International Journal of New Technology and Research (IJNTR)
ISSN:2454-4116, Volume-3, Issue-5, May 2017 Pages 54-56

Shear Behaviour of Reinforced Concrete Using PET Bottle Fibre

Divya Prabha V M, Dr. Sunilaa George

***Abstract*— Utilization of waste materials for new products which in turn minimize the heavy burden on the nation's landfill. Recycling of plastic helps to reduce the high rates of plastic pollution. Lots of journals are published about the utilization of waste materials. Concrete is most widely used man made construction material in the world.**

This study is aimed to determine the shear behavior of Polyethylene terephthalate fibre reinforced concrete of M 25 mix proportion. The plastic bottle were shredded into fibres of specific size and shape. This study deals with different aspect ratio of 4, 8 and 12 respectively. The pet fibres were added in proportions 0.5%, 1%and 1.5% respectively. Different tests were conducted and the results obtained from the tests are compared with control specimens.

***Index Terms*— PET fibre, Aspect ratio, Push off, Shear Strength..**

I. INTRODUCTION

Concrete is a very hard material made by mixing together cement, sand, coarse aggregates and water. It is commonly used in buildings and other important engineering works where strength and durability is of prime important. Concrete has relatively high compressive strength, but significantly lower tensile strength

Mineral water bottle made of polyethylene terephthalate can be recycled to reuse the material out of which they are made and to reduce the amount of waste going into landfills. Hence reusing of PET wastes in the building industry is an effective advance towards preventing surrounding pollution and designing economical buildings. Use of PET bottle fibre in concrete can get better mechanical properties. The PET fibres addition in concrete is an innovative material that can be encourage in construction field.

The use of Pet fibre has given better results than any other forms. In this study behavior of PET fibre reinforced concrete under shear strength and models for prediction of shear strength of PET fibre reinforced concrete in terms of cube compressive strength and fibre volume fraction is presented.

II. PAST STUDIES

Number of researches are conducted on fibre reinforced concrete to improve the weakness of the concrete material. Mark Adom-Asamoah et al. (2009) have discussed about Flexural and Shear behavior of Reinforced concrete beam made from recycled material, 50% recycled concrete beams were made using aggregates demolished from three year old concrete components. The study found that Polypropylene fibres enhance the cracking properties, fracture toughness and impact resistance of the material. R.N.Nibudey et al. (2014) have studied about the shear strength of plastic fiber reinforced concrete. In his study the maximum increase in shear strength of PFRC was 27.25% for M20 grade of concrete at 1% fiber volume fraction with aspect ratio 50 over the normal concrete. Harish Kumar N R et al. (2015) have conducted experiments to study the direct shear transfer capacity of normal strength concrete, self-compacting concrete and high strength concrete by conducting a recently developed push off specimen. They concluded that all types concrete as the height of shear plane increases, ultimate shear stress decreases.

III. ABBREVIATION

PET fibre - Polyethylene terephalate
FRC – Fibre reinforced concrete
AR – Aspect Ratio of Fibre

IV. EXPERIMENTAL STUDY

The materials investigated in this study are as follows

A. Cement

Ordinary Portland cement of 53 grade used in this investigation and it confirming specifications as per IS 12269-1987.

B. Fine Aggregate

M Sand is used in this experimental purpose confirming to zone II as per IS 383-1970.

C. Coarse Aggregate

Angular coarse aggregate of maximum size 20mm was used as per IS 383-1970.

D. Water

Ordinary drinking water available in the casted area and it is confirming to IS 10500 -2012

E. PET (polyethylene terephalate) fibre

The PET bottles of Crimped type were collected for the experiment. The fibres were cut after removing the neck and bottom of the bottle. The length of fibres was kept 8 mm, 16 mm, 24 mm and the breadth was 2 mm. The aspect ratio of waste plastic fibres were 4, 8 and 12. The plastic fibres used were having specific gravity 1.34, water absorption 0%.

Divya Prabha V M, P.G. Student, Department of Civil Engineering, EASA College of Engineering and Technology Navakkarai, Coimbatore, India
Dr. Sunilaa George, Professor and Head of Civil Engineering Department, EASA College of Engineering and Technology Navakkarai, Coimbatore,India

V. CONCRETE MIX PROPORTION

The mix proportions for ordinary grade concrete of M25 are designed using IS: 10262-1982.

