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Improving compressive strength of pervious concrete using polymer fiber-a review

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ABSTRACT

Pervious concrete as a paving substance is the most increasingly used concrete worldwide to minimize the amount of runoff water in the surface of the pavement on the road and also to upgrade the water qualities near road pavement and parking lots. Owing to this remarkably lower strength due to high porosity, pervious concrete for the currently mix design can't be used for the highway pavement bearing high load in case of highways. This paper will spread the awareness for making use of pervious pavements for water conservation and ground water recharge with pervious concrete through rural roads and pavement. There is still lot of scope to work on comparison of durability, workability, the tests to check the relation between the durability with the usage of fine aggregate and the permeability with usage of fly-ash.

Key words: *Pervious, permeability, pavement, strength, fiber etc.*

Introduction

The pervious concrete is a new kind of pavement materialwhich consists of coarse aggregate, binding materials, some admixtureswith water. Also there is less or no fine aggregate in the mixture (Singh, *et al* 2016). Suitable quantity of water and Cementitious materials is used to make a paste which forms a tinny coat surrounded aggregate particles but on the other hand it gives voidsin-between making the concrete of suitable permeability which allows water to pass through the subgrade, unlike the normal concrete it has a void ratio approximately3%-5%, on the other side the pervious concrete can have a void ration of 15% - 35%. We can say that the pervious concrete is an instrumental recharging ground water and minimizing stormwater runoff. (Huang, *et al* 2010). The application of pervious concrete was started in 1852 but the last 3 decades it became of the highest interest for use and application in many countries, especially in Japan and United States of America. There are various places where pervious concrete is used like low traffic volumes and roads, construction of residential streets, drive ways, tennis courts

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S.no	Mix	3 days	7 days	28 days
1	MIX-1	0.39	0.40	0.41
2	MIX-2	0.37	0.37	0.38
3	MIX-3	0.33	0.32	0.33
4	MIX-4	0.30	0.29	0.29
5	MIX-5	0.26	0.24	0.24
6	MIX-6	0.24	0.20	0.20

and parking lots along with beach structures, sea walls, bridge embankment (Guntakal & Selvan, 2017)

Literature review and Discussions

Putman & Neptune, 2011compared the mechanical strength of the conventional and the pervious concrete after 28 days as shown in (Table 1).

Table 1. Comparison of Compressive Strength between CC and PC

S.no	No. of days	Compressive Strength of CC(MPa)	Compressive Strength of PC(MPa)
1	3 days	28.22	7
2	7 days	39.9	15
3	28 days	46.5	22

Results show that the conventional concrete is having much compressive strength for 50% or more when we compare the pervious concrete. Various researchers alsostudied comparisons for flexural strength, tensile strength and so on. On the other handthere is some important sides unattendedlike comparisonof durability workability etc. where there is much scope for study.

Murthy & Rajeswari, 2018used cement OPC 53, coarse aggregate with maximum size of 20mm, water cement ratio 0.35, casted the blocks, cured and checked the compressive strength of the concrete only for 3, 7 and 28 days (Table 2).

Table 2. Compressive Strength Result (N/Mm^2)

S.no	Mix	3 days	7 days	28 days
1	MIX-1	5.82	7.30	10.52
2	MIX-2	7.5	12.5	18.23
3	MIX-3	8.11	13.52	19.54
4	MIX-4	8.72	13.7	20.44
5	MIX-5	9.18	14.72	21.77
6	MIX-6	9.69	15.41	22.42

On the same time, they looked for the result of permeability also (Table 3).

Table 3. The Result of Permeability (Mm/sec)

The results show that fine aggregate or sand improve the strength but on the other side of the coin the permeability of the concrete isreduced, when the percentage of the fine aggregate increases the strength will increase and permeability will decrease.This research also lack the test of the durability on the concrete to check the relation between the durability and the usage of fine aggregate.

Dey, 2017improved the compressive strength of this type pervious concrete replacingcement by fly-ashfor M-25 mix grade with three different proportion of fly-ash with cement to analyze the difference and how this different amounts of fly-ash can affect the compressive strength of the concrete.In the first experiment he used 30%, the second 50% and the last 70% of fly-ash with cement. The results of every experiment (Table 4, 5, 6).

Table 4. Compressive Strength for 30% replacement of fly-Ash with cement

S.No	No.days	Compressive Strength(N/Mm^2)
1	7	5.23
2	14	9.13
3	28	14.24

Table5. Compressive Strength for 50% replacement of fly-ash with cement

S.No	No.days	Compressive strength(N/Mm^2)
1	7	5.01
2	14	8.47
3	28	14.24

Table6. Compressive Strength for 70% replacement of fly-ash with cement

S.No	No. of days	Compressive strength(N/Mm^2)
1	7	3.9
2	14	6.41
3	28	11.9

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Sharma and Agrawal, 2018 reviewed for the green concrete which could also be prepared for the permeability characteristics. There was still scope to work on the pervious concrete.

When we look collectively all these tree experiment show that there is a less effect in the compressive strength, also we see that as the percentage of fly-ash increases the strength decreases. The scope of this research is that the researcher didn'tattend the relation between the permeability and the usage of fly-ash as well as the durability and workability properties of the concrete.

