IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"COMPARATIVE STUDY ON POROUS CONCRETE WITH CONVENTIONAL CONCRETE"

1Kavati Gnaneshwari, 2Thonti Ravalika, 3Marishetti Saiteja, 4Gajula Vishnu teja, 5Prashanth pinnoji

1Student of B.E in Matrusri Engineering College , 2Student of B.E in Matrusri Engineering College , 3Student of B.E in Matrusri Engineering College , 4Student of B.E in Matrusri Engineering College , 5Assistant professor in civil engineering

1Osmania university,

2Osmania university,

3Osmania university,

4Osmania university,

5Osmania university

ABSTRACT

The main objective of our project is to conduct the comparative study on mechanical properties of porous concrete with conventional concrete. We used M30 grade design for our project. We used coarse aggregate, cement, fine aggregate and water of mix design proportions and made 9 cubes of 100*100*100mm,9 beams of size 100*100*500mm and 9 cylinders of size 150 diameter and 300mm height for both porous and conventional concrete. We test the cubes for compression strength test, beam for flexural strength test and cylinder for split tensile test for 7,14,28 days. Pervious concrete is a special type of concrete with high porosity but it has less strength compared to conventional concrete. So it is not used for heavy load structures, but it can be used for low loaded flatworks applications that allow the water to pass through it.

1. INTRODUCTION

Porous concrete is generally defined as the concrete that allows water to flow through it. It is also called as pervious concrete or permeable concrete. Porous concrete leaves void spaces throughout, allowing water to flow through it. It is a structural concrete with a large volume (15%-25%) of interconnected voids. Porous concrete, sometimes referred to as no fines, gap graded, permeable or enhanced porosity concrete, is an innovative approach to controlling, managing and treating storm water runoff. Pervious concrete is a light weight concrete material. It is made from a mixture of cement, coarse aggregates and water. However, it contains little or no sand. Permeable platform is beneficial to the environment because it can reduce storm water volume, treat the storm water quality and replenish the ground water supply and lower air temperatures on hot days.

2. USE OF POROUS CONCRETE

The use of pervious concrete has increased significantly in the last several years, perhaps largely because it is considered as environmentally friendly, sustainable product. The use of pervious concrete provides a number of benefits, most notably in the effective management of storm water runoff. Other significant benefits include reducing contaminants in waterways, recharging groundwater supplies, reducing heat island effects. The unique ability of porous concrete offers advantages to the environment, public agencies and building owners by controlling rain water on-site and addressing storm water runoff issues. This technology creates more efficient land use by eliminating the need for retention ponds and other storm water devices. It also has the ability to lower overall project costs on a first cost basis.

3. LITERATURE REVIEW

1. **Amartya Waghmare(2021)** et al concluded that the strength of the pervious concrete is low as compared to the normal/conventional concrete because of high porosity, but total cost can be substantially lower. But the pervious concrete serves most economical benefits like it reduce surface run off water and it recharge the ground water. It prevents the polluted water from entering the streams. They can be used in swimming pull decks, parking areas, sidewalks, pathway, in most of place we can use the pervious concrete.
2. **Harshith(2021)** et al concludes that Pervious concrete have less compressive quality contrasted with traditional cement. Permeability is high because of high void substance. The utilization of pervious cement ought to be constrained to zones not exposed to high volumes of traffic. His Suggestions are that pervious concrete be compelled to regions that are presented to little vehicle loads with intermittent use by greater vehicles.
3. **S W Megasari(2021)** et al concluded that the highest average compressive strength of porous concrete is obtained in the ratio of cement to aggregate variation of 1: 3. So that it can be used for the sidewalk. Obtained a trend to increase the compressive strength value of porous concrete will increase with the reduction in the amount of coarse aggregate. All of the compressive strength values of porous concrete with the addition of 0.7% additive are higher than without the addition of additives.

4. OBJECTIVES OF PROJECT

- To determine the compressive strength, flexural strength and split tensile strength of porous concrete.
- To check the water allowance through porous concrete.
- To analyse and compare the strength of porous concrete to conventional concrete.

5. MATERIAL SURVEY

Materials required for porous concrete:

- Ordinary Portland cement
- Coarse Aggregate
- Fine Aggregate
- Water

Mix design:

1.Grade designation M-30.

2. Type of cement and grade of cement – OPC 43 grade.

Material quantity calculation:

Volume of cube = 0.001x9 = 0.009m^3

Volume of beam = 0.005x9 = 0.045m^3

Volume of cylinder = 0.005x9 = 0.045m^3

As per Codal provisions (Is: 456-2000) &(Is:10262-2009) &(ACI522R-10) & (IS: 516-1959)

Mix ratio for conventional concrete:

1:2.01:2.72(cement: fine aggregate: coarse aggregate)

We have used 9 cubes, 9 cylinders,9 beams to find the mechanical properties of conventional concrete.

