

Structural Fill



Tire shreds used as lightweight fill.

Introduction

Structural fill is typically a screened earthen material used to create a strong, stable base. For example, the native soil at a site may be too weak to support a structure, so the native soil is replaced by compacted structural fill to provide the needed bearing capacity. Another common application is the filling of trenches and other excavations that will support roadways or other structures when completed. Structural fills are usually constructed by compacting earthen materials in place, so the compaction properties (optimum water content and maximum dry density) are very important to the performance. The compressibility and shear strength are also important measures of the compacted material. Traditionally, fill materials have been composed of soil and natural aggregates. However, a number of IRC byproduct materials have been used successfully as high quality, cost effective substitutes for natural materials in this application.

IRC Materials in Portland Cement

Traditional structural fill materials tend to be sandy soils that compact well and have good drainage properties. There are a number of IRC materials that have similar particle size gradations and mechanical properties, which them very good materials for structural fill applications. Foundry sands have performed well in the field, which is expected because the material is essentially high quality sand. Foundry sand has been used in a number of projects, and it has been found that design specifications for traditional materials will also apply foundry sands, which means no special equipment is required. Similarly, the use of coal fly ash in embankments and fills is actually the second highest use of this material, with more than 7 million tons placed in 2006. It behaves like a fine sand material but has a lower density. Embankments and fills are also the highest use application of coal bottom ash.

Air cooled and expanded blast furnace slags have been used in several large volume projects. Steel slags have been used in fill applications where expansion is not an issue. Exposure to moisture may lead to expansive chemical reactions, so care should be used when used when considering using steel slags under pavements or foundations where expansions may lead to poor performance.

The use of crushed concrete in embankments and fill applications may not provide the best value, but crushed concrete makes a good embankment material and sometimes the specific situation provides the best use of the material. Tire shreds provide an excellent low density fill material, typically one-third the weight of gravel, and provide good drainage.

In general, the use of IRC materials for embankments is relatively straightforward from an engineering point of view, and a number of materials have associated guidance documents and best practices for use in these applications. However, different states have different requirements with regards to design considerations such distance to ground water or requirements for liners, and should be consulted prior to beginning a project.

Benefits

The use of IRC materials in high volume applications like embankments and fills reduces the need for mining virgin aggregate and the associated use of water, fuel and reduces carbon dioxide emissions, while also saving valuable landfill space. At the same time, the performance of these materials is as good or better than natural materials, which provides added value to the project because of the reduced costs.