ISSN (Online): 2455-7838
SJIF Impact Factor : 6.093

EPRA International Journal of

Research & Development

(IJRD)

Monthly Peer Reviewed & Indexed International Online Journal

Volume: 4, Issue:6, June 2019

Published By
EPRA Publishing

SJIF Impact Factor: 6.093 Volume: 4 | Issue: 6 | June | 2019 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Peer Reviewed Journal

EXPERIMENTAL STUDY ON NO FINES CONCRETE

Mahesh S M[1]
Assistant Professor, Dept. of Civil Engineering, Dayananda Sagar Academy of Technology and Management, Bangalore, Karnataka, India

Rukitha C[2]
BE Student, Dept. of Civil Engineering, Dayananda Sagar Academy of Technology and Management, Bangalore, Karnataka, India

S. Karthika[3]
BE Student, Dept. of Civil Engineering, Dayananda Sagar Academy of Technology and Management, Bangalore, Karnataka, India

ABSTRACT
The paper provides investigation on the properties of no fines concrete through laboratory testing. An extensive experimental program was conducted to investigate the compressive strength, split tensile strength and water permeability. No fines aggregate is a type of pervious concrete which is obtained by omitting fine aggregates and it is also termed as light weight concrete. The mixture is composed of cementitious materials, coarse aggregates and water with no fines aggregate. In this present work we have taken single sized aggregates i.e. 12.5mm. The single size aggregates make a good no fines concrete, which in addition has large voids and hence light weight, also offers architecturally attractive look. It was found that the strength of no fines concrete is lower than that of normal weight concrete and in the range of 0.8 to 8 Mpa, but appears to be sufficiently enough for specialised construction works where compressive stress demand is not very high. Laboratory tests were conducted on standard cubes of (150x150x150) mm, with different mix proportions to estimate compressive strength. No fines concrete is sufficient enough to be used in different constructions, like low rise buildings, pavements and other applications.
KEYWORDS: *No fines concrete, pervious concrete, low rise building, permeability.*

1. INTRODUCTION

One of the disadvantages of concrete is the high self-weight of concrete. Density of normal Concrete is in the order of 2200 to 2600 kg/m3. This heavy self-weight will make it to some Extent an uneconomical structural material. Attempts have been made in the past to reduce The self-weight of concrete to increase the efficiency of concrete as a structural material. The light weight concrete density varies from 300 to 1850 kg/m3.No – fines concrete is a type of lightweight concrete produced by omitting the fines from conventional concrete. It is a two – phase material – single sized coarse aggregates, surrounded by a coating of thin layer of cement paste. The single sized aggregates make a good No – fines concrete, which in addition to having large voids and hence light in weight, also offers architecturally attractive look. The history of pervious concrete dates back to 1852 in England with the construction of residential houses and it became considerably more widespread during the material shortages after World War II, for cast in place load bearing walls of single and multi-storeyed buildings. The use of No – fines concrete in pavement applications had started in US and Japan since 1980s. Since then a lot of researches have been

done on pervious concrete in developed countries like US and Japan and they have been extensively used in field. In the United States, pervious concrete is mostly used for light – duty pavement applications, such as residential streets, parking lots, driveways, and sidewalks. Such applications require the pervious concrete pavement to carry a normal traffic load. The strength of the pervious concrete depends on the properties of the cement paste and the interface between the paste and the aggregate. To improve the strength of such concrete, three components must be improved; strength of the paste, the paste thickness around the aggregate, and the interface between the aggregate and the paste. The compressive strength ranging from 1.4 to 13.7 MPa is more common (Malhotra, 1976). Abadjieva & Sephiri (2000) have identified No – fines concrete as having a density around 1600 – 2000 Kg/m3, this compares well with traditional concrete whose density is between 2300 – 2400 Kg/m3.

The objective of the present work is to study the properties of concrete mixes of aggregate cement ratio of 1:4 and 1:6 without fine aggregate using single sized aggregate and to see if it is possible to use this type of concrete in constructions like walls in low-rise and low cost housing.

Fig 1. Test specimens

2. AIM AND SCOPE OF INVESTIGATION

The main objectives of the project are as follow:

- To identify the strength of no-fines concrete specimen.
- To identify the most economical mix for blocks.
- To Reduce the dead loads & savings in foundations and reinforcement.
- To Improve thermal properties & fire resistance.
- Savings in transporting and handling precast units on site.

