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ANALYTICAL STUDY ON PRECAST SLAB STRUCTURE WITH CARBON REINFORCED COMPOSITE CONCRETE

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Abstract - *Carbon fibers are preferred as reinforcing polymers because of its irrefutable properties such as high modulus of elasticity as compared to steel, high tensile strength, low density and high chemical inertness. The structure which loses its load – bearing capabilities can be retrofitted with carbon fiber reinforced polymer sheets. With the rise in temperature strength of structural components decreased rapidly. This can be strengthened using CFRP sheets. Application of CFRP sheets to the Reinforced concreate structural members reduced deflection, crack width and stress in steel reinforcements. The purpose of the study is to analyze, examine behaviour property of precast structural members (slab) using finite element analysis. The finite element analysis was carried out using ANSYS software. A model is to be developed and analyzed accordingly. The parameters such as load deflections, maximum and minimum stresses, total deformations were studied from the analysis.*

***Key Words*: Precast slab, carbon fibers, CFRP< load deflection, maximum and minimum stress, total deformation.**

1.INTRODUCTION

In construction field we use both in-site cast structures and precast structures. Precast members or precast slab is constructed outside the construction site to allow better and controlled conditions that much up to industry standards. In this paper we discuss about precast slab structure with carbon reinforcement. Here we have done mainly two cases which are truss cases and corrugation cases. In truss case 4 rows of truss are added in 3 ways i.e., 4 truss in straight alignment, 4 truss in inclined alignment, 2 truss in straight and 2 truss in inclined alignments. In corrugation cases two method is studied. One is single raw corrugation and the other is double raw corrugation. In single raw corrugation, corrugation sheet is given in a single raw and different thickness is studied. In double raw corrugation, the best of single raw corrugation is taken and the second layer of corrugation sheets is given across on it in three different numbers.

2. LITERATURE SURVEY

Rafael Alves de Souza et.al (2018), [1] This paper discusses the procedures taken to repair and strengthen a damaged concrete corbel od an industrial biomass boiler. The process is carried out by providing carbon fiber reinforced polymer sheets, keeping the requirement imposed by the in-site conditions and the design plans. In this process the scarification of loose concrete of corbel is done manually and then the polymer modified mortar is applied there. After regularization of the dried maintained surface, surface holes. voids etc. are filled with epoxy resin. Over this treated surface resin primer is applied and CFRP sheet is applied of specific size and shape. Removal of excess resin is done using a celluloid spatula and finally the whole corbel is painted with epoxy paint.

F. R. Mansour et.al (2014), [3] Usage of steel fiber to re-evaluate the properties like ductility, tensile, flexural, fatigue and load bearing capacity after cracking and toughness. Hooked-end steel fibers are used with 30mm length and 0.75mm diameter size. Higher energy absorption, toughness and ductility were found where the steel fibers was introduced to the composite slab. And also the interface surface was roughened in the transverse direction.

3. ANALYTICAL STUDY

In truss case 4 rows of trusses are considered comparing CFRP and steel reinforcement. Which is 4 truss in straight alignment, 4 truss in inclined alignment and 2 truss in straight and 2 truss in inclined alignments.

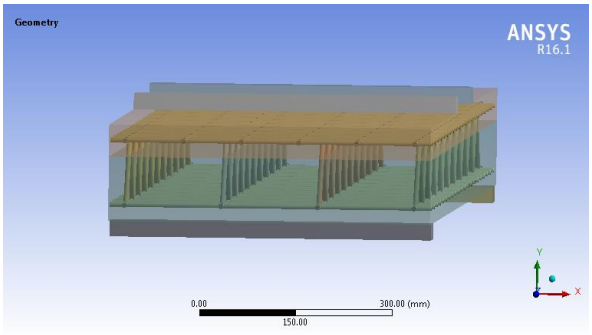

Fig -1: Geometry of 4S alignment

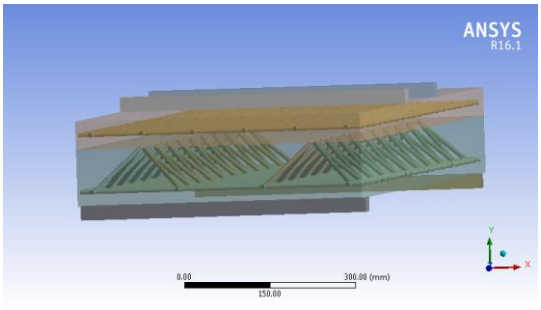

Fig -2: Geometry of 4I alignment

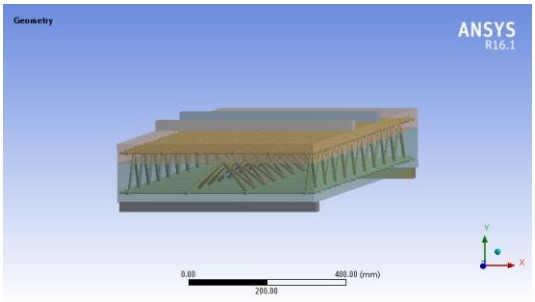

Fig -3: Geometry of 2S and 2I alignment

In corrugation case study is carried out on single raw corrugation and double raw corrugations. In single raw corrugation, corrugation sheet is given in a single raw and in different thickness. In double raw corrugation, the best of single raw corrugation is taken and the second layer of corrugation sheets are added across on it in three different numbers.

