International Journal of Research in Advent Technology (IJRAT) Special Issue "ICADMMES 2018"
E-ISSN: 2321-9637
Available online at www.ijrat.org

Experimental Investigation on Properties of Concrete Paver Block With Inclusion of Swarf

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Abstract - Recharging ground water is a main issue in global, due to use of rigid and flexible pavement, water may not able to discharge into the ground. An alternate source of this issue may be solved by No-fine concrete. No-fines concrete is a type of light weight concrete which is made by either omitting fine aggregate particle completely or by using small amount of sand content in a concrete mix, which allows interconnected void spaces to be formed in the concrete. No fine is used in worldwide from past decades, it leads to recharge groundwater aquifer and reduce water stagnation. In this experimental investigation it s tried to understand the strengthen properties of no-fine concrete using swarf (lathe waste) by replacing the fine aggregate. The paver blocks are prepared both as conventional and no fine concrete with swarf in various proportions as 0%, 10% and 25%. We adopted M35 grade of concrete for conventional one with mix ratio 1:1.81:1.64 and for no fine concrete 1:5 ratio was adopted with water cement ratio as 0.45.

Index Terms-Ground water, rigid, flexible pavement, no-fine concrete, swarf (lathe waste), Compressive strength, split tensile strength and flexural strength

1. Introduction

Concrete paver blocks are playing an important role in construction field as the usage of concrete paver blocks are highly improved from the past decades. Mostly paver blocks are used for exterior landscapes, pedestrian footpath, and vehicle moving areas. Because of its reliability and constancy, it is widely preferred in any kind of area. In earlier these blocks were made by natural stone and clay, from the past six decades we are insisting concrete pavers. No fine concrete is also known as pervious concrete, porous concrete and zero fine concrete. It is an experiment on paver blocks by eliminating the fine aggregate and to check its physical characteristics. If no fine paver blocks results good it could be more economical. To achieve the strength swarf is introduced in a concrete paver blocks. Inclusion of swarf in a concrete paver block is mainly to improve the strengthen characteristics of the paver blocks. Swarf is a waste from the steel industries in tonnes. In order to use those waste in an effective manner, it has been used in a concrete and expecting good strength

Materials Used

Cement

The type of cement used in this work was 53- grade OPC. The specific gravity of the cement was 3.15 and the fineness modulus was 7.5%

Fine Aggregate

Fine aggregate was M-sand and having the specific gravity of 2.684. The zone of fine aggregate was determined by Sieve analysis. As per Indian standards the zone obtained zone-II.

Coarse Aggregate

Coarse aggregate having a size of 10mm its specific gravity and fineness modulus were 2.67and 5.96% respectively was shown in Fig.1.

Swarf

Swarf is collected from lathe and added partially (0%, 10% , 25%) to the concrete. Swarf is added in order to increase the compressive strength was shown in Fig.2.

I. Table 1: Properties of swarf

Fig. 1 Coarse Aggregate

Fig. 2 Swarf

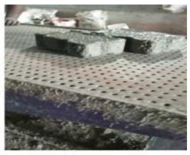


Fig. 3 Table Vibrator

Mix Proportion

S. NO	Description	Specification
1	Appearance	Irregular
2	Size	Passing through 10mm and retained on 2.36mm.

The following sections of this chapter describe in detail the testing that follows and the methodology used to produce the result to be analyzed. A discussion of the preliminary mix design that was conducted during the early stages of this project follows.

Water	Cement	Fine aggregate	Coarse aggregate
0.45	489.956 kg	887.28 kg	803.612 kg
-	1	1.81	1.64

Methodology

After the literature study is completed rough estimation for materials is calculated. Physical test on the materials is done on the materials. Mix design for the conventional and no fine concrete with inclusion of swarf in different percentages was calculated. By the mix design the sample was prepared in company work bench and in the laboratory by machine mixing. For the vibrating table vibrator was used for the paver blocks it was shown in the Fig.3. The paving blocks are kept under shadow for curing for 28 days. Various tests like Compression test, Abrasion and permeability test has been done for the samples prepared.

Results

Tests on Fine Aggregate Grading

Table 1 – Grading of Fine Aggregate

IS Sieve Size	Weight Retained (kg)	% Weight Retained	Cummulative % Retained	Cummulative % Passing
10.00 mm	0.000	0	0	100
4.75 mm	0.065	6.5	6.5	93.5
2.36 mm	0.105	10.5	17	83
1.18 mm	0.175	17.5	34.5	65.5
600 μm	0.120	12	46.5	53.5
300 μm	0.155	15.5	62	38
150 μm	0.290	29	91	9

Specific Gravity

Pycnometer (A) (kg)	Pycnometer + water (B) (kg)	Pycnometer + sand (C) (kg)	Pycnometer + water +sand (D) (kg)	Specific Gravity ={C-A} / {(B-A)-(D-C)}
0.625	1.520	1.175	1.865	2.68

Test on Coarse Aggregate Crushing Test

Totalweight Of Dry Sample (A) - (kg)	weight of the fraction passing through 2.36 mm is sieve (B) - (kg)	Aggregate Crushing Value = {B/A} * 100
3	0.81	27%

Impact Strength on Coarse Aggregate

S.NO	Net Weight Of Aggregates In The Measure In kg (A)	The Fraction Passing Through 2.36 Mm Is Sieve In kg (B)	The Fraction Retained Through 2.36 Mm Is Sieve In kg (C)	Aggregate Impact Value = {B/A}* 100
1	0.36	0.085	0.275	23.6%

