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Experimental Investigation on Replacement of Sand by Graded Quarry Dust in Concrete

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Abstract: ***Now a days the utilization and consumption of natural aggregates and cement as largest concrete component is rapidly and constantly increasing in the production of concrete. The developing countries like India, the infrastructure such as express highways, power projects, industrial structures, ports and harbors to meet the requirements of globalization in construction of buildings and other structures. River sand is one of the constituent used in the production of concrete, become expensive and also a scarce material. In view of this, there is a need to identify suitable alternative material from industrial waste in place of river sand. The utilization of quarry dust which is a waste material has been accepted as building material in many countries for the past three decades. Recycling involves processing used materials into new products in order to prevent the waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air and water pollution by reducing the need for conventional waste disposal. Concrete traditionally consists of cement, fine aggregate, coarse aggregate and water. An attempt has been made to replace the fine aggregate with quarry dust with an objective of utilizing the waste material.***

I. INTRODUCTION

Concrete plays a very important role in the construction industry. It is widely used in the worldwide due to its durability, versatility and low cost.For a concrete mix, fine aggregate is an essential component of the concrete and the most commonly used fine aggregates is the river sand. The demand of natural sand in the field of construction is increasing day by day due to extensive use of concrete, the price was increasing which resulting a huge reduction in the sources of sand. Natural River sand takes a million of years to form and it is not replenish able.Because of its limited supply and excessive cost of transportation from natural source, The developing country like India facing shortage of good quality of natural sand and particularly in India, natural sand deposits are being used up and causing serious threat to environment as well as the society. Therefore it becomes more necessary to find alternative sources of fine aggregates to minimize river sand extraction.

Therefore, an investigation is required to find a suitable substitute which is eco-friendly and inexpensive. Quarry dust has been proposed as an alternative to river sand that gives the additional benefits to the strength of the concrete..

II. OBJECTIVE

1) To use of the quarry dust replacement of fine aggregate reduces the environmental pollution as well as providing an economic value for the waste material.
2) To improve durability, ductility using replacing fine aggregate
3) To study the mechanical and physical properties of construction waste aggregate by conducting experimental work.
4) To find out the % use feasible for construction

III. ADVANTAGES

1) Environmental benifits: Reduce the waste and conserve natural resource.
2) Cost effective: Quarry dust is often cheaper than sand.
3) Improve durability: Quarry dust can reduce shrinkage and improve concrete resistance to cracking.
4) Increasing the strength: Quarry dust can improve compreesive strength due to its finer particals.
5) Better workability: Quarry dust can improve concrete's workability.
6) Reduce water absorption: Quarry dust can reduce water absorption, improve concrete's resistance to weathering.

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IV. DISADVANTAGES

1) Quality variability: Quarry dust quality can vary depending on the source and processing.
2) higher drying shrinkage: Quarry dust can increase drying shrinkage if not properly proportioned
3) Reduce flow: high Quarry dust content reduce concrete flow.
4) Increase risk of segregation: Quarry dust can increase segregation risk if not properly mixed.
5) Limited standardization:No standardized guidelines for Quarry dust usage in concrete.

V. MATERIAL USED IN CONCRETE

- CEMENT
- QUARRY DUST
- SAND
- AGGREGATE
- Water

1) *Cement*

Ordinary port land cements of Grade-53 are used.

Test on cement

- Color test: - visually inspecting the cement for its shade, with high-quality cement typically exhibiting a uniform greenish-grey color.
- Presence of lumps: - Upon opening the cement bag, carefully examine its contents for any lumps. The presence of lumps suggests that the cement has come into contact with moisture.
- Adulteration test: - Rub a small amount of cement between your fingers. Quality cement should feel smooth and fine to the touch.

2) *Quaary Dust*

Quarry dust, also known as stone dust or crusher dust, is a fine, powdery byproduct of the dry rock crushing process in quarries, often used as a filler material in construction projects like concrete mixes and paving. In concrete production it could be used as a partial or full replacement of natural sand. Besides, the utilization quarry waste, which itself is a waste material, will reduce the cost

VI. METHODOLOGY

1) Collect the cement, sand, aggregate,quarry dust in proportion 1:1:2.
2) Take weighing of all the materials required for the project.
3) Dry mixing of the materials by using concrete mixture machine.
4) Add the water in dry mixture and ready wet concrete.
5) Apply the lubricant oil in the mould.
6) 6. Take workability test on the concrete by using slump cone apparatus. Raised slump cone apparatus and see that subsidence of concrete observed and measured the slump.
7) Fill the concrete on the mould by each layer of tamping 25 gloves
8) Mould placed above the vibration machine for 2min.
9) Cube placed for a specified room temperature for 24 hours.
10) After 3,7,28 day's take the test of cube in the CTM (compressive testing machine).

