USE STRENGTH BEHAVIOUR OF CONCRETE MIXTURE BY PARTIAL REPLACEMENT OF HARDEN MOLTEN RECYCLED PLASTIC (HMRP) AS COARSE AGGREGATE AND HOOKED STEEL FIBER IN M35 GRADE FIBER REINFORCED CONCRETE.

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ABSTRACT: *This project is aimed to study the characteristic strength of concrete by replacing the CA with HMRP. In this study the M35 FRC with OPC 53grades, natural sand, CA of down size 20mm with partially replacing it with HMRP waste at various percentages to achieve the optimum strength. This project is also focuses to embed the plastic waste in concrete safely as a disposal method of waste plastic. As the replacement of 100% of NCA by HMRP is not feasible, In this research HMRP is used as partial replacement of CA in M35 FRC with constant 1% of hooked steel fiber as cement's weight. The replacement of CA is taken as 0%, 11%, 21% and 31%. Investigation result indicates that HMRP has potential replace to CA as 21% safely with no change in its strength characteristics.*

Keywords: hooked steel fiber, M35 Grade concrete, OPC 53, w/c 0.45, HMRP Aggregate.

I. INTRODUCTION

We live in the plastic world. In our daily life, the plastic is one of the things most usually used which are used at various ends. The day starts with the package of milk is composed of plastic with high density and much more products which are packed with the plastic. As we know it all on the serious damage with the environment and the plastic is the leading causes of pollution.

The plastic is not-degradable in nature thus the elimination of the plastic is a headache for the engineers. When the plastic is flaring it releases poisonous gases in the environment which can lead to the diseases of lungs, when it is laid out inside with the ground which causes ground and as well the water pollution. There exist many methods which are adopted for the elimination of the plastic and they are: hiding, the incineration, recycling and biological breakdown. But this project aims at introducing a new method of plastic waste disposal.

As we all know it that the concrete has very a long life and after its useful life, the concrete is used for the filling of the grounds. The ingredient of the concrete is also integrated in it during very long time. Thus, when plastic waste is used as ingredient of the concrete, it is in full safety integrated in the concrete for very a long period of time without causing pollution. Indian scenario, the government of Indian Roads congress builds the concrete roads in the rural regions and as well as in the urban areas. Thus, the plastic of reject can be integrated inside by employing the suitable method according to this project.

In this research task, harden molten recycled plastic aggregates were used like replacement partial of the aggregate gross natural of the concrete. The percentages envisaged of harden molten recycled plastic aggregates (HMRP) were variable expressed as a percentage from 11% to 31% with an increase of 10% (11%, 21% and 31%). The compressive strength of each sample recorded was compared with the mixture of conventional concrete.

II. OBJECTIVES:

The current industry of the Indian concrete consumes approximately 374 million meter cube of concrete every year and it is envisaged, that it must reach to approximately 580 million meter cube by 2022, Reformation of The natural sources are beyond the proportion of humanity from where the increased demand for concrete brought up a major issue about the fast disappearance of invaluable natural sources. It thus became necessary to find another material might be utilized as well as conventional materials and to try to reduce the fast and enormous use of precious sources.

2.1 Other Objectives Of Project

1. To judge against the various properties like the resistance of compression and the density of the concrete modified with partial alternate of N.C.A by H.M.R.P used for concrete modified with conventional concrete
2. To judge against the physical properties of the natural coarse aggregates (NCA) with coarse plastic aggregates recycled (HMRP).
3. To decrease the pressure on materials of natural availability by replacing it by a recycled plastic aggregate.
4. To judge against the physical characteristics of the natural aggregate with the aggregate recycled plastic.
5. To study the behavior of the concrete freshly-mixed and hardened with recycled
6. W.C.A and to evaluate its properties with C.V concrete.
7. To produce light concrete for a general-purpose use, it represents an ecological and economic solution viable, for the use of plastic scrap.
8.

