

# Comparative Study of Concrete Strength by Partial Replacing of Coarse Aggregate with Crushed Tiles and Sea Shell

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## Abstract

Concrete is a very important component of construction material which is used in all country. This importance has created a huge demand for concrete manufacture. Henceforth the cost of concrete is also increasing nowadays. Because of this condition the construction has become very expensive. This coupled with harmful consequence of concrete manufacture on the environment lead to studies on various materials which could be used as partial replacement for coarse aggregate. This has necessitated investigate into optional materials of construction and analysing the compressive behaviour and split tensile strength of the concrete which was designed by partial replacement of the coarse aggregates by construction tiles waste and sea shell. For this research, M25 Grade of concrete was selected. The comparative study of strength obtained by the mix design by varying the replacement ratios of coarse aggregate by sea shell and construction tile waste was also done. Fine aggregate and coarse aggregates samples are sieved and the sample required is selected accordingly. Specific gravity test is done for fine and coarse aggregate. In our project Design mix use for M25 grade for using 1:1:2 with ratio 0.50. The crushed tiles and seashell were cast the cube test for slump test and compressive strength and we tested in the interval of 7 days, 14 days and 28 days.

## 1. Introduction

Construction works in India depend to a very large extent on concrete. Concrete is the vital building material in the construction industry that can be delivered to the job site in a plastic state and can be cast into required mould. The constituents of concrete are cement, fine aggregate, coarse aggregate and water. The primary scope of our study is to insist the use of replaceable products as construction materials in low-cost. The pollution caused by the waste in construction field and to recycle the same, it has created an urge among civil engineers to develop new materials. These include the use of by-products and waste materials in building construction. Many such recyclable materials are used as replacement material for coarse aggregate. This also gives light weight to concrete in high strength. Naturally occurring and construction waste are selected for such replacement instead of coarse aggregate, manufactured aggregates, and aggregates from industrial by-product. Seashell which acts as waste material has been selected in this study to add partially in aggregate. After the death of sea shells the muscles and soft part of sea shell decay. This is consumed by other sea animals in the deep sea and oceans. This hard shell becomes fossils. This is due to chemical composition of hard shells. This hard shell has 90% of calcium carbonate which contributes to hardness and behaves as protective outer layer of animals that live in sea.

## 2. Literature Rivew

**Aruna D (2015)[1]**

In place of tile waste based concrete, coarse aggregates were exchanged by 20mm down size, tile wastes by 0, 6%, 12%, 18%, 24% and 30% and also the cement is partially exchanged by fly-ash. The average maximum characteristic compressive strength of construction waste tile aggregate concrete is obtained by replacing at 25%. A decrease in strength of 10-15% is observed compared to conventional concrete at 25% replacement of construction waste tile aggregate. The workability obtained by construction tile waste concrete was found to be medium. Overall, the replacement of tiles in concrete is satisfactory for small constructions.

**Batruti Monhun R. Marwein (2016)[2]**

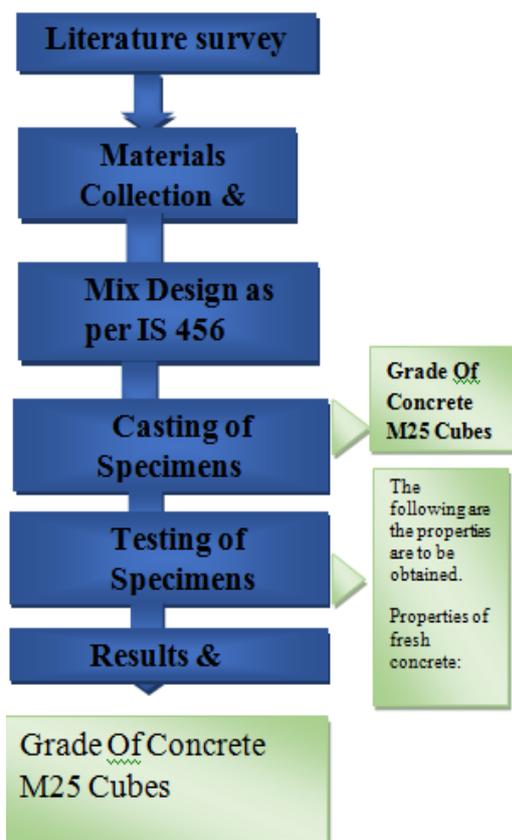
The ceramic tiles waste take on is broken tiles. Ceramic tiles waste concrete prepared using these tiles waste at 0%, 15%, 20%, 25% and 30%. M20 grade concrete is taking a constant water cement ratio of 0.50 is keep up for all the concrete mixes. The important characteristics of concrete like workability for garden-fresh concrete, as well characteristic Compressive Strength, Split Tensile Strength are found at 3, 7day and, 14 day and 28 days. The paper suggests that the replacement of waste tile aggregate should be happening the range of 5-30% and also it is suitable to ordinary mixes like M15 and M20.

