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Experimental Study on Granulated Steel Slag as an Alternative to River Sand

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Abstract : River sand is the most preferred fine aggregate for mortar and concrete. River sand is a product of natural weathering of rocks over a period of millions of years and is mined from river beds. Sand mining has disastrous environmental consequences. The excessive mining of river bed is creating an ecological imbalance. This has lead to have restrictions imposed by ministry of environment on sand mining. Driven by the acute need for sand, stone dust or manufactured sand prepared from the crushing and screening of coarse aggregate is being used as sand in the recent past. However manufactured sand is also a natural material and has quarrying and quality issues. To reduce the burden on the environment, alternative materials to be used as fine aggregates are being extensively investigated all over the world. Looking to the quantum of requirements, quality and properties there has been a global consensus on a material – Granulated slags. Granulated slag has been proven as a suitable material for replacing natural sand / crushed fine aggregates. In developed countries, the use of granulated slag as fine aggregate to replace natural sand is well established and is in regular practice. In the present paper Granulated slag has been experimented for usage in mortar. Slags are the main by-products generated during iron and steel production in the steel industry. Over the past decades, the steel production has increased and, consequently, the higher volumes of by-products and residues generated which have driven to the reuse of these materials in an increasingly efficient way. In recent years new technologies have been developed to improve the recovery rates of slags. Increase of slags recovery and use in different fields of applications like cement making, construction and fertilizers help in preserving natural resources. In addition to the environment protection, these practices produced economic benefits, by providing sustainable solutions that can allow the steel industry to achieve its ambitious targets of “zero waste” in coming years. Slags are generated at two different stages of steel production, iron making and steel making known as BF(Blast Furnace) slag and steel slag respectively. The slagging agent or fluxes, such as lime stone, dolomite and quartzite added into BF or steel making furnaces in order to remove impurities from ore, scrap and other ferrous charges during smelting. The slag formation is the result of a complex series of physical and chemical reactions between the non-metallic charge(lime stone, dolomite, fluxes), the energy sources(coal, coke, oxygen, etc.) and refractory materials. Because of the high temperatures (about 15000 C) during their generation, slags do not contain any organic substances. Due to the fact that slags are lighter than the liquid metal, they float and get easily removed. The slags protect the metal bath from atmosphere and maintain temperature through a kind of liquid formation. These slags are in liquid state and solidified in air after dumping in the pit or granulated by impinging water systems. Generally, BF slags are granulated and used in cement making due to its high cementious properties, and steel slags are mostly dumped due to unfavourable physio-chemical conditions. The increasing dump of steel slag not only occupies a plenty of land but also wastes resources and can potentially have an impact on the environment due to water pollution. Since BF slag contains little Fe and can be used directly. BF slag has found a wide application, such as cement production, road construction, Civil Engineering work, fertilizer production, landfill daily cover, soil reclamation, prior to its application outside the iron and steel making process.

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