# Sustainable Lightweight Concrete: The Role of Vermiculite in Fine Aggregate Replacement

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## ABSTRACT

This study presents an experimental investigation on light weight concrete by using vermiculite with fine aggregate replacement (25%, 30%, and 50%). Light weight concrete i.e., by the inclusion of air in concrete. After each mix proportion, 27 cubes and 9 cylinders specimens are cast and cured. The specimens are cured in water for 7, 14, 28 days .Light weight concrete is of utmost importance to the construction industry. The most important characteristic of light weight concrete is the relatively low thermal conductivity, decreasing density. The compressive strength and split tensile strength are carried in the universal testing machine. In order to make concrete a structural material by improvising it to an extent where self weight is been decreased and efficiency is increased .vermiculite with concrete enhances shrinkage, crack resistance fire resistance diminishing environmental impact and cost.

**KEYWORDS**: Vermiculite, compressive strength, split tensile strength, cement, Fine aggregates, coarse aggregates.

## I. INTRODUCTION

As Two-thirds of the world's surface is comprises of water. It is, therefore, so regular that there has been much activity involving concrete in the sea in recent decades. Numerous ideas and schemes have been promoted and many have been executed. Vermiculite is a phyllosilicate mineral group and is micaceous in nature and laminar structure. It is not found in so many parts of the world but only a limited number of sources are worked as commercial deposits. The concrete made with vermiculite as aggregate, therefore, will have very low density and hence very low strength. When heated Vermiculite adopts it commercial property of exfoliation to a yellow colour bronze mass makes it look to be a cluster of worms-where the Italian word vermicular means worm from which the word vermiculite is originated.

## II. LITERATURE REVIEW

Light weight concrete induces an inherited property of concrete i.e., expanding which increases the volume of mixture which imposing additional features like ability and reduces the dead weight.

It was first introduced by the **Romans** in the second century where '**The Pantheon'** has been constructed using pumice, the most usual type of aggregate used in that particular year. From there on, the usage has been so often that concrete has been spread widely across countries like USA, United Kingdom and Sweden. It is highly reliable that there is an eventual rise in faster building rates and gradual reduction of dead load and lower haulage and handling cost.

Its advantages are that there is a reduction of dead load, faster building rates in construction and lower haulage and handling costs. The building of 'The Pantheon' of light weight concrete material is still prominent in Rome until now for about 18 centuries. It also ensures an economic advantage while using lighter materials in concrete.

**M.R. Divya et al.,** (2016) have study M20 grade concrete using vermiculite as partial replacement with 25%, 40%and 50% to the total weight of fine aggregate. Massive study is held to study the parameters such as compressive strength and tensile strength of concrete.

**S Syed Abdul Rahman and Gijo K Babu (2016)** In their study, structural light weight aggregate concrete was designed with the use of natural vermiculite aggregate that will provide an advantage of reducing dead weight of structure and to obtain a more reasonable structural light weight concrete by the use of aggregate.

**S. Sharmila and L.Vijayan (2016)** Have study replacement of the fine aggregate with the material called vermiculite .It belongs the family of light weight concrete aggregate. The exfoliated vermiculite is used as a replacement of fine aggregate.

## III. OBJECTIVES

The objectives of these studies are:

- To compare the weights of conventional concrete and light weight concrete.
- Improves the strength of M20 grade concrete by using admixtures.
- To determine the compressive strength and split tension strength of concrete.

## IV. METHODOLOGY

- This invokes nominal mix design m20 proportion.
- Fill the concrete mould by required quantities.
- In order to eliminate airspaces or voids compaction must be proceeded.
- Three equal proportionate layers of concrete must be filled.
- Compaction rod has 380 mm long bar, weighs 1.8kgs and has a 25mm square end for Rammering.
- Finishing must be done up to the mould when excess, remove it by using trowel or rod.

The following tests were conducted:

- Slump cone test
- Compaction test
- Normal consistency test
- Initial setting time
- Bulk density of coarse aggregates
- Bulk density of fine aggregates
- Specific gravity of cement
- Specific gravity of vermiculite

## V. RESULTS

**Weight comparsion between conventional concrete and light weight concrete**

| NO OF DAYS | 0% | 25% | 50% |
|---|---|---|---|
| 7 days | 9.270 | 8.320 | 7.950 |
| 14 days | 9.090 | 8.030 | 7.520 |
| 28 days | 8.950 | 8.090 | 7.960 |

**Strength comparsion between conventional concrete and light weight concrete**

| VERMICULITE | O% | 25% | 50% |
|---|---|---|---|
| Compressive strength(N/mm2) | | | |
| 7 days | 37.33 | 8.13 | 7.48 |
| 14 days | 37.77 | 9.02 | 8.49 |
| 28 days | 44.44 | 13.33 | 8.80 |

**Tensile strength for light weight concrete**

| VERMICULITE | 25% | 50% |
|---|---|---|
| Split tension test (N/mm2) | | |
| 7 days | 0.21 | 0.342 |
| 14 days | 0.67 | 1.029 |
| 28 days | 0.92 | 1.061 |

## VI. REFERENCES


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