



By Daniel C. Brown, Contributing Editor

Subgrade Strength from Lime Stabilization

There's value from in-place treatment with no need to remove and waste poor soil.

When engineers and contractors faced the construction of Municipal Drive and Galena Boulevard in Sugar Grove, Ill., it became obvious that poor subgrade soils presented a problem. For the first phase of the project, Contract A, unstable soils forced the contractor to undercut the subgrade and backfill with coarse aggregate.

Conditions for the second phase were similar. Some areas presented fat clay with high plasticity and high swell potential. In other areas, wet lean clay with more silt and sand were

By contrast, the unit cost for lime modification – to a depth of 16 inches – was put at \$4.85 per square yard, for a total of \$92,029. That represented a savings of \$220,489 over the undercutting alternative. This example helps explain the rapid growth of lime stabilization in recent years.

As a result, the construction team elected to go with lime stabilization. With stabilization, there is no need to remove and waste poor soil. It can be treated in place and made stable. Speed of construction is another benefit. Lime modification happens very quickly, and there is no extensive curing period. Mt. Carmel can typically complete a minimum of 10,000 square yards per day with a single crew. In fact, in a typical year, Mt. Carmel will complete more than 500 stabilization projects.

common. Based on soil test results, officials at Engineering Enterprises, Sugar Grove, and Geneva Construction, North Aurora, Ill., figured the entire area would have to be undercut to a depth of 12 to 18 inches and replaced with coarse aggregate.

At a meeting of project principals last November, Geneva Construction mentioned that the Mt. Carmel Stabilization Group, Mt. Carmel, Ill., could be hired to perform lime stabilization. The Illinois Department of Transportation advised the group that lime modification is certainly a viable alternative and said the decision should be based on construction costs.

Improve load bearing capacity

According to the Asphalt Recycling and Reclaiming Association (ARRA), soil stabilization is the permanent physical and chemical alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of a soil and/or control the shrink-swell properties of a soil, thus improving the load-bearing capacity of a subgrade to support pavements and foundations. A number of ARRA members, including the Mt. Carmel Stabilization Group, perform soil stabilization.

For the Sugar Grove project, the undercut area was fairly large – 18,975 square yards. Based on a 12-inch undercut, the total volume of material to be removed and replaced was 6,325 cubic yards. The unit price per square yard for undercutting and backfilling with coarse aggregate was estimated at \$16.47, for a total of \$312,518.

Specially-built equipment

For the Sugar Grove project, Mt. Carmel's custom-built spreader trucks applied Lime Kiln Dust (LKD) at the rate of 5 percent, a very common treatment rate. Water is added to the area to ensure that the LKD is properly hydrated and that the soil is at its optimum moisture content for compaction.

Next the Mt. Carmel crew used a Caterpillar RM 350 Road Reclaimer – a rotary mixer that works like a roto-tiller – to mix the lime to a depth of 16 inches. "This mixing equipment is specially built for soil stabilization and can thoroughly pulverize and mix even the most difficult soils with any chemical in one or two passes," said Neil Ryan, marketing manager for Mt. Carmel.

Following mixing, the area is shaped with a motor grader, compacted with a padfoot roller and then sealed with a smooth drum roller.

Lime modification improves a number of engineering properties of poor soils. This treatment reduces the plasticity index, reduces or eliminates the swell potential, and increases the unconfined compressive strength, Immediate Bearing Value and Illinois Bearing Ratio. The latter is a measure of strength very closely related to California Bearing Ratio, a common measure of soils' bearing capacities.

On average, the Illinois Department of Transportation does about 1.5 million square yards of lime modification every year. This Sugar Grove project, however, was a first for District 1, which covers the Chicagoland area. ♦