ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

INVESTIGATION OF PERVIOUS CONCRETE IN SMALL SCALE

K.Dhivya [1] ,P.Lavanya [1],D.Nirmaldevi[1] ,P.Vasuki[1] ,P.Bhuvaneshwari[2]

[1]UG students and [2]AssistantProfessor

Department of Civil Engineering

Bharathiyar Institute of Engineering for Women, Deviyakurichi, Salem, Tamil Nadu.

Email ID:,[1] dhivyacivil1995@gmail.com [2] bhuvaneshwaripoomalai@gmail.com

ABSTRACT: Pervious concrete is the form of lightweight porous concrete, obtained by eliminating the sand from the normal concrete mix. Merits of this type of concrete are lower density, lower cost due to lower cement content, lower thermal conductivity and relatively low drying shrinkage, no segregation and capillary movement of water, better insulating characteristics than conventional concrete because of the being there of large voids. In recent times many studies have been carried out on no fines concrete. The main objective of this research is to investigate the performance characteristics of concrete mixes made without using fine aggregates and to suggest possible applications of no-fines concrete. The scope of this work is to carry out a detailed investigation of the following secondary system for the prescribed conditions:-

1. Cement: concrete mix by volume is taken as 1:2, 1:4 and 1:6

2. Ordinary Portland cement of 43 / 53 grade

3. Water/cement ratios is limited to 0.5

The following tests to be performed & results are compared with the conventional concrete.

- **a) Compressive Strength**
- **b) Flexural strength**
- **c) Slump Cone**

Keywords: Thermal conductivity, Conventional concrete, No fines concrete.

I. INTRODUCTION

No fines concrete is a composite material consisting of coarse aggregate, Portland cement and water. It is dissimilar as of normal concrete the mixture contains no fines in it. The aggregate is usually of a single size and is bonded jointly in a cement paste. Pervious concrete has lower compressive strength, higher permeability with a lesser density. Its compressive strength would be 65% lower than the normal concrete . Pervious concrete is being installed to improve storm water quality and reduce runoff produced by urban settings. For defining the basic behaviour of pervious concrete and pervious pavement systems, an tentative investigation were conducted to study the following properties: porosity, density, water permeability, drying shrinkage, and compressive strength. The result is a concrete with high percentage of interconnected voids that allow the diffusion of water through the material matrix. conventional concrete has a void ratio around 3-5% no fines concrete has higher void ratios from 18-40% depending on its application.

II. LITERATURE REVIEW

Krishna Raju et al (1975) focused on the premium water content for no-fines concrete. It was firm that for the particular aggregate cement ratio there is a fine range for optimum water-cement ratio.

(Malhotra 1976) determined that the unique use of no-fines concrete was in the United Kingdom in 1852 with the construction of two residential houses and a sea groyne. It was a additional 70 years before any further recorded use of

All Rights Reserved © 2016 IJARTET

no-fines concrete occur when it was reintroduced into the integrated Kingdom in 1923 from Holland. The use of no-fines concrete become more important after the ending of World War II with the associated material shortages. He found that the density of no-fines concrete is generally about 70 percent of conservative concrete when made with similar constituents. The thickness of no-fines concrete using conservative aggregates varies from 1602 to 1922 kg/m3. A clinker aggregate was trailed and the no-fines concrete fashioned a density of 961 kg/m3. Adequate vibration is imperative for strength of conventional concrete. The use of no-fines concrete is special and is a self-packing manufactured goods therefore the use of mechanical vibrators and ramming is not optional with no-fines concrete. A light rodding should be adequate and used to make sure that the concrete reaches throughout sections of the formwork. This is not a problem with conventional concrete from the time when it has superior flow ability than no-fines concrete. The light rodding ensures that the concrete has penetrated every one the areas impede through reinforcing steel. Malhotra (1976) stresses that in situations where average environment are not achieved throughout placement and curing, the formwork must not be uninvolved after 24 hours as with conservative concrete. pervious concrete has very low cohesiveness with formwork should stay put until the cement paste has hardened sufficiently to hold the aggregate particle mutually. However, this is more of a thought in low temperature conditions and while used in non-pavement applications wherever the concrete be not adequately supported by the ground or other means and noted that the depth of diffusion in no-fines concrete by this system under conditions of high clamminess and no air progress is generally no larger than two or three times the largest aggregate diameter. The penetration of humidity was superior in no-fines concrete made from conservative aggregates than residue aggregate.