III.MATERIALS AND MIX DESIGN

3.1 Cement: Cement of category CCI OPC 53 is used for profitable fast constructions where initial resistance is higher than the criteria. It offers durability to the concrete structures. More ... Cement of category CCI OPC 53 reached the force of compression of 53 Mpa (mega Pascal's) in 28 days of adjustment

S. No	TEST	RESULT OBTAINED EXPERIMENTALLY
1	Standard Consistency	40%

2	Fineness	3.0%
3	Initial setting time	30 min
4	Specific gravity	3.15

Table 3.1.1: Physical Properties of Cement

3.2 Fine aggregate: The natural sand of the river extracts from the Shahabad pit to the provisions of IS: 383-1970 (zone I) having a specific gravity 2.70 is used. Sand must be utilizing to produce concrete which must be free from organic matter, dirtiness and does not have to undergo alkaline reactions while mixing the mixture. The absorption of water = 0.9%, weight of sample = 1 kg (1000gm)

S. NO	TEST	RESULT OBTAINED EXPERIMENTALLY
1.	Fineness	3.54
2.	Specific gravity	2.62

Table 3.1.2: Physical Properties of Fine Aggregate

3.3 Water: The is relationship between weight 0f water and the weight 0f cement use in mixture to make concrete. A weaker report leads to a greater resistance and durability, but can make the mixture difficult to work with and to form. Work can be solved with the use of plasticizers or Super-plasticizers. The w/c ratio was taken as 0.45 for this investigation.

3.4 Coarse Aggregate: The crushed fresh aggregates must be useful to produce concrete which must be free from organic matter, dirtiness and does not have to undergo alkaline reactions while mixing the mixture, specific gravity average of 2.65 and aggregates is sized of 20mm.

S. NO	TEST	RESULT OBTAINED EXPERIMENTALLY
1.	Fineness	8.27
2.	Specific gravity	2.65

Table 3.1.4: Physical properties of Coarse Aggregate

3.5 Hooked Steel Fiber: Hooked steel fiber with ¼ 50 made of Steel. The length of hooks is 6 mm, with 30°& 45° bending angles.

3.6 Hard Molten Recycle Plastic Waste (HMRP): Waste bag dustbin the plastic was collected in the discharge and other places in the environment and as used for manufacturing of light aggregates. The sheet of plastic waste worked like was wished, for example. The aggregate of waste plastic was customized by heat action 0160 ° C -0200 ° C in the machine of recycling granules of plastic. Then hot aggregate is withdrawn from machine and made it possible to cool down with the normal temp, but it is a mixture of round and angular forms, a little as the crushed stone. And the plastic granules obtained are crushed in a crusher with a size of 20mm. It is also known as Reprocess plastic Granules.

Figure 3.6 Shows HMRP Sample

S. NO	TEST	RESULT OBTAINED EXPERIMENTALLY
1.	Fineness	7.35
2.	Specific gravity	0.81

Table 3.1.6: Physical properties of HMRP

3.7 Slump Cone Test: As per IS 7320-1974 the test was carried out to see the consistency of the coldly made concrete. The wetter mixtures will be handier than the drier mixtures, but same consistency of concrete can vary according to the practice. "The recession of the prepared concrete was 152mm, so that the concrete can be used for normal structures RCC and roads.

4.0 DESIGN MIXTURE (IS: 10262-2009) PER CUBIC METER

M35 Grade Concrete	Cement	Water	Fine Aggregate	Harden molten recycle plastic aggregate	Natural Coarse Aggregate
Conventional	440kg	197 Lit	678.2 kg	0	1086 kg
	1	0.45	1.54	0	2.48

Table 4.1: Shows Mix Proportion

V RESLUTS & DISCUSSI0NS

5.1 COMPRESSION STRENGTH (C.S) TEST: The most important test carried out to check the resistance and the durability of the concrete is the test of compressive strength. The tests were carrying out according to

516- 1959. The UTM was used in this test, charges to which the sample of cube failure or crushing is noted, and then the compressive force is given by dividing the load by zone of the sample of cube. 30 cubes were molded for this test & Results of C.S of 7 & 28 days.

