iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** X **Month of publication:** October 2016

DOI:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Influence of Supplementary Materials on Properties of Concrete – A Review

Pankaj Rao Mahore[1], Ajeet Saxena[2], Yogesh Bansal[3]
[1]*Professor & Guide M. Tech,* [2]*Professor & Co- Guide M. Tech,* [3]*Student of Final year*
M. Tech (Construction Tech. & Management) Radharaman Engineering College, Bhopal, M.P

Abstract— ***A well-maintained infrastructure is a fundamental necessity for a modern society that provides great value, but ensuring that it meets all the requirements is challenging. Concrete as a construction material is in use for several decades. Concrete can withstand the severest environments and engineers are constantly trying to improve its performance with the aid of modern admixtures and waste materials with or without cementitious properties. The use of waste material in concrete as construction material helps to consume these waste materials and also improves the properties of concrete in fresh and hydrated states. Present paper reviewed several works conducted worldwide on using waste materials in construction industry.***
Keywords— Concrete, cement, sand , glass powder, steel powder

I. INTRODUCTION

Concrete is a mixture of cement, sand, coarse aggregate and water. Its success lies in its versatility as can be designed to withstand harshest environments while taking on the most inspirational forms. Engineers and scientists are further trying to increase its limits with the help of innovative chemical admixtures and various waste materials. Utilization of glass powder, steel powder or other desecrate materials in preparing concrete for various civil engineering projects is a subject of high significance. Integration of extra materials in concrete or mortar affects its several characteristics such as strength, workability and other relative performances.

There are various purposes of applying additional materials as substitute to cement and other components in concrete – first is the financial saving obtained by replacing a considerable part of the sand or other ingredients with these materials and second is enhancement in the properties of concrete. The ecological aspects of cement are now receiving more concern of researchers, as cement developing is liable for about large amount of total worldwide waste emissions from manufacturing sources. The trend of mixing several kinds of additional materials in building engineering is now growing. This has double advantage -

A. To reduce the quantity of deposited waste.

B. To conserve natural resources.

Partial substitution of sand in concrete minimizes the use of natural resources and thus, decreases the global warming. Current practice may permit up to a certain limit of reduction in the content of sand in the concrete mix.

II. LITERATURE REVIEW

The main factor that adds value to concrete is that it can be designed to withstand harshest environments. The growth of concrete technology can reduce the utilization of natural resources and energy sources and reduce the trouble of pollutants on environment. Currently enormous amounts of fly ash are generated in thermal industries with an important impact on environment and humans. In recent years, many investigators have established that the use of supplementary cementitious materials (SCMs) like fly ash (FA),glass powder, blast furnace slag, glass powder, metakaolin (MK), rice husk ash (RHA) and hypo sludge etc. not only improves properties of concrete both in its fresh and hardened states, but also reduces the construction costs. Fly ash is made of the non combustible mineral part of coal. Particles of fly ash are glassy, spherical ‘ball bearings’ finer than cement particles. Sizes of particle ranges from 0.1µm to 150 µm. it is a pozzolonic material which reacts with free lime in the presence of water and finally converted into calcium silicate hydrate, which is the strongest and robust portion of the paste in concrete.

Bernal et al. [1] carried out Research work in Performance of an alkali-activated slag concrete reinforced with steel fibers. They concluded that the developed concrete presents higher compressive strengths than the OPC reference concretes. Splitting tensile strengths increase in both OPCC and the AASC concretes with the incorporation of fibers at 28 curing days.

Qasrawi et al. [2] carried out Research work in Use of low CaO unprocessed steel slag in concrete as fine aggregate. Their conclusion is that regarding the compressive and tensile strength of concrete steel slag is more advantageous for concretes of lower strengths.

Boukendakdji et al. [3] carried out Research work in Effect of slag on the rheology of fresh self- compacted concrete. They inferred that the slag can produce good self-compacting concrete.

Wu et al. [4] carried out Research work in Utilization of steel slag as aggregates for stone mastic asphalt (SMA) mixtures. Results of the analysis showed excellent performances after 2-years service, with abrasion and friction coefficient of 55BPN and surface texture depth of 0.8 mm.

