

# **BENEFITS OF SUBGRADE STABILIZATION USING GEOSYNTHETICS VERSUS LIME TREATED SOIL**

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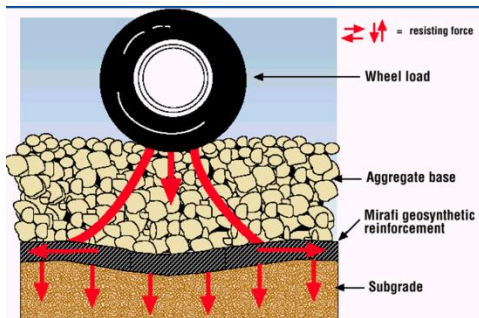
Revised: May 18, 2010

This technical note will focus on the benefits of sub grade stabilization and reinforcement using geosynthetics versus lime stabilization. Subgrade preparation for pavement sections can be one of the most time consuming aspects of roadway construction. Soft subgrade conditions can delay construction significantly, putting the entire project behind schedule. Using traditional methods of recompacting the subgrade or undercutting and replacement can be time consuming and costly. Alternative modifications to improve subgrade support include geosynthetic stabilization and reinforcement or lime soil treatment.

Lime soil treatment is a chemical process in which lime (quicklime, hydrated lime or lime slurry) is mixed with the in place subgrade soil and a chemical reaction takes place. The lime reacts with the clay particles in the soil to create a cementitious matrix. Lime treatment is limited to clay soils with relatively high plasticity indices in order to react with the soil. Additives are available that can be mixed with soils, allowing lime treatment to be used on soil with plasticity indices.

However, the result is added project cost, and the treated soil's effectiveness variable. Lime is also limited to use in soils that do not contain sulfates. Sulfates in the soil react with the lime treatment to create calcium sulfate, which in turn reacts with water causing the treated soil to heave or swell.

Dry Lime and Lime Slurry



Geosynthetic stabilization and reinforcement is a mechanical process. The geosynthetic is placed within the subgrade or subbase and works with the soil and stone to create a reinforced section through separation, confinement and/or reinforcement.

The lime treatment process requires several pieces of specialty construction equipment and an experienced specialty contractor. Geosynthetics can usually be installed with the equipment already on site and doesn't require a specialty contractor. Lime treatment involves several steps, including spreading, mixing, mellowing, secondary mixing, moisture conditioning, compacting, curing and sealing. Several of the steps require a waiting period and some steps may need to be repeated if the results are unsatisfactory. Geosynthetics are delivered to the site in ready to use rolls and can be installed quickly and easily. Once the geosynthetics are installed, construction can continue immediately. There is no waiting during a mellowing or curing period, nor is there uncertainty as to whether the material has been mixed sufficiently.

Lime treatment is generally limited to unique and very special soil types and project conditions. There are several negative factors that the Engineer and Contractor must consider before choosing to use lime treatment. Lime mixing is weather dependent. Wind, rain or cold temperatures can halt construction. Lime can be very difficult to use. It can be difficult to get the mix proportions correct and achieve a uniform mixture as site soils are homogeneous and isotropic. Several test mixes must be developed, and subsequent laboratory testing is required on treated soils from field test strips before installation can be initiated.

The long term performance of lime treated subgrades is not well documented, particularly with respect to transient water conditions, seasonal changes, wet/dry cycles and freeze/thaw cycles. Studies have shown that when a lime treated subgrade is subjected to continuous water leaching, the lime treated soil can have less desirable engineering properties than the untreated soil (McCallister and Petry, 1990). The effects of saturated subgrade conditions or several freeze/thaw cycles over the course the pavement life are not well documented at this time.

Using lime also presents several safety issues during the installation process. Lime poses eye, skin and inhalation hazards to workers and to anyone in vicinity of the working area. It is a caustic alkaline material and can cause severe eye irritation or burning, including permanent damage. Lime can also irritate and burn exposed skin, so prolonged contact with unprotected skin must be avoided. Lime also is an irritant if inhaled; respiratory protection must be worn during its use. Property damage to vehicles or structures is also a concern; any lime dust should be washed off chrome and painted surfaces immediately.

Dry hydrated lime or quicklime is a fine powder, and the resulting lime dust created during mixing and construction can be a significant problem, particularly during windy conditions. Thus, this application is generally unsuitable for population areas. Additionally, dry quicklime requires a significant amounts of water to hydrate. There is significant water evaporation due to the exothermic reaction, requiring greater source requirements and possible additional mixing. This can significantly delay construction and increase the cost of the project if water is not readily available locally. To combat these disadvantages, a slurry lime can be used to reduce dust and reduce water requirements during final mixing. However, the slurry is more expensive due to the additional equipment requirements and slower application rates. In addition, it is not practical to use in very wet soils or for soil drying applications.



Advantages of using geosynthetics include their relative low cost and the fact that there are no safety concerns with regard to mixing chemicals or airborne particles. Geosynthetics Mirafi® geogrids and geotextiles can be installed in any weather conditions, including wind or cold, and there is no concern when installing geosynthetics in a populated area or near active traffic zones. Installation is quick and does not require specialty equipment or labor. Construction can continue immediately after installation; there is no waiting or curing time.

The wide variety of geotextiles and geogrids available for stabilization and reinforcement applications insure that geosynthetics are the right choice for any



subgrade soil type and condition. Manufacturers and marketers are the most comprehensive line of geosynthetics in the industry, including geogrids, woven geotextiles, and nonwoven geotextiles, along with other specialty products. All of these products can be used in subgrade stabilization, reinforcement or separation; individually or in combination with each other to improve subgrade support roadway construction and pavement service life. Their use is not limited to certain soil types or soft conditions.

The next time you encounter a soft subgrade soils on your roadway or pavement project, consider using geosynthetics for stabilization or reinforcement before trying to overcome all the disadvantages of lime.

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