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ASSESSMENT OF COMPRESSIVE STRENGTH, SPLIT TENSILE STRENGTH AND FLEXURAL STRENGTH OF CFRC WITH FLY ASH

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ABSTRACT

Research carried out in past suggest improvement in compressive strength and flexural strength using carbon fibre. Use of byproducts obtained in thermal power plants Viz. Fly ash Poses a lot many problems and has to be reused or safely disposed. In this dissertation fly ash has been used to replace cement resulting in reduction in the cost. Various fly ash percentages were tried for various grades of concrete and from view point of obtaining maximum compressive strength optimum fly ash percentage was found. For grades M20, M25, M30 20% cement has been replaced by fly ash. For grades M35 and M40 16.5% and 12.5% cement has been replaced by fly ash. Using above optimum fly ash percentage carbon fibres were added as 0.4%, 0.5% and 0.6% by weight of cement and compressive strength of concrete at 3, 7 and 28 days of curing were determined and 7 day flexural strength of concrete for various carbon fibre percentages as above. Also, Split tensile strength was determined.

Keywords*-Carbon fibre, Fly ash, compressive strength, split tensile strength, flexural strength*

I. INTRODUCTION

Since the last century there is a continuous increasing demand for urbanization. To cater for needs of increasing population having a high density in localized patches a number of buildings as residential, commercial complexes, schools, amenity building etc. has to be constructed. These localized areas range from the taluka places to metropolitan cities. As grade of the township is raised to next higher level, due to the dirth of land the cost increases tremendously. There is no scope for horizontal expansion. Naturally multistoried buildings are preferred. One requires designing the structure, say, as reinforced concrete structures or pre-stressed concrete structures. Dependent on the type of locality and the township, for types and groups of income slabs people prefer to use the construction of their choice. If the land costs are too high, people prefer to use high rise buildings that require the use of high grade concrete whereas in rest all cases people would use structures with limited height using the ordinary concrete or standard concrete as aptly defined by the IS codes.

As such use of concrete of various grades is a must. The behavior of reinforced or pre-stressed concrete structures, by and large, is governed by the behavior of the plain concrete which forms the major component of such structures. In this work various grades of concrete M20, M25, M30, M35, and M40 have been used and properties of the same have been studied. In this work an attempt is made to minimize the cost of concreting for same required grade of concrete by replacing the cement by optimum percentage of fly ash calculated on the basis of experimental results arrived at by considering the type and quality of the aggregates as are available in the local region. Hence, though use of 35% of Fly ash by weight of cement under codal provisions is permissible a lesser percentage of fly ash has been proposed consistent with the grade of concrete for producing the required strength using locally available aggregates. This results in the cost cutting.

I. USE OF CARBON FIBRE

- A number of technical papers published in various journals that were referred reveal that various carbon fibre percentages were used by number of research workers. While deciding carbon fibre percentage for the purpose of this research work the percentages by weight of cement has been used as the basis and were decided as 0.4%, 0.5% and 0.6% for carrying out the trials Using above carbon fibre percentages, concrete of various grades, incorporating optimum fly ash percentage to replace cement, was cast. A number of cubes, cylinders and beams were tested.

Table 1

- *Optimum FA content*

Grade	FA %
M20	20
M25	20
M30	20
M35	16.5
M40	12.5

II. EXPERIMENTAL PROGRAMME

In this research work 6mm carbon fibres with percentages as 0%, 0.4%, 0.5% and 0.6% by weight of cement has been used. For fresh concrete, the standard slump cone test was conducted according to IS 1199-1959 for all mixes immediately after the mix was completed. For finding compressive strength 150 X 150 X 150mm cube moulds were used and for split tensile tests 150 dia X 300 mm long cylinder moulds were used and for flexural strength determination 150 X 150 X 700mm size beam were used. Specimens were tested at 3, 7 and 28 days age for compressive strength, 7 days for split tensile strength and 7 days for flexural strength.

Table 2 given below shows the finally adopted mix proportions for various grades of concrete using locally available materials. The component W listed in the table referred to the free water cement ratio after accounting for water content, water absorption of various ingredients.

Table 2 Mix details

Final weight proportions					
Grade	**W**	**C**	**S**	**M-I**	**M-II**
M20	0.6384	1	1.8	1.47	1.2
M25	0.613	1	1.717	1.47	1.2027
M30	0.59	1	1.644	1.47	1.2
M35	0.534	1	1.455	1.47	1.2027
M40	0.477	1	1.264	1.47	1.2027

3.1 3days Compressive strength

	3 day P	3 day FA	3 day 0.4% CF
M20	14.06	15.99	18.93
M25	16.96	12.85	14.68
M30	18.70	15.05	19.33
M35	20.24	14.07	22.02
M40	26.49	22.95	28.25

P= PCC
FA=PCC + FA
CF=PCC + FA + Carbon fibres

3.2 7 days split tensile strength

	7 day P	7 day FA	7 day 0.4% CF
M20	2.23	2.16	2.46
M25	2.36	2.27	2.39
M30	2.38	2.36	2.35
M35	2.80	2.9	3.07
M40	2.94	2.97	3.04

3.3 Flexural strength

	7 day P	7 day FA	day 0.4% CF
M20	3.21	2.81	4.72
M25	3.24	3.22	3.25
M30	3.34	2.94	3.29
M35	4.17	2.83	3.37
M40	4.45	4	4

CONCLUSION

Above result show that in adding fibre percentage the compressive, split tensile and flexural strength was increased.

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