

PERVIOUS CONCRETE BY ADDING FLYASH MATERIAL

Chauhan Joyal¹, Prajapati Bhupendra², Prajapati Ketan³, Patelia Smit⁴,
Asst Prof. Vipul Solanki⁵, Asst Prof. Pal Shailesh⁶

*BE student, Dept. of civil engineering Dr Jivraj Mehta Institute of Technology, Anand,
Gujarat, India*

Dept. of civil engineering Dr Jivraj Mehta Institute of Technology, Anand, Gujarat, India

Dept. of civil engineering Dr Jivraj Mehta Institute of Technology, Anand, Gujarat, India

Dept. of civil engineering Dr Jivraj Mehta Institute of Technology, Anand, Gujarat, India

ABSTRACT

Advancements in concrete technology have resulted in the development of a new type of greener concrete, which is known as Pervious concrete. The research on pervious pavement materials has begun in developed countries such as the US and Japan since 1980s. In recent times, leader cities around the world have experienced numerous flooding due to the combination of increased rainfall and reduced in permeable surface areas.

In this report we had justified the strength and permeability of Pervious concrete adding with fly ash. The OPC 53 Grade Kamal cement was used for all concrete mixes. Cement is mixed with water, sand, aggregate, and fly ash to make Pervious concrete. We made block, cylinder, and panel of pervious concrete adding with fly ash. Fly ash use in this PC is 10%, 15%, 20%. Size of aggregate use in this project are 12mm to 16 mm, 16mm – 20 mm. After performing the compressive strength test on cubes of coarse aggregate and cubes of rounded aggregate, we gained the strength of cubes in which coarse aggregates are used is less than the cubes in which rounded aggregates are used. Field sites for existing pervious concrete were located in our collage DJMIT. It is hoped that by developing more standardized installation method and documentation concrete pervious block strength can be achieved.

KEYWORD: *Pervious concrete, flyash materials, tests, compressive strength, permeability/*

1. INTRODUCTION

2. Pervious concrete is a special type of concrete with a high porosity used for concrete applications.

3. It allows water from precipitation and other sources to pass directly through, thereby reducing the runoff from a site and allowing ground water recharge.

4. It is also known as permeable concrete.

5. The mixture is composed of cementations materials, coarse aggregate and water with little to no fine aggregates.

- 6.** streets, pedestrian walkways, and greenhouses.
- 7.** It is an important application for sustainable construction and is one of the techniques used for ground water recharge.

8. MATERIAL AND PROPERTIES

- A. Cement:** Cement acts as a building agent for materials. Cement as applied in civil engineering industry is produced by calcining at high temperature. It is admixture of calcareous, siliceous, aluminous substances and crushing the clinkers to a fine powder. Cement is the most expensive materials in concrete. The cement used in this experimental work is Sanghi cement of 53 grade ordinary Portland cement. The specific gravity of cement is 3.15; standard consistency of cement is 31.3%. All properties of cement are tested by references of IS 12269-1987.
- B. Fine aggregates:** Locally available sand passes through of 4.75mm IS sieve is to be used. The specific gravity of sand is 2.60 and fineness modulus of 2.84 is used. Water absorption of sand is 1.23%
- C. coarse Aggregates:** The coarse aggregates with the sizes of 20mm and 10mm aggregates are used. Specific gravity of 20mm coarse aggregates is 2.88 and for 10mm it is 2.87. And fineness modulus is 7.38.
- D. water:** Water should be free from all injurious amount of acids, organic and inorganic impurities, and it should be used for proper mixing and curing of concrete.
- E. Fly ash:** Fly ash can replace a portion of port land cement (up to 20%) in pervious concrete. It provides improved placing and finishing characteristics including improved workability of the low slump mix. This is a major benefit, particularly when surface texture and design concerns are of high priority. Because of its ability to enhance concrete products, fly ash has become a necessity in pervious concrete technology.

Not only does it create a better final product, using fly ash in pervious concrete is an environmentally prudent way to control the pollution. Fly ash, otherwise slated for landfills, is used as a mineral admixture to enhance the overall performance of the pervious concrete. When fly ash is used, the use of landfill space is drastically reduced, and by replacing a portion of cement in concrete with fly ash, CO₂ emissions created during cement production are greatly reduced, lessening the negative impact on our atmosphere.

