iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** I **Month of publication:** January 2021

DOI: https://doi.org/10.22214/ijraset.2021.32921

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue I Jan 2021- Available at www.ijraset.com

Experimental Study on Compressive Strength and Cost Analysis of M30 Concrete by Replacing Artificial Sand against Natural Sand

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Abstract: Being cheapest in earlier days the natural sand used in concrete without any alternate even though natural sand containing organic impurities, clay and silt content more than permitted level. Due to excessive mining the river basin environment got affected, the demand for fine aggregate increased and the prevailing market unable to meet the need. Nowadays crushed sand also called as manufactured sand being used as an alternate to natural sand partially or fully. an attempt has been made to experimentally study the properties of concrete by replacing the 100% natural sand with artificial sand. The results have shown that the natural sand can be replaced with the artificial sand to produce concrete of Satisfactory strength and durability. Experiments conducted on M30, grade concrete with fine aggregate replacement proportion 10%,20% 30%, 40%,50%,60% and 70%. We have investigated workability, compressive strength for all different cases and cost analysis between artificial sand and Natural Sand.

Keywords: Manufactured Sand, River Sand, Compressive strength, Flexural strength, Split Tensile Strength, Workability.

I. DRAWBACKS OF USING NATURAL RIVER SAND

Natural Sand (NS) is deficient in many aspects when used directly for concrete production, due to some of the listed factors: From the environmental point of view: Extraction of the sand from river bed in excess quantity is hazardous to the environment It is a common sight that well foundations of the bridges are exposed considerably, due to excessive extraction of sand around the sub structure endangering the sub structure of the bridges. Excessive mining of the sand from river beds reduces the water head. This is due to the less percolation of rainwater in the ground. The absence of sand in river bed results in more water being evaporated due to direct sunlight. The sand shortfall in river beds will affect the water filtration. The arguments are mostly in regard to protecting river beds against the erosion and the importance of having natural sand as a filter for ground water. For these reasons, periodic restrictions are being introduced by governmental authorities against the collection of river sand. Recently many countries have established policies aimed at utilizing the local materials as much as possible for building construction. The growing shortage and price rise of the natural sand also raise questions that a construction industry shall think about it.

A. Manufactured Sand

The Manufactured Sand (MS) is a by-product of the crushing and screening process in the quarries. Quarry generates considerable volumes of quarry fines while crushing the rock into aggregates. It is also referred to as crushed rock sand, stone sand, crusher sand and crushed fine aggregate. Quarry fines consist of a graded mix of coarse sand, medium sand and fine sand sized particles, plus clay/silt fraction known as the 'filler' grade.



Production of M sand in plant

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II. LITERATURE REVIEW

Illangoan. R (2000) has completed an investigation on 100% substitution of sand by quarry dust in concrete. The compressive strength of cement with quarry dust has 40% more than that of the concrete with sand.

M. Shukla and A K Sachan (2000) contemplated ecological hazardous stone dust use in building development. It is discovered that halfway substitution won't influence the quality and furthermore take care of the issue of disposal of stone dust. The workability of cement reduces with the increase in stone dust and this can be enhanced by including reasonable admixtures.

Anjali Prajapati et al (2017) studied the effect of performance of HPC using mineral admixture i.e. fly ash and GGBS with M-60 grade of IS cube specimen .We partially replaced Portland cement by weight of binder. Fly ash and GGBS replacement varies from 10% to 30%. We used Conplast SP430-Sulphonated Naphthalene Polymers as a superplasticizer for better workability for high performance concrete. Dosage for superplasticizers is same for all mix proportions.

