
Partial Replacement of Aggregate using Porcelain & Development of Pervious Concrete

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ABSTRACT:

The Paper deals with the Partial Replacement of Aggregate Using Porcelain & Development of Pervious Concrete.

We are aiming to develop standard concrete mixes of grade M25 by partially replacing the aggregate with broken porcelain pieces and a Pervious Concrete mix. The Mix Design for M25 has been worked out following IS 10262: 2009 & IS 456: 2000.

The BROKEN PORCELAIN PIECES used herein are sourced from the Electricity board & Demolished Buildings which has been tagged Scrap.

The PERVIOUS CONCRETE whereas will be formed by Cement to Aggregate ratio 1:7 using aggregate size ~ 9mm.

Quality control will be brought out by carrying out tests on fresh batches, hardened concrete as per IS 516 : 1959 and other methods of evaluation.

The Reinforced Pervious Concrete developed is expected to allow easy seepage of storm water and prevent clogging of drains.

The project on successful completion will be a boon to metro cities and the other urban areas with high density of Concrete & Bitumen Pavements, where there is inefficiency in the storm water drainage system and those suffering from Flash floods.

It has been found that on using Porcelain as a replacement for coarse aggregate substantial cost savings and for Pervious concrete on maintaining the nominal size of aggregate as 10 mm better compressive strength was observed

KEYWORDS — PORCELAIN PIECES, PERVIOUS CONCRETE, BITUMEN PAVEMENT.

I. INTRODUCTION

Refurbished concrete using Porcelain aggregate of grade M25 has been developed. The Refurbishing material used herein is Broken Pieces of Porcelain.

The replacement of coarse aggregate has been done on volumetric basis.i.e.various percentages of coarse aggregate volume have been replaced using Porcelain aggregate.

The water cement ratio has been slightly altered considering the water absorbing nature of Porcelain.

The concrete mix was brought to required consistency by hand mixing of constituents along with water.

II.SCOPE

The Refurbished Concrete Using Porcelain aggregate has a fair feasibility due to the low scrap value of porcelain and its ease of availability making the concrete section more economical.

Since the strength parameters are satisfactory and being used for storm water drainage system. The above said concrete is widely acceptable for hydraulic Structures.

III.SOURCE OF PORCELAIN MATERIALS

The porcelain material used herein is sourced from the scrap yards of power stations & sub stations and demolition sites. The material on having a low scrap value and fair accesses makes it economical.

Advantages & Disadvantages

- Low scrap value.
- Easily available.

- Recycled material.
- Eco Friendly material.

Disadvantages

- Hazardous Material due its sharp surfaces.
- Material Handling is Tough due to the bulky nature of the material



Figure :1



Figure :2



Figure :3

Figure :1,2,3 - Alternate Material for Coarse Aggregate- Porcelain

IV. MATERIALS USED FOR REFURBISHED CONCRETE USING PORCELAIN AGGREGATE



Figur: 4PortlandPozzolona Cement



Figur: 5 Fine Aggregate – River Sand



Figur:6Coarse Aggregate- Porcelain Aggregate



Figure:7 Coarse Aggregate- Stone Aggregate



Figure: 9 Cube Samples

V. MIXING OF CONCRETE

Mixing of concrete was carried out by hand mixing using trowels as per standard specifications. A Batch of Concrete required for 3 cube moulds weremixed at a time. Similar process was carried out throughout.



Figure: 8 Mixing of Concrete

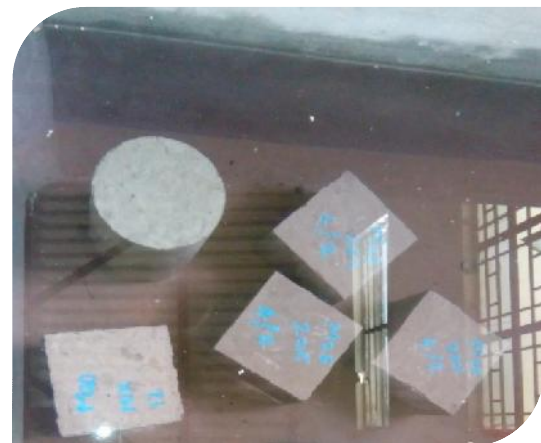


Figure:10 Cube & Cylinder Samples

VI. LAYING OF SAMPLES:

The details of Concrete samples have been detailed below:

Cube samples - 150 mm x150 m x150 mm

Cylindrical Samples - 150 mm ϕ and 300 mm Height

VII. TESTING OF FRESH CONCRETE

Slump Cone Test

	M25	M25 - 10% Porcelain	M25 - 20% Porcelain	M25 - 30% Porcelain	M25 - 40% Porcelain	M25 - 50% Porcelain
Water Cement Ratio	0.40	0.45	0.50	0.55	0.55	0.60
Slump Value	71	73	75	76	77	77

	M25	M25 - 10% Porc elain	M25 - 20% Porc elain	M25 - 30% Porc elain	M25 - 40% Porc elain	M25 - 50% Porc elain
Water Cemen t Ratio	0.40	0.45	0.50	0.55	0.55	0.60
Compa ction Factor	0.94	0.93 5	0.93 5	0.93 5	0.93 5	0.93 5

Compaction Factor Test

Cube Compression Test Results - After 7 days of Curing

Partial Replacement in %	Initial crack load (kN)	Ultimate load (kN)	Ultimate Compressive strength (M Pa)
0	342.4	502.4	22.33
10	543.8	708.8	31.504
20	595.3	751.3	33.394
30	631.8	793.8	35.282
40	688.6	858.6	37.897
50	714.2	864.2	38.410