3. MATERIALS

The present investigation the following materials were used:

Ordinary Portland Cement of 53 Grade cement conforming to IS: 169-1989

coarse aggregate conforming to IS:2386-1963

3.1 Cement

Ordinary Portland Cement of 53 Grade of brand name UltraTech Company, available in the local market was used for the investigation. Care has been taken to see that the procurement was made from single batching in air tight containers to prevent it from being effected by atmospheric conditions. The cement thus procured was tested for physical requirements in accordance with IS: 169-1989 and for chemical requirement in accordance IS: 4032-1988. The physical properties of the cement are listed in Table 1

Table 1 Physical Characteristics of OPC 53 grade

PROPERTY	TEST RESULTS	REQUIREMENT OF IS: 8112 - 1989	
Setting time: a) Initial b) Final	 50 Min 10 hr	Should not be Less than Should not exceed	 30 Min 600 Min
Standard Consistency	31 %	-	-
Specific Gravity	3.15	-	-

3.2 Coarse Aggregates

Crushed aggregates of less than 12.5mm size produced from local crushing plants were used. The aggregate exclusively passing through 12.5mm sieve size and retained on 10mmsieve is selected. The aggregates were tested for their physical requirements such as gradation, fineness modulus, specific gravity and bulk density in accordance with IS:2386-1963. The individual aggregates were mixed to induce the required combined grading. The particular gravity and water absorption of the mixture are given in table 3.

Table 2: Properties of coarse aggregates

Specific Gravity of coarse aggregate	**2.60**
Water absorption	**1%**

3.3 Water

Potable water fit for drinking is required to be used in theconcrete and it should have pH value ranges between 6 to 9

4. MIX DESIGN

4.1 General

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible. The main objective is to stipulate the minimum strength and durability. The mix design proportions adopted in our project is M20.

4.2 MIX PROPORTIONS

By the trial and error method we found that, the excess water content leads to the paste flows to the bottom of the concrete. On the other hand, if the water content is too low the paste will be so dry that aggregates do not get properly smeared with paste which results insufficient adhesion between the particles. By means of adding optimum water content the maximum strength of the concrete can be obtained.

Table 3 represents mix proportion of concrete

Sl.no.	PROPERTY	1ST TRAIL	2ND TRAIL
1	Water : Cement	0.45	0.45
2	Cement :aggregate	1:4	1:6

Table 4: Mix proportions for M20 grade of concrete

Materials	Proportions for Conventional concrete (kg/m^3)	Proportions for No fines concrete(kg/m^3)
Cement	380	380
Fine aggregates	563.06	0
Coarse aggregates	1113.75	1113.75
Water cement ratio	0.45	0.45

5. RESULTS AND DISCUSSION

5.1 Compressive Strength

The test was conducted as per IS 516-1959. After the completion of required curing period, the standard cube specimens (150mm x 150mm x 150mm) are taken out and tested in a saturated surface in dry condition. These results are obtained by testing the total specimensfor 7 days, 14 days and 28 days and by considering the average of the test results and that are tabulated in table

Table 5: Compression test for aggregate cement ratio 4:1

Sl. No	No. of curing days	Load(KN)	Compressive strength (Mpa)
1	7	164.5	7.3
2	14	175.6	11.2
3	28	333.6	14.8

TABLE 6:Compression test for aggregate cement ratio 6:1

Sl.no	No. of curing days	Load(kN)	compressive strength (Mpa)
1	7	164.5	8.3
2	14	175.6	12.5
3	28	333.6	16.8

5.2 SPLIT TENSILE TEST

This test is conducted using universal testing machine. After completion of required curing period, the standard cylinder specimen of size 150mm diameter and 300mm height were used for the determination of the flexural strength. These results are obtained by testing the total specimens for 7 days, 14 days and 28 days and by considering the average of the test results and that are tabulated in table