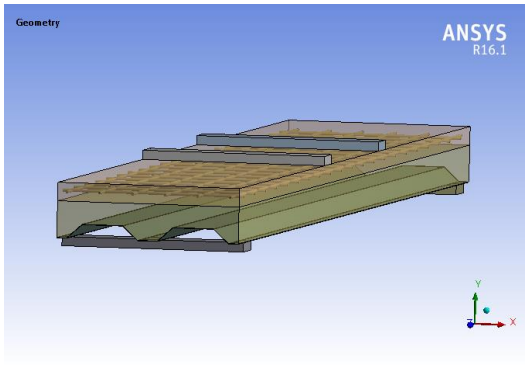

Fig -4: Geometry of single raw corrugation

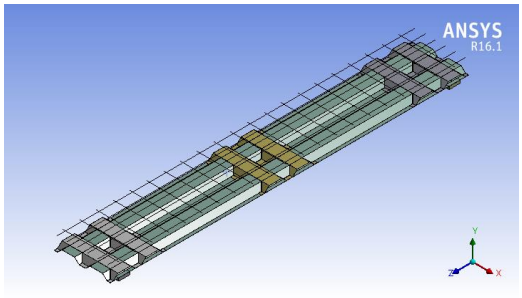

Fig -5: Geometry of double raw corrugation – 3 Nos.

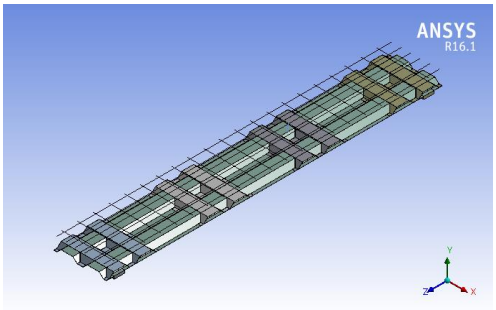

Fig -6: Geometry of double raw corrugation – 4 Nos.

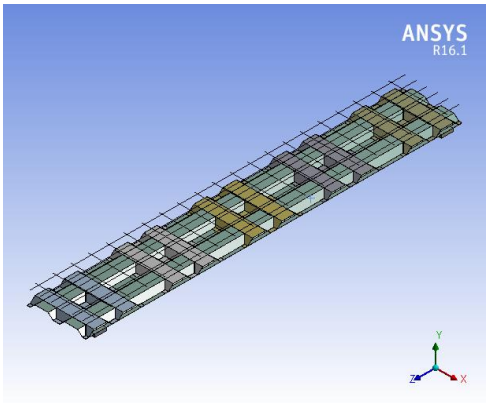

Fig -7: Geometry of double raw corrugation – 5 Nos.

4. RESULTS AND DISCUSSIONS

From the analytical study of the truss case it was clear that the 4 way inclined alignment had more load bearing and more ductility compared to other alignment patterns.

	DEF (mm)	LOAD (KN)	% of increase in load	Yield Disp. (mm)	DUCTILITY
4S-CFRP	150.23	68.85	2.86	35.715	4.21
4I-CFRP	230.90	71.48	6.78	40.827	5.66
2S -2I-CFRP	217.75	71.72	7.15	40.806	5.34
4S-STEEL	137.24	69.10	3.23	35.738	3.84
4I-STEEL	159.79	70.90	5.92	40.812	3.92
2S -2I-STEEL	149.59	70.39	5.17	40.788	3.67

Table -1: Analytical values of truss case alignment

From corrugation case it was clear that the double layer arrangements of 5 numbers of cross corrugation sheets of 1.2 mm thickness single row corrugation alignment had more load bearing and more ductility compared to other alignment patterns.

	DEFmm)	LOAD (KN)	% of increase in load	Yield Disp. (mm)	DUCTILITY
SR-CFS-0.8mm	131.16	60.04	10.30	35.588	3.69
SR-CFS-1 mm	115.56	65.33	2.40	35.622	3.24
SR-CFS-1.2mm	131.72	70.57	5.43	35.656	3.69
DR-CFS-3 NOS	45.47	88.98	32.93	35.588	1.28
DR-CFS-4 NOS	54.21	101.35	51.42	12.484	4.34
DR-CFS-5NOS	81.45	121.73	81.87	12.489	6.52

Table -2: Analytical values of corrugation case alignment

5. CONCLUSIONS

Based on the analytical study carried out on precast concrete of fiber reinforcement, it become clear that 4 way inclined alignment is good in truss type case and 5 number double row corrugation with main corrugation sheet of 1.2mm thickness is good in corrugation type case. This is because these cases give the maximum load bearing capacity design and also the ductility.

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