M. N. Bajad Sarang Sakhare 2018 studied the the properties of concrete and mortar by replacing the 100% natural sand with artificial sand. The results have shown that the natural sand can be replaced with the artificial sand to produce concrete and mortar of satisfactory strength and durability

III. OBJECTIVES OF STUDY

The general objective of this research work is

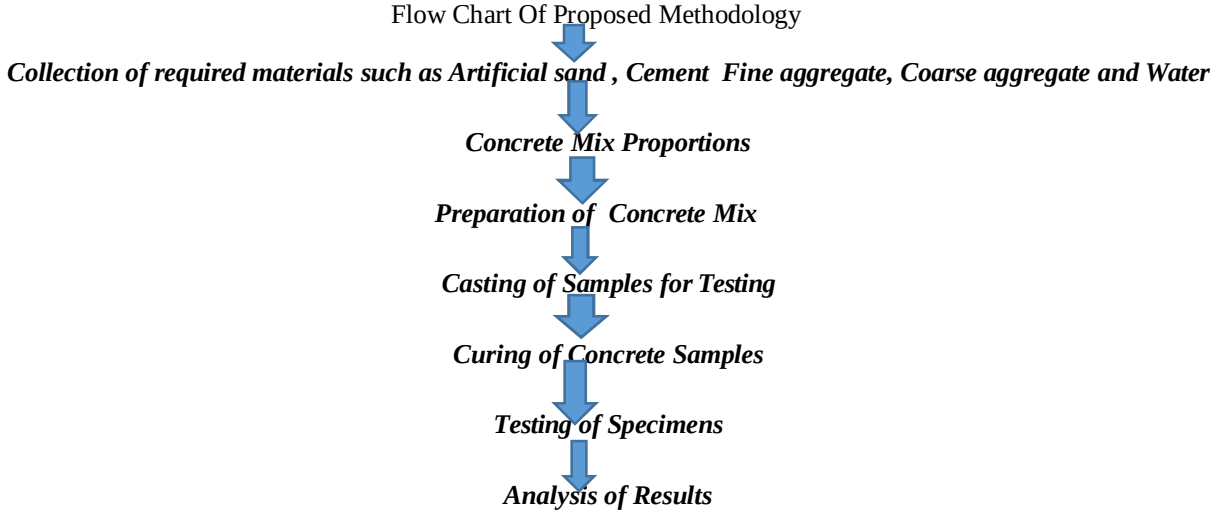
A. To find out workability, compressive strength, split tensile strength and flexural strength of concrete specimens for Mix design for M 30 grade concrete with various
replacement levels of manufactured sand.
B. To find out the optimum percentage of artificial sand to get maximum strength of concrete.
C. Study on properties of fresh and hardened concrete with the replacement of fine aggregate by various proportions of manufactured sand.
D. Comparing the results with conventional concrete mix.
E. The objective of this study is to search alternatives material which can fully or partially replaced naturally available material in construction
F. The main purpose of this study is to reduce the use of conventional material for making the concrete.

