COMPUTERISED INVESTIGATION OF CCD OPTIMIZED FRGPC BEAM COLUMN JOINT SUBJECTED TO QUASISTATIC LOADING

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▼ Abstract

Geopolymer concrete is widely accepted as a sustainable alternative for the conventional concrete and in this study the behavior of fiber-reinforced beam column joint made with geopolymer concrete is studied under quasi-static loading. In addition to fly ash, steel fibers, M-sand as an alternative for river sand as fine aggregate, granite as coarse aggregate, NaOH and Na2SiO3 as activators and potable water, are used as ingredients. Initially the mix design is carried out for casting cubes and tested for compressive strengths by varying the concentration of NaOH, curing temperature and duration for optimization of input parameters experimentally. Then the optimization is done analytically using Central composite design (CCD). The optimum parameters determined from experimental investigation for the production of Fibre-reinforced geopolymer concrete (FRGPC) are: NaOH concentration of 16 M, curing temperature of 100oC and curing duration of 18 h, and thus a maximum compressive strength of 48.67 MPa is produced. By using CCD it was possible to obtain a 48 MPa strength with optimized parameters of 12 M NaOH concentration, 94oC curing temperature and 22 h curing duration. The numerical results validated with experimental ones show a ratio of Partial differential equations to experimental value of 0.975. Based on the optimized mix design, beam column joint is casted and tested under static load and compared with FEM Model using ANSYS 16.2. The ultimate load carrying capacity of beam column joints made with CC, GC-EXP-OP, GCCCD-OP by numerical investigation are 3.77, 1.86 and 3.18{\%} than the experimental results. The beam column joints behavior is also studied under forward and reverse cyclic loading conditions.

▼ Keywords

Central composite design (CCD); Fibre-reinforced geopolymer concrete (FRGC); beam column joint; geopolymer concrete; structural performance