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EFFECT OF STONE DUST ON THE SPECIFIC PROPERTIES OF FRESH AND HARDENED CONCRETE

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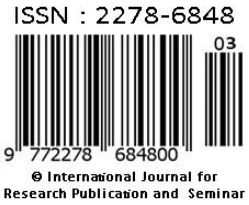
ABSTRACT:



The main aim of this project is to study about stone dust's effect on few particular properties of concrete that is fresh and hardened (M25). In this we will be studying the experimental tests conducted for concrete's fresh and hardened properties for M25 grade and then we are comparing the results with the normal concrete. The waste material that is obtained from the crusher plants is stone dust. Stone dust is having great potential as we can use it as natural river sand's partial replacement in the concrete. We can use it not only in improving concrete's quality but also we can use it for conserving natural river sand for the coming generation.

For studying concrete's compressive strength and workability with the help of stone dust as fine aggregate's partial replacement ranging from 10-100% grade of design that was designed with the help of OPC, they have conducted experimental program in this. "Workability and Compressive strength were determined at different replacement level of fine aggregate viz a viz referral concrete and optimum replacement level was determined based on compressive strength".

KEY WORDS: - concrete, compressive strength, optimum, replacement, stone dust, workability.

INTRODUCTION:

The multipurpose material that is used for the construction of yard is stone dust. They suit a compacted layer of it with the yard or the surface of the passageway. For the sub-base that is in laying the paving blocks and slabs and also natural stone, it is a very good option or choice.

We must take baking into the consideration as we know that the surface of stone dust is extremely compacted and also waterproof.

It is a waste material that comes out at the time of blasting and crushing the aggregate. A big issue also arises at the time of damping these. It becomes easy to dispose these when they are taken into the work of the construction. There are various kinds of pollution that are produced because of these such as air pollution. And various kinds of diseases also took birth because of these pollutions. Disposing of these is a very serious issue and matter of concern as pollution is increasing on daily basis because of these materials.

They have added steel fiber to concrete as it always act as reinforcing material that helps in providing few benefits if compared to the traditional reinforcement. They are created differently from the wire materials, they are mainly designed for providing concrete "with ultimate load bearing capacity with temperature and shrinkage crack control, enhanced flexural reinforcement, improved shear strength and increase the crack resistance of concrete".

REVIEW OF LITERATURE:

(Of & Engineering, 2014) Studied "Studies on unprocessed stone dust as fine aggregate in making concrete" and observed that "Experimental investigation was carried out to establish the feasibility of unprocessed stone dust as fine aggregate in place of river sand which has become a scarcity now-a-days, by casting cube and determining the compressive strength for the two grades of concrete M15 and M20". The results obtained are compared with conventional concrete.

Conclusion: "compressive strength at 28 days of unprocessed stone dust used as fine aggregate in concrete gives 35% higher strength for M15 and 4% for M20 grade concrete when compared to the reference concrete. The split tensile strength of unprocessed stone dust concrete is 2.98 N/mm2 and 3.25 N/mm2 for M15 and M20 grade respectively where as the reference concrete is 2.58 N/mm2 and 3.18 N/mm2 only. This investigation has demonstrated that the unprocessed

stone dust is equally good as fine aggregate like river sand and hence can be used in making concrete"

(Kovler & Roussel, 2011) Studied "Properties of fresh and hardened concrete" and observed that "Workability and fundamental rheological properties, reversible and non-reversible evolution, thixotropy, slump loss, setting time, bleeding, segregation and practical issues related to formwork filling and pressure, are addressed among the properties of fresh concrete. Among hardened concrete properties compressive strength and other mechanical and physical properties of hardened concrete, such as tensile strength, elastic properties, shrinkage, creep, cracking resistance, electrical, thermal, transport and other properties are covered. Testing, interpretation, modeling and prediction of properties are addressed, as well as correlation with properties of fresh concrete and durability, effects of special binders, recycled and natural aggregates, fiber reinforcement, mineral and chemical admixtures". The special focus is given to properties of concrete that is hardened lightweight and self-compacting.