IV. MATERIALS AND METHODS

Material used in Experiment

A. Cement
B. Aggregate (Coarse Sand)
C. Artificial Sand
D. Natural Sand
E. Water

Flow Chart Of Proposed Methodology

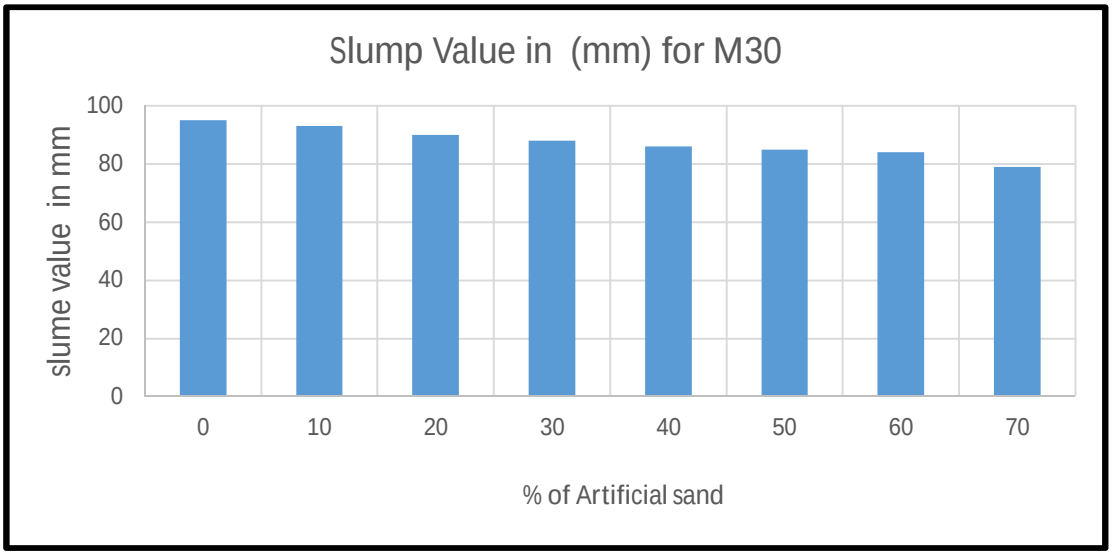


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V. EXPERIMENTAL RESULTS AND DISCUSSIONS

A. Slump Test Result for M30

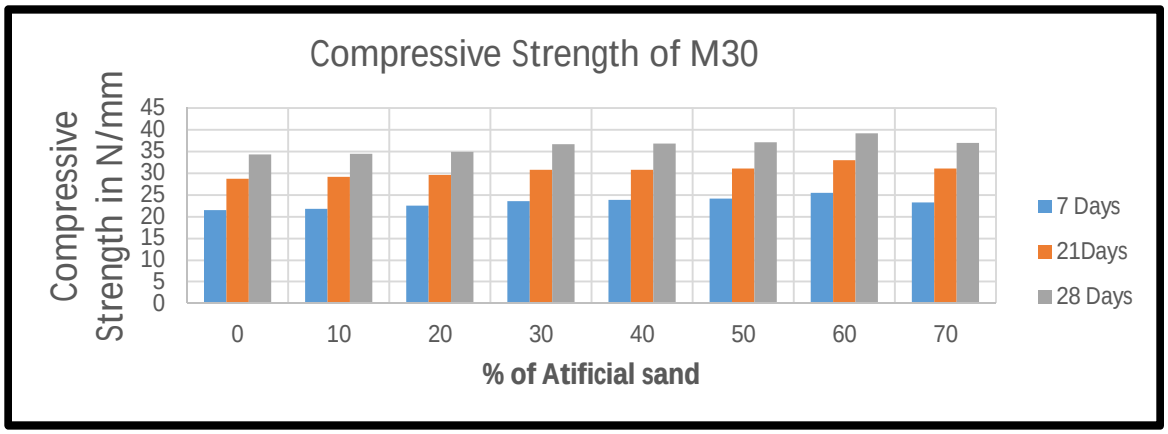
The workability is tested by slump test. When the concrete is freshly mix then it is tested by filling the fresh concrete in the slump cone. The workability is measured by removing the slump cone and measured the subsidence of the concrete this value is called the slump value of the concrete



Slumps of M-30 at Different percentage of AS

From the Experiment work ,It is also observed that, as the percentage of Artificial Sand increases from 0% to 60%, the concrete mix becomes stiffer, and workability results in low slump value. Low slump value may have great impacton the workability of concrete

