JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

POROUS PAVEMENTS BLOCK FOR RAIN WATER HARVESTING

Prof. Pallavi Kharat[1], Prashant Nagawade[2], Omkar Jadhav[3], Sumit ubale[4], Vaibhav Chavan[5]

[2345]*Student U.G Civil Department, Dr.D.Y.Patil School Of Enginnering And Technology, Pune, India.*

[1]Professor Civil Department , *Dr.D.Y.Patil School Of Enginnering And Technology* Pune, India.

Abstract.

Porous concrete paving block (PCPB) is a block with continuous voids which are intentionally incorporated into concrete. The permeability and strength of PCPB with different sizes of coarse aggregate was presented in this study. Three different sizes of coarse aggregate were used namely passing 10 mm retained 5 mm (as control), passing 8 mm retained 5 mm (CA 5 – 8) and passing 10 mm retained 8 mm (CA 8 – 10). Furthermore, a series of test were conducted in this study such as compressive strength, porosity and permeability. It was found that the size of coarse aggregate affects the strength and porosity of the specimens. The result also shown that PCPB with CA 8 – 10 caused in low strength, but high in porosity and permeability compared to the other blocks. Beside that PCPB using CA 8 – 10 is able to remove surface runoff efficiently.

Introduction

Rapid economic growth in the last two decades has turned many sub-urban areas into busy cities, which created unpredictable urbanization effects. Coupled with the global climate change and also the large ratio of road compares paved to water-permeable (porous) surface road, these in turn lead to increased volume of surface runoff and flash flood. High volume of surface runoff, low skid resistance, minimum appearances, glace and splash water is the factors contributing to the increased number of accidents during rainy weather.

Recently, road pavements with a water-permeable (porous) surface have been increasingly used. Porous surface for pavements are adopted for various reasons, such as to increase the driving safety during rainy weather, to reduce the traffic noise, to recharge ground-water and to alleviate the heat island phenomena in urban city centres. It is designed to reduce surface runoff by allowing infiltration [1]. Unlike traditional installation of concrete, porous concrete usually contains a void content 15 % to 25 %, which allows water to infiltrate directly through the pavement surface to the sub surface**.** It was very difficult to imagine few decades before that you will require to buy drinking. The use value of water was never undermined, but it's about time that even its exchange value is given due importance.

Fresh water today is a scarce resource, and it is being felts the world over. More than 2000 million people would live under conditions of high water stress by the year 2050according to the UNEP (United Nations Environment Programme), which warns water could prove to be limiting factor for development in a number of regions in the world to date, much attention has been given to the first option and only limited attention has been given to optimising water management systems Among the various alternative technologies to augment freshwater resources, rainwater harvesting and utilisation is a decentralised, environmentally sound solution, which can avoid many environmental problems often caused in conventional large-scale

Project using centralised approaches cope of project work. Porous block for Concrete Blocks Pavement nowadays enthused by many developed countries. It is known as porous concrete paving blocks, permeable or pervious interlocking concrete paving blocks.

Report that permeable concrete block pavement is suitable for trafficking and also acts as the drainage system Other than that, porous surface in parking lots are believed to help infiltration and the cleansing of storm water

OBJECTIVES

1.Rain water harvesting under pervious concrete.

2.Drain of water to avoid water logging and optimization of rain water.

3.To reduce problem with traditional surface water drainage system.

4.To minimize risk of surface water flooding.

5.Use of stored water for various purposes.

Materials and methods

Selection of standard quality material.

1. **Cement**

As in traditional concreting, Portland cements (ASTM C 150, C 1157) and blended cements (ASTM C 595, C 1157) may be used in pervious concrete. In addition, supplementary cementations materials (SCMs) such as fly ash, pozzolans (ASTM C 618), and ground-granulated blast furnace slag (ASTM C 989) may be used. Testing materials beforehand through trial batching is strongly recommended so that properties that can be important to performance (setting time, rate of strength development, porosity, and permeability, among others) can be determined.

2. **Coarse aggregate**

Single-sized aggregate 28mm without any binder, e.g. loose gravel, stone-chippings, is another alternative. Although it can only be safely used in very low-speed, low-traffic settings, e.g. car-parks and drives, its potential cumulative area is great.

3.

