INTERNATIONAL RESEARCH JOURNAL IN ADVANCED ENGINEERING AND TECHNOLOGY (IRJAET) E - ISSN: 2454-4752 P - ISSN : 2454-4744
VOL 4 ISSUE 1 (2018) PAGES 2715 - 2719
RECEIVED : 05.01.2018 PUBLISHED : 23.01.2018 Jan 23, 2018

AN EXPERIMENTAL STUDY ON OPTIMUM USAGE OF GGBS FOR THE COMPRESSIVE STRENGTH OF CONCRETE

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Abstract:

Concrete is the most widely used construction material having several advantages such as high strength, good mould ability durability weather and fire resistance. The use of ground granulated blast furnace slag (GGBS) in mortar has increased in recent years. Records indicate that blast furnace cement was used for the mortar during the construction of the Empire State Building in the 1930s.On its own, ground granulated blast furnace slag (GGBS) hardens very slowly and, for use in concrete, it needs to be activated by combining it with Portland cement. Atypical combination is 50 per cent GGBS with 50 per cent Portland cement, but percentages of GGBS anywhere between 20 and 80 per cent are commonly used. The greater the percentage of GGBS, the greater will be the effect on concrete properties.

Keywords: CGBS, Portland, Mould.

1. INTRODUCTION

Ground blast furnace slag is obtained during the manufacturing process of pig iron in blast furnace. The slag is a mixture of lime, silica, and alumina, the same oxides that make up Portland cement, but not in the same proportion. The composition of blast-furnace slag is determined by the ores, fluxing stone and impurities in the coke charged into the blast furnace. The silicon, calcium, aluminum, magnesium and oxygen constitute 95% or more of the blast furnace slag. This material is rapidly cooled to form a granulate and then ground to a fine white powder (GGBS), which has many similar characteristics to Portland cement. When GGBS is blended with Portland cement further recognized cementations materials such as Portland-slag cement and blast furnace cement are produced. In the UK, GGBS is manufactured and generally sold as a separate powder which is then batched and blended within the mixer. It is used extensively in the construction industry to produce concretes, grouts and mortars. The hydration mechanism of a combination of GGBS and Portland cement is slightly more complex than that of a Portland cement. This reaction involves the activation of the GGBS by alkalis and sulfates to form its own hydration products. Some of these combine with the Portland cement products to form further hydrates which have a pore blocking effect. The result is a hardened cement paste with more of the very small gel pores and fewer of the much larger capillary pores for the same total pore volume. Generally, the rate of strength development is slower than for a Portland cement mortar. Cementations content, the dimensions of the structure, the type of

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formwork and ambient weather conditions. The greater the percentage of GGBS, the lower will be the rate at which heat is developed and the smaller the maximum temperature rise. As well as depressing the peak temperature, the time taken to reach the peak will be extended. For mass concrete structures, it is common to use 70 per cent GGBS to control the temperature rise. With thinner sections, significant savings in crack control reinforcement can be achieved even with lower levels of GGBS of 50 per cent or less

2. RELATED WORK

At higher GGBS percentages the cementitious content may need to be increased to achieve equivalent 28-day strength. GGBS concrete gains strength more steadily than equivalent concrete made with Portland cement. For the same 28-day strength, a GGBS concrete will have lower strength at early ages but its long-term strength will be greater. The reduction in early-strength will be most noticeable at high GGBS levels and low temperatures. Typically a Portland cement concrete will achieve about 75 per cent of its 28-day strength at seven days, with a small increase of five to 10 per cent between 28 and 90 days. Deleterious reactions between certain types of Reactive Aggregates in concrete with alkalies(K_2O and Na_2O) in cement/water are known to cause cracking, expansion and distress to concrete dams, bridges etc. Concrete made with GGBS has 85% less expansion due to Alkali-Aggregate Reaction than OPC. Low Alkali-ion diffusion rate and low permeability to water of GGBS Concrete reduces the harmful reaction. Because of these two factors any expansion that occur may develop 100 to 1000 times late in a GGBS can be used safely where Reactive Aggregates are used in the construction. The optimal striking of formwork when using CEM II(A-L)/GGBS concrete requires reliable early age strength estimates. The methodology outlined in this paper allows this and is based on investing resources in data determination specific to one concrete mix at one point in one element. Its benefit is where the data determined can be further utilized throughout a project and therefore its application is particularly relevant to projects with significant repetition of element type. For example, once the relationship between the maturity function and TMC

India is one of the fast developing countries in the world. Various fields like Industry, Infrastructure, Construction, Agriculture etc., have a major role in achieving an all round development. This development has urged the industrial sector to produce various goods that are necessary. These industries and factories besides producing various useful goods have also become a source of waste products. And it has become necessary to find ways and means of disposing off or utilizing these waste materials, which may otherwise end up in polluting the surroundings. This led to the investigation of searching fields of utilization of these waste products for a better purpose. Research work was carried out on this subject not only in India but also all over the world. The results of such works showed that there could be no better place other than the construction field, where a large quantity of such materials can be utilized in a better and economical way.

3. PROPOSED SYSTEM

On the other hand the field of Construction has also its role to play in the development of the country by not only in increasing the construction work but also in a more sophisticated manner. This in turn has an effect on the various materials and their quantities that are to be used. Therefore, this also led to the investigation of new materials, which can be utilized for the purpose even more economically. Especially work has done on the utilization of the by-products obtained from various industries. In this way the construction field and the industrial sector have been linked together, reducing the environmental hazards and serving the economical problems.

