**ANALYSIS AND IMPROVEMENT OF PERVIOUS CONCRETE FOR GROUND WATER RECHARGE**

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**ABSTRACT**

This paper describes the effect of size of aggregate and proportions of cement, aggregates and water on porosity of pervious concrete which is the main feature of pervious concrete. Different sample blocks were made in lab with variations in mixture to see the compressive strength and porosity for final conclusion.

**INTRODUCTION**

Pervious concrete pavement is one of the leading materials used by the concrete industry in affecting significant “GREEN” industry practices.

Pervious concrete is a unique cement-based product whose porous structure permits free passage of water through the concrete and into the soil without compromising the durability or integrity of the concrete. Pervious concrete is a zero-slump, open graded material consisting of hydraulic cement, coarse

Aggregate, admixtures and water. Because pervious concrete contains little or no fine aggregate such as sand, it is sometimes referred to as “no-fines “concrete. The increased porosity due to no fines in the mix and 15-20% air voids allows for the flow of water through the material.

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PERVIOUS CONCRETE

**LITERATURE REVIEV**

**Aggregate Size:-**

Coarse aggregate grading in pervious concrete normally consists of either a single sized coarse aggregate or a narrow grading from 3/4 to 3/8 in. (19~9.5 mm) (ACI 522 pervious concrete, 2006). Though the range of coarse aggregate size was limited, Schaefer et al. (2006) briefly described the effect of aggregate size on compressive strength.

**Mixture Proportion: -**

(Mulligan, 2005; Schaefer et al., 2006; Luck et al., 2006).

Various mixture proportions of pervious concrete have been studied for various research purposes. All mixture proportions are in a similar range. Pervious concrete contains minimal fine-aggregate so that large amounts of coarse aggregate are used compared with mixture proportion of conventional concrete

**Compressive strength: -**

(Paul D. Tennis, Michael L. Leming, and David J. Akers in 2004)

Pervious concrete mixtures can develop compressive strengths in the range of 500 psi to 4000 psi (3.5 MPa to 28 MPa), which is suitable for a wide range of applications. Typical values are about 2500 psi (17 MPa).

**Durability:-**

(Paul D. Tennis, Michael L. Leming, and David J. Akers in 2004)

Durability of concrete is substantially affected by the material permeability. Since pervious concrete facilitates mobility of moisture, one would expect this to affect durability. The durability problems should not be analogous to traditional concrete since the permeability of pervious concrete is not same as traditional concrete; that is, traditional flow-through permeability is not a measure of durability for pervious concrete.

**Density and porosity: -**

(Paul D. Tennis, Michael L. Leming, and David J. Akers in 2004)

The density of pervious concrete depends on the properties and proportions of the materials used, and on the compaction procedures used in placement. In-place densities on the order of 100 lb/ft3 to 125 lb/ft3 (1600 kg/m3 to 2000 kg/m3) are common, which is in the upper range of lightweight concretes.

**METHEDOLOGY**

1. **MIX DESIGN**
   1. TRIAL ONE

1. Cement = 1.0 kg

2. Aggregates= 6.0 kg (20mm+10mm)

3. Sand= 250 gm

4. Water= 340 ml

OBSERVATION TABLE & RESULT

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sr.No | Aggregate (%) in 6kg | | Load ( KN) | | 7 days Compressive Strength( N/mm2) | 28 days Compressive Strength(N/mm2) |
| 20mm | 10mm | 7 Days | 28Days |
| 1 | 50 | 50 | 170 | 225 | 7.55 | 10 |
| 2 | 60 | 40 | 140 | 195 | 6.22 | 8.66 |
| 3 | 70 | 30 | 175 | 230 | 7.77 | 10.22 |
| 4 | 80 | 20 | 210 | 300 | 9.33 | 13.33 |
| 5 | 90 | 10 | 200 | 275 | 8.88 | 12.22 |
| 6 | 100 | 0 | 230 | 310 | 10.22 | 13.77 |

COMPRESSIVE STRENGTH OF 1st TRIAL

(N/mm2)

