CIRCA
ASSOCIATION OF CANADIAN INDUSTRIES RECYCLING COAL ASH

STRUCTURAL FILL

Structural Fill

Structural fill is an engineered fill that is typically constructed in layers of uniform thickness and compacted to a desired unit weight (density) in a manner to control the compressibility, strength, and hydraulic conductivity of the fill (ASTM E–1861–97).

Coal Ash as Structural Fill

The many beneficial properties of Coal Ash make it highly suitable for use as structural fill, provided that guidelines and regulations for its use are followed.

Structural Fill Applications

"Structural" may imply making a structure, or improving the physical characteristics of the land, or land surface for purposes of supporting a structure and may include:

1. Road or rail line construction, e.g. embankments for highways and railroads, dikes, bridge approaches, road cloverleaf, and levees.
2. Foundations immediately below buildings and other structures.
3. Vehicle parking areas.
4. Erosion control, drainage works and dams.
5. Berms for noise or visual screening.
6. Sewer, water line or other pipeline or transmission line construction.

Structural fill does not include:

1. Application to land to improve the soil for crop or ground cover growth.
2. Alteration of land contours for landscaping purposes, or
3. General raising of land contours for flood control, pit and quarry rehabilitation, the construction of buildings or other purposes.

General Requirements

Before using coal ash in structural fill, the person or agency proposing such use may be required to submit a written notice to their respective provincial government ministry, or meet other such requirements mandated by responsible provincial and/or municipal agencies. The notice shall contain a project description, which includes as a minimum:

1. The nature, purpose, and location of the project, including a topographic map of the project site.
2. The estimated start and completion dates for the project.
3. A plan prepared by a qualified professional engineer in accordance with sound engineering practice. The plan shall meet the guidelines outlined in "Environmental Considerations" and "Design and Construction Guidelines" sections below. As a minimum requirement, the design shall comply with the ASTM Guide E-1861.
4. An estimate of the volume of coal ash to be used for the project.
5. A chemical and leaching analysis using the applicable provincial Leachate Extraction Procedure for coal ash. If coal ash was generated at a facility for which the provincial government has previously approved a chemical and leaching analysis, the person or agency may submit a copy of the analysis that was approved.
6. A signed statement by the land owner on which the structural fill is to be placed, acknowledging and consenting to the use of coal ash in structural fill. This statement may not absolve the responsibility of the Professional Engineer identified in item 3 above, and the person or agency proposing to use the product.

The provider shall ensure the coal ash characteristics meet the regulation and are consistent with the requirements of this fact sheet.

Environmental Considerations

As Fly Ash use in concrete increases, it leads to greater environmental sustainability through both the avoidance of landfill and the reduction of natural resource consumption, saving precious resources for future use.

1. Coal ash shall be placed above the seasonal high groundwater table, unless it is determined to be inert, as defined in provincial regulations.
2. Coal ash shall be placed in well-compacted layers to reduce infiltration, thereby minimizing the quantity of leachate produced.
3. Exposed surfaces shall be promptly covered with pavement, a layer of vegetated soil, or another form of permanent cover to prevent surface erosion and dusting. The soil shall be seeded and mulched as soon as practical. The covered material shall be graded to ensure proper drainage of surface runoff.
4. Adequate dust control shall be provided during transport and temporary storage at construction sites.

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5. Surface runoff from the site shall be contained in sedimentation traps constructed to capture suspended ash particles in the drainage water.
6. Users shall be provided with a Material Safety Data Sheet or similar communication of relevant product environmental information

Design and Construction Guidelines

1. Unsuitable materials such as vegetation and topsoil shall be removed and sub-grade must be compacted in order to facilitate the structural fill.
2. Provision must be made for controlling erosion of the coal ash fill by providing surface cover and appropriate drainage.
3. A stability analyses shall be conducted to demonstrate that embankments are stable to withstand any slumping or sliding.
4. Concrete structures supported on the coal ash fill shall be sulphate resistant by the selection of appropriate cement type.
5. When coal ash is applied close to water bodies or the groundwater table, the requirement for a capillary break must be evaluated.
6. Proper and uniform compaction of wetted ash shall be performed to ensure homogeneous structural fill. The compaction shall be done in layers not exceeding 300 mm in thickness to achieve 95 to 100% of the maximum dry unit weight, as determined by ASTM Test Method D698 (Standard Proctor) at optimum moisture content.
7. Coal ash obtained directly from the silos or hopper may be placed in a cold environment to dissipate heat prior to fill compaction. If the frost penetrates the compacted surface, the frozen layer shall be removed and re-compacted upon thawing and drying.
8. Quality control programs shall be implemented for using coal ash in structural fill. These programs include visual inspection of coal ash placement operation, supplemented with laboratory and field testing to ensure proper implementation of the design specifications.

Accessing Additional Information

For more information, refer to the following government guidelines and standard industry practices on the use of coal ash in structural fill:

- Ontario Ministry of Transportation Specifications (OPSS Criteria)
- National Building Code (Sections 4.2.4.15 and 4.2.5.8)
- Standard Guide for Use of Coal Combustion Products in Structural Fills ASTM E-1861
- Fly Ash Construction Manual for Road and Site Applications EPRI CS-5981

References

American Coal Ash Association. 1995. Fly Ash Facts for Highway Engineers. U.S. Dept. of Transportation, Federal Highway Administration Report No. FHWA-SA-94-081.

American Coal Ash Association. 1998. Innovative Applications of Coal Combustion Products.

ASTM. 1997. Standard Guide for Use of Coal Combustion By-Products in Structural Fills. ASTM E-1861.

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