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EFFECT ON CONCRETE BY PARTIALLY REPLACING SAND WITH MARBLE DUST ALONG WITH WATER REDUCING ADMIXTURE

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ABSTRACT :

With rapidly growing town and infrastructures development , India is now developing and doing construction so fast. This rapid increase in the construction giving birth to the various new problem in India. Concrete is one of the major component of construction , without it no construction can take place. Country like India and other developing countries , which are now focusing on infrastructure demands concrete for their development. And concrete needs sand for its grade composition. This increase in demand of sand creates huge erosion of river bed for the extraction of sand so that the demand can be fulfilled. This over extraction of sand not only effect the physical geography of the river but also effect the various other properties like the infiltration rate, irrigation , river path, shrinkage of river , somewhere widening of river, intrusion of unpure water into ground water , result in reduction of biodiversity, diseases in plants. These changes are so minute that we cannot notice instantly , but eventually when we get to know , it is too late. This long term damage creates so much problem for us , that at last everything will be endangered and the environment will have to suffer due to human causes. Thus , by observing all these changes, there is a need of substitute or alternative material that can take place of the sand , and shows the same properties like sand. And it will be great ,if that substance is waste. This will help us in resolving two problems at one time , first is we are now reducing the erosion of river bed. And second is the reduction in the pollution or unnecessary humps that we are creating here and there by disposing off the waste, also the waste here we are taking have so many small particles that they keep deposited in the air as a particulate matter , causing rapid increase in the air pollution. So the marble dust will be economic , sustainable and environment friendly substitute of the sand that is obtained from the river. Moreover sand and the marble dust have similar performance by chemical analysis. And here in this study here we are going to analysized the performance of concrete of M20 and M25 grade , by partially replacing the sand with the marble dust by 0%, 15%, 25%, 35%, 40% and 50%. And after then we have evaluated the compressive strength of the concrete cube at seventh, fourteenth and twenty-eight day. And examining this we found out that this procedure is so environment friendly and very economical for the project.

Keyword: Marble dust, workability , compressive strength, slump.

INTRODUCTION:

Concrete a part which cannot be ignored in the world of civil engineering. Concrete is very important element in the construction world , without we cannot imagine the construction can even take place, and without sand composition of the sand cannot be made. Sand which is obtained from the river ,due to rapid development in the infrastructure there is scarcity of sand , that is extracted from the river bed. Sand that is generated from the river bed , play a part of fine aggregate in the grade composition of the concrete along with cement and coarse aggregate. Properties of sand , that are durability, fire resistant, compressive strength, workability are excepted all over the world and therefore it is not easy to fulfil the demand of the sand by over extracting the sand from the river bed, giving rise to various other problem. Rapid development there is a need of substitute , which posses the same properties like concrete , and have low cost i.e should be economical, and also reduces the environmental problem so help in the sustainable development. And marble dust is promising element for the substitute of river sand, it will help in every aspect along with good properties. This will help us in resolving two problems at one time , first is we are now reducing the erosion of river bed. And second is the reduction in the pollution or unnecessary humps that we are creating here and there by disposing off the waste, also the waste here we are taking have so many small particles that they keep deposited in the air as a particulate matter , causing rapid increase in the air pollution. So the marble dust will be economic , sustainable and environment friendly substitute of the sand that is obtained from the river. Moreover sand and the marble dust have similar performance by chemical analysis. Hence , marble dust is a good alternative of replacing sand , along with this , it also resolves the negative impact that a marble dust cause in air by polluting it.

OBJECTIVE:

Main objective of the project are discussed below:

1. The properties that a marble dust holds are similar to the concrete ,so the objective is to reduce the over use of sand that is extracted in a problematic manner from the river bed causing the over erosion of the bed.
2. The problems that are generated in the environment ,like infiltration , river bed , salinity, etc, and due to which problem in biodiversity and physical geography arising get resolved.
3. Problem of pollution that is generated by the disposal of the marble dust, and the particles that settle in the air and help in formation of the particulate matter to be reolved.
4. Finding an alternative for the rapid development , in the place of sand , with the economic aspect , and no compromise in the property of the concrete. So the construction can go further easily and the demand can be fulfilled.
5. To obtain the result and the conclusion by comparing the property of the concrete by replacing sand with the marble dust , and to observe impact and compare, when mixed in the different proportion.