Table 1

Cement	FA	CA	Water
1	1.65	3.23	0.43

VI. EXPERIMENTAL PROGRAM

The Experimental program comprised of Cube test, cylinder test, push off specimen test, prism test and beam test. The push off test is based on the idea of applying an axial force to produce a pure shear on a plane of the specimen. All the casted specimens were de moulded after 24 hrs and placed in a water tank for a period of 28 days. The results were compared and analyzed with that of control mix.

A. Compressive Strength Test

Representative samples of concrete has been taken and used for casting cubes 15cmx15cmx15cm. The samples stored in clean water for 28 days. Tested the cube with the help of UTM Machine. Compressive strength of PET fibre concrete and Conventional concrete are plotted in the graph sheet.

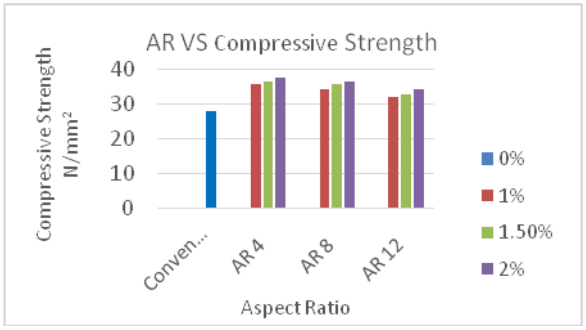

Figure: 1 Compressive Strength

B. Split Tensile Test

In this, cylinder are tested with the help of UTM Machine. The load was applied continuously at a specified rate of loading until the resistance of specimen to the increasing load breaks and no longer is load sustained, the breaking load was noted.

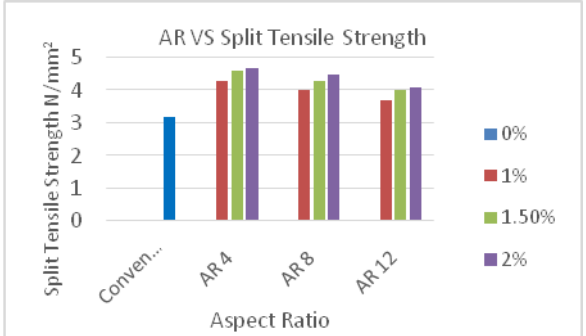

Figure: 2 Split tensile strength

C. Flexural Strength Test

Total 10Prisms were cast, each with c/s having 10 x 10 cm and length 50 cm. Concrete prism loaded by single point loads placed at center point of the span. The load is increased gradually until flexural failure occurs.

Dial gauges are placed at selected location of prism. All loads and the deflection data were recorded and crack patters of the prism is noted. Results are plotted in a graph below in Fig.4

Figure: 3 Flexural strength test

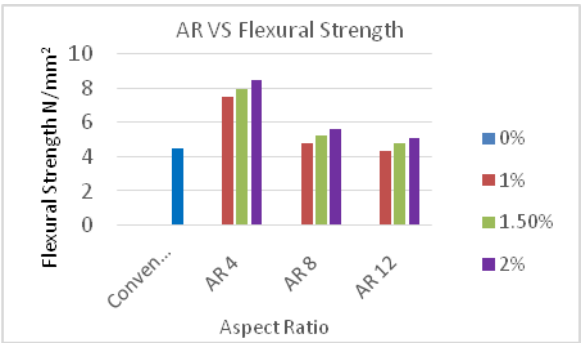

Figure: 4 Flexural Strength Test

D. Shear Strength Test

Geometry

Total 10 Beams each with C/S 10 x 15 cm and length 150 cm were casted with different proportion of pet fibre in each beam. Out of which 3 beam specimens were treated as controlled specimen. All beams were reinforced with 4 nos 10 mm dia road as main reinforcement. 8 mm dia transverse reinforced was provided in beam at 200 mm c/c spacing. Clear cover provided to the reinforcement is 20 mm.

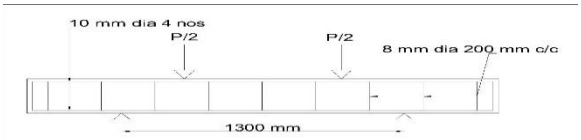

Figure: 5 Reinforcement Details of RC beam

Test Procedure

Testing was carried out on loading frame. All beams were tested as simply supported beam under two point loading over an effective span of 1300 mm, the loads were applied at a distance of 500 mm on either side of the beam .The loads were monitored through the dial. Deflection at the mid-point and loading points was measured using dial gauges.