Meininger (1988) investigated the produce on the properties of pervious concrete with the calculation of sand. He found that when a small amount of sand was added to the combination, the Compressive strength of the concrete improved from 10.3 MPa to 17.2 MPa. improvement of this material in roadway applications do not obtain off awaiting the late 1970's, where it was first used as a exhausting course for a parking lot. The primary no-fines concrete roadway plan was original as a "porous pavement" and a successive no-fines pavement design was called a no fines pavement. He found that poor curing technique allowed the cement paste to dry too rapidly and did not allow the hydration method to finish. It could be seen by the misdeed of the pavement exterior that no compaction was undertaken. All these factors unnatural one exacting parking lot studied and in progress raveling one year after construction. Another asphalt road was constructed and it was made sure that enough compaction was provided to ensure the top aggregate was fittingly seated and covered with plastic to establish suitable curing conditions.

Ghafoori et al. (1995) undertake a significant amount of laboratory analysis to determine the efficiency of no-fines concrete as a road surface material. The curing types were investigated to find out if there was any difference between wet and preserved curing. There appeared to be only a insignificant difference in strength connecting the different curing methods. It was obvious from the test consequences that the strength development of no-fines concrete was not needy upon the curing situation. The oblique tensile test conducted by him found that the sample tests varied between 1.22 and 2.83 MPa. The superior tensile strength was achieved with a lesser aggregate-cement ratio. He explain the more favorable properties obtained by the lesser aggregate-cement ratio by an enhanced mechanical interlocking behavior between the aggregate particles. Ghafoori et al. (1995) formed no-fines concrete with a Compressive strength in excess of 20 MPa when with an aggregate-cement ratio of 4:1. The insist for no-fines concrete for pavement applications continued to increase

All Rights Reserved © 2016 IJARTET

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

and an organization called "Portland Cement no fines Institute" was formed in 1991 to continue the consider. Ghafoori et al. (1995) documents the growth of porous base equipment capable of storing a superior volume of water until it dissipates into the immediate soil. Raveling can take place in no-fines concrete pavements when there is a absence in the curing process or indecent compaction and spaces of the top aggregate particles. Ghafoori et al., (1995) Opined that later than World War II, permeable concrete became wide extend for applications such as cast-in-place load-bearing walls of only and multistory houses and, in some instances in dwelling buildings, prefabricated panels, with stem-cured blocks.

Abadjieva et al., (2000) resolute that the Compressive force of no-fines concrete increases with age at a equivalent rate to conservative concrete. The no-fines concrete specimen experienced had aggregate-cement ratios unstable from 6:1 to 10:1. The 28 day Compressive strength obtained in these mixes ranged from 1.1 and 8.2 MPa, during the aggregate-cement ratio of 6:1 individual the strongest. He completed that the most probable explanation for the reduced strength was caused by the improved porosity of the concrete samples. This strength is sufficient for structural weight bearing walls and linked applications. He investigated the pressure of the aggregate-cement ratio on top of the tensile with flexural strength of pervious concrete. This revise only assessed aggregate-cement ratios ranging from 6:1 to 10:1. The maximum strengths were obtained with an aggregate-cement proportion of 7:1 and the force decreased with an growing aggregate-cement ratio. He establish that the tensile and flexural strengths of no-fines concrete were significantly lower than those obtained from conservative concrete. (Tennis et al. 2004) determined that no fines concrete can be used to lessen storm water runoff, decrease contaminants in waterways, and repair groundwater provisions. With far above the ground levels of permeability, pervious concrete be able to efficiently capture the "first blush" of rainfall (that part of the runoff with a higher contaminant attention) and allow it to percolate into the ground where it is filtered and "treated" from end to end soil chemistry and biology.no fines concrete contains small otherwise no fine aggregate (sand) and carefully prohibited amounts of water and cementitious supplies. The paste coats and binds the aggregate particles jointly to create a system of greatly permeable, organized voids that promote the speedy drainage of water. characteristically, between 15 and 25 percent voids are achieved in the toughened concrete, and flow rates for water through the pervious concrete are usually in the collection of 81 to 730 L/min/m^2. Also applications take in walls for two-story houses, load-bearing walls for dwelling buildings (up to 10 stories) and infill panels for dwelling buildings (Tennis et al. 2004). **(Wanielista et al. 2007)** declared that the main use of porous concrete was in the cohesive Kingdom in 1852 with the construction of two residential houses and a ocean groin. Cost competence seems to have been the main reason for its earliest convention due to the narrow amount of cement used. It was not awaiting 1923 when porous concrete re surface as a viable construction material. This time it be limited to the construction of 2-story homes in areas such as Scotland, Liverpool, London with Manchester. Use of porous concrete in Europe greater than before steadily, especially in the World War II era. as porous concrete use a smaller amount cement than conventional concrete and cement was fright at so as to time. It seemed that porous concrete was the best material for so as to stage.