MATERIAL USED:

1. Cement: cement used in this study is of grade43 ordinary Portland cement.
2. Fine aggregate: sand is used as fine aggregate as per sieve analysis of zone 3.
3. Coarse aggregate: aggregate of nominal size 20mm is used in this study.
4. Water: normal water that is easily available is used.
5. Marble dust: dust of marble is obtained by crushing the stones that are abundantly available at marble quarries.
6. Water reducing admixture: these will help in the water reduction for a specific given workability at same water content, and help in getting higher workability at same water content.

METHODOLOGY:

1. Sample that we have discussed above are collected together which contain: cement, coarse aggregate , fine aggregate , water.
2. Basic test that are need to be done for checking the quality of the material are done.
3. Design mix of M20 i.e (1:1.5:3), and M25i.e(1:1:2) are formed.
4. Cement , marble dust, coarse aggregate , water are mixed in proportion and the mixture is formed.
5. Slump test is performed to observe the workability.
6. Concrete of grade proportion is filled in the moulds , by proper compaction with the help of vibrator.
7. After 24 hours the demoulding procedure is done, then they kept in the water tank and the curing is done.
8. Then after the curing the 3 cubes that are casted are check for the compressive strength by applying a loading of 140kg/cm sq , at a interval of 7^{th} , 14^{th} and 28^{th} day.

RESULTS AND DISCUSSION:

S.N	EXPERIMENTS	READINGS
1.	FINENESS	10%
2.	CONSISTENCY	34%
3.	INITIAL SETTING TIME	105 MIN
4.	FINAL SETTING TIME	197 MIN
5.	COMPRESSIVE STRENGTH	46.34 MPa

TABLE: Results of cement.

S.N	EXPERIMENTS	READINGS
1.	SAND BULKING	4.2%
2.	FINENESS MODULUS OF SAND	3.13
3.	FINENESS MODULUS OF DUST	3.03
4.	SPECIFIC GRAVITY OF SAND	2.1
5.	SPECIFIC GRAVITY OF DUST	2.4
6.	WATER ABSORPTION OF SAND	1.5%
7.	WATER ABSORPTION OF DUST	0.5%

TABLE: Test on fine aggregate.

S.N	EXPERIMENT	READINGS
1.	WATER ABSORPTION TEST	0.56%
2.	IMPACT VALUE TEST	12.89%
3.	ABRASION VALUE TEST	31.78%
4.	CRUSHING VALUE TEST	23.54%
5.	SPECIFIC GRAVITY TEST	2.9

TABLE: Test on coarse aggregate.

RESULTS ON CONCRETE:

Material used in M20 and M25 grade of concrete

REPLACEMENT PERCENTAGE OF SAND BY MARBLE DUST (%)	WT. OF CEMENT(KGS)	WT. OF SAND (KGS)	WT. OF COARSE AGGREGATE (KGS)	WT. OF MARBLE DUST(KGS)	WT. OF WATER REDUCING ADMIXTURE(ML)
0	3.5	5.25	10.5	0	0
15	3.5	4.46	10.5	0.79	21
25	3.5	3.94	10.5	1.31	21
35	3.5	3.41	10.5	1.84	21
40	3.5	3.15	10.5	2.1	21
50	3.5	2.625	10.5	2.625	21

TABLE: Material used in M20.

REPLACEMENT PERCENTAGE OF SAND BY MARBLE DUST (%)	WT. OF CEMENT(KGS)	WT. OF SAND (KGS)	WT. OF COARSE AGGREGATE (KGS)	WT. OF MARBLE DUST(KGS)	WT. OF WATER REDUCING ADMIXTURE(ML)
0	3.5	3.5	7	0	0
15	3.5	2.975	7	0.525	21
25	3.5	2.625	7	0.875	21
30	3.5	2.45	7	1.05	21
35	3.5	2.275	7	1.225	21
40	3.5	2.1	7	1.4	21

TABLE: Material used in M25.