4. **Potable water**

Water-to-cement ratios between 0.27 and 0.36 are used routinely with proper inclusion of chemical admixtures, and those as high as 0.40 have been used successfully. The relation between strength and water-to-cement ratio is not clear for pervious concrete, because unlike conventional concrete, the total paste content is less than the voids content between the aggregates. Therefore, making the paste stronger may not always lead to increased overall strength. Water content should be tightly controlled. The correct water content has been described as giving the mixture sheen, without flowing off of the aggregate. A handful of pervious concrete formed into a ball will not crumble or lose its void structure as the paste flows into the spaces between the aggregates (see Figure 5). Water quality is discussed in ACI 301. As a general rule, water that is drinkable is suitable for use in concrete. Recycled water from concrete production operations may be used as well, if it meets provisions of ASTM C 94 or AASHTO M 157. If there is a question as to the suitability of a water source,

trial batching with job materials is recommended.

3 Fly ash

Fly ash is the waste byproduct of burning coal in electrical power plants; it used to be land filled, but now a significant amount is used in cement. This material can be used to replace 5-65% of the Portland cement

4 Admixtures

Chemical admixtures are used in pervious concrete to obtain special properties, as in conventional concrete. Because of the rapid setting time associated with pervious concrete, retarders or hydration-stabilizing admixtures are commonly used. Use of chemical admixtures should closely follow manufacturer's recommendations. Air-entraining admixtures can reduce freeze-thaw damage in pervious concrete, and are used where freeze-thaw is a concern. ASTM C 494 governs chemical admixtures, and ASTM C 260 governs air-entraining admixtures. Proprietary admixture products that facilitate placement and protection of pervious pavements are also used.

RESULT

compressive strength report

Age after a 7days

Sr. No	grade	Date of testing	Weight(kg)	Area (mm2)	Load(kg)	Correction factor	Compressive strength	Avg compressive strength
1	M 30	18/3/2022	5.780	40,000	845	1.18	24.92	
2	M 30	18/3/2022	5.780	40,000	865	1.18	25.51	25.16
3	M 30	18/3/2022	5.780	40,000	860	1.18	25.07	

Age after a 14days

Sr. No	grade	Date of testing	Weight(kg)	Area (mm2)	Load(kg)	Correction factor	Compressive strength	Avg compressive strength
1	M 30	25/3/2022	5.765	40,000	1095	1.18	32.30	
2	M 30	25/3/2022	5.730	40,000	1120	1.18	33.04	33.28
3	M 30	25/3/2022	5.740	40,000	1170	1.18	34.51	

Age after a 28days

Sr. No	grade	Date of testing	Weight(kg)	Area (mm2)	Load(kg)	Correction factor	Compressive strength	Avg compressive strength
1	M 30	7/4/2022	5.790	40,000	1240	1.18	36.58	
2	M 30	7/4/2022	5.795	40,000	1280	1.18	37.76	37.51
3	M 30	7/4/2022	5.800	40,000	1295	1.18	38.20	

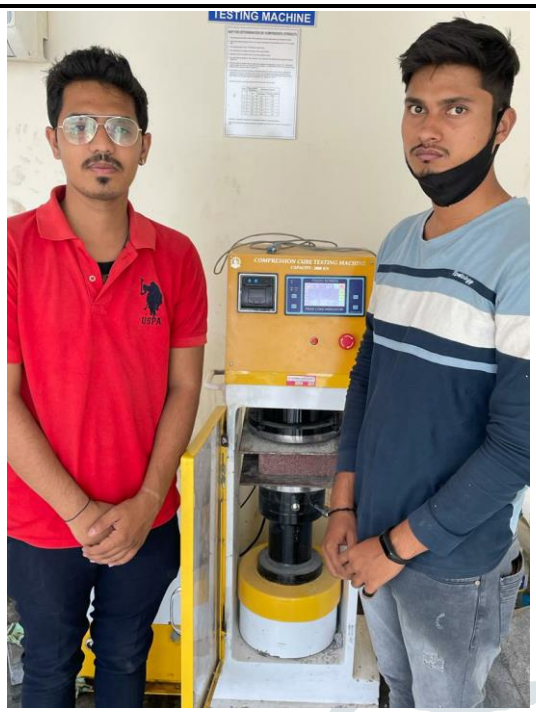

Fig 1. Test for compressive strength

From the above test and research the porous pavement block found to be having compressive strength of

after a 7 days=25.16 N/mm2

after a 14 days = 33.28 N/mm2

after a 28 days = 37.51 N/mm2

Permeability test

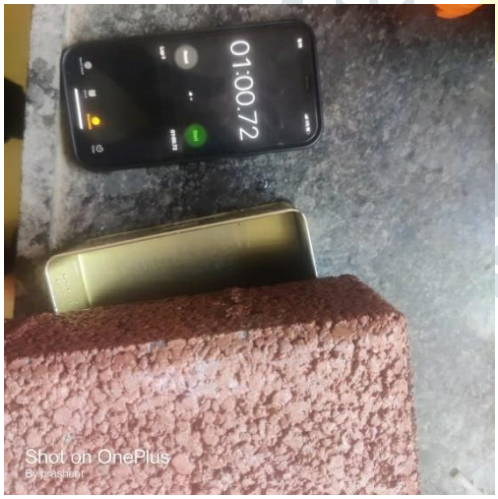

Fig 2. Permeability test

From the above test and research the porous pavement block found to be having permeability test

