Mahesh, 2021, 9:4
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

Experimental Investigation on Concrete By Using Partial Replacement Of Marble Powder With Fine Aggregate And Silica Fume With Cement

Asst. Prof. A.Kavya, Prof. Dr. K. Chandramouli, Asst. Prof. J. Sree Naga Chaitanya, Associate Prof. Dr.N. Pannirselvam, B.Tech. Student Mahesh
Department of Civil Engineering, NRI Institute of Technology
Perecherla, Guntur, AP, India.

Abstract- This study is about use marble powder as a waste material for partial replacement of sand And silica Fume as partial replacement of cement in concrete for modifying its properties. In the concrete mixes sand was replaced with marble powder at 5%, 10%, 15%, 20%, 25% and cement with silica fume at 5%, 7.5%, 12.5%, by weight and effects of replacement on concrete are observed. Use of marble powder in concrete permits disposal of waste (marble powder) and make concrete light in weight. Marble powder will helps to improve the strength of Concrete, Tests are conducted to determine the compressive and tensile strength tests of concrete at 7 and 28 days. The maximum strength is obtained for 15% replacement of marble powder with sand and 7.5% of silica fume with cement.

Key words- Marble Powder, Silica Fume, Compressive strength and Split tensile strength.

I. INTRODUCTION

Utilization of waste materials in con Utilization of waste materials in concrete mixes is now recognized as one of the meaningful ways to dispose the solid waste from other industries. Concrete is a composite material composed of coarse aggregate bonded together with a fluid cement which hardens over time. Most concretes used are lime- based concretes such as Portland cement concrete or concretes made with other hydraulic cements.

The most important construction materials are cement based materials and it is most likely that they will continue to have the same importance in the future. Concrete is mixture of cement, sand, gravel and water. Concrete is the most important material in construction industry other than timber and steel. It is Estimated that current consumption of concrete in the world is of the order of 10 billion tones once a year.

II. LITERATURE REVIEW

Nikhil graval (**2016**)

Due to increase of utility of cement, many environmental problems are faced at the National level. It is necessary to think about the materials which can be used as alternative in the concrete. The use of specific amount of silica fume in replacement of cement provides better strength. It is very much essential to develop profitable building materials from silica fume. The innovative use of silica fu mein concrete making formula as a cement replacement material was tested as an

International Journal of Science, Engineering and Technology

An Open Access Journal

alternative to traditional concrete in the present study. To find optimum dosage of silica fume. Cement is replaced by silica fume in the range of 0%, 5%, 10%, 15%, 20%, 25% & 30% by weight for M-40 grade concrete. Concrete mixtures were produced, tested and compared in terms Of compressive and flexural strength with the conventional concrete. The setests were carried out to evaluate the mechanical properties for 7, 14 and 28 days. The present study is focused on investigating the behavior of concrete while replacing silica fumein different proportion in concrete

Ali Ergun (2011) From the experimental work the author concluded the concrete containing 5% waste marble powder as partial replacement of cement with a super plasticizing admixture had higher compressive strength than that of normal concrete cube specimens. 5% Waste marble powder partial replacement improved the mechanical properties of concrete. The positive effect that causes the increase in concrete cube compressive strength stems from filler properties of waste marble powder as in limestone powder.

III. OBJECTIVES

The objectives of this study as follows,

- To optimize the fine aggregate with marble powder.
- To optimize the cement with silica fume.
- To evaluate the compressive and split tensile strength tests.

IV. MATERIALS

1. Cement - cement is mainly used as a binder material in concrete which is used for construction that sets, hardens to other materials bind together. OPC (ordinary Portland cement) of 53 grade is used in construction purpose and its properties presented in table1.

Table 1. Physical Properties of OPC

S. No	Description Of Item	Values
1	Specific Gravity	3.15
2	Fineness	8%
3	Water Absorption	2.8%
4	Bulk Density	1392kg/M^3

2. Fine aggregate- Fine aggregate is the essential in gradient in concrete that consists of natural sand or crushed stone. The quality of fine aggregate density strongly influences the hardened properties of the concrete.

3. Coarse aggregate- The aggregate which is retained over IS Sieve 4.75 mm is termed as coarse aggregate. The normal maximum size is gradually 10-20 mm as per IS383:1970.

4. Water- Water is one of the most important elements in construction and is required for the preparation of mortar, mixing of cement concrete and for curing work etc.The quality of water used has a direct impact on the strength of the motor and cement concrete in the construction work.

