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Durability Properties on Fuel Dispenser Hose Pipe Rubber as a Course Aggregate in Self Compacting Concrete

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ABSTRACT:-
The fuel dispenser hose pipe rubber is mostly available in all the petroleum bunk. Open burning of hoses for steel mining causes several pollution problems. An effort was made to reinstate coarse aggregate with the fuel dispenser hose pipe. When it was cut to a mandatory size of 20 mm and less in self compacting concrete. This fuel dispenser hose pipe with dissimilar percentage of 10%, 20%, 30%, 40%, and 50% was tested for fractional replacement of coarse aggregate for M30 grade concrete. The replacement of coarse aggregate by fuel dispenser hose pipe rubber effects on the workability of the concrete. To determine the workability slump- cone and J-ring test are determined. The compressive strength of fuel dispenser hose pipe with 10% substitute was found at the end of 28 days which is surplus the conventional concrete. The workability of rubberized concrete shows a decrease in slump with increase of waste fuel dispenser hose pipe rubber content of total aggregate volume. The water absorption and Sulphate Resistance test for self-compacting fuel dispenser hose pipe rubber concrete on 56^{th} day was tested. It was found that, there is an increase in water absorption and weight loss with the increase in addition of fuel dispenser hose pipe rubber in concrete. Hence 10% of fuel dispenser can be replaced for coarse aggregate in cement concrete.

Key Words – Fuel dispenser Hose pipe Rubber, Self-compacting Concrete, Workability, Water Absorption Test, Sulphate Resistant Test, Steel Mining

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I. REVIEW OF LITERATURE

Khalid B.najim et al (2011) Crumb rubber from scrap tyres was used as a partial replacement for Fine Aggregate (FA), Coarse Aggregate (CA) and combined Fine and Coarse Aggregate (FCA) at 5, 10, 15 wt % proportions. In Compression strength,the FCR replacement offered best results, Mixes with <10 wt % crumb rubber replacement meet the target of 28-35 MPa compressive strength that is required for civil infrastructure application.

Wang Her Yung et al (2012) done an extensive research work to determine the A study of the durability properties of waste tire rubber applied to SCC **.**Part of fine aggregate was replaced with waste tire rubber powder had been passed through sieves at volume ratios of 5%, 10%, 15% and 20%, respectively, to produce cylinder specimens and obtain the optimal replacement value.SCRC was the best when 5% of the waste tire rubber that has been passed through a #50 sieve was added (increased by 1-10%).

A.Turatsinze et al (2008) has examined on the modulus of elasticity and strain capacity of self- compacting concrete incorporating rubber aggregates.Rubber aggregate from scrap tyres was used as a partial replacement for Coarse Aggregate (CA) at 5, 10, and 15 % by volume proportions. The replacement of natural coarse aggregate (4-10mm) by coarse rubber aggregate of similar dimensions induces a modification of the fresh properties Drastic reduction in compression strength with increasing rubber aggregate content.

M.SyarifAlaydrus (2011) studied the performance of fresh state behavior of self-compacting concrete containing waste material fibers. Fibers were recycling product of wastes material such as, plastic bottle, rubber tire and alloy cans. Thirteen mixtures with 0.47of w/c ratio of SCCs were added micro size (fine tire fibre) and macro (coarse tire fibre) size of rubber fiber, alloy can fibre and plastic bottle fibre with 0.5%, 1.0%, and 1.5% of volume fibre dosage respectively. Mixture of SCC with fine rubber tire fibre recorded the best performance on flow ability, passing ability, self-leveling compared to other SCC with fibres. This is because of it is made flexible and finer form that allow it easy and flexible to deform in inter-space of SCC aggregate.

M.M. RedaTaha et al (2008) investigated the Mechanical, Fracture, and Micro structural Investigations of Rubber concrete. Using crumbed tire rubber particles to replace fine aggregate resulted in a reduction in the 28 days compressive strength by 15, 25, 50, and 67% for replacement levels of 25, 50, 75, and 100%, respectively. Similarly using chipped tire rubber particles to replace coarse aggregate resulted in a reduction in the 28 days compressive strength by 40, 48, 73, and 78% for replacement levels of 25, 50, 75, and 100%, respectively.

