A Study of Structural Concrete Using Polyester And Polypropylene Fiber

Mr. Prashant V. Khatri[1], Dr. Kalpana V. Maheshwari[2], Ms. Kanan Thakkar[3]
[1, 2] H.J.DI.T Kera.
[3] S.V.N.I.T. Surat.

Abstract- *As concrete is the most commonly used material in construction, improvement of cementitious material become more and more essential. Conventional concrete has two major drawbacks: low tensile strength and a destructive and brittle failure. In an attempt to increase concrete ductility and energy absorption, Fibre Reinforced Concrete (FRC) has been introduced. By studying the research paper it is clear that by using synthetic fibre in concrete it gives better result. And we also used this kind of fibre in concrete where required high strength. Now as we studied that Many Researchers studied and gave good results for Polypropylene fiber reinforced Concrete with Different Proportions but no researchers doing work on polyester fibre. So this may be new attempt To compare Cost And Strength Parameters of Polypropylene Fiber Reinforced Concrete And Polyester Fiber Reinforced Concrete Because Nowadays PPFR is Used broadly In Construction.*

Keywords- Fibre reinforced concrte(FRC), Polyster, Polypropylene Fibre reinforced concrete

I. INTRODUCTION

Concrete has been proved to be a leading construction material for more than a century. It is estimated that the global production of concrete is at an annual rate of 1 m3 per capita (Neville 2003). The global consumption of natural aggregate will be in the range of 8–12 billion tonnes after 2010 (Tsung et al. 2006) Over 1 billion tonnes of construction and demolition waste (C&DW) is generated every year worldwide (Amnon 2004).

Figure 1.

The concept of using fibres in a brittle matrix was first recorded with the ancient Egyptians who used hair from animals and straw as reinforcement for mud bricks and walls in housing. This dates back in 1500 B.C. (Balaguru et. al, 1992). At the similar time period, about 3500 years ago, straws were used to reinforce sun-baked bricks for a 57m high hill of 'Aqar Quf', which is located near Baghdad. It is until the 1900's that asbestos fibres were developed, manufactured and widely used to augment mechanical properties of cement matrix as described by Bentur and Mindess (1990). Balaguru and Shah (1992) reported that the modern developments of using only straight steel fibres began in the early 1960's. Till now, a widely range of other type of fibres were used in cement matrices. Construction industries have led the development of type of conventional fibres such as steel, stainless steel and glass; where new types of fibres such as Kevlar and carbon; and several low modulus fibres, such as man made fibres (polypropylene, nylon) or natural fibres (jute, sisal, bamboo and wood pulp), as they are varies in their properties, cost and effectiveness.

II. LITERATURE REVIEW

- Nemkumar Banthia et al.(2006) stated that this study observe that Polypropylene fibers are highly effective in controlling plastic shrinkage cracking in concrete.
- Atef Badra et al. (2006) examined that The impact resistance of polypropylene fibre-reinforced concrete (FRC) was investigated using the repeated drop-weight impact test recommended by ACI Committee 544. The results were analysed based on a statistical approach. Impact resistance of PPFRC, as determined from the ACI repeated drop-weight impact test, has a large standard deviation and coefficient of variation. The observed coefficients of variation were about four-fold the recommended value for compressive strength. The values were about 60% and 50% for first-crack and ultimate impact resistance .
- Nemkumar Banthia et al. (2006) studied the polypropylene fibre properties. In this study we can observe that Polypropylene fibers are highly effective in controlling plastic shrinkage cracking in concrete.

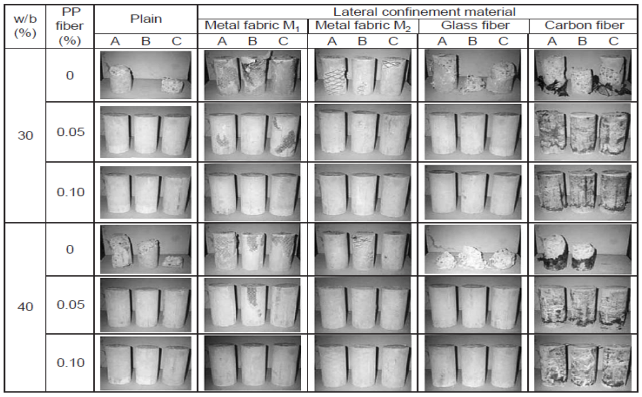

Figure 2.