Water perculates through pores

All PCPB with different size of coarse aggregate cause a great reduction in the water volume during permeability test. However, differences in this reduction between the samples are depending on the coarse aggregate size and porosity. PCPB with CA 8 – 10 give better results in permeability and more suitable be applied at areas with high surface runoff. The permeability results indicate that there are large differences in permeability for all samples when the curing duration increases. Furthermore, the permeability of sample with 28 days curing was lower than the sample with 7 days curing; indicating that age is a factor affecting permeability.

Conclusions

All PCPB with different size of coarse aggregate cause a great reduction in the water volume during permeability test. However, differences in this reduction between the samples are depending on the coarse aggregate size and porosity. PCPB with CA 8 – 10 give better results in permeability and more suitable be applied at areas with high surface runoff. The permeability results indicate that there are large differences in permeability for all samples when the curing duration increases. Furthermore, the permeability of sample with 28 days curing was lower than the sample with 7 days curing; indicating that age is a factor affecting permeability.

Scope for Future Work

Pervious concrete is having a lot of potential and demand in the construction industry thanks to its infiltration property and reduction in temperature around due to its breathing holes present. It is similar to conventional concrete but manufactured without or minimum of fine grained aggregates. The voids present in the block in the absence of fine aggregates allow water to flow through the concrete, and drain through the sub-grade filtering surface water reducing overall storm water runoff enhancing groundwater recharge.

The need for pervious concrete has grown. It's definitely growing and spreading but it still has a long way to go. The greatest market potential for Porous Concrete block is used in parking lots, Parks, road with light traffic, pedestrian walk way, green houses, courtyards, playground, etc. It can also be used as a structural drainage fill behind retaining walls

References

1. Wan C N C, Jaya R P and Hamzah M O 2012 Adv. Mater. Res. 486 378-383
2. Zachary Bean E, Frederick Hunt W and Alan Bidelspach D 2007 J. Irrig. Drain. Eng. 133 583- 592
3. Hassani A, Mohammad S and Ghoddusi P 2010 P. I. Civil. Eng-Transp, 163 183-190
4. Chindaprasirt P, Hatanaka S, Chareerat T, Mishima N and Yuasa Y 2008 Constr. Build. Mater. 22 894-901
5. Jusli E, MdNor H, Ramadhansyah P J and Zaiton H 2014 Appl. Mech. Mater. 554 128-132
6. NurHidayah A H, Hasanan M N and Ramadhansyah P J 2014 Appl. Mech. Mater. 554 111-115 [8]
7. Ramadhansyah P J, Mohd Ibrahim M Y, MohdRosli H and MohdHaziman W I 2014 Appl. Mech. Mater. 554 37-41
8. Yusak M I M, Jaya R P, Hainin M R and Ibrahim M H W 2016 ARPN J. Eng. Appl. Sci. 11 11832-11835

9. Bakar B A, Ramadhansyah P J and Azmi M M 2011 Mag. Concrete. Res. 63 313-320

10. A.K. Jain et al. "Effect Of Shape And Size Of Aggregate On Permeability Of Pervious Concrete" [Dec 2011] Journal ofEngineering Research and Studies PP- 48-51

11 .AlirezaJoshaghani "Mechanical Characteristic of Pervious Concrete Considering the Gradation and Size of Course Aggregates" [September 2014] Res earch Journal of Environmental and Earth Sciences 6(9):

12. Prof M.S Shetty on Concrete Technology – For mix design of Concrete.

13. Darshan S. Shah et al. "Pervious Concrete: New Era For Rural Road Pavement"(Aug 2013) International Journal of Engineering Trends and Technology (IJETT) – Volume 4 PP 3495-3499

14. IS CODE 456:2002- For Mix Design

15. Highway Engineering ByC.E.G.Justto&S.K.Khanna – To find properties of aggregate.

16. Mr.V. R. Patil et al. "Use of Pervious Concrete In Construction of Pavement For Improving Their Performance" IOSR

17. Science direct & American Society of civil Engineering – To find Paper & Journals

18 S.O. Ajamuet al. "Evaluation of Structural Performance of Pervious Concrete in Construction"May 2012] International Journal of Engineering and Technology Volume 2 No. 5 PP-829-836