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ANALYSIS ON PERMEABLE CONCRETE PAVEMENT MATERIAL BY USING COCONUT COIR FIBER

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ABSTRACT

Pervious concrete is otherwise known as permeable concrete or no-fine concrete. This is a specific type of concrete which allows the rain water or water from any source to percolate through it to the ground directly. Main advantage of this type of concrete that it helps to increases the underground water level and eliminate the surface runoff and evaporation loss of rain water. The main composition to prepare this concrete is cement and large size course aggregate. A little amount of or no fine aggregate is used in this. As compared with the conventional concrete this concrete has a less strength, so it is used in the low traffic areas. But as the decrease in the ground water is the main concern of nature now-a-days so this type of concrete is very useful. This research is done to scrutinize the strength of permeable concrete reinforced with coconut fiber with compared to the strength of conventional concrete. The tests have been done with two different grades of concrete M15(1:2:4) and M20 (1:1.5:3). It has been tested with coconut fibre and coconut dust as well and also with 1% and 2% of (weight of cement)coconut fiber.

Keywords: Pervious Concrete, Coconut Fiber, Different Types Of Strength Comparision, Infiltration Rate.

I. INTRODUCTION

Flaky concrete, also known as non-abrasive, standard concrete, leaky concrete, and solid concrete, has proven to be a reliable tool for rainwater management. Extracting concrete with a mixture of granite, cement, water, light or non-sand (a good mixture) with or without mixtures. When waterproofing concrete is used for plastering, open cell structures allow storm water to filter through the paved area and subsoil. In other words, flexible concrete helps to protect the paved area and surrounding area. The use of natural fibers in construction is widely used in building materials engineering. However, using coir debris as a natural material in construction is very important, as it can increase cracking control and ductility of concrete. In addition, the use of coir in construction can reduce environmental pollution.

II. MATERIALS REQUIRED

This chapter describes the methodology and materials used to achieve the objectives. The main materials characterized in the present study are cement, aggregate and coconut coir fibre ; experimental methodology followed for characterization of these materials are discussed.

2.1 Ordinary Portland Cement

Common Portland cement is a very important type of cement and is a powder produced by grinding Portland cement paste. OPC is divided into three degrees, 33 degrees, 43 degrees, and 53 degrees in 28 days power. It has been possible to improve the quality of cement through the use of high quality limestone, modern materials, to maintain the distribution of better particle size, better grinding and better packaging. In general, the use of high-quality cement offers many advantages in making strong concrete. Ordinary Portland Cement (OPC) grade 53 (Ambuja Cement) was used throughout the investigation. Cement is carefully stored to prevent damage to buildings due to contact with moisture. Various tests performed on cement for the first and last set times, specific gravity, slippery, and compressive strength.

2.2 Aggregates

Aggregates form a mass of concrete mix and provide dimensional strength to the concrete. To increase the density of the resulting dough, aggregates are often used in two or more formats. The most important function of a good aggregate is to help produce performance and consistency in the mix.

2.3 Coir fiber

Coconut fiber or coir is a product that is extracted from the outer shell of the coconut fruit. It is used in a variety of ways around the world, is very popular with yarn and mating, and has a wide range of cod and kraal products. Coir comes from the fibrous matted layer found between the inner and outer shells of the coconut.

There are Two Types of coir Fibre.

1. White coir Fibre
2. Brown Coir Fibre

2.4 Water

Water is an important ingredient in concrete construction. The water used in the concrete mix has two functions: the first is the chemical reaction of the cement, which will eventually be set and strengthened, and the second is to lubricate all the other materials and make the concrete work.

III. MIX DESIGN CALCULATION

Although pervious concrete contains the same basic ingredients as the conventional concrete, the proportions of the ingredientscan vary.

3.1 Mix proportion for M15 grade of pervious concrete

Volume of the cube=(150*150*150) mm^3

Unit weight of concrete=2400 Kg/m^3

Total concrete required for 1 cube=Unit weight of concrete*Volume

=2400*3.375*10^{-3}=8.1 Kg

Material required for M15 grade concrete,(M15=1:2:4)

Total weight of concrete=Total part

=>1 part=Total weight of concrete/Total part

Total part of concrete,x+2x+4x=7x

=>7x=8.1 Kg

=>x=8.1/7=1.15 Kg(Cement)

=>6x=6.9 Kg(C.A)

Coir fibre=1% of cement=1.15*1/100=0.0115 Kg

=11.5gm

*In pervious concrete fine aggregate is non-existent.