Table 7:Split tensile test for aggregate cement ratio 4:1

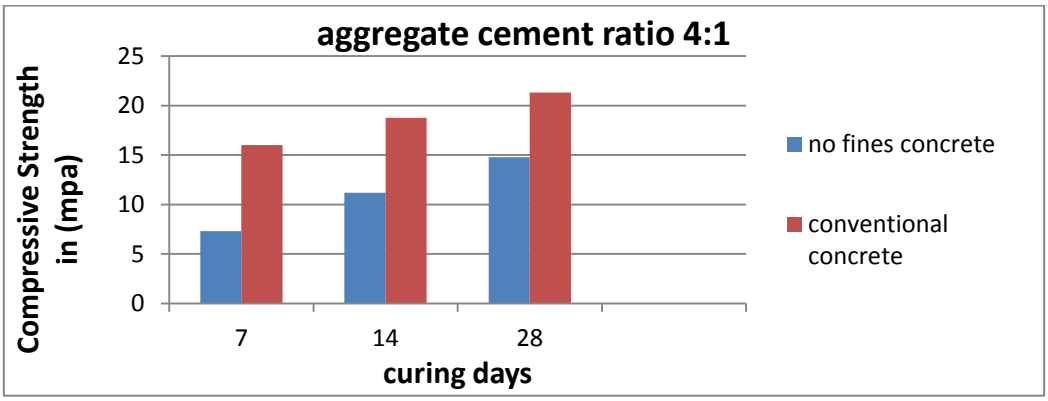
Sl. No	No. of curing days	Load (KN)	Tensile strength (Mpa)
1	7	110.3	0.69
2	14	120.65	1.19
3	28	124.1	1.63

Table 8: Split tensile test for aggregate cement ratio 6:1

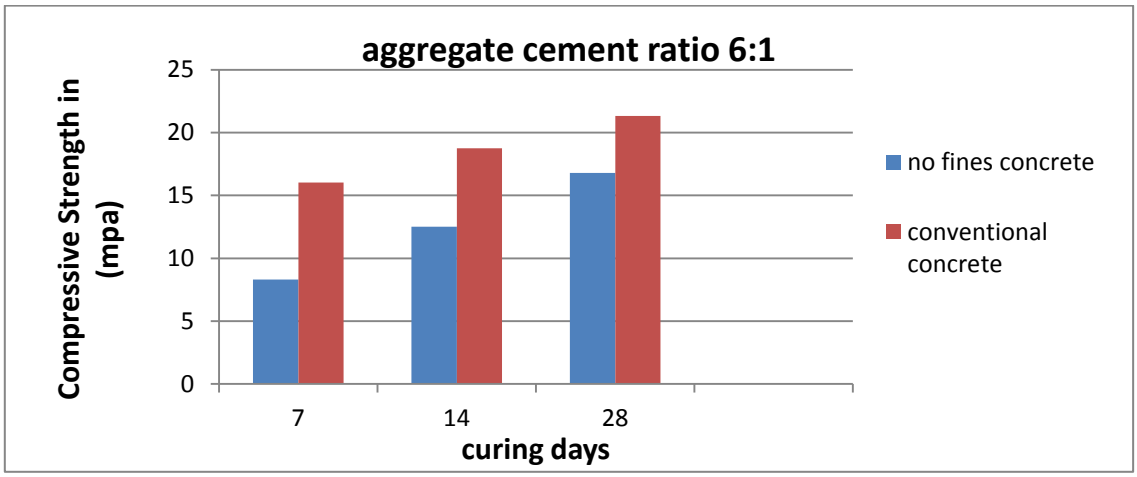
Sl. No	No. of curing days	Load (KN)	Tensile strength (Mpa)
1	7	508.3	1.14
2	14	135.6	1.65
3	28	185.5	2.27

