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Analyze the Mechanical Properties of Pervious Concrete by Using Titanium Dioxide (Tio2)

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Abstract – **In many developed countries, the use of pervious concrete for the construction of pavements, car parking and driveway is becoming popular. The pervious concrete is produced by using titanium dioxide (TIO_2). This concrete are tested and its properties, such as compressive strength, spilt tensile strength, and water permeability. The most important properties of pervious concrete is drainage facility through permeability. Pervious concrete is a concrete containing with or without fine aggregate (no fines concrete); it consists of coarse aggregate and cement paste. It seems pervious concrete would be a natural choice for use in structural application. It consumes less raw material than normal concrete (no sand), it provide superior insulation value when used in walls and through the direct drainage of rain water its help to recharge ground water in pavement application by using the titanium dioxide.**

Keywords – **Titanium Dioxide, pervious concrete, Compressive Strength, Flexural Strength, Split Tensile Strength.**

I. INTRODUCTION

Pervious concrete is the one type of concrete in which no fine aggregate are used pervious concrete is also called **no fine** concrete.

General

Previous concrete is the homogeneous mixture of cement, aggregate, water and any admixture. To increase the concrete strength by using titanium dioxide pavement techniques for applications such as sidewalks, driveways, and parking lots [1-5].

II. LITERATURE REVIEW

Pervious concrete literature that details are given below:

C. Manoj kumaar, et.al. [11], Shows that the Experiment is explained that Experimental analysis has been done on fabricated pervious concrete of cubes and cylinders using Universal Testing Machine to find the compressive strength and tensile strength. Permeability of the concrete has been tested using constant head method. From this investigation it is found that addition of TiO2 cause aeration reaction considerably improves the permeability. The result of this than conventional pervious concrete. From the mechanical properties studied, it clearly shows that the pervious Concrete can be blended with tio2 can be used in practical application in future. It is inferred from the study that the usage of tio2 in pervious concrete can be recommended for drainage facility and control of air pollution during rains

KetanBrijesh et.al., Shows that the experiment is explained that the ACI 522R-10 define the terms "perious concrete" typically describes a near-zero-slump, open-graded material consisting of portland cement, coarse aggregate, little or no fine aggregate, admixture, and water. It is such a concrete that has high porosity and allows draining freely unlike dense, high strength concrete. Its applications are therefore in conditions where water from precipitation or other sources needs to be drained. The high porosity is achieved by the absence or very low content of fine aggregate. Pervious concrete is also known as no-fines concrete, gap graded concrete or porous concrete. It essentially consists of cement, coarse aggregate, water and little or no fine concrete.

Darshan S, et.al. [10], Explained that the experiment is explained that the This paper represents the experimental methodology and experimental results related to durability and water absorption. Cylinder of size 100mm dia and 200 mm height are prepared to investigate both these properties [6-8]. This investigation should be carried out at the end of 28 days for water absorption and 56 days for durability in which cylinder are immersed in sodium chloride solution after 28 days of casting. Different concrete mix proportion such as different size of gravel.18.75mm size of aggregate with 1:10 mix proportion made with OPC has more water absorption % value (1.08%) compared to other and similar 9.375 mm size aggregate.

V.R. Patil et.al.[9], Portland cement pervious concrete is being more frequently due to its benefits in reducing the quality of runoff water, improving water quality, enhancing pavement skid resistance during storm events by rapid drainage of water, and reducing pavement noise. In the united states, PCPC typically has high porosity and

low strength, which has resulted in the limited use of pervious concrete, especially in hard wet freeze environment improving the strength and freeze-thaw durability of pervious concrete will allow an increase in its use in these region. The objective of the research is to develop a PCPC mix that not only has sufficient strength and porosity for storm water infiltration, but also desirable strength and freeze-thaw durability. In this research, concrete mix was measured. Results indicate that PCPC made with single sizes type aggregate high permeability but not adequate strength. The engineering properties of the aggregate were evaluated. Additionally the porosity, permeability strength, and freeze-thaw durability of each of these mixes was measured.

