International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 01 | Jan 2020 www.irjet.net p-ISSN: 2395-0072

STUDY ON SELF COMPACTING CONCRETE USING RECYCLED AGGREGATE AS PARTIAL REPLACEMENT FOR FINE AGGREGATE AND COARSE AGGREGATE WITH ADDITION OF STEEL FIBRES

Rakesh[1], Er. Abhishek Sharma[2]

[1]*M.Tech Student, Department of Civil Engineering, Galaxy Global Group of Institutions, Dinarpur, Haryana, India*
[2]*Asstt. Professor, Department of Civil Engineering, Galaxy Global Group of Institutions, Dinarpur, Haryana, India*

Abstract - *Concrete is a construction material composed primarily of cement, aggregate, and water. The aggregate is in general a coarse gravel or crushed rocks as, granite or limestone along with sand as fine aggregate. The cement, generally Portland Pozzolana cement and other cementitious materials such as slag cement and fly ash serve as a binder for the aggregate.*

To achieve varied properties, various chemical admixtures are also added. Mixing of this dry composite with water enables it to be shaped (typically poured) and then harden and solidify into rock-hard strength through a chemical phenomenon known as hydration. The water reacts with the cement and bonds the other components together, eventually creating a rigid stone like material.

In order to achieve the objectives of present study, an experimental program was planned to investigate the effect of marble dust and steel fibre on compressive strength, split tensile strength and flexure strength of concrete.

KeyWords: Portland, Pozzolana, Admixtures, Cementitious, Hydration

1.INTRODUCTION

The environmental influence or effect of concrete is a complex mixture having not entirely negative effects; while concrete is a major donor to greenhouse gas emissions, recycling of concrete is highly common in structures that have reached the extent of their life. Structures built of concrete can have a long serving life. As concrete possesses a high thermal mass and very less permeability, it can be used for making energy efficient housing.

As we know Concrete is a gifted construction material. Firstly it was introduced as protective cover of steel members, after that it was modified and now a day's concrete is used as a structural material comprehensively and steel is reinforced to modify its properties and give better strength to the concrete. Concrete can yield benefits like excellent resistance to water, fire resistance, has ability to mould into various sizes and shapes easily as per requirement, economic and readily available material on the job site. It is noticed that the normal concrete has many drawbacks like low value of strength to water cement ratio as compared to steel. So as to overcome this weakness, development of high strength concrete (HSC) came into existence.

Now a days, with the excess use of admixtures and widely distributed application of concrete technology, it is easy to achieve cylindrical compressive strength of 50.00 MPa in 12 to 18 hours and near to 71Mpa or above at 28 days of curing. As per economic point of view, it is very necessary to design a higher proportion of the available strength of concrete with efficiency and effectively rather than a lesser proportion of much higher strength.

2. OBJECTIVES OF THE STUDY

In this study an attempt is made to find the effect of various additives on paving concrete. The objectives of the proposed work can be summarised as follows:

• The main objective of the proposed work is to read the effect of steel fibres on strength characteristics like compressive strength, split tensile strength and flexural strength of Rigid Pavement Quality Concrete.

• Additionally, the effect of partial replacement of cement by marble dust has also been proposed to be studied in this dissertation.

• Moreover, the behavior on addition of both Marble Dust and Steel Fibre in Concrete for various conditions and cases has also to be studied.

3. LITERATURE REVIEW

The following are the some past research survey:-

Wang et al. (1996) explored the fibre reinforced beams of concrete under impact loading. Impact tests were carried out on small beams reinforced with concrete of different volumes of both steel fibres and polypropylene. The drop height of the instrumented drop weight impact machine was so selected that Some test samples failed completely under one drop of the hammer, while others required two or more blows to bring about complete failure. It was found that, at volume less than 0.5%, polypropylene fibres gave only a small increase in fracture energy. Steel fibres could bring about much greater improvement in fracture energy, with a

passage in failure modes occurring between steel fibre volumes of 0.50% and 0.750%. Below 0.50%, fibre breaking was the main failure mechanism and the increase in fracture energy was also very less; above 0.750% fibre pull-out was the primary mechanism with increase in fracture energy.

