Journal of Civil Engineering and Environmental Technology
p-ISSN: 2349-8404; e-ISSN: 2349-879X; Volume 3, Issue 1; January-March, 2016, pp. 75-77

http://www.krishisanskriti.org/Publication.html

Experimental Study used of SCMs on Engineering Properties of Reactive Powder Concrete: A Review

Gohil Gaurav P.[1], Indrajit Patel[2] and Amit Raval[3]

[1]PG Student (Structure)
[2]BVM Engineering College
[3]B & B Institute of Technology, V.V Nagar, Gujarat
E-mail: [1]gohilgaurav534@gmail.com, [2]inpatel34@gmail.com, [3]raval_amit01@yahoo.co.in

Abstract—*In world concrete is second most consumable material after water, as per record more than 80 million cubic meter volume concrete used every year. And cement is most predominant and key material in concrete as binder and for strength gaining. During manufacturing process of cement large amount of carbon dioxide released in to the atmosphere and it is contribute 18.2% of total only due to manufacturing and infrastructure industries and it is approximately 76% of the anthropogenic Green House Gases contained of carbon dioxide. So it is require to develop green concrete by using the supplementary Cementitious material in concrete as alternative. The main objective behind use of sustainable supplementary cementitious material is to reduce the use of cement content with out effect on its strength parameter and performance. Reactive Powder Concrete contain most higher amount of cement compared with other concrete. So reducing cement contain by adding various Supplementary cementitious materials like Ground Granulated Blast Furnace Slag, Fly ash, alccofine, metakoline etc. up to optimum contain which is not affected the engineering property of RPC.*

1. INTRODUCTION

Construction is an essential part of any country special reference to infrastructure and industrial development. In India Construction has accounted for around 40 percent of the development investment during the past many years and around 16 percent of the nation's working population depends on construction. Concrete is key structural material in the construction industry and is the second most consumed substance on Earth after water. The development of modern concrete industry also introduces many environmental problems such as pollution, waste dumping, emission of dangerous gases, and depletion of natural resources. The concrete construction industry is not sustainable because it consumes huge quantities of virgin materials.

Concrete is actually the final product made from cement. Cement is the Principal binder in concrete. The production of cement is a major contributor to greenhouse gas emissions that are implicated in global warming and climate change. Cement manufacturing is highly energy and emissions intensive because of the extreme heat required to produce it. Production of one ton of ordinary Portland cement (OPC) releases approximately one ton of carbon dioxide to the atmosphere. Around 18.2% of carbon dioxide (CO2) emission is because of cement and infrastructure industries only.

It is essential to find environmentally friendly concrete containing low OPC content but with high performance in strength and durability and that are Supplementary Cementitious Materials (SCM). Use of industry waste like fly ash, silica fume & grounded furnace slag as partly replace cementing material concrete system addresses all three sustainability issues, its adoption is enable the concrete construction industry to become more sustainable.

In the last few years research on high strength and high performance concrete is used in modern structure in which compressive strength more than 180 Mpa achieved, as move toward normal strength to high strength concrete required content of cement also higher compared to normal concrete. Solution is to use of SCMs in high strength concrete which makes concrete sustainable and durable.

RPC is new era s recent high strength concrete with very low water cement ratio and cement content in between 800-1000 kg/m^3. The conventional RPC used minerals like silica fume and Quartz silica with cement. By using this concrete increase the cost initially very high and more heat of hydration and problems regarding to shrinkage. In RPC, Because of no coarse aggregate porosity decrease and strength increase and problems related to heterogeneity are substantially reduce and Ductility increase by introducing of fibres.

2. OBJECTIVE OF STUDY

- To analysis various literature on RPC for the study of effect of various SCMs on engineering property of RPC.
- To decided objective and scope of final dissertation work.

3. LITERATURE REVIEW

At present literature study development of Reactive powder concrete with various Sustainable cementitious material like GGBS, Silica Fume, Metakioline, Fly Ash etc with fibres. The main objective is to review the engineering and durability parameter by incorporate with various SCMs with various W/c ratio.

Tomasz ZDEB, Izabela HAGER, Jacek SLIWINSKI [6]have conducted the on strength of RPC at elevated temperature by using polyropreline fibres. In this study microstructure is significantly modifying by autoclave heat curing or steam curing. Polypropylene fibres are commonly used at a proportion of 0.1 % -0.2% by volume of concrete in order to limit the risk of spelling behavior at hightemperature. The disadvantages of used of excessive amount of pp fibres leads to decrease the compressive strength up to 20% and modulus of elasticity also reduced by 7%.