SLUMP OBSERVATION:

On increasing the value of natural sand in percentage, the slump value also increases keeping water cement ratio constant. Increase in the fineness of the marble dust requires more water for good and closer packing, hence decrease in the workability.

Here slump value is measured for concrete with marble dust at w/c= 0.5 for grades of M20 and M25.

COMPRESSIVE TEST OBSERVATION:

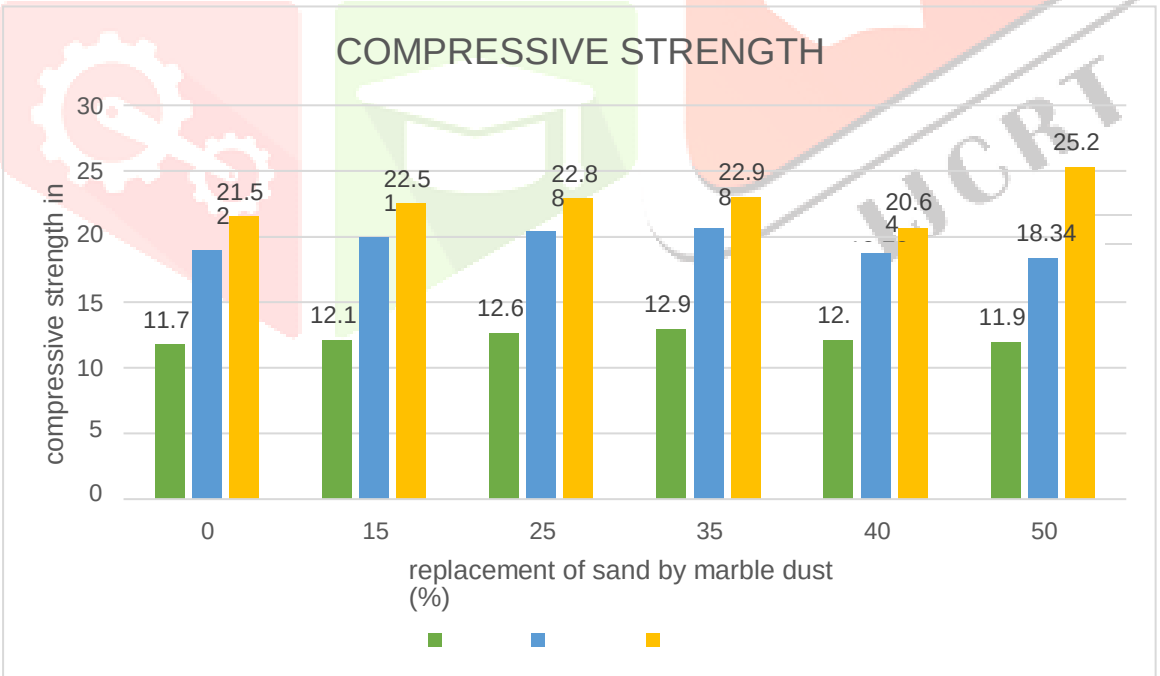
S.N.	REPLACEMENT PERCENTAGE OF SAND BY MARBLE DUST	7 DAY	14 DAY	28 DAY
CS1	0	11.78	18.98	21.52
CS2	15	12.12	19.95	22.51
CS3	25	12.67	20.39	22.88
CS4	35	12.96	20.61	22.98
CS5	40	12.10	18.72	20.64
CS6	50	11.96	18.34	20.31

TABLE: Compressive strength test (MPa)

It is clear from the above table that compressive strength for the cube CS1 at 28 day 21.52 MPa for M20 grade. At 35% replacement of sand maximum maximum compressive strength of 22.98 is achieved.

Compressive strength began to decline as the dust content became greater than 35%. For the cubes the dust content casted between 0% to 25 % particles are not sufficient to fill the voids, resulting in low compressive strength, comparison to the cube casted at 35%.

Conclusionally, we can say that, compressive strength of concrete increase when we replace the sand with the marble dust upto 35%.



Strength in compression in M20 grade.

