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ORIGINAL ARTICLE

STUDY OF FIBER REINFORCED GEO-POLYMER CONCRETE SLAB FOR CONTINUOUSLY INCREASING HEIGHT OF IMPACT LOAD

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Abstract:

Geo-polymers are a kind of materials that are formed by the polymerization of aluminium (Al2O3), silicon (SiO2) and oxygen species to form a 3-D framework structure. Concrete made by such a binder system possess many advantages as compared to conventional ordinary Portland cement concretes (OPCCs). Many research works has been Reported on the behaviour of reinforced concrete structural elements under impact load whereas similar studies have not been reported on GPCs. This project work describes the experimental study on the behaviour of reinforced GPC slabs under repeated impact loading of low velocity. The aim of this project work is to study the impact behaviour of reinforced GPC slabs with and without steel fibers then compare the result with OPCC slabs. The overall dimensions of the GPC slab are 100cmx100cm, with 6cm thickness. Further there are wide scopes of geo-polymer need to develop in many engineering applications. Also it is use as a substitute of cement in the construction field with many limitations because it is sensitive to its production as well as in its use.

Keywords— *local available fly-ash, GGBS, Alkaline activated solution etc.*

1. INTRODUCTION

Impact load is an instantaneous application of load on the structure. Impact load may occur in reinforced concrete slabs and walls in certain types of structures, under low speed accidentally. Any structure which is strong under large static load may get failure due to sudden application of loads of relatively small magnitudes due to the effect of impact. There are many studies have been carried out on cementitious materials under impact load effect. A conventional ordinary Portland cement concrete have large CO2 emission and high energy consumption, so it is necessary to develop more eco-friendly concrete. Geopolymer concrete can full fill such a requirement of eco-friendly concrete.

This project work carried out an experimental investigation on the behavior of Reinforced geopolymer concrete slab with and without fibers under repeated impact loading of low velocity. Since In Portland cement 90% of carbon dioxide and 85% of the energy attributed to ready-mixed concrete (Marceau et al. 2007), so the carbon dioxide and potential energy can save by the use of geopolymers. Consequently, there is growing interest of geopolymer concrete application in various structures.

The extensive world-wide research efforts can be made on Eco-friendly geopolymer concrete which can be used in similar condition as for Portland cement. Such a kind of cement should be capable of being mixed with a relatively low-alkali activated solution and must cure in a under ambient conditions.

A geopolymer concrete when steam cured attain high early strength. A geopolymer concrete can be used to develop precast railway sleepers and other pre-stressed concrete structures. The property of geopolymer concrete to attain high early strength can be utilized in the precast industry where steam curing

is a common practice.

In general the sodium silicate solution is available in different grades.

	compound		% by mass	
	Na_2O		14.7	
	SiO_2		29.4	
	H_2O		55.9	
Material		**Mix 1**		**Mix 2**
		(kg/m^3)		**(kg/m^3)**
20mm aggregate		280		280
7mm aggregate		638		638
Sand		549		549
Fly ash		399		399
NaOH solution		39		39
Sodium	silicate	98		98
Solution				
plasticizer		5		5
Extra water added		nil		19.8

3 MATERIAL USED

1. FLY ASH – In the production ofgeopolymer concrete the low calcium fly ash is used which is obtained from coal-burning power stations. Most of the globally available low calcium fly ash formed as a by-product of burning of bituminous coal.

ALKALINE SOLUTION- An alkaline solution is prepared by mixing together sodium silicate solution and sodium hydroxide (NaOH). It is recommended that alkaline solution should be used within 24 hour after making this solution.

4 . Experimental Programme

Preparation of test specimen

To prepare geo-polymer concrete mix fly ash, ground granulated blast furnace slag, fine aggregate and coarse aggregates were used. For binding property in geo-polymer concrete an alkaline solution was used which consist of NaOH and sodium silicate solution. The GPC mix was produced using pan tilting drum mixture.

Slab test specimen of dimensions of 90x90 and thickness of 50 cm were developing using geo-polymer concrete mix. This geo-polymer concrete should have good workability i.e. the slump value should be a minimum of 90 mm and easily compactable.