Water Absorption

Total Weight Of Dry Sample (A) (kg)	Weight Of Bucket In Water (B) (kg)	Weight Of Bucket +Sample In Water (C) (kg)	Weight Of Dried Sample (D) (kg)	Water Absorption (%)
2.00	1.120	1.67	3.1	0.42

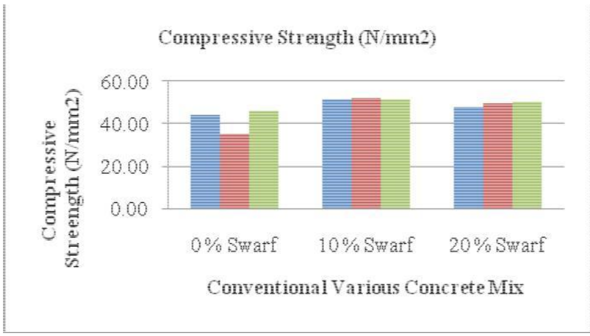
Compression Test

Conventional Concrete

The compressive strength is determined by dividing the maximum of failure load of the specimen during the test by the cross sectional area of the specimen.

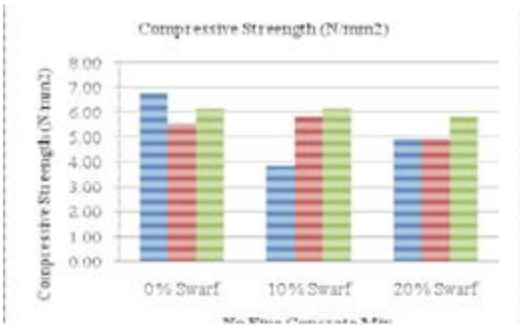
Compressive strength = Load / Area (N/mm^2)

Sample	Load (N)			Area (mm^2)	Compressive Strength (N/mm^2)		
	0 % Swarf x10^4	10 % Swarf x10^4	20 % Swarf x10^4		0 % Swarf	10 % Swarf	20 % Swarf
1	144	166	155	32400	44.44	51.23	47.84
2	113	168	161	32400	34.88	51.85	49.69
3	150	167	163	32400	46.30	51.54	50.31



No Fine Concrete

Sample	Load (N)			Area (mm^2)	Compressive Strength (N/mm^2)		
	0 % Swarf $x10^4$	10 % Swarf $x10^4$	20 % Swarf $x10^4$		0 % Swarf	10 % Swarf	20 % Swarf
1	22	12.5	16	32400	6.79	3.86	4.94
2	18	19	16	32400	5.56	5.86	4.94
3	20	20	19	32400	6.17	6.17	5.86



Abrasion Test

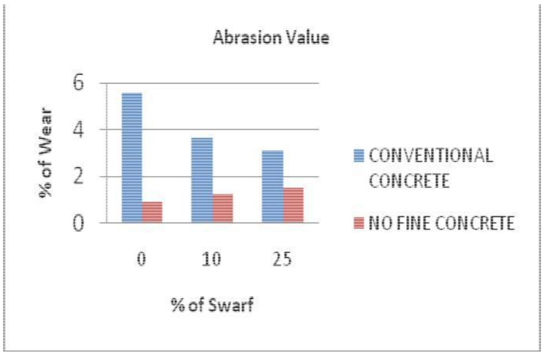
Abrasion is a wear process. Wear is erosion or movement that occurs on a solid surface when it comes into contact with another surface was shown in Fig.4. and includes adhesive wear, abrasion, surface fatigue, erosion and fretting wear. As per IS 15658-2006,

% Wear= (Loss of weight/ initial weight)*100

Fig.4 Abrasion Equipment

Fig.5 Sample Abrasion Result

S. No	% of Swarf	Conventional Concrete	No Fine Concrete
1	0	5.55	0.9
2	10	3.63	1.24
3	25	3.125	1.524



chemical attack, abrasion, or any process of deterioration was shown in the Fig.6

Fig.6 Permeability Equipment

Permeability Test

Permeability is defined as the property that governs the rate of flow of a fluid into a porous solid. Permeability is also can be defined ability to resist weathering action

Fig.7 Sample

Formula, **K = Q / (AT*(H/L))**

S. No	% of Swarf	Conventional Concrete	No Fine Concrete
1	0	$3.09*10^{-8}$	$1.18*10^{-3}$
2	10	$2.80*10^{-8}$	$1.22*10^{-3}$
3	25	$2.95*10^{-8}$	$1.29*10^{-3}$

Conclusion

- The feasibility of concrete blocks with inclusion of swarf was shown technically in the present study. Based on the experimental investigation, the following are the conclusions.
- The result of compression test conclude that as in conventional concrete, the blocks which are made with inclusion of 10% swarf attains high strength compared to 0% and 25% .And in case of no fine concrete, the blocks which are made without inclusion of swarf (i.e) 0% , shows high strength compared to 10% and 25%.
- Then the results of abrasion test concludes that blocks made of conventional concrete with inclusion of 25%swarf shows good results as its percentage wear is less than other two ratios and in case of no fine paver blocks, the blocks without inclusion of swarf possess less percentage wear compared to other two ratios.
- Even though no-fines concrete has lower compressive strength, it has high permeability which is capable of capturing storm water and recharging the ground water.
- Hence it can be used at parking areas and at residential areas where traffic movement is moderate.
- From this study, for road application the conventional concrete pavers with inclusion of 10% swarf and no fine concrete pavers without swarf was recommended as these shows good results in the tests performed.

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