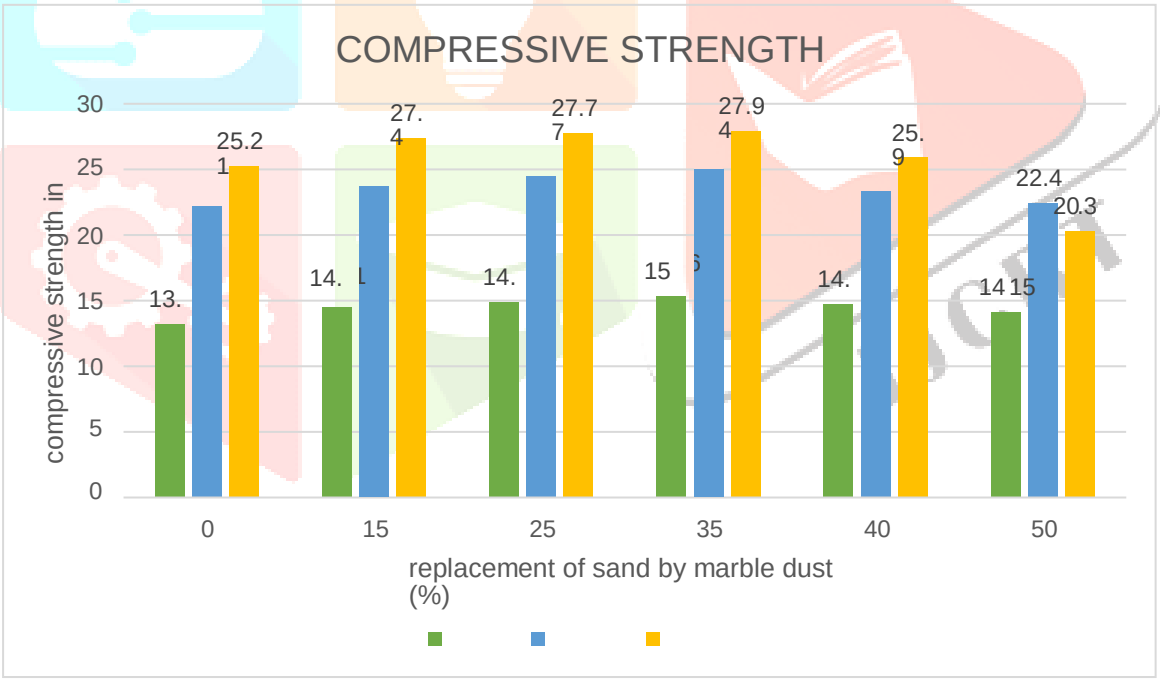
S.N.	REPLACEMENT PERCENTAGE OF SAND BY MARBLE DUST	7 DAY	14 DAY	28 DAY
CS1	0	13.20	22.2	25.21
CS2	15	14.51	24.1	27.40
CS3	25	14.90	24.45	27.77
CS4	35	15.36	25.21	27.94
CS5	40	14.70	23.32	25.90
CS6	50	14.51	22.41	25.27

TABLE: Compressive strength of M25 grade.

It is clear from the above table that compressive strength for the cube CS1 at 28 day 25.21 MPa for M25 grade. At 35% replacement of sand maximum maximum compressive strength of 27.94 is achieved.

Compressive strength began to decline as the dust content became greater than 35%. For the cubes the dust content casted between 0% to 25 % particles are not sufficient to fill the voids, resulting in low compressive strength, comparison to the cube casted at 35%.

Conclusionally, we can say that, compressive strength of concrete increase when we replace the sand with the marble dust upto 35%.



Compression strength of M25 grade concrete.

CONCLUSION:

1. On replacing sand with the dust at percentage of 35% , maximum compressive strength is achieved, for both M20 and M25 grade concrete.
2. By using the waste , the land that we use for the disposing of the waste material that is marble dust is save, so we can use this land for other purposes.
3. Reduction in the pollution of land , as well as air by using the waste, ultimately led to environment friendly option.
4. By using the , great reduction in river erosion for the extraction of the sand.
5. Fulfilling the demand of sand in economical way , by reducing demand of natural sand.

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