Abdullah Demir et al (2007) made a study on the Durability of Rubberized mortar and concrete. In this study, the control mixture and four sets of concrete specimens were produced with 10, 20, 30% crumbed rubber aggregate in volume of which the grain size is 1-4 mm. The cube was moist cured for 28 days at 20˚ C. Freeze-thaw experiments were conducted on the concrete specimens. Although increasing rubber ratios in concrete have negative effect on concrete durability, it was determined that the damage as a result of freeze-thaw in the concrete of the RC-10 set was less than the damage in the control concrete.

Chen Bing et al (2014) in this study, the use of tire- rubber particles as a replacement for coarse aggregate in concrete is investigated. Rubber has replaced coarse aggregate at content levels of 25, 50, 75, and 100% in concrete by volume. Two different series, I-series the w/c ratio is .40, II-series the w/c ratio is .60. As seen in series I and II mixtures rubber particle replacement, the compressive strength was reduced relative to that of the control mixture.

Ganjian et al (2008), investigated into performance of concrete tyre rubber by weight as a replacement of aggregate and cement. Rubber has replaced coarse aggregate at content levels of 5, 7.5, and 10% by weight. Mechanical properties of rubberized concrete decreases as the % of rubber increased.

Malladi (2004), Experimental study on concrete by replacing the coarse aggregate by waste tyre rubber. Fine aggregate replaced by rubber fibre and crumb rubber. The content levels of fibre is 5%, 10%, 15%, 20%,and crumb rubber level is10%, 20%, 30% by weight. Mechanical properties of rubberized concrete decreases as the % of rubber increased.

A.K. Abdel Gaward (2010) determined the compressive strength of concrete utilizing waste tire rubber. Fine aggregate replaced by crumb rubber and coarse aggregate replaced by chipped rubber. The content level of rubber is 50% and 100% by weight. Compression strength of rubberized concrete decreases as the % of rubber increased.

II. EXPERIMENTAL INVESTIGATON

1. Cement

Ordinary Portland cement (OPC 53 grade) is used as the main binder. The physical properties of cement obtained and used are given in Table 1

Table 1Physical Properties of Cement

Si .No	Properties	Test Results
1	Standard consistency	29%
2	Initial setting time	55 min
3	Final setting time	185 min
4	Specific gravity	3.15

2. Fly Ash

The fly ash used in this study was obtained from Neyveli Thermal power plant. It falls in the category of class C grade.Fly ash is one of the important substances which is required for the preparation of SCC. The physical properties of fly ash are determined as per IS: 1727-1967, is given in Table 2

Table 2 Properties of Fly Ash

Si .No	Properties	Test Results
1	Type	C
2	color	Brownish black
3	Specific gravity	2.28
4	consistency	38%

3. Fine Aggregate

Good Quality River sand, free from silt other impurities were used in this study. Sand passing through 4.75 mm has to be used in this experimental work. The following properties of fine aggregates are determined as per: 2386-1963, is given in Table 3

Table 3 Properties of Fine Aggregate

Si .No	Properties	Test Results
1	Fineness modulus	2.18
2	Size of aggregate	4.75 mm passing
3	Specific gravity	2.59
4	Water absorption	1.55%
5	Loose Bulk density	1560 kg/m^3
6	Zone	II

4. Coarse Aggregate

Aggregate blocking must be avoided as SCC flows through the reinforcement. The coarse aggregate passing through 20 mm and retaining 4.75 mm has to be used for experimental work. The following properties of coarse aggregate are determined as per IS: 2386-1963, is given in Table 4

Table 4 Properties of Coarse Aggregate

Si. No	Properties	Test Results
1	Fineness modulus	9.16
2	Size of aggregate	20 mm
3	Specific gravity	2.7
4	Water absorption	0.4%
5	Bulk density	1570 kg/m^3
6	Impact value	19%

5. Fuel Dispenser Hose pipe Rubber

The Fuel dispenser hose pipe rubber aggregate passing through 20 mm and retaining 4.75 mm has to be used for experimental work. The following properties of rubber aggregate are determined as given in Table 5

Table 5 Properties of Fuel Dispenser Hose Pipe Rubber

Si. No	Properties	Test Results
1	Size of aggregate	20 mm
2	Specific gravity	1.82
3	Water absorption	1.6%
4	Bulk density	970 kg/m^3

