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A Critical Review on the Uses of Waste Pozzolanic Material in Concrete Production

Preritsaxena
Ug Student, Civil Engg Department, Srmgpc, Lucknow, Uttar Pradesh, India

Abstract:-This review emphasis on the use of pozzolanic materials as a partial substitute of fine aggregates as well as cement. The natural waste material generated in the environment by construction industries could be utilized as a substitute in concrete production. The fineness of these materials can be utilized in enhancing the density and compactness of beams, Columns as well as in increasing the compressive strength of cement mortar. In this paper the concerned is on maximum utilization of naturally available pozzzolanic waste materials in modern construction practice and attaining maximum strength as compared to conventional process and reducing the release of greenhouse gas (CO_2)emission from manufacturing of cement from cement industries. The pozzolanic materials used as a partial replacement of fine aggregates and cement are fly ash, granite powder, and stone dust which is freely available.
The study focuses in find the optimum quantity of partial replacement of these pozzolanic materials and to gain maximum strength in different components and is determined by different tests such as compressive test, split tensile strength test, flexure strength test etc.

Keywords:- Fly Ash; Granite Powder; Stone Dust; OPC; Strength.

I. INTRODUCTION

As construction has an everlasting future, thus advancement in this field is an important factor which can be majorly done by utilising the waste material produced by different industries in construction practises and thus reducing the environmental impact as well as reducing the cost of construction, thus fulfilling the basic requirement of construction i.e. economy and serviceability criteria.Pozzolanic materials are those which shows binding properties when reacted with lime in the presence water.
The aim of this writing is to find the optimum proportion in which pozzolanic waste material can be mixed in the design mix of different structural components and attaining maximum strength as compared to conventional design.

II. LITERATURE REVIEW

AnkitNileshchandra Pateland Prof. JayeshkumarPitroda [1] has studied the feasibility of using stone dust in the production of concrete as a partial replacement of cement (PPC & OPC) is focused. The stone used in this study is brought from Uma Marble, GIDC, VallabhVidyanagar, Anand, Gujrat. The replacement is done in the range of 0%, 10%, 20%, 30%, 40% & 50% by weight for the preparation of M-25 Grade concrete. In this study split tensile test is performed to determine the mechanical properties for 28 days. As a result the strength of the mix is increased up to 30% on replacing of stone dust in OPC and 20% on replacing in PPC.

A. M. Mustafa Al Bakriet. al. [2] researched on the optimum proportion of Fly ash based on geopolymer with aggregates. Different ratio for which compressive strength, water absorption, density and porosity are determined are FA 50% : AGG 50%, FA 40% : AGG 60%, FA 30% : AGG 70% & FA 20% : AGG 80%. As the result highest compressive strength compared with conventional OPC concrete was obtained when the proportion was kept as FA 30% : AGG 70% and the water absorption & porosity of geopolymer concrete was found lower than that of OPC concrete.

Dr. T. Felix Kala [3] the objective of his thesis was to produce High Performance Concrete of 28 days strength to the maximum of 60 MPa by partially replacing fine aggregates with granite powder and partial replacement of cement with admixtures. The proportion of replacement were 0%, 25%, 50%, 75%, 100% for granite powder and cement was replaced with 7.5% silica fume, 10% fly ash, 10% slag and the dosage of super plasticiser added 1% by weight. The maximum strength was achieved when sand is replaced by 25% of granite powder by weight along with the admixtures.

Abhinav Singh and Dilip Kumar [4] their research emphasis on effect of partial replacement by fly ash and the addition of granite powder as admixture on the properties of concrete. In this study fly ash is varied as 5%,

10%, 20% & 25% and compressive strength and flexure strength is determined. As the result, maximum compressive strength of 41.33 N/mm^2 at 28 days was obtained when fly ash is replaced by 20% and maximum flexure strength of 4.74 N/mm^2 at 28 days was obtained when fly ash is replaced by 15%.

H. M. A. Mahzuzet. al. [5] has investigated an alternative of sand by using stone powder. As a result of this study, concrete made of stone powder and stone chip gained about 15% higher strength than that of normal sand and brick chip. When concrete of stone powder and brick chip gained about 10% higher strength than that of normal sand and stone chip concrete. The maximum compressive strength of mortar by using stone powder is 33.02 N/mm^2. Also compressive strength of concrete from stone powder shows 14.76% higher value than that of the concrete manufactured from normal sand while concrete from stone powder and brick chip produce higher compressive value from that of normal sand and brick chip.

Y. Yaswanth Kumar et. al. [6] has described effect on compressive strength, tensile strength and flexure strength when cement is partially replaced by granite powder in the range of 5% to 20% by weight. As the result, it was observed that maximum compressive, tensile and flexure strength of 48 N/mm^2, 3.6 N/mm^2 and 4.6 N/mm^2 respectively as compared to conventional concrete of strength 35 N/mm^2, 2.4 N/mm^2 and 3.2 N/mm^2 was attained when 10% granite powder is used as the partial replacement of cement by weight. While same strength can be achieved as that of the conventional concrete when 20% substitution is allowed.

Soman. K et. al. [7] has utilized M sand confirming to zone II and fine aggregate in concrete production. The replacement range is 2.5% to 20% of cement by quarry dust of less than 75 micron particle size. As the result, up to 7.5% replacement of cement there was no reduction in compressive, split tensile and flexure strength. Also it was found that the results are the same whatever be the fine aggregate used.

III. CONCLUSION

1. The optimum percentage in which granite powder can be used as a partial replacement of cement to improve strength of the mix is 10% by weight.
2. The optimum percentage in which granite powder can be used as a partial replacement of fine aggregates to produce concrete with strength higher than conventional concrete is 25% by weight.
3. The optimum percentage in which fly ash can be used as a partial substitute of fine aggregates in the manufacture of concrete without admixture to improve compressive strength is 20% by weight and with admixture the percentage rises to 30% by weight.
4. The optimum percentage in which fly ash can be used as a partial substitute of fine aggregates in the manufacture of beams to enhance flexure strength is 15% by weight when granite powder is used as an admixtures.
5. The analysis shows that stone powder when used as a partial substitute of fine aggregates or cement all strength increases but the optimum percentage depend on different type of stone used locally.
6. An eco-friendly, high strength concrete structures can be built by using various naturally available waste material as a partial substitute of different components of design mix with a considerable economy.

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