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Mangalore Tile Waste As Coarse Aggregate In Concrete

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ABSTRACT

Concrete is the most widely used man made material, with constituents of cement, fine aggregate, coarse aggregate and water. In which the coarse aggregate occupies three fourth of the volume of concrete and influences the properties and performance of concrete with various physical, chemical and thermal properties. Concrete has several appealing characteristics that have made it as a widely used construction material. It is the material of choice where strength, performance, durability etc., are required and concrete is undoubtedly most versatile construction material. The present study aims at utilization and to ascertain the suitability of tile aggregate as partial replacement to coarse aggregate in normal concretes. The strength performance of these concretes with conventional concrete is studied and important findings are reported.

INTRODUCTION

Concrete is the most widely used manmade construction material and studies indicating that this trend will continue to be so in the years to come. The constituents of concrete are cement, fine, coarse aggregate and water. Coarse aggregates which occupy nearly 70 to 75% volume of concrete are sometimes referred as ingredients in more than one sense. Aggregates are in general cheaper than cement and impart greater volume stability and durability to concrete. However it is now well recognized that physical, chemical and thermal properties of aggregates substantially influence the properties and performance of concrete. Hence selection and use of aggregates are important considerations in economical as well as technical aspects. In general classification of aggregate can be done on the basis of their sizes, geological origin, soundness, unit weight etc,. As far as the sizes are concerned, aggregates range from a few microns to a few centimeters. The maximum size of coarse aggregate used in concrete may vary but in each case the aggregate is to be graded that particles of different size fractions are incorporated in the mix in appropriate proportions. The properties and performance of concrete are dependent upon characteristics and properties of aggregates to a large extent and thus the knowledge of properties of aggregate is inevitable. In case of marginal aggregate, the record of performance of concrete made with them may be the best guide. In general the aggregate which brings about the desired quality in concrete with economy should be selected.

THE UTILITY OF PARTIAL REPLACEMENT OF TILE WASTE AS AGGREGATES

The use of more and more concrete in construction not only results in scarcity of materials but also turns out to be expensive. In order to cope up with the depletion of conventional resources it would be worth to make use of suitable by-products to replace some of the

conventional materials. The industrial wastes like fly ash and tile aggregates, which are produced in huge quantities that cause environmental pollution need safe disposal. But these materials possess potential characteristics, which can be tapped for various uses. Thus, by using these wastes instead of conventional materials would be preserving the natural resources, but also solving the problem of disposal of waste, which has become a national problem. There are quite a number of clay tile manufacturing industries existing in Dakshina Kannada district, located in the coastal belt of Arabian Sea. A brief survey was made regarding the availability of the broken tiles. There are nearly 74 tile factories in the whole Dakshina Kannada district producing about 6000 patented Mangalore roof tiles per factory per day, out of which about 2% results as wastage. Taking the weight of the single tile as about 2 kg it comes to about 18 tonnes of waste produced per day. Disposal of such a huge quantity is a severe problem to the tile manufacturing industries. Fly ash is available in large quantities in the country as a waste product from a number of thermal power stations and industrial plants. Its disposal and pollution effects are posing serious problems. Almost all the fly ash produced in the country possesses good pozzolanic activity. Fly ash can be used as part replacement to OPC. In addition to saving in the cement and cost, the fly ash cement mortar and concrete possess lower permeability and better workability. Conventional Portland cement concrete is generally used for pavement construction. The impervious nature of the concrete pavements contributes to the increased water runoff into the drainage system, over-burdening the infrastructure and causing excessive flooding in built-up areas. Pervious concrete has become significantly popular during recent decades, because of its potential contribution in solving environmental issues. Typically, pervious concrete has no fine aggregate and has just enough cementitious paste to coat the coarse aggregate particles while preserving the interconnectivity of the voids. However, usage of fine aggregates to the extent of 10% in pervious concretes is reported in literature. It has been mainly developed for draining water from the ground surface, so that storm water runoff is reduced and the groundwater is recharged. Pervious concrete has been developed in USA in order to meet US Environmental Protection Agency (EPA) storm water regulation requirements. European countries have developed pervious concrete, not only for water permeability but also for sound absorption. In Japan, pervious concrete has been researched for the usage in not only for road surfaces but also to support vegetation along river banks. Strength and permeability of pervious concrete are found to be affected by several factors including binder types, aggregate type, aggregate grading, mix combination, compaction and water content. The compressive strength for highly pervious concrete is half or one-third that of conventional concrete. The present study aims at utilization and to ascertain the suitability of tile aggregate as partial replacement to coarse aggregate in normal concrete.

TEST RESULTS AND DISCUSSION

Values of compressive strength at different percentage of replacement of Mangalore tile at different age are given below:

Compressive Strength of Mangalore Tile Concrete (N/mm^2)

Days	0%	10%	20%	30%
7	18.66	18.32	16.84	14.04
28	31.44	31.02	28.98	25.45

The compressive strength of conventional concrete is 18.66 N/mm^2 and 31.44 N/mm^2 at 7 and 28 days respectively. The compressive strength is reduced as the percentage of replacement of Mangalore tile increases.

Split Tensile Strength Test

Values of split tensile strength at different percentage of replacement of Mangalore tile at different age are given below:

Split tensile Strength of Mangalore Tile Concrete (N/mm^2)

Days	0%	10%	20%	30%
7	3.02	2.99	2.87	2.62
28	3.92	3.89	3.76	3.53

The split tensile strength of conventional concrete is 3.02 N/mm^2 and 3.92 N/mm^2 at 7 and 28 days respectively. The split tensile strength is reduced as the percentage of replacement of Mangalore tile increases.

Flexural Strength Test

Values of flexural strength at different percentage of replacement of Mangalore tile at different age are given below:

Flexural Strength of Mangalore Tile Concrete (N/mm^2)

Days	0%	10%	20%	30%
7	3.14	3.05	2.93	2.68
28	4.02	3.96	3.82	3.60

The flexural strength of conventional concrete is 3.14 N/mm^2 and 4.02 N/mm^2 at 7 and 28 days respectively. The flexural strength is reduced as the percentage of replacement of Mangalore tile increases.

WORKABILITY

Workability of Mangalore Tile Concrete

Test	0%	10 %	20 %	30%
Slump (mm)	84	80	76	72
Compaction Factor	0.912	0.90	0.89	0.875

The workability is decreased as the percentage of replacement of Mangalore tile increases.

CONCLUSIONS

Concrete is the most widely used man made material, with constituents of cement, fine aggregate, coarse aggregate and water. In which the coarse aggregate occupies three fourth of the volume of concrete and influences the properties and performance of concrete with various physical, chemical and thermal properties. The properties and performance of concrete are dependent upon characteristics and properties of aggregates to a large extent and thus the knowledge of properties of aggregate is inevitable. In case of marginal aggregate, the record of performance of concrete made with them may be the best guide. In general the aggregate which brings about the desired quality in concrete with economy should be selected. In this study an attempt is made to investigate experimentally, the effect of Mangalore tile waste as aggregate in concrete. The compressive, split tensile and flexural strength is reduced as the percentage of replacement of Mangalore tile increases. The workability is decreased as the percentage of replacement of Mangalore tile increases.

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