Pervious Concrete Pavement Using Low-Cost Material

Dr. D. Jyothi Swarup[1], S. Siva Rama Krishna[2]
[1]*Associate Professor, St. Ann's College of Engineering & Technology*
[2]*Assistant Professor, St. Ann's College of Engineering & Technology*

Abstract: **The pervious concrete system and its corresponding strength are as important as its permeability characteristics. The strength of the system not only relies on the compressive strength of the pervious concrete but also on the strength of the soil beneath it for support. Previous studies indicate that pervious concrete has lower compressive strength capabilities than conventional concrete and will only support light traffic loadings. There is lot of research work is going in the field of pervious concrete. The compressive strength of pervious concrete is less when compared to the conventional concrete due to its porosity and voids. Hence, the usage of pervious concrete is limited even though it has lot of advantages.**

I. INTRODUCTION

Pervious cement is a composite material comprising of coarse total, Portland concrete, and water. It is unique in relation to regular cement in that it contains no fines in the underlying blend, perceiving in any case, that fines are presented during the compaction procedure. The total ordinarily comprises of a solitary size and is fortified together at its places of contact by a glue framed by the bond and water. The outcome is a solid with a high level of interconnected voids that, when working effectively, license the fast permeation of water through the solid. In contrast to ordinary solid, which has a void proportion somewhere in the range of 3-5%, pervious cement can have void proportions from 15-40% relying upon its application. Pervious solid attributes contrast from ordinary cement in a few different ways. Contrasted with customary concrete, pervious cement has a lower compressive quality, higher penetrability, and a lower unit weight, roughly 70% of regular cement.

Fig.1 Pervious Concrete

2. LITERATURE REVIEW

V.M. Malhotra (1976) examined pervious concrete as it identifies with applications and properties. He gave subtleties on such properties as consistency, extents of materials, unit weight, compatibility, and relieving trying to expand porousness in the pervious cement. Malhotra additionally directed numerous trials on different test chambers trying to discover a relationship between compressive quality and any of the material's properties. He presumed that the compressive quality of pervious cement was reliant on the water concrete proportion and the total bond proportion.

Schaefer et al. 2006 gives a rundown of the accessible writing concerning the development materials, material properties, surface attributes, pervious asphalt plan, development, support, and ecological issues for PCPC. The essential objective of the examination led was to build up a pervious solid that would give solidify defrost opposition while keeping up sufficient quality and penetrability for asphalt applications.

3. DETAILS OF THE STUDY

The detailed laboratory investigations are carried out on all the ingredient materials like cement, fine aggregate and coarse aggregate in the laboratory in order to establish the basic parameters of ingredient materials such as specific gravity, finesses of cement, water absorption capacity etc. all the tests were conducted as per the IS code of Practice.

Table 1 Properties of Cement (OPC 53 Grade)

S.No	Property	Value
1	Specific gravity (G)	3.1
2	Bulk density (ρ)	1120 kg/m^3
3	Fineness	230 m^2/kg
4	setting time (Initial)	31 min
5	setting time (Final)	608 min
6	Consistency	28%

Table 2 Properties of Coarse Aggregates

S. No	Property	Value
1	Bulk density (ρ)	1583.34 kg/m^3
2	Impact strength	26.4%
3	Crushing strength	25.45%
4	Void content	37.16%
5	Specific gravity (G)	2.65

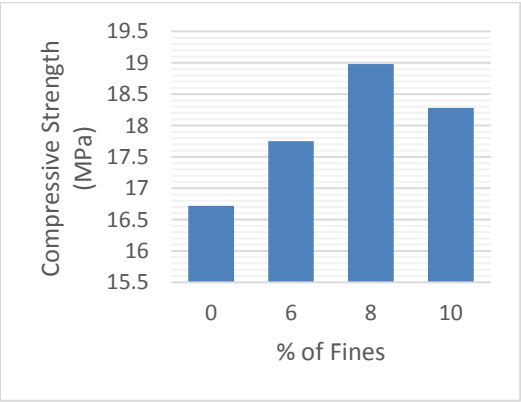
Table 3 Properties of Fine Aggregates

S.No	Property	Value
1	Specific gravity	2.62
2	Fineness modulus	2.5
3	Dry rodded unit weight	1720 kg/m^3
4	Water absorption	0.6%

The compressive strength of pervious concrete with 0, 6,8, and 10% of fines was evaluated for 7,14 and 28 days of curing period.

