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Experimental Study on Implementation of Pervious Concrete in Pavements

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Abstract

Pervious concrete is concrete in which water and air pass through it .pervious concrete consists on little or nill fine aggregates, which create voids 10-25 % to allow the ease drain of water, considering its exceptional characteristics in terms of good compression strength performance in spite of elevated interconnected voids porous interlock blocks is constructed in a similar fashion to traditional method, the primary goal is to obtain the adequate porosity with the good flexural strength. The fine aggregate powder is varying percentage is 0%,5%and10%. A small amount of super plasticizer is used in this investigation. The obtained variations is been tested for compression and abrasion test The samples are kept for curing at room temperature.

Keywords: *Pervious interlocks, Compression Strength, Flexural Strength*

1. Introduction

Porous concrete is described as open graded material consists of cement, course aggregate, with or without fine aggregate, admixture and water. porous concert is also referred as pervious concrete or porosity concrete .The combination of these give the interlock the compression strengths from 1.8 to 35.4 N/mm^2 , with the porosity ratio up to 20% . However porous interlock has several limitations preventing the application of interlock in various normal ways.

The high porosity in porous interlock reduce the compression and abrasion value of the interlock .clogging ia an additional problem for porous interlock. Dirt and debris fill will reduce the porosity of the interlock. Durability of the porous interlock can be considered from long time performance

2. Scope and Objectives

- The main objective of the study is to provide tools to evaluate and improve the strength of porous concrete by varying sand and cement content
- Pervious interlock is confidently employed in urban roadways, driveways, and parking lots.
- To determine the relationships between porosity, permeability, and strength in porous concrete mixes..
- To determine the compression test , the test are conducted at 7,14 and 28 days
- Reduce the water runoff, and increase the ground water table pe

3. Literature Review

Hariet et.al., has explained the experimental investigation carried on minor scale, the pervious concrete. They have created a miniature scale model in pragmatic way so that real time problems which are possible in the future may be realized. So they have chosen an area to create that pervious concrete placement, test like infiltration test according to ASTMCI70. Tests were carried out on the pervious concrete miniature model were two quantities of water were used for conduction of the test say 1 gallon, 5gallon.They observed that infiltration rate was 312.64 inch/hour suggested that good rate of percolation and use of practical purpose. Hence they understood that infiltration largely varies depending on the voids present in concretes and size of aggregate [1].

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Ketan et.al., has conducted an experimental investigation of pervious concrete using titanium Dioxide. They have partial replaced cement by TiO_2.thay have laid pervious concrete trial mixes with the different size of aggregates with and without fine aggregates and tests for compression strength, water permeability, porosity and density. Trial mixes for their investigation was selected with optimum compression strength along with sufficient permeability The come to conclusion that addition of TiO_2 replacement to cement increased compression strength and split tensile strength and had no adverse effect on permeability of pervious concrete [2]

S Deepika et.al., has conducted an experimental investigation of pervious concrete using single size aggregate (course aggregate) without fine aggregates and as an admixture they used fly ash by partially replacing the cement. They have laid pervious concrete trial mixes with the different size of aggregates with and without fine aggregates and tests for compression strength, split tensile test and infiltration test. They conducted the mix proportions to select the optimum effective mix designed. They have done 9 mix proportions having variation of cement – 300, 350, 400 kg/meter cube, RCA percentage of replacement – 0, 50, and 100[3].

Nandhin et.al., has conducted a study on characterization of previous concrete for pavement, so that study the effect of various size of coarse aggregate, fine aggregate percentage and the use of fly ash on previous concrete and characterize the mix for use in pavement. They conducted 10 mixes were formulated and studied.. Various tests like compressive, tensile and flexural strength were done. (Permeability, pores, abrasion).They found that with the addition of fly ash, the mix yielded lower strength than that of conventional pervious concrete mainly because of lower bond strength. Hence fine aggregate was added to the concrete mix for strength improvement [4].

Kolluru et.al., has done a review paper on permeable pavement system is the compact the wide range and spread the relevant on permeable pavement system.. They found that the permeable pavement systems are changing the way human developments interact with the natural environment. It's applications towards parking lot, highway and even airport runways are all improvements in terms of water quality, water quantity and safety [5].

4. Experimental Investigation and Results

4.1 Materials Used:

To begin with, the ordinary Portland cement are been use (Ultratech), the course aggregate are been used of 12mm down size aggregates , the fine aggregates are been used are 6mm down , The variations are made in the different % usage of fine aggregates as 0%,5%and10% with and without super plasticizer. The admixture sp430 as a super plasticizer is being used. Mix design is for M_{30} Grade¸ The interlock is caste in regular manner with the mix variation of fine aggregate and super plasticizer. The specimens are been caste as zigzag .with size of 22.5x11.25 cm. Calculation for 10% fine aggregate mix with super plasticizer for a specimen as shown in Fig 1.

