

# Development of the Durability of Pervious Concrete by Using Crushed Seashells

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**Abstract** – Pervious concrete is one of the chief significant rising advances for supportable offices and foundation, sustainable facilities and infrastructure. Infrastructure development across the world created demand for the construction development materials. Framework improvement over the world made an interest in development advancement materials. Cement is the chief structural building development material. Concrete is the premier civil engineering construction material. We have replaced the sea shell after grinding it to the maximum size of 4.75 mm. The IS 10262-2009 was followed for the mix design of M20 grade concrete after that optimization of cement is done. Sea shell which is used in concrete confirming to the zone II as per IS 383-1970. Then cubes were casted for the 5 parts of partial replacement as 20%, 40%, 60 %, 80%, and 100 %. All the specimens are used for 7 & 28 days and tested for compressive, flexural and split tensile strength, Permeability test and Durability test is 90 days.

**Index Terms** – Pervious concrete, Shell Concrete, Workability, flexural and split tensile strength, Permeability test and Durability test.

## 1. INTRODUCTION

Concrete is the widely used material in the world. This automatically creates a huge demand for ingredient of concrete (Fine Aggregate, Coarse Aggregate and cement). From the environment point of view, the huge extraction of the aggregate creates depletion and manufacturing of cement causes pollution. This scenario affects the world's ecological balance. As a civil engineer, we have planned to replace the river sand which is widely used in construction by sea shell. Sea shell is the dead remain of the marine organism. We have replaced the sea shell after grinding it to the maximum size of 4.75 mm

Different types of seashells are used for this research mainly are names as below as.

1. CRepidula (CR)
2. Scallop (SC)
3. Queen Scallop (QS)
4. Oyster shell (OS)
5. Periwinkle

These seashells are very abundant on the Andhra Pradesh and Chennai coasts of India. They were gathered from fish organizations and exposed to various arrangements, for example, crushing and screening nearby to acquire the division 2/4 mm. Without a doubt, through past examination, the portion 2/4 mm is ideal to have a trade-off between the compressive quality and porousness to the water of pervious cement.

## IMPORTANCE OF RESEARCH

We are mainly concentrated on the eco friendly materials uses to aggregates for the construction. Infrastructure development and small area driveways are used these constructions. One more major problem solves the land wastage by the seashell wastage dump yards.

## AIMS AND OBJECTIVES

This goal of the examination proposition is to ponder the impact of the level of a seashell as a fractional substitution and different blend assignment of fine total sand supplanted the seashell. Blend assignment is sand supplanted the seashell bit by bit method is 0%, 20%, 40%, 60%, 80%, and 100%. These are utilizing the leading exploratory investigations of mechanical properties of seashell fine totals.

## 2. LITERATURE REVIEW

The present proposed study is relied upon to delivered results to upgrade the comprehension of seashell as a coarse total on cement alongside halfway substitution of bond by fly powder of 25% further it was wanted to broaden the investigations into usefulness qualities while utilizing seashell fractional substitution, this can be adequately utilized for the improved solid development with nearby materials.

## 3. MATERIALS AND PROPERTIES

This chapter briefly describes the final results of the properties of all materials used in this project. The IS codes (Indian Standard) important practice considered for all tests in the reference and all test on materials were performed by the code system is pertinent and rules.

## CEMENT

There are numerous components relies on the quality of cement wherein the quality of the bond is the profitable contemplations. The utilization of 53 Grade OPC is favored as it was seen from the past records of concretes accessible in the market. In that fundamental compound constituents of concrete are C3A, C3S, C2S.

The properties of the concrete are explicit gravity of 3.04, Normal consistency of 28%, Initial setting time and last setting time of 27 min and 535 min separately.

## FINE AGGREGATE

The material which is for the most part made out of silica and it is a dormant or artificially inert material which should go through 4.75mm IS sieve. The waterway sand which we use is from common deterioration of rocks and which has been kept by operators of enduring like the stream as a rule. The sieve examination for fine total communicated a fineness modulus of 2.36. The particular gravity of fine total is 2.59.