Cube Compression Test Results - After 28 days of Curing

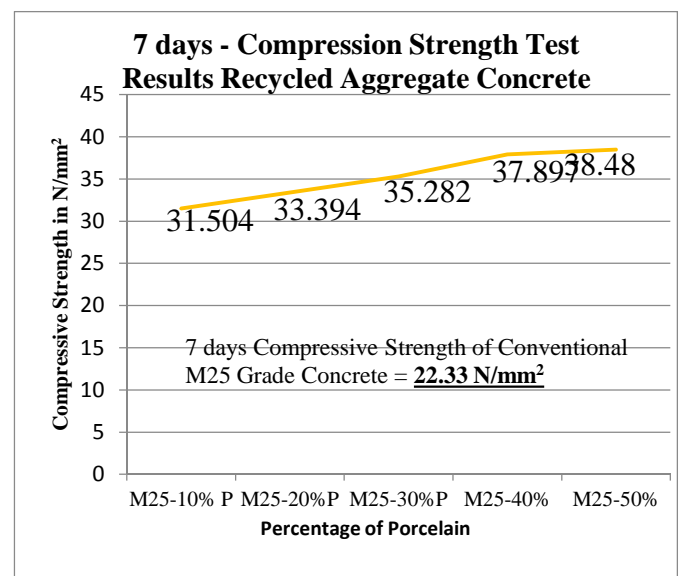
Partial Replacement in %	Initial crack load (kN)	Ultimate load (kN)	Ultimate Compressive strength (M Pa)
0	476.2	726.0	32.266
10	555.3	776.3	34.503
20	624.3	845.3	37.570
30	675.9	891.9	39.644
40	701.3	907.2	40.320
50	706.6	919.6	40.870

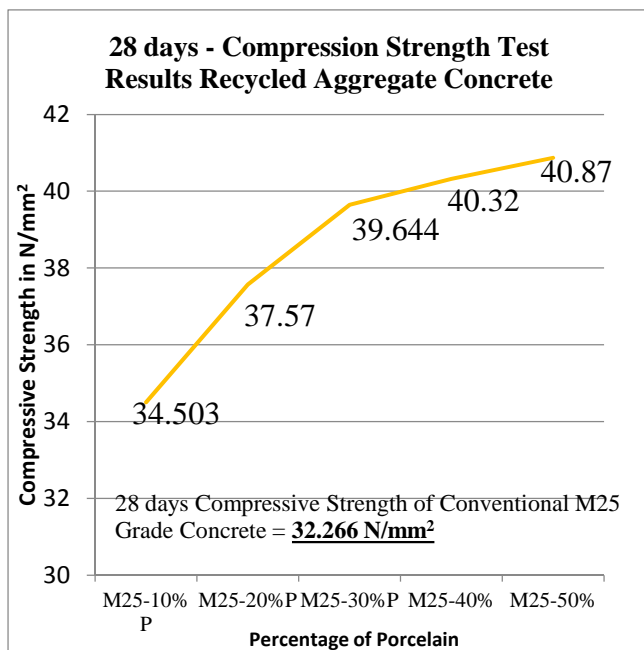
Split Tension Test Results - After 7 days of Curing

Partial replacement in %	Ultimate Split Tensile strength (M Pa)
0	15.901
10	22.052
20	22.700
30	25.750
40	23.496
50	27.271

Split Tension Test Results - After 28 days of Curing

Partial replacement in %	Ultimate Split Tensile strength (M Pa)
0	18.500
10	22.420
20	25.045
30	25.370
40	29.836
50	28.200





VIII. PERVIOUS CONCRETE:

Pervious concrete is a special type of concrete with high porosity used for concrete flatwork applications that allows water from precipitation and other sources to pass through it, thereby reducing the runoff from a site and recharging ground water levels.

The high porosity is attained by a highly interconnected void content. Typically pervious concrete has little to no fine aggregate and has just enough cementitious paste coat the coarse aggregate particle while preserving the interconnectivity of the voids

IX. SCOPE

Pervious concrete can be successfully used for pavements and slabs which are not subjected to heavy loads. Pervious concrete is also an environmentally friendly paving material that offers the durability of standard concrete while retaining storm water runoff and replenishing ground water.

On improving the strength of Pervious Concrete the same can be used for the Cover Slab of Storm Water Drains, Improving the efficiency of the system exponentially, which is one of the major objectives of this project

X. Test Results

Slump Cone Test on Porous Concrete

	Porous Concrete
Water Cement Ratio	0.3
Slump Value	12

Vee Bee Consist meter on Porous Concrete

	Porous Concrete
Water Cement Ratio	0.30
Vee Bee Degree	6secs

Compaction Factor Test on Porous Concrete

	Porous Concrete
Water Cement Ratio	0.30
Compaction Factor	0.6

Cube Compression Test Results on porous concrete -After 7 days of Curing

	Initial crack load (kN)	Ultimate load (kN)	Ultimate Compressive strength (MPa)
Porous Concrete	145.3	167.9	7.466

Cube Compression Test Results on porous concrete -After 28 days of Curing

	Initial	Ultimate	Ultimate
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	crack load (kN)	load (kN)	Compressive strength (MPa)
Porous Concrete	266.7	298.1	13.250

It is concluded that it has been found that on using Porcelain as a replacement for coarse aggregatesubstantial cost savingsand and for Pervious concrete on maintaining the nominal size of aggregate as 10 mm better compressive strength was observed.

XI. CONCLUSION: