Comparative Study of Flexural Strength of Behavior of RC Slab Using Armid Fiber& Carbon Fiber

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Abstract: To deal with the strength requirements related to flexure in structural systems Aramid Fiber and Carbon Fiber is used extensively. In this paper the behavior and performance of rectangular reinforced concrete slab strengthened with externally bonded Aramid Fiber and Carbon Fiber subjected to flexure is studied experimentally. Rectangular RC slab externally bonded with Aramid Fiber and Carbon Fiber. Each panel is subjected to equal static loading during the experiment. Total eighteen RC slab will be cast and tested for the study. In that nine panels will be design for one way and same for two way. six panels will be use as a control panel and six slab panels were strengthened using different configurations and different types of Aramid Fiber and Carbon Fiber . The study is restricted to continuously wrapped Aramid Fiber and Carbon Fiber wrapped with strip of Aramid Fiber and Carbon Fiber. The effect of different types and configuration of Aramid Fiber and Carbon Fiber on first crack load, ultimate load carrying capacity and failure mode of the slab were investigated. The experimental results have been validated with finite element analysis by using ANSYS software and found to be in good agreement with analytical values. The results also indicate that the most effective configuration is the full-wrap of Aramid Fiber and Carbon Fiber.

Key Words: **Aramid Fiber, Carbon Fiber , Flexural Strength , Strengthening.**

1. INTRODUCTION

Strengthening of existing structures has become a major part of construction activity in our country. Many civil structures are no longer safe due to increased load specifications in the design codes. Such structure must be strengthened in order to maintain their serviceability. Strengthening refers to the reconstruction or renewal of any part of an existing building to provide better structural capacity like higher strength and ductility than the original building. The various strengthening techniques include steel plate bonding, polymer injection followed by concrete jacketing, use of advanced composite materials like aramid fiber reinforced polymer (AFRP), carbon fiber reinforced polymer (CFRP), and ferrocement etc. the choice of a particular strengthening method depends upon the type, nature and cause of distress to be repaired. Nowadays, strengthening using CFRP, AFRP etc. is gaining popularity due to their high strength-to-weight ratio and corresponding fatigue resistance.In RC buildings, slab are subjected to large forces during severe ground shaking and its behavior has a significance influence on the response of the structure. Hence slab is the crucial zone in a reinforced concrete moment resisting frame. The revisions of Indian code provisions have necessitated strengthening of several existing structure in country. The exposed joints in those structures such as frames of industrial buildings, water tanks, bridges and other structure can be strengthened by giving adequate lateral confinement using ferrocement or fiber reinforced polymer (FRP) composites.[2].

2. METHODOLOGY

- Flexural Strengthening of RC slab: Early efforts for understanding the response of plain concrete subjected to pure torsion disclosed that the fabric fails in flexural instead of shear. Structural members hooklike in set up, members of an area frame, final loaded block, hooklike box girders in bridges, spandril beams in buildings, and spiral stair-cases square measure typical samples of the structural components subjected to Flexural moments can not be neglected whereas planning such members. Structural members subjected to flexural square measure of various shapes like a method, 2 approach block sections. These completely different configurations build the understanding of flexural in RC members a posh task. additionally, torsion is typically related to bending moments and cutting off forces, and therefore the interaction among these forces is vital. Thus, the behavior of concrete components in flexural is primarily ruled by the tensile response of the fabric, significantly its tensile cracking characteristics. spandril beams, settled at the perimeter of buildings, carry masses from slabs. This loading mechanism generates flexural forces within the block. concrete (RC) block has been found to be deficient in flexural capability and in want of strengthening. These deficiencies occur for many reasons, like too little stirrups ensuing from construction errors or inadequate style, reduction within the effective steel space owing to corrosion, or inflated demand owing to a amendment in occupancy. like the flexure and shear strengthening, the aramid fiber is secured to the flexural surface of the RC members for flexural strengthening. within the case of flexural, all sides of the member square measure subjected to diagonal tension and thus the FRP sheets ought to be applied to all or any the faces of the member cross section. However, it's not continuously attainable to produce external reinforcement for all the surfaces of the member cross section. In cases of inaccessible sides of the cross section, extra means that of strengthening needs to be provided to ascertain the adequate mechanism needed to resist the torsion

