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Performance Study of Geopolymer Concrete by Partial Replacement of Fly Ash with Cement and Full Replacement of River Sand by Crushed Sand

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Abstract : Recent infrastructure growth all around the world lead to increase in demand for concrete day by day. Cement being binding material for concrete the usage of cement also gone up significantly. Cement manufacturing utilizes abundant natural resources and causes environment pollution by releasing a huge quantity of CO_2 into the atmosphere. So, it is high time to look for alternates to reduce the cement consumption in concrete. Geopolymer concrete is one such material which utilizes the industrial waste such as fly ash, ground granulated blast furnace slag and low-cost alkaline liquids such as sodium hydroxide and sodium silicate to produce the concrete. On the other side, river sand is becoming very expensive due to its large-scale depletion at source and the high cost of transportation. In this view, river sand is replaced by crushed sand in this study. In this work, an attempt has been made to understand the durability parameters of geopolymer concrete by partially replacing fly ash with cement. Fly ash is replaced by cement at various levels e.g., from 0 to 50%. Concrete cubes of 100x100x100mm were used for investigating different durability parameters. The various parameters studied includes compressive strength, split tensile strength, drying shrinkage, sodium sulphate attack resistance, sulphuric acid attack resistance and chloride permeability. Highest compressive strength & highest split tensile strength is observed in 30% replacement level. Least drying is observed with 30% replacement level. Very good resistance for sulphuric acid & sodium sulphate is found with 30% replacement. However, it was not possible to find out the chloride permeability due to the high conductivity of geopolymer samples of all replacement levels.

Keywords : crushed sand, compressive strength, drying shrinkage, geopolymer concrete, split tensile strength, sodium sulphate attack resistance, sulphuric acid attack resistance
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