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"Investigation on behaviour of reinforced and glass fibre Geopolymer concrete slabs under impact loading"

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***Abstract*—The experimental investigation carried out to determine and to compare the impact behaviour of Geopolymer concrete with normal grade concrete and glass fibre concrete slab elements. For impact testing numbers of slab elements are casted out of these consist of conventional concrete and glass fibre concrete of having 80mm and 100mm thickness. Here conventional method is used and prepared a frame setup to place a slab elements and weight and height of drop is also fixed. This work exhibits the crack pattern of different number of drops and generation of first crack considering the number of drops.**

***Keywords*— Ordinary Portland cement, Fly ash, GGBS, Alkaline solution, glass fibre.**

I. INTRODUCTION

Concrete is the most commonly used construction material. Its usage by the communities across the world is second only to water. Concrete is produced by using the ordinary Portland cement (OPC) as the binder. However, Portland cements are highly internal-energy-intensive and cause emission of green house gas, CO2 during their production. Cement production is also highly energy-intensive, after steel and aluminium. On the other hand coalburning power generation plants produce huge quantities of fly ash. Most of the fly ash is considered as waste and dumped in landfills. These concretes are found to be less durable in some of the very severe environmental conditions, therefore there is a need for development of alternate concretes. In this regard, geopolymer concrete (GPCs) can be considered as potential candidate materials. The studies on these new concretes are being carried out at SERC for more than 10 years. These new concretes utilize industrial wastes such as fly ash (FA) and GGBS to produce inorganic binder in the form of alumino-silicates. Industrial wastes, such as fly ash and GGBS , can be activated directly to produce geoplymeric binders which can be used to manufacture novel concretes are much less than Portland based conventional concretes(CCs) and CO2

The cement industry is the India's second highest payer of Central Excise and Major contributor to GDP. With infrastructure development growing and the housing sector

II.COMPOSITION OF GEOPOLYMERCONCRETE MIXES

Following materials are generally used to produce GPCCs:

i. Fly ash,
ii. GGBS,
iii. Fine aggregates and
iv. Coarse aggregates
v. Catalytic liquid system (CLS): It is an alkaline activator solution (AAS) for GPCC. It is a combination of solutions of alkali silicates and hydroxides, besides distilled water. The role of AAS is to activate the geopolymeric source materials (containing Si and Al) such as fly ash and GGBS.
vi. Glass fibres

III. GEOPOLYMER CONCRETE SLABS:

The number of slabs for normal concrete with same M20 grade with proper compaction. Dimensions of the slabs are 50cm x 50cm x 8cm and 50cm x 50cm x 10cm.The slabs are casted as shown in Fig 4.10 below.

Fig.4.10 Normal concrete slab

While making the geo-polymer concrete slab use GGBS with fly ash and use sodium hydroxide solution & sodium silicate solution for mixing. After mixing the slabs are casted as shown in fig .4.11.below.

Fig.4.11 Geo-polymer concrete slab

Then we casted the slab for glass fibre also of the same dimensions with well compaction. We tried to provide the glass fibre perpendicular to the direction of application of load to achieve the better strength. We are used M20 Grade concrete and water cement ratio 0.4. The casted slabs shown in Fig 4.12 below.

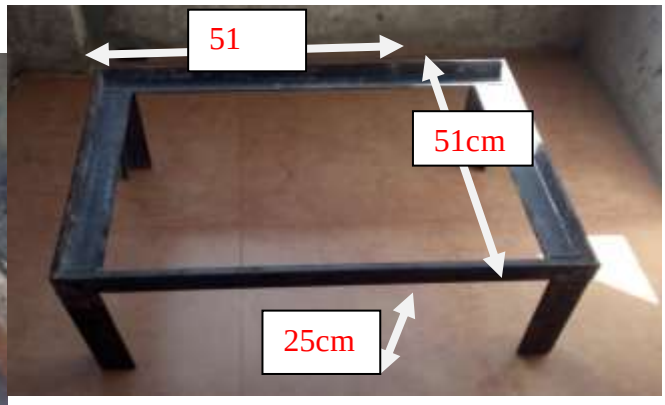
Fig.4.12 Glass fiber slabs.

VII.IMPACT STRENGTH OF GEOPOLYMER CONCRETE SLAB:

First of all kept the slab of normal concrete in frame then make the arrangement of the load such a way that the load should be impact centrally of the slab. Then stretch the rope to keep the load at height of 3m from the slab top surface then kept load free to fall on the slab centrally. If the crack will not happen then kept next blow on the same slab .we need to take no. of blows on the same slab till the crack will not happened .While the cracks occurs we have to measure the no. of cracks and thickness of cracks to plot the graph against the no.of blows.

Then do the same test for the remaining slabs of glass fibre and geo-polymer concrete.

The frame we used of "**L**" section of size 40x40x5 mm which is having length of 51cm and height of 29cm to hold the slab as shown in Fig4.16. For easily taking an impact test we are used the available iron ball of weight 15kg as shown in Fig



Frame

Iron Ball

The frame as shown in fig 4.18 below having total height 4m. After fixing of pulley and putting the frame on ground and suspend rope fixed with iron ball.

Testing Setup

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iv. IMPACT STRENGTH TEST RESULTS AND DISCUSSION:

NORMAL CONCRETE SLAB –

Sr. no	Dimension	No of blows	Result		Remark
			NO OF CRACKS	THICKNESS OF CRACKS	
1.	50cm*50cm*08cm	1	-	-	-
		2	3	0. 5 mm	-
		3	4	1 mm to 2 mm	-
		4	4	5 mm	Slab Fail
2.	50cm*50cm*10cm	1	-	-	-
		2	-	-	-
		3	3	3 mm to 5 mm	-
		4	4	4 mm to 6 mm	Slab Fail

NORMAL CONCRETE SLAB CRACK PATTERN –

GLASS FIBRE CONCRETE SLAB –

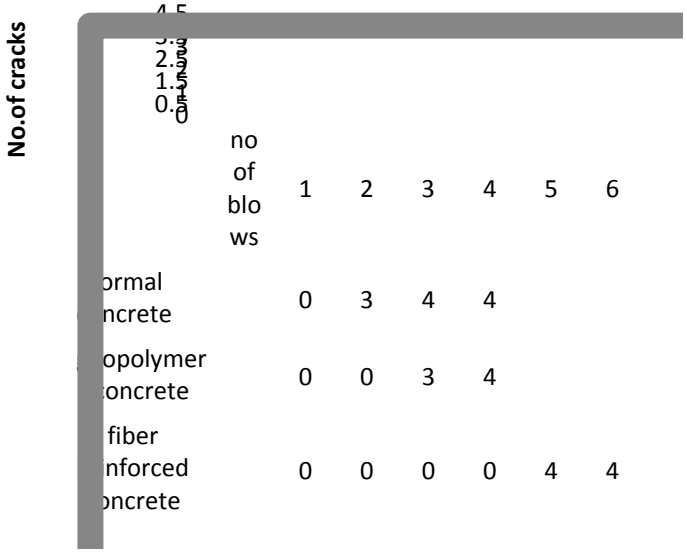
SR.NO	DIMENSION	NO OF BLOWS	RESULT		REMARK
			NO OF CRACKS	THICKNESS OF CRACKS	
1.	50cm*50cm*08	1	-	-	-
		2	-	-	-
		3	-	-	-
		4	-	-	Bottom cracks
		5	4	1 mm	-
		6	4	4 mm	Slab Fail
2.	50cm*50cm*10cm	1	-	-	-
		2	-	-	-
		3	-	-	-
		4	-	-	Bottom cracks
		5	3	0.5mm	Bottom cracks
		6	4	1mm to 2mm	Top cracks
		7	4	3mm to 5mm	Slab Fail

GLASS FIBER CONCRETE SLAB CRACK PATTERN

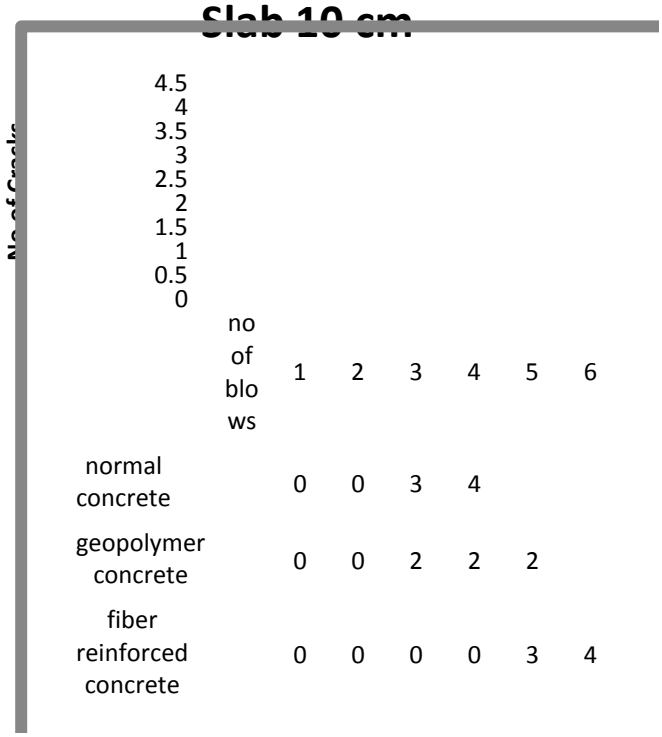
Sr. no	Dimension	No of blows	Result		Remark
			NO OF CRACKS	THICKNESS OF CRACKS	
1.	50cm*50cm*08cm	1	-	-	-
		2	-	-	-
		3	3	0.5	Bottom surface
		4	4	1mm to 2mm	Slab Fail
2.	50cm*50cm*10cm	1	-	-	-
		2	2	1mm	Bottom Surface
		3	2	3 mm	Top Surface
		4	2	5 mm	Slab Fail

GEOPOLYMER CONCRETE SLAB CRACK PATTERN

After taking impact test on each specimen of all three materials we plotted graph of number of blows v/s number of cracks as shown in fig.for 8cm slab thickness and for slab thickness 10cm.



Graph A



Graph B

v Conclusion

1. In all the impact test of slab the damage is found localized I .e. at the point of impact load & failure is characterized by formation of cracks initially at the bottom surface of slab propagated to the top surface.
2. From the test result and graph A & B we conclude that the fiber reinforced concrete is the best material and the geo-polymer is the second best material for impact loading.
3. From table it shows that glass fiber slabs require more number of blows to crack than others.
4. The compressive strength of conventional concrete is :24.02N/mm2 and the compressive strength of geopolymer concrete is :48.44N/mm2.
5. By observing above table is concluded that crack width is goes on increases by increasing number of blows in Geopolymer concrete.

vi References

[01] Christopher Wright P.E.(2012),” *Introduction To Impact Loading*”

[02] S.Elavenil and G.M. Samuel Knight(2012),”*Impact Response Of Slabs Under Drop Weight Impact Testing”*

[03] PetrMáca, et al.(2014),” *Impact Testing Of Concrete*”

[04] Madhswaran C. K. , et al.(2014),”*Investigation on behavior of reinforced geo polymer concrete slab under impact loading***”**

[05] Baturay Batarlar (JULY 2013*),” Behavior Of Reinforced Concrete Slabs Subjected To Impact Loads”*

[06] ACI 211.2, Selection proportions for structural lightweight concrete, standard
a. practice.

[07] Davidovits. J., (1991), Geopolymers: inorganic polymeric new materials, Journal Thermal Analysis, 37, pp 1633–1656.

[08] IS : 2770 (Part I) – (1967), Indian StandardMethods Of Testing Bond in Reinforced Concrete Part I Pull-Out Test, Reaffirmed 1997, BIS, New Delhi.

[09] IS: 456:2000, Indian Standard Code for Plain and reinforced concrete-code of

[010] practice, 4th Revision, BIS, New Delhi.

[011] IS: 3812:1981, Specification for fly ash for use as pozzolana and admixtures
a. 3812(part1): 2003.

[012] IS: 2386: Part I-1963 Methods of tests for aggregates for concrete.