LAFARGE CEMENT

WHITE PAPER

Ash Utilization: Geotechnical Applications Taking Off in Midwest

Airports Use Self-Cementing Fly Ash to Reduce Costs, Help Environment

Industry-wide, approximately 43 percent of coal combustion products (CCPs) produced annually in the United States are used as a replacement for portland cement in concrete, as mineral filler in asphalt, as stabilizing material in soil, and as a beneficial application in various other construction activities. The cost of disposing the remaining 57 percent of CCPs – nearly 75 million tons a year – is enormous. These disposal costs are immediate and long-term, and the indirect costs can be huge when taken in the context of locating sites and permitting new coal-fueled generation. Communities do not want landfills and beneficial CCP utilization certainly helps to reduce potential environmental issues.

With over 50 years of experience in the business, Lafarge has well established fly ash programs throughout North America not only for use as supplementary cementitious material in high-performance concretes for constructing roads, bridges and buildings but also for use in a wide variety of geotechnical applications. The cementitious properties of class C fly ash make it useful for stabilizing soil and aggregate bases, as a drying agent and structural fill, for hot mix asphalt pavement recycling, and for reducing shrink/swell in expansive clay soils. Ten years ago, these nontraditional markets for fly ash were essentially nonexistent in the Midwest; today they account for a significant portion of fly ash production.

Soil and Runway Improvement Projects

While CCPs are well known in the market, Lafarge's technical expertise and reputation – including its rigorous quality assurance programs – play an important role in promoting the use of CCPs in the Milwaukee-Chicago area. These efforts have helped stimulate demand for fly ash throughout the region.

Chicago's O'Hare International Airport and airports in Antigo, Merrill, and Waukesha Wisconsin are among the many recent users of Lafarge-supplied fly ash for soil and runway improvement projects in the Midwest. Fly ash – used instead of portland cement – works as a lubricant to bind recycled pieces of pulverized asphalt together for airport runways and roads. At O'Hare, it is being used to help stabilize the soil.

There are significant environmental and economic benefits from choosing fly ash. The U.S. Environmental Protection Agency previously acknowledged that beneficially reusing fly ash helps reduce greenhouse gases, landfill requirements, and utilization of virgin resources. The use of fly ash also can significantly reduce costs. At Crites Field in Waukesha County, for example,

fly ash utilization saved taxpayers about 25 percent – an estimated $50,000 – on a $200,000 airport pavement project.

O'Hare Runway Extension

Kiewit-Western, one the world's largest heavy highway contractors, selected Lafarge to supply class C fly ash for a runway extension at Chicago's O'Hare International Airport.

To match the existing runway, Kiewit-Western had to raise the existing subgrade an average of 14 feet. This formidable task required drying more than a million cubic yards of silty clay at the site.

Self-cementing fly ash is a very economical and effective drying agent that can reduce soil moisture content by 30 percent or more within a matter of hours. Drying soils is faster and less expensive than replacing with dry soil, aggregates or other materials. Since the drying effect is quick and the soil is made resistant to further moisture infiltration, self-cementing fly ash can be of great benefit to owners and contractors when schedules require immediate, unimpeded construction.

Over two construction seasons, Lafarge spread about 100,000 tons of fly ash for Kiewit-Western grading crews. Kiewit-Western mixed the fly ash into eight-inch lifts of the wet subgrade material before compacting and grading it. Crews continued the layering process until they achieved the desired elevation. Without the use of a drying agent such as class C fly ash, Kiewit-Western would not have met their production milestones.

Kiewit-Western understands the many environmental, economic, and performance advantages of using class C fly ash in mass dirt excavation projects. The U.S. Environmental Protection Agency previously stated that using one ton of fly ash instead of cement saves enough energy to provide electricity to an average American home for 19 days. By using Lafarge class C fly ash for the O'Hare project, Kiewit-Western saved enough energy to provide electricity to about 1.9 million American homes for a day.

Merrill Airport Pavement Recycling

Cold-in-place recycling involves breaking up asphalt pavement, crushing it and applying it as the base for a new runway. Fly ash is mixed with the recycled asphalt, where it acts as a cementing agent and stabilizer. A new asphalt surface is then placed over the recycled material. This recycling process reduces the need for virgin materials and eliminates the need for disposal of the old runway. Construction costs are significantly less than removal and replacement. Compared with other asphalt-recycling methods, the process uses less energy and creates pavements that last five times or more longer.

Despite limited funds, improvements were needed to the badly cracked runway and apron hot mix asphalt (HMA) pavement at Wisconsin's Merrill Airport. Soils under the pavement were

clays and silty clays with high natural moisture content and little support value. Surface drainage needed to be reestablished and engineers designed an under-drain system to assure pavement performance. The existing HMA was only 3 inches thick and the base course thickness varied only between 4 to 6 inches.

Contractors were concerned about the ability of the old paved area to hold up under construction equipment loads.

The engineers recommended adding 5 to 7 inches of crushed aggregate over the existing pavement, pulverizing through the added material and existing HMA, establishing the required surface drainage grades, stabilizing the new blended base material with fly ash and paving directly on the strengthened surface. This technique allowed most of the existing base course to remain undisturbed, providing a good platform for construction equipment to operate. Once pulverizing was completed, fly ash was spread at 120 pounds per square yard over the surface, blended with the pulverizer while adding 5 to 6 percent moisture, compacted with a vibratory pad-foot roller, graded, rolled again with a smooth drum roller and paved. The entire process took only 2 days and new 4-inch HMA pavement was constructed a day later. The cost of cold-in-place recycling was only 65 percent of the cost to undercut and replace.

For more information on the beneficial use of self-cementing fly ash in varied geotechnical applications thoughout North America, visit the Lafarge website at www.lafarge-na.com.

Photos and Captions

As part of a $15-billion program at O'Hare Airport, Lafarge supplied 100,000 tons of class C fly ash to help stabilize the soil under an extended runway.

Compacting treated materials at Merrill Airport.

LAFARGE NORTH AMERICA INC.
12950 Worldgate Drive, 5th Floor, Herndon, Virginia 20170
Telephone: (703) 480-3600 Fax: (703) 480-3899
Web: www.lafargenorthamerica.com