Assem Abdelalim, Mohamed Ramadan, Tarek Bahaa and Wael Halawa [1] Have conducted experiment on RPC to achieves compressive strength level in the range of 120-200 N/mm2 and flexural strength in the range of 30-60 N/mm2 by using local available materials by optimization of cement and water cement ratio and optimum doses of silica fume and quartz sand with reference of cement content.

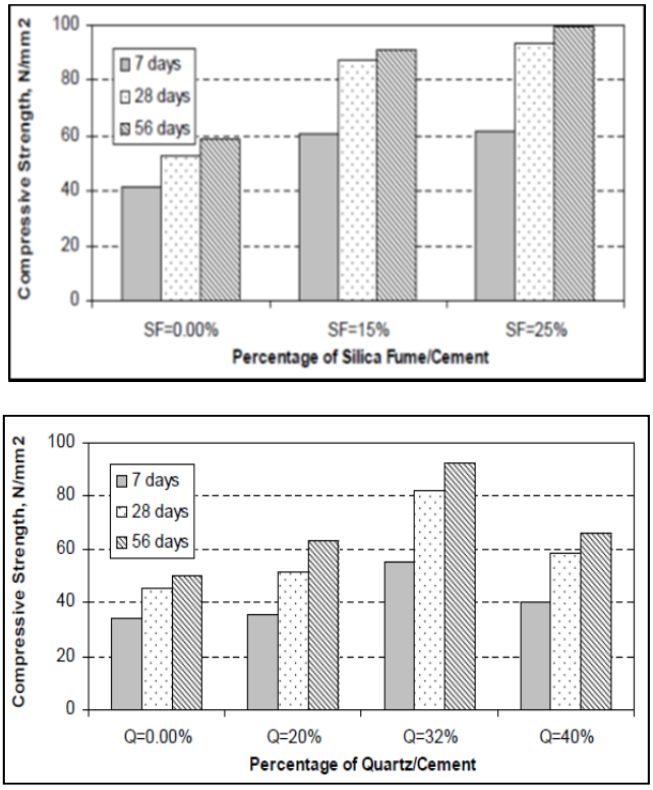

Fig. 1: Effect of percentage of Quartz sand and silica fume on compressive strength.

In this study optimum water cement ratio for 7, 28 and 56 day compressive strength is 0.19 Fig. 1 shows optimum uses of quartz sand 32 % to achieved optimum compressive strength and optimum use of silica fume is 25%. Curing condition plays a important role in determining the strength of RPC. Air curing adversely affected the performance and did not allow the RPC to achieve its target strength level.

Sumith Kumar K,Gururaj Acharya, Siddesh R Kamat Mhamai [5] In this study performance of RPC for workability test for fresh concrete and compressive strength, split tensile strength and flexural strength test at age of 3,7, 14 and 28 days is carried out in addition of mixture with cement composition alccofine and metakaoline used. In this study various doses of alccofine and metakaoline with and without steel fibers for mechanical property of concrete is carried out. Conducting Various test mix design with or without steel fibres one of the final mix design without steel fibres of cement contant 51% which replaced by alccofine 34% and metakaolin 15% gives a strength of 106Mpa at 28 days shown in Fig. 2.

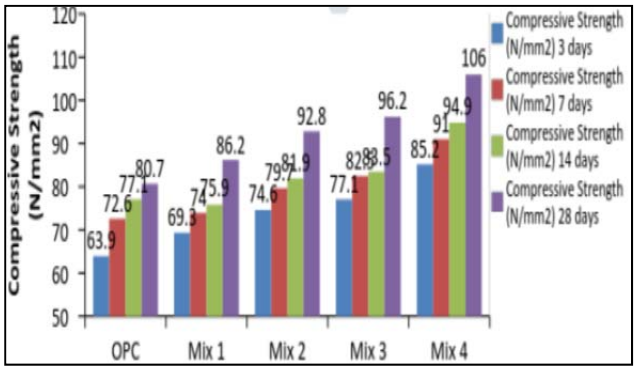

Fig. 2: Compressive strength of various mix designs.

M K Maroliya[3]conducted study on reactive powder concrete to influence of silica fume, super plasticizers, steel fibres and curing condition on workability, compressive strength and flexural strength in that cement replace with fly ash. It is found that workability in context of silica fume, when content of silica fume increase as increase in water content also and as water cement ratio increase strength decrease. For effect on super plasticizer, At water cement ratio as low as 0.23, the polycarboxylic ether can give a good workable concrete, which is not possible with normal super plasticizers even by increasing the dose of super plasticizers and steel fibers on flexural strength of RPC increase by 15% to 20% as compared without steel fibres. The curing condition also influence of RPC 18% higher than plain RPC when normal curing is adopted.