- Nemkumar Banthia et al. (2006) research on behavior of polypropylene fibre and they conclude that the study observe that Polypropylene fibers are highly effective in controlling plastic shrinkage cracking in concrete.
- Saeid Kakooei et al. (2012) determine concrete freshand hardened properties by using polypropylene fibre In this study, the results of polypropylene fibers reinforced concrete properties have been presented. The compressive strength, permeability and electric resistivity of concrete samples were studied.

As per above all the research paper all the researcher done work on polypropylene fibre. A s we analyze result of polypropylene fibre it indicates there is considerably increase in strength criteria at one limit. Now the main problem in this polypropylene fibre is its cost. So for high rise building, bridges, and other liquid structure there is required high strength. If we used this kind of fibre in it than it gives us better result. Also there no researchers doing work on fresh concrete properties by using polypropylene fibre.

III. METHODOLOGY

Test Done on Ingredients

1) Natural Coarse Aggregates

- Abrasion Value
- Impact Value
- Crushing Value
- Water Absorption
- Specific Gravity
- Fineness Modulus

2) Sand

- Water absorption
- Specific Gravity
- Silt Content
- Fineness Modulus

IV. PROPERTIES OF MATERIAL

1) Cement

Physical properties of cement

Table 1.

Sr. No.	Test	Result
1	Consistency	32.50%
2	Initial setting time	105
3	Final setting time	235
4	Soundness	2.45
5	Compressive strength after 3-days	29.39
6	Compressive strength after 7-days	39.52
7	Compressive strength after 28-days	57.18

2) Coarse Aggregates

Physical Properties of C.A.

Table 2.

Sr. No.	**Properties**	**20mm DN**	**10mm DN**
1	Impact value	9.56	11.37
2	Crushing value	10.24	13.05
3	Specific gravity	2.88	2.86
4	Water absorption	0.86	0.96
6	Flakiness Index	12.43	8.69
7	Elongation Index	11.88	9.24

3) Fine Aggregates

Physical Properties of F.A.

Table 3.

Sr. No.	**Properties**	**Values**
1	Fineness Modulus	2.27
2	Water absorption	1.23
3	Specific Gravity	2.65
4	Silt Content	0.82
5	Density (gm/cc)	1.57

4) Polypropylene Fibre

Table 4.

Sr. No.	**Test**	**Normal**	**Treated For 200 hrs 13-14 PH & 50°**
1	Denier	3.08	0.55

2	Tenacity	5.0	2.7
3	Elongation	32.18	7.44

5) Polyster Fibre

Table 5.

Sr. No.	Test	Normal	Treated For 200 hrs 13-14 PH & 50°
1	Denier	2.94	2.94
2	Tenacity	5.30	5.2
3	Elongation	35.83	34.78

V. CASTING SCHEDULE

Table 5.

Sr. No.	Mix	Mix Name	Polyproplene Fibre		Polyester Fibre	
			Length (mm)	Volume Changes	Length (mm)	Volume Changes
1	M-25	A	0	0	0	0
2	M-25	B	6	0.2	6	-
3	M-25	C	6	0.5	6	-
4	M-25	D	6	1.0	6	-
5	M-25	E	6	1.5	6	-
6	M-25	F	6	2.0	6	-
7	M-25	G	6	-	6	0.2
8	M-25	H	6	-	6	0.5
9	M-25	I	6	-	6	1.0
10	M-25	J	6	-	6	1.5
11	M-25	K	6	-	6	2.0

VI. RESULTS

Compressive strength results

Table 6.

