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Experimental Investigation on Compressive Strength of Cement Mortar using m Sand, p sand, g Sand and Dolomite Sand

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Abstract - *Manufactured sand is the most commonly used in fine aggregates for construction purpose throughout India. The research focused on comparing the compressive strength of cement mortar cubes produced using fine aggregate from different sources. This project involves preparation of cement mortar cube of CM (1:3) proportions and also fine aggregate is replaced with 100 percentages using P-sand, G-sand and Dolomite sand for 53 grade of OPC cement at uniform water cement ratio and tested to determine the compressive strength of cement mortar cubes for 7 & 14 days under normal curing conditions. Finally the graph is prepared using the obtained results for comparative analysis.*

***Key Words: M-sand, P-sand, G-sand, Dolomite sand, compressive strength*.**

1. INTRODUCTION

River sand is becoming a scarce commodity and hence exploring alternative to it has become imminent. Rock crushed to the required grain size distribution is termed as manufactures sand (M-sand). In order to arrive at the required grain size distribution the coarser stone aggregate are crushed in a special rock crusher and some of the crushed material is washed to remove fines. Following are the characteristics of M-sand and Natural river sand. Manufactured sand (M-Sand) is a substitute of river sand for concrete construction. Manufactured sand is produced from hard granite stone by crushing. The crushed sand is of cubical shape with grounded edges, washed and graded to as a construction material. As the field of industry application gradually expanded, the gradual application of natural sand work more and failed to keep pace with the various sectors of modern world development needs. Historically, a large percentage of sand has been produced from alluvial deposits. However we are now experiencing a global shortage of natural sand, and environmental pressures, costs and a shortage of this type of deposit has necessitated the manufacture of sand from quarried material.

2. MATERIALS

This section deals with the various materials used in the study including the cement and coal fly ash products. The materials have been deals with individually along with their properties.

Cement

Cement is a binder, a substance used for construction that sets, hardens and adheres to other materials, binding them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement is used with fine aggregate to produce mortar for masonry, or with sand and gravel aggregates to produce concrete. Portland cement consists essentially of compounds of lime (calcium oxide, CaO) mixed with silica (silicon dioxide, SiO_2) and alumina(aluminum oxide, Al_2O_3). The lime is obtained from a calcareous (lime-containing) raw material, and the other oxides are derived from an argillaceous (clayey) material. Additional raw materials such as silica sand, iron oxide (Fe_2O_3), and bauxite containing hydrated aluminum, Al (OH) 3may be used in smaller quantities to get the desired composition.53 Grade OPC is a higher strength cement to meet the needs of the consumer for higher strength concrete. As per BIS requirements the minimum 28 days compressive strength of 53 Grade OPC should not be less than 53 MPa. For certain specialized works, such as prestressed concrete and certain items of precast concrete requiring consistently high strength concrete, the use of 53 grade OPC is found very useful. 53 grade OPC produces higher-grade concrete at very economical cement content. This grade was introduced in the country by BIS in the year 1987 and commercial production started from 1991. Advent of this grade in the country owes it to the improved technology adopted by modern cement plants. OPC 53 Grade cement is required to conform to BIS specification IS:12269-1987 with a designed strength for 28 days being a minimum of 53 MPa or 530 kg/sq.cm.

Fig 1 53 Grade of Cement

M sand

M-sand is crushed aggregates produced from hard granite stone which is cubically shaped with grounded edges, washed and graded with consistency to be used as a substitute of river sand. Manufactured Sand is sand produced from crushing of granite stones in required grading to be used for construction purposes as a replacement for river sand. M-sand having major chemical constituents as silica (70.74%), Aluminum dioxide (20.67%), Ferric oxide (2.28%), Magnesium oxide (1.57%). Size of fine M-sand passing through 75 microns.

Fig 2 M sand

P sand

P sand is used for wall plastering and brick work purposes. The Granular thickness 150 microns to2.38mm is ideal for block masonry and plastering purposes. Plastering M sand to be mixed in the cement ratio 14 for internal works and 16 for external works.

Fig 3 P sand

G sand

G sand is a cubical in shape and is manufactured using international technology like high carbon steel hit rock and then ROCK ON ROCK process Which is synonymous to that of natural process under going in river sand in information.

Fig 4 G sand

Dolomite sand

Dolomite is a common rock-forming mineral. It is the primary constituent of dolomite rock (dolostone) and dolomarble. It is similar to the most common carbonate mineral calcite. Dolomite is an anhydrous carbonate mineral composed of calcium magnesium carbonate, Ideally Ca Mg (co3)2.The term is also used for a sedimentary carbonate rock composed mostly of the mineral dolomite. An alternative name sometimes used for the dolomite rock type is dolostone.