The quantities used for conventional mix

1.Cement=47.752kg

2.Fine aggregate =96.354kg

3.Coarse aggregate=130.16kg

4.water=23 litres

Mix ratio for porous concrete:

1:1.8:4.46 (cement: fine aggregate: coarse aggregate)

We have used 9 cubes, 9 cylinders,9 beams to find the mechanical properties of porous concrete.

The quantities used for porous mix

1. Cement =38.79kg
2. Fine aggregate =69.82kg
3. Coarse aggregate=173.32kg

4.water=13.57litres

6. TESTS:

1.Water Allowance test :

Fig.1 Water passing through porous cube

Fig.2 Water passing through porous beam

2.Compression test:

Fig.3 Porous cube under compression

Fig.4 Conventional cube under compression

3.Flexural strength test:

Fig.5 Beam under flexural strength test

Fig.6 Failure of beams

4.**Split Tensile Test:**

Fig.7 Porous cylinder

Fig.8 Conventional cylinder

7. RESULTS :

Table 1: Compression strength values for 7 days:

Type	Specimen	Load (KN)	Strength (N/mm^2)	Average strength (N/mm^2)
Porous concrete	1	71.6	7.1	7.13
	2	78.4	7.8	
	3	65.6	6.5	
Conventional concrete	1	293.4	29.3	29.9
	2	325.3	32.5	
	3	280.6	28.0	

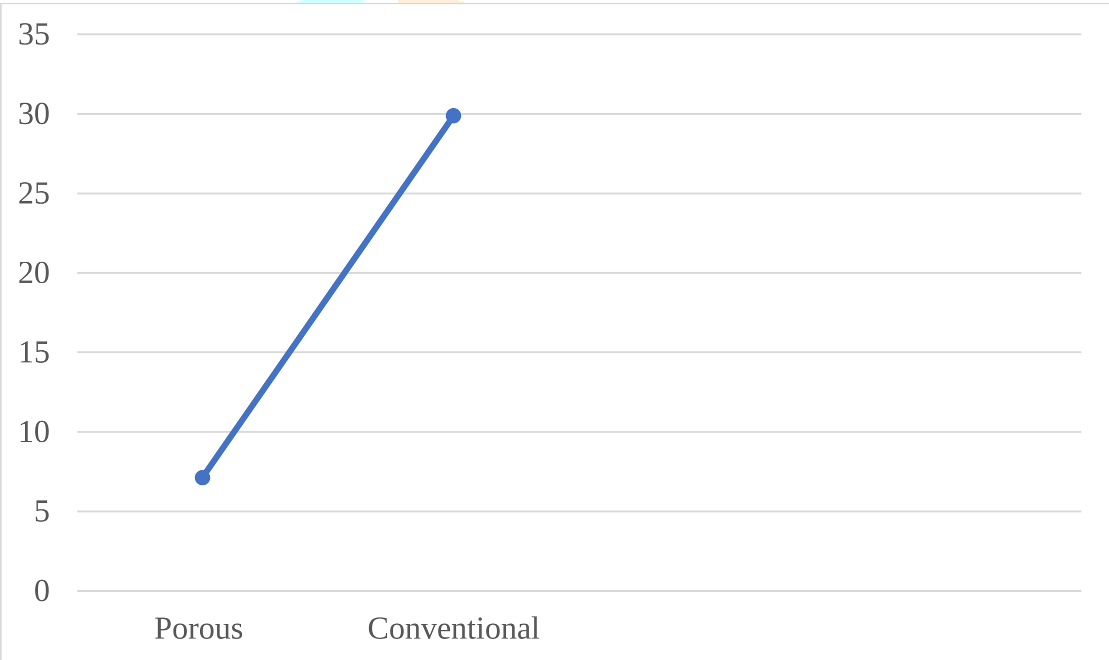

Fig.9 Compression strength for 7 days

Table 2: Compression strength for 14 days:

Type	specimen	Load (KN)	Strength (N/mm^2)	Average Strength (N/mm^2)
Porous concrete	1 2 3	44.4 42.8 40.3	4.4 4.2 4.0	4.2
Conventional concrete	1 2 3	284 201.7 250	28.4 20.1 25.0	24.5

