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Creating a New Foundation:
E&A Provides Materials Testing for JEA's new product for Base and Subgrade Stabilization

Introduction

The cost of earthwork materials is a significant portion of the total construction cost of a project. As Jacksonville and the surrounding counties rapidly grow, sources of adequate construction material will be scarce and highly priced in the future. Alternative sources to naturally-occurring earth construction materials would help in reducing the cost of earthwork on selected projects.

The Jacksonville Electric Authority (JEA) generates approximately one million tons of a fly ash-like material annually at their Northside Generating Station (NSGS). To generate electricity, fossil fuels, mainly coal and petcoke, are mixed with limestone and burned in Circulating Fluidized Bed (CFB) boilers. Water is added to the resulting bed ash (the portion that settles at the bottom of the boilers) and fly ash, after which the mixture is pumped to excavated pits located within the northwest portion of the facility. After a three-day solidification period, a milling machine grinds the product. The moisture of the resulting material is adjusted to near optimum levels and shipped to construction sites. JEA has dubbed this new material "EZBase."

What we have been doing…

Ellis & Associates (E&A) is happy to be included on the EZBase testing team. E&A has been involved with the laboratory and field testing of the material since 2001. Laboratory and field testing currently underway will determine the physical behavior and the anticipated strength and compressibility characteristics of the material. E&A performed a series of laboratory Limerock Bearing Ratio (LBR) tests, with modifications as outlined in this article, as well as tests to verify that the index properties of the EZBase meet the FDOT requirements for subgrade stabilization, Section 914 of the *Standard Specification for Road and Bridge Construction*. EZBase/fine sand mix designs were used to optimize the amount of EZBase needed for subgrade stabilization.

From the onset of testing, we understood the sensitivity of the material to moisture change. We were informed by the JEA team that the optimum method in determining the moisture content of the EZBase is to oven-dry the material samples at 60^0 Celsius for a period of three days (oven-dry method). This method was determined during previous testing performed on EZBase and a similar material in Louisiana by other laboratories. Also, we understood that an air-dry curing period is needed for the material to gain its initial strength. Four-, seven-, and ten-day air-dry curing periods were used for the EZBase LBR testing; no curing period was used for the EZbase stabilized subgrade testing.

EZBase field testing consisted of constructing five test pads at the NSGS and two test pads at project sites in Jacksonville. The moisture contents of the NSGS test pads were determined daily using the oven-dry, speedy moisture and nuclear density methods. Wet and dry densities with percent compaction using a nuclear density gauge also were determined. Attempts to obtain cores from the test pads for unconfined compression testing continue to date.

Results

The EZBase LBR testing results are summarized in the following table:

	Maximum Dry Density, pcf	Optimum Moisture Content, %*	LBR Value
4-Day Air Curing Period	75.5	34.5	80
7-Day Air Curing Period	76.2	34.0	102
10-Day Air Curing Period	75.4	35.0	94