Figure 5.1 Shows Compression Testing Machine

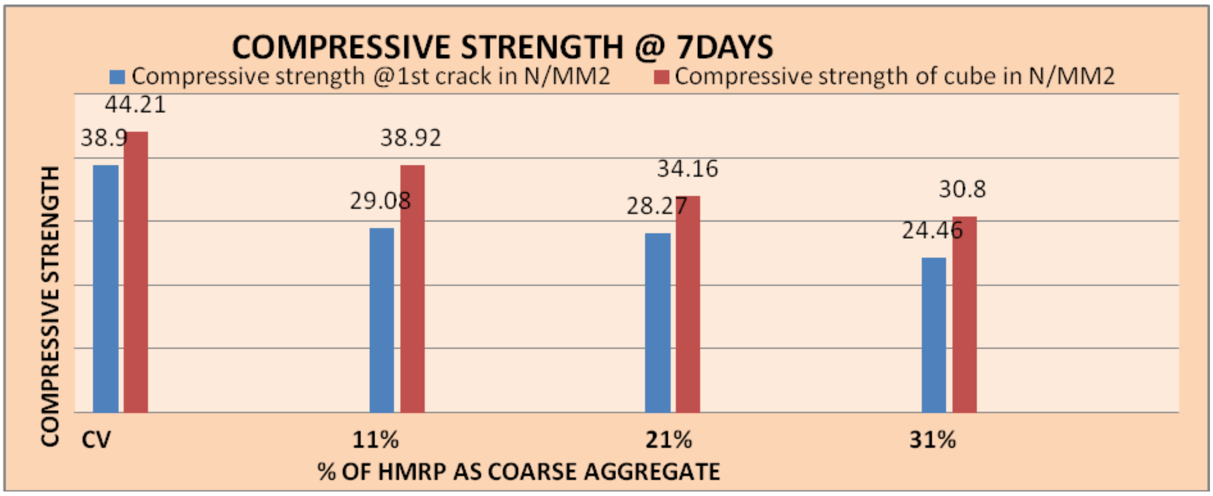
SL No.	% of HMRP as coarse agg.	Descr-iption of cube	1st Crack load in KN	Compressive strength at 1st crack in N/mm²	Average compressive strength at 1st crack in N/mm²	Failure load in KN	Compressive strength of cube in N/mm²	Average compressive strength in N/mm²
1	CV	DC1	875	38.89	38.90	985	43.78	44.21
		DC2	882	39.20		1002	44.53	
		DC3	869	38.62		997	44.31	
2	11%	DC1	665	29.56	29.08	885	39.33	38.92
		DC2	627	27.87		850	37.78	
		DC3	671	29.82		892	39.64	
		DC1	632	28.09		769	34.18	

ISBN : 978-93-87793-33-0

3	21%	DC2	641	28.49	28.27	762	33.87	34.16
		DC3	635	28.22		775	34.44	
4	31%	DC1	544	24.18	24.46	691	30.71	30.80
		DC2	535	23.78		701	31.16	
		DC3	572	25.42		687	30.53	

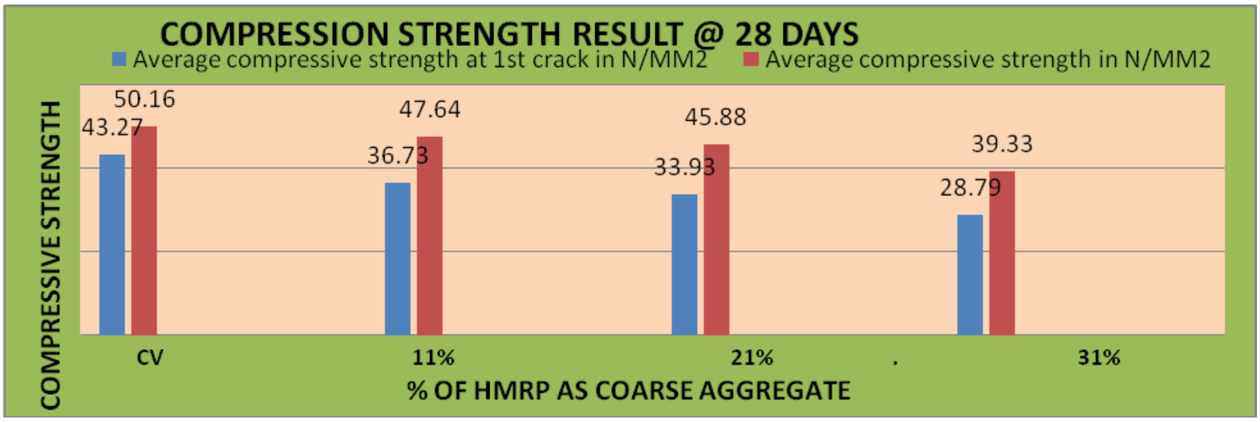
Table 5.1(a): Shows Compression strength result @ 7 days

