"EFFECT OF METAKAOLIN AND BASALT FIBRE ON CONVENTIONAL CONCERETE"

Vaibhav balasaheb kachre[1], Khetmalis Vinod shahaji [2], Ghate pratik bhausaheb [3], Puja Ishwar Bramhane [4],

1-UG Student, Department of Civil Engineering, Hon. Shri Babanrao Pachpute Vichardhara Trust's Parikrama College of Engineering Kashti,Ahamadnagar,India.

2- UG Student, Department of Civil Engineering. Hon. Shri Babanrao Pachpute Vichardhara Trust's Parikrama College of Engineering Kashti,Ahamadnagar,India.

3- UG Student, Department of Civil Engineering. Hon. Shri Babanrao Pachpute Vichardhara Trust's Parikrama College of Engineering Kashti,Ahamadnagar,India.

4- UG Student, Department of Civil Engineering. Hon. Shri Babanrao Pachpute Vichardhara Trust's Parikrama College of Engineering Kashti,Ahamadnagar,India.

ABSTRACT

Concrete is one of the notable development materials. Be that as it may, the development of Portland concrete, a fundamental constituent of cement, prompts the arrival of critical measure of CO2, an ozone harming substance; one ton of Portland concrete clinker creation is said to makes roughly one ton of CO2 and other ozone harming substances. Natural issues are assuming a significant part in the supportable advancement of the concrete and substantial industry. Today many explores are progressing into the utilization of Portland concrete substitutions, utilizing many waste materials like crushed fly debris (PFA) and ground granulated impact heater slag (GGBS). Like PFA and GGBS, a metakaolin is additionally utilized as a folio with halfway substitution of concrete which take some piece of response at the hour of hydration, likewise it is go about as a filler material. Concrete substitution by metakaolin in the reach 5% to 25% augmentation of 5% is to be concentrate also with basalt rock fiber by volume part in range from 0.05% to 0.25% with addition of 0.05%. It was tried for mechanical properties at the age of 7, 28 days and contrasted and those of traditional cement.

KEYWORDS: Granulated Blast Furnace Slag, Pulverized Fly Ash

1. INTRODUCTION

Concrete is a mix of concrete, sand, coarse total and water. The key variable that enhances concrete is that enduring most extreme conditions critical role can be planned. Today a worldwide temperature alteration and ecological annihilation have become manifest damages as of late, worry about natural issues, and a changeover from the mass-squander, massconsumption, large scale manufacturing society of the past to a zero-radiation society is currently seen as huge. Because of an unnatural weather change the need to chop down energy utilization has expanded. The impact of a worldwide temperature alteration has influenced everybody in the world and is a very much perceived idea. The interest of development local area in involving waste or reused materials in concrete is expanding a direct result of the accentuation put on reasonable development. Metakaolin is one of the creative earth items created as of late. It is created by controlled warm treatment of kaolin. Metakaolin can be utilized as a substantial constituent, supplanting some portion of the concrete substance since it has pozzolanic properties. The utilization of metakaolin as an incomplete concrete substitution material in mortar and cement has been concentrated on generally as of late. Basalt is notable as a stone found in practically every nation round the world. Its primary use is a squashed stone in development, modern and high way designing. Nonetheless, it isn't usually realize that basalt can be utilized in assembling and made into fine, superfine and ultrafine strands. Contain single-fixing unrefined components soften basalt filaments are bosses to different strands concerning warm steadiness, intensity and sound protection properties, vibration obstruction and strength. plastics, 10% wood, 5%metal, and 10% International Journal of Scientific Research in Civil Engineering | www.ijsrce.com | Volume 4, Issue 3 Wable Arti C et al. Int J Sci Res Civil Engg, May-June-2020,

4 (3) : 23-27 24 different combinations. As revealed by worldwide knowledge, development in worldwide development area predicts an expansion in development expenditure of 4800 bilion US dollars in 2013. These figures demonstrate a huge development in the development area, practically 1.5 times in 5 Years.

3. MATERIAL AND METHODOLOGY

The material used and their methodology is discussed in this Chapter . In this work metakaolin is used as partial replacement for cement with addition of basalt fiber. After that, all the related laboratory experiments conducted to achieve the research objectives.

Material used in this context of investigation are Metakaolin ,Basalt fiber, cement, water, fine aggregate and coarse aggregate and the same are tested in the environmental conditions and their various test parameters like compressive strength, spilt tensile strength, etc are determined. Also fresh concrete test like test for workability of concrete such as slump cone test, etc are carried out.

Material Used :

The materials used in this present work are Metakaolin, Basalt fibre, Ordinary Portland cement (43 grade), coarse aggregates and fine aggregates

4. RESULT AND DISCUSSION

In BFMC concrete as metakaolin content increases (i.e. cement content decreased) workability decreases. As there is a reduction in fineness modulus of cementatious materials, cement paste available is less for providing lubricating effect per unit surface area of aggregate. Therefore, there is a restrain on the mobility.

The compressive strength test on both conventional and BFMC concrete was performed on standard compression testing machine of 3000 KN capacity, as per IS: 516-1959.As the percentage replacement cement with metakaolin by 15% and addition of basalt fiber strength increases up to 0.15% and beyond that it decreases. The highest percentage increase in the compressive strength was about 25.70%, split tensile strength was 24.03% and flexural strength was about 19.55% at 0.15% addition level. Also pull-out strength increases with the percentage increase of basalt fiber in concrete. An increase of 19.90% strength was observed for 0.15% addition by volume fraction.