5. Marble powder- A Waste marble powder is an inert material which is obtained as an industrial by product during sawing, shaping and polishing of marble powdery in a marble industry. Waste marble powder which is of lime stone origin waste material not being recycled nor used in any industries.

6. Silica fume- Silica fume is used as an artificial pozzolonicad mixture which is also called as micro silica or condensed silica fume. Silica fume is obtained from coal with quartz reduction in an electric arc furnace and is waste bi-product of manufacturing silicon or ferro silicon alloys. Silica fume is a by-product from the production of elemental silicon or alloys containing silicon in electric arc furnaces. At a temperature of approximately 2000°C the reduction of high-purity silicon produces silicon dioxide vapor, which oxidizes and condenses at low temperature to produce silica fume.

V. RESULTS AND DISCUSSIONS

1. Compressive strength test- The cube specimens of 150mm x 150mm x150mm were cast and tested in compression testing machine for 7 and 28days of curing period for different

International Journal of Science, Engineering and Technology

An Open Access Journal

proportions of concrete mix and presented in table2.

Table 2: Compressive strength of concrete with marble powder as partial replacement of sand in concrete

S.No.	% of Marble powder	Compressive Strength, N/mm^2	
		7 Days	28 Days
1	0	27.03	39.12
2	5	27.22	40.46
3	10	28.74	41.97
4	15	31.29	43.95
5	20	29.20	42.45
6	25	28.37	40.73

Table 3 Compressive strength of concrete with silica fume as partially replaced of cement in concrete

S.No.	% ofSilica fume	Compressive Strength, N/mm^2	
		7 Days	28 Days
1	0	27.03	39.12
2	5	28.28	40.64
3	7.5	30.75	44.38
4	12.5	28.80	41.24

Table 4: Compressive strength of concrete for combined partial replacement of cement by 7.5% of silica fume and fine aggregate by 15% of marble powder.

Mix No	Combined replacements (%)	Compressive strength, N/mm^2	
		7 days	28 days
1	0	27.09	39.12
2	15%MP+7.5%SF	33.28	46.75

Split tensile strength test: At the age of 7 and 28days, the cylindrical specimens (150mm diameterx300mm height) were tested for evaluating the split tensile strength. The experiment is performed by putting a cylindrical sample horizontally between a compression testing machines loading surface and the load is applied until the cylinder fails along the vertical diameter.

Table 5: Split tensile strength of concrete with marble powder as partial replacement of sand in concrete

S.No.	% of Marble powder	Split tensile Strength, N/mm^2	
		7 Days	28 Days
1	0	2.62	3.79
2	5	2.62	4.0
3	10	2.86	4.13
4	15	3.05	4.31
5	20	2.91	4.20
6	25	2.79	4.01

Table 6: Split tensile strength of concrete with silica fume as partially replaced of cement in concrete

S.No.	% of Silica fume	Split tensile Strength, N/mm^2	
		7 Days	28 Days
1	0	2.62	3.79
2	5	2.77	4.02
3	7.5	3.04	4.37
4	12.5	2.59	3.71

Table 7: Split tensile strength of concrete for combined partial replacement of cement by 7.5% of silica fume and fine aggregate by 15% of marble powder.

Mix No	Combined replacements (%)	Split tensile strength, N/mm^2	
		7 days	28 days
1	0	27.09	39.12
2	15%MP+7.5SF	3.29	4.62

VI.CONCLUSION

- At 15% replacement of marble powder with fine aggregate the compressive strength of concrete at 7 and 28 days is 31.29 and 43.95 N/mm^2.
- At 15% replacement of marble powder with fine aggregate the split tensile strength of concrete at 7 and 28 days is 3.05 and 4.31 N/mm^2.
- At 7.5% replacement of silica fume with cement the compressive strength of concrete for 7 and 28 days is 30.75 and 44.38 N/mm^2.

- At 7.5% replacement of silica fume with cement the split tensile strength ofconcrete for 7 and 28 days is 3.04 and 4.37 N/mm^2.
- By constant maintaining of 15% MP +7.5% SF the compressive strength of concrete value at 7 and 28 days is 33.28 and 46.75N/mm^2.
- By constant maintaining of 15% MP +7.5% SF the split tensile strength of concrete value at 7 and 28 days is 3.29 and 4.62N/mm^2.

