www.ijiarec.com

ISSN:2348-2079

Volume-6 Issue-2

International Journal of Intellectual Advancements and Research in Engineering Computations

Experimental investigation of pervious concrete

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ABSTRACT:

Pervious concrete is one of the most promising sustainable materials. Nowadays, Pervious Concrete is a light-weight concrete produced by omitting the fines from conventional concrete also known as “No-fine Concrete” or “Porous Concrete” is a material comprised of narrowly graded coarse aggregates, cement materials, water and admixture are used. In this paper pervious concrete with admixture is used to analyze the property strength, durable, permeability of pervious concrete. The most important property of pervious concrete is its drainage facility through permeability. The use of titanium di oxide is found to enhance the permeability in pervious concrete by oxidizing the pollutants and helping in washing down the clogged particles from the pores during rainy season.

Key words: No-fine, Permeability, Strength

I. INTRODUCTION:

A larger amount of rainwater ends up falling on impervious surfaces such as parking lots, driveways, sidewalks, and streets rather than soaking into the soil. This creates an imbalance in the natural ecosystem and leads to a host of problems including erosion, floods, ground water level depletion and pollution of rivers, lakes, and coastal waters as rainwater rushing across pavement surfaces picks up everything from oil and grease spills to de-icing Salts and chemical fertilizers. Conventional normal weight Portland cement concrete is generally used for pavement construction. The impervious nature of the concrete pavements contributes to the increased water runoff into the drainage system, over-burdening the infrastructure and causing excessive flooding in built-up areas. Thus pervious concrete can play a vital role in filtration and rain water harvesting due to its porosity. This type of concrete has become significantly popular as a sustainable application during recent decades due to its potential contribution in solving environmental issues. Using sufficient paste to coat and bind the aggregate particles together creates a system of highly permeable, interconnected voids that drains quickly.

II. OBJECTIVE:

- To strengthen the pervious concrete using Titanium dioxide as admixture.
- To recharge the water table of soil beneath the construction.
- To increase life of structure.

III. MATERIALS:

Cement:

Ordinary Portland cement (OPC) of M53 grade used for casting.

Coarse aggregate:

The coarse aggregate was natural gravel of 6mm to 10mm maximum size was used.

IV. MIXING, CASTING AND CURING:

MIX PROPORTION

S.NO	MIX TYPE	COARSE AGGREGATE	FINE AGGREGATE	TITANIUM DIOXIDE
1	Trial mix - 1	6mm	-	2.5% by wt of Cement
2	Trial mix -2	10mm	-	5% by wt of Cement
3	Trial mix - 3	6mm – 50% 10mm – 50%	2% by wt of CA	7.5% by wt of Cement
4	Trial mix - 4	6mm-75% 10mm- 25%	2% by wt of CA	10% by wt of Cement
5	Trial mix - 5	6mm – 25% 10mm- 75%	2% by wt of CA	11% by wt of Cement

All concrete samples (cubes, cylinders and prisms) are casted in steel moulds. They were cleaned and oiled before casting. The fresh concrete was placed inside the moulds with approximately three equal layers and compacted by tamping rod. After 24 hours the specimens were demoulded and kept it in curing tank.

V. RESULT AND DISCUSSION:

5.1 Compressive strength

The compressive strength development for all types of mixes is presented .Test results illustrate that in general, reference pervious concrete specimens exhibited continuous development in strength up to 7 and 28 days of curing. There is a considerable improvement in strength for different mixes. There was a slight increase in the compressive strength with increasing the admixture volume fraction, unless the admixture volume is so high leading the air voids content to become excessively high. The air voids tends to have a negative effect on the compressive strength.

While increasing the particular percentage addition of admixture the compressive strength of pervious concrete is decreasing. Up to 0.2% addition of admixture the compressive strength is increasing gradually above 0.2% the compressive strength get reduced.

Compressive strength for Mix-(1-5):

T_io_2	Curing days Compressive strength N/mm^2		
	7	14	28
2.5%	5.1	8.9	11.2
5%	5.3	8.3	11.6
7.5%	6.11	9.2	14.3
10%	5.9	8.0	13.8
11%	5.4	7.2	13.5

Table 1: Result of Compressive strength for Mix -1,2,3,4&5

Figure No 1: Compressive test on prism

5.2 Split tensile strength

Results of splitting tensile strength of reinforced fibre concrete mixes cured up to 7 and 28 days are demonstrated. The incorporation of admixture (T_io_2) leads to higher splitting tensile strength compared to their corresponding reference concrete. The tensile strength of the T_io_2 concrete mixes increases with the increase of T_io_2 volume content. This is due to the nature of binding effect of fibre available in concrete matrix. This shows that the pervious concrete has the ability to absorb energy in the post- cracking state. The comparison of percentage difference in splitting tensile strength for pervious concrete to its control batch is presented below, for example the Percentage increase in tensile strength for admixtures mixes containing T_io_2 by volume fraction of (2.5%, 5%, 7.5%,10% ,11%).

T_io_2	Curing days Tensile strength N/mm^2		
	7	**14**	**28**
2.5%	3.68	4.0	4.2
5%	3.9	4.2	4.6
7.5%	4.1	4.6	5.3
10%	4.3	4.9	5.5
11%	4.65	5.1	5.7

Table 2: Result of Tensile strength for Mix - 1,2,3,4&5

Figure No 2: Split tensile test on prism

5.3 Flexural strength:

The influence of content on the modulus of rupture for all types of pervious concrete specimens is presented in Results demonstrate that all concretes specimens exhibited considerable increase in flexural strength with increasing T_io_2 content. The modulus of rupture trend for T_io_2 varies as the volume fraction of T_io_2 is increased. It is found that, the modulus of rupture increases as the T_io_2 volume fraction is increased. The concrete specimens containing no T_io_2 are cracked and failed in a brittle manner when strain in concrete reached its ultimate value. However, f T_io_2 pervious concrete also cracked at ultimate strain, but the section is still capable to carry the load well after the initiation of the first crack.

Figure No 3: Flexural test on prism

T_io_2	Curing days Flexural strength N/mm^2		
	7	**14**	**28**
2.5%	2.1	2.5	2.7
5%	2.2	2.6	2.9
7.5%	2.4	2.8	3.1
10%	2.5	3.0	3.3
11%	2.9	3.2	3.5

Table 3: Result of Flexural strength for Mix - 1,2,3,4&5

VI. CONCLUSION:

From the experimental study following conclusions were obtained:

1. Compressive strength of specimens for 1:4 ratio with Titanium dioxide (T_io_2) increased by 27.6% when 0.2% addition of fibre at 28 days compared with control specimens.
2. Tensile strength of specimens for 1:4ratio with Titanium dioxide (T_io_2) increased by 26.2%
When 11% addition of Titanium dioxide (T_io_2) at 28 days compared with control specimens.
3. Flexural strength of specimens for 1:4 ratio with Titanium dioxide (T_io_2) increased by 25% when 11 % addition of Titanium dioxide (T_io_2) 6.45% at 28 days when compared with control specimens.

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