VISVESVRAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

A
PROJECT REPORT
ON

"EXPERIMENTAL STUDY ON STRENGTH PROPERTIES OF GEOPOLYMER CONCRETE"

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ABSTRACT

The use of Portland cement in concrete construction is under critical review due to highamount of carbon dioxide gas released to the atmosphere during the production of cement. In recent years, attempts to increase the utilization of fly ash to partially replace the use of Portland cement in concrete are gathering momentum. Most of this by-product material is currently dumped in landfills, creating a threat to the environment.

Geopolymer concrete is a 'new' material that does not need the presence of Portland cement as a binder. Instead, the source of materials such as fly ash, that are rich in Silicon (Si) and Aluminium (Al), are activated by alkaline liquids to produce the binder. Hence concrete with no Portland cement. This thesis reports the details of development of the process of making fly ash-based geopolymer concrete. Due to the lack of knowledge and know-how of making of fly ashbasedgeopolymer concrete in the published literature, this study adopted a rigorous trial and error process to develop the technology of making, and to identify the salient parameters affecting the properties of fresh and hardened concrete. As far as possible, the technology that is currently in use to manufacture and testing of ordinary Portland cement concrete were used.Fly ash was chosen as the basic material to be activated by the geopolimerizationprocess to be the concrete binder, to totally replace the use of Portland cement. The binder is the only difference to the ordinary Portland cement concrete. To activate the Silicon and Aluminium content in fly ash, a combination of sodium hydroxide solution and sodium silicate solution was used. Manufacturing process comprising material preparation, mixing, placing, compactionand curing is reported in the thesis. Napthalene-based superplasticiser was found to be useful to improve the workability of fresh fly ash-based geopolymer concrete, as well as the addition of extra water. The main parameters affecting the compressive strength of hardened fly ash-based geopolymer concrete are the curing temperature and curing time, the molar H2O-to-Na2O ratio, and mixing time.Fresh fly ash-based geopolymer concrete has been able to remain workable up to at least 120 minutes without any sign of setting and without any degradation in the compressive strength. Providing a rest period for fresh concrete after casting before the start of curing up to five days increased the compressive strength of hardened concrete.The elastic properties of hardened fly ash-based geopolymer concrete, i,e. the modulus of elasticity, the Poisson's ratio, and the indirect tensile strength, are similar to those of ordinary Portland cement concrete. The stress-strain relations of fly ash-based geopolymer concrete fit well with the expression developed for ordinary Portland cement concrete.