B. Compressive Strength test Results



Variation of compressive strength after7,14 and 28 days curing for M30

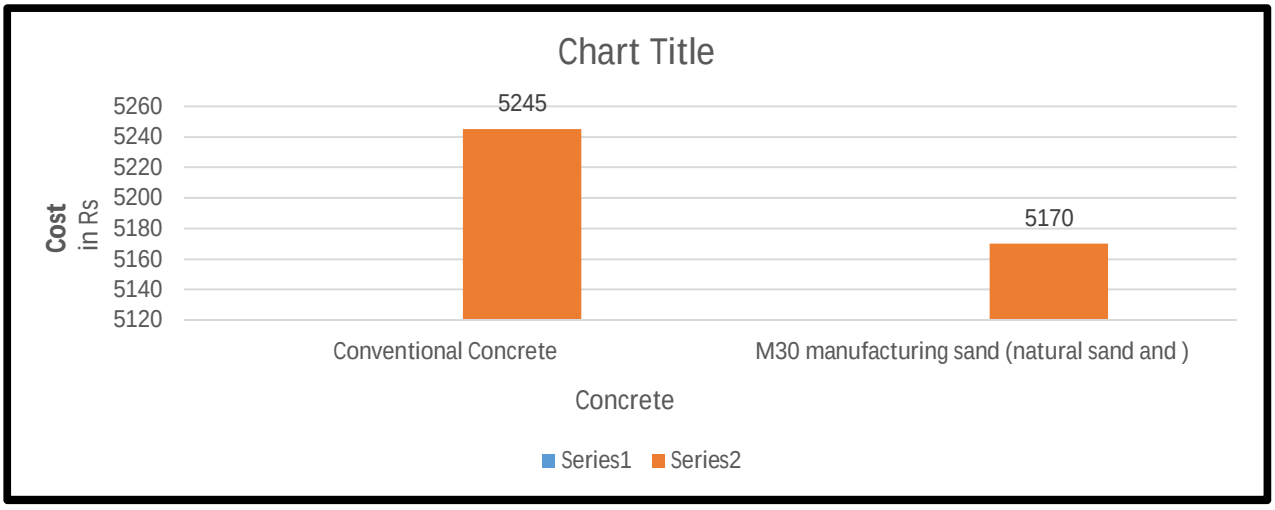
In the above figure , the cube compressive strength for sample B_1 - 0 to sample B_1 – 70 for different replacement levels of fine aggregate with manufactured sand (0%, 10%, 20%, 30% ,40%, 50% 60% and 70%) is shown at the end of 7,21and 28 days curing period. Sample B_1 60 with 40% natural sand and 60% manufactured sand shows an increase for M30 it values is14.45% The compressive strength of concrete with manufactured sand is increased to 60% and after 60% of the replacement the strengths are gradually reduced. The maximum compressive strength values for 40% natural sand and 60% manufactured sand are for M30 its values is 39.2 N / mm2. The maximum percentage of natural sand and manufactured sand on the natural sand substitution must therefore be 40% and 60% when OPC is used

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VI. COST ANALYSIS OF M30 GRADE

Cost of material per cubic meter of concrete for M30

Material	Rate	Conventional Concrete		M30 manufacturing sand (natural sand and)		% Saving
Quantity	Cost	Quantity	Cost			
Cement	Rs. 350 per bag (50 kg)	8 bags	Rs. 2800	8 bags	Rs. 2800	1.42%
Manufacturing Sand	Rs. 600/m3	0	0	0.27 m3	Rs. 168	
Natural sand	Rs. 900/m3	0.45m3	Rs. 405	0.18 m3	Rs. 162	
Coarse Aggregate	Rs. 2400/m3	0.82 m3	Rs. 1968	0.82 m3	Rs. 1968	
Super Plasticizer	Rs. 40/Kg	1.807 Kg	Rs. 72.28	1.807 Kg	Rs. 72.28	
			Rs 5245		Rs 5170	



Cost Comparison for M30

From the above table we note that the use of manufacturing sand in concrete saves money up to 1.42 % over the conventional cement concrete. This is a significant saving of money.

There are good prospects of obtaining a good concrete strength at relatively cheaper cost even while replacing part of the sand with manufacturing sand. Figure 6.1 shows the comparison of costs between conventional concrete and M30 mixture.

VII. CONCLUSION

A. From the test results it has been observed that the compressive strength of different concrete mixes, increases at all ages in comparison of the control mix, From the Result is seen that the compressive strength in M30 grade of concrete at 7, 21, and 28 days increases when the percentage of the Artificial Sand from 0% to 60% . At 60% replacement of Artificial Sand strength observed to be maximum and after strength is decreasing. The strength increase at 28 days is up to 18.36%,for M30 grade of concrete at 28 days .

