International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

# Partial Replacement of Silica Fume and Fly Ash in Pervious Concrete

**V.Prakash[1], K.Chandrasekar[2], P.Vinoth[3]**

[1] *M.E Construction Engineering and Management, Builders Engineering College, Kangayam, Tamil Nadu, India*
[2,3]*Assistant Professor, Dept. of Civil Engineering, Builders Engineering College, Kangayam, Tamil Nadu, India*

---

**Abstract -** *Pervious concrete is one of the most promising sustainable material now a days for pavements, parking lots, garden, and swimming pools etc., Pervious concrete used to drain the water through it by having a high void content of about 30%. Pervious concrete is the mixture of cement, smaller size coarse aggregates, water, and admixtures. The Pervious Concrete is enhanced by the addition of Silica fume & Fly ash in it. The adequate durability of concrete is ensured by the addition of Silica fume & Fly ash in concrete. In this study, we experimented that Silica fume & Fly ash is used as a partial replacement of cement in various combinations. The addition of silica fume & fly ash was assigned as 5%-5%, 10%-10%, and 15%-15% by volume of cement and the mechanical properties like compressive strength, flexural strength and split tensile strength were evaluated.*

***Key Words****: Pervious Concrete, Fly Ash, Silica Fume, ConplastSP4340…*

## 1. INTRODUCTION

Pervious concrete may be a mixture of coarse mixture, cement, water and tiny or no sand that creates associate degree open cell structure that permits water and air to tolerate it. It's conjointly known as porous concrete, porous concrete and no fines concrete and it's conjointly a special sort of concrete with high consistence used for concrete ironing applications that permits water from precipitation and alternative sources to pass directly through, thereby reducing the runoff from website and permitting water recharge.

Pervious concrete is created mistreatment massive aggregates with very little or no fine aggregates. The power of pervious concrete to permit water to flow through itself recharges water and minimizes the extent of pollution and storm water flee. Pervious concrete is employed to permit storm water to infiltrate through the pavement and cut back or eliminate the requirement for added management structures, like retention ponds. In alternative words, pervious concrete helps in protective the surface of the pavement and its setting.

Pervious concrete is additionally a novel and effective means that to handle vital environmental problems and property growth. It is rough rough-textured, and incorporates a honey combed surface, with moderate quantity of surfaces fibre that happens on heavily cosmopolitan road ways that.

Pervious concrete may be a zero-slump, open-graded material consisting of cement, coarse mixture, admixtures and water. Pervious concrete contains very little or no fine mixture like sand, it's typically observed as "no-fines" concrete.

The order of reference in the running text should match with the list of references at the end of the paper.

## 2. LITERATURE COLLECTIONS

**Sanket Sharma, et al., (2012)** determined the effect of percentage of fine aggregates and cement to coarse aggregate ratio to study the mechanical properties of pervious concrete. Tests and results concluded that the addition of 5% fine aggregate in pervious concrete, it increased the compressive strength but also strength decreased with then further increment of percentage of fine aggregates. And compared to fine aggregates in concrete, flexural strength of pervious concrete increased by 50% with addition of 10% fine aggregates.

**Jing Yang, et al., (2012)** investigated the effect of smaller sized aggregates, silica fume and super plasticizer to increase the pervious concrete greatly. Based on results, they concluded that with us of smaller sized aggregates, it helped to improve the significance of strength of pervious concrete. SP also enhances the strength of concrete. Also compressive strength of composition of these materials can be reach up to 50Mpa and it can be applied to footpath and also the low traffic vehicle road.

**Baoshan huang, et al., (2009)** carried out the experiment on pervious concrete with the use of latex polymer to improve the strength properties. With use of latex, natural sand and fiber they evaluated the effect of polymer modification on mechanical and physical properties. Based on results it absolutely was doable to supply pervious concrete mixture with acceptable permeableness and strength through the mix of latex and sand.