Gonen and Yazicioglu [5] carried out research work in the influence of mineral admixtures on the short and long term performance of concrete, hence, concluded that glass powder contributed to both short and long term properties of concrete, where as fly ash shows its beneficial effect in a relatively longer time. As far as the compressive strength is concerned, adding of both glass powder and fly ash slightly increased compressive strength, but contributed more to the improvement of transport properties of concrete.

Maslehuddin et al. [6] carried out experimental work on comparison of properties of steel slag and crushed limestone aggregate concretes, finally concluded that durability characteristics of steel slag cement concrete were better than those of crushed limestone aggregate concrete. Some of physical properties were better than of crushed lime stones concrete.

Toutanji and El-Korchi [7] carried out experimental work on Oxygen and water vapor transport in cement pastes, hence concluded that the increase in compressive strength of mortar containing glass powder as a partial replacement for cement, greatly contributes to strengthening the bond between the cement paste and aggregate. It was also demonstrated that super plasticizer in combination with glass powder plays a more effective role in mortar mixes than in paste mixes.

Pacheco-Torgal and Jalali [8] studied on the properties and on the performance of concrete containing ceramic wastes. A number of concrete mixes with a target mean compressive strength of 30 MPa were made up with 20% cement substitution by ceramic powder (W/B = 0.6). A concrete mix with ceramic sand and granite aggregates have been also prepared with a concrete mix with natural sand and coarse ceramic aggregates (W/B = 0.5). The mechanical and durability performance of ceramic waste based concrete have been examined by means of mechanical experiments, water performance, permeability, chloride diffusion and furthermore accelerated aging tests. Results demonstrate that concrete with fractional cement replacement by ceramic powder although it has slight strength loss have increase durability performance.

According to Akbulut and Gürer (2007)[9], Asphalt pavements are mainly composed of aggregates. Large amount of aggregates have been utilized by industries involved in highway construction. Several tests over aggregates have been conducted such as Los Angeles abrasion, aggregate impact value, freezing and thawing, flakiness index and Marshall stability flow tests. It has been revealed from the experimental results that the physical properties determined of the aggregates are within particular range.

Saikia and Brito (2012)[10] divided his research in four dissimilar categories, in initial part types of plastics and methods used to organize plastic aggregate had been briefly discussed. Thereafter, in the next couple of sections properties of plastic aggregates and properties of cement concrete in occurrence of plastic aggregate have been discussed.

Westerholm et al. (2008)[11] presented the results obtained by performing a laboratory investigation over the rheological properties, such as yield stress and viscosity of the concrete. The consequence of grading and particle shape of the sand has been investigated using proper equipments. The results of experiments illustrate that the quantity and characteristics of san influenced the properties of mortar such as consistency and workability. The influence of the sand properties significantly depends over the quantity of mortar.

As per Zega (2010) [12] several ecological issues initiated by waste produces form big constructions and their waste obtained by demolition. The deficiency of enough deposition space and the lack of natural objects cause the use of waste aggregates in the production of new concrete.

Yun-feng et al. [13] carried out experimental work on comparison of properties of steel slag and crushed limestone aggregate concretes, finally concluded that durability characteristics of steel slag cement concrete were better than those of crushed limestones aggregate concrete.

Velosa and Cachim [14] carried out experimental work on Oxygen and water vapour transport in cement pastes, hence concluded that the increase in compressive strength of mortar containing glass powder as a partial replacement for cement, greatly contributes to strengthening the bond between the cement paste and aggregate. It was also demonstrated that super plasticizer in combination with glass powder plays a more effective role in mortar mixes than in paste mixes. This can be attributed to a more efficient utilization of super plasticizer in the mortar mixes due to the better dispersion of the glass powder.