6. GRAPH

6.1 COMPRESSIVE STRENGTH RESULTS

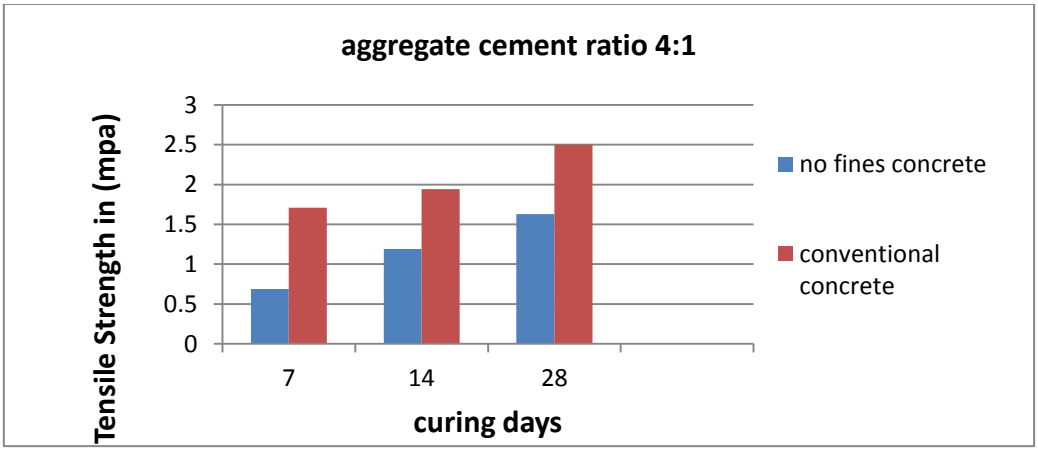


Graph 1: Comparison of compression strength of no fines concrete of aggregate cement ratio 4:1 with conventional concrete

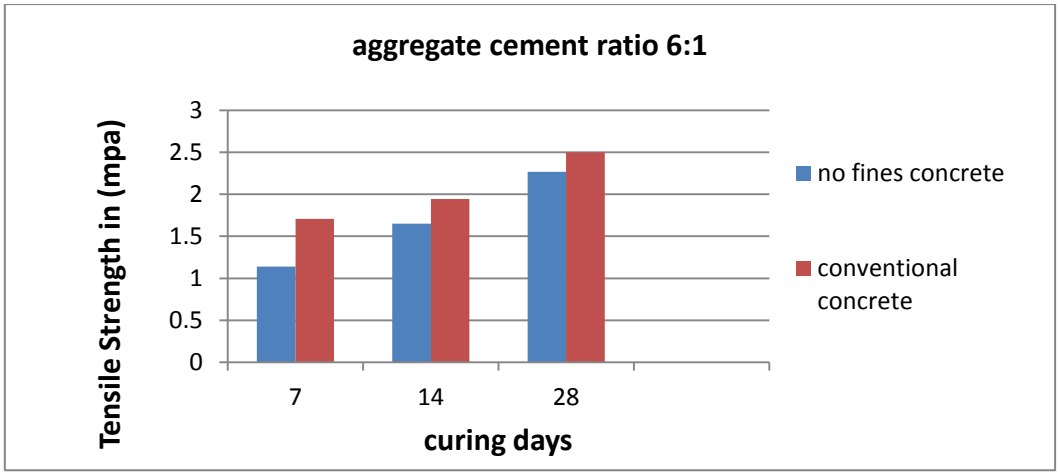


Graph 2: Comparison of compression strength of no fines concrete of aggregate cement ratio 6:1 with conventional concrete

6.2 SPLIT TENSILE STRENGTH RESULTS



Graph 3: Comparison of split tensile strength of no fines concrete of aggregate cement ratio 4:1 with conventional concrete



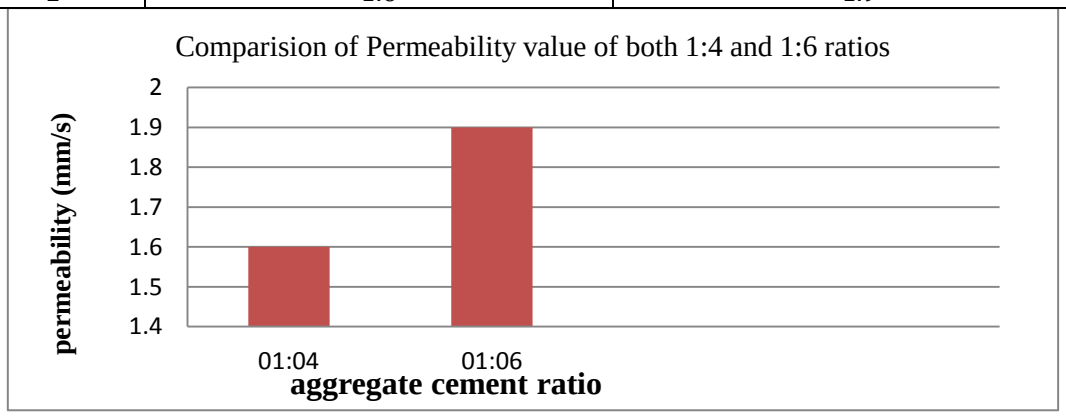
Graph 4: Comparison of split tensile strength of no fines concrete of aggregate cement ratio 6:1 with conventional concrete

6.3 WATER PERMEABILITY TEST

Permeability is the property of concrete that controls the amount of water passes into the aggregate pores. This property of concrete is extremely important in determining the durability of concrete structure. The permeability of the samples was determined using the falling head permeability test. The test was performed using several water heights which represented values that a pavement may experience in determined using the following equation.