Nataraja et al.(1999), carried out an investigation on Stress-strain curves for steel-fibre reinforced concrete under compression. The stress-strain curve of the material in compression is required for the design and Study of structures. In this experimental probe, an experiment has been made to generate the stress-strain curve experimentally for steel-fibre reinforced concrete for compressive strength ranging from 30.0 to 50.0 KN/mm2. Round crimped fibres with three volume fractions of 0.50%, 0.750% and 1.00% (39.0, 59.0, and 78.0 kg/m3) and for two aspect ratios of 55.0 and 82.0 are considered. The effect of fibre inclusion to concrete on some of the main parameters namely the toughness of concrete, peak stress, strain at peak stress, and the nature of the stress-strain curve is studied. A simple analytical model is proposed to generate both the descending and ascending portions of the stress-strain curve. There lies a good correlation between the experimental results and calculations based on the analytical model. Equations are also proposed to quantify the effect of fibre on compressive strength, strain at peak stress and the toughness of concrete in terms of fibre reinforcing parameter.

Elsaigh et al. (2005),carried out investigation on steel fibre reinforced concrete for road pavement applications. In this paper, they established that the use of SFRC for road pavements and compare its execution with plain concrete under traffic loading. The determining of SFRC properties on performance and design aspects of concrete roads are discussed. Results coming out from road trial sections, tested under in-service traffic, are used to validate the use of the material in roads.

Aukour (2009), studied that the marble sludge is very useful in house building materials. The main objectives of using marble sludge are to save natural resources and to reduce the dumping problem of industrial waste materials quantity. The experimental outcomes and their theoretical interpretation shows suitable incorporation of marble sludge results in building blocks of 15.0 cm with superior properties in terms of water absorption (7.0%). The compressive strength at age of 28 days curing only to a maximum of 7.80N/mm2.

Reddy (2010), carried out investigations on stone dust and ceramic scrap as aggregate replacement in concrete. In this research paper, he authenticated that stone dust has been tried as fine aggregate in spite of sand and ceramic scrap has been used as limited/full substitute to conventional coarse aggregate in concrete making. Cylinders, cubes and prisms were cast and checked for compressive, split tensile strength and modulus of rupture after a curing period of 28 days. The outcomes indicated effectiveness of stone dust as fine aggregate and partial replacement of traditional coarse aggregate by ceramic scrap up to 20 %, without affecting the design strength

4. CONCLUSION

IRJET sample template format ,Conclusion content comes here. Conclusion content comes here Conclusion content comes here Conclusion content comes here Conclusion content comes here Conclusion content comes here Conclusion content comes here Conclusion content comes here Conclusion content comes here Conclusion content comes here Conclusion content comes here Conclusion content comes here Conclusion content comes here . Conclusion content comes here.

5. RESEARCH METHODOLOGY

In order to achieve the objectives of present study, an experimental program was planned to investigate the effect of marble dust and steel fibre on flexural strength, compressive strength and split tensile strength of concrete so as to assess its feasibility for use in highway pavement. The experimental program consists of casting, curing and testing of controlled and marble dust-steel fibre concrete specimen at different ages.

Following parameters were included in this experimental study:

- Testing of properties of materials used for making concrete.

- Design of mixes for pavement quality concrete and steel fibre reinforced concrete by making trials.

- Casting and curing of specimens.

- Tests to determine the flexural strength, compressive strength and Split Tensile strength of high strength steel fibre reinforced concrete.

The procedure of methods used for testing cement, coarse aggregates, fine aggregate, marble dust and concrete are given below:

5.1 Tests on Cement

Specific gravity test, Consistency test, Initial and Final Setting time Determination, Fineness test, Soundness test and Compressive Strength test on cement were conducted. Cement is one of the prominent materials in building of Concrete, most of the strength imparted in concrete is because of cement. Any change in its weight reduces the Compressive Strength of Concrete with a very big effect.

The tests were conducted as per requirements of IS: 8112-1989 and in its accordance. Three different cement samples were taken in this experimental study and those three samples were subjected to the above mentioned tests.

After all the tests were conducted, the experimental values of all these tests were put forward.Then these tests compared with the required Indian Standard specifications and were checked of the feasibility whether can be used in the further study or not.

5.2 Sieve Analysis for Marble Dust , Coarse and Fine Aggregates

The sieve analysis is used for the determination of particle size distribution of fine and coarse aggregates by sieving or screening.

Sieve Analysis of Marble Dust and Aggregates was done with a particular set of sieves. Sieves ranging from sizes 80mm to 4.75 mm were used for Coarse Aggregates (20mm), Sieve sizes ranging from 100mm to 4.75 were used for Coarse Aggregates (10mm),for Fine Aggregates, Sieve sizes ranging from 10mm to 150 μ were used and for Marble Dust Sieves of sizes ranging from 4.75 mm to 150 μ were used. These Sieve tests gave the value of the fineness modulus for all these materials.