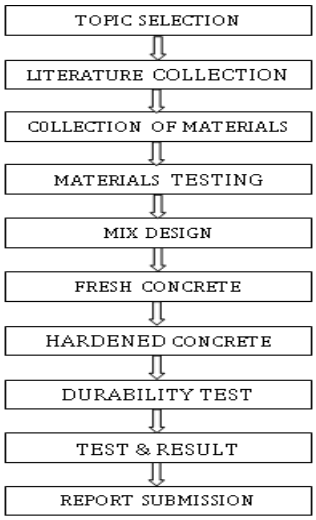
**V.T. Giner, et al., (2011)** studied the influence of SF addition in quantities ranging from 0% to 15% of cement mass on the dynamic and static mechanical properties of concrete. The results proved that SF additions or replacement reduce both the dynamic modulus of elasticity and damping ratio of concrete. The dynamic elastic properties of concrete, with and without SF, present higher values than their static counterparts. These differences are smaller in concrete containing SF.

**N.K. Amudhavalli, et al., (2012)** investigated the partial replacement of cement with silica fume at various percentage

and studied about compressive strength, flexural strength and split tensile strength in M35 grade concrete. The results concluded that the increment in compressive strength of concrete obtained in range of 10-15% of replacement of silica fume. But with other mixes, the loss in weight and compressive strength percentage was found to be reduced by 2.23 and 7.69 when 10%cement replaced by silica fume.

**Rui zhong, et al., (2015)** deals with oxide fume and ultrafine oxide powder to boost the ultra-high performance pervious concrete matrix. To achieve the goal of ultra-high performance cement based matrix with compressive strength in excess of 150 MPa and high durability properties designed and applied to mixture design concept of pervious concrete. Based on increased mechanical properties still as improved sturdiness, high performance pervious concrete probably permits extending the applying of pervious concrete and therefore carries an important potential in effectively counteracting the expansion of moth-resistant urban areas.

## 3. METHODOLOGY




## 4. MATERIALS USED IN PERVIOUS CONCRET

### 4.1 Cement

Types of cements used for this project are PPC, OPC & SPC. And the mentioned above three cements were satisfied as per the IS: 12269 -1987.

### 4.2 Coarse aggregate

Coarse aggregate obtained from local quarry units has been used for this study conforming to IS: 383-1970 is used, Maximum size of aggregate used is 20mm with specific gravity of 2.707.

### 4.3 Water

The water used for experiments was potable water conforming as per IS: 456-2000.

### 4.4 Fly ash

Fly ash is byproduct of the thermal power plants. Class f Fly ash was used have a lower content of Cao and exhibit Pozzolonic properties. Specific gravity of fly ash is 2.2 as per Specific gravity Test IS: 2386Part III, 1963.

### 4.5 Silica Fume

The Specific gravity of silica fume is 2.2. It consists of 0.1 to 1 micron sized fine, smooth spherical particles with fineness conforming to ASTM C1240 – 1999 standards.

### 4.6 Conplast SP 430

Conplast SP430 has been specially formulated to give high water reductions up to 25% without loss of workability or to produce high quality concrete or reduced permeability. It is a chloride free, superplasticising admixture based on the Sulphonated naphthalene polymers. It is the brown solution which instantly disperse in water. It is suitable to use with all types of Portland cement.

## 5. TEST COMPARISON

### 5.1 Comparison of Compressive Strength Test

| DAYS | CONVENTIONAL CONCRETE (N/mm2) | PERVIOUS CONVENTIONAL CONCRETE (N/mm2) | PERVIOUS WITH 10% SILICA FUME ADDED (N/mm2) | PERVIOUS WITH 20% SILICA FUME ADDED (N/mm2) | PERVIOUS WITH 30% SILICA FUME ADDED (N/mm2) |
|---|---|---|---|---|---|
| 7 | 19.94 | 4.44 | 4 | 4.88 | 4.44 |
| 14 | 36 | 10.67 | 11 | 12 | 11.33 |
| 28 | 42.6 | 12.44 | 7.11 | 14 | 10 |