## COARSE AGGREGATE

Coarse total will comprise of normally happening material, for example, rock or coming about because of the breaking down of rocks. The molecule is more noteworthy than 4.75mm the total which we have utilized is of the greatest size of about 20mm and it is fit as a fiddle. The coarse total utilized in the solid blend is of ostensible size of 20 mm total with a particular gravity is 2.7. The size of totals utilized is 20mm and the grain size of sand utilized is of zone2.

## WATER

Typical faucet water was utilized to blend the solid with a water-concrete (water-cement ratio) proportion of 0.45 acquired from droop test.

## SEASHELL-BY-PRODUCTS

Seashell is additionally referred to just as a shell, is a hard, defensive external layer made by a creature that lives in the ocean. The shell is a piece of the body of the creature. Void seashells are regularly discovered appeared on shorelines by drifters. The shells are vacant in light of the fact that the creature has kicked the bucket and the delicate parts have been eaten by another creature or have spoiled out. The term seashell more often than not alludes to the exoskeleton of an invertebrate (a creature without a spine). Most shells that are found on shorelines are the shells of marine mollusks, incompletely in light of the fact that a large number of these shells bear superior to different seashells.

The seashell By-items (SBP) that was utilized for this exploration was included ruler scallop that was progressively squashed and sieved to acquire the portion 2/4mm and fine totals utilizing. It is noticed that there is no cleaning venture to

expel the polluting influences, as needs are, the natural issue and chloride particles substance is high, the molecule sizes dispersion of squashed ruler scallop.



Fig: Seashells before Crushing



Fig: Seashells after Crushing

## 4. EXPERIMENTAL PROGRAM

We have maintained the various types of mix designation casting moulds calculated the compressive test, permeability test and durability tests. The compressive quality is estimated on the cubic 15x15x15 cm examples as per the european standard en 12390. Tests were tried for the compressive quality at 28 days of age. These tests were performed utilizing a consistent stacking of 0.06 mp.s-1. The revealed outcome is normal of three to five tests.

## WORKABILITY TEST

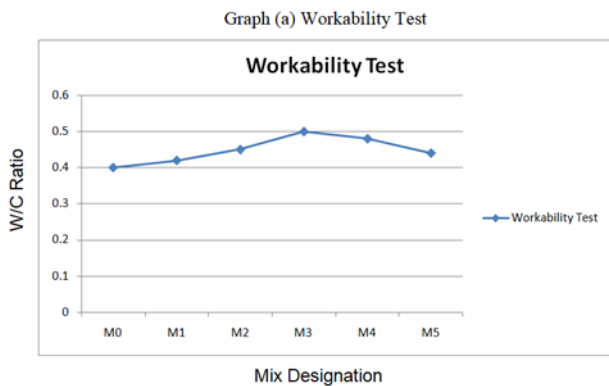
Usefulness is the primary property of the solid which will influence the measure of speculation and the nature of solid compaction. Droop is characterized as the proportion of the usefulness or ease of the solid. It is adequate to utilize both in the research facility and on location. Despite the fact that the droop test is simple, it must be done cautiously that any unsettling influence can cause a gigantic drop causing subsidence esteems. This test will bring about a noteworthy sign of the instance of blending can be put.



Fig: Slump cone test

MIX DESIGNATION	W/C RATIO
M0	0.40
M1	0.42
M2	0.45
M3	0.47
M4	0.48
M5	0.50

Table: Workability Test Mix designation and w/c ratio



M<sub>0</sub> = Normal concrete (conventional concrete)

M<sub>1</sub> = Cement, Sand 80%, Coarse aggregate and Replaced 20% of sand with Crushed Seashells

M<sub>2</sub> = Cement, Sand 60%, Coarse aggregate and Replaced 40% of sand with Crushed Seashells

M<sub>3</sub> = Cement, Sand 40%, Coarse aggregate and Replaced 60% of sand with Crushed Seashells

M<sub>4</sub> = Cement, Sand 20%, Coarse aggregate and Replaced 80% of sand with Crushed Seashells

M<sub>5</sub> = Cement, Coarse aggregate and Replaced 100% of sand with Crushed Seashells

**SPLIT TENSILE TEST**

Split tensile strength is an indirect method used for determining the tensile strength of concrete. After curing drying of these specimens for 7, 28 and 28 days are taken to test them to get the peak load at which specimen fails. These specimens are placed with its axis horizontal between plates of the testing machine CTM and load is applied gradually until the specimen fails that means specimen split into two pieces.

