Design of Eco Friendly: Permeable Concrete

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Abstract— Permeable concrete is also known as the no-fines, porous, gap-graded and pervious concrete. It has been found to be a reliable storm water management tool. By definition, permeable concrete is a mixture of gravel or granite stone, cement ,water little to no sand (fine aggregate) with or without admixtures when permeable concrete is used for paving, the open cell structures allow storm water to filter through to pavement and into the under flying soils. This concrete for tested its density, porosity, permeability and drying shrinkage like properties this concrete cardinally used in parking areas, areas with light traffic. This is an important application for sustainable construction. Thus, in short this is an important application for sustainable construction and is one of many low impact development techniques used by builders to protect water quality.

Keywords: Permeable concrete, PVC plastic waste material

I. Introduction

Pervious concrete is traditionally used in parking areas, areas with light traffic, residential stresses, pedestrian walkways and green houses. It is an important application for sustainable construction and is one of many low impact development techniques used by builders to protect water quality.

The basic ingredients of pervious cement concrete mix are not very different from the conventional cement concrete mix, except in the proportion of ingredients. The main ingredients are cementations material, water, aggregate and if required admixtures.

Permeable concrete was first used in the 1852 in Europe when sand & other fine aggregate were not easily available used as pavement surfacing, residential wall, cost efficiency was the main motive due to decreased amount of cement. It becomes popular again in the 1920 for two storey homes in Scotland and England. It become popular in Europe after will due to the scarcity of cement. It did not become as popular in the US until the 1970. In India it becomes popular in 2000.

II. Objective

A large amount of rain water ends up falling on impervious surfaces such as parking lots, drive ways, sidewalks and streets rather than soaking into the soil.

This creates an imbalance to the natural ecosystem and leads to a host of problems including erosion, floods, ground water level depletion and pollution of rivers, lakes etc..

A simple solution to avoid these problems is to stop constructing impervious surfaces that block natural water infiltration into the soil

III. Scope

1) Storm water runoff reduction
2) Storm water treatment
3) Wetlands protection
4) Tree protection
5) Zoning credits
6) Road shoulders
7) Parking areas

IV. Material

1) Cement: - cement is binder material and gives strength to the concrete
2) Coarse aggregate: - coarse aggregate gives the strength and bulk of concrete
3) P.V.C. pipe waste material: - we collect pvc pipe waste material from various construction site, it can help to become economical and light weight concrete

V. Mix proportion

As per IS 10262:2009

Cement	520 kg/m^3
Fine aggregate (5% of C.A.)	56.551 gm
Coarse aggregate	1131.02 kg/m^3
Water	206 ltr
Water / Cement ratio	0.38

Table 1: (Mix design for pervious concrete 5% sand and 10mm to 12.5mm size of aggregate)

Cement	465 kg/m^3
Fine aggregate (5% of C.A.)	51.641 gm
Coarse aggregate	1032.82 kg/m^3
Water	186 ltr
Water / Cement ratio	0.38

Table 2: (Mix design for pervious concrete 5% sand and 16mm to 20mm size of aggregate)

Cement	520 kg/m^3
P.V.C. plastic pipe waste material (5% of Coarse aggregate)	56.551 gm

Coarse aggregate	1131.02 kg/m^3
Water	206 ltr
Water / Cement ratio	0.38

Table 3: (Mix design for pervious concrete 5% P.V.C. plastic pipe waste and 10mm to 12.5mm size of aggregate)

Cement	465 kg/m^3
P.V.C. plastic pipe waste material (5% of Coarse aggregate)	51.641 gm
Coarse aggregate	1032.82 kg/m^3
Water	186 ltr
Water / Cement ratio	0.38

Table 4: (Mix design for pervious concrete 5% P.V.C plastic pipe waste and 16mm to 20mm size of aggregate)

VI. DATA COLLECTION

Pervious concrete Compressive Strength (Mpa) 5% sand of C.A.	Cube- 1	Cube- 2	Cube-3
After 7 days	1.83	2.93	2.50
After 28 days	2.63	3.24	3.63

Table 5: (Compressive strength of concrete with 5% of sand and 10mm to 12.5mm size of aggregate)

Pervious concrete Compressive Strength (Mpa) 5% of P.V.C pipe waste of C.A.	Cube- 1	Cube- 2	Cube-3
After 7 days	4.75	3.25	3.02
After 28 days	5.37	5.24	4.31

Table 6: (Compressive strength of concrete with 5% of PVC pipe waste and 10mm to 12.5mm size of aggregate)