SL No.	**of HMRP coarse agg**	**Descrip tion of cube**	**1st Crack load in KN**	**Compress ive strength at 1st crack in N/mm^2**	**Avg compressiv e strength at 1st crack in N/mm^2**	**Failur e load in KN**	**Compressiv e strength of cube in N/mm^2**	**Avg compres sive strength in N/mm^2**
1	CV	DC1	1125	50.00	43.27	1135	50.44	**50.16**
		DC2	894	39.73		1125	50.00	
		DC3	902	40.09		1126	50.04	
2	11%	DC1	766	34.04	36.73	1075	47.78	**47.64**
		DC2	856	38.04		1073	47.69	
		DC3	857	38.09		1068	47.47	
3	21%	DC1	775	34.44	33.93	1035	46.00	**45.88**
		DC2	753	33.47		1029	45.73	
		DC3	762	33.87		1033	45.91	
4	31%	DC1	597	26.53	28.79	885	39.33	**39.33**
		DC2	691	30.71		879	39.07	
		DC3	655	29.11		891	39.60	



Graph No-5.1(a): Shows The Compression Strength Result @ 28 Days

Table 5.1(b): Shows Compression strength result @ 28 days



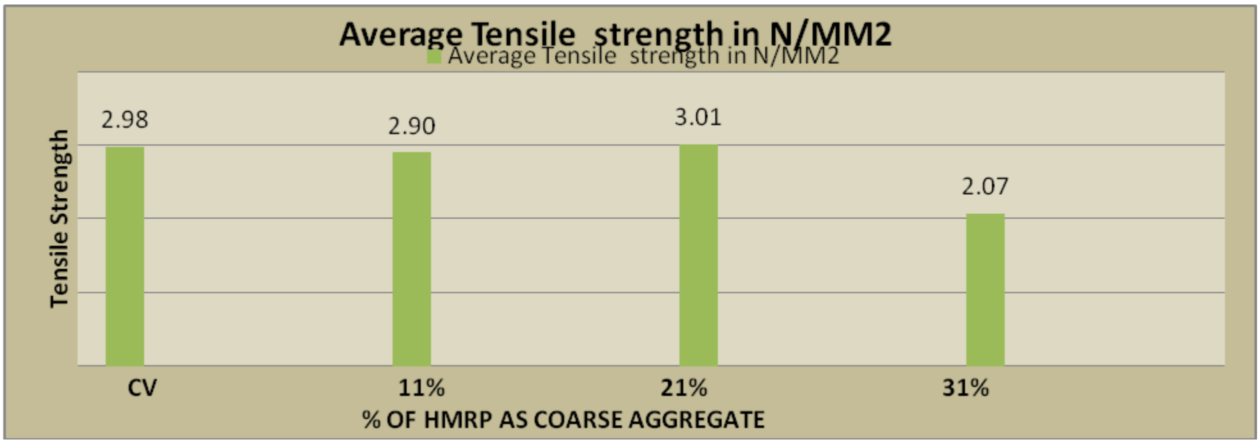
Graph No-5.1(b): Shows the Compression Strength Result @ 28 Days

5.2 THE SPLIT TENSILE STRENGTH(S.T.S) TEST: For the creation of structural members subjected to torsion, transverse shearing and contracting, tensile strength is necessary. The resistance test split is carried out specimen 0f of size 0150 mm diameter X 0300 mm ht. The cylinder is tested under UTM as per IS: 5816- 1970. 30 cylinders were molded for the test. The cylinder when it crushes in the UTM, the load is noted and the tensile strength is calculated & Maximum S.T.S result of 3.01N/mm2 was obtained with mix proportion of 21% of HMRP at 28 days curing.