**Falade, Ikponmwosa and Ojediran (1995)[3]**

Considered the performance of lightweight concrete having sea shell at higher temperature and set up characteristic compressive strength reduced with increase in water/cement ratio and temperature.

A. P. Adewuyi and T. Adegoke et al (2008)[4]:-Determined that the strength of a sea shell concrete is determined base upon the properties of the sea shell and also about the quantity of measurement alternative; Concrete with 35.4% and 42.5% sea shells are found to provide the minimum 7-days cube strength values of 19.9 N/mm<sup>2</sup> and 13.9 N/mm<sup>2</sup> expected for concrete mixes 1:2:4 and 1:3:6, respectively.

### 3. Methodology



#### Material Used

In this investigation, the following materials were used for the mix design:-

- I. Ordinary Portland cement of grade 54 cement conformed to IS: 169-1989.
- II. Aggregate (Fine and coarse) conformed to IS: 2386-1963, code of practice
- III. Water.

#### 3.1 Mix Design

M25 GRADE CONCRETE (Standard)

Mix design calculations

- 1. Grade designation = M25
- 2. Type of cement = OPC 53 Grade
- 3. Maximum size of aggregate = 20mm
- 4. Minimum cement content = 300kg/m<sup>3</sup>
- 5. Maximum water slump value = 0.50
- 6. Workability = 100-120mm
- 7. Exposure condition = Moderate
- 8. Type of aggregate=Crushed angular aggregate
- 9. Maximum cement content = 340kg/m<sup>3</sup>

#### Material Specification:

- 1. Cement used = OPC 53 Grade
- 2. Specific gravity, cement = 3.15
- 3. Specific gravity, coarse aggregate

(Test data for materials 20mm) = 2.67

- 4. Specific gravity of fine aggregate = 2.65
- 5. Water absorption of coarse aggregate = 0.5%.
- 6. Water absorption of fine aggregate (M. sand) = 2.5%
- 7. (i) Free (surface) moisture coarse aggregate = Nil.
- (ii) Free (surface) moisture fine aggregate = Nil.

### 3.2 Mix Proportion for Standard Concrete (1m<sup>3</sup>)

CEMENT	FINE AGGREGATE	COARSE AGGREGATE	WATER
336 kg/m <sup>3</sup>	834kg/m <sup>3</sup>	1114kg/m <sup>3</sup>	158kg/m <sup>3</sup>
1	2.48	3.31	0.47

### 3.3 Mixing Materialpreparation for Project

#### 3.3.1:-Mixing of material and const. Waste tiles



#### 3.3.2:- Mixing cement for casting cube.

REPLACEMENT DETAILS	SLUMP VALUE
30% Crushed Tiles	120mm
20% Crushed Tiles	110mm
30% Sea Shell	70mm
20% Sea Shell	50mm

#### 3.3.3:-Design mixture in fresh concrete.



#### 3.3.4:- Preparation for casting.



### 3.4:- Slump Cone Test-Fresh Concrete Test

Slump test is used to determine the workability of fresh concrete. Mould for slump test, non porous base plate, calculating scale, tamping rod all the materials used for carrying out the test. The mould for the test in the form of the frustum of a cone has height 30 cm, bottom diameter 18 cm and top diameter 12cm. The tamping rod of steel 18 cm diameter and 55 cm long and rounded at one end. Fresh concrete is poured into slump in 3layer of 25 tamping and then slump is reposed upward. Distance of all in fresh on top of slump is measured.



1.	30% Crushed Tiles	24.2
2.	20% Crushed Tiles	28.7
3.	30% Sea Shell	21.3
4.	20% Sea Shell	25.2

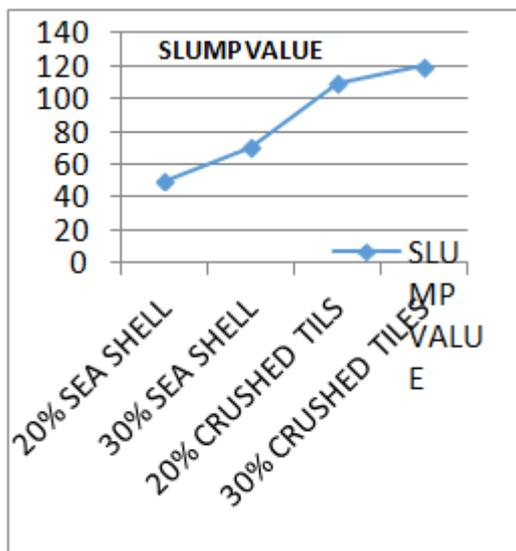
**Table4.2:**

Si. No.	Replacement Details	Compressive Strength Test(N/mm <sup>2</sup> )
1.	30% Crushed Tiles	18.1
2.	20% Crushed Tiles	22.3
3.	30% Sea Shell	14.9
4.	20% Sea Shell	18.7

## 4. RESULTS

### 4.1 Slump Test

#### 4.1.1 Slump Test Graph



### 4.2 Compression Strength Test

The specimen is tested by universal testes machine after curing the specimen for 7 days, 14 days and 28 days . Load should be applied at rate of 140kg/cm<sup>2</sup> per minute till specimen crack and yield load is noted. Load at the failure divided by area of specimen gives the compressive strength of concrete at that particular age. Similarly compressive strength is calculated for all ages.