II. METHODOLOGY AND MIX DESIGN

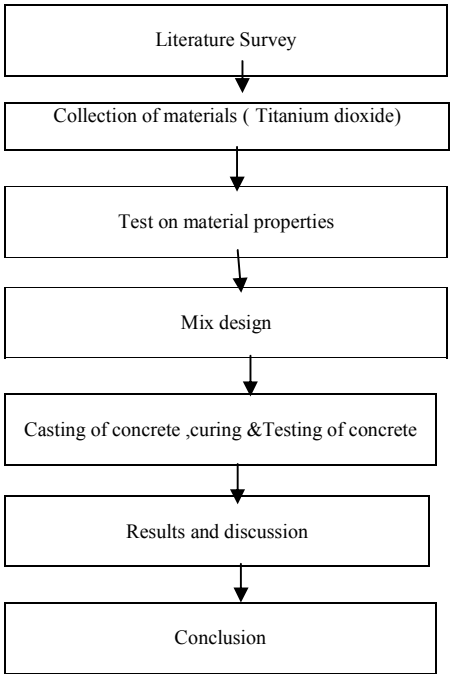


Fig.1 Mix Design

1. Constituent Materials

Table 1 Material Test Results

Properties	Results
Fineness Test on Cement	6%
Specific Gravity of Cement	3.12
Specific Gravity of Coarse Aggregate	2.75
Specific Gravity of Fine Aggregate	2.37
Zone	II
Water Absorption test on Coarse aggregate	0.3%
Standard Consistency test	34%
Initial Setting time	30minutes
Final Setting Time	10 hours
Compaction Factor Test	0.9

2. Physical and chemical properties of titanium dioxide

S.NO	Properties name	Unit/%
1	Appearances	White crystalline powder
2	Density	130 kg/m3
3	Specific gravity	3.77
4	Particles size	3nm-8□m
5	Surface area	33.3m2/g
6	Moisture	1.5%
7	PH	4.5%
8	Al_2o3	0.3%
9	Sio_2	0.2%
10	Fe_2o_3	0.010
11	Sieve residue (45 □m)	0.05
12	Molar mass	79.866 g/mol
13	Odor	Odorless

3. Mix design

Water cement ratio 0.62, weight of cement is 322.58kg/m^3 , weight of Fine aggregate is 215.67kg/m^3 and weight of Coarse aggregate is 1609.8kg/m^3. A mix ratio is **1: 0.6: 4.9:0.62.**

IV RESULT AND DISCUSSION

1. Hardened Concrete Test

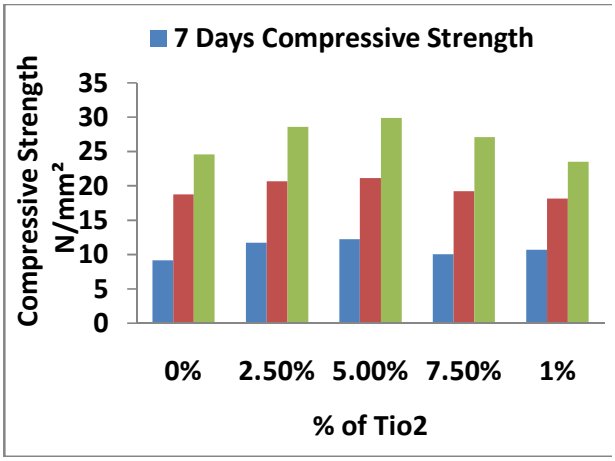
Compressive strength in 7,14 &28 days

The cube compressive strength of concrete in determined by conducting tests on 150mm x 150mm x 150mm cube in specimen at 7 ,14and 28 days test shown in figure 2 . The cubes are placed in the Universal Testing Machine.The specimen will be cylindrical in shape in

150mm diameter and 300mm long. The prism size is 100mmx100mmx500mm.
The Compressive Strength of Concrete in 7, 14 and 28 days for with 0%,5%,10%,15%,20%,25% with by using titanium dioxide (tio2).

Table 3 Compression test in 7, 14 & 28 days.

Tio2	Compressive Strength (N/mm²) 7 Days	Compressive Strength (N/mm²) 14 Days	Compressive Strength (N/mm²) 28 Days
0%	9.15	18.77	24.57
2.50%	11.75	20.67	28.62
5%	12.23	21.15	29.9
7.50%	10.05	19.21	27.11
1%	10.68	18.12	23.51



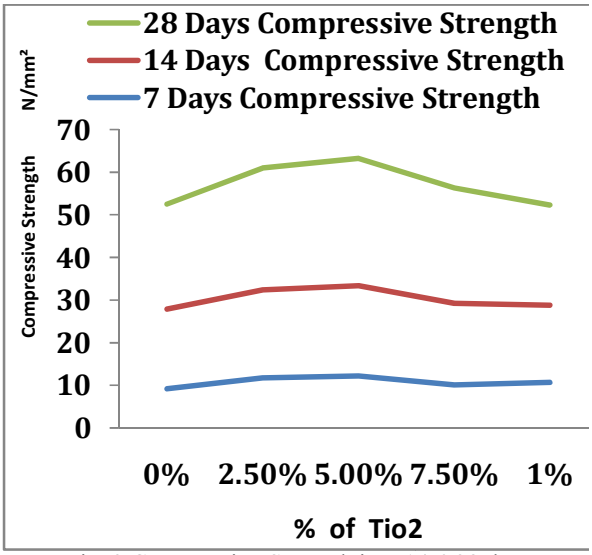


Fig. 2 Compressive Strength in 7,14 &28 days.