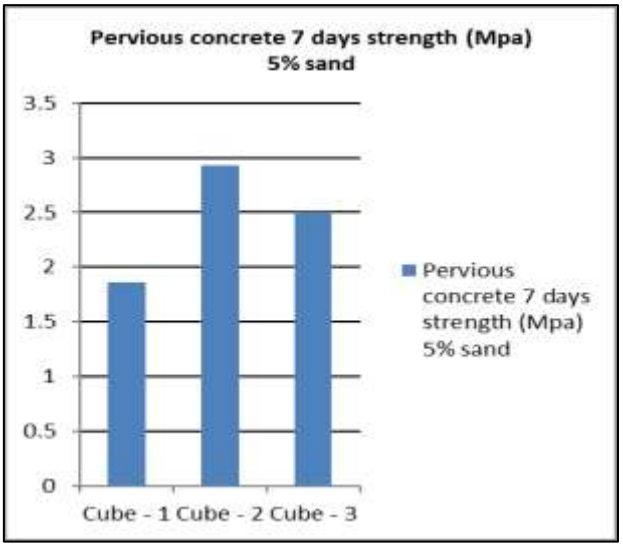
Pervious concrete Compressive Strength (Mpa) 5% of P.V.C pipe waste of C.A.	Cube- 1	Cube- 2	Cube-3
After 7 days	6.57	5.37	5.28
After 28 days	7.15	9.82	8.17

Table 7: (Compressive strength of concrete with 5% of PVC pipe waste and 16mm to 20mm size of aggregate

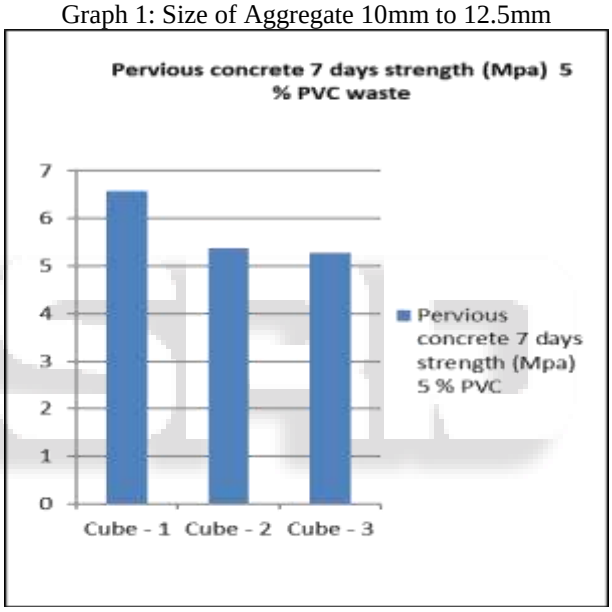
Sieve Analysis	Average Compressive Strength (Mpa)	
	After 7 days	After 28 days
12.5mm pass 10mm retain	3.67	4.97
20mm pass 16mm retain	5.74	8.38

Table 8: (Average Compressive strength of Concrete)

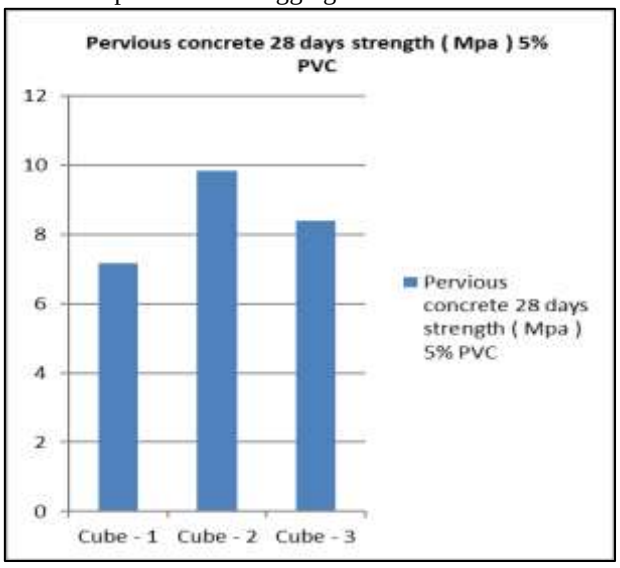
VII. DATA ANALYSIS



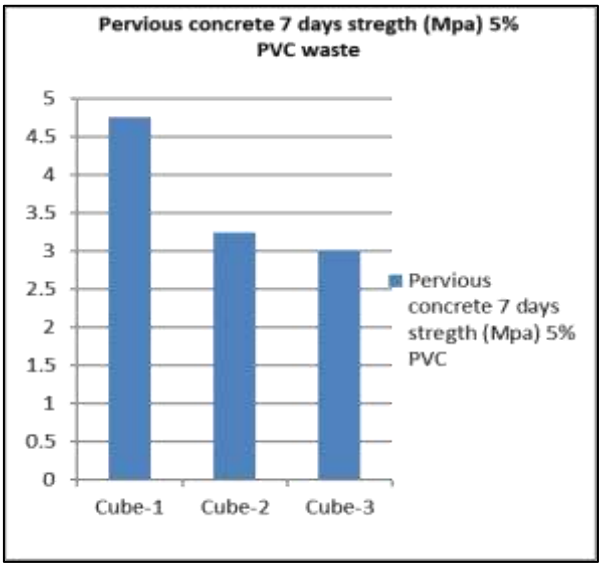
Graph 1: Size of Aggregate 10mm to 12.5mm



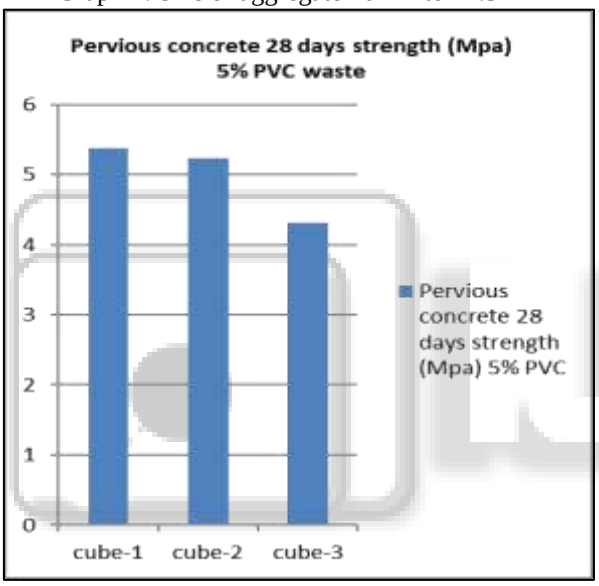
Graph 2: Size of Aggregate 16mm to 20mm



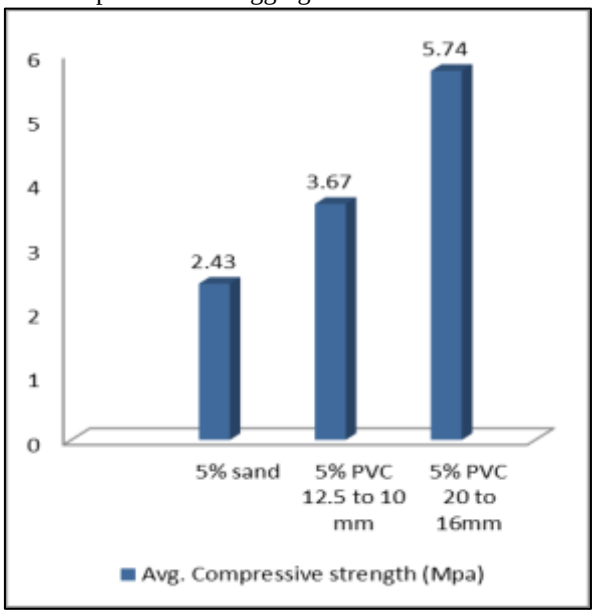
Graph 3: Size of aggregate 16mm to 20mm



Graph 4: Size of aggregate 10mm to 12.5mm



Graph 5: Size of aggregate 10mm to 12.5mm



Graph 5: Average compressive strength at 7 days

VIII. CONCLUSIONS

1) When we added 5% sand by replacing coarse aggregate we have get Average compressive strength at 7 days 3.68 N/mm^2. So, it is increased up to 1.25 N/mm^2 as compared to pervious concrete without any waste material.
2) When we added 5% PVC plastic waste material and used 10mm to 12.5mm the Average compressive strength is increased by 1.29 N/mm^2 at 28 days as compared to pervious concrete with adding 5% sand.
3) When we added 5% PVC plastic waste material and used 16mm to 20mm the Average compressive strength is increased by 4.45 N/mm^2 at 28 days as compared to pervious concrete of 10mm to 12.5mm size aggregate.
4) It is evident from the project that no fines concrete has more coefficient of permeability. Hence, it is capable of capturing storm water and recharging the ground water. As a result, it can be ideally used at parking areas and at residential areas where the movement of vehicles is very moderate.

REFERENCES

[1] India standard recommended guidelines for concrete Mix design, IS: 10262: 2009. First revision, bureau of Indian standards, New Delhi.
[2] Sourabh rahangdale, "STUDY OF PERVIOUS CONCRETE", International Journal of Engineering and Technology.
[3] M. Harshavarthana balaji, DESIGN OF ECO FRIENDLY PERVIOUS CONCRETE.
[4] International Journal of Engineering and Technology. IJCIET, Volume 6, Issue 2, February (2015).
[5] Concrete technology, theory of practice, A test book of MS shetty.