SL No.	Percentage of Waste plastic as course agg	Description of Cylinder	Weight of Cylinder in kg	Failure load "KN"	Tensile strength of Cylinder	Average Tensile strength

					N/mm²	**N/mm²**
1	Conventional concrete	DCY1	14.066	211	2.98	**2.98**
		DCY2	14.071	210	2.97	
		DCY3	14.068	212	3.00	
2	11%	DCY1	13.934	205	2.90	**2.90**
		DCY2	13.941	206	2.91	
		DCY3	13.938	204	2.89	
3	21%	DCY1	12.856	211	2.98	**3.01**
		DCY2	12.855	212	3.00	
		DCY3	12.862	215	3.04	
4	31%	DCY1	12.904	146	2.07	**2.07**
		DCY2	12.899	142	2.01	
		DCY3	12.901	151	2.14	

Table 5.2 : Shows the Test On Split Tensile Strength result @ 28 days



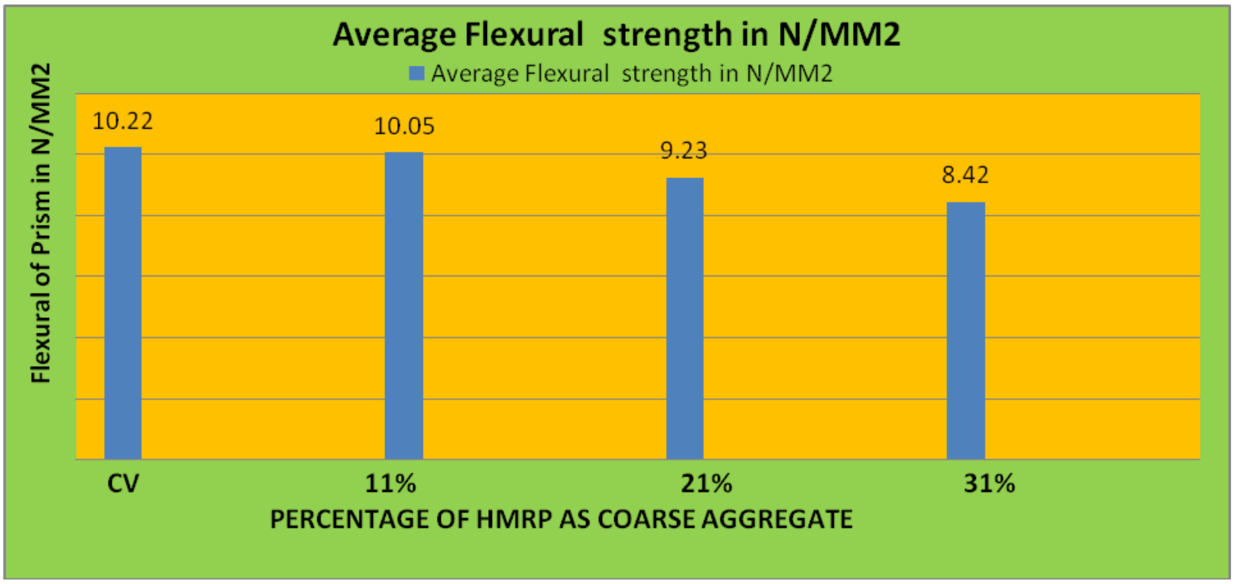
Graph No-6.2: Shows the Test on Split Tensile Strength result

5.3 THE FLEXURAL STRENGTH (F.S) TEST: This test is carried out with a prism of size 100mm X 100mm X 500mm. the test should be carried out according to the directives: 516-1959. The prisms are examined under the load of 2 points for to calculate the F.S & The Maximum flexural strength of 9.23N/mm2 was obtained with mix proportion of 21% of HMRP at 28 days curing.

