

EXPERIMENTAL INVESTIGATION ON PERVIOUS CONCRETE USING NANO SILICA

S.N.Kannan¹, B.Mohan Raj², G.Sugila Devi³

¹PG Student, Nadar Saraaswathi College of Engineering and Technology, Theni, Tamilnadu, India

² PG Student, Nadar Saraaswathi College of Engineering and Technology, Theni, Tamilnadu, India

³Assistant Professor, Nadar Saraaswathi College of Engineering and Technology, Theni, Tamilnadu, India

Abstract - As a civil engineer and human being it's our prime duty to save environment, because lack of water absorption and air permeability of common concrete pavement, rain water is not entered in to the ground directly. It reduces ground water table, and difficult to maintain temperature and humidity of the earth. To minimize such affects, the new concept of pervious concrete pavement is done. Pervious concrete as a paving material has seen renewed interest due to its ability to allow water to flow through itself to recharge groundwater level and minimize storm water runoff. Pervious concrete pavement is unique and effective means to meet growing environmental demands. By capturing rainwater and allowing it to seep into the ground. This pavement technology creates more efficient land use by eliminating the need for retention ponds, swell, and other costly storm water management devices. In this the determination of compressive strength between pervious concrete with silica and conventional concrete. The compressive strength is relatively low on pervious concrete compare to conventional concrete because of its porosity but at the same time we increase water absorption quality. Due to low strength we cannot be used as a road pavement. The pervious concrete can only be applied to footpaths, light traffic areas, and parking where low strength is required.

Key Words: Pervious concrete, Storm water, Porosity, Ground Water recharge, Nano Silica.

1. INTRODUCTION

Pervious concrete (also called porous concrete, permeable concrete, no fines concrete and porous pavement) it is a special type of concrete with a high porosity used for concrete flat applications allows water from precipitation and other sources to pass directly to reach the ground, thereby reducing the runoff from a site and allowing groundwater recharge. Pervious concrete is made using large aggregates with no fine aggregates. The concrete paste then coats the aggregates and allows water to pass through the concrete slab. Pervious concrete is mainly used in parking areas, areas with light traffic, residential streets, pedestrian walkways, and green houses. It is an important application for sustainable construction and is one of many low impact development techniques used by builders to protect water quality. The basic ingredients of pervious

cement concrete mix are not very different from the conventional cement concrete mix, except in the proportion of ingredients. The main ingredients are cementations material, water, aggregate and admixtures.

2. EXPERIMENTAL INVESTIGATION

2.1 Material Used

2.1.1 Cement

Ordinary Portland cement, 53Grade conforming to IS: 269 – 1976. Ordinary Portland cement, 53 Grade was used for casting all the Specimens. Different types of cement have different water requirements to produce pastes of standard consistence. Different types of cement also will produce concrete have a different rates of strength development. The choice of brand and type of cement is the most important to produce a good quality of concrete. The type of cement affects the rate of hydration, so that the strengths at early ages can be considerably influenced by the particular cement used. It is also important to ensure compatibility of the chemical and mineral admixtures with cement.

2.1.2 Coarse Aggregate

Grading of combined coarse aggregate having the sizes of 5-10mm was used. The properties of coarse aggregate are tabulated below.

Table -1: Properties of Coarse Aggregate

S.No	CHARACTERISTICS	VALUES
1	Type	Crushed
2	Specific gravity	2.89
3	Fineness modulus	6
4	Water absorption	0.83%
5	Particle Shape	Angle
6	Impact Value	9%
7	Crushing Value	19

2.1.3 Silica

The silica is an admixture that used in pervious concrete. The small size of silica with 236nm. It increases the strength in concrete compare to conventional concrete. It is also strengthening filler for concrete and other construction composites.

2.1.4 Water

The amount of water used in a mix is critical. Too much water and the mix will segregate; too little water will lead to balling in the mixer and slow unloading times. The correct amount of water will impart a wet metallic appearance. Squeezing and releasing a handful of the mix should result in a mix that neither crumbles (too dry) nor lose its structure as paste flows away from the aggregates (too wet). Too little water can also hinder curing of the concrete and could lead to premature of the surface.

2.2 Mix Design of Pervious Concrete

Table -2: Mix Design for Pervious Concrete

Specimen size m	Cement Kg	Coarse Aggregate Kg	3% Silica Kg	Water Kg
0.15X0.15X0.15	1.741	7.179	0.054	0.629
0.6X0.6X0.1	18.543	76.464	0.573	6.696

2.3 Preparation of Pervious Concrete Specimen

The admixture of cement, coarse aggregate and silica was weighed and mixed in the dry form for 4 minutes, then the water is added and mix in wet form for 3 minutes, for the equal and proper bond with the admixtures then the concrete was casted within the cube and slab (as per code IS 10086-1982) and kept in ambient condition for the rest day until date of testing.



Fig -1: Preparation of Pervious Concrete

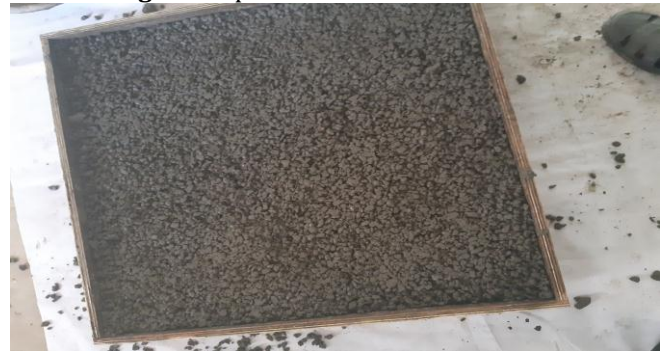


Fig 2-: Casting of Pervious Slab



Fig 3-: Curing of Pervious Concrete

2.4 Strength Test on Concrete

2.4.1 Compressive Strength Test

It is to determine the hardness of cube and compressive test for 7, 14, 28 days.

Table -3: Compressive Strength Test

Testing Period	Compressive strength N/mm ²	
	Conventional concrete	Pervious concrete with 3% silica
7	13.8	7.42
14	17.48	14.07
28	20	16.82



Fig 4-: Permeability Test

2.5 Application of Pervious Concrete

1. Residential roads and driveways
2. Pervious Concrete as a Road pavement
3. Sidewalks and pathways
4. Parking lots
5. Noise barriers
6. Slope stabilization
7. Hydraulic structures
8. Swimming pool decks
9. Tennis courts

3. CONCLUSIONS

From results obtained following conclusion are described-

1. The pervious concrete is suitable only for low volume road pavement like foot path, parking slots. Due to voids in pervious concrete it is difficult obtained required compressive strength.
2. Using smaller size aggregate (5-10 mm) can enhance the compressive strength of pervious concrete than bigger size aggregate (20mm).
3. Compressive strength was increase by using 3% silica with proper proportion of admixtures.
4. Compressive strength is inversely proportional to porosity hence, when compressive strength increases porosity decreases.
5. Using Vibrator also decrease the porosity in pervious concrete.
6. Friction is more on pervious concrete than other material roads.
7. It is an eco friendly concrete material.

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BIOGRAPHIES



S.N.Kannan
M.E Structural Engineering
Nadar Saraswathi College of
Engineering And Technology,
Theni.



B.Mohan Raj
M.E Structural Engineering
Nadar Saraswathi College of
Engineering And Technology,
Theni.



G.Sugila Devi
Assistant Professor,
Department of Civil Engineering,
Nadar Saraswathi College of
Engineering And Technology,
Theni.