Table 4 Compressive Strength of Concrete 7 days curing

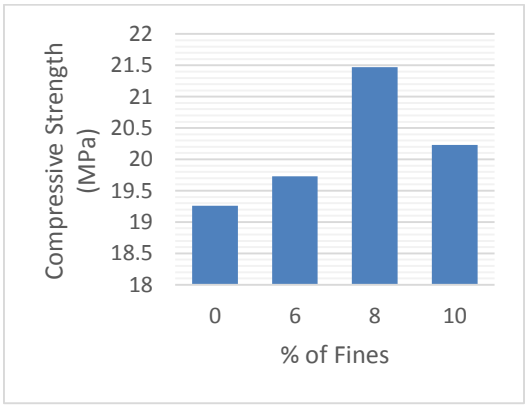
S.No	% of Fines	Compressive Strength (MPa)
1	0	16.72
2	6	17.75
3	8	18.98
4	10	18.28



Graph 1. Variation of Compressive strength with % of fines for 7 days Curing

Table 5 Compressive Strength of Concrete for 14days curing

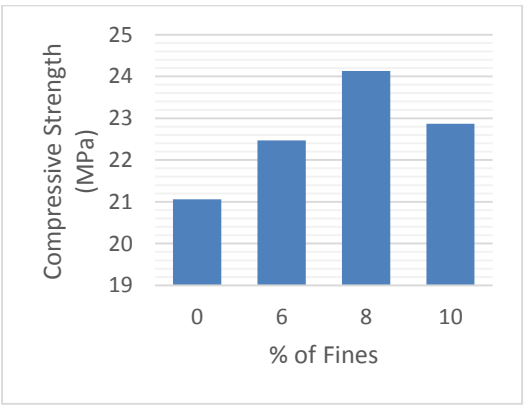
S.No	Curing Period (Days)	Compressive Strength (MPa)
1	0	19.26
2	6	19.73
3	8	21.47
4	10	20.23



Graph 2. Variation of Compressive strength with % of fines for 14 days Curing

Table 5 Compressive Strength of Concrete for 28 days curing

S.No	Curing Period (Days)	Compressive Strength (MPa)
1	0	21.06
2	6	22.47
3	8	24.13
4	10	22.87



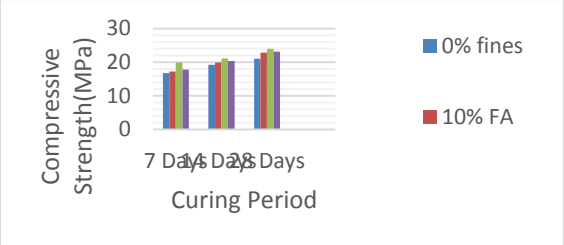
Graph 3. Variation of Compressive strength with % of fines for 28 days Curing

The Compressive strength of previous concrete was examined by replacing the cement with fly ash(FA) and rice hush ash(RHA) at different percentages.

Table 5 Compressive Strength of Concrete by replacement of cement by different % of FA & RHA

Curing Period	0% fines	10% FA (MPa)	10%RHA (MPa)	10% FA and

	(MPa)			RHA (MPa)
7	16.72	17.26	19.92	17.79
14	19.26	19.92	21.13	20.33
28	21.06	22.87	23.93	23.12



Graph 4. Variation of Compressive strength

4. CONCLUSIONS

By Conducting extensive laboratory investigations on pervious concrete by replacing cement with FA and RHA with different percentages the following conclusions were drawn.

1. The compressive strength of pervious concrete is obtained as a maximum of 18.98 MPa when 8% fines were added to standard pervious concrete for 7 days of curing
2. The compressive strength of pervious concrete is obtained as a maximum of 21.47 MPa when 8% fines were added to standard pervious concrete for 14 days of curing
3. The compressive strength of pervious concrete is obtained as a maximum of 24.13 MPa when 8% fines were added to standard pervious concrete for 728days of curing
4. The compressive strength of pervious concrete is more (23.12MPa) for a combination of 10% FA & RHA over 0% fines previous concrete(21.06MPa).

5. REFERENCES

[1] Ajamu S.O., Jimoh A. "Evaluation of structural Performance of Previous Concrete in Construction", International Journal of Engineering and Technology Volume 2 No. 5, May, 2012

[2] Darsha S. Shah, Prof. J. R. Pitroda, "Assessment for use of Gravel in Pervious Concrete", International Journal of Engineering Trends and Technology (IJETT) ISSN No. 2231-5381, Volume: 4, Issue: 10, October 2013, Page: 4306 –4310

[3] Ghafoori, N., and Dutta, S., "Building and Non pavement Applications of No-Fines Concrete," Journal of Materials in Civil Engineering, Volume 7, Number 4, November1995.

[4] J.T. Kerven, V.R. Schaefer, Mixture proportioning considerations for improved freeze- thaw durability of pervious concrete, J Mater Civil Eng (2013)25:886–892.

[5] Leming, M.L., Rooney, M.H., and Tennis, P.D., "Hydrologic Design of Pervious Concrete," PCAR&D.