The increase in strength of BFMC concrete up to 15% replacement of cement by metakaolin powder may be due to the pozzolanic reaction of metakaolin powder due to high silica content. Also it effectively fills the voids and gives a dense concrete microstructures. However, beyond 15%, the dilution effect takes over and strength starts to drop.

Thus it can be concluded that 15% was the optimum level for replacement of cement with metakaolin powder. The strength improvement at early curing ages was due to good filling effect. The smaller particle size of the metakaolin powder has higher activity with lime present in the cement resulting in higher strength in the concrete mix. Thus, Very finely ground metakaolin has been shown to be excellent filler and may have sufficient pozzolonic properties to serve as partial cement replacement, the effect of alkali silica reaction appear to be reduced with finer metakaolin particles, with replacement level.

As the replacement of metakaolin powder increases, unit weight of the cube decreases. This effect is due to lower specific gravity of metakaolin powder compared to that of cement. However, the strength increase has taken place because of pozzolanic action of metakaolin powder. Since the metakaolin powder acts as a pozzolanic material the effect of carbonation is reduced and the durability of concrete increases. The pH value observed from the alkalinity test showed that the specimen tested found to be more alkaline and hence more resistant towards corrosion.

5. CONCLUSIONS

The influence of replacement of cement by metakaolin powder has been studied. Based on theexperimental work conducted, the following conclusions are drawn:

1) In BFMC concrete as the Percentage of metakaolin powder increases, workability of concrete decreases. A decrease of 3.23%, 12.91%, 19.36% workability was observed for 5%, 10% and 15% replacement respectively. As metakaolin content increases,cement paste available is less for providing lubricating effect per unit surface area of aggregate which reduces the workability of concrete.
2) The addition of basalt fiber in BFMC concrete increases the compressive strength of concrete. For 28 days increase of 4.50 %, 14.53% and 25.70% strength can be achieved with the 0.05%, 0.10% and 0.15% addition of basalt fiber respectively. Also metakaolin helps to improve strength at early curing ages was due to good filling effect.

3) The addition of basalt fiber and metakaolin in BFMC concrete also increases the split tensile strength of concrete. Increase of 2.82 %, 7.05 % and 16.47 % strength can be achieved with addition of 0.05%,0.10% and 0.15% basalt fiber and constant 15% replacement of metakaolin when water/ cement ratio was maintained constant.
4) The flexural strength of BFMC concrete increases by 6.43%, 14.85% and 19.80% with addition of 0.05%, 0.10% and 0.15% basalt fiber respectively when compare with conventional mix.
5) The pull-out strength increases with the percentage increase of metakaolin powder in BFMC concrete. An increase of 8.19%, 13.42% and 19.90% strength was observed with addition of 0.05%, 0.10% and 0.15% Basalt fiber respectively.
6) The pH value observed from the alkalinity test showed that the specimen tested found to be more alkaline and hence more resistant towards corrosion. The high alkalinity forms a thin passivating layer around steel reinforcement and protect it from the action of oxygen and water. As long as steel is placed in a highly alkaline condition, it is not going to corrode.
7) Water absorption of BFMC concrete reduces as the percentage of metakaolin in concrete increases.A decrease of 25.83% water absorption was observed for 15% replacement of metakaolin powder. As voids in the concrete reduces water absorption goes on reducing. Also unit weight of concrete goes on reducing with the replacement of cement due to lower specific gravity of metakaolin powder compared to cement.
8) Use of Phenolphthalein indicator changed the colour of hardened concrete to pink which indicates that concrete was not affected by the atmospheric carbon dioxide.
9) Velocity of an ultrasonic pulse passing through the concrete is more than 3.5 km/second which suggest that concrete quality isgood.Due to good filling effect voids from the concrete reduces which increases velocity of ultrasonic pulse through metakaolin powder concrete.
10) In BFMC replacement of cement by metakaolin powder makes the pore structure of concrete denser. metakaolin powder concrete is less permeable which reduces the effect of chlorine on the reinforcement which helps to prevent the corrosion of reinforcement. Hence life of structure increases.

6. REFERENCES

1. S.S. Potgieter-Vermaak, Metakaolin as an extender in south African cement *Journal of Materials in Civil Engineering 18(4):619 - 623* · August 2006DOI: 10.1061/(ASCE)0899-1561(2006)18:4(619)
2. Jian-Tong Ding and Zongjin Li, Effects of Metakaolin and Silica Fume on Properties of Concrete *ACI MATERIALS JOURNAL* Title no. 99-M39
3. Kunal Singh,A Short Review on Basalt FIBRE, 2012, pp. 20, 23.
4. Dr. N. Subramanian., Sustainability of RCC structures using Basalt composite rebars, September 2010.PP 5.
5. Van De Velde K. ,et al., Basalt fibres as reinforcement for composites , March 2006
6. EythorThorhallssonetal., Reykjavik University & Iceland GeoSurvey, November2013, PP 2.
7. Kunal Singh,A Short Review on Basalt FIBRE, 2012, pp. 20, 23.
8. Matthews, F.L., Rawlings, R. D., *Composite Materials: Engineering and Science*.1994.