Split tensile strength at this breaking load =  $2P/\pi DL$

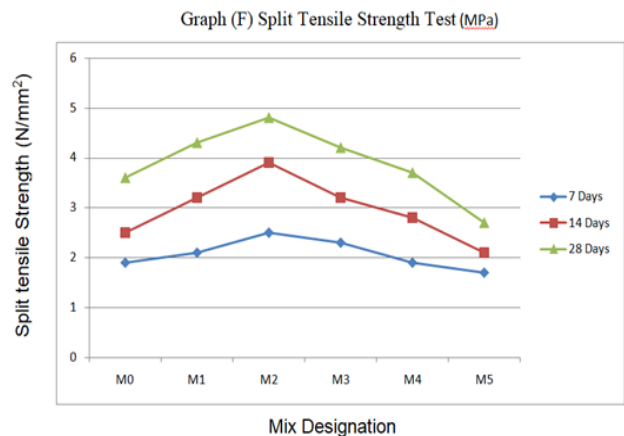
Where P = split tensile load

D = Diameter of the specimen

L = Length of the specimen

Table: Split Tensile Strength Test

S.N O	MIX DESIGNATION	7 Days (N/mm <sup>2</sup> )	14 Days (N/mm <sup>2</sup> )	28 Days (N/mm <sup>2</sup> )
1.	M0	1.9	2.5	3.6
2.	M1	2.1	3.2	4.3
3.	M2	2.5	3.9	4.8
4.	M3	2.3	3.2	4.2
5.	M4	1.89	2.8	3.7
6.	M5	1.7	2.1	2.7



**FLEXURAL STRENGTH OF SEASHELL CONCRETE TEST**

This test is done determine the flexural strength of concrete mix prepared to resist bending, the beam, is given a two point loading and the values in table and in form of a graph. it is found that the seashell replaced gives a lower flexural strength.

Table : Flexural Strength in (MPa)

% of seashell replaced	28 Days
M0	7.2
M1	6.9
M2	6.5

M3	6.1
M4	5.8
M5	5.3

Graph (G) Flexural Strength Test (MPa)

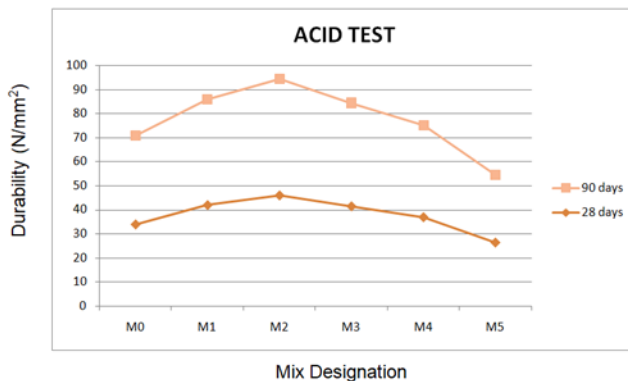
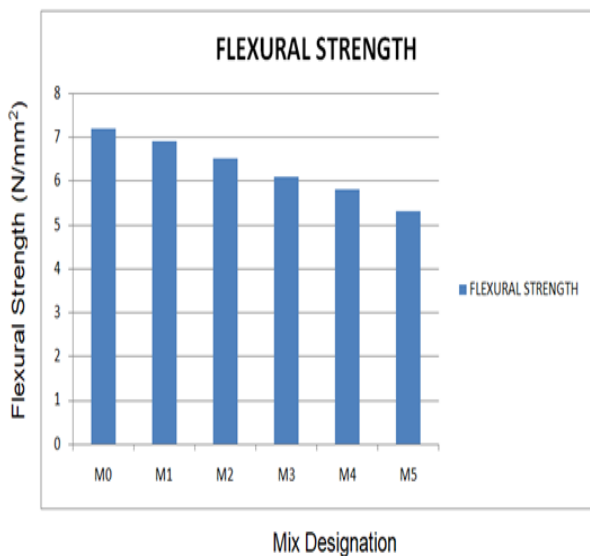


Fig: The Strength Comparison of Normal concrete and various types of mix proportion on crushed seashells test in Acid.

