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Characteristic Study of Pervious Concrete

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ABSTRACT: Our cities are being covered with building and the air-proof concrete road more and more. In addition, the environment of city is far from natural environment. Without constant supply of water to the soil, plants are difficult to grow normally. Present scenario is more about energy saving and more use of renewable energy sources. At the same time, the splash on the road during a rainy season, reduces the safety of traffic for vehicle and a foot passenger. Pervious concrete is a special type of concrete with a high porosity used for concrete flatwork applications that allows water from precipitation and other sources to pass through it, thereby reducing the runoff from site and recharging ground water levels. Typically, pervious concrete has little to no fine aggregate and has just enough cementations paste to coat the coarse aggregate particles while preserving the interconnectivity of the voids. Pervious concrete is used for light traffic, pedestrian walkways, and the concrete is traditionally used for parking areas. Pervious Concrete is an important application for sustainable construction. In current research total 21 cubes were casted by pervious mix design and tested for compression and flexure. Also, the additive named as poly carboxylate ether were used as plasticizer. Addition of 4% of it to mix design gives relatively better results.

KEYWORDS: Pervious Concrete, Storm Water, Runoff, Pollutant.

I. INTRODUCTION

Pervious concrete is also called as no fines concrete as it contains less or literally does not have any fine particles or aggregates. The aggregate usually consists of a single size and is bonded together at its points of contact by a paste formed by the cement and water. The result is a concrete with a high percentage of interconnected voids that, when functioning correctly, permit the rapid percolation of water through the concrete. In this research, the effects varying the components of pervious concrete has on its compressive strength are investigated. The goal is to achieve a maximum compressive strength without inhibiting the permeability characteristics of the pervious concrete. This will be accomplished through extensive experiments on test cubes created for this purpose. Experiment includes compression tests and flexural test.

Pervious concrete has become significantly popular during recent decades, because of its potential contribution in solving environmental issues. Pervious concrete is a type of concrete with significantly high water permeability compared to normal weight concrete. It has been mainly developed for draining water from ground surface, so that storm water runoff is reduced.

II. MATERIAL SPECIFICATIONS

Target of research

The Aim of the research is to study the strength of Pervious Concrete.

The objective includes:

1. To prepare the mix proportions for pervious concrete.
2. To study the trial mix with various percentages of admixture, cement and water.
3. To Compare test results of pervious concrete for applying it to the model.
4. To find mechanical properties such as compressive, flexural strength of concrete

Material Specification

1. Cement

Ordinary Portland cement "BIRLA SUPER 53 GRADE" was used. Tests were carried out on various physical properties of cement



2. Coarse Aggregate

Crushed granite stones from local queries were used as aggregate. The size of aggregate used was 12.5mm to 6.5

Product	PCE 50% liquid
Appearance	Pale Brown Viscous Liquid
Density	1.12±0.2

mm retained on IS sieve. The properties of aggregate where determine by conducting tests.

3. Water

Portable fresh water available from local sources are used for mixing and curing of concrete blocks.

4. Plasticizer (poly carboxylate ether)

Here in this research plasticizer used was poly carboxylate ether.

Product	PCE 50% liquid
Appearance	Pale Brown Viscous Liquid
Density	1.12±0.2

III. METHODOLOGY

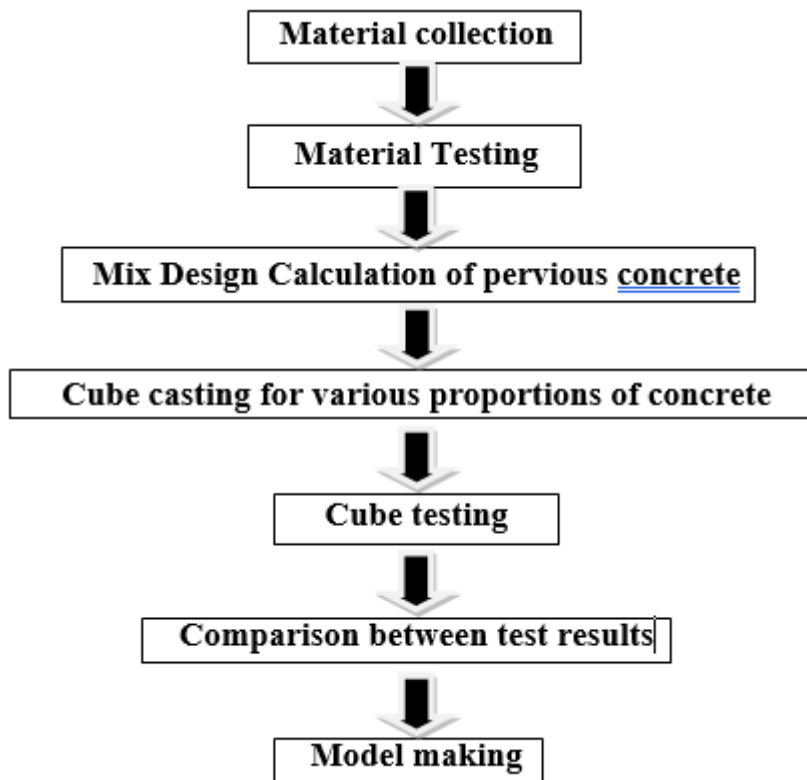


Fig 1. Applied Methodology



**1. Tests on Cement
Fineness Test**

Table 1. Fineness Test

Sr. No.	Wt. of Dry Cement (gm.)	Wt. of Residue (gm.)	% of Residue	% Average
1	10	0.116	1.16	1.073
2	10	0.095	0.95	
3	10	0.111	1.11	

Result: 1.073% is residue on the 90µm sieve.

Consistency of Cement

Table 2. Consistency Test

Sr. No.	Wt. of Dry Cement (gm.)	Water (ml)	Gauge Reading (mm)	% of Water
1	400	150	2	37.5
2	400	130	9	32.5
3	400	145	6	36.2

Result: 36.2 % water of the weight of the dry cement is required to produce a cement of standard consistency.

Soundness of Cement

Table 3. Soundness Test

Sr. No.	D1 (mm)	D2 (mm)	Expansion (D2-D1) (mm)
1	9	10	1

Result:Expansion of cement used is 1mm

**2. Tests on Coarse Aggregate
Water Absorption**

Table 4. Water absorption test

Sr. No.	W1 (gm.)	W2 (gm.)	Water Absorption (%)	Average (%)
1	2000	2006	0.3	1.316
2	2000	2028	1.4	
3	2000	2045	2.25	

Result: Water absorption of these sample = 1.3%

Specific Gravity

Table 5. Specific Gravity of aggregates

Sr. No.	W1 (gm.)	W2 (gm.)	W3 (gm.)	W4 (gm.)	Specific Gravity
1	644	944	1650	1464	2.63

Result: Specific Gravity of the sample = 2.63



Aggregate Impact Test

Table 6. Impact Value

Sr. No.	W1 (gm.)	W2 (gm.)	AIV
1	400	54	13.5

Result: Aggregate Impact Value of the sample = 13.5

Installation Process

The pervious concrete installation process consists of four basic steps:

- Mixing
- Placing
- Compaction
- Curing

For the current analysis all the four steps were applied and concrete was casted. The mix design used is as follows -

Mix Design

Trial Mix 1

- Cement : Coarse aggregate (1:5.50)
- Water :Cement (0.3)
- Polycarboxylate ether (PCE) Super plasticizer

Trial Mix 2

- Cement: Coarse aggregate (1:6.75)
- Water :Cement (0.318)
- Polycarboxylate ether (PCE) 0.4%

Trial Mix 3

- Cement: Coarse aggregate (1:7.43)
- Water :Cement (0.325)
- Polycarboxylate ether (PCE) 0.4%

- Variations for PCE
- 0.3% of cement weight
 - 0.4% of cement weight
 - 0.5% of cement weight
 - 0.64% of cement weight

Table 7. Test results after 7 days

PCE %	Compressive stress (N/mm ²)
0.3	6.41
0.4	10.49
0.5	4.88
0.6	1.57

Remark: For 0.4% PEC gives the maximum strength.



IV. EXPERIMENTAL RESULTS

Compression Test Results

Table 8. Test results after 14 days for trial mix 2

Sr.no	Load (KN)	Compressive Strength (N/mm ²)
1	151.7	6.74
2	236.1	11.69
3	161.2	7.16
4	183.7	8.16
5	182.8	8.12
6	198.3	8.81

Compressive strength= 8.45N/mm²
 permissible compressive strength as per IRC 58 1988 is 27.45N/mm²

Flexural test results

Table 9. Test results after 14 days for trial mix 2

Sr.no	Load (KN)	Flexural Strength(N/mm ²)
1	12.5	5.33
2	11	4.88
3	11.8	5.24

Flexural Strength = 5.15N/mm²
 Flexural Strength as per IRC 58 1988 is 3.92N/mm²

VI. CONCLUSION

- 1.Performing test mentioned in above slides it is concluded that the concrete castedwere permeable and got enough strength. So, it can be use as pavement purpose for walkways, sidewalks, light traffic.
- 2.It is clearly seen from the experimental result that pervious concrete has very low compressive strength, so it cannot be used for structural application, but it can be significantly used for sidewalks, parking lots, sports surfaces, driveways, etc.
- 3.By doing various trials it can be concluded that smaller size aggregate from 6.5mm to 12.5mm gives better results like smooth surface.
- 4.For pervious concrete it is required to give less vibration, or it can be use for tamping for better percolation, it was experienced that more vibrations gives saturation of cement slurry in bottom.



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