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Study on engineering properties of nylon fibre reinforced pervious concrete

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ABSTRACT

Pervious cement is a composite material comprising of coarse total, Portland concrete and water. It is different from conventional concrete in that it contains no fine aggregate in the initial mixture. The result is a concrete with high percentage of interconnected voids that, when functioning correctly permits the rapid percolation of water through the concrete. Since the blend contains practically zero sand, the pore structure has numerous voids permitting water and air to go through. The most significant property of pervious cement is its water penetrability. Reinforcing concrete with nylon fibre, results in increased permeability, minimized crack growth and improved surface durability. Pervious cement is utilized for solid flatwork applications that permit water from precipitation and other source to go legitimately through along these lines diminishing the spillover from a site and permitting ground water energize. Pervious concrete is traditionally used in parking areas, residential streets, pedestrian's walkways etc. It is an important application for sustainable construction. The project aims at studying the engineering properties of nylon fibre reinforced pervious concrete. Tests like compression test, split tensile test, flexural test, void ratio test, infiltration tests and permeability tests are carried out on test specimens with different percentages of nylon fibres with different specific gravities and the properties compared with that of plain pervious concrete samples.

Index terms: Pervious concrete, Nylon fiber, Split tensile test, Flexural test, Void ratio test, Infiltration test

INTRODUCTION

Increasing in infrastructure development and resulting increase in urban storm water over the past few decades have led to increase in pollution and runoff problems. As more available land area in the major cities gets paved over, a maximum quantity of rainfall ends up falling on impermeable surfaces such as parking area, driveways, sidewalks, and highways rather than to pass into the ground. This leads to environmental issues such as erosion, decrease in the ground water table, pollution of rivers, lakes, and coastal waters as rainwater flowing across pavement surfaces picks up everything from oil and grease spills and chemical

fertilizers. One of the simple solutions to avoiding these problems is to install the Pervious Concrete pavement which allows water to percolate through its pores reducing surface runoff and offering durability; unlike Conventional Concrete or asphalt pavement.

Due to its high porosity it can used for concrete flatwork applications that allows water from precipitation and other sources to pass directly through, thereby reducing the runoff from a site and allowing ground water recharge. The concrete paste then coats the aggregates and allows water to pass through the concrete slab. Pervious concrete is traditionally used in parking areas, areas with light traffic, residential streets, pedestrian walkways, and greenhouses. It is an important

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application for sustainable construction and is one of many low impact development techniques used by builders to protect water quality.

AIMS AND OBJECTIVES

The main aim of the project is to strengthen the pervious concrete by reinforcing with nylon fiber in different quantities. Also we have to understand the difference in strength due to the variation of nylon fiber specifications.

- To reinforce pervious concrete with various proportions of nylon fiber (i.e. 0.1%, 0.2%, 0.3%, 0.4% of volume of concrete).
- To study the engineering properties of pervious concrete reinforced with nylon fiber.
- To compare the behaviours of plain pervious concrete and nylon fiber reinforced pervious concrete
- To compare the engineering properties of two types of nylon fiber reinforced pervious concretes, having same length and different diameters.

LITERATURE REVIEW

Shinde, Dr S.S Valunekar (2015) presented a paper on “An experimental study on compressive strength, void ratio and infiltration rate of pervious concrete”. The paper represents the experimental methodology and experimental results related to compressive strength, void content and infiltration rate. Various mix designs of pervious concrete was tested, results were determined and analyzed. Cube size of 150mm x 150mm x 150mm was prepared to investigate compressive strength, void ratio and infiltration rate. Different concrete mix proportion such as 1:5, 1:6, and 1:1:5 and 1:4:5 with different size of gravels such as 9mm to 12mm was used to check these properties of pervious concrete. It was observed that when void ratio increases, infiltration rate also increases and compressive strength decreases and vice versa. Strength of Pervious concrete was found to be less than that of conventional concrete of nearly same mix design but pervious concrete has very high degree of permeability as compared to conventional concrete which is nearly zero [1].

Thakre, Rajput, Saxena (2014) conducted a comparative study on strength and permeability of pervious concrete by using nylon fiber. Cubical specimens were cast to conduct compression strength tests using a water cement ratio of 0.36 and an aggregate to cement ratio of 4. Nylon fibre was used in various proportions i.e. 0.1%, 0.15%, 0.2%, 0.25%, 0.3% and 0.4% of volume of concrete. The specimen after a fixed curing period of 7 days, 14 days and 28 days were tested for compressive strength 2000 KN compressive testing machine (UTM). The compressive strength of pervious concrete is increased when fibre used is up to 0.2%. If more than 0.2% of fiber is incorporated in concrete the strength is decreased. Permeability of the porous concrete samples was also determined. The property of the concrete which permits water (fluids) to percolate through its continuously connected voids is called its permeability. The permeability of pervious concrete as determined by passing 1000ml of water through voids of the concrete cube and measuring the amount

is increased in comparison to plain pervious concrete. of water passing through it. It was found out that the permeability of nylon fibre mixed pervious concrete [2, 7].