M K Maroliya[4]investigated the effect of direct tensile strength of RPC with including of steel fibres and silica fume. For the study direct split tensile strength and direct tension using modified dog bone test was carried out. Strength obtain using cylinder splitting tensile strength gives higher tensile

strength compared with modified dog bone test. Fig. shows that the tensile strength for RPC with inclusion of fibers increases considerably over its plain RPC. Tensile strength of 1% steel fiber greater than 0%, 2%, 3% fiber volume content.

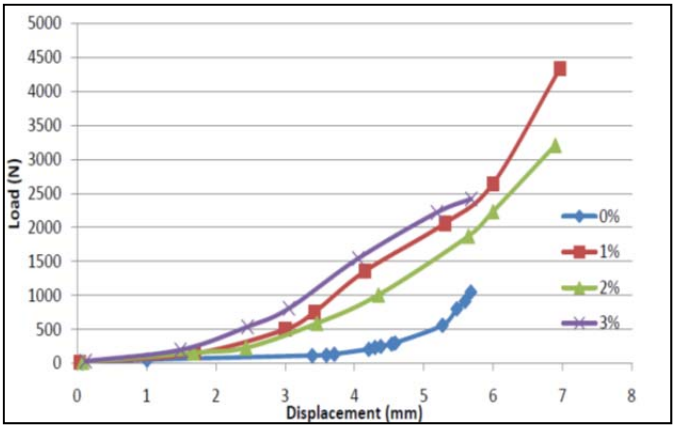

Fig. 3: Tensile load-displacement relation for different % fibre content in modified dog bone test

Khadiranaikar R.B. and Muranal S. M.[2]investigatedthe effect of compressive strength due to various parameter like water cement ratio, silica fume, effect on addition of quartz sand and curing condition. In experiment shows the average compressive strength to the water cement ratio graph and it shows 0.2 gets a maximum strength at 28 days and the effect of influence of silica fume on compressive strength, and optimum doses of silica fume is 15% at 0.2 water cement ratio. Another study shows the effect of addition of quartz sand on compressive strength and it shows that increase the strength up to 20% at accelerated curing condition and the influence of curing regime on compressive strength by normal curing at 27 temp. and hot water curing at 90 temp for 48 hours and results shows the increment up to 10% in strength at 90 temp.

4. OUT COMES

- In RPC, target strength up to 200 Mpa reached by addition of sustainable materials like GGBS, Silica Fume etc.
- The addition of GGBS is not influence of setting time of RPC but increase in silica fume can decrease the workability of RPC.
- Durability increase by adding various fibres like steel, basalt etc. and also increase the mechanical property of concrete.
- Percentage of uses silica fume for optimum strength experimented range is 15 to 22%.
- Water cement ratio for RPC in between 0.22 to 0.25 for optimum strength.
- Various fibres used in RPC and critical use of fibres is 1.5 to 2.0% of volume of cementitious material.
- Comparing to normal and accelerated curing, accelerated curing increase compressive strength up to 15%.

5. CONCLUSION

From the literature study, by using of SCMs and Fibres in RPC strength and durability property increase at low water cement ratio and temperature condition. Various authors experiment RPC with different proportion of SCMs with different water cement ratio and fibres. It is noted from various literature study that very few research work is been carried out with Basalt Fibres and GGBS. So my future dissertation work on to decide optimum doses of GGBS and Basalt Fibres for the study on engineering property of RPC at various water cement ratio.

REFERENCE

[1] Assem Abdelalim, Mohamed Ramadan, Tarek Bahaa and Wael Halawa “performance of reactive powder concrete produced using local materials”. *Published by HBRC Journal VOL. 4 No. 3 December 2008*

[2] Khadiranaikar R.B. and Muranal S. M “factors affecting the strength of reactive powder concrete (rpc)”*published by IAEME,Volume 3, Issue 2, July- December 2012.*

[3] M K Maroliya “An Investigation on Reactive Powder Concrete containing Steel Fibers and Fly- Ash” *Published by International Journal of Emerging Technology and Advanced Engineering, Sep-2012.*

[4] M K Maroliya “Tensile behavior of reactive powder concrete containing steel fibres and silica fume” *Published by International Journal of Engineering Research and Development, Volume 4, Issue 4 October 2012*

[5] Sumith Kumar K, Gururaj Acharya, Siddesh R Kamat Mhamai “Reactive Powder Concrete with mineral admixtures” *published by JETIR vol 2 issue 6, 2015*

[6] Tomasz ZDEB, Izabela HAGER, Jacek SLIWINSKI “reactive powder concrete - change in compressive strength and modulus of elasticity at high temperature”. *Research project (L-1/234/DS/2012)supported by Faculty of Civil Engineering of Cracow University of Technology. 2012*