* oven-dry at 60^0 C for 3 days

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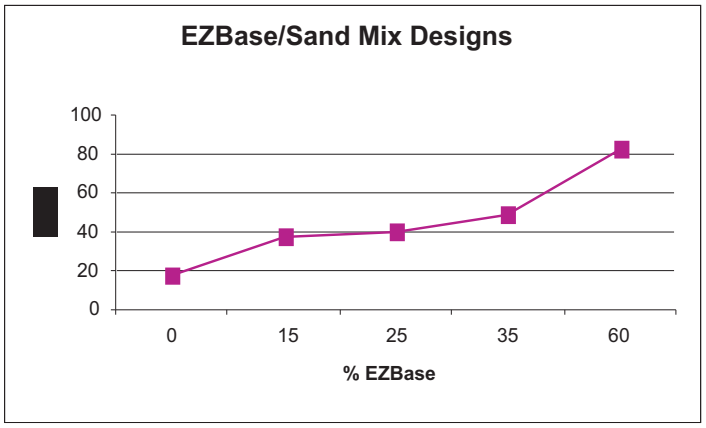
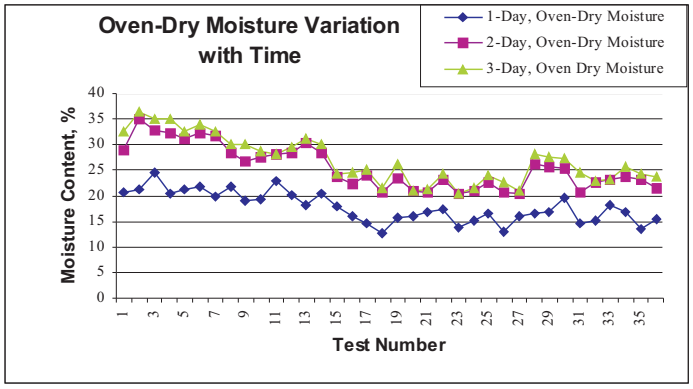
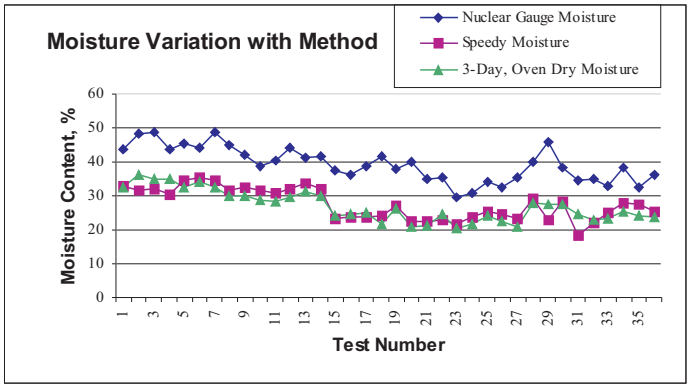
The EZBase/fine sand mix designs indicated the following results:



As discussed earlier, EZBase exhibits sensitivity to moisture determination. The moisture contents of 37 samples obtained from the NSGS test pads were determined using the nuclear, speedy moisture and oven-dry method. The moisture content of the oven-dry samples was checked daily for a period of three days. The following graph indicates the variation in moisture with time, using the oven-dry method.



The following graph indicates the variation in moisture using the three methods of moisture determination.



Performance of EZBase

Based on the data obtained and our limited experience with the EZBase material, the following observations can be made:

- EZBase exhibited LBR values of approximately 80 and 100 at four- and seven-day air-dry curing periods. No increase in the LBR value was noted after the seven-day air-dry curing period. Attempts to obtain cores for unconfined compression testing from the test pads continue.
- EZBase indicated favorable results for use as a subgrade stabilizer. Index properties met the FDOT requirements for subgrade stabilization, Section 914 of the Standard Specification for Road and Bridge Construction.
- While the upper layer of the EZBase placed at the test pads formed a very thin and stiff layer, the underlain EZBase retained the original moisture content.
- The moisture content of the material varied with the method used. Nuclear gauge moisture, speedy moisture and oven moisture were rarely similar. It appeared that the moisture contents determined using the nuclear gauge and speedy moisture methods should be reduced by 10 and 2 percent, respectively.
- The moisture content tests indicated relatively similar results after two- and three-day drying periods.

Future for "EZBase"

While some people are pleased with the early performance of EZBase in roadway construction as a base course layer, the long-term performance of the material should be studied further. Specifications for laboratory and field quality control should be developed to address: 1) a standardized moisture determination method; 2) a curing period to allow initial strength gain; 3) a pavement design layer coefficient that is consistent with the physical behavior of the material; and 4) a mechanism of bonding between EZBase and subsequent asphalt pavement layers.

EZBase has shown favorable results when used as a subgrade stabilizer. A mix of 35 percent EZBase and 65 percent fine sand would result in an LBR value of approximately 50. Its relatively light weight suggests EZBase could be used as a light-weight fill to reduce settlement of embankment over soft soils. Depending on the future cost of structural fill soils, EZBase may become a competitive product for roadway embankment construction.