# A Review on use of Artificial Sand in Concrete Production

**Puja Kiran[1] Pushpendra Kumar Kushwaha[2]**
[1]P.G. Scholar [2]Professor
[1,2]Department of Civil Engineering
[1,2]RKDF, Bhopal, India

*Abstract*— Any Civil Engineering Structure must rest on a Structures are founded with concrete and steel materials mainly. Traditionally, concrete is mixture of cement, sand and aggregate. The most commonly used fine aggregate is natural river sand and coarse aggregate is stone quarry. Scarcity of good quality Natural River sand due to depletion of resources and restriction due to environmental consideration has made concrete manufactures to look for suitable alternative. One such alternative is "Artificial sand" namely if graded by means may also be called as manufactured sand. A review is presented in this work about the application of artificial sand as a smart material in concrete. After a brief outline of the theoretical as well practical studies few measures are reviewed to replace natural sand with manufactured crushed sand.

***Key words:*** Crushed Sand, Workability, Water Absorption, Compressive Strength, Flexural Strength, Tensile Strength

## I. INTRODUCTION

Structures are founded with concrete and steel materials mainly. Concrete is a main constituent of the Civil Engineering structures. It is becoming the backbone of infrastructural development of whole world. Concrete has capacity to enhance its properties with the help of other suitable constituents. The concrete is the most important construction material, which is manufactured at site. It has the advantage of being formed into any desired shape most conveniently. As it is artificially manufactured at site it has wide uses in various construction works. As an importance of the use of waste materials, number of research is currently being conducted concerning the use of artificial sand in increasing the workability and strengthening of reinforced cement concrete and plain cement concrete members. The main disadvantages of concrete are brittleness, low tensile strength, less resistance to cracking, plastic and drying shrinkage properties. Approximately 70 to 80% of the total volume of the concrete is made up of mainly aggregates. Aggregates characteristics (size, shape, texture, grading) influence the workability, finish ability, bleeding, and segregation of fresh concrete and durability of hardened concrete. Environmental concerns are also being raised against uncontrolled extraction of natural sand. The arguments are mostly in regards to protecting riverbeds against erosion and the importance of having natural sand as a filter for ground water.

## II. PROBLEMS FACED BY CIVIL ENGINEERING COMMUNITY REGARDING NATURAL SAND

The huge quantity of concrete is consumed by construction industry all over the world. In India, the conventional concrete is produced by using natural sand, cement, coarse aggregate and water. One major challenge facing the civil engineering community is to involving the use of high performance, environmental friendly materials produced at reasonable cost. In the context of concrete, which is the predominant building material, it is necessary to identify less expensive substitutes. Now-a-days sand is not readily suitable, it should be transported from long distance. Those resources are also exhausting very rapidly. With natural sand deposits the world over drying up, there is an acute need for a product that matches the properties of natural sand in concrete. In the last few years, it has become clear that the availability of good quality natural sand is decreasing. With few local exceptions, it seems to be a global trend also dwindling sand sources poses the environmental problem and hence government restrictions on sand quarrying resulted in scarcity and significant increase in its cost. So it is need of the time to find some substitute to natural river sand.

## III. SUITABILITY OF ARTIFICIAL SAND

Sand is a major material used for preparation of mortar and concrete and plays a most important role in mix design. In general consumption of natural sand is high, due to the large use of concrete and mortar. Hence the demand of natural sand is very high in developing countries to satisfy the rapid infrastructure growth. The developing country facing shortage of good quality natural sand and particularly in India, natural sand deposits are being used up and causing serious threat to environment as well as the society. Rapid extraction of sand from river bed causing so many problems like losing water retaining soil strata, deepening of the river beds and causing bank slides, loss of vegetation on the bank of rivers. Due to shortage of river sand in India so therefore the need to find an alternative concrete and mortar aggregate material to river sand in construction works has assumed greater importance now a days. Researcher and Engineers have come out with their own ideas to decrease or fully replace the use of river sand and use recent innovations such as artificial sand.

## IV. LITERATURE REVIEW

Rajendra P. Mogre et. al. (2013) studied the replacement of natural sand by artificial sand. They concluded from experimental results that, mixes with artificial sand as a fine aggregate gives better strengths than mixes of natural sand due to sharp ages of the particle in artificial and provide better bond with cement than rounded particle of natural sand.

M. Ranjitham and Vennila (2014) investigated high performance concrete wit partial replacement of fine aggregate by foundry sand with cement by mineral admixtures. In this project, investigations were carried out on strength properties such as compressive strength, split tensile strength and flexural strength of M75 grade of HPC mixes with different replacement levels such as 10%, 20%, and 30% of foundry sand with fine aggregate and 10%, 20%, 30% and replacing cement by mineral admixtures such as fly ash and

 

ground granulated blast furnace slag by adopting water-binder ratio of 0.3. Conplast SP430 is based on Sulphonated Napthalene Polymers can be used as a super plasticizer for better workability for high performance concrete.