The Southern California Ready Mix Concrete Association has provided the following guidelines and recommendations for pervious concrete mix designs with fly ash:

Table:1 Physical properties of Flyash

Compacted Voids	Minimum 10%
Cement	At least 263.086 kg/m ³

Fly Ash	22-50 Kg/m ³
Total Cementitious Materials	285.7632 kg/m ³
Aggregate	0.7646 cubic meter

9. METHODOLOGY:

A. Mix proportion

The mix proportion shown in table 2 was made for a concrete with the slump of 40mm (25mm50mm), the design of M30 OPC concrete as per IS:10262-2009

Table 2: Mix proportion

Material	Weight kg/m³
Cement	478.95
Fine aggregate	717.158
Course aggregate (20mm)	1173.73
Water	191.58

B. Casting and Curing

Concrete hardens due to chemical reactions between Portland cement and water. Concrete derives its strength by the hydration of cement particles. The hydration of cement is not a momentary action but a process continuing for long time. The rate of hydration is fast to start with, but continues over a very long time at a decreasing rate. The quantity of the product of hydration and consequently the amount of gel formed depends upon the extent of hydration. After 72 hours of casting the specimens is to be de moulded and is transferred to the curing tank, wherein they will allow to cure for 28 days before testing.

4. TESTING

To find out the mechanical properties of concrete 14days and 28day by mix proportion by compressive strength test.

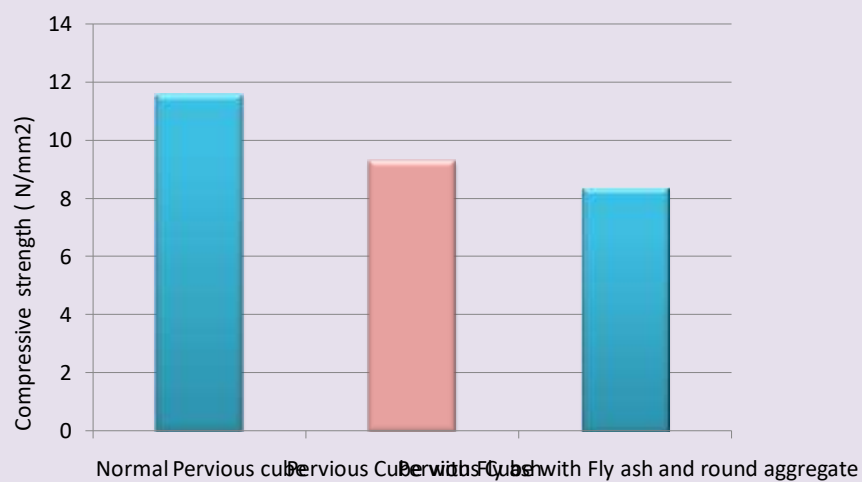
COMPRESSIVE STRENGTH TEST

Compressive strength test was conducted in accordance with IS 516-1959. The compressive strength test on hardened concrete was performed on a 3000 KN capacity compression testing machine. Compressive strength of concrete is the most important characteristic of concrete, which is measured by engineers in designing structures. The compression test shows the best possible strength concrete can reach in perfect conditions. The compression test measures concrete strength in the hardened state. Compressive strength test was conducted on concrete cube of size 150mm x 150mm x 150mm

Table-3: compressive strength result at 14 & 28 days

	Strength (after 14 days in N/mm ²)
Normal pervious Cube	10.54
Pervious Cube adding with Fly ash	9.25
Pervious Cube adding with Fly ash and round aggregate	8.36

