Experimental Study on Investigation of Partial Replacement of Fine Aggregate By Quarry Dust and Fly Ash-A Review

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Abstract- *Over 5% of global CO_2 emissions can be attributed to Portland cement production. Demand for sand continues to grow. Increase in the cost of conventional building materials and to provide a sustainable growth. The construction field has prompted the designers and developers to look for 'alternative materials' for the possible use in civil engineering constructions. This study is about replacing the sand by flash ash and quarry dust upto 60% in separate and mixed manner for 7, 14 sand replacements, fly ash, and quarry dust. From the replacement of cement, fine aggregate with this fly ash & quarry dust materials provides maximum strength at 40% replacement. Cost of cement and fine aggregate should become low from this project. Environmental effects from wastes and maximum amount of cement manufacturing is reduced through this project. A better measure by a New Construction Material is formed out through this project.*

I. INTRODUCTION

The construction companies using the natural resources from long decades as raw materials directly. Due to the continuous usage of natural resources such as river sand, the demand increases inevitably regardless of usage. The increasing demand will continue in future also. River sand, which is one of the constituents used in the production of conventional concrete, has become highly expensive and also scarce. The abundant production of quarry dust from stone crushing units as a waste product is becoming problem for its disposal. Due to the scarcity of natural sand is overcome by utilization of quarry dust, which can be called as manufactured sand. The use of manufactured sand in India has been low, when compared to the developed nation. It's an attempt to study the effect of partial replacement of fine aggregates by quarry dust and cement by fly ash on cement concrete.

Fly ash, ground granulated blast-furnace slag, silica fume, and natural pozzolans, such as calcined shale, calcined clay or metakaolin, are materials that, when used in conjunction with portland or blended cement, contribute to the properties of the hardened concrete through hydraulic or pozzolanic activity or both (Fig. 3-1). A pozzolan is a siliceous or aluminosiliceous material that, in finely divided form and in the presence of moisture, chemically reacts with the calcium hydroxide released by the hydration of portland cement to form calcium silicate hydrate and other cementitious compounds. Pozzolans and slags are generally catergorized as supplementary cementitious materials or mineral admixtures. The use of these materials in blended cements is discussed in Chapter 2 and by Detwiler, Bhatty, and Bhattacharja (1996). The practice of using supplementary cementitious materials in concrete mixtures has been growing in North America since the 1970s. There are similarities between many of these materials in that most are byproducts of other industrial processes; their judicious use is desirable not only from the national environmental and energy conservation standpoint but also for the technical benefits they provide concrete. Supplementary cementitious materials are added to concrete as part of the total cementitious system. They may be used in addition to or as a partial replacement of Portland cement or blended cement in concrete, depending on the properties of the materials and the desired effect on concrete. Supplementary cementitious materials are used to improve a particular concrete property, such as resistance to alkali-aggregate reactivity. The optimum amount to use should be established by testing to determine whether the material is There are similarities between many of these materials in that most are byproducts of other industrial processes; their judicious use is desirable not only from the national environmental and energy conservation standpoint but also for the technical benefits they provide concrete. Supplementary cementitious materials are added to concrete as part of the total cementitious system. They may be used in addition to or as a partial replacement of Portland cement or blended cement in concrete, depending on the properties of the materials and the desired effect on concrete. Supplementary cementitious materials are used to improve a particular concrete property, such as resistance to alkali-aggregate reactivity. The optimum amount to use should be established by testing to determine whether the material is indeed improving the property, and the correct dosage rate, as an overdose or underdose can be harmful or not achieve the desired effect. Supplementary cementitious materials also react differently with different cements. Traditionally, fly ash, slag, calcined clay, calcined shale, and silica fume were used in concrete individually. Today, due to improved access to these materials, concrete producers can combine two or more of these materials to optimize concrete properties. Quarry wastes are a largely unavoidable by-product of the extraction and processing of aggregates. They are defined as wastes because no market currently exists for them, but unlike many other wastes they are generally inert and non-hazardous. Materials that may be classified as quarry wastesinclude overburden (although this is frequently used in restoration) and interburden (material of limited value that occurs above or between layers of economic aggregate material) and processing wastes (non-marketable, mostly fine-grained material from screening, crushing and other processing activities). Quarry plant and waste stockpile.The type and amount of waste depends on the nature of the operation. Most sand and gravel workings do not produce much, if any, permanent waste. Some produce significant volumes of clay and silt, which could be dug from settling ponds and used during restoration; although most is left in situ and is typically removed to free up space for more plant washings.