B. At 28 day Maximum compressive strength M30 grade of concrete is 36.23 N/mm2 at 60% of Artificial sand Sand .

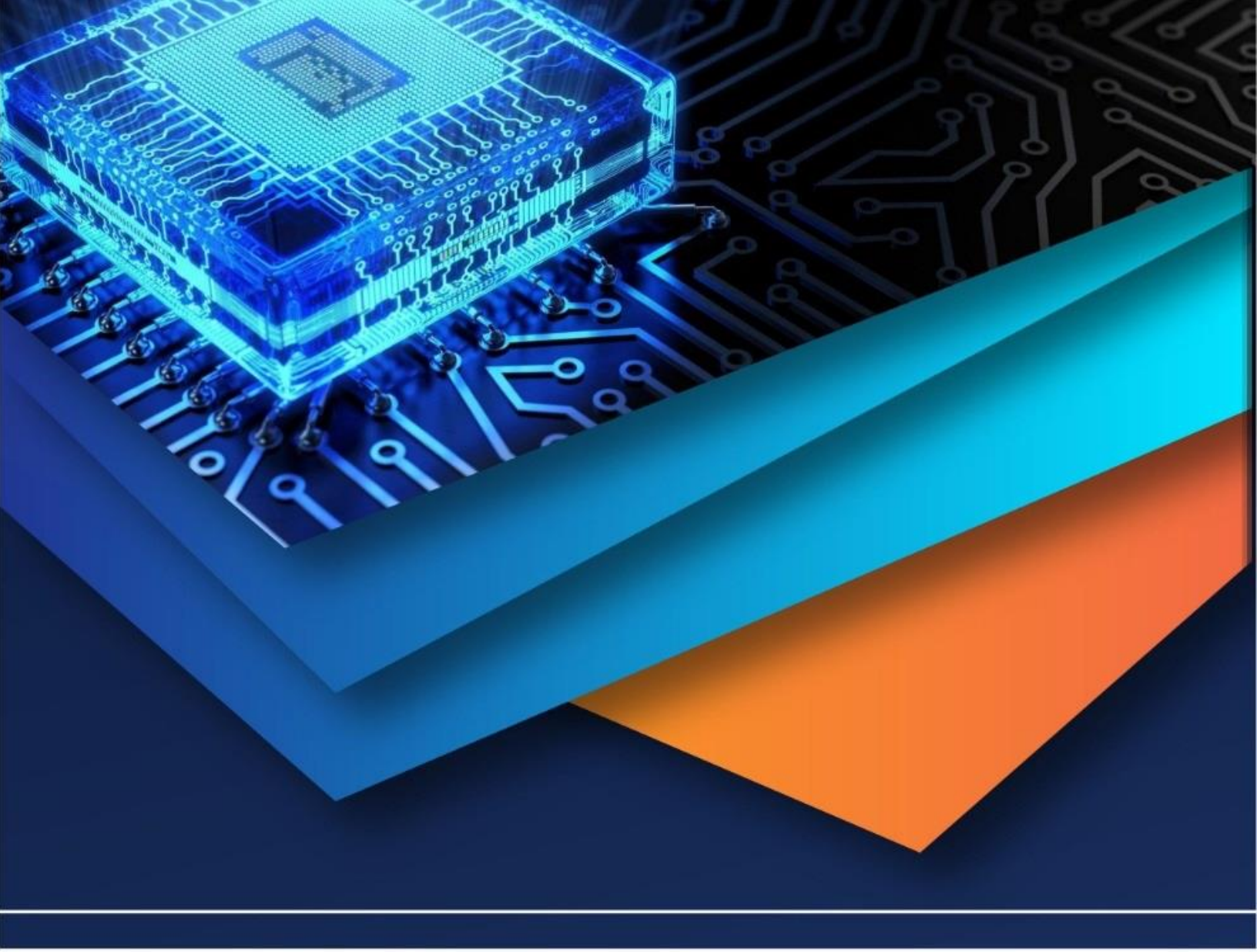
C. From the test results it is observed that the use of sand in concrete saves up to 1.46 % of the conventional cement concrete. This is a considerable saving of money. There are good prospects for obtaining good concrete strength at relatively lower costs, even when a part of the sand is replaced by Artificial sand.