Sheetal A. Sahare et al (2015) has been investigate an effects of artificial sand with quarry dust on compressive strength, split tensile strength and flexural strength of different concrete mixes when natural sand is completely replaced by artificial sand.

Harshlata R. Raut and Ashish B. Ugale (2016) presented review of research work on effects of artificial sand on compressive strength and workability of concrete. A brief summary of the most significant investigations on the behaviour of concrete by replacing natural sand with artificial sand due to which environmental and social problems arise due to acute shortage of natural sand will be overcome.

Prasanna K and Anandh K S (2017) conducted experiments on M60 grade concrete with fine aggregate replacement proportion 0%, 25%, 50%, 75% and 100%. The properties such as compressive strength, split tensile strength and ultrasonic pulse velocity are determined from cubes and cylinders cast with manufactured sand procured from kundrathur and river sand taken from Araniar basin. The replacement of 75% natural sand by manufactured sand recommended as this proportion gives comparatively better results in special concrete such as high performance concrete. Hence the manufactured can be used in high performance without any doubt which will also improve the environment as well as sustainability of construction industry.

Chandrasekar R et al (2017) carried out for utilization of waste foundry sand (WFS) in High strength concrete. The waste foundry sand was replaced in the place of normal sand with four different percentages (10%, 20%, 30%, and 40%). The several tests such as compressive strength, split tensile strength, modulus of elasticity, flexural strength, ultrasonic pulse velocity (UPV), rebound hammer test, are performed for 7 days and 28 days to obtain the behavior the concrete due to foundry sand. The temperature effects of concrete were observed for the different temperatures such as (200, 400, 600, 800, and 1000℃) for 28 days. In this test results there is sudden decrease in compressive strength due to the increase in percentage of foundry sand from 30%. But moreover 10% to 20 % replacement of foundry sand almost has similar strength as to that of the control mixture.

## V. Conclusion

A review of different experimental studies performed by various researchers have been carried out to examine various operational parameters viz. workability, durability and compressive strength of concrete with crushed sand as replacement to the natural sand. The data assembled during the course of investigation lead to the following conclusions;

- The concrete with crushed sand performed better than concrete with natural sand as the grade of concrete mix increased.
- The flexural strength of concrete with crushed sand was marginally increased on the strength of concrete with natural sand.
- The workability of concrete manufactured with crushed sand was lesser than that manufactured with natural sand.
- The round shape and smooth surface texture of natural sand reduces the inter particle friction in the fine aggregate component so that the workability is higher in natural sand. Manufactured sand particles are angular in shape and their rough surface texture improves the internal friction in the mix. Because of that the workability is reduced.
- Manufactured sand is free from chemical impurities such as sulphates and chlorides which improves the properties of concrete like strength and durability.
- Manufactured sand contains no organic impurities; hence it gives increased strength of Concrete with same cement content. And does not harm the environment in any way. No wastage since Sand is already sieved in the required size (below 4.75 mm).
- Manufactured sand is economical as compared to natural river sand.

## References

[1] Rajendra P. Mogre, Dr. Dhananjay K. Parbat and, Dr. Sudhir P. Bajad (2013), "Feasibility of Artificial Sand in Concrete", International Journal of Engineering Research & Technology, Vol. 2, Issue 7, PP: 1606-1610.
[2] 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.
[3] 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.
[4] 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.
[5] 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.
[6] 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.
[7] 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.
[8] 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.
[9] 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.
[10] 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.
[11] 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.
[12] 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.
[13] 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.
[14] 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.
[15] 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.
[16] 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.
[17] Anjali Prajapati, Piyush Prajapati, Mohammed Qureshi (2017), "An experimental study on high performance concrete using mineral admixtures", International Journal of Engineering Development and Research, Vol. 5, Issue 2, PP: 2080-2090.IS: 456- Plain and reinforced concrete code of practice Bureau of Indian Standards, New Delhi.
[18] IS: 10262- 2009, Concrete mix proportioning guidelines (first revision), Bureau of Indian Standards, New Delhi,
[19] IS: 516-1959, Methods of tests for strength of concrete Bureau of Indian Standards, New Delhi.
[20] IS: 383- 1977, Specification for coarse and fine aggregates from natural sources for concrete Bureau of Indian Standards, New Delhi.
[21] IS 1199- Methods of sampling and analysis of concrete Bureau of Indian Standards, New Delhi.
[22] Shetty, M.S., Concrete Technology, S. Chand & Co. Ltd, 2004.
[23] Gamhir, M.L., Concrete Technology, Tata McGraw hill publishing co. ltd., 2006.

 