- • Aramid fiber: Aramid Fiber could be a stuff created by combining 2 or additional materials to administer a brand new combination of properties. However, aramid fiber is {different|totally completely different|completely different} from different composites therein its constituent materials square measure different at the molecular level and square measure automatically divisible. The mechanical and physical properties of aramid fiber square measure controlled by its constituent properties and by structural configurations at small level. Therefore, the planning and analysis of any aramid fiber support needs an honest information of the fabric properties, that square measure captivated with the producing method and therefore the properties of constituent materials. Aramid fiber composite could be a 2 phased material, thus its aeolotropic properties. it's composed of fiber and matrix, that square measure secured at interface. every of those completely different phases needs to perform its needed perform supported mechanical properties, in order that the composite system performs satisfactorily as a full.

- • Carbon Fiber: Carbon fibers square measure manufacture by bonding carbon atoms along in an exceedingly crystals that square measure aligned parallel to the axis of fiber. Carbon fibers are factory-made with crude and coal pitch with 5-10 micrometer in diameter with relative density close to concerning one.9. The crystal alignment provides the fiber high strength to volume magnitude relation and therefore the modulus of physical property is on top of steel and it's double or thrice stronger than steel. they need high stiffness , high chemical resistance , heat tolerance and low thermal enlargement.
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- **Properties of CFRP & AFRP**

Name	Carbon Fiber	Aramid Fiber
Modulus of elasticity	125- 181 kN/mm^2	7.5-112.4 kN/mm^2
Tensile strength	4127 MPa	2757 MPa
Ultimate strength	1600 MPa	1430 MPa
Density	1.58g/cm^3	1.44 g/cm^3
Color	Back	Light golden

Table 1.1 *Properties of CFRP & AFRP*

3. EXPERIMENTAL RESULTS:

- **One Way Slab Controlled Panel:-**

Table 3.1: *One Way Slab Controlled Panel*

Sr. No.	Load (kg)	Deflection (mm)
1	250	2.0
2	300	2.8
3	400	3.1
4	450	3.37
5	500	3.55
6	550	3.78
7	600	4.3
8	650	5.0
9	700	5.83
10	750	6.75
11	800	7.93
12	850	8.12
13	900	8.3
14	950	8.65
15	1000	9.05
16	1050	9.5
17	1100	10

One Way Panel Wrapped with Carbon Fibre:-

Table 3.2: One Way Panel Wrapped with Carbon Fibre

Sr. No.	Load (kg)	Deflection (mm)
1	250	0.64
2	300	0.9
3	350	1.1
4	400	1.21
5	450	1.4
6	500	1.52
7	550	1.85
8	600	2.75
9	650	3.24
10	700	3.5
11	750	4.0
12	800	4.55
13	850	5.0
14	900	5.75
15	950	6.35
16	1000	7.09
17	1050	7.6
18	1100	8.15
19	1150	8.85
20	1200	9.45
21	1250	10

- **One Way Panel Wrapped with Aramid Fibre:-**

Sr. No.	Load (kg)	Deflection (mm)
1	250	0.75
2	300	0.86
3	350	0.91
4	400	0.95
5	450	0.98
6	500	1.03
7	550	1.23
8	600	1.34
9	650	1.70
10	700	2.35
11	750	2.49
12	800	2.59
13	850	2.76
14	900	3.30
15	950	3.60
16	1000	4.30
17	1050	4.60
18	1100	4.95
19	1150	5.64
20	1200	6.21

21	1250	6.95
22	1300	7.34
23	1350	7.59
24	1400	7.85
25	1450	8.24
26	1500	8.70

Two Way Slab:-Two Way Controlled Panel:-

Sr. No.	Load (kg)	Deflection (mm)
1	250	1.20
2	300	1.35
3	350	1.45
4	400	1.6
5	450	1.81
6	500	2.2
7	550	2.7
8	600	2.85
9	650	3.0
10	700	3.09
11	750	3.15
12	800	3.50
13	850	3.87
14	900	4.10
15	950	4.30
16	1000	5.20
17	1050	5.50
18	1100	6.00
19	1150	6.70
20	1200	7.85
21	1250	8.00
22	1300	8.30
23	1350	8.70
24	1400	9.00
25	1450	9.85
26	1500	10.00