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REFERENCES

[1] T. Kaosol, "Reuse concrete waste as crushed stone for hollow concrete masonry units," in Proc. The 3rd Technology and Innovation for sustainable development international conference (TISD2010), Faculty of engineering, Khon Kaen University, Thailand, 2010, pp. 176
[2] M R Chitlange, 2010, Appraisal of Artificial Sand Concrete, IE(I) Journal Volume 90
[3] Vinayak R.Supekar, Popat D.Kumbhar Properties Of Concrete By Replacement Of Natural Sand With Artificial Sand International Journal of Engineering Research & Technology (IJERT) Vol. 1 Issue 7, September – 2012
[4] M. Adams Joe, A. Maria Rajesh, P. Brightson, M. Prem Anand (2013), "Experimental Investigation on the Effect of M-Sand in High Performance Concrete", American Journal of Engineering Research, Vol. 2, Issue 12, PP: 46-51.
[5] G. Balamurugan, P. Perumal (2013), "Use of Quarry Dust to Replace Sand in Concrete– An Experimental Study", International Journal of Scientific and Research Publications, Volume 3, Issue 12, PP: 250-255.
[6] Nimitha Vijayaraghavan and A S Wayal (2013), "Effects of Manufactured Sand on Compressive Strength and Workability of Concrete", International journal of Structural & Civil Engineering Research, Vol. 2, No. 4, PP: 228-232.
[7] Priyanka A. Jadhav, Dilip K. Kulkarni (2013), "Effect of replacement of natural sand by manufactured sand on the properties of cement mortar", International Journal of Civil and Structural Engineering, Vol. 3, Issue 3, PP: 621-630.
[8] Sheetal A. Sahare, Mugdha N. Priyadarshini, Shweta S (2015), "Effect of Artificial Sand on Compressive Strength and Workability of Concrete", International Journal for Science and Advance Research in Technology, Volume 1 Issue 4, 183-188, April 2015.
[9] P Daisy Angelin, P Ravi Kishore (2015), "Durability Studies on Concrete with Manufacturing Sand As A Partial Replacement of Fine Aggregate In HCL Solution", International Journal of Engineering Research and Development, Volume 11, Issue 12, PP: 44-50.
[10] Nithyambigai. G (2015), "Partial Replacement of Manufactured Sand and Fly Ash in Concrete", International Journal of Emerging Technology and Advanced Engineering, Vol. 5, Issue 6, PP: 166-170.
[11] Harshlata R. Raut, Ashish B. Ugale (2016), "Effect of Artificial Sand on Compressive Strength and Workability of Concrete", International Journal of Engineering Research, Vol 5, Issue 3, PP: 673-674.
[12] S. Suresh, J. Revathi (2016), "An Experimental Investigation of High Strength Concrete Using Manufacturing Sand", International Journal of Advanced Engineering Technology, Vol. 3, Issue 2, PP: 1112-1114.
[13] Roshan Sasidharan, Ranjan Abraham (2016), "Study of Properties of High Strength Concrete Prepared by Replacement of Fine Aggregate with Weathered Crystalline Rock Sand & Partial Replacement of Cement with GGBS", International Journal of Engineering Research & Technology, Vol. 5, Issue 9, PP: 124-130.
[14] Swastik S. Shinde, Swanand R. Kadam, Avinash A. Waychal (2016), "Experimental Study of Compressive Strength of Concrete with Partial Replacement of Natural Sand with Manufactured Sand", International Research Journal of Engineering and Technology, Vol. 3, Issue 1, PP: 719-722.
[15] Muthu Kumar. T, Sirajudeen. K (2016), "Experimental Investigation on High Performance Concrete Using Alternate Materials" International Research Journal of Engineering and Technology, Vol. 3, Issue 1, PP: 719-722.
[16] Prasanna K, Anandh K S, kiruthiga K (2017), "Study on High Performance Concrete with Replacement of Fine Aggregate by Manufactured Sand", International Journal of Civil Engineering and Technology, Volume 8, Issue 8, PP: 1502–1514.
[17] Chandrasekar R, Chilabarasan T, Roshan Thariq Shah A, Visuvasam J (2017), "Development of high strength concrete using waste foundry sand", Journal of Chemical and Pharmaceutical Sciences, Vol. 10, Issue 1, PP: 348- 351.
[18] M. Manoj Pravarly, S. Mahesh (2017), "Characteristic of High Performance Concrete by using ROBO Sand and Fly ash", International Journal of Scientific Engineering and Technology Research, Volume 6, Issue 6, PP: 1015–1022.

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