Compressive strength:-
When concrete have the high compressive strength, but at the same time have very poor tensile strength. The type of mixes gives the various strength. The freshly mixed concrete was field in the mould of size 150mm X 150mm X 150mm and then cubes were kept for curing. Testing of hardened cube was carried out in 7 days and 28 days respectively


Compression Strength Test Result on normal concrete

SR.NO.	Sample concrete cubes	Load (KN)	Area in mm	Strengthin N/mm^2
1.	3 DAYS	350	150X150	15.56
		360.2	150X150	16.00
		372	150X150	16.53
2.	7 DAYS	410	150X150	18.22
		415.15	150X150	18.45
		419.5	150X150	18.64
3.	28 DAYS	590	150X150	26.22
		571	150X150	25.37
		585	150X150	26.00

Compression Strength Test Result on quarry dust concrete(20%)				
SR.NO.	Sample concrete cubes	Load (KN)	Area in mm	Strength in N/mm^2
1.	3 DAYS	375	150X150	16.66
		360.2	150X150	16.00
		379	150X150	16.84
2.	7 DAYS	440	150X150	19.55
		450.45	150X150	20.02
		455	150X150	20.22
3.	28 DAYS	645	150X150	28.68
		623.25	150X150	27.69
		629	150x150	27.95

DIFFERENCE BETWEEN RIVER SAND AND QUARRY DUST

Feature	River Sand	Quarry Dust
Origin	Naturally formed by river erosion	Byproduct of rock crushing in quarries
Shape	Rounded and smooth	Angular and rougher
Particle Size	Mix of different sizes	Smaller, sand-sized particles
Uses	Fine aggregate in concrete, etc.	River sand replacement in concrete, etc.
Advantages	Good workability, packing properties	Better strength, workability, eco-friendly
Disadvantages	Environmental issues, rising prices Potential environmental	Potential environmental pollution

VII. CONCLUSION

1) From following studies and results we found that the quarry dust as a fine aggregates relatively weaker as compared To river sand which is used in the study?
2) The various properties of used Quarry dust such as aggregate crushing value, pH value, flakiness index and soundness Gives the significant effects to the strength and durability of concrete.
3) The concrete mix of dust as partial replaced to sand, results a reduction in the compressive strength.
4) But the reduction in the compressive strength of the quarry dust concrete was compensated by the inclusion ofMineral admixtures into the concrete mix.
5) In the presence of silica fume or fly ash, quarry dust can be a suitable partial replacement material to sand to produce

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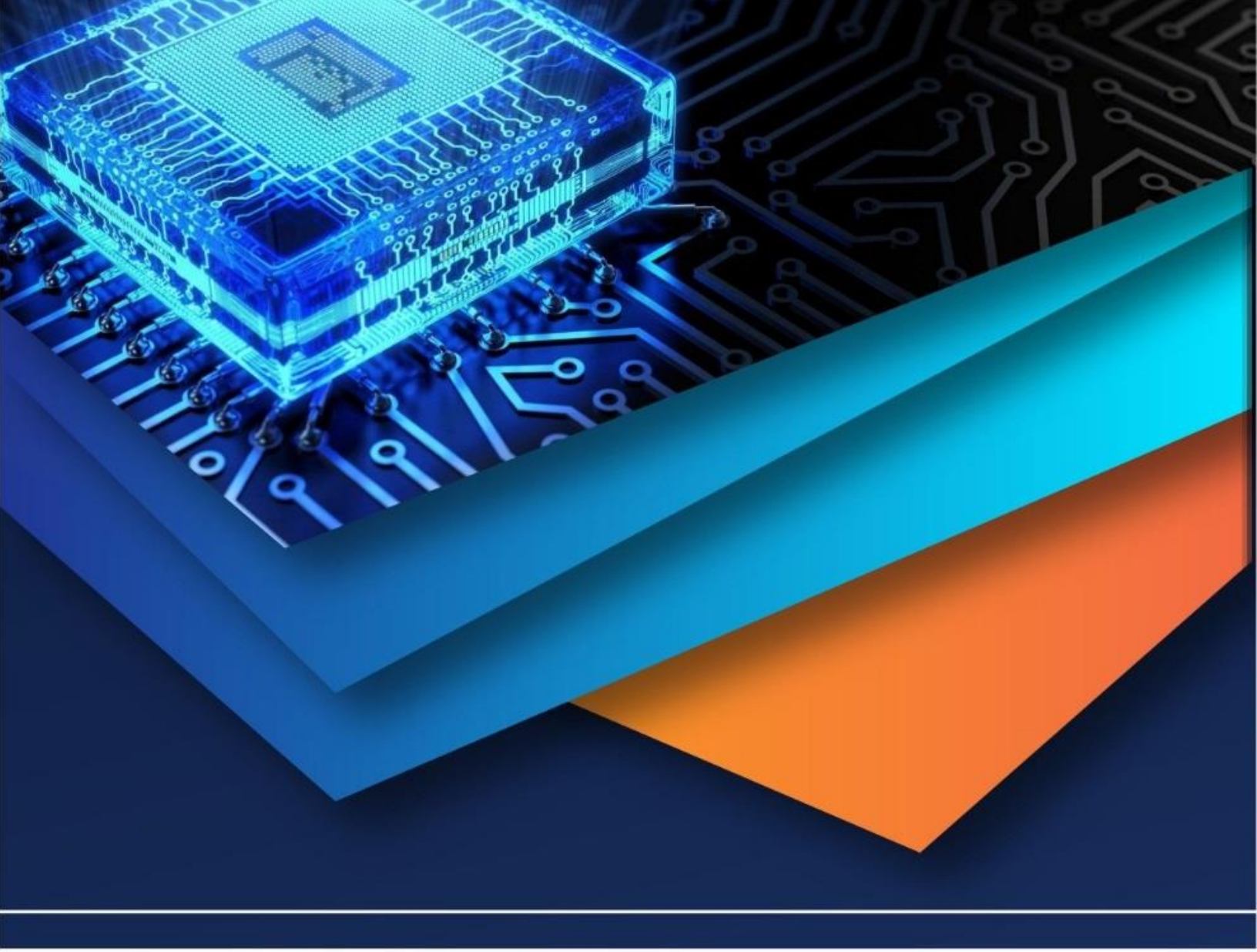

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