Table 9: represents water permeability of concrete cubes

Sl.no	Cement aggregate ratio	Permeability value (mm/s)
1	1:4	1.6
2	1:6	1.9



Graph 6.3 Water Permeability of concrete cubes

7. DISCUSSION

7.1 Compressive Strength

When comparing the no fines concrete with 1:4 and 1:6 cement aggregate ratio, that the strength of 1:6 ratio concrete is higher. The compressive strength of no fines concrete with 1:6 cement ratio has been 30% higher than 1:4 ratio of cement aggregate ratio. The computed values of the compressive strength of both conventional and no fines concrete establish that compressive strength of no fines concrete is less than that of conventional concrete.

7.2 Split Tensile Strength

The split tensile strength of 1:6 ratio has been 28% higher than 1:4 ratio of cement aggregate ratio. The calculated split tensile strength values of both conventional and no fines concrete prove that the tensile strength of no fines concrete is less than that of conventional Concrete.

7.3 Density of Concrete

The computed density of no fines concrete is noted to have decreased in comparison with that of conventional concrete. The density of no-fines concrete is about 25 -30 % less than conventional

concrete. Therefore it exerts less pressure on formwork.

7.4 Permeability

Computations establish that the coefficient of permeability values is more for no fines concrete than the conventional concrete

8. CONCLUSIONS

The following conclusions are drawn based on the experimental investigations on compressive strength, split tensile, permeability considering the "environmental aspects" also

- Pervious concrete has less strength than conventional concrete by 14.5% for M20
- When comparing the no-fines concrete with the cement aggregate ratio 1:4 and 1:6 it is apparent that, the compressive and split tensile strength of concrete with cement aggregate ratio 1:6 is high.
- The density of no-fines concrete is about 25 -30 % less than conventional concrete.
- It is evident from the project that no fines concrete has more coefficient of permeability. Hence, it is capable of capturing storm water and recharging the ground water. As a result, it can be ideally used at parking areas and at residential areas where the movement of vehicles is very moderate.
- Further, no fines concrete is an environmental friendly solution to support sustainable construction. In this project, fine aggregates as an ingredient has not been used. Presently, there is an acute shortage of natural sand all around. By making use of FA in concrete, indirectly we may have been creating environmental problems. Elimination of fines correspondingly decreases environment related problems.
- In many cities diversion of runoff by proper means is complex task. Use of this concrete can effectively control the run off as well as saving the finances invested on the construction of drainage system. Hence, it can be established that no fines concrete is very cost effective apart from being efficient.

9. REFERENCES

1. *Amjad, "International Journal of Engineering Innovation and Research", pp 799-802, vol.4, Issue 6, (2015).*
2. *Basir alam, "International journal for civil and structural engineering", pp 302-312, vol. 3, no. 2, (2012).*
3. *Carsana. M, Cement and Concrete Research, pp 64-73, vol. 48, (2013).*
4. *Francesca Tittarelli, International Journal of Chemical, Environmental & Biology Sciences, pp 784-788, vol.1 (2013).*
5. *Iftekhar Alam, 2ndInternational Conference on Civil Engineering for sustainable development (2014).*
6. *IS 456-2000 "Code of practice for plan of Indian Standards", New Delhi.*
7. *James Sommerville, "No fines concrete in UK social housing stock": 50 years on, Structural Survey Journal (in press), pp 294-302 in 2010.*
8. *Moss. J. k No fine building gives energy conserving homes, International construction, UK (1979).*
9. *Abadjieva, T. and Sephiri, P., (2000), Investigations on some properties of no-fines concrete, University of Botswana, Botswana*
10. *Malhotra, V.M., (1976), No-fines concrete – Its properties and applications. ACI Journal, 73(11), pp 628-644.*