Graphical representation of compressive strength of Pervious concrete

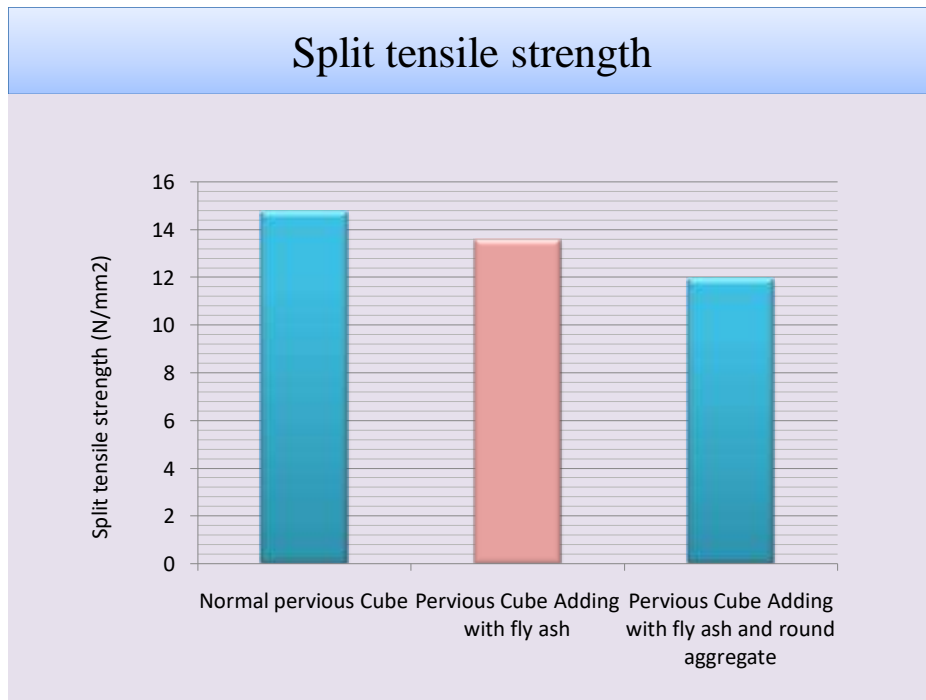


SPLIT TENSILE TEST

Split Tensile strength was obtained in accordance with IS 5816-199. It is a method of determining the tensile strength of concrete using a cylinder which splits across the vertical diameter. Cylindrical specimens of 150 mm x 300 mm were casted and tested after 7 & 28 days curing. Two cylinders were casted using coarse aggregates and rounded aggregates with flyash.

Table-4: Split tensile test results of cylinders

	Strength(after 14 days in N/mm ²)
Normal pervious Cube	14.72
Pervious Cube adding with Fly ash	13.56
Pervious Cube adding with Fly ash and round aggregate	11.89



5. CONCLUSION Pervious concrete have less compressive strength compared to conventional concrete.

1) After performing the compressive strength test on cubes of coarse aggregate and cubes of rounded aggregate, we gained the strength of cubes in which coarse aggregates are used is less than the cubes in which rounded aggregates are used.

2) The strength of cylinder containing coarse aggregates is less than the strength of cylinder containing rounded aggregates.

3) Raveling of the pervious concrete is limited to the entrance and exit points of parking areas. Therefore, areas subjected to high volumes should not be constructed of pervious concrete but either asphalt or conventional concrete. Another concern is maintenance vehicles such as garbage trucks. Although existing parking lots are able to withstand these vehicles driving through the lot, that portion of the pavement where these vehicles load and unload is heavily damaged. Recommendations are that pervious concrete should not be Pervious concrete have less compressive strength compared to conventional concrete.

4) Pervious concrete, although not as strong as conventional concrete, provides an acceptable alternative when used in low volume and low impact areas. Strength is sacrificed for permeability but not to any degree which would render the pervious concrete non-functional.

6. REFERENCES

- 1) Tennis, P., Leming, M.L., and Akers, O.1., "Pervious concrete pavements", Portland Cement Association (PCA). Skokie, Illinois, 2004. pp.25.
- 2) Yang, J. and O. Jiang, "Experimental study on properties of pervious concrete pavement materials", Cement and Concrete Research, Vol.3, 2002, pp. 381- 386.
- 3) Hnzaree, C., Ceylan, H. "High volume Fly ash concrete for pavement applications with gap graded aggregates: Marginal and fine sands", Airfield and Highway Pavements, 2006, pp.528-542.
- 4) An Cheng, Hui-Mi Hsu, Sao-Jeng Chao & Kae-Long Lin. "Experimental Study on pervious concrete Made with Recycled Aggregate", Internal Journal of Pavement Research and Technology, Vol.4, 2011, NO.2, pp.104-110.
- 5) Ohafoori, N. and S. Dutta, "Laboratory investigation of compacted no-fines concrete for paving materials", Journal of Materials in Civil Engineering, 1995, Vol.7, No.3, pp.183-191.
- 6) Zouaghi, A. and M. Kumagai, "Adaptability of porous concrete to the environment", A monthly report of the Civil Engineering Research Institute For Cold Region, 2000, No.566: pp.11-24.
- 7) Zbuge, Y., "A review of permeable concrete and its application to pavements"