REFERENCES

1. Ali Ergun, "Effects of the usage of Diatomite and waste marble powder as partial replacement of cement on the mechanical properties of concrete," Construction and BuildingMaterials,Vol.25, pp.806-812,2011.
2. Chandramouli, K, Pannirselvam, N, Vijayakumar,D, (2018), A Review on Programmable Cement, International Journal of Current Advanced Research, 7(11), pp. 16302-03.
3. Chandramouli, K, Marouthuramya Sai, Anitha,V, Pannirselvam et.al., (2019), Improvement of Silica Fume on Concrete by using Mix Proportions, Journal of Applied Science and Computations, 6(4), pp. 187-192.
4. Chandramouli, K, Pannirselvam,N, Vijayakumar,D, (2019), Strength Studies on Pine Apple Fibre Concrete with Nano Silica, International Journal of Innovative Technology and Exploring Engineering, 8(7), pp. 3063-3065.
5. Gencel O, Ozel C, Koksal F, Erdogmus E, Martínez-Barrera G, Brostow W (2012)Propertiesofconcretepavingblocksmadewithwastemarble.JCleanProd21(1):62–70.
6. Gulden Cagin Ulubeyli &RecepArtir, "Properties of hardened concrete produced by waste marble powder,"Proceedia Social and behavioral sciences,Vol.195,pp.2181-2190,2015.
7. Omar M.omar, GhadaD. Abd Elhameed, Mohamed A.Sherif, Hassan A. Mohamdien," In fluence of Limestone waste as partial replacement material for and &Marble powder in concrete properties,"HRBCjournal, Vol.8,pp.193-203,2012.
8. Pannirselvam, N, Chandramouli, K, Anitha, V, (2019), Dynamic Young's Modulus of Elasticity of Banana Fibre Concrete with Nano Silica, International Journal of Civil Engineering and Technology, 10(1), pp. 3018-3026.
9. Pannirselvam,N, Chandramouli,K, Anitha,V, (2018), Pulse Velocity Test on Banana Fibre Concrete with Nano Silica, International Journal of Civil Engineering and Technology, 9(11), pp. 2853-58.
10. Santhikala,R, Chandramouli, K, Pannirselvam,N, (2019), Strength Studies on Bio Cement Concrete, International Journal of Civil Engineering and Technology, 10(1), pp. 147-154.
11. Sarkar R, Das SK, Mandal PK, Maiti HS (2006) Phase and microstructure evolutionduring hydrothermal solidifcation of clay– quartz mixture with marble dust source ofreactivelime. J Eur Ceram Soc26(3):297–304.
12. Singh M, Choudhary K, Srivastava A, Singh Sangwan K, Bhunia D (2017) A study on environmental and economic impacts of using waste marble powder in concrete. J BuildEng13:87–95.
13. Talha A, F.Kharchi& R. Chaid, "Influence of marble powder on high performance concrete behavior,"Proceedia Engineering, Vol.114, pp.685-690,2015.
14. Ulubeyli GC, Bilir T, Artir R (2016) Durability properties of concrete produced by marble waste as aggregate or mineral additives. Procedia Eng161:543–548.
15. Varadha rajan S (2020) Determination of mechanical properties and environmental impact due to inclusion of fly ash and marble waste powder in concrete. Structures 25:613.

Dr. K. CHANDRAMOULI Working as Professor & HOD Civil Engineering at NRI Institute of Technology, Andhra Pradesh, INDIA. He completed Ph.D. from JNTU Hyderabad. His research interests include Concrete Technology and Structural Engineering. He published over115 papers in various international journals and International

International Journal of Science, Engineering and Technology

An Open Access Journal

Conferences, which includes 14 SCOPOUS INDEXED research papers. He received 5 International awards for his research in concrete technology. He is the member of WORLD RESEARCH COUNCIL,M.I.S.T.E., M.I.C.I., IAENG.

A.Kavya, Assistant Professor at NRI Institute of Technology, Andhra Pradesh, India, she completed her M. Tech in structural engineering from KL university. Her research interests include concrete Technology and structural engineering.

J.SREE NAGA CHAITANYA Assistant Professor at NRI Institute of Technology, Andhra Pradesh, India, she completed M. Tech in structural engineering from JNTUH. Her research interests include concrete Technology and structural engineering. She is the author of over 10 papers in referred journals and International Conference including 1 paper. She is a member of M.I.S.T.E, IAENG.

Dr. N. Pannirselvam working as Associate Professor in SRMIST, Kattankulathur, Tamilnadu, He completed Ph.D. from Annamalai University, Tamilnadu as full-time research scholar and has 15 years of teaching experience and 4 years in VIT University, Vellore. At presently guiding 7 PhD Scholars. His research interests include concrete composites, concrete materials and structural engineering. He published over 60 papers in various international journals. He has been serving as reviewer and editorial board member in reputed international journals.