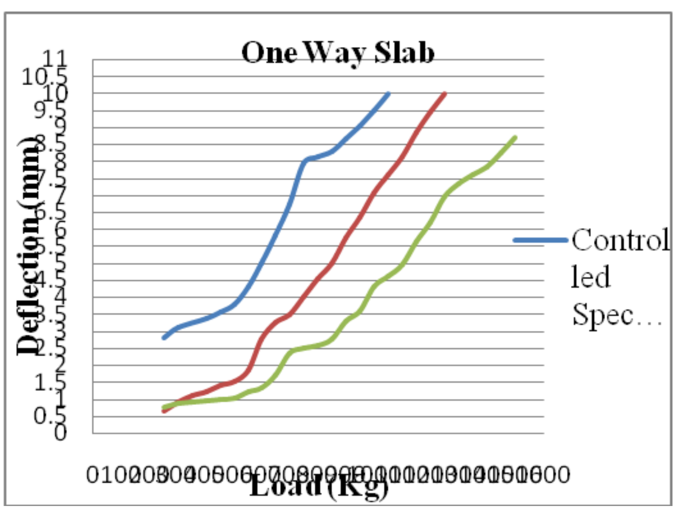
Two Way Panel Wrapped with Carbon Fibre:-

Sr. No.	Load (kg)	Deflection (mm)
1	250	0.9
2	300	0.9
3	350	1.18
4	400	1.31
5	450	1.41
6	500	1.59
7	550	1.72
8	600	1.81
9	650	1.92
10	700	2.21
11	750	2.50
12	800	2.80
13	850	2.95
14	900	3.20
15	950	3.60
16	1000	3.85
17	1050	4.45
18	1100	4.85
19	1150	5.00
20	1200	5.31
21	1250	6.00
22	1300	6.28
23	1350	6.80
24	1400	7.32
25	1450	7.65
26	1500	8.30

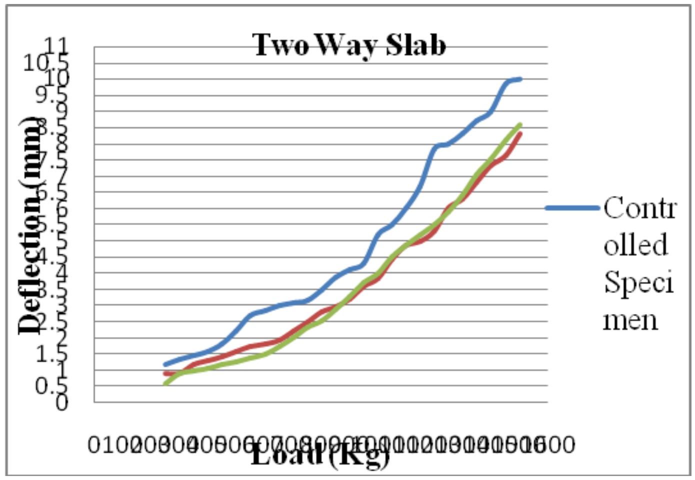
Two Way Panel Wrapped with Aramid Fibre:-

Sr. No.	Load (kg)	Deflection (mm)
1	250	0.60
2	300	0.90
3	350	1.00

4	400	1.05
5	450	1.17
6	500	1.28
7	550	1.39
8	600	1.50
9	650	1.72
10	700	2.00
11	750	2.35
12	800	2.55
13	850	2.90
14	900	3.30
15	950	3.70
16	1000	4.00
17	1050	4.50
18	1100	4.85
19	1150	5.20
20	1200	5.50
21	1250	5.90
22	1300	6.40
23	1350	7.05
24	1400	7.53
25	1450	8.13
26	1500	8.59



Graph No. 01:- Load Vs. Deflection for One Way Slab



Graph No. 02:- Load Vs. Deflection for Two Way Slab

4. CONCLUSION

According to the study it is expected that there will be increment in strength of RC slab. Strengthening refers to the reconstruction or renewal of any part of an existing building to provide better structural capacity like higher strength and ductility than the original building. Using carbon fiber and aramid fiber the strength will be increase and it is economical as compare to reconstruction of existing building.

5. REFERENCES

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