ISBN : 978-93-87793-33-0

SL No.	Percentage of Waste plastic as course agg	Description of Prism	Weight of Prism in kg	Failure load in T	Flexural of Prism in N/mm^2	Average Flexural strength in N/mm^2
1	Conventional concrete	DPM1	13.11	2.1	10.30	**10.22**
		DPM2	13.12	2.05	10.05	
		DPM3	13.11	2.1	10.30	
2	11%	DPM1	12.83	2	9.81	**10.05**
		DPM2	12.834	2.05	10.05	
		DPM3	12.835	2.1	10.30	
3	21%	DPM1	12.651	1.9	9.32	**9.23**
		DPM2	12.654	1.95	9.56	
		DPM3	12.655	1.8	8.83	
4	31%	DPM1	11.71	1.7	8.34	**8.42**
		DPM2	11.712	1.75	8.58	
		DPM3	11.711	1.7	8.34	

Table 5.3: Shows Result Of Flexural Strength Test



Graph No-5.3: Shows the Flexural Strength Test Result

5.4 SORPTIVITY TEST: The sorptivity value remains same for Conventional concrete and Coarse aggregate as HMRP replaces concrete, during the test it was observed that, the plastic doesn't show any absorption.

SL NO.	Description of Disc	% of waste PP pellets as fine aggregate	Dry weight in gm	wet weight in gm	Sorptivity (mm/min^0.5)	Average Sorptivity (mm/min^0.5)
1	DC1	21%	1198	1202	0.09297	**0.093**
2	DC2		1197	1201	0.09297	
3	DC3		1199	1203	0.09297	
4	DC1	0%	1315	1319	0.09297	**0.093**
5	DC2		1312	1316	0.09297	
6	DC3		1314	1318	0.09297	

Table 5.4: Shows result of Sorptivity Test

5.5 TEMPERATURE TEST: At 2000 C temperature there is little change in compressive strength were as at 3000 C there were main cracks formed in specimen and compressive strength decrease by 48% as compared to conventional concrete.

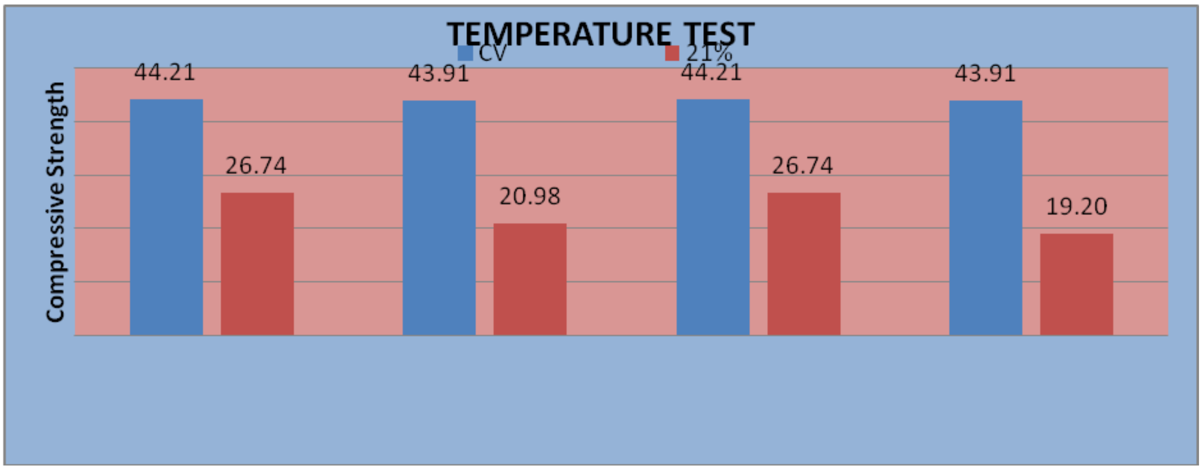
SL No.	% of HMRP as coarse agg	Description of cube	Weight of cube after Temp test in kg	weight reduction in %	compressive strength before Temp of 200^0 C in N/mm2	Average compressive strength before Temp of 200^0 C in N/mm2	compressive strength after Temp of 200^0 C in N/mm2	Average compressive strength after Temp of 200^0 C in N/mm2
1	CV concrete	DC1	8.268	0.02	43.78	44.21	43.01	**43.91**
		DC2	8.249	0.01	44.53		44.44	
		DC3	8.27	0.00	44.31		44.27	
2	21%	DC1	7.351	0.26	26.76	26.74	20.80	**20.98**
		DC2	7.372	0.24	27.16		20.62	
		DC3	7.341	0.26	26.31		21.51	