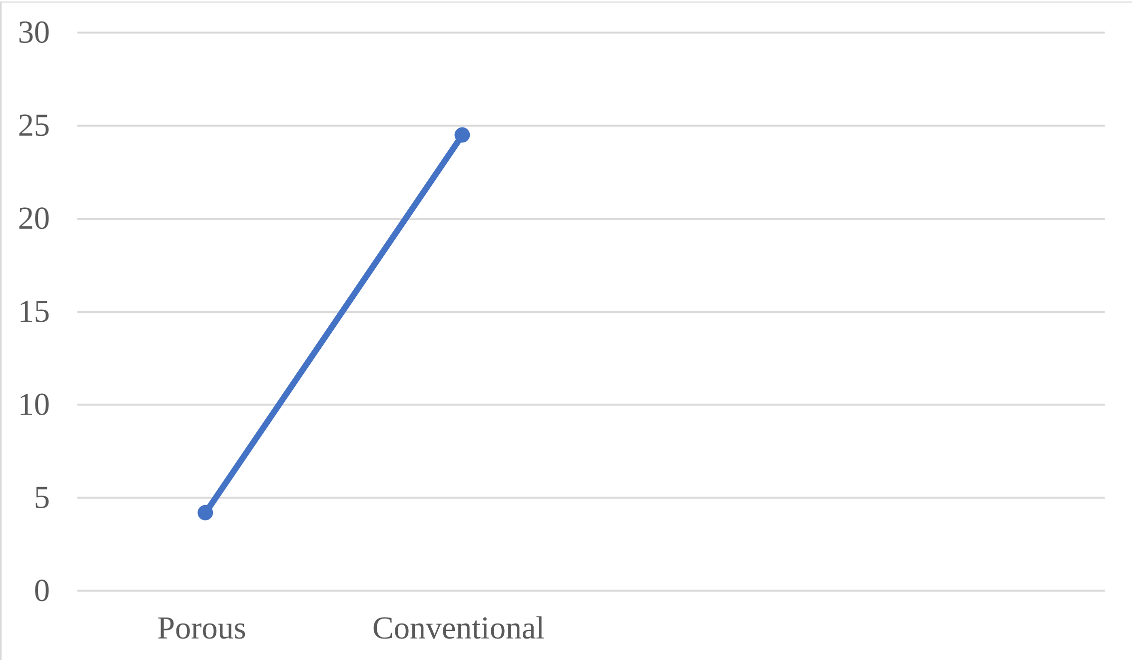

Fig.10 Compressive strength for 14 days

Table 3: Compression strength after 28 days:

Type	Specimen	Load (KN)	Strength (N/mm^2)	Average strength (N/mm^2)
Porous concrete	1 2 3	53.1 60.8 57.3	5.3 6.0 5.7	5.7
Conventional concrete	1 2 3	325.4 380.1 384.5	32.5 38.0 38.4	36.3

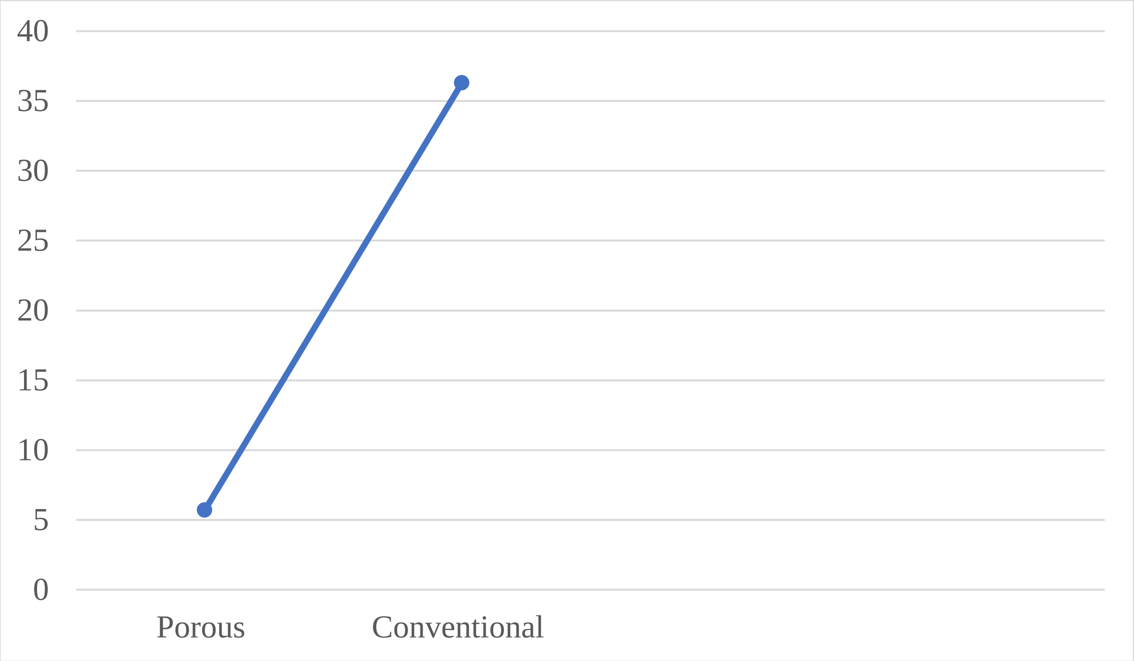

Fig.11 Compressive strength for 28 days

Table 4: Comparison of 7,14,28 days compressive strength :