**Table4.1:-** Compressive Strength test results in 7days.

Si. No.	Replacement Details	Compressive Strength Test(N/mm <sup>2</sup> )
1.	30% Crushed Tiles	19.6
2.	20% Crushed Tiles	23.9
3.	30% Sea Shell	16.2



**Fig 4.1:-**Compressive Strenght Test.

#### Compressive Strength of Cylinder:-



**Fig 4.2:-** Test for cylinder.

**Table 4.3:** Comparison of Compressive Strength of Cube of M25 Graph:-

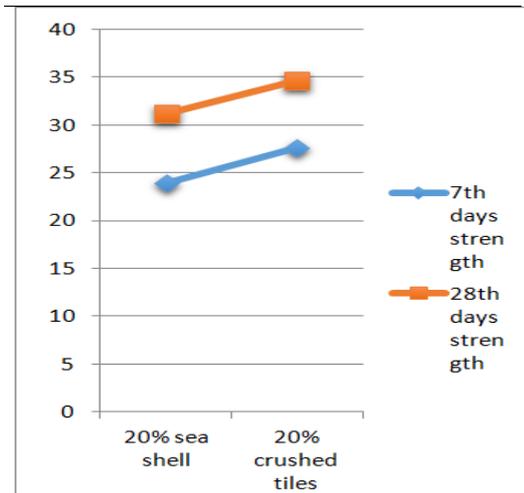
Si. No.	Replacement Details	Compressive Strength Test(N/mm <sup>2</sup> )
1.	30% Crushed Tiles	19.6
2.	20% Crushed Tiles	23.9
3.	30% Sea Shell	16.2

4.	20% Sea Shell	20.3
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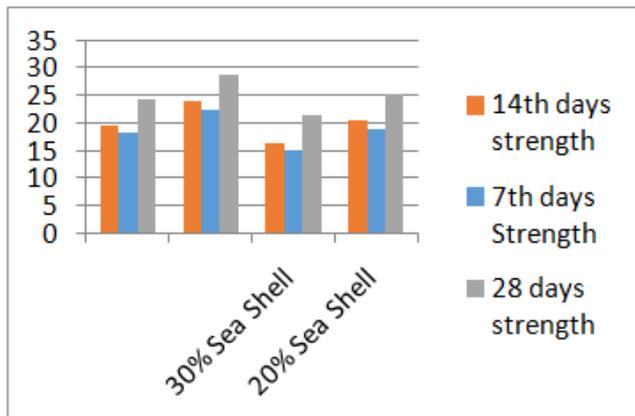
**Table 4.4:** Comparison Of Compressive Strength Result

Replacement Details	7 <sup>th</sup> Days Compressive Strength(N/mm <sup>2</sup> )	28 <sup>th</sup> Days Compressive Strength(N/mm <sup>2</sup> )
20% Crushed Tiles	27.6	34.65
20% Sea Shell	23.9	31.15

**Comparison of Compressive Strength of Cylinder of M25 Graph**



**Fig 5.2:-**Variation of compressive strength of sea shell and crushed tiles.



**Fig 5.3:-**Graphical variable of cube compressive strength of Replacing with ages.

**Split Tensile Test**

The split tensile behaviour of concrete is one of the preliminary and important property. Split tensile strength test on cylindrical concrete to determine the tensile behaviour of concrete.

The concrete is generally weak in tension since it is brittle in nature and does not resist the tension force. The concrete develops crack when subjected to tensile forces.

Thus, it is required to find the tensile characteristics of concrete to find point of application of load at which the concrete member fails.

**5. Conclusion**

The mechanical behaviour of concrete by partial replacement of seashell and crushed tiles as coarse aggregate were investigated

and presented. The following results can be over and done with based on the analysis.

The above calculation, it is concluded that the crushed tiles form to be more strength compare to the sea shell.

It is also found that the strength increase in as the replacement ratio decrease hence it is economical and best concreting.

A study on properties of concrete made with combination of sea shell aggregate and tile aggregate in different proportions can be investigated to enhance the concrete properties and also to reduce the pollution or waste generation from construction industry.

The split tensile strength of ceramic tile aggregate is very much in a straighter path compared to the sea shell aggregate.

Crushed tile aggregate in high strength concrete can be studied further to check the possibility of its use in high rise buildings.

After performing workability test observed that, when increasing percentage of sea shell and crushed tile pieces in concrete leads to the decrease in workability of the concrete.

Utilizing of waste materials such as sea shell and crushed tiles in developing green concrete should be explored, expended and supported through focus researches. Development of green concrete should be proved through.

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