The College of Graduate Studies and the College of Engineering Cordially Invite You to a

Master Thesis Defense

Entitled

PERFORMANCE EVALUATION OF CEMENT-FREE GEOPOLYMER CONCRETE MADE WITH RECYCLED CONCRETE AGGREGATES AND STEEL FIBERS

by

Jamal Ahmad Samer Medljy

Faculty Advisor

Dr. Hilal El-Hassan, Department of Civil and Environmental Engineering
College of Engineering

Date & Venue

2:00 PM
Thursday, 22 April 2021
Microsoft Teams
https://bit.ly/3ga9qHR

Abstract

Sustainable and innovative alternatives have been investigated to replace concrete's two non-environment-friendly components, natural aggregates (NA) and cement. Previous studies have been carried out to replace NA and cement with recycled concrete aggregates (RCA) and inorganic alkali-activated geopolymeric binders, respectively. Yet, such sustainable concrete has only been proposed for non-structural purposes, owing to the inferior properties of RCA. This research work aims assess the feasibility of reutilizing RCA from construction and demolition waste and locally available industrial solid by-products in the production of sustainable geopolymer concrete for structural applications. The binding materials were either in the form of a single precursor, ground granulated blast furnace slag (simply slag), or a blend of slag and fly ash. Steel fiber reinforcement was added at different volume fractions to promote the use of structural geopolymer concrete made with 100% RCA. The mechanical behavior of such steel fiber-reinforced RCA geopolymer concrete was studied through extensive testing of compressive strength, splitting tensile strength, and modulus of elasticity. The flexural strength, toughness, deflection, and residual strength were used to describe the flexural performance. In turn, the durability properties were assessed by measuring the bulk electric resistivity, water absorption, sorptivity, and abrasion resistance. Experimental findings revealed the ability to produce 100% RCA slag-based and slag-fly ash blended geopolymer concrete incorporating a 2% steel fiber volume fraction having superior mechanical performance and comparable durability properties relative to those of the plain NA-based control mix. The steel fiber-reinforced RCA geopolymer concrete developed in the current study is considered a feasible and sustainable alternative to conventional concrete that promises to recycle industrial wastes, alleviate carbon dioxide emissions, and conserve natural resources without compromising performance.

Keywords: Geopolymer, recycled concrete aggregate, steel fibers, performance evaluation.