Type	7 days	14 days	28 days
Porous concrete	7.13	4.2	5.7
Conventional concrete	29.9	24.5	36.3

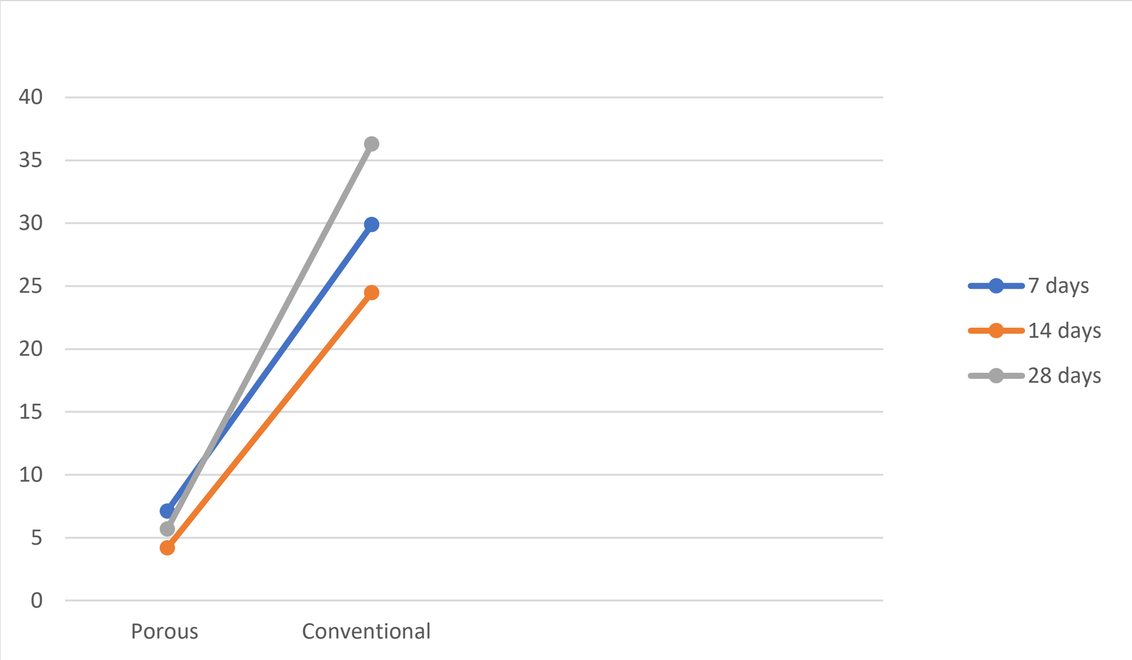

Fig.12 Compressive strength for 7,14,28 days

Table 5 : Flexural Strength for 7 days:

Type	Specimen	Load (KN)	a (mm)	Strength (N/mm^2)	Average strength (N/mm^2)
Porous concrete	1	8	230	4	4.37
	2	9.5	232	4.75	
	3	8.75	243	4.37	
Conventional concrete	1	16	230	8	8.12
	2	16.5	240	8.25	
	3	16.25	235	8.125	

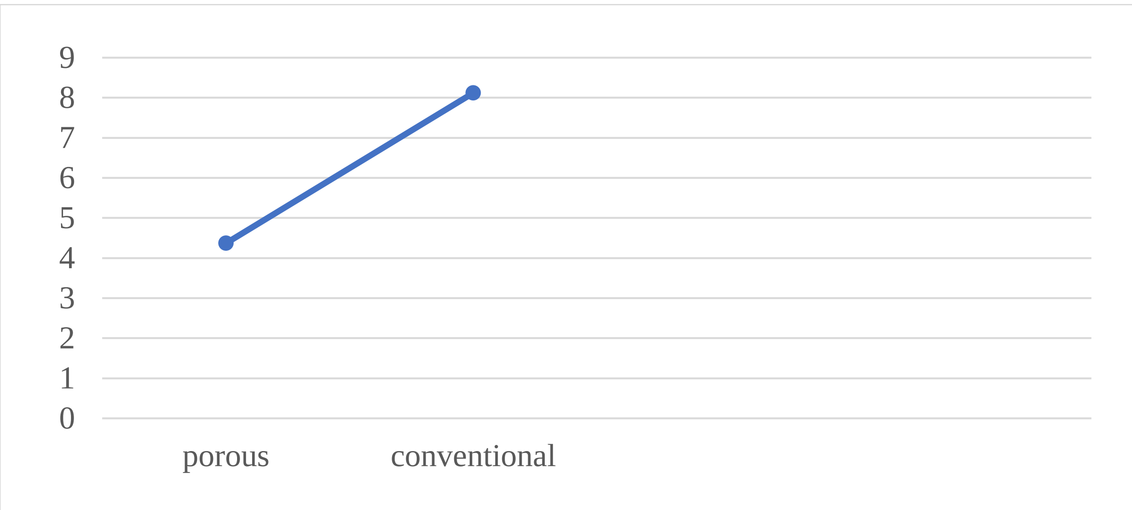

Fig.13 Flexural strength for 7 days

Table 6: Flexural strength for 14 days:

Type	Specimen	Load (KN)	a (mm)	Strength (N/mm^2)	Average strength (N/mm^2)
Porous concrete	1	8	200	4.8	4.98
	2	8.25	180	4.6	
	3	9.5	195	5.56	
Conventional concrete	1	16.5	190	9.40	9.05
	2	18	210	9	
	3	17.5	235	8.75	

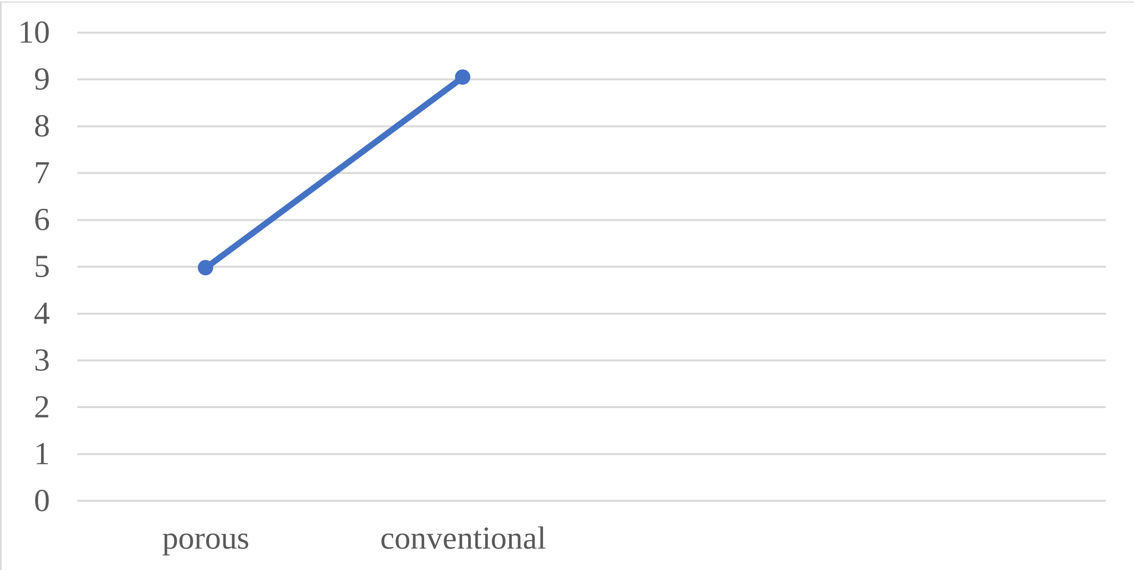

Fig.14 Flexural strength for 14 days

Table 7: Flexural strength for 28 days:

Type	Specimen	Load (KN)	a (mm)	Strength (N/mm^2)	Average strength (N/mm^2)
Porous concrete	1	9.6	230	4.8	4.92
	2	9	175	4.72	
	3	10	162	5.25	
Conventional concrete	1	21.5	200	12.9	15.2
	2	19	160	9.12	
	3	18	156	8.42	

