
Standard Practice for Coal Combustion Fly Ash for Embankments

AASHTO Designation: PP 59-09 (2013)¹



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1. SCOPE

- 1.1. This practice covers the use of coal combustion fly ash (typically but not limited to non-self-hardening ash) as a fill material for the construction of embankments.
- 1.2. When properly processed, hauled, spread, and compacted on a prepared grade to appropriate density standards, coal combustion fly ash used alone, or blended with traditional soil aggregate or other approved aggregate materials, can be expected to provide a lighter-than-normal weight fill material (85 to 100 pcf, 1360 to 1600 kg/m³) with adequate stability and load support for use as road or highway embankment.
- 1.3. The technique described in this practice uses containment berms, cover fill material, and sometimes a liner and leachate system to isolate the fly ash and any resulting effluent. This is a conservative approach to the environmental issues raised by the use of fly ash as fill, and may not be required for all fly ashes or for all regulatory requirements.
- 1.4. This practice recognizes that since fly ash is a by-product of the burning of coal in electricity- and steam-generating facilities, various state, county, and local environmental laws and regulations apply if fly ash is used as an alternative embankment material. Aspects of fly ash that are of environmental concern are identified. Therefore, this standard discusses elements such as impermeable layers and leachate collection, as they may be required according to the environmental regulations affecting the proposed installation.
- 1.5. More specific guidance for the detailed use of fly ash as embankment material may be found in ASTM E2277.
- 1.6. The values stated in SI units are to be regarded as the standard.

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
 - M 146, Terms Relating to Subgrade, Soil-Aggregate, and Fill Materials
 - M 295, Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - T 2, Sampling of Aggregates
 - T 27, Sieve Analysis of Fine and Coarse Aggregates
 - T 99, Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
 - T 180, Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
 - T 272, Family of Curves—One-Point Method
 - T 310, In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

- 2.2. *ASTM Standards:*
- C295/C295M, Standard Guide for Petrographic Examination of Aggregates for Concrete
 - C311/C311M, Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
 - D5918, Standard Test Methods for Frost Heave and Thaw Weakening Susceptibility of Soils
 - E2201, Standard Terminology for Coal Combustion Products
 - E2277, Standard Guide for Design and Construction of Coal Ash Structural Fills (withdrawn 2012)
- 2.3. *U.S. EPA Test Method:*
- SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 3rd Edition

3. GENERAL DESCRIPTION

- 3.1. Fly ash is the finely divided residue that results from the combustion of coal. Fly ash is the airborne residue that exits a coal combustion chamber with the flue gas and is removed from the flue gas by electrostatic precipitation, baghouses, or other particulate control devices prior to the introduction of scrubber reagents. It contains siliceous and aluminous materials.
- 3.2. For purposes of this practice, fly ash is divided into two types. One is self-hardening and the other is non-self-hardening. Both types contain siliceous or siliceous and aluminous materials, which in the presence of lime or portland cement and water react to form a cementitious material.
- 3.2.1. *Self-Hardening Fly Ash (Class C)*—For the purpose of this practice shall mean fly ash that will form cementitious material in the presence of water alone.
- 3.2.2. *Non-Self-Hardening Fly Ash (Class F)*—For the purpose of this practice shall mean fly ash that requires the presence of lime or portland cement and water to form a cementitious material. It is likely that fly ash used in accordance with this practice will commonly be the non-self-hardening type, as it is less desirable for other uses.
- 3.3. Additional definitions relative to fly ash and other coal combustion by-products are provided in ASTM E2201.
- 3.4. The very fine-grained nature of fly ash, similar to that of natural silt-sized materials, makes it susceptible to vertical capillary water migration. Capillary water migration in embankments could lead to embankment saturation and instability under loading or frost heaving due to the development of ice lenses. As such, this practice recommends that a layer of open-graded granular material be constructed at the base of the fly ash embankment, and a layer of cover material be constructed on top of the embankment to prevent frost penetration into the fly ash in frost-prone locations.
- 3.5. Aqueous solutions that percolate through fly ash or fly ash containing admixtures could exhibit pH values that fall outside the range of 5 to 9. The engineer is cautioned that aqueous solutions with pH values that fall outside this range could result in corrosive conditions detrimental to concrete or metal conduit structures.
- 3.6. For cases where applicable laws and regulations raise concern regarding the quality of the leachate from the fly ash embankment, this practice includes a liner and leachate collection system.
- 3.7. The definitions of fill material and other soil aggregate terms are provided in M 146.