Ri-onoh and Hyan Kim (2014) conducted an experimental study on the durability performance of latex modified nylon fibre reinforced concrete for pervious concrete pavement applications. In this study the nylon fibre volume fraction (0%, 0.05%, & 0.1%) and the amount of latex (0, 5, 10 and 15% of the cement weight) added are varied and the slump, compressive strength and flexural strength, abrasion resistance and impact resistance are measured. Increasing the latex content improved the flexural strength, permeability, abrasion resistance and impact resistance of the pervious concrete. These improvements are attributed to stronger bonding and great impact absorption capability by the nylon fibres and latex. Compressive strength decreased with increasing latex content but increased with increasing nylon fibres content. However slump decreased as the amount of nylon fiber increased [3, 5].

A.A Rahman (2012) conducted a test on some properties of fiber reinforced no fine concrete. The paper focuses on studying the mechanical

characteristics of polypropylene and carbon fiber reinforced no fine aggregate concrete containing a different percentage of fiber. Tests to determine workability, density, compressive strength, splitting tensile strength and modulus of rupture were carried out. It was found that pervious concrete mixes without fibers have higher density than fiber reinforced concrete mixes containing polypropylene and carbon. The test results also indicated that the inclusion of fiber to the pervious concrete mixes did not affect the compressive

strength significantly, while the splitting tensile strength and modulus of rupture were improved significantly [4, 6].

METHODOLOGY

Experimental investigation on the strength and permeability characteristics of nylon fiber reinforced pervious concrete has to be carried out by reinforcing porous concrete with different amount of fibres by volume of concrete.

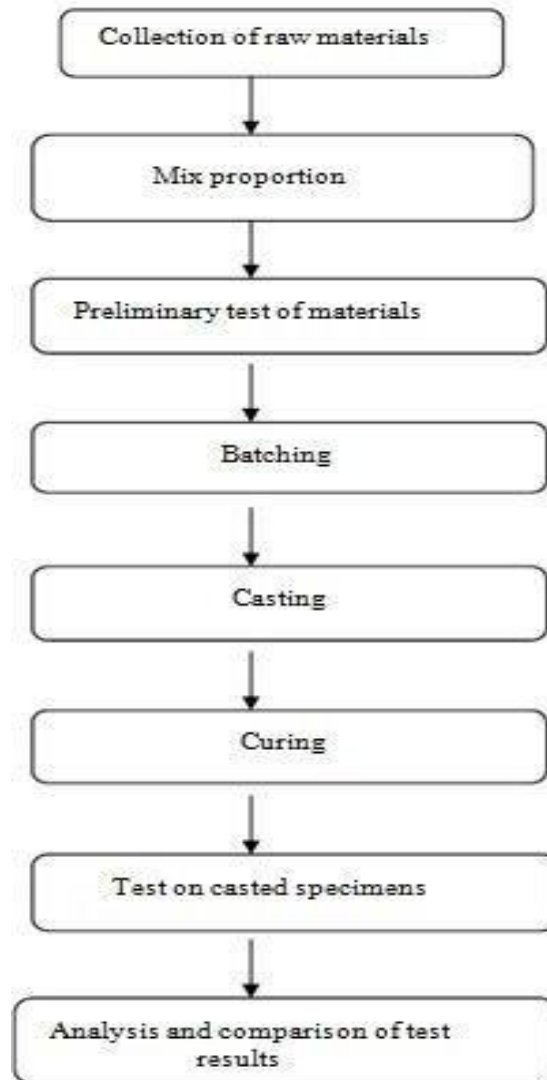


Fig1. Chart showing the methodology

MATERIAL PROPERTIES

Cement

PROPERTIES	STANDARD VALUE (IS 12269-1987)
Specific gravity	3.10-3.20
Standard consistency	30-35
Initial setting time(min)	>30min
Final setting time(min)	<600 min
Fineness (%)	<10%

Coarse aggregate

PROPERTIES	PERMISSIBLE RANGE (IS 15658 – 2006)
Bulk Density	1.52 – 1.68
Void Ratio	0.3 – 0.6
Specific Gravity	2.5 - 3
Porosity (%)	15 – 30
Aggregate Impact Value (%)	Less than 30 %
Los Angeles Abrasion Value (%)	Less than 30 %

Water

Water is an important ingredient of concrete because it actively participates in the hydration of cement. Since it helps to form the strength giving cement gel, the quantity and quality of water is to be assessed carefully. Water used should be free from acids, alkalies, organic impurities, iron, vegetable matter etc. Normal clean tap water is fit

for making concrete. The water should have confirming of IS 456- 2000.

Nylon fiber

Nylon fibres of length 6mm and diameter 0.023 mm is one type to be used. Nylon fibres of length 6mm and diameter 0.05 mm is the second type to be used.

