Cement-Modified Soil Solves Kentucky Airport Problem

By Doug Smith, PG, PCA Southeast Region

Muhlenberg County Airport located in Greenville, Kentucky was in need of improvements including a new 2,800 foot partial parallel taxiway. During the design it was discovered that the soils to support the one to three foot taxiway embankment were weak and would create issues with stability. Some method to improve the stability of the weak in-situ soils was necessary to allow construction of the embankment.

One method for dealing with unstable soil conditions in embankment construction is to place select aggregate fill onto a geotextile fabric in an effort to spread the load and "bridge" the unstable soils. Due to the material cost of geotextile fabric and aggregate as well as labor and hauling costs, the price tag can be quite hefty. In addition, the use of virgin aggregates for this purpose is not the most efficient and environmentally sound use of natural resources. On the other hand, in-place cement modification of unstable soils can provide a quick, cost effective and eco-friendly solution.

The Portland Cement Association's publication *Guide to Cement-Modified Soil* (CMS), EB242 defines CMS as a soil material that has been treated with a relatively small proportion of portland cement in order to amend its undesirable properties so that it is more suitable for use in subgrade and foundation construction. The cement does this by lowering the plasticity index (cohesiveness), reducing volume change, accelerating drying and providing greater strength than the untreated soil. This sounded exactly like what the soils at the Muhlenberg County Airport needed.

After reviewing options, the design firm of Garver, LLC decided to use cement modification as a means to provide a solid foundation for the embankment construction. Initial estimates indicated a significant cost and construction time savings using CMS, since modification would replace 9,000 tons of aggregate and associated geotextile fabric. From a sustainability standpoint, it would have taken approximately 360 truck trips to deliver the aggregate

Figure 1 – Weak materials evidenced during modification

Figure 2 – Mixer incorporating portland cement to a depth of 16 inches

Figure 3 – Stability is apparent with little rutting under the weight of a water truck

Figure 4 – Embankment being placed easily over cement-modified soil

needed compared to 25 truckloads of portland cement. The eco-friendliness of CMS is evident in the tremendous reduction in emissions and fuel savings from the hauling of construction materials.

Mt. Carmel Stabilization Group was chosen to perform the cement modification. The design called for 6 percent cement content mixed to a depth of 16 inches with a seven-day cure before embankment construction proceeded. Modification was completed in two days during June of 2008. Stability was gained immediately and embankment construction began one week later. When the final costs were tabulated, the CMS process saved 50 percent compared to the geotextile fabric and aggregate alternative. Not included in this savings estimate was the additional disposal cost of on-site material associated with the use of a geotextile fabric and aggregate. When asked about the cement modification solution, Mr. Daniel Taylor, airport manager was quoted "… it worked out great and appears to have been a great answer for our problem." Fast, cost effective and environmentally friendly, cement modification of soil can be counted on to provide a solid foundation for years of dependable service.

Credits

Airport Manager: Daniel Taylor

State Sponsor: Kentucky Department of Aviation

Engineer/Designer: Ryan Sisemore, Garver, LLC

Prime Contractor: Parkway Construction, Inc

Stabilization Contractor: Mt. Carmel Stabilization Group, Inc

More Information

PCA offers a broad range of resources on cement-based applications for pavements. Visit our Web site at **www.cement.org/pavements** for design and construction guidelines, technical support, and research on conventional concrete, roller-compacted concrete, pervious concrete, cement-modified soil, cement-treated base, and full-depth reclamation.

For local support, tap into the cement industry's network of regional groups covering the United States. Contact information is available at **www.cement.org/local.**

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