The Compressive Strength of Concrete by using titanium dioxide (tio2) of 2.5% shows 16.48% increase when compared to Conventional Concrete.

The Compressive Strength of Concrete by using titanium dioxide (tio2) of 5% shows 21.69% increase when compared to Conventional Concrete .

The Compressive Strength of Concrete by suing titanium dioxide (tio2) of 7.5% shows 10.37% increase when compared to Conventional Concrete.

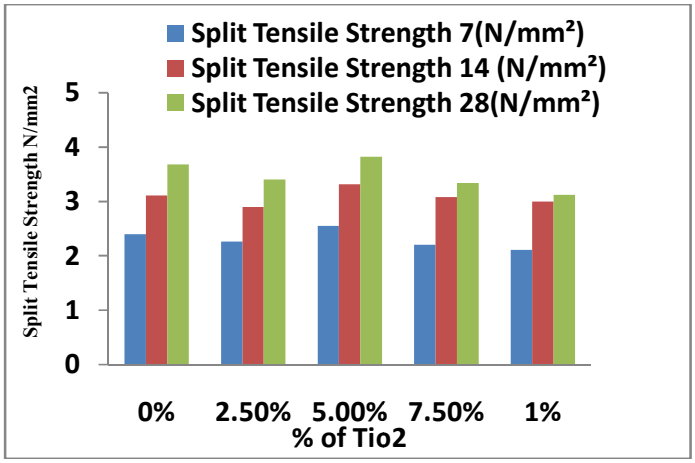
The Compressive Strength of Concrete by using titanium dioxide (tio2) of 1% shows 4.31% decrease when compared to Conventional Concrete

II. Split Tensile Strength

The split tensile strength of concrete in 7, 14 and 28 days for 0%, 2.5%, 5% 7.5%, 1%, of by using titanium dioxide (tio2).

Table 4 Split Tensile strength in 7,14 & 28 days.

TIO2	Split Tensile Strength 7(N/mm²)	Split Tensile Strength 14 (N/mm²)	Split Tensile Strength 28(N/mm²)
0%	2.4	3.11	3.68
2.50%	2.26	2.9	3.4
5.00%	2.55	3.32	3.82
7.50%	2.20	3.08	3.34
1%	2.11	3	3.12



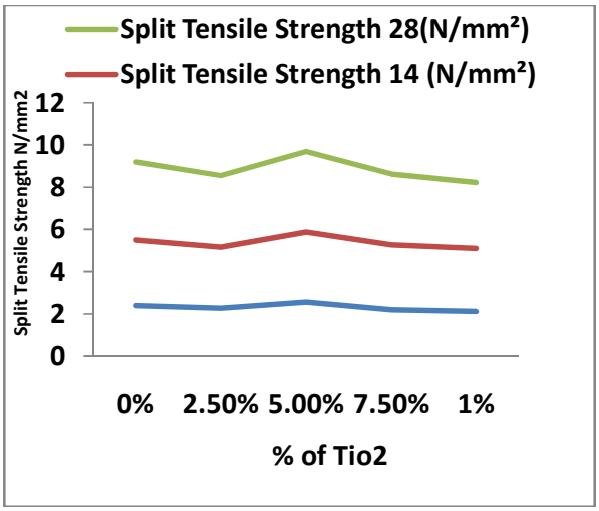


Fig. 3 Split Tensile Strength in 7,14& 28 days.

The Split Tensile Strength of Concrete by using titanium dioxide (tio2) of 2.5% shows 7% decrease when compared to Conventional Concrete.

The Split Tensile Strength of Concrete by using titanium dioxide (tio2) of 5% shows 3.80% increase when compared to Conventional Concrete .

The Split Tensile Strength of Concrete by using titanium dioxide (tio2) of 7.5% shows 10.17% decrease when compared to Conventional Concrete.

The Split Tensile Strength of Concrete by titanium dioxide (tio2) of 1% shows 15.21% decrease when compared to Conventional Concrete .

V. Conclusion

The flexibility and application of titanium dioxide is used in the construction works very economical. Titanium dioxide are reported as smooth and most organic waste material. It is concluded that titanium dioxide have the potential to be used in composites for different purposes. Various aspects of titanium dioxide composites have already been investigated and the economical and good results are achieved as report by many researchers. Since the use of titanium dioxide is the chemical products, there is still possibility of the invention of new products contain titanium dioxide with improved result. In civil engineering titanium dioxide have been used as in composites for non-structural components. Based on the findings from this study, the following conclusions can be arrived at:

1. Concrete strengths increases with curing age and decreases with increasing percentage of titanium dioxide.

2. Titanium dioxide concretes do not attain their design strengths at 28days. The strengths of titanium dioxide concrete are dependent on its pozzolanic activities.

"There is need of investigating the behavior of titanium dioxide concrete to be used in main non structural components and controlling the environment from pollution"

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