

USE OF QUARRY DUST IN CONCRETE AS REPLACEMENT FOR NATURAL SAND

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Abstract - Cement, sand and aggregate are basic need for any construction industry. All the materials are mix with water and make a paste this paste is called as mortar in other words mortar is a mixture of cement, sand, fine aggregate and coarse aggregate with water make a paste and this paste called as mortar. Fine aggregate material in mortar generally used as sand. Since the old time, sand has been used in building construction, road construction and other construction work. Sand demand is increasing day by day. Mining of sand is continuously increase as per demand so effects of mining is generally affect physical properties of river, water quality of river and ecological effect. Therefore, looking at the need of Sand in the future, it is very important to find Sand Alternate. The lack of sand directly affects the construction work. Many researchers are finding different materials to replace sand and one of the major materials is quarry stone dust. By the using of quarry stone dust make a proper mix of concrete with a satisfactory strength. In this research paper we use different alternate material of sand and use in sand in different proportions and check their characteristics with sand.

Key Words: cement, sand, alternative of sand, quarry stone dust, physical properties, Chemical properties, mechanical properties.

1. INTRODUCTION

In now day's sand is prime need of every type of construction work without sand we don't think about any construction work. Use of sand in construction work is very large scale and quantity of sand in concrete and mortar play an important role. Rapid extraction of sand from river bed causing so many problems like losing water retaining soil strata, deepening of the river beds and causing bank slides, loss of vegetation on the bank of river, Disturbs the aquatic life as well as disturbs agriculture due to lowering of water table in the well etc are some of the examples. Due to shortage of river sand the Rajasthan government restrictions on sand mining in river like Chambal. For improvement of any country like India is required good infrastructure but good infrastructure and large infrastructure require large quantity of fine aggregate. Researchers and engineers have come out with their own ideas to decrease or fully replace the use of river sand and use recent innovations such as manufactured sand, stone crusher dust, filtered sand, sieved silt. So new innovation in sand replacement is required for development of nation and development of infrastructure.

2. ALTERNATE MATERIAL OF SAND:-

Industrial waste and by-products of all industry, which have been raising hazardous problems for the environment, agricultural and human health can have major use in construction activity which may be useful for not only from the economy point of view but also to preserve the environment as well. In india waste material is a big problem because collection, transport, treatment and disposal of waste material is very hard and environmentally not good process. Current systems in India cannot cope with the volumes of waste generated by an increasing urban population, and these impacts on the environment and public health. All waste material can be use in construction work and by this process land pollution will decrease and cost of construction work will also be decrease. India consumes an estimated 600 million cubic meter of concrete annually and which approximately comes to 1.26 tonne per Indian. This quantity of concrete is very large quantity. But do we have enough sand to make concrete and mortar? We know that quantity of sand in india is not sufficient as per requirement of construction work. Value of construction work increase continuously at the rate of 16.17 % annually even in the economic crash. If construction work of any country in increase then GDP of these country also increase. Construction industry have own importance in nation development.

In this research paper, we will tell about the material from which the sand can be replaced. We have to find some material in the future that can replace the sand completely. In this research paper, we will tell about the materials that are able to replace sand completely.

2.1 GRANULATED BLAST FURNACE SLAG (GBFS):-

The granulated blast-furnace slag is sand-type slag Manufactured by spraying high-pressure water jets on a blast-furnace molten slag. This product is used for the construction works and for the high-grade Glass as a raw material. The compressive strength of concrete and mortar increases as the replacement of sand by the granulated blast furnace slag. After many test result of concrete sample which are made by using GBFS sand we conclude that GBFS is an alternative material of natural sand.

2.2 FOUNDRY SAND:-

India ranks fourth in terms of total foundry production according to the 42 census of world casting production of 2007. Foundry sand is high quality silica sand this sand is generally used in foundry casting processes. The sand is bonded to form moulds or patterns used for ferrous (iron and steel) and non-ferrous (copper, aluminium, brass) metal castings.

2.3 QUARRY DUST: -

Quarry dust is an alternate material of sand which is use in construction work. Quarry dust is produced from crusher unit and each crusher unit is produced nearly 22% to 27% of dust. This dust is completely waste material for crusher unit but quarry dust is useful for construction work as sand. If we mix quarry dust in sand then only 65% to 75% of sand replaced by quarry dust because strength of concrete is affected by this process. In other process if we mix quarry dust and fly ash are added together in concrete mix then we replace complete sand by quarry dust and fly ash. The use fly ash in concrete is desirable because of benefits such as useful disposal of by a by-product, increased workability, reduction of cement consumption, increased sulphate resistance, increased resistance to alkali – silica reaction decreased permeability. Therefore the concurrent use of quarry dust and fly ash in concrete will lead to the benefits of using such materials being added.