Fig 5 Dolomite sand

Water

The good quality of water using for concrete have pH value is 6 to 8.0 have using the good quality of water for casting of cubes.

3. SAMPLE PREPARATION

Moulds were made from stainless steel of 10mm thickness. The moulds were fabricated in college workshop. The size of moulds is 70.2X70.2X70.2 mm inner dimensions. The cement to sand ratio is 1:3 and water cement ratio 0.5. The moulds were oiled before casting of cubes.

4. EXPERIMENTAL TEST VALUES & RESULTS

This chapter covers the results of the various experimental studies. The results that are presented include M sand, P sand, G sand and dolomite sand and the various testing results.

Effect of P sand cement mortar properties

This section deals with the effect of compressive strength the various properties of the cement. The properties that have been analyzed for interpretation is compressive strength test for P sand mortar cubes.

Table 1 Compressive Strength Test for P sand mortar

TYPE OF SAND	DAYS	ULTIMATE LOAD(KN)			AVERAGE ULTIMATE LOAD(KN)	COMPRESSIVE STRENGTH (P/A) IN N/mm²
M SAND	7	133	130	128	130.33	26.44
	14	187.5	191.2	192.6	190.43	38.64
P SAND	7	48	47.1	49.6	48.23	9.87
	14	65.8	66.6	72	68.13	13.82

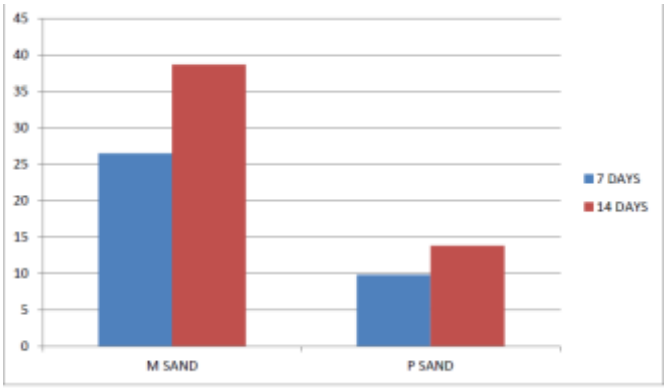

Fig 6 Combined Result of Compressive Strength Test for P sand mortar

Effect of G sand cement mortar properties

This section deals with the effect of compressive strength the various properties of the cement. The properties that have been analyzed for interpretation is compressive strength test for G sand mortar cubes.

Table 2 Compressive Strength Test for G sand mortar

TYPE OF SAND	DAYS	ULTIMATE LOAD(KN)			AVERAGE ULTIMATE LOAD(KN)	COMPRESSIVE STRENGTH (P/A) IN N/mm²
M SAND	7	133	130	128	130.33	26.44
	14	187.5	191.2	192.6	190.43	38.64
G SAND	7	112.7	114.5	115	114	23.13
	14	215	210.5	218.3	214.6	43.54

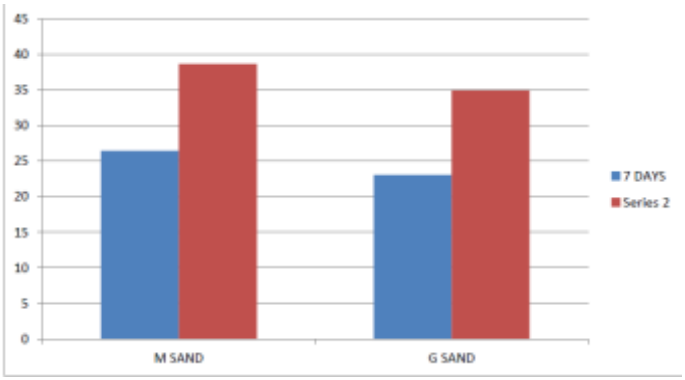

Fig 7 Combined Result of Compressive Strength Test for G sand mortar

Effect of Dolomite sand cement mortar properties

This section deals with the effect of compressive strength the various properties of the cement. The properties that have been analyzed for interpretation is compressive strength test for G sand mortar cubes.

