RESEARCH ARTICLE OPEN ACCESS

Impact Strength of Glass Fibre Reinforced Concrete Panels

Dr. K.V. Krishna Reddy
Professor, MGIT, Hyderabad, Telangana, India

ABSTRACT:
High rise structures have become a regular phenomenon. As the height increases, use of flexible members in the structure makes it earth quake resistant. Moreover, the need of the day is to make the structures blast resistant Decrease in the dead load of the structure by use of prefabricated members makes the structure economical both in terms of time and labor. The aim of this study is to fabricate Glass Fiber Reinforced panels of various thickness to urge the Impact strength so as to suggest a suitable replacement to the regular RCC panels. 60 mm thick glass fibre reinforced panels were found to be equivalent to 100 thick conventional nominal reinforced concrete slab panels.

Keywords: Glass fibres, high volume fibre, Impact strength

Date of Submission: 11-04-2020 Date of Acceptance: 27-04-2020

I. INTRODUCTION

Fibre Panels also called as claddings is a type of skin or layer on the outside of a building. It can be a part of building's framework or an intermediate layer with battens or spacers. It is mainly used not only to make the structures flexible to take dynamic loads of earthquake and blasts but also stop wind and rain from entering the building. In this regard an attempt is made to optimize the thickness of high-volume glass fibre reinforced panels in terms of their impact strength.

II. LITERATURE REVIEW

Kiran T. and Sadath Ali Khan Zai [3] focused on impact loading of high performance concrete of M60 grade of concrete integrated with carbon fibers and polypropylene fibers. The experimental result showed a significant increase in the energy absorption. Number of impact blows for the carbon and polypropylene fiber reinforced concrete test slab specimen were reported to be same. Kiran T. and N. Jayaramappa [5] reported their work on use of 1% Steel fibers with an aspect ratio of 70 on labs with dimensions of 600 x 600 x 60 mm cast with varying percentage of fly ash and ground granulated blast furnace slag. Muhammed Iskende and Bekir Karasu [4] in their work have concluded that Glass fibers have positive effect on stress–strain curve of glass fibre reinforced concrete and flexural strength, because of the increase in the aspect ratio of fibers resulting in an increase pull-out and energy absorption. Andreas Andersson [6] has presented work on slabs with an outer layer of 30 mm of steel reinforced fibre concrete, none of the slabs showed any significant fallout of concrete. The static and dynamic response of the slabs have been simulated using nonlinear finite element models. The models generally showed good agreement, both for static load, crack widths and response during impact. Philipp Löber and Klaus Holschemacher [7] worked on use of alkali-resistant macro glass fiber reinforced concrete in load-bearing members. They reported that glass fibers can be used in combination with conventional reinforcing bars and investigations indicated promising results.

III. METHODOLOGY

M30 grade of concrete has been designed confirming IS 10262-2009 [1] as control specimen. 15 cm cubes were cast to evaluate the mix design to cast slab of 100 mm thickness with minimum nominal reinforcement. Glass fibres 12 mm in length and 14micron meter in diameter with 1:1 sand to cement ratio are used to cast glass fibre reinforced panels of 500mm X 500mm at various thicknesses of 40mm, 60mm and 80mm.

Impact strength is measured by a fabricated tripod device with a weight attached as in Fig 1.

Figure 1. Impact strength measuring device

IV. EXPERIMENTAL PROGRAM

53 grade cement [2] confirming to the standards was considered for the testing. Fine aggregate with fineness modulus of 3.01 and coarse aggregate with fineness modulus of 7.3 is used for testing. Poly carboxylic ether polymer based high range water reducing agent is used as super plasticizer. M30 mix was designed with the following proportion 1: 2:2.6 at a water cement ratio if 0.35 has been found to give the desired result, which is used as conventional control concrete specimen.

Glass fibres were added to 1:1 cement mortar at 4.5% of combined weight of cement and sand. 9 Slabs each of 500mm X 500mm as in fig. 2 with 100 mm thickness for control specimen and 40mm, 60mm and 80mm thickness for glass fibre reinforced panels were cast and cured for 28 days before testing.