Fig.1.Casting

Products like foamed blast furnace slag, furnace clinker, cinder, pulverized fuel ash etc. are the waste products obtained from various industries. It has been found that each one of these has quite a good use in the construction field. These products are either used in their original form as are obtained or changed slightly so as to serve a better purpose. The pulverized fuel ash for example, is used in concrete either as a replacement to cement and sand or converted to sintered fly ash to be used as coarse aggregate. Traditionally, concrete has been characterized by its compressive strength. Through the tremendous progress achieved over the last few years, high strength concrete was produced. However, for new concretes to solve some important engineering problems, many other properties had to be improved, thus leading to the production of high-performance concrete (HPC).

4. ANALYSIS

The enhancement of two concrete properties basically required to identify a high performance concrete are rheological characteristics and durability. Even though these properties can be attained separately, but both properties are simultaneously achieved in HPC. A high- performance concrete which flows readily into places even in the presence of congested reinforcement, filling formwork eliminating the need for compaction and without undergoing any significant segregation. Due to the densification of the matrix, mechanical properties considerably increased. Durability of concrete has increased because the

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permeability has been controlled by porosimetry modifications, thereby reducing the total porosity and pore range size, and closing all pore connections. It is not possible to produce HPC having improved rheological properties and durability using traditional concrete with OPC and normal aggregate proportioning. It is necessary to use supplementary cementitious products(SCM) and admixtures (mineral and chemical) of the latest generation.

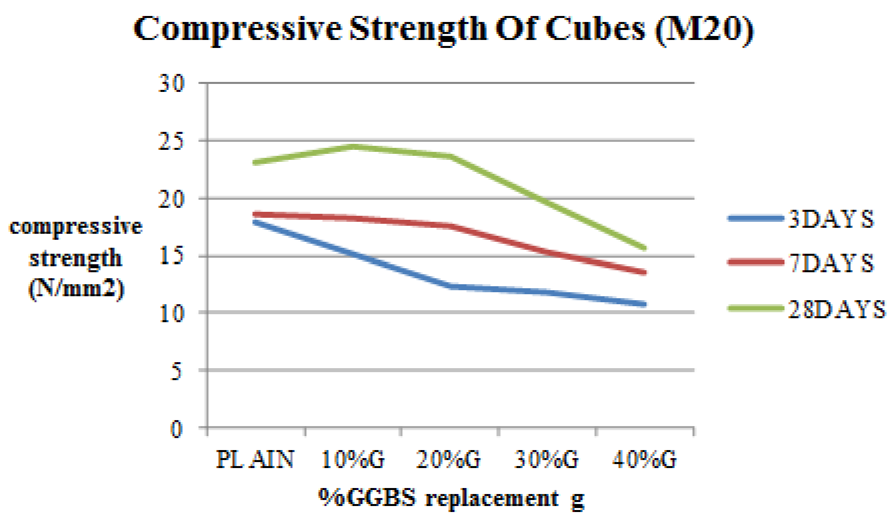

Fig.2.Compressive Test

It should be emphasized that appropriate mineral and chemical admixtures will produce HPC but they cannot, whatever the conditions , correct poor quality of materials, unsatisfactory proportioning of concrete and inappropriate setting and curing producers. The concept of efficiency can be used for comparing the relative performance of GGBS when incorporated into concrete performance. Efficiency factors found from Bolomey's strength equation are used to describe the effect of the GGBS combination replacement in concrete in the enhancement of strength and durability characteristics. This factor will give only an indication of the added materials effect on concrete strength, since it does not distinguish between filler effect and/or chemical reactions. Varying the percentage of GGBS were tried to study the effect of partial replacement of cement on the properties of concrete.

CONCLUSION

Cement is replaced by GGBS in percentages of' 10,20,30 and 40% by weight. With cement, natural sand, coarse aggregate, GGBS constituting the basic materials, number of cubes were cast varying the percentages of GGBS. The mix design for M20 grade concrete and M40 grade concrete was done in accordance with IS method and the same was adopted for the work. Therefore, concrete with and without GGBS replacement was tested for cube compressive strength. Development of high strength GGBS concrete manufactured with silicates and hydroxides of potassium and the effects of higher strength in the flexural behaviour of GGBS concrete beams. Investigations on the effect of varying percentage of reinforcement on flexural and shear capacity of reinforced GGBS concrete beams. Study on the addition of various fibres in GGBS concrete and their effect on enhancement of strengths.

REFERENCES

1. Matsufuji, Y., Kohata, H., Tagaya, K., Okaw, Y., and Okazawa, S. 1992. Study on properties of concrete with ultra-fine particles produced from fly ash. In proceedings, 4th CANMET/ ACI International Conference on the Use of fly ash, Silica Fume, Slag and National Pozzolans in Concrete, Istanbul, Turky, May 3-8, 1992. *Edited by* V.M.Malhotra. American Concrete Institute, Detroit, MI, Special Publication SP-132, Vol. 1, pp.351-365.
2. Tikalsky, P.J., Carrasquillo, P.M., and Carrasquillo, R.L. 1988. Strength and durability considerations affecting mix proportioning of concrete containing fly ash. ACI Materials journal, 85: 505-511.
3. American Society for Testing and Materials 1975. ASTM C 595 standard specification for blended hydraulic cements.
4. Davis, R.E., Carlson, R.W., Kelly, J.W., and Davis, H.E. 1937. Properties of cements and concretes containing fly ash. Journal of the American Concrete Institute
5. Abdun-Nur, E.A. 1961. Fly ash in concrete: An elevation. Highway Reasearch Board, Washington, DC, Highway Research Bulletin 284.Ravina, D. 1980. Optimized determination of PFA (fly ash) fineness with reference to pozzolanic activity. Cement and Concrete Research, 10: 573-580