Singh et al., 2016worked on the improvement of main properties of the pervious concrete by considering a different proportion of water-cement ratio and admixtures and observed that Admixtures enhance the workability without increasing or decreasing the quantity of water-cement ratio, prevent the shrinkage of the concrete and sometimescreate little bit of expansion, Reduce of the segregation and reduce the rate of bleeding (Table 6).

Table 6. Admixtures and W/C Ratios

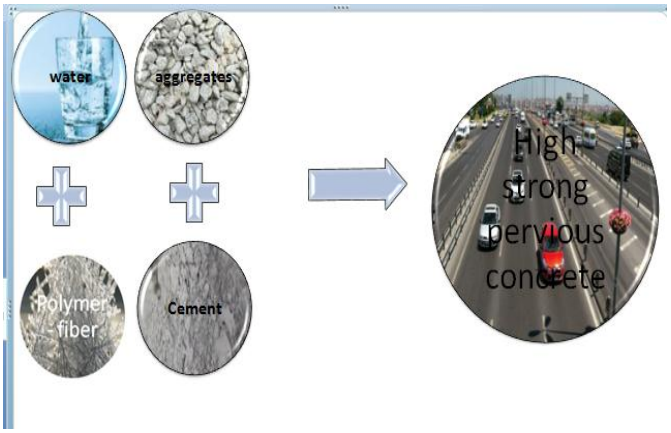
S.no	Quantity of admixtures in the mix(ml/kg of cement)	w/c ration
1	5	0.38
2	10	0.36
3	15	0.34

Admixtures and W/C ratios are inversely proportional to each other, whenever the admixtures increase the W/C decreases. In this research the researcher found that 9% to 15% use of super plasticizers is needed for the improvement of the compressive strength of the pervious concrete

The researchers examined and evaluated the effect of different types of materials which areusedto modify the permeability properties and mechanical strength of the pervious concrete such as fly-ash, slug, fine aggregate or sand. In the study theymade the efforts to optimize the strength and permeabilityof the pervious concrete, so as to obtain the desired results having enough permeability properties as well as strong enough to take the traffic loadproperly without any failure (Alaica *et al* 2010).

Conclusion

From the existing researches on pervious concrete we can conclude that various properties in the previous concrete such as mechanical strength, permeability (hydrological) porosity, water-cement ratio, waste replacement to cement and aggregates, admixtures characteristics and effects and etc. have already been studied. The scope of the existing research will undoubtedly help for making decisions and policiesfor overall implementation and modification of standards for permeable pavements. It is observed that strength decreases with increase in permeability. The use of fly-ash and silica-fume did not provepotential for ehancement of the pervious concrete (Bonicelli, *et al* 2016).



The main objective behind this review research paper was to find a research gap to work and to spread the awareness for making use of pervious pavements for water conservation and recharge along withthe advantages for rural roads and pavement.As a research gap there is still a lot of scope to work on comparison of durability

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workability, the testson durability on the pervious concrete to check the relation between the durability with the usage of fine aggregate and the permeability with the usage of fly-ash and the workability properties of the concrete having pervious characteristics etc.

References

Alaica, A. L., Dolatabadi, M. H., Sucic, A., & Shehata, M. 2010. Optimizing the strength and permeability of pervious concrete. *TAC/ATC 2010 - 2010 Annual Conference and Exhibition of the Transportation Association of Canada: Adjusting to New Realities*.

Bonicelli, A., Arguelles, G. M., & Pumarejo, L. G. F. 2016. Improving Pervious Concrete Pavements for Achieving More Sustainable Urban Roads. *Procedia Engineering*, *161*, 1568–1573. https://doi.org/10.1016/j.proeng.2016.08.628

Dey, D. 2017. Study on Compressive Strength of Pervious Concrete for Utilisation As Pavenent, 809–817.

Guntakal, S. N., & Selvan, S. 2017. Application of pervious concrete for pavements: A review. *Rasayan Journal of Chemistry*, *10*(1), 32–36. https://doi.org/10.7324/RJC.2017.1011533

Hirendra Pratap Singh, Kapil Sharma, Rakesh Sakale, & Satish Kumar Kushwah. 2016. Enhancement the Strength of Pervious Concrete with Different Water Cement Ratio and Admixture. *International Journal of Engineering Research And*, *V5*(01), 582–588. https://doi.org/10.17577/ijertv5is010465

Huang, B., Wu, H., Shu, X., &Burdette, E. G. 2010. Laboratory evaluation of permeability and strength of polymer-modified pervious concrete. *Construction and Building Materials*, *24*(5), 818–823. https://doi.org/10.1016/j.conbuildmat.2009.10.025

Murthy, B. V. R., & Rajeswari, G. 2018. Study on Strength Improvement of Pervious Concrete. *International Journal of Engineering Science Invention*, *7*(3), 29–31. Retrieved from http://www.ijesi.org/papers/Vol(7)i3/Version-4/F0703042931.pdf

Putman, B. J. & Neptune, A. I. 2011. Comparison of test specimen preparation techniques for pervious concrete pavements. *Construction and Building Materials*, *25*(8), 3480–3485. https://doi.org/10.1016/j.conbuildmat.2011.03.039

Sharma, P.K. and Agrawal, P. (2018) "Green Concrete: A Sustainable Solution." *International Journal of Computational Engineering Research (IJCER*), ISSN (e) 2250-3005, vol. 08, no. 01, January-2018, pp. 40–43.