PROPERTIES (type 1)	VALUES
Fiber length(L)	6mm
Fiber diameter(d)	0.023mm
Aspect ratio(L/d)	261
Density	1.16g/mm ³
Specific gravity	1.16

PROPERTIES (type 2)	VALUES
Fiber length(L)	6mm
Fiber diameter(d)	0.05mm
Aspect ratio(L/d)	120
Density	1.12g/mm ³
Specific gravity	1.13

ANALYSIS AND RESULTS

Table1 Compression test values of pervious concrete at 28 days curing

SI. NO	% OF FIBER	AVRG LOAD (kN)	AVERAGE COMPRESSIVE STREGTH (N/mm ²)
1	0%	225	10
2	0.1%	105	4.67
3	0.2%	230	10.22
4	0.3%	190	8.44
5	0.4%	150	6.67

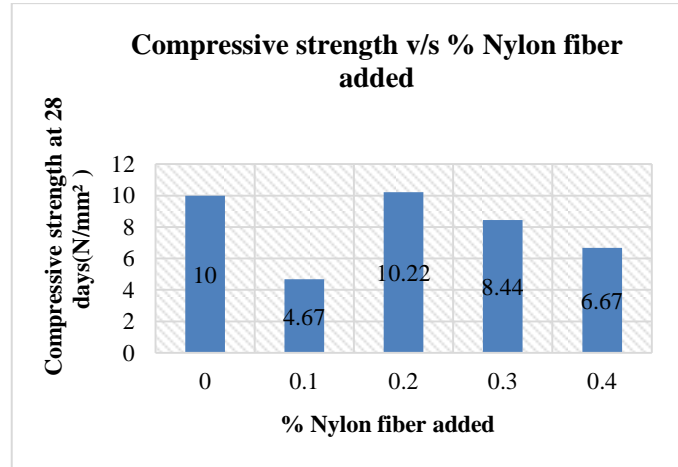


Fig2.Graph showing variations in compressive strength

Table2 Compression test values of pervious concrete at 28 days curing

SI.NO	% OF FIBER	AVERAGE LOAD (kN)	AVERAGE COMPRESSIVE STREGTH (N/mm ²)
1	0%	220	9.8
2	0.1%	100	4.44
3	0.2%	230	10.22
4	0.3%	180	8.00
5	0.4%	140	6.22

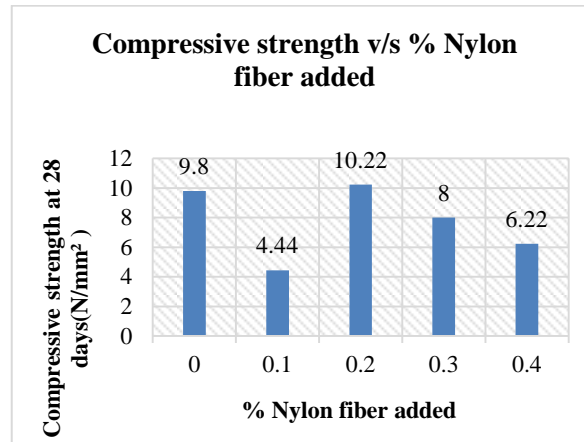


Fig3.Graph showing variations in compressive strength

DISCUSSION

According In this paper, we could understand the nylon fiber reinforcement will increase the compressive strength of the pervious concrete as the amount increases than .2% the strength decreases. Also there is no much difference in the strength of nylon fiber reinforced pervious concrete based on the variation of the properties of nylon fiber. There is more future chances of studies in this field by varying different properties of materials.

CONCLUSION

The main objective of the paper is to evaluate the strength and permeability characteristics of the pervious concrete. Thus thereby comparing the

plane pervious concrete and nylon fibre reinforced pervious concrete. The overall characteristics with the increase of nylon fibre content and the characteristics with change in size of nylon fiber have to be found. There by the new applications in the construction and vast verities of application of pervious concrete has to be discussed. Here we have selected a particular mix and going to analyze the increase and decrease in the percentage of nylon fibre in nylon fibre reinforced pervious concrete. Thus have to look for the future scope and hope in future studies about the nylon fibre reinforced pervious concrete

REFERENCES

- [1]. Dhawal Desai, "Pervious concrete – Effect of material proportion on porosity", International journal of engineering and science, 2(3), 2010.
- [2]. Gaurav Uttam Shinde, Dr S.S Valunjkar, "An experimental study on compressive strength, void ratio and infiltration rate of pervious concrete", International journal of Engineering Research and technology, 4(4), 2015.
- [3]. Hussam A.A Rahman, "Some properties of fiber reinforced no fine concrete", Al-Qadisiya journal for engineering science, 5, 2012.
- [4]. IS 383-1970, "Specification for coarse and fine aggregate from natural sources for concrete"
- [5]. Jaya Saxena, Anil Saxena, "Enhancement the strength of pervious concrete by using nylon fiber", International journal of engineering and science, 5(2), 2015.
- [6]. Nalini Thakre, Hirendra Rajput, Jaya Saxena, "Comparative study on strength and permeability of pervious concrete by using nylon fiber and polypropylene fiber", International journal of computing and technology, 1(4), 2014.
- [7]. Ri-onoh, Changhi Park, "Durability performance of latex modified nylon fiber reinforced concrete for pervious concrete pavement application", Indian journal of engineering and material science 21, 2014.