Crack Pattern and Failure Mode

Very few flexural cracks were observed near mid span in the early stage of loading. With increasing load, additional flexural cracks in each shear span were observed. These cracks were began to turn towards the loading point due to
Combined shear and flexural stress. On further loading, preliminary shear cracks formed in shear span, this load which shear strength of concrete is defined.

Table: 2

Specimen Description	Volume of pet fibre	First crack load KN	Ultimate load KN	Deflection at ultimate load	Mode of failure
NC	0%	20	27.5	19	Diagonal Tension
AR4 -1	1 %	15	30	19	
AR4 -2	1.5%	15	34	20.23	
AR4 -3	2%	20	37.5	22.5	
AR8 -1	1%	15	30	15.57	
AR8 -2	1.5%	15	32.5	16.68	
AR8 -3	2%	17.5	36	19.23	
AR12 -1	1%	15	30.5	18	
AR12 -2	1.5%	17.5	33	18.96	
AR12 -3	2%	20	32.5	20.8	

Figure: 6 Crack pattern

Load Deflection Curve: The deflection of the beam were found out with the help of dial gauges placed at mid-point and loading point.

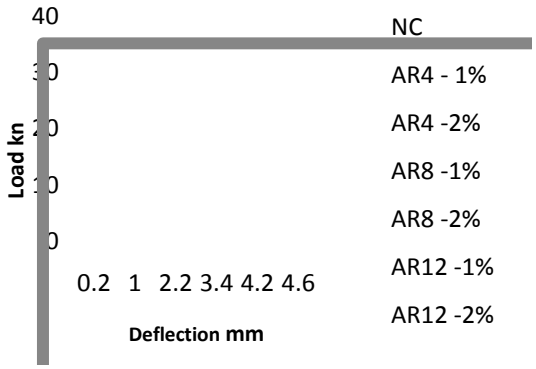

Figure: 7 Load Deflection curve

CONCLUSION

The focus of the present work is the compressive, Split tensile, shear and flexural strengths of PET fibre reinforced concretes. From the investigations carried out, a number of conclusions may be deduced.

1. The experiment observed that conventional concrete specimens fails suddenly at ultimate strength whereas FRC specimens did not fail suddenly. Use of PET fibres in the concrete structures helps to resolve solid waste the land fill.
2. Increasing PET fibre in the concrete mix, the compressive, shear and flexural strengths of the concrete is progressively increased in relation to the reference concrete.
3. Finally in respect of the tests conducted in the study, it is observed that FRC having pet fibre aspect ratio 4 up to a level of 2% volume in M25 grade concrete may be utilized in infrastructural applications like concrete structures.

REFERENCES

1. Aswathy N, Allzi Abraham, 'Experimental Study on Concrete with Straight and Crimped Plastic Fibres', International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 Impact Factor (2015): 6.391, pp. 1589-1592.
2. R. N. Nibudey, P. B. Nagarnaik, D. K. Parbat, 'Shear Strength of Waste Plastic (PET) Fibre Reinforced Concrete', International Journal of Modern Trends in Engineering and Research, Scientific Journal Impact Factor :1.711,pp. 58-65
3. Fernando Pelissera, Oscar Rubem Klegues Montedoa, Philippe Jean Paul Gleizeb, Humberto Ramos Romanb, 'Mechanical Properties of Recycled PET Fibers in Concrete', Materials Research. 2012; pp. 679-686
4. Ms. K.Ramadevi, Ms. R. Manju, 'Experimental Investigation on the Properties of Concrete with Plastic PET (Bottle) Fibres as Fine Aggregates'. International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, Volume 2, Issue 6, June 2012) 42, pp. 42-46
5. P. Ganesh Prabhu, C. Arun Kumar, R. Pandiyaraj, P. Rajesh & L. Sasi Kumar, 'Study On Utilization Of Waste Pet Bottle Fibre In Concrete', International Journal of Research in Engineering & Technology (IMPACT: IJRET) ISSN(E): 2321-8843; ISSN(P): 2347-4599 Vol. 2, Issue 5, May 2014, pp. 233-240
6. IS 10262: 2009, 'Indian Standard, recommended guidelines for concrete mix designs', Bureau of Indian Standard, New Delhi.
7. IS 383:1970 'Specifications for coarse and fine aggregates for natural sources for concrete, Bureau of Indian Standard, New Delhi.
8. IS 456:2000 'Indian standards plain and reinforced concrete- code of practice' Bureau of Indian Standard, New Delhi.