Embankments

Shredded tires used as coarse aggregate in an embankment.

Introduction

An embankment usually refers to an earthen structure that is used to raise the elevation of a roadway or railway above the elevation of the surrounding area. One common example of an embankment is the approach to a bridge, where the embankment raises the road to the level of the bridge deck. Embankments are typically built by compacting earthen materials in place, so the compaction properties of the soil (optimum water content and maximum dry density) are very important to performance. The compressibility and shear strength are also important measures of the compacted material. In addition, drainage is an important consideration to prevent the loss of shear strength due to saturation. Traditionally, embankment 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 these applications.

IRC Materials in Flowable Fill

There are a number of IRC materials that have particle size gradations and mechanical properties that make them very good materials for embankment applications. 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. Foundry sands have also performed well, which is expected because the material is essentially high quality sand. A number of instrumented foundry sand embankments have been performing well for more than a decade. Air cooled and expanded blast furnace slags have been used in several large volume projects. Steel slags have been used in embankments 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 structures where expansions may lead to poor performance. The use of crushed concrete in embankments 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 material, typically one-third the weight of gravel, and provide good drainage. Tire shreds also have good vibration dampening properties, and have been used in embankments in light rail projects to lessen train induced vibrations.

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 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 then natural materials, which provides added value to the project because of the reduced costs.

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