(Oliveira Andrade & Camargo Boldo, 2018) Studied "Influence of stone dust as fine aggregate replacement on concrete compressive strength using an analysis of variance (ANOVA)" and observed that by reducing the impacts that are produced by natural sand's extraction, we can get environmental advantages of using stone dust in the concrete. Economic advantages might also be offered by using this material because it is less costly. "In this way, the present work evaluated the compressive strength of concretes made with stone dust in different replacement levels (30% and 100%) compared to the use of natural sand". With the help of ANOVA-Analysis of Variance, they have analyzed the results for verifying replacement levels' statistical influence and the mix proportioning at the time of making out the results about compressive strength. They found that concrete's compressive strength that is having replacement level of 30% is same as the behavior to concrete that is referred.

(Pathankot & Pathankot, 2018) Studied "The Comparative Analysis and Examination of Strength Properties Using Crushed Nallah Stone Dust and Recycled Crushed Concrete" and observed that "the paper is based on the tremendous advancement in construction in India as well as other developing countries increases, the utilization and consumption of energy and resources is also increasing in a panic way. In this present work a comparative analysis is done on the fresh and

hardened concrete with different replacement ratios of natural coarse aggregates and natural fine aggregates with recycled coarse aggregate (RCA) and crushed nallah stone dust (CNSD) respectively". Concrete's properties are also improved by using crushed Nallah stone dust and recycled crushed concrete.

METHODOLOGY: In this research paper we will be using below methodology.

Sieve Analysis:

- "The sieve analysis is conducted to determine the particle size distribution in a sample of aggregate which we call gradation".
- "The aggregates used for making concrete are normally of the maximum size 80 mm, 40 mm, 20 mm ,10 mm, 4.75 mm, 2.36 mm, 600 micron, 300 micron and 150 micron".
- "The aggregate fraction from 80 mm to 4.75 mm are termed as coarse aggregates and those fraction from 4.75 mm to 150 micron are termed as fine aggregates".
- "Grading pattern of a sample of CA or FA is assessed by sieving a sample successively through the entire sieves mounted one over the other in order of size, with large sieve at the top".
- "The material retained on each sieve after shaking, represents the fraction of aggregate coarser than the sieve in question and finer than the sieve above. Sieving can be done either manually or mechanically".
- "In the manual operation the sieve is shaken giving movements in all possible directions to give chance to all particles for passing through the sieve".
- "Operation should be continued till such time that almost no particle is passing through".
- "From the sieve analysis the particle size distribution in a sample of aggregate is found out. In this connection a term called fineness modulus is being used. F.M is a ready index of coarseness or fineness of the material".
- "It is an empirical factor obtained by adding the cumulative percentage of aggregates retained on each of the standard sieves ranging from 80 mm to 150 micron and dividing this sum by an arbitrary number 100".
- 'The larger the figure, the coarser is the material".

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FINE AGGREGATES: (STONE DUST/ CRUSHED STONE)

"The fine aggregate used in all the mixes was stone dust conforming to grading zone -2 after sieve analysis as per IS-383-1970.Its bulk specific gravity at SSD was 2.69 and its fineness modulus ranged from 2.91 to 2.94"

The waste material that we get from crusher plants is the stone dust. Stone dust is having great potential that we can use it as natural river sand's partial replacement in concrete. It also helps in conserving natural river sand for the coming generations, also helps in improving concrete's quality. "Quarry dust can be utilized in concrete mixtures as a good substitute for natural river sand giving strength at 50% replacement. While using crushed stone dust as fine aggregate in concrete it is found that there is increase in compressive , flexural and tensile strength of concrete upto a larger extent".

ANALYSIS:

CALCULATIONS OF MIX PROPORTIONS:

a) "Volume of concrete= 1 m^3"

b) "Volume of cement" $=\frac{Mass\ of\ cement}{Specific\ gravity\ of\ cement} x \frac{1}{1000}$

$=\frac{328.6}{3.15} x \frac{1}{1000} = 0.104 m^3$

c) "Volume of water" $=\frac{mass\ of\ water}{specific\ gravity\ of\ water} x \frac{1}{1000}$