* 1. TRIAL TWO

1. Cement = 1.0 kg

2. Aggregates= 6.0 kg (10mm+6mm)

3. Sand= 150 gm

4. Water= 340 ml

OBSERVATION TABLE & RESULT

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sr.No | Aggregate (%) in 6kg | | Load ( KN) | | 7 days Compressive Strength(N/mm2) | 28 days Compressive Strength  (N/mm2) |
| 10mm | 6mm | 7 Days | 28Days |
| 1 | 50 | 50 | 95 | 125 | 4.22 | 5.56 |
| 2 | 60 | 40 | 110 | 145 | 4.87 | 6.45 |
| 3 | 70 | 30 | 100 | 130 | 4.45 | 5.79 |
| 4 | 80 | 20 | 125 | 165 | 5.56 | 7.34 |
| 5 | 90 | 10 | 135 | 180 | 6.0 | 8.02 |
| 6 | 100 | 0 | 140 | 185 | 6.23 | 8.23 |

COMPRESSIVE STRENGTH OF 2nd TRIAL

(N/mm2)

* 1. TRIAL THREE

1. Cement = 1.0 kg

2. Aggregates= 6.0 kg (6mm+10mm)

3. Sand= 150 gm

4. Water= 340 ml

OBSERVATION TABLE & RESULT

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sr.No | Aggregate (%) in 6kg | | Load KN | | 7 days Compressive Strength N/mm2 | 28 days Compressive Strength(N/mm2) |
| 6mm | 10mm | 7 Days | 28Days |
| 1 | 50 | 50 | 100 | 130 | 4.45 | 5.78 |
| 2 | 60 | 40 | 80 | 105 | 3.57 | 4.66 |
| 3 | 70 | 30 | 85 | 110 | 3.78 | 4.89 |
| 4 | 80 | 20 | 90 | 120 | 4.0 | 5.34 |
| 5 | 90 | 10 | 80 | 105 | 3.56 | 4.67 |
| 6 | 100 | 0 | 70 | 90 | 3.11 | 4.0 |

COMPRESSIVE STRENGTH OF 3rd TRIAL

(N/mm2)

* 1. TRIAL FOUR ( part A )

1. Cement = 2.0 kg

2. Aggregates= 6.0 kg (10mm+20mm)

3. Sand= 250 gm

4. Water= 680 ml

OBSERVATION TABLE & RESULT

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sr.No | Aggregate (%) in 6kg | | Load ( KN) | | 7 days Strength N/mm2 | 28 days StrengthN/mm2 |
| 10mm | 20mm | 7 Days | 28Days |
| 1 | 50 | 50 | 385 | 534 | 17.11 | 23.74 |
| 2 | 60 | 40 | 320 | 425 | 14.23 | 18.89 |
| 3 | 70 | 30 | 325 | 430 | 14.45 | 19.11 |

COMPRESSIVE STRENGTH (N/mm2)

4th trial (Part A)

TRIAL 4 (Part B)

1. Cement = 1.5 kg

2. Aggregates= 6.0 kg (10mm+20mm)

3. Sand= 250 gm

4. Water= 510 ml

OBSERVATION TABLE & RESULT

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sr.No | Aggregate (%) in 6kg | | Load ( KN) | | 7 days Compressive Strength N/mm2 | 28 days Compressive Strength(N/mm2) |
| 10mm | 20mm | 7 Days | 28Days |
| 1 | 80 | 20 | 245 | 295 | 10.88 | 13.11 |
| 2 | 90 | 10 | 215 | 285 | 9.56 | 12.67 |
| 3 | 100 | 0 | 160 | 205 | 7.11 | 9.13 |

COMPRESSIVE STRENGTH (N/mm2)

4th Trial (Part B)

RELATIONSHIP BETWEEN SAND CONTENT AND POROSITY

Presence of sand content in pervious concrete affects the porosity and permeability of the concrete. While adopting different amount of sand content we observed that the little amount of sand in the concrete mix gives the better rate of porosity and vice versa.

The following graph shows the relationship between sand content and the porosity of pervious concrete.

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CONCLUSION:-

By adopting different trials of various proportions of aggregates, cement and sand we conclude that,

* Compressive Strength increases as size of aggregate increases
* Maximum compressive Strength of 23.74 N/mm2 obtained when 50% aggregate of 20mm and 50% of 10mm aggregate were taken
* As the sand content in the concrete mix increases the porosity of pervious concrete decreases and vice versa.
* Water cement ratio of 0.34 is suitable in making of pervious concrete.

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