Hard rock quarries produce variable amounts of quarry waste. Some produce small amounts of overburden while others may have large amounts of overburden and inter burden that is not of sufficient quality for the desired product. Any waste that cannot be used immediately is stored in bunds or tips within the boundaries of the aggregates operation. The term tip is used to describe any accumulation of quarry wastes, including waste and soil heaps, stockpiled materials, backfill, screening embankments, and lagoons and settling ponds. All are strictly regulated under the Quarries Regulations 1999422 and the accompanying code of practice (available from the HSE at www.hse.gov.uk). Tips may be permanent or temporary. For example, permanent screening embankments comprise waste or other materials not required for restoration works or other uses. They are generally designed so that they can be incorporated into the final long-term landscape on closure and restoration of the operation. Temporary amenity banks are often formed from stockpiled soil to the height of a few metres and are designed so that they can be re-excavated and used as a cover material during site restoration.

Concrete is the second largest material consumed by human beings after food and water as per WHO. It is obtained by mixing cement, fine aggregate, coarse aggregate and water in required proportions. The mixture when placed informs and allowed to cure becomes hard like stone. The hardening is caused by chemical action between water and the cement due to which concrete grows stronger with age. The strength, durability and other characteristics of concrete depend upon the properties of its ingredients, proportion of the mix, the method of compaction and other controls during placing, compaction and curing. Concrete possess a high compressive strength and is usually more economical than steel and is non-corrosive which can be made with locally available materials. Hence concrete is used widely in all present-day constructions. The concrete is good in compression and bad in tension. Hence liable to be cracked when subjected to tensile load. In situations where tensile stresses are developed concrete is strengthened by steel bars forming a composite construction called Reinforced Cement Concrete (RCC).

II. TREATMENT METHODS

Design of concrete mixes involves determination of the proportions of the given constituents namely, cement, water, coarse aggregate and fine aggregate with admixtures if any. Workability is specified as the important property of concrete in the fresh state. For hardened state compressive strength and durability will be considered.

Methods of Concrete Mix Design

The mix design methods being followed in different countries are mostly based on empirical relationships, charts and graphs developed from extensive experimental investigations.

Following methods are in practice

1. ACI Mix design method
2. USBR Mix design method
3. British Mix design method
4. Mix design method according to Indian standard

Since ACI Mix design method is an originator for all other methods, including Indian standard method, wherein every table and charts are fully borrowed from ACI, so we follow the ACI Mix design method in practice.

Objectives of Study

The following are the objectives of the present study:

i. To study different strength properties of Quarry Dust and Fly Ash concrete with age in comparison to control concrete.
ii. To study the relative strength development with age of Quarry Dust and Fly Ash concrete with control concrete of same grade.

Scope of Study

- To provide a most economical concrete.
- It should be easily adopted in field
- Using the waste in useful manner
- To reduce the cost of the construction.

III. CONCLUSIONS

Based on experimental investigation on the compressive strength of concrete, the following observations are regarded. From this level, replacement of cement, fine aggregate with this fly ash & quarry dust materials provides maximum strength at 40% replacement. Cost of cement and fine aggregate should become low from this project. Environmental effects from wastes and maximum amount of cement manufacturing is reduced through this project. A better measure by a New Construction Material is formed out through this project.

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