$=\frac{190.8}{1} x \frac{1}{1000} = 0.197 m^3$

d) volume of all in aggregates = 1-(0.169+.197 $=0.634 m^3$

e) "Mass of coarse aggregates =d x Volume of coarse aggregate x Specific gravity of coarse aggregate x I 000 = 0.634x0.626x2.68x1000 =1063.64Kg/m^3"

f) "Mass of fine aggregate=d x volume of fine aggregate x specific gravity of fine

Aggregate x 1000 = 0.634 x 0.374x2.69 x 1000= 637.84Kg/m^3"

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WATER CORRECTIONS

1) WATER ABSORPTION

A) CA =0.5% = $\frac{0.5}{100}$ x 1063.64=5.31L

B) FA =0.6%=$\frac{0.6}{100}$ x 637.84=3.83 L

Total quantity =9.14L

2) FREE MOISTURE

a) FA= 1.5%=$\frac{1.5}{100}$ x 637.84 = 9.56L

b) CA

20 mm aggregates = $\frac{40}{100}$ x 1063.64 x 0.2%= 0.85

10 mm aggregates = 60% x1063.64 x 0.1%= 0.638

Total quantity= 11.048 kg

∴ Actual amount of water to be used= 197.16+ 9.14-11.048=195.252 Kg

Actual F.A = 637.84 +9.56-3.83=643.57 Kg

Actual CA = 1063.64-5.31+.85+.638=1059.818 Kg

CALCULATIONS FOR DESIGN MIX OF CONCRETE TRIAL V (M 25 WITH STONE DUST)

- Same specifications as followed in T1N
- w/c =0.60

CALCULATION OF WATER CEMENT RATIO:

"From table 2 0f IS 10262-2009",

"W=186L"

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Since As per IS 10262-2009,

∴ w=186(1-19%) =150.66L

As w/c=0.60

∴ c=$\frac{150.66}{0.60}$=328Kg/m^3

CALCULATIONS OF MIX PROPORTIONS:

a) "Volume of concrete"= 1m^3
b) Volume of cement =$\frac{Mass\ of\ cement}{Specific\ gravity\ of\ cement}x\frac{1}{1000}$ =$\frac{328}{3.15}$x$\frac{1}{1000}$ = 0.104m^3
c) "Volume of water" =$\frac{mass\ of\ water}{specific\ gravity\ of\ water}x\frac{1}{1000}$ =$\frac{150.66}{1}$x$\frac{1}{1000}$ =0.150m^3
d) Volume of stone dust = 0.38m^3
e) "Volume of all in aggregates"= 1-(0.145 +0.150 +0.0068)=0.6982m^3
f) "Mass of coarse aggregates"=d x Volume of coarse aggregate x Specific gravity of coarse aggregate x I 000= 0.6982x0.596x2.68x1000=1115.22Kg/m^3
g) "Mass of fine aggregate"= d x volume of fine aggregate x specific gravity of fine
h) "Aggregate x 1000= 0.6982 x 0.404 x2.69 x1000=758.78 Kg/m^3"

CONCLUSION:

The net results considering strength criteria can be summarized as

S.No.	**w/c**	**28 day compressive strength**
Trial 1 N	0.60	30.83
Trial 2 N	0.60	29.66
Trial 3 N	0.55	31.36
Trial 4 N	0.55	33.81

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Trial 5 N	0.50	31.50
Trial 6 N	0.50	32.66
Trial 7 S	0.60	34.86
Trial 8 S	0.60	33.81
Trial 9 S	0.55	36.86
Trial 10 S	0.55	37.13

FINAL RESULTS

For finding stone dust's effects on concrete's properties in fresh and hardened state with variable water reduction and constant water reduction, The properties tested were

- Slump Retention
- Compressive Strength
- Compaction factors

The results obtained are as follows

Without stone dust

- The compressive strength was obtained to be 30.83MPa
- The slump was obtained to be 8 cm

The results obtained can be interpreted as

- "The workability of concrete can be increased by addition of stone dust however very high dosage of stone dust tends to impair the cohesiveness property of concrete".
- "Compressive strength is improved by stone dust on the other hand its ultimate strength is higher than the desired characteristic strength".
- "The strength of concrete without stone dust is found to be greater than the characteristic strength but the slump obtained is less which means that though this concrete will fare well in terms of strength but it is not workable for major works".

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