Mix	Cement (kg)	Fine Aggregate (kg)	Coarse Aggregate (kg)	Water (lit.)
10%	0.3	0.313	1.565	0.158

Table 1 Mix Proportions

4.2 Experimental Investigation:

THE MIX DESIGN

The table 2 is generated , the mix design values for the various ratio of fine aggregate 0% 5%and 10 %, with and without fine superplasticizer, the volume of cement ,course aggregate and fine aggregate volume as above

The volume of materials is calculated for 3 specimen in each ratio , for the compression and abrasion test conducted on each ratio, the value is compared in between with super plasticizer and without, also with the standard vales

(a) (b)

Fig 1. Tests on pervious interlock (a) Various mix (b) 0%Fine aggregate mix

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4.3 Results:

Type of mix	7 Days Strength (N/mm^2)	14 days strength (N/mm^2)	28 Days Strength (N/mm^2)
0%w	2.97	16.55	35.43
5%w	3.145	14.28	32.8
10%w	3.32	17.76	32.97
0%wo	3.27	13.73	29.74
5%wo	3.81	14.14	31.29
10%wo	3.46	13.56	32.3

Table2**:** compression test values

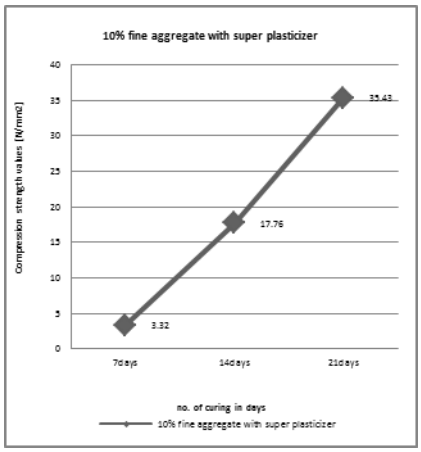

Fig 2. Compression strength 10% with super plasticizer

% of fine aggregate used with and without super plasticizer	Average Abrasion value at top 1cm (mm)
0 with super plasticizer	2.2
0 without super plasticizer	2.6
5 with super plasticizer	1.9
5 without super plasticizer	2.2
10 with super plasticizer	1.6
10 without super plasticizer	1.8

TABLE 3: ABRASION VALUE

Abrasion values are been calculated through the abrasion test where the specimen under goes 2 different tests, to find the average abrasion value at top 1cm.

Permeability value is checked for 0,5%, 10% fine aggregate with and without using super plasticizer an add mixture .The value are been collected at hourly intervals , as shown in Fig 3.


(a)


(b)

Fig 3: (a) lab setup for permeability test (b) pervious interlock casted for test

Flow of water (hr.)	10%wsp	10%wosp	5%wsp	5%wosp	0%wsp	0%w0sp
1	1.75	4.5	6.4	11.2	13.5	15.7
2	2.3	5.2	7.75	10.8	14.8	16.4
3	2.2	5	8.5	10.8	15.2	16.1
4	3.3	4.8	7.9	11	15.4	16.5
5	3.1	4.9	8.2	11.2	15.4	16.7

TABLE 3: POROSITY VALUE

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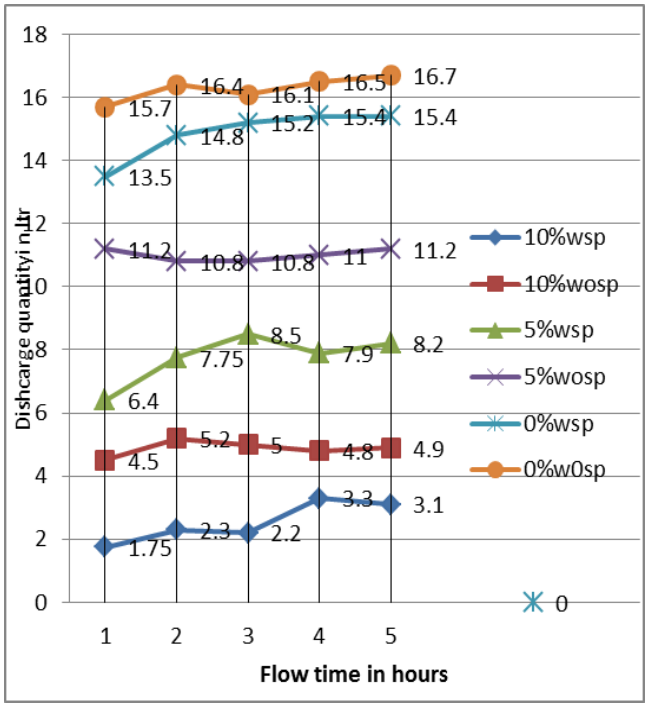

Fig 4: Permeability value for all design mix

5. CONCLUSION

1. It is found that compression strength minimum has attained for 7, 14 and 28 days at 0% fine aggregate usage . Hence 0% no strength will be obtained initially.
2. It is found that maximum value of compression strength is obtained, 10 % of mix provide high strength as shown in Fig 2.
3. The compression test results showed that the increase in the compression strength of concrete sample as the curing period increases.
4. Lesser the percentage of fine aggregate used, more will be the porous voids will be created.
5. 10 % mix provide low abrasion value and high efficient blocks, takes more time to wear out, as 0% mix have a high abrasion value.
6. 0% fine aggregate mix will provide max voids, its the best porous block.
7. Porosity is max at 10% fine aggregate usage with super plasticizer, and minimum at 0% fine aggregate without using super plasticizer.
8. Using super plasticizer sp430 gives more Porosity value, with reduce marginally compressive strength of it.
9. More porous created in the block less the strength, bonding with the material will be poor.

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