5.3 Test for Compressive Strength of Concrete

Test specimens of size 150x150x150 mm were manufactured for testing the compressive strength of both controlled as well as marble dust-steel fibre reinforced pavement quality concrete. The modified concrete mixtures with varying percentages of steel fibres and partial replacement of cement with marble dust were prepared and cast into cubes and tested.

5.4 Test for Flexural Strength of Concrete

Test specimens of beam size 150 mm X 150 mm X 700 mm were chosen for testing the flexural strength of steel fibre reinforced concrete and replacement of cement with marble dust in different percentages.

5.5 Test for Split Tensile Strength of Concrete

The split tensile strength of concrete is determined by casting cylinders of size 150 mm X 300 mm. The cylinders were tested by placing them uniformly. Specimens were taken out from curing tank at age of 28 days of moist curing and tested after surface water dipped down from specimens. This test was performed on Universal Testing Machine (UTM).

6. FINDINGS OF THE STUDY

An experimental program was planned to investigate the effect of marble dust and steel fibre on flexural strength, compressive strength and split tensile strength of concrete so as to assess its feasibility for use in highway pavement. The experimental program consists of casting, curing and testing of controlled and marble dust-steel fibre concrete specimen at different ages.

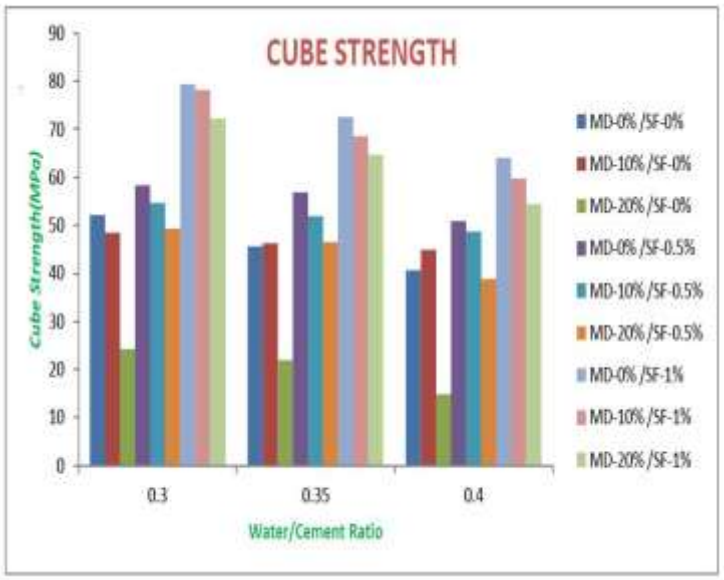

Fig.1- Variation of Compressive Strength Vs Water/Cement ratio of Concrete with different percentages of Steel Fibres (S.F) and Marble Dust (M.D).

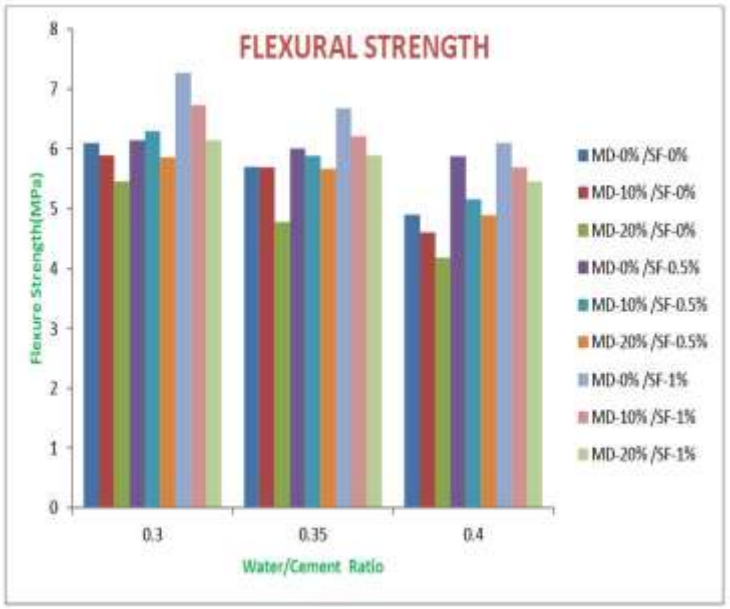

Fig.2- Variation of Flexural Strength Vs Water/Cement ratio of Concrete with different percentages of Steel Fibres (S.F) and Marble Dust (M.D).