Darshan S. Shah et al. (2013) opined that no fines concrete is a comparatively new concept for rural road pavement, with increase into the troubles in rural areas linked to the low groundwater level, agricultural problem. By capturing rainwater and allowing it to leak into the ground. This pavement knowledge creates more efficient ground use by eliminating the want for preservation ponds,

All Rights Reserved © 2016 IJARTET

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

swell, and extra costly storm water management policy.Patil et al. opined that our cities are organism covered with building and the air-proof concrete road more and additional. In addition, the environment of city is far from normal. Because of the lack of water permeability and air permeability of the general concrete pavement, the rainwater is not drinkable underground. Without stable supply of water to the soil, plants are hard to grow normally. In adding, it is complicated for soil to replace heat and dampness with air; therefore, the temperature and humidity of the Earth's exterior in large cities cannot be adjusted. The investigate on pervious pavement materials has begun in urbanized countries such as the US and Japan since 1980's. no fines concrete pavement has been worn for over 30 years in England and the United States. No fines concrete is also widely worn in Europe and Japan for roadway applications as a outside course to improve skid resistance and decrease traffic blare. However, the strength of the material is comparatively low because of its porosity. The compressive force of the material can only reach about 20 – 30 MPa. Such equipment cannot be used as pavement due to low strength. The no fines concrete can only be functional to squares, footpaths, parking masses, and paths in parks. Using selected aggregates, fine mineral, admixtures, natural intensifiers and by adjust the concrete ratio, strength and abrasion resistance can get better the no fines concrete greatly. Although no-fines concrete is a flexible material able to be used in many situations present are times when its use is not a viable choice. Pervious concrete pavements have a rough-textured, honeycomb akin to surface, which lacks the high bonding potency on the wearing course. Moderate amounts of raveling are normal with little or no problems but this becomes a chief issue on extremely trafficked roadways. This trouble is being investigated with the top 10 mm being ground missing so the exposed aggregate have stronger bonds with the nearby material. Pavement plan is of critical importance, as the base of the pavement is required to grip water until it permeates into the soil devoid of failing. This requires the use of storm water management principles to establish what happens to the water once it penetrates the exterior and pavement design principles to plan a pavement structure so as to is capable of withstand the interior pressures caused in the water in the pavement.

III. OBJECTIVE AND SCOPE

In fresh times lots of studies have been carried out on pervious concrete. The objective of the present study is to check the presentation of no fines concrete on a variety of sizes of aggregates. Concrete is the the majority important material for construction purposes and cement is the the majority expensive component in it. The name of pervious concrete itself explains so as to the fine aggregate has be absent in this brand of concrete. Due to the absence of fine aggregate in no fines concrete, there is a tall proportion of void space which results inside high permeability. The unit weight, ventilation shrinkage and hydrostatic force for no fines concrete is a smaller amount compared to conservative concrete. Due to the a smaller amount cement contented in no fines concrete, the cost of the in general project reduces. No fines concrete also helps in the decrease of urban heat island effect outstanding to its brightness color.In this project cubes of 150 mmxl50 mm x 150 mm size coarse aggregates. The cubes are experienced and their consequent Compressive strengths and density are prominent.The objective of demanding a variety of ratios and their combinations is toward arrive at a join for M15 grade concrete and plan a pavement with the mix.The range of the present work is to carry out a exhaustive analysis of the subsequent sub systems for the prearranged situation:-

1. Cement: concrete mix by quantity is taken as 1:2,1:4,and 1:6.

2. Ordinary Portland reinforce of 43/53 grade

3. Aggregates of sizes are in use 20mm passing with 10mm retained aggregates

All Rights Reserved © 2016 IJARTET

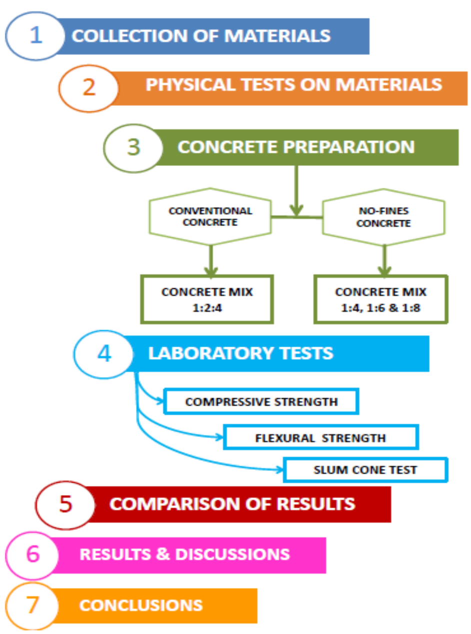
ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