2.3.1 PHYSICAL PROPERTIES OF QUARRY DUST:-

The physical properties of quarry dust are determined by much result which is obtained by laboratory testing. These test are performed as per Indian standard code

S.NO	PROPERTY	NATURA L SAND	QUARR Y DUST	IS CODE
1	Specific Gravity	2.6	2.53-2.68	IS2386(PAR T III)-1963
2	Bulk Density(kg/m ³)	1460	1710-1850	IS2386(PAR T III)-1963
3	Absorption(%)	Nil	1.20-1.50	IS2386(PAR T III)-1963
4	Moisture content(%)	1.50	Nil	IS2386(PAR T III)-1963
5	Fine particles less than 0.075 mm (%)	6	12-15	IS2386(PAR T III)-1963
6	Sieve Analysis	Zone -II	Zone -II	IS 383-1970

2.3.2 CHEMICAL PROPERTIES OF QUARRY DUST:-

The Chemical properties of quarry dust are determined by much result which is obtained by laboratory testing. These test are performed as per Indian standard code

S.NO.	CONSTITUENTS	QUARRY DUST (%)	NATURAL SAND	IS CODE
1	SiO ₂	62.58	80.78	IS 4032-1968
2	Al ₂ O ₃	18.60	10.52	IS 4032-1968
3	Fe ₂ O ₃	6.56	1.75	IS 4032-1968
4	CaO	4.83	3.21	IS 4032-1968
5	MgO	2.46	0.77	IS 4032-1968
6	Na ₂ O	Nil	1.37	IS 4032-1968
7	K ₂ O	3.28	1.23	IS 4032-1968
8	TiO ₂	1.21	Nil	IS 4032-1968
9	Loss of ignition	0.48	0.37	IS 4032-1968

2.3.3 COMPRESSIVE STRENGTH :-

Concrete has higher compressive strength with relatively other. Tensile strength of concrete is poor so generally concrete use in compression. The different mix of concrete gives various strength, according to the IS 10262: 1982 gives the characteristic and design compressive strength values for various grade of concrete. We prepare both concrete and mortar mix using quarry dust and results are very surprisingly. Compressive strength of quarry dust concrete and mortar is comparatively high with normal concrete.



Fig -1: Sample of material

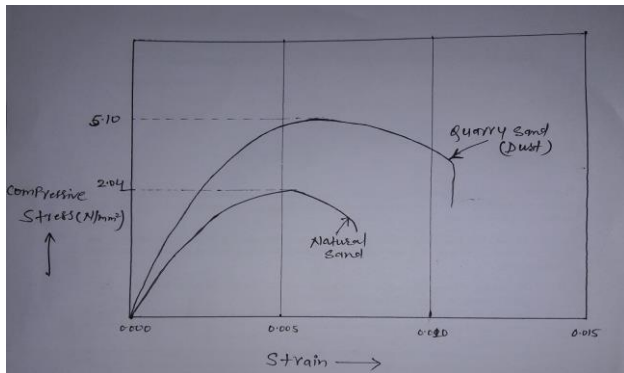


Fig -2: Stress –Strain Curve (compressive)

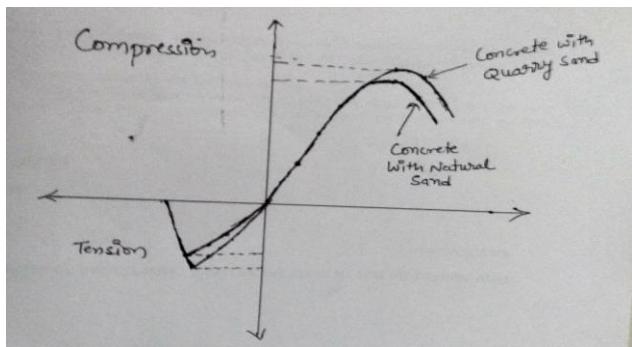


Fig -3: Stress –Strain Curve (compressive and tensile)

3. CONCLUSIONS:-

1. Reduction of consumption of natural sand.
2. Improvement in concrete strength and durability.
3. Use of waste material and reduction in quantity of use less material.
4. The physical and chemical properties of quarry dust satisfy the requirements of sand.
5. Use of quarry dust in concrete help in workability of concrete.
6. Quarry dust is a waste product from stone crushing industry and available almost free-of-cost, as partial replacement for river sand.

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