

## **DURABILITY OF PERVIOUS CONCRETE FOR SUSTAINABLE APPLICATION**

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*Abstract: Pervious Concrete can be used for the low traffic carrying areas like parking areas, road sides, footpath etc. But its use for low laying application is mainly depends upon its durability. Pervious concrete which allow water to pass water deep into the ground offers high porosity due to which its durability get decrease with the time. In this study, laboratory performance have been carried out to check permeability of pervious concrete by performing loss of weight test with the help of sea water. Mix design is carried out for mix proportion 1:3 by using W/B ratio 0.40. Coarse aggregate 20mm and 10mm are selected and fly ash is incorporated by 10% of Cement. Fly ash which is a waste material generated in a tremendous amount from the thermal power station create the problem of its disposal so utilization of this material in the concrete mix reduce the problem of disposal and helps in the sustainable development. Addition of Fly ash increases the tensile strength of pervious concrete but also reduce the permeability of the mix.*

*Keywords: Durability, Fly Ash, Pervious Concrete,*

### **INTRODUCTION**

Pervious Concrete is a zero-slump, no-fines, open graded material consisting of Portland Cement, Coarse Aggregate, water and if required then admixtures are added. Pervious Concrete (also called porous concrete, permeable concrete, no fines concrete) is a special type of concrete. High Porosity used for Concrete flat work applications that allows water from precipitation and other sources to pass directly through, thereby reducing the runoff from a site and allowing ground water recharge. Pervious concrete is one of the leading materials used by the concrete industry in effective significant “green” industry practices and is considered as best management practice by the U.S.

### **DESIGN MIX MATERIALS**

During experimental study following materials have been incorporated to make pervious Concrete mix and before selection of the material various properties of cement, Fine aggregate and coarse aggregates has been checked out.

*A. Materials for the pervious concrete Mix:*



Figure 1: Pervious concrete materials

*B. Fly Ash*

Fly ash is a by-product obtained during the combustion of coal in thermal power plants. Nearly 73% of India’s electricity generation is through coal-burning thermal power stations it has been tested for various chemical ingredients for its beneficial application in the concrete.

TABLE I: - PROPERTIES OF FLY ASH

CHARACTERISTIC	VALUES (%)
SILICON DIOXIDE (SiO <sub>2</sub> )	62.22
MAGNESIUM OXIDE (MGO)	6.09
TOTAL SULPHUR TRIOXIDE (SO <sub>3</sub> )	3.00
CALCIUM OXIDE (CAO)	5.30
ALUMINIUM OXIDE (AL <sub>2</sub> O <sub>3</sub> )	7.63
FERRIC OXIDE (FE <sub>2</sub> O <sub>3</sub> )	0.13
LOSS ON IGNITION	9.98
OTHERS	5.65

SOURCE: GEO TEST HOUSE, (ISO 17025) GORWA ESTATE , VADODARA, GUJARAT

**DESIGN MIX AND RESULTS**

**A. PERVIOUS MIX PROPORTION**

The mix proportion 1:3 was selected and was used with 10% fly ash and with the OPC cement without fly ash to prepare the test samples. The design mix proportion is shown in the below tables.

TABLE II: MIX DESIGN PROPORTION

For 1m <sup>3</sup> Cube	Water/Cement Ratio	Water (Liter)	Cement(Kg)	Kapchi(Kg)	Fly Ash(Kg)	Grit (Kg)
By Weight [kg]	0.40	218	543	1629	-	1629
For 1:3 Mix		218	489	1629	54.3	1629

TABLE III: TYPES OF PERVIOUS CONCRETE

Sr. No.	Type of Concrete	Description of Mix Proportion	Water/Cement Ratio
1	A(1:3)	STANDARD 1:3 MIX PROPORTION (20MM)	0.40
2	A1(1:3)	1:3 WITH 10% FLY ASH (20MM)	
3	X(1:3)	STANDARD 1:3 MIX PROPORTION (10MM)	
4	X1(1:3)	1:3 WITH 10% FLY ASH (10MM)	

**TEST FOR DURABILITY OF PERVIOUS CONCRETE**

To check durability of pervious concrete mix, Cubes of size 150 mm X 150 mm X 150 mm was casted using different mix proportion. After 24 hours the specimens will remove from the mould and subjected to water curing for 28 days. The specimens were taken out from the curing tank and initial weight was taken. After this step, cubes was immersed in sea water for 28 days and again weighted and then weight in loss was calculated.

**RESULTS**

TABLE IV: DURABILITY OF PERVIOUS CONCRETE WITH 20MM AND 10MM AGGREGATE (KAPCHI) AT 28 DAYS

Type of Concrete	Average Flexural Strength of
A(1:3)	0.45
A1(1:3)	0.46
X(1:3)	0.27
X1(1:3)	0.36

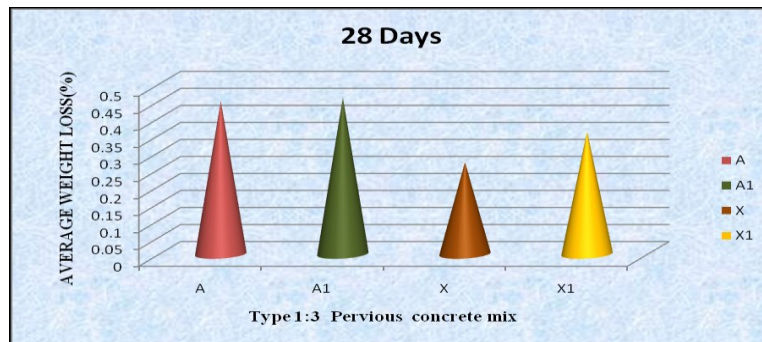


Figure 2:-Durability results for 1:3 at 28 days

From the test result for Conventional and Fly ash Pervious Concrete, we can clearly say that as fly ash has been incorporated in the Pervious Concrete mix, maximum durability, we can able to achieve for the mix proportion 1:3 with 10% replacement of the fly ash.

**Conclusion**

From this study the following conclusion can be drawn:

- From the Experimental results maximum durability for mix proportion 1:3 by using 20mm size of coarse aggregate with fly ash utilization.
- Incorporation of fly ash in the Mix shows good results but there is decrease in durability for mix X1 of pervious concrete as compared to A1 type of mix proportion.
- Fly ash utilization can help for sustainable development by using such waste material in the mix proportion.

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