Effect of Steel Slag Hydrated Matrix on Characteristics of Concrete- A Review

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Abstract- Iron slag and steel slag are the byproducts of the iron making and steelmaking processes. These types of slag have been widely used in cement and as aggregate for civil works. A new product developed called Steel slag hydrated matrix (SSHM) which is made mainly from slag and absolutely free from natural aggregate. Steel slag hydrated matrix is made up of 100% recycled resources. SSHM is having good strength excellent wear resistance. This paper reviewed the effect of SSHM over the basic characteristics of concrete.

Keywords- Concrete, Steel Slag, Aggregates, Strength, Characteristics.

I. INTRODUCTION

Iron and steel making slag are byproducts of the iron making and steelmaking processes. To date, these types of slag have been widely used in cement and as aggregate for civil works. There are two main types of slag, blast furnace slag and steelmaking slag.

As useful recycled materials, iron and steel making slag are mainly used in fields related to civil engineering, for example, in cement, roadbed material, and concrete aggregate. Their recycling ratio is close to 100%, making an important contribution to the creation of a recycling-oriented society. However, public works projects that are strongly related to recycled fields tend to be reduced recently and, moreover, other recycled materials, such as reused roadbed materials and fly ash, become competitor of slag in the fields. Thus, the development of new application technologies has become an urgent matter. Recently, steel slag hydrated matrix (SSHM) has been developed as a construction material for reducing environmental problems.

II. LITERATURE REVIEW

Bernal et al. [1] carried out Research work in Performance of an alkali-activated slag concrete reinforced with steel fibers. And concluded that developed AASC present 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. Their conclusion is that 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. Their conclusion is that the test roads shows 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 silica fume 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 silica fume 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 silica fume 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 silica fume plays a more effective role in mortar mixes than in paste mixes.

III. APPLICATION OF SSHM

Artificial stones and cover blocks using SSHM were manufactured and placed in a shore protection repair project at JFE Steel's West Japan Works (Kurashiki) between Sept. 2000 and Sept. 2002. A continuous type mixer was used in mixing the materials, and the cover blocks were manufactured by pouring into forms and curing in the same manner as with ordinary concrete blocks.

The artificial stones were manufactured by breaking SSHM which had been cast in the yard into large pieces. It was possible to handle the SSHM artificial stones and cover blocks in the same manner as natural stones and concrete blocks.

This is manufactured by basically the same process as the ordinary concrete. The material for steel slag hydrated matrix are steelmaking slag, ground granulated blast furnace

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slag (GGBS),fly ash, slaked lime, water and sometimes some admixture is also used. The replacement for the coarse aggregate is the steel slag, the replacement for fine aggregate is GGBS and the replacement for cement is the mixture of fly ash and slaked lime. Because this process is the same as with concrete, concrete manufacturing equipment can be used without modification.

IV. DISCUSSION ON SSHM

The new material called SSHM consisting of mainly of steel making slag, ground granulated blast furnace slag, fly ash, and water matrix has a number of excellent features, including the following:

- Made from 100% recycled resources.
- Considerable strength as ordinary concrete.
- Excellent wear resistance and other physical properties.
- Low alkaline dissolution.
- Excellent growth habitat for bio-fouling organism in marine environment.
- Economical.
- Little adverse effect on environment.

The steel slag hydrated matrix has been used as material for artificial stone and cover blocks, confirming its ease of use in construction with conventional techniques. Test also confirms that it has low impact on the ecological system. A trial calculation shows that this material will make substantial contribution to reducing natural aggregate consumption and CO_2 emission.

V. CONCLUSION

The major motivation of this project is the increase in waste products and increasing consumption of cement in construction industry. By decreasing the use of cement and natural ingredients, cost of construction may be reduced and it also reduces the environmental hazards. The emphasis of researcher is to investigate the suitability of waste materials. In these research, all attempts are made to introduce another material to concrete exploritation mostly waste product of steel industry. It involves no burning of fossils fuel that is otherwise used for producing cement , helps in emission of greenhouse emission and protects environmental pollution.

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