### 5.2 Comparison of Flexural Strength Test

| DAYS | CONVENTIONAL CONCRETE (N/mm²) | PERVIOUS CONVENTIONAL CONCRETE (N/mm²) | PERVIOUS WITH 10% SILICA FUME ADDED (N/mm²) | PERVIOUS WITH 20% SILICA FUME ADDED (N/mm²) | PERVIOUS WITH 30% SILICA FUME ADDED (N/mm²) |
|---|---|---|---|---|---|
| 7 | 4.3 | 2 | 2.5 | 3.5 | 2 |
| 14 | 5.45 | 3 | 3.25 | 3.75 | 3 |
| 28 | 6 | 2 | 2.75 | 3.75 | **9.5** |

### 5.3 Comparison of Split Strength Test

| DAYS | CONVENTIONAL CONCRETE (N/mm²) | PERVIOUS CONVENTIONAL CONCRETE (N/mm²) | PERVIOUS WITH 10% SILICA FUME ADDED (N/mm²) | PERVIOUS WITH 20% SILICA FUME ADDED (N/mm²) | PERVIOUS WITH 30% SILICA FUME ADDED (N/mm²) |
|---|---|---|---|---|---|
| 7 | 2.28 | 0.72 | 1.03 | 1.17 | 0.09 |
| 14 | 3.04 | 1.11 | 1.13 | 1.57 | 1.41 |
| 28 | 4 | 1.34 | 1.17 | 1.62 | **1.99** |

## 6. CONCLUSION

Pervious concrete is a cost- effective and environmentally, friendly solution to support sustainable construction. Pervious concrete is made with smaller size of gravel with no fines of 1:1.72:3.17 concrete mix proportion and with OPC53 grade cement has highest compressive strength compared to any other mix proportion.

It is clearly seen from the experimental result that pervious concrete has very low compressive strength as well as flexural strength, so it cannot be used for structural applications but it should be significantly used for so many other applications such as, sidewalks, parking lots, sports surfaces, swimming pool decks and drive ways. The smaller the size of coarse aggregate should be able to produce a higher compressive strength and at the same time produce a low permeability rate.

Finally, further can should be conducted on the pervious concrete pavement produced with these material proportions to meet the condition of increased abrasion and compressive stresses dude to high vehicular loading and traffic volumes. Pervious concrete pavements should be designed to withstand the traffic load and mainly for storm water. As with any pavement, proper subgrade preparation is important.

The durability is maximum for pervious concrete. Hence, concrete durability id one of the most important considerations in the design of new structures and when assessing the condition of existing structures. The main purpose of durability is about minimizing the rate of deterioration. Durability of concrete is related to the design process, specifications of materials, workmanship, environmental effects, accidents and repairs.

## REFERENCES

[1] IS10262: 2009, "Concrete mix proportioning – guidelines", Bureau of Indian standards, New Delhi.

[2] IS3812: 2013, "Pulverized fuel ash specification", Bureau of Indian standards, New Delhi.

[3] IS383: 2016, "Coarse and fine aggregate for concrete - specification", Bureau of Indian standards, New Delhi.

[4] IS516: 1959, "Methods of tests for strength of aggregate", Indian standard Institute, New Delhi.

[5] IS2386: 1963, "Methods of test for aggregates for concrete", Bureau of Indian standards, New Delhi.

[6] Neville.A.M, "Properties of concrete", 5th edition

[7] Shetty.M.S, (1982), "Concrete technology – theory and practice", S.Chand & company, New Delhi.

[8] Y.Aoki, R. Sri Ravindraraja, H.Khabbaz, (2015), "Properties of pervious concrete containing fly ash" University of Technology, Sydney.

[9] M.Harshavarthanabalaji, M.R.Amarnath, R.A.Kavin, S.Jayapradeep, (2015), "Design of eco-friendly pervious concrete", Knowledge institute of technology, India.

## BIOGRAPHIES

MR.V.PRAKASH was born in the year 1995 in Tamil Nadu. He is right now pursuing second year M.E. Construction Engineering and Management Department of Civil Engineering from Builders Engineering College, Kangayam, Tamil Nadu, India.

Mr.K.CHANDRASEKAR Assistant Professor, Dept. of Civil Engineering, Builders Engineering College, Kangayam, Tamil Nadu, India

Mr.P.VINOTH Assistant Professor, Dept. of Civil Engineering, Builders Engineering College, Kangayam, Tamil Nadu, India