Durability test in Base			
S.NO	Mix Designation	28days	90days
1.	M0	38	36
2.	M1	44.2	43
3.	M2	49.3	47.2
4.	M3	42.3	42.2
5.	M4	38	37
6.	M5	28.2	27.5

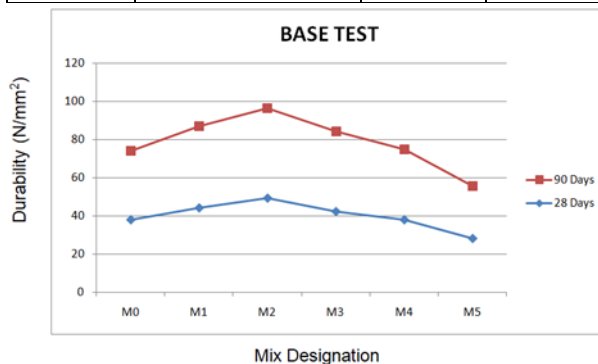


Fig: The Strength Comparison of Normal concrete and various types of mix proportion on crushed seashells test in Base.

**DURABILITY TEST**

To check durability of pervious concrete mix, Cubes of size 15cmX15cmX15cm was casted using different mix proportion. Next 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.

Durability test in Acid			
S.NO	Mix Designation	28days	90days
1.	M0	34	37
2.	M1	42	44
3.	M2	46	48.5
4.	M3	41.5	43
5.	M4	37	38
6.	M5	26.5	28

**PERMEABILITY TEST**

The penetrability coefficient of the pervious cement is essential to guarantee legitimate structure and work for porousness asphalt. Furthermore, water ought to be completely penetrated when it downpours, paying little heed to how substantial the precipitation is. The penetrability to the water of pervious cement with or without squashed shells fluctuates somewhere in the range of 2.2 and 3.4 mm.s-1.

It very well may be seen that the variety of the pervious solid penetrability is exponentially corresponding to the porosities.

S.NO	Mix Designation	Permeability test (mm/sec)
1.	M0	$5.37 \times 10^{-3}$
2.	M1	$4.04 \times 10^{-3}$
3.	M2	$3.73 \times 10^{-3}$
4.	M3	$5.96 \times 10^{-3}$
5.	M4	$6.34 \times 10^{-3}$
6.	M5	$7.37 \times 10^{-3}$

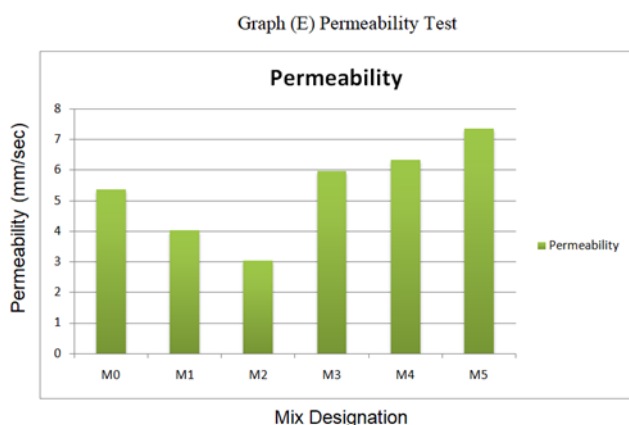


Fig: The Permeability and various types of mix proportion on crushed seashells.



## 5. CONCLUSION

The motivation behind this examination was to build up a pervious solid utilizing reused clam shells as the total. To achieve this, the accompanying assignments were performed.

In this investigation, seashells were utilized as a total to make pervious cement. The investigation focuses on the toughness of pervious cement from the squashed shells (Crepidula, scallops, and ruler scallop).

The squashed shells are more delicate than the regular totals.

Pervious cements produced using the squashed shells have lower mechanical quality than control pervious cement without shells. In addition, the pervious cement with shells is generally utilizable for applications, for example, low-traffic stopping territories.

Draining of pervious cements rapidly happens after contact with the filtering arrangement; the nearness of the shells seems to impact the amount of filtering calcium. For sure, the calcium carbonate in the shells separates in demineralised water to discharge calcium.

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