Figure 2. Slabs cast for testing

A weight of 5 kg in form of iron sphere with a height of fall of 1.5m using the impact strength measuring device simulating irregular pattern of impact loads on the panels due to various effects is used to note the number of blows required to produce the first crack in the slab placed on a levelled surface. Table 1 shows the average energy absorption by various panels before giving in. Fig 3. Shows Impact energy for different type of slabs,

Table1 average energy absorption

Slab type	No. of blows resisted	Energy absorption (JOULES)
Nominal reinforced CC slab (100mm)	24	1764
GFRP (40mm)	18	1323
GFRP (60mm)	39	2866
GFRP (80mm)	51	3748

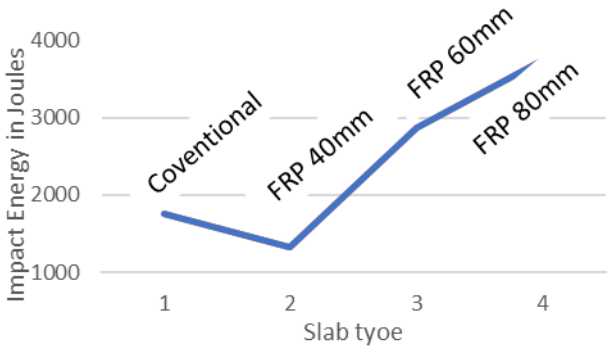

Figure 3. Impact energy for slabs

V. CONCLUSION

1. Glass fibre reinforced panel of 60mm thick could be taken as a replacement for 100mm thick conventional reinforced cement concrete (RCC) slab.
2. Glass fibre reinforced slab of 80mm thick has 33 percent more energy absorption than 40mm thick panel.
3. Glass fiber reinforced panel of 60mm thick can take 116.67 percent more impact than 40mm thick panel and 62.5 percent more than RCC slab.
4. Glass fiber reinforced panel of 80mm thick has 183.33 percent more energy absorption than 40mm thick panel and 112.5 percent more than RCC slab and 30.77 percent more than 60mm thick fibre reinforce panel.
5. Cracks are formed first at the bottom of the slabs and panels that are visible on the sides of panels and propagate to the top of the specimens with increase in number of blows.

ACKNOWLEDGMENT

Author would acknowledge student group of Anshuman, Karthik, Vinay and Venkatraj for their contribution made in completing the above work.

REFERENCES

[1]. IS.: 10262–2009, "Indian Standard Recommended Guidelines for concrete mix design," BIS, New Delhi.
[2]. IS.: 383-2016, "Specification for coarse and Fine Aggregate from Natural source for

concrete," Bureau of Indian Standards, New Delhi.

[3]. Kiran T., Sadath Ali Khan Zai , "Behaviour of Fiber Reinforced Concrete Slabs under Imapct Loads" International Journal Of Current Reasearch ,Volume : 9, Issue No. 11, Nov-2017 , pp. 60349-60354.

[4]. Muhammet Iskender ,Bekir Karasu, "Glass Fiber Reinforced Concrete" Research Gate , Volume : 05 ,Isssue No. 1 , feb-2018 , pp.136-162

[5]. Kiran T., N.Jayaramappa " Behaviour FRC slabs Subjected to Impact Loads"International Journal Of Trend In Research and Development , , Volume: 4 , Issue No.3, may-2017, pp.86-92

[6]. Andreas Anderson , "Impact Loading On Concrete Slabs" Internatinal Scholarly Research Notices, Volume: 10 , Issue No.3, apr-2015, pp.1103-1158.

[7]. Philipp Lober, Klaus Holschemacher, "Structural Glass Fiber Reinforced ConcreteFor Slabs On Ground" World Journal of Engineering and Technology, Volume:02, IsuueNo.04,sep-2014,pp.48-54.

Dr. K.V. Krishna Reddy. "Impact Strength of Glass Fibre Reinforced Concrete Panels." *International Journal of Engineering Research and Applications (IJERA*), vol.10 (04), 2020, pp 20-22.