S.NO	SIZE OF AGGREGATE (MM)	BULK DENSITY AT ROD STATE (Kg/M^3)	BULK DENSITY AT LOOSE STATE (Kg/M^3)
1	10	1453	1365
2	12	1484	1369
3	20	1443	1345

4. Water/cement ratio are 0.5.
5. cubes of size 150 ×150 ×150 mm be cast with different w/c ratio plus different aggregate size.
6. Testing of specimen on the ages of 7, 28 days.
7. Find out the flexural strength of M15 grade mix.

IV.METHODOLOGY

The methodology adopted with material characterization and plan mix is carried out is presented in the figure of flow chart plus parameters studied. Also the chronological activities involved in this study be presented in graphical form. Details of investigational study in materials be presented in the subsequent headings.



V.EXPERIMENTAL PROGRAMME

Concrete cubes of size 150mm x 150mm x 150mm, cylinders of size 150mm diameter and 300mm height, prisms of size

100mm x 100mm x 500mm were casted and demoulded after 24 hours.By replacing 30%,60%and 100% of recycled coarse aggregates three cubes were tested to find cube compressive strength at the age of 7 days, 28 days. Three cylinders were tested to find out the split tensile strength at the age of 7 days,28 days and three prisms were tested to find flexural strength at the age of 7 days and 28 days.

Mix Design:

Mix design can be definite as the procedure of selecting proper ingredients of concrete and formative their relative extent with the object of producing concrete of certain lowest amount strength and durability as economically as possible. The main objective is to demand the minimum strength and durability. The mix design proportions adopted in our project for the grade of M15.

S.NO	MIX PROPORTION
1	1:2
2	1:4
3	1:6

VI. MATERIALS

General

Material analysis is done to test the a variety of materials that be used in making concrete cubes. According on the way to these test consequences obtained we planned the mix proportions for the equipment and arranged the concrete cubes, beams and cylinders. The in order be given below,

Cement

OPC of 43/53 grades in one lot be procured and stored in air fixed container. The cement used was new, i.e., used inside three months of fabricate. It should convince the obligation of IS12262. The property of cement be to find out as per IS4031:1968 and results are tabulate.

Coarse Aggregate

The coarse aggregate is strongest and porous section of concrete. Presence of coarse aggregate reduce the drying

All Rights Reserved © 2016 IJARTET

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

shrinkage and additional dimensional changes departure on account of faction of moisture. The coarse aggregate used passes within 10 mm and retained in 20 mm sieve. It is well graded(should of special particle size and maximum dry packing density plus least amount voids) and cubical in shape.

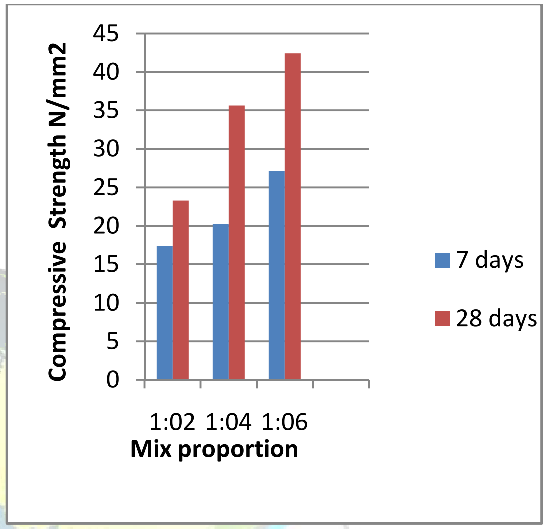
S.NO	MIX PROPORTION	FLEXURAL STRENGTH IN N/MM^2	
		7 DAYS	28 DAYS
1	1:2	2.50	3.35
2	1:4	4.29	5.92
3	1:6	6.20	9.40

S.NO	MIX PROPOSTION	COMPRESSIVE STRENGTH IN N/MM^2	
		7 DAYS	28 DAYS
1	1:2	17.40	23.30
2	1:4	20.27	35.65
3	1:6	27.10	42.42

