Iron and Steel Slag

Slag-based stone matrix asphalt pavement.

Introduction

Blast furnace slag (BFS) and steel furnace slag (SFS) have a long history of being utilized as an industrial by-product, going back almost 100 years in the United States. BFS is composed of the non-metallic components removed from iron ore during processing in a blast furnace. It consists essentially of silicates and aluminosilicates of calcium and other bases. SFS is the nonmetallic product that is developed simultaneously with steel in the basic oxygen, electric, or open-hearth furnaces. It consists of calcium silicates and ferrites combined with fused and mineralogically combined oxides of iron, aluminum, manganese, calcium and magnesium. Both BFS and steel SFS have unique physical and chemical properties that make them particularly well suited to a variety of uses in construction and civil engineering projects.

Applications

The physical properties of slag can vary greatly depending on the processing done once the slag is removed from the furnace. Air-cooled BFS produces a durable aggregate that performs well in unbound applications as well as in Portland cement and asphalt concretes. Cooling the slag with water produces a lightweight aggregate for use in masonry blocks and lightweight concrete. Pelletized and granulated BFS are both water-cooled slags that can be ground and used to make slag cement. Slag cement provides reduced heat of hydration and improved resistance to sulfate attack and alkali-silica reaction than regular Portland cement.

Steel furnace slag typically forms a very angular, durable aggregate that makes it ideal for use in the transportation industry. SFS has been used successfully in the friction course of hot mix asphalt pavements, can be used in Superpave mix designs and has been used in stone matrix asphalt. In addition, the chemical composition of SFS slag makes it a cost effective and environmentally sound feed stock material for the production of Portland cement.

Environmental Benefits

An independent nationally renowned chemical laboratory and risk assessment team has conducted a human and ecological risk assessment of both BFS and SFS. The risk assessment scientist's analyzed samples from a representative cross-section of the slag industry in accordance with the EPA's risk assessment guidelines. The results of this study reinforced that BFS and SFS conforms to the EPA's stringent requirements and does not pose a threat to human or plant life. As in most applications, when materials are used in environmentally sensitive areas they should be tested to assess environmental impact. It should be noted that BFS and SFS have a long history of environmentally safe application, and that the use of slag have very positive environmental benefits. The use of slag in cement manufacturing significantly decreases carbon dioxide emissions, and reduces the energy needed to calcine limestone. The use of slag as aggregate reduces the need for virgin materials and the energy use and emissions produced during the mining, processing and transportation of those materials.

IRC
Industrial Resources Council
www.industrialresourcescouncil.org

For more information, see:
The National Slag Association
www.nationalslag.org
and
The Slag Cement Association
www.slagcement.org

NSA
SCA
SLAG CEMENT ASSOCIATION