

Analysis of Compressive Strength of Concrete with Partial Replacement of Cement with Marble Powder

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Abstract: This paper presents an analysis of compressive strength of concrete with partial replacement of cement with marble powder

Keywords: Cement production Marble dust, calcinating limestone

1. Introduction

Cement is the key ingredient in concrete products and it is considered as one of the most important infrastructure building materials around the world. Cement production is not only one of the most energy-intensive materials of construction but also is responsible for a large amount of greenhouse gases. Producing a ton of Portland cement releases approximately 1 ton of carbon dioxide into the atmosphere. The global release of CO₂ from all sources is estimated at 23 billion tonnes a year and the Portland cement production accounts for about 7% of total carbon emissions. Furthermore, mining large quantities of raw materials such as limestone, clay, and fuel such as coal, often results in extensive deforestation and top-soil loss. The cement industry has made significant progress in reducing CO₂ emissions through improvements in process and efficiency, but further improvements are limited because CO₂ production is inherent to the basic process of calcinating limestone. The cement industry does not fit the contemporary picture of a sustainable industry because it uses raw materials and energy that are non-renewable; extracts its raw materials by mining and manufactures a product that cannot be recycled. The environmental impact of the concrete industry can be reduced through resource productivity by conserving materials (cement, aggregate) and energy for concrete-making and by improving the durability of concrete products. This task is challenging but can be accomplished if pursued diligently. Concrete may be defined as a mixture of aggregates with a binding material, after aggregate cement is the major component of concrete. The yearly production of cement is nearly 3 billion tons. The construction industry relies heavily on cement for production of concrete. Nearly 8% of the global CO₂ emission is contributed by cement industries. Reducing the consumption of cement in

the concrete will thus reduce the emission. The quality of concrete is determined by the quality of mix. Its great adaptability and relative economy in filling wide range of needs has made it a competitive building material. The demand of concrete for today's infrastructural expansion is increasing gradually. Following a natural growth in population, the quantity and variety of waste materials have increased accordingly

2. Literature review

A literature review is necessary to know about the research area and what problem in that area has been solved and need to be solved in future. A proper literature review provides solid background for a noble research work. To start a research work, the first step is to find the problem of research and to choose specific objectives of need. There has been many procedures and processes defined by the researchers to undergo through and arrive at certain conclusion of research objectives. In order to choose specific objectives of research on need to follow a typical process to arrive at the conclusion of uniqueness, novelty and significance of the problem in a specific area / sub area. One has to start with a broader domain of some area / sub area and while doing study of literature narrow down the domain to specific point of issue to decide upon. Literature survey includes the study of various sources of literature in the area of research. It includes finding the related material from magazines, books, research articles, scientific research papers published in various conferences, journals & transactions. Study and understanding the literature other than scientific research papers is bit easy as it elaborates the concepts in simple and explanatory techniques. At the same time these contents cannot be considered as base to arrive at the conclusion of framing research objectives as it is not supported through proper review by various researchers working in the area. Review of a scientific research paper is a tedious job. It needs the prior knowledge of the area of research. The scientific research papers are highly structured, compact and precise in explanation. One may take few days to few weeks to understand

a research paper published in standard peer reviewed journals. The researchers need to adopt certain path for doing literature review of such literature. One of the typical processes was followed by us to make a literature review and frame the objectives of research. The process diagram is shown in which includes in all five stages defined as under. All research papers under the following sections, describes the particular issues found in the

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A. Objective

The main objective of this study is to replace the certain percentage of cement with marble dust and addition of steel fiber to gain the best result in conjunction with the compressive strength, split tensile strength, flexural strength and workability of concrete etc. The upshot of this debate will lead us to save Environmental problems that are caused by the Residuals of Marble dust at the disastrous level with the satisfactory outcome. Including this following are the objectives of the work:

- To design MD based SFRC mix specimens.
- To design normal OPC based Concrete specimens (Control mix).
- To prepare specimen and carryout various tests as per IS-CODE provision.
- To compare the performance and give inference.

B. Methodologies used by the researchers

Methodology opted by many investigators is either experiment based or modeling based. The Use of steel fiber, marble dust as Partial Replacement of Cement in Concrete affects properties of concrete like Compressive Strength, Split tensile strength, Flexural strength, Workability, Water Absorption, etc. So, if we are partially replacing Cement with MD and it needs to withstand all the critical conditions and that must be similar to the data's which are obtained from complete involvement of Cement in Concrete. So, that it could be practically used in Industrial level and have optimum benefits as well as it'll be great help for taking step to save environment.

Following tests have been conducted by the Researchers for testing the Specimens that were prepared with Partial Replacement of Concrete:

- Compressive Strength Test
- Split Tensile Strength Test
- Flexural Strength Test
- Workability Test
- Water-Absorption Test
- Consistency Test

C. Technologies

- Compression testing machine (CTM)
- Universal Testing machine (UTM)
- 4P bending machine

- Slump cone apparatus
- Compaction factor apparatus
- Concrete moulds
- Concrete Mixer

4. Conclusion

- The partial replacement of marble dust gives satisfactory results in all the strength criteria like, increment in 7 and 28 days compressive strength was found to be 21.6% and 22.3%, increment in 7 and 28 days split tensile strength was found to be 33.8% and increment in 28 days flexure strength was found to be 38.6%.
- Compressive strength of concrete increased with addition of marbel dust (0% to 15%) after 7 days & 28 days. It was also observed that optimum percentage increment in compressive strength of concrete was 21.6% for 7 days curing and 22.03% after 28 days curing (from 0% to 15% addition of marbel dust) which was actually found at the addition of 15% of marbel dust.
- Split tensile strength also increased when percentage of marbet dust (0% to 15%) added in concrete after 7 & 28 days curing. The optimum percentage increment in split tensile strength was 54% for 7 days curing and 33.8% for 28 days that was found at 15% of marbel dust. This trend observed because modulus of elasticity of matrix is much lower than marbel dust.

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