable with regard to the requirements of the Iraqi Standard Specification No.1042/1987.