

SOIL STABILIZATION IS THE ALTERATION OF SOIL PROPERTIES

to improve the engineering performance of soils. Modification of soil properties is intended to enhance subgrade stability and expedite construction. Typically, the properties altered are density, moisture content, plasticity and strength.

Class C fly ash, with its self-cementing properties, is typically used for soil stabilization; however, Class F ash with an additional activator (cement, cement kiln dust, lime and lime kiln dust) can be used successfully to modify soil properties, as well as for numerous geotechnical applications commonly found on Federal, state and commercial construction projects.

The self-cementitious behavior of fly ash is determined by ASTM D-5239 (“Characterizing fly ash for use in Soil Stabilization”).

Very self-cementing	>500 psi (3,400 kPa)
Moderately self-cementing	100 – 500 psi (700 – 3,400 kPa)
Non self-cementing	<100 psi (700 kPa)

Note: Results obtained from ASTM D-5239 only characterize the properties of the representative fly ash as tested at 7 days with a 0.35 water/fly ash ratio. They do not provide the basis for evaluation of interactions between fly ash and soil.

Fly ash can be used to enhance and stabilize bases, subgrades, and embankments; to enhance strength properties and to control shrink/swell properties of expansive soils. Fly ash can also be used as a drying agent to reduce soil moisture contents to permit compaction and avoid delays in construction during periods of wet weather.

SOIL STABILIZATION TO IMPROVE SOIL STRENGTH

The primary reason fly ash is used in soil stabilization applications is to improve the compressive and shearing strength of soils. Typical stabilized soil depth is 6-12 inches. The compressive strength of fly ash treated soils is dependent on:

- In-place soil properties (clay/plastic vs granular)
- Delay time of compaction (1-2 hrs)
- Moisture content at the time of compaction (optimum moisture content)
- Fly ash addition ratio to soil content (8-16%)



ASTM C-618/AASHTO M-295 (SPEC VS. NON SPEC ASHES)

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Although fly ash for state department of transportation projects is usually specified to meet ASTM-C618/AASHTO M295, this is not necessary for soil stabilization, since compliant materials may increase the ash supply cost. Fly ash not meeting ASTM C618/AASHTO M295 is commonly used for soil stabilization projects. It should be noted that virtually any fly ash that has some self-cementitious properties can be engineered to enhance soil quality for construction purposes.

Some fly ash containing > 5% SO₃ content may be prone to swelling once added to soils. This ash must be thoroughly tested and evaluated before using to stabilize soils on construction projects.

TYPES OF EQUIPMENT REQUIRED FOR STABILIZING SOILS

Equipment may include a distributor truck for spreading ash, a roto-reclaimer for blending ash into the soil, pad foot roller, a drum roller and a water truck.

CONSTRUCTION SEQUENCE OF STABILIZING SOILS WITH FLY ASH

- Establish final grade on existing base course or sub-base.
- Spread the predetermined percentage of fly ash as dictated by the laboratory geotechnical data on the surface of the soil. Preferred method of placement is a pneumatic truck with spreader bar, or vane feeder truck.
- Blend the fly ash and the predetermined water to the soil with the reclaimer. Preferred method is a reclaimer with a sprayer/injection manifold to add water to the mixture.
- Compact the blended materials with the vibratory pad foot roller and grade the surface to the design criteria. The optimum time frame to compact the soil is within 1-3 hours.

- Complete final grading and roll with drum roller.
- Surface is now ready for addition of wearing course and light traffic. Wearing course may be concrete, asphalt, chip and seal, or gravel.