Table 5.5(a): Shows the Temperature Test Results @ 200^0 C

8th July 2018 www.conferenceworld.in ISBN : 978-93-87793-33-0

SL No.	% of HMRP as coarse agg	Description of cube	Weight of cube after Temp test in kg	weight reduction in %	compressive strength before Temp of 300^0 C in N/mm2	Average compressive strength before Temp of 300^0 C in N/mm2	compressive strength after Temp of 300^0 C in N/mm2	Average compressive strength after Temp of 300^0 C in N/mm2
1	CV concrete	DC1	8.269	0.07	43.78	44.21	43.01	**43.91**
		DC2	8.253	0.02	44.53		44.44	
		DC3	8.307	0.04	44.31		44.27	
2	21%	DC1	7.369	0.12	26.76	26.74	19.02	**19.20**
		DC2	7.383	0.12	27.16		19.38	
		DC3	7.358	0.11	26.31		19.20	

Table 5.5(b): Shows the Temperature Test Results @ 300^0 C



Graph No-5.5: Shows the Temperature Test Results @ 200^0 C & 300^0 C

VI CONCLUSION

1. In comparison with 11%, 21%, & 31% with constant of hooked Steel fiber 1% with partial replacement of coarse aggregate as HMRP is perceived as best fiber volume for both strength and cost aspects.
2. While comparing with 11%, 21%, & 31% with constant of hooked Steel fiber 1% with partly replacement of C.A as HMRP, 21% is optimal replacement to O.P.C.
3. Overall strength such as, c0mpressive, tensile and flexural strength increase with the adding up of hooked S.F was minor in HMRP Concrete.

4. Compressive strength increases with adding up of hooked steel fiber for the concrete of HMRP appreciably compared to normal concrete. Maximum resistance to compression was of 34.16 N/mm2 and 45.88 N/mm2 @ 21% of replacement of HMRP like natural coarse aggregate with 7 & 28 days of hardening.
5. The adding up of Steel fiber appreciably improved the ductility of the HMRP as a C.A in concrete, but significantly does not have an effect on value of compressive strength.
6. The results 0f split tensile strength, maximum were got with a proportion 0f mixture 21% at 3.01 N/mm2 by the replacement of the HMRP like natural coarse aggregate.
7. The maximum results of flexural strength were got with a proportion of mixture 21% at 9.23 N/mm2 by the replacement of the HMRP like natural coarse aggregate.
8. The value of sorptivity is rest identical for the conventional concrete and the coarse aggregate as HMRP replaces the concrete, during the test it was observed that, the plastic do not show any absorption.
9. Lastly, one can say that HMRP can be used like a substitute with the exchange of natural coarse aggregates, therefore to lower the use of the natural coarse aggregate and the cost cutting of construction.
10. After having carried out all the tests above, HMRP can be replaced by 21% like coarse aggregate without any harmful effect in the long run and with properties of acceptable development of resistance, which is in full safety integrate plastic waste in the concrete like a method of plastic waste disposal.
11. Because of the low density of HMRP the concrete became light weight in nature like comparing with the conventional concrete.
12. This concrete HMRP can be used in work of R.C.C such as slab, beams and columns. Especially in the concrete roads it can be replaced.
13. At 200 c temperature there is little change in compressive strength were as at 300 c there were main cracks formed in specimen and compressive strength decrease by 48% as compared to conventional concrete.
14. A special type of coating of fire resistance is necessary to increase resistance against the effect of the temperature on the concrete.

VII.SCOPE

1. The split tensile strength of concrete HMRP must be carried out to determine behavior in traction of the modified concrete.
2. Experimental study must be carried out for other varieties of plastic like HDPE, PP, PT
3. The durability of such a concrete must be tested for the slab, beams and the columns with variable proportions of plastic scrap at various ages.
4. The fire resistance of the HMRP concrete must be tested in a State controlled to check fire protection of the building

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