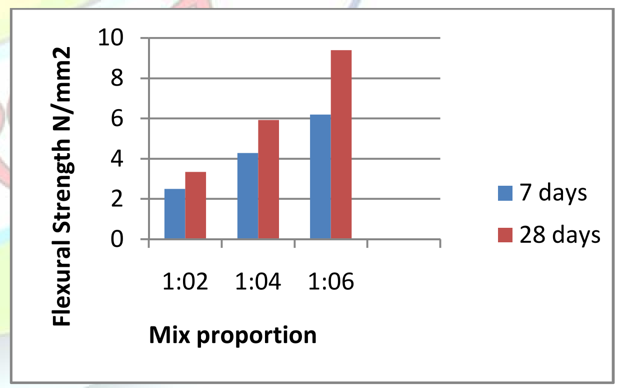
Water

Ordinary drinking water on hand in the construction laboratory be used for casting every one specimens of this analysis. Water helps in dispersing the cement though, so that every element of the aggregate is coated with it and brought into ultimate contact by means of the ingredients.

COMPRESSIVE STRENGTH RESULTS:



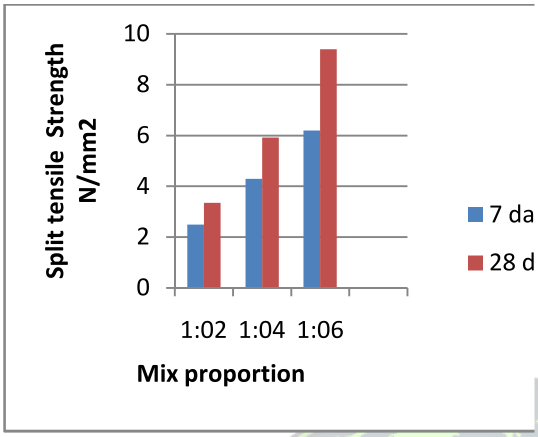
FLEXURAL STRENGTH RESULTS:



SPLIT TENSILE STRENGTH RESULTS:

S.NO	MIX PROPORTION	SPLIT-TENSILE STRENGTH IN N/MM^2	
		7 DAYS	28 DAYS
1	1:2	1.85	2.62
2	1:4	2.87	3.25
3	1:6	3.86	4.34

All Rights Reserved © 2016 IJARTET



VII. CONCLUSION

The 1:6 mix proportions gives extra compressive strength than the additional two mix proportions. The consequence of water/cement ratio include greater force on ultimate strength as0.45% water substance gives more strength than other water content worn in this investigation. The use of water content extra than 0.45% causes the stream of cement to the bottom of the specimen. The use of different size aggregates also have superior impact on the ultimate strength as 12 mm size aggregate gives additional strength than other sizes namely 6 mm and 20 mm. The utilize of 6 mm aggregate causes raise in dry density. The use of 20 mm aggregate causes more voids within the concrete thereby decrease in strength. The ultimate strength of no-fines concrete is of the range linking 5 N/mm^2-12 N/mm^2. From the analysis, the most economical mix with high strength identified was 1:6 mix ratios through 12 mm aggregate and 0.45% water content. The cost of developed of no-fines concrete blocks be 3.5-5 rupees but for nominal concrete blocks it was 4.5-6.5 rupees. Therefore, the no-fines concrete blocks were more inexpensive than nominal concrete blocks.

REFERENCES

[1] Goh Kau Soon, Koh Heng Boon, Lee Yee Loon, Ismail Bakar, foam Aggregate no fines Concrete – An Option for Road on Peat. events of MUCEET2009 Malaysian Technical Universities symposium on top of Engineering and Technology, June 20-22, 2009: p.1,26-29**.**

[2] Delatte N, Mrkajic A, Miller DI. Ground with laboratory evaluation of no fines concrete pavement. Transport Res Rec 2009;2113:132–9.

[3] Delatte, N., Miller D, Mrkajic A. Field performance investigation going on parking lot and roadway pavements (last report). Silver Spring (MD): RMC investigate & Education Foundation; 2007.

[4] Schaefer, V.R., Wang K, Suleiman MT, Kevern JT. Mix plan development for pervious concrete in cold temperature climates. Final report, Ames (IA): National Concrete Pavement machinery Center, Iowa State University; 2006.

[5]N. Ghafoori and Sh. Dutla. "Laboratory Investigation of compressed no fines concrete used for road surface Materials" Journal of Materials in civil Engineering. August 1995.

All Rights Reserved © 2016 IJARTET