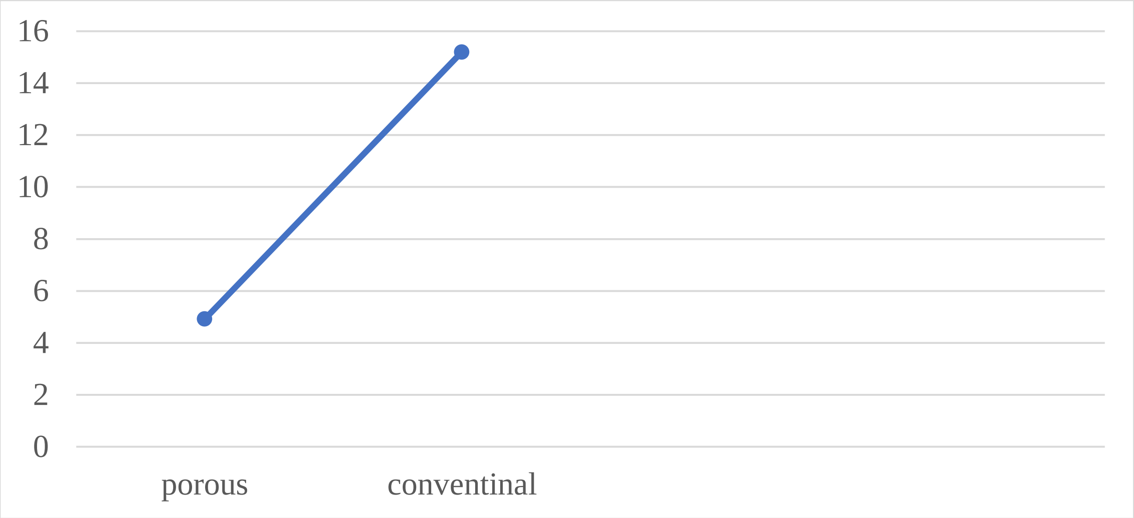

Fig.15 Flexural strength for 28 days

Table 8: Comparison of flexural strength for 7,14,28 days :

Type	7 days	14 days	28 days
Porous concrete	4.3	4.98	4.92
Conventional concrete	8.12	9.05	15.2

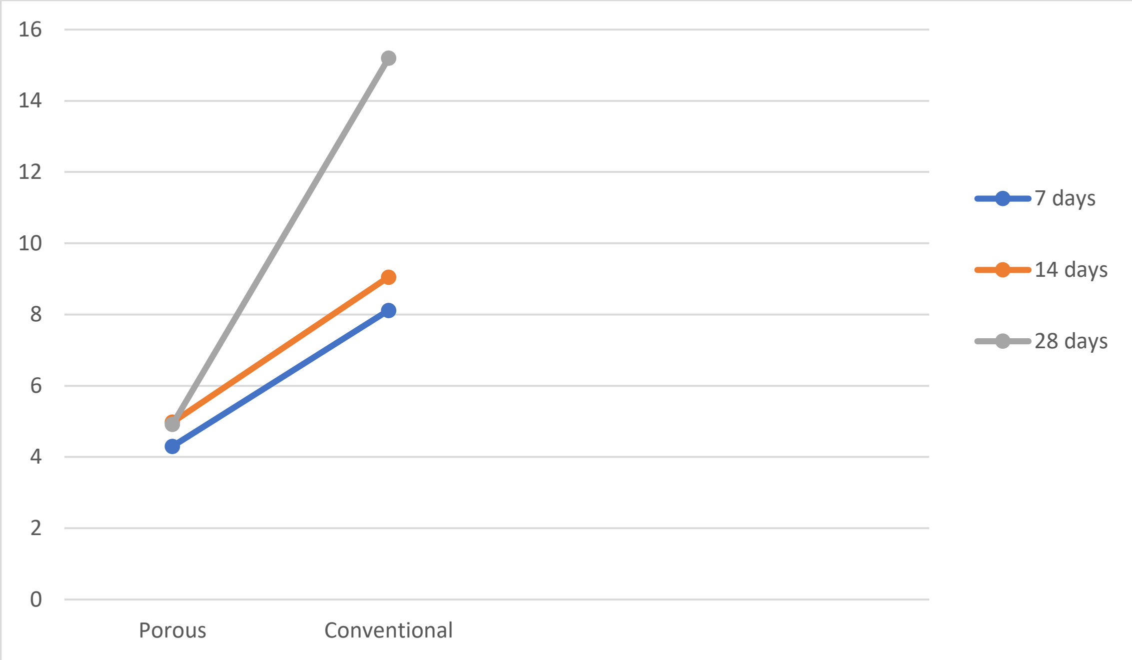

Fig.16 Flexural strength 7,14,28 days

Table 9: Split tensile strength for 7 days:

Type	Specimen	Load (KN)	Strength (N/mm^2)	Average strength (N/mm^2)
Porous concrete	1	45.9	2.59	2.22
	2	38.6	2.18	
	3	33.4	1.89	
Conventional concrete	1	160.3	9.07	9.06
	2	158.2	8.92	
	3	162.8	9.21	

