

Investigation on the Properties of Concrete by Replacing Coarse and Fine Aggregate with Granite Waste and Crushed Tiles, Quarry Dust

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ABSTRACT

In India, Concrete is the main constituent material for construction purpose. Concrete consists of cement, sand, aggregate and in some cases admixtures are used. Since concrete is majorly used construction field, the ingredients present in concrete are led to scarcity. Due to this reason, the demolished construction waste and solid waste from manufacturing units are used as replacement material, to reduce the need of natural aggregate. First part of the study, deals with the compressive strength of concrete by partial replacement of fine aggregate with crushed tiles and coarse aggregate with granite cutting waste with various percentage such as 15%, 30% and 50%. Second part of the study, deals with the compressive strength of concrete by partial replacement of fine aggregate with quarry dust and coarse aggregate with granite cutting waste with various percentage such as 15%, 30% and 50%. From the study, it was found that 30% replacement in concrete was the optimum percentage, beyond which the compressive strength reduces. From the test result, the specimens were casted with replacement of fine aggregate with 15% crushed tiles aggregate, 15% of quarry dust and 30% of crushed granite aggregate in replacement with coarse aggregate. From the test results, it was found that the replacement of fine and coarse aggregate with crushed tiles, quarry dust and crushed granite respectively depicted improvement in the compressive strength and splitting tensile strength of concrete. By the replacement of natural resources with environmental waste and construction waste leads to decrease in scarcity and environmental pollution.

KEY WORDS: Crushed Tiles, Crushed granite, Quarry dust.

1. INTRODUCTION

Now a days aggregate become costly for the usage in construction industry. The aggregates are chosen according to the use, environmental conditions and availability of the aggregate. Development of a country depends upon the infrastructure and construction works carried out. For the development purpose the natural resources are being depleted. So, necessary steps for the future must be taken to save the natural resources. Various methods were developed to save the natural resources from depleting. One of the methods used was replacing the natural resources with waste material such as construction waste, environmental waste etc. This will help us to ensure the sustainability environmental pollution and depletion of natural resources. In this project, the environmental waste such as crushed granite, crushed tiles and quarry dust were reused instead of natural aggregate.

The maximum compressive strength was obtained for the concrete mix of 20% of tiles powder replaced as fine aggregate (Hemanth Kumar, 2015). 40% replacement of quarry dust as fine aggregate gives maximum result in compressive strength than normal concrete and then decreases from 50% (Hanumantha Rao, 2016). Substitution of 10% of sand replaced by granite powder was the most effective in increasing the compressive and flexural strength (Rosa Vasconez, 2016). The compressive strength of concrete is same with the conventional concrete only at 10%, 20%, 30% replacement of granite waste as coarse aggregate and it is reduced at 40% and 50% (Haripriya, 2016).

In this paper, Natural fine aggregate (NFA) was partially replaced by crushed tiles (CT) and quarry dust (QD) and natural coarse aggregates (NCA) was partially replaced with crushed granite aggregate (CGA). This replacement was carried out with various percentages such as 15%, 30% and 50%. The fresh concrete and hardened concrete properties were tested. The workability of the concrete was tested by the slump value and the compressive and splitting tensile strength of concrete was determined under various percentage of replacement. The compressive strength and splitting tensile strength was determined at 7, 14, 28 days with various replacements of fine and coarse aggregate.

2. MATERIALS AND SETUP

The basic materials of concrete are tested and results are obtained. The replacing materials of fine and coarse aggregate are tested for its properties. The various tests on cement, NFA and NCA were conducted as per Indian Standard (IS) codal recommendations. Ordinary Portland Cement (OPC) cement was used with grade of 53. The specific gravity and fineness of cement was found to be 3.15 and 7% respectively. The initial and final setting time of cement was found to be 45 mins and 553 mins respectively. The compressive strength of mortar cubes at 7, 14 and 28 days was 24 MPa, 35 MPa and 52 MPa respectively. The NFA, NCA, QD, CT and CGA were tested and results are given in table.1.