LIME TREATED SOIL SAVES TIME & MONEY

Benefits of Lime Treatment

Drying with Lime

- Minimizes weather-related construction delays
- Acts quickly - allowing work to continue even in wet conditions

Lime Improvement / Modification

- Speeds construction with stable working platform
- Maximizes use of low cost, on-site materials
- Reduces plasticity
- Improves compactability
- Permits reworking

Lime Stabilization

- Chemically transforms clay soils
- Permanently increases strength
- Eliminates soil expansion
- Creates excellent freeze-thaw resistance
- Resists cracking
- Reduces thickness of overlying pavement layers, saving money
- Permits reworking
- Maximizes use of low cost, on-site materials

- Lime **drying** of wet soils minimizes weather-related construction delays.
- Lime **improvement / modification** chemically transforms clay soils into friable, workable, compactable material.
- Lime **stabilization** creates long-term chemical changes in unstable clay soils to create strong, but flexible, permanent structural layers in pavement systems and other foundations.

Lime Dries Wet Soils

Because quicklime chemically combines with water, it can be used very effectively to dry any type of wet soil. Heat from this reaction further dries wet soils. The reaction with water occurs even if the soils do not contain significant clay fractions. When clays are present, lime's chemical reactions with clays increase the moisture-holding capacity of the soil, which reduces free liquids and causes further drying. Generally, between 1 and 4 percent lime by mass of dry soil will improve a wet site sufficiently to allow construction activities to proceed.

Site Investigation / Mixture Design

A site investigation should be carried out to determine the suitability of the soil for Modification or Stabilisation.This investigation should include the laboratory testing of samples to determine the type and quantity of stabilizers that are required to produce the desired properties. In addition to lime, other stabilizing materials include cement and pozzolans which may be used for specific purposes.

Lime Improves / Modifies Clay Soils

On many construction sites there is a need for soil *improvement / modification* to temporarily strengthen the working area. The benefits of improved / modified soils include:

1. Making clay soils friable and easier to handle
2. Providing a working platform for subsequent construction
3. Reducing plasticity to meet specifications
4. Conditioning the soil for further treatment
5. Spot treatment of spongy subsoil areas

After initial mixing, the soil becomes friable and granular, making it easier to work and compact. At this stage the Plasticity Index of most soil decrease dramatically, as does the tendency to swell and shrink. The process, which is called "flocculation and agglomeration", generally occurs in a matter of hours. Small amounts of lime, such as 1 to 4 percent by mass of dry soil, can upgrade many unstable fine-grained soils. With heavy clay soils, additional lime may be necessary for these purposes.

Lime Permanently Stabilizes Clay Soils

In contrast to lime modification, lime *stabilization* creates long-lasting changes in soil characteristics that provide structural benefits. Lime is used in stabilizing and strengthening subgrades (or subbases) and bases below pavements. Non-pavement applications for lime treatment include building foundations and embankment stabilization.

Lime stabilization chemically changes most clay soils:

1. Markedly reduces shrinkage and swell characteristics of clay soils
2. Increases unconfined compressive strength by as much as 40 times
3. Substantially increases load-bearing values as measured by such tests as CBR, R-value, Resilient Modulus, and the Texas Triaxial tests
4. Develops beamstrength in the stabilized layer and greatly increases the tensile or flexural strength
5. Creates a water-resistant barrier. Impedes migration of surface water from above and capillary moisture from below; thus helping to maintain foundation strength
6. In addition to lowering the plasticity in most cases and initially strengthening the improved soil, the strengthening effect increases over time

When adequate quantities of lime and water are added, the pH of the soil quickly increases to above 10.5, which enables the clay particles to break down. Silica and alumina are released and react with calcium from the lime to form calcium-silicate-hydrates (CSH) and calcium-aluminate-hydrates (CAH). These compounds form the matrix that contributes to the strength of lime-stabilized soil layers. As this matrix forms, the soil is transformed from its highly expansive, undesirable natural state to a more granular, relatively impermeable material that can be compacted into a layer with significant load bearing capacity. In a properly designed system, days of mellowing and curing produce years of performance. The controlled pozzolanic reaction creates a new material that is permanent, durable, resistant to cracking, and significantly impermeable. The structural layer that forms is both strong and flexible.

Conclusions

In addition to environmental benefits, Lime treatment of soils is a proven method to save time and money on construction projects.

- By treating unsuitable materials to produce a valuable construction resource
- By minimising lorry movements for disposal of site material
- By reducing lorry movements for importation of aggregates
- By conserving landfill capacity
- By minimising wear and tear on the local road network

Further sustainable and economic benefits can be obtained by designers who acknowledge that strengthening the lower layers of a pavement allows for possible economies in the upper layers.
Further information and reference documents are available from Clogrennane Lime.

Clogrennane Lime Ltd, Clogrennane, Carlow A CRH group company

T: 059 9131811 • F: 059 9131607 • E: office@clogrennane.ie • www.irishlime.ie

1816 CLOGRENNANE LIME