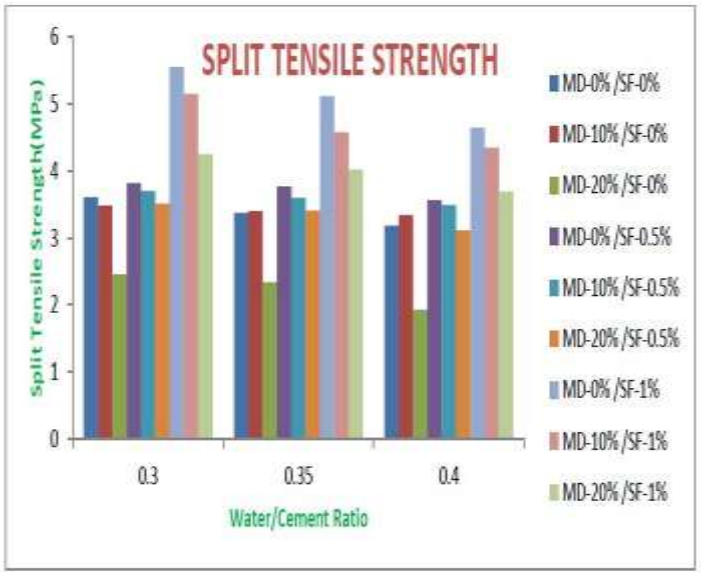

Fig.3- Variation of Split Tensile Strength Vs Water/Cement ratio of Concrete with different percentages of Steel Fibres (S.F) and Marble Dust (M.D).

7. CONCLUSIONS

From the experimental results carried out with different samples and with varying ratios of contents, the following conclusion can be drawn:

- Concrete mix similar to grade M20, with 10 percent marble dust as replacement of cement by weight in its composition is the optimum level as it has been observed to show a significant increase in compressive strength up to 10% at water cement ratio 0.40 at 28 days curing when compared with nominal mix without marble dust and Concrete mix prepared in the study that is nearly similar to grade M20 when reinforced with steel fibre up to 1% shows an increased compressive strength of 53.2% at water cement ratio of 0.30 as compared to nominal mix without the steel fibres.

- The split tensile strength also tends to increase with increase percentages of steel fibres in the mix up to 50% with use of 1% steel fibres for water/cement ratio of 0.30 and also tends to increase up to 10% when 10 percent of marble dust as replacement of cement by weight is induced in the concrete mix. On increasing the percentage replacement of cement with marble dust beyond 10%, there is a slight reduction in split tensile strength.

- The flexure strength also tends to increase up to 25% with the increase percentages of steel fibres up to 1%, a phenomenon similar to increase in split tensile strength and compressive strength, whereas in case of marble dust when added to concrete mix, the percentage flexure strength reduces.

8. REFRENCES

- Baboo, Rai, et al. "Influence of Marble powder/granules in Concrete mix."International Journal of Civil & Structural Engineering 1.4 (2010): 827-834.

- Demirel, Bahar. "The effect of the using waste marble dust as fine sand on the mechanical properties of the concrete." International Journal of the Physical Sciences 5.9 (2010): 1372-1380.

- G.Murali, C.M. VivekVardhan, P. Sruthee, P. Charmily. “Influence of Steel Fibre on Concrete.” International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 (2012), Vol. 2, Issue 3, pp.075-078.

- IRC: 58-2002, “Guideline for Design of Rigid Pavements for Highways.” The Indian Road Congress, New Delhi, 2002.

- IS: 456-2000: Code of practice- plain and reinforced concrete, Bureau of Indian Standard, New Delhi-2000.

- IS: 383-1970: Specification for Coarse and Fine Aggregates from Natural Sources for Concrete, Bureau of Indian Standard, New Delhi-1970.

- IS: 1199-1959 (Reaffirmed 1999): Methods of Sampling and Analysis of Concrete, Bureau of Indian Standard, New Delhi-1999.

- IS: 2386 (Part I,III)-1963: Methods of Test for Aggregates for Concrete, Bureau of Indian Standard, New Delhi-1963.

- IS: 5816-1999: Methods of test for Splitting Tensile Strength of Concrete, Bureau of Indian Standard, New Delhi-1999.

- Katzer, J. "Impact and dynamic resistance of SFRCC modified by varied superplasticizers." Archives of Civil and Mechanical Engineering 11.1 (2011): 103-113.

- Kim, Byung-Gi, et al. "The adsorption behavior of PNS superplasticizer and its relation to fluidity of cement paste." Cement and Concrete Research 30.6 (2000): 887-893.

- Manjrekar, S. K. "Use of Super plasticizers: Myth sand Reality." Indian concrete Journal 68 (1994).