3.2 Mix proportion for M20 grade of pervious concrete

Similarly, for M20 grade(M20=1:1.5;3)

5.5X=8.1 Kg

=>x=1.47 Kg(CEMENT)

=>6x=6.615 Kg(C.A)

Coir fibre=1% of cement weight=1.47*1/100=0.0147 Kg =14.7gm

IV. TEST METHODS

The procedure of method used for compressive strength, Flexural strength, and permeability.

4.1 Compressive strength

The seven-day and 28-day stress test was performed in accordance with ASTM C39, the General Compression Trial Method for Cylindrical Concrete Examples. Previous concrete samples were covered with neoprene pads before being loaded for testing.

4.2 Flexural strength

After a 28-day healing period, the perforated prepared concrete beams (plain and fiber-reinforced) were tested for flexible strength properties. The test was performed in accordance with the third loading point of the ASTM C293. The cracking modulus is computerized to be used in the construction of the durable flexible concrete

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structures. Sample breaks were in the middle of the third span. The modulus of rupture (MR), is computerized using the following formula:

$$MR = (P * L) / (B * D2)$$

when P = load (strength) in the fracture area

L = Span length (distance between foundations)

B = width

D = thickening

4.3 Permeability Test

Permeability refers to the ease with which water can flow through flowing concrete. The entry of each sample, K, is computerized using the following formula

$K=(Q*L)/(A*t*h)$,

where Q = Volume

L = Length

A = Area

t = time

h = head

V. TEST RESULT

Compressive Strength of permeable concrete at M15 grade

The 150mm x 150mm x 150mm test template was developed and tested using a pressure test 28-day pressure test is performed in accordance with ASTM € 39, the Standard Compression Trial Testing Model Material.

SPECIMEN	7 DAYS	14 DAYS	28 DAYS
NPC	5.1	8.88	11.6
COCONUT FIBRE(0.1%)	8.88	12.1	13.5
COCONUT DUST(0.1%)	2.88	6.5	10.1

*In 14 days, the strength must be 12 N/mm^2

In 28 days, the strength must be 14.85 N/mm^2

Compressive Strength of permeable concrete at M20 grade

SPECIMEN	7 DAYS	14 DAYS	28 DAYS
NPC	12.5	16.1	17
COCONUT FIBER(1%)	14	16	19
COCONUT FIBER(2%)	11	128	16

VI. APPLICATIONS

Continuous concrete compaction reduces the flow from the paved areas, which reduces the need for separate storm water storage ponds and allows for the use of smaller sewers. This allows homeowners to upgrade a large area of available space at low cost. Flowing concrete also naturally filters stormwater and can reduce contaminants that fall into streams, lakes, and rivers. It triggers the first rain (30 to 30 minutes of rain that will lead to more polluted runoff) and allows that rain to break through the soil so that soil chemistry and biology can treat polluted water. Continuous concrete acts as a storm water storage container and allows storm water to seep into the ground over a large area, thus facilitating the recharge of stagnant groundwater. All of these benefits lead to more efficient land use. Continuous concrete can reduce the impact of development on trees. The flow of paved concrete allows for both the transfer of both water and air to the root systems which allows trees to thrive even in the most developed areas.

VII. CONCLUSION

Pervious concrete is an inexpensive and environmentally friendly solution to support sustainable construction. Its ability to capture storm water and re-charge groundwater while reducing storm water flow makes flowing concrete play an important role. Because of its ability to reduce flow, it is often used as a road surface. The small size of the solid aggregate should be able to produce high pressure forces and at the same time produce a high penetration rate. Blends with a high aggregate cement ratio 8: 1 and 10: 1 are considered useful for paved roads requiring low pressure and high penetration. A good mix of flexible concrete is expected to provide maximum compression strength, as well as a good penetration rate

VIII. FUTURE SCOPE

Permeable concrete can be used to build rainwater harvesting as well as cooling by providing a waterproof wall. If there is clay soil, the water can be drained by providing holes every 1- 2km with the help of a drainage system.

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