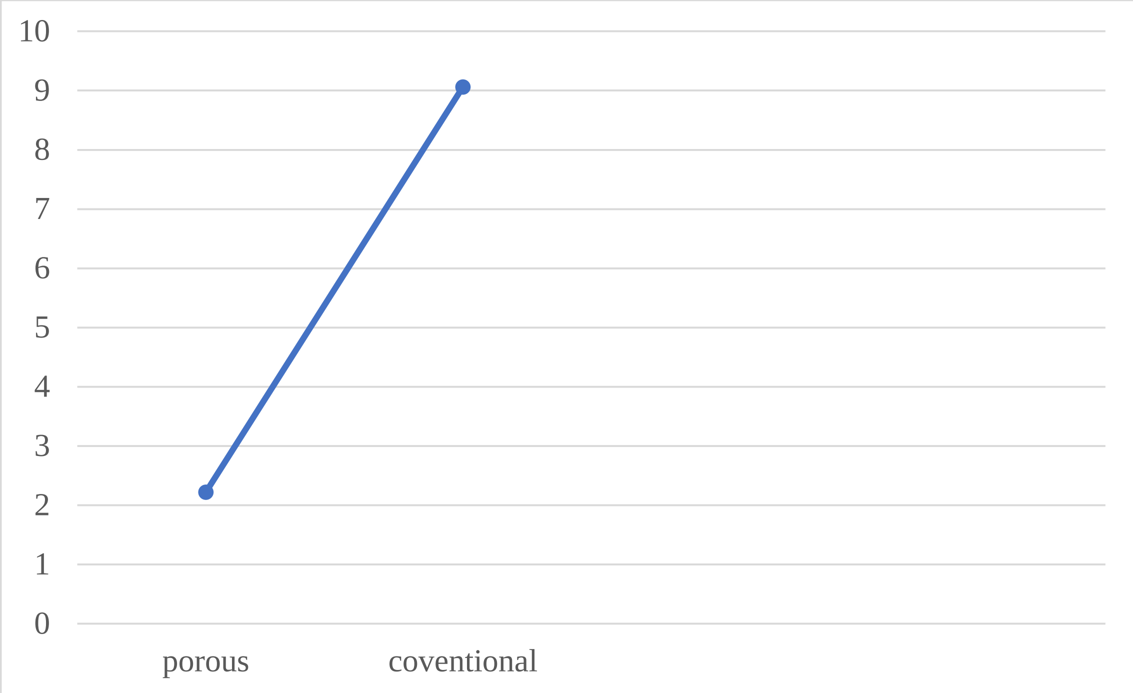

Fig.17 Split tensile strength for 7 days

Table 10: Split tensile strength for 14 days:

Type	Specimen	Load (KN)	Strength (N/mm^2)	Average strength (N/mm^2)
Porous concrete	1	39.3	2.22	
	2	42.8	2.42	2.21
	3	35.6	2.01	
Conventional concrete	1	153.4	8.68	
	2	170.3	9.63	9.27
	3	168.3	9.52	

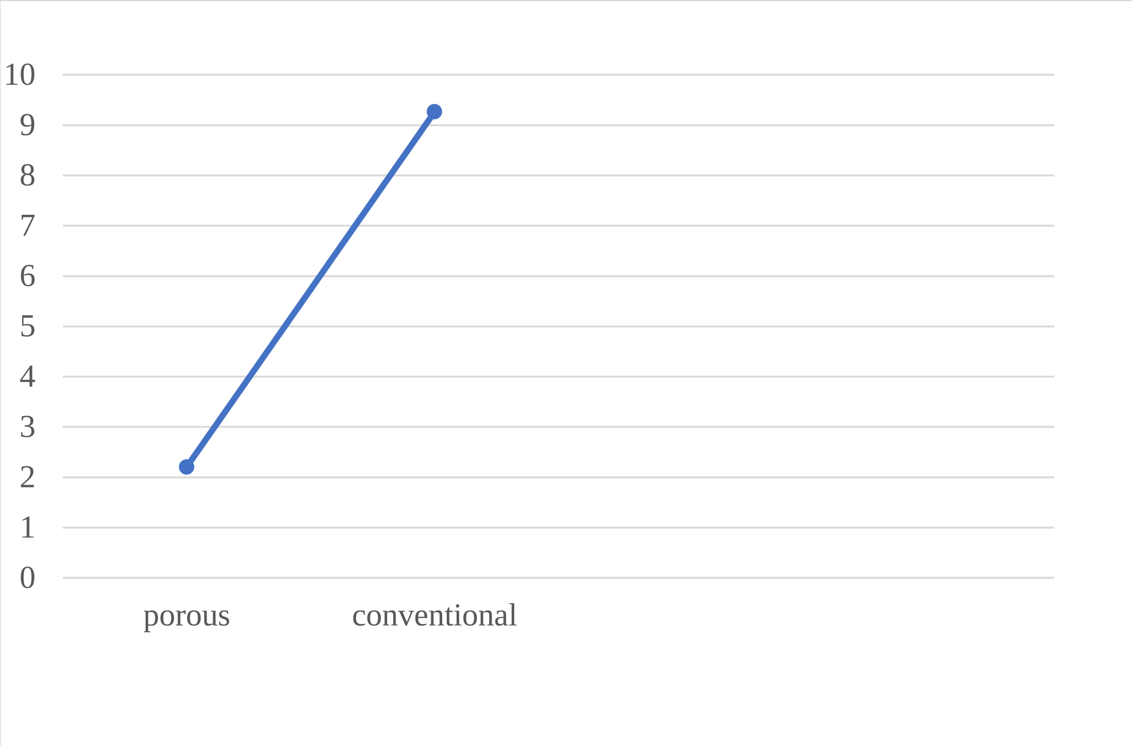

Fig.18 Split tensile strength for 14 days

Table 11 : Split tensile strength for 28 days:

Type	Specimen	Load (KN)	Strength (N/mm^2)	Average strength (N/mm^2)
Porous concrete	1	39.5	2.23	2.43
	2	46.8	2.64	
	3	43.2	2.44	
Conventional concrete	1	161.9	9.16	10.33
	2	179.9	10.18	
	3	206.4	11.67	

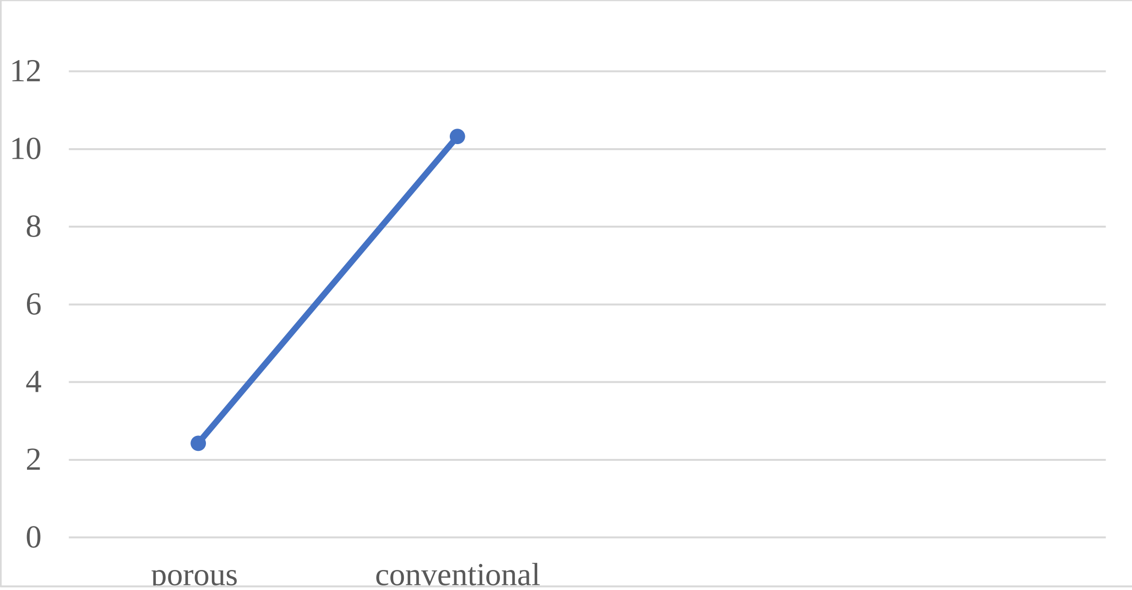

Fig.19 Split tensile strength for 28 days

CONCLUSION :

- The compressive strength of porous concrete to conventional concrete is 76% less for 7 days, 82% less for 14 days, 84% less for 28 days.
- The Flexural strength of porous concrete to conventional concrete is 46% less for 7 days, 44% less for 14 days, 67% less for 28 days.
- The Split tensile strength of porous concrete to conventional concrete is 75% less for 7 days, 76% less for 14 days, 76% less for 28 days.
- The porous concrete has less strength compared to the conventional concrete. So this concrete is suitable for concrete flat works where heavy loads do not exists.

REFERENCES :

1. IS 456-2000: Plain and reinforced concrete-code of practice
2. IS 10262-2009: Guidelines for concrete mix design proportioning
3. IS 516-1959: Methods of tests for strength of concrete
4. ACI522R-10: Report on pervious concrete
5. IS 5816-1999: Methods of test splitting tensile strength
6. IS 1199-1959 : Methods of sampling and analysis of concrete
7. Amartya Waghmare, Pratiksha Mahadik, Pravin Salunkhe, Abhishek Mohite, Prof.KhultejGurav2021, review on Study of pervious concrete on water absorbing road, international research of modernization in technology and science e-ISSN: 2582-5208, Volume:03/Issue:05/May-2021
8. Ashish Kumar Kanoujina, Hanumanth Sharan Singh 2020, review on A study on water absorbing road by pervious concrete, international journal of innovative science and research technology, volume5,issue4,ISSN No.2456-2165.
9. Shengnan Dai et al 2019 IOP Conference Series: Earth Environment Science. 233 032037 Experimental Study on Mechanical Properties of Permeable Concrete.