Figure1 Fuel Dispenser Hose Pipe Rubber

6. Chemical Admixtures

VARAPLAST 123 from Akarsh Chemicals (INDIA) Ltd was used. It is a non-toxic brown liquid based on naphthalene polymer. The properties of the super plasticizers (SP) as given in the literature of the manufacturer are in the Table 6

Table 6 Properties of Admixture as Given By Its Manufacturer

Si. No	Physical State	Brown Liquid
1	Dry Matter Content	35%
2	Specific Gravity	1.21
3	Chloride Content	Nil
4	pH	7 To 8
5	Air Entertainment	Less Than 1%

7. Mix Proportioning of SCC for M30

Table 7 Mix proportion per m³ of SCC

SI.NO	Ingredients	SCC
1	Cement Content	380 kg/m^3
2	Fly Ash Content	160 kg/m^3
3	Coarse Aggregate	850 kg/m^3
4	Fine aggregate	890 kg/m^3
5	W/C ratio	0.45
6	Water	216 kg/m^3
7	SP	4.85 kg/m^3

III. RESULTS AND DISCUSSION

A. Workability

The workability of rubberized concrete shows a decrease in slump with increase of waste fuel dispenser hose pipe rubber content of total aggregate volume. The results of the slump and J-Ring test and are shown in Table 8 &Fig 2

Table 8 Slump and J-Ring Values of Self-Compacting FDHP Concrete

Mix Identity	Slump Values (mm)	J-Ring values (mm)	Reduction in slump (mm)	Reduction in J-ring(mm)
MC-00	665	650	-	-
MCR-10	660	645	5	5
MCR-20	645	620	20	30
MCR-30	630	590	35	60
MCR-40	590	540	75	110
MCR-50	550	485	115	165

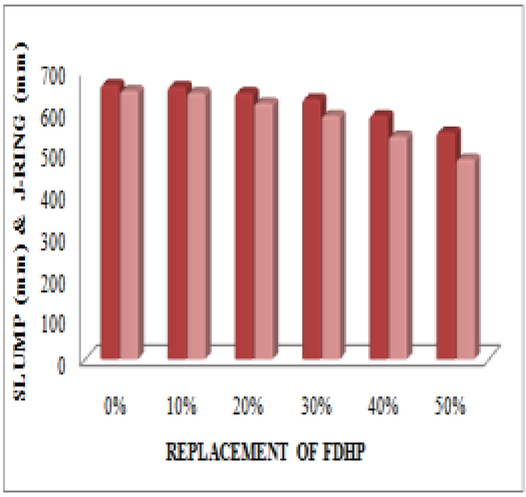

Fig 2 Slump and J-Ring of Self-Compacting FDHP Concrete

Fig 3 Slump Flow of Self-Compacting FDHP Concrete

Fig 4 J-Ring of Self-Compacting FDHP Concrete

B. Water Absorption Test

The water absorption for self-compacting fuel dispenser hose pipe rubber concrete is tested on 56th days. Water absorption was found to be between 3.6 – 5.3. It was found that, there is an increase in water absorption with the increase in addition of fuel dispenser hose pipe rubber in concrete

Table 9 Water Absorption

Mix Identity	Dry Weight(kg)	Wet Weight(kg)	Water absorption (%)
MC-00	2.410	2.496	3.6
MCR-10	2.290	2.374	3.7
MCR-20	2.090	2.172	3.93
MCR-30	1.870	1.948	4.18
MCR-40	1.620	1.694	4.6
MCR-50	1.550	1.632	5.3

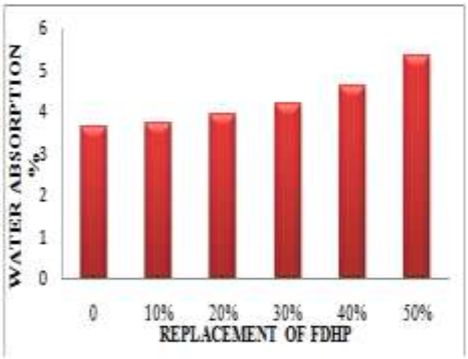

Fig 5 Water Absorption of Self-Compacting FDHP Concrete at 56 Days

C. Sulphate Resistance Test

The Sulphate Resistance test of self-compacting fuel dispenser hose pipe rubber concrete cubes was tested at 56 days and it is given in Table 10. The weight loss increases with the increase in addition of fuel dispenser hose pipe rubber in concrete