Table 3 Compressive Strength Test for Dolomite sand mortar

TYPE OF SAND	DAYS	ULTIMATE LOAD(KN)			AVERAGE ULTIMATE LOAD(KN)	COMPRESSIVE STRENGTH (P/A) IN N/mm²
M SAND	7	133	130	128	130.33	26.44
	14	187.5	191.2	192.6	190.43	38.64
DOLOMITE SAND	7	110.7	112.6	117.5	113.6	23.05
	14	168.8	172.6	174.3	172	34.90

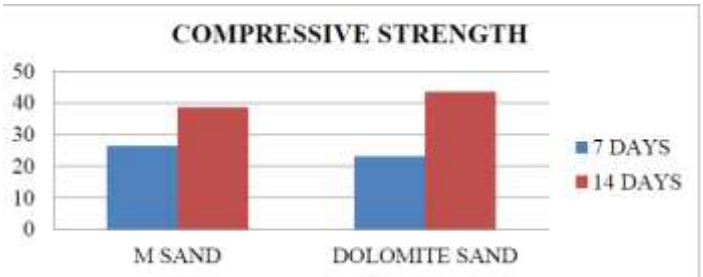

Fig 8 Combined Result of Compressive Strength Test for dolomite sand mortar

Comparative graphical results:

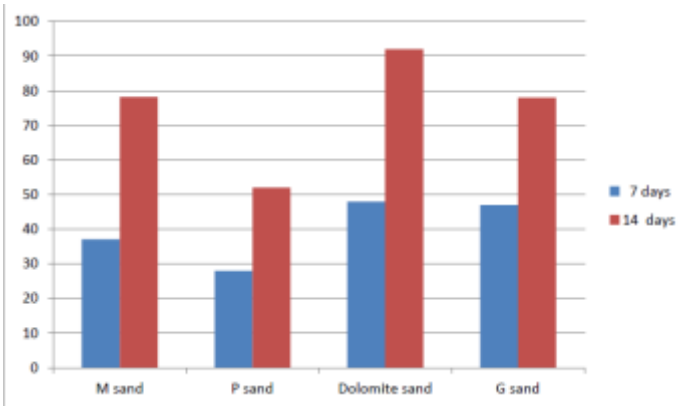

Fig 9 Combined Result of compressive strength with cement mortar

From the experimental results and from graphical output, it is inferred that when dolomite sand is added to the cement mortar there is an increase in the compressive strength.

Full replacement of dolomite sand gave probable increase in strength values comparing to M sand mortar cubes. Hence 15 % of dolomite sand can be used with cement mortar to increase the compressive strength.

5. CONCLUSION

The use of M sand, P sand, Dolomite sand and G sand slightly improves the properties of mortar. It was observed that by the fully replacement of fine aggregate for mortar, the compressive strength values have been increased with the fully replacement of fine aggregate. By using the mortar, the construction methodology will be simple and can be maintained for longer time. It has the main advantage such as it will be economical for any type of construction and it mainly provides an eco-friendly environment by avoiding different type of pollution effects and from harmful hazards. From the present investigation the compressive strength is attained high in the dolomite sand among the M sand, P sand and G sand.

REFERENCES

1. Replacement Of Natural Fine Aggregate With Granular Slag - A Waste Industrial By-Product In Cement Mortar Applications As An Alternative Construction Materials Mohammed Nadeem1, Dr. A. D. Pofale2 Vol. 2, Issue 5, September- October 2012

2. Use Of Granulated Blast Furnace Slag As Fine Aggregate In Cement Mortar M C Nataraja1*, P G Dileep Kumar2, A S Manu1 And M C Sanjay1, Vol. 2, No. 2, May 2013

3. Effect Of Replacement Of Natural Sand By Manufactured Sand On The Properties Of Cement Mortar Priyanka A. Jadhav, Dilip K. Kulkarni, International Journal Of Civil And Structural Engineering Volume 3, No 3, 2013.

4. Characteristics Study On Different Types Of Cement Mortars Replaced With SCBA As A Admixture P.V. Rambabu1, T. Murali Sai Krishna2, G.V. Ramarao3, (IJETT) – Volume 36 Number 3- June 2016

5. Replacement of Fine Aggregate By M-Sand Halesh Kumar B T Anusha H S IJSTE - International Journal Of Science Technology & Engineering | Volume 3 | Issue 12 | June 2017.

6. Partial Replacement of Fine Aggregate by Used Foundry Sand in Concrete Amrutha K1, Adharsh S2, Ashirwad K3, Fareen K4, Najila M5, Praseedha R6(IRJET) Volume: 04 Issue: 03 | Mar -2017 .

7. The Compressive Behavior Of Cement Mortar With The Addition Of Nano Metakaolin ,Guo Xiaoyu, Fan Yingfang, And Luan Haiyang, Volume 8: 1–7ª The Author(S) 2018.

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