Sr. No.	Mix Name	Comp. Strength After 7 days	Comp. Strength After 28 days	Comp. Strength After 56 days	Comp. Strength After 90 days
1	A	22.6	32.6	36.6	Pending
2	B	23.8	34.1	38.9	Pending
3	C	25.1	36.3	40.8	Pending
4	D	26.0	37.2	41.2	Pending
5	E	27.0	38.9	44.1	Pending
6	F	25.6	36.7	41.2	Pending
7	G	27.0	39.1	43.9	Pending
8	H	30.1	43.2	49.0	Pending
9	I	31.2	44.8	50.6	Pending
10	J	30.2	43.1	48.3	Pending
11	K	28.0	40.3	45.6	Pending

Split tensile strength

Table 7.

Sr. No.	Mix Name	Split Tesnile Strength After 7 days	Split Tesnile Strength After 28 days	Split Tesnile Strength After 56 days	Split Tesnile Strength After 90 days
1	A	2.10	3.08	3.32	Pending
2	B	2.22	3.18	3.45	Pending
3	C	2.32	3.31	3.60	Pending
4	D	2.35	3.35	3.68	Pending
5	E	2.42	3.46	3.72	Pending
6	F	2.33	3.33	3.60	Pending
7	G	2.43	3.48	3.73	Pending
8	H	2.52	3.67	4.12	Pending
9	I	2.67	3.82	4.18	Pending
10	J	2.53	3.72	4.00	Pending
11	K	2.48	3.62	3.89	Pending

Flexural Strength

Table 8.

Sr. No.	Mix Name	Flexural Strength After 7 days	Flexural Strength After 28 days	Flexural Strength After 56 days	Flexural Strength After 90 days
1	A	2.83	4.00	4.18	Pending
2	B	2.91	4.12	4.40	Pending
3	C	3.12	4.23	4.46	Pending
4	D	3.06	4.28	4.49	Pending
5	E	3.21	4.39	4.60	Pending
6	F	3.08	4.24	4.50	Pending

7	G	3.12	4.39	4.63	Pending
8	H	3.32	4.62	4.92	Pending
9	I	3.41	4.68	4.98	Pending
10	J	3.31	4.62	4.86	Pending
11	K	3.25	4.45	4.75	Pending

Slump Test

Table 9.

Sr. No.	Mix Name	Slump Value
1	A	110
2	B	93
3	C	91
4	D	88
5	E	83
6	F	67
7	G	86
8	H	83
9	I	79
10	J	82
11	K	80

VII. CONCLUSION

- As per above results we observed that upto 56 days strength polyester fibre perform well.
- In compressive strength it gives higher compressive strenth than normal concrete mixes. Here results after 90 days is missed.
- Same as higher stregnth observed in split tensile strength as well as flexural stregnth increased.
- In workability there difficulty observed. It didn't give proper flow of concrete as per normal concrete.
- To getting workability here we used superplasticizers.

REFERENCES

[1] Badr, A., Ashour, A.F. and Platten, A.K., 2006. Statistical variations in impact resistance of polypropylene fibre-reinforced concrete. International Journal of Impact Engineering, 32(11), pp.1907-1920.

[2] Banthia, N. and Gupta, R., 2006. Influence of polypropylene fiber geometry on plastic shrinkage cracking in concrete. Cement and Concrete Research, 36(7), pp.1263-1267.

[3] Han, C.G., Hwang, Y.S., Yang, S.H. and Gowripalan, N., 2005. Performance of spalling resistance of high performance concrete with polypropylene fiber contents and lateral confinement. Cement and concrete research, 35(9), pp.1747-1753.

[4] Kakooei, S., Akil, H.M., Jamshidi, M. and Rouhi, J., 2012. The effects of polypropylene fibers on the properties of reinforced concrete structures. Construction and Building Materials, 27(1), pp.73-77.

[5] Richardson, A.E., 2006. Compressive strength of concrete with polypropylene fibre additions. Structural survey, 24(2), pp.138-153.