Table 10 Sulphate Resistance (Weight Loss & Compressive Strength) at 56 Days

Mix Identity	Dry Weight(kg)	Wet Weight(kg)	Loss of Weight (%)	Compressive strength (MPa)		% Deviation in Compressive Strength
				Before	After	
MC-00	2.410	2.400	0.4	39.44	38.92	1.31
MCR-10	2.290	2.262	1.2	32.88	31.20	5.10
MCR-20	2.090	2.052	1.8	27.81	26.32	5.35
MCR-30	1.870	1.819	2.7	22.24	20.50	7.82
MCR-40	1.620	1.566	3.3	17.84	15.23	14.63
MCR-50	1.550	1.480	4.5	15.04	11.03	26.66

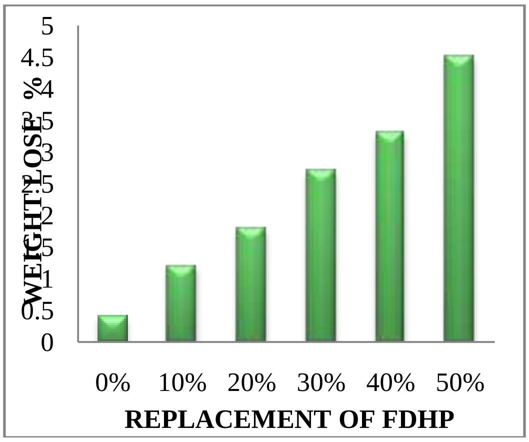

Fig 6 Sulphate Resistance (Weight Loss) of Cubes at 56 Days

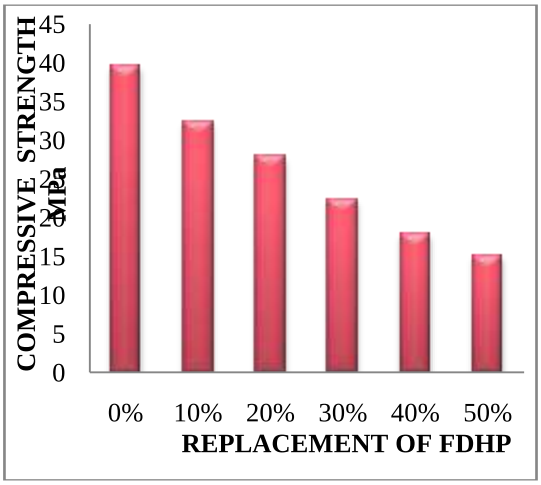

Fig 7 Before Sulphate Resistance (Compressive Strength) of Cubes at 28 Days

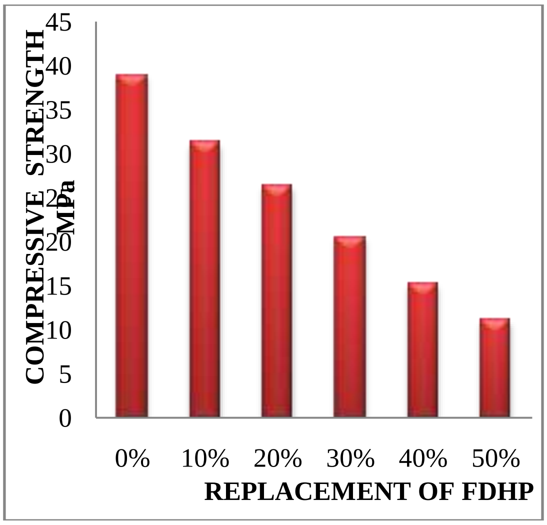

Fig 8 After Sulphate Resistance (Compressive Strength) of Cubes at 56 Days

IV. CONCLUSIONS

1. Lack of proper bonding between rubber particles and the cement paste. Due to replacement of the aggregates by rubber particles, the weight was reduced and the compressive strength has reduced. .
2. Compressive strength of self-compacting fuel dispenser hose pipe rubber concrete various from 39.54 MPa to 15.04 MPa at 28 days, for the replacement of 10% to 50%.
3. Water absorption was found to be between 3.6 %- 5.3% for the replacement of 10% to 50%.
4. Weight loss in fuel dispenser hose pipe rubber concrete was found to be between 0.4% - 4.5%.
5. In self-compacting concrete with 10% addition of fuel dispenser hose pipe rubber can be effectively used in aggressive environment.

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