Turkmen [15] carried out experimental work on the Cements Made from Blastfurnace Slag, hence concluded that Slag has found a considerable use in the road and building industries, in the production of cementing materials, as an aggregate in concrete and tarmacdam, in the production of light weight aggregate, and in the manufacture of slag wool for thermal insulation.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

III.CONCLUSIONS

A. Present work intend spotlight on the chances of using waste materials from numerous manufacturing activities in the making of modern mortar and concrete.

B. The use of waste glass powder and steel powder has been proposed in partial replacement of cement, for the manufacturing of Concrete and Mortar Mix. In particular, tests were performed on the mortars and concrete mix cured for dissimilar times in order to decide their workability as well as compressive strength.

C. Global utilization of concrete presently is around 9 billion tons per year and it is expected to increase during this century because concrete has become the most important material for construction of highways, dams, bridges, and other types of civil construction works. This means, more than 1.3 ton concrete is required per person in the world.

D. Production of concrete could be more than the production of food. The researches on concrete have been introducing innovative types of cements based on the utilization of wastes and byproducts from the industries.

E. The investigators and field experiences have been shown that the benefits attained when the basic ingredients of concrete is intermingle with wastes, that have been verified not to be deleterious to the performance of cement based products.

REFERENCES

[1] Bernal, S., De Gutierrez, R., Delvasto, S., & Rodriguez, E. (2010). Performance of an alkali-activated slag concrete reinforced with steel fibers.Construction and Building Materials, 24(2), 208-214.

[2] Qasrawi, H., Shalabi, F., & Asi, I. (2009). Use of low CaO unprocessed steel slag in concrete as fine aggregate. Construction and Building Materials, 23(2), 1118-1125.

[3] Boukendakdji, O., Kenai, S., Kadri, E. H., and Rouis, F. (2009). “Effect of slag on the rheology of fresh self-compacted concrete.” Construction and Building Materials, Vol. 23, No. 7, pp. 2593-2598.

[4] Wu, S., Xue, Y., Ye, Q., & Chen, Y. (2007). Utilization of steel slag as aggregates for stone mastic asphalt (SMA) mixtures. Building and Environment, 42(7), 2580-2585.

[5] Gonen, T., & Yazicioglu, S. (2007). The influence of mineral admixtures on the short and long-term performance of concrete. Building and Environment,42(8), 3080-3085.

[6] Maslehuddin, M., Sharif, A. M., Shameem, M., Ibrahim, M., & Barry, M. S. (2003). Comparison of properties of steel slag and crushed limestone aggregate concretes. Construction and building materials, 17(2), 105-112.

[7] Toutanji, H. A., & El-Korchi, T. (1995). The influence of silica fume on the compressive strength of cement paste and mortar. Cement and Concrete Research, 25(7), 1591-1602.

[8] Pacheco-Torgal, F., & Jalali, S. (2011). Compressive strength and durability properties of ceramic wastes based concrete. Materials and structures, 44(1), 155-167.

[9] Akbulut, H., & Gürer, C. (2007). Use of aggregates produced from marble quarry waste in asphalt pavements. Building and environment, 42(5), 1921-1930.

[10] Saikia, N., & de Brito, J. (2012). Use of plastic waste as aggregate in cement mortar and concrete preparation: A review. Construction and Building Materials, 34, 385-401.

[11] Westerholm , C., Dilonardo, I., de Oliveira Romano, R. C., Pileggi, R. G., & de Figueiredo, A. D. (2008). Effect of the substitution of cement by limestone filler on the rheological behaviour and shrinkage of microconcretes.Construction and Building Materials, 125, 375-386.

[12] Zega, A (2010). Materials for sustainable sites: a complete guide to the evaluation, selection, and use of sustainable construction materials. John Wiley & Sons.

[13] Yun-feng, J., Cwirzen, A., & Penttala, V. (2014). Effects of mineral powders on hydration process and hydration products in normal strength concrete.Construction and Building Materials, 72, 7-14.

[14] Velosa and Cachim (2012). Comparative study of oxygen and water vapor transport in concrete (Doctoral dissertation)..

[15] Turkmen, M. (2015). A comparison of the sustainability of common construction materials: Based on embodied carbon data and materials specification of a single-family house.