LECTURE 38

Lime Stabilization.

Lime reacts with medium, moderately fine and fine-grained soils to produce decreased plasticity,increased workability, reduced swelling, and increased strength. The major soil properties and characteristics that influence the soils ability to react with lime to produce cementitious materials are pH, organic content, natural drainage, and clay mineralogy. As a general guide, treated soils should increase in particle size with cementation, reduction in plasticity, increased in internal friction among the agglomerates, increased shear strength, and increased workability due to the textural change from plastic clay to friable, sand like material.

The following procedures shall be utilized to determine the amount of lime required to stabilize the subgrade. Hydrated or quick lime and lime by-products should be used in the range of 4 ± 0.5% and 5 ± 1% by weight of soil for modification respectively. The following procedures shall be used to determine the optimum lime content.

Perform mechanical and physical tests on the soils.

Determine the separate pH of soil and lime samples.

Determine optimum lime content using Eades and Grim pH test.

• A sufficient amount of lime shall be added to soils to produce a pH of 12.4 or equal to the pH of lime itself. An attached graph is plotted showing the pH as lime content increases. The Optimum lime content shall be determined corresponding to the maximum pH of lime-soil mixture. (See Figure 4.0 A).

• Representative samples of air-dried, minus No. 40 soil is equal to 20 g of oven-dried soil are weighed to the nearest 0.1 g and poured into 150-ml (or larger) plastic bottles with screw on tops.

• It is advisable to set up five bottles with lime percentages of 3, 4, 5, 6, and 7. This will insure, in most cases, that the percentage of lime required can be determined in one hour. Weigh the lime to the nearest 0.01 g and add it to the soil. Shake the bottle to mix the soil and dry lime.

• Add 100 ml of CO_2-free distilled water to the bottles.

• Shake the soil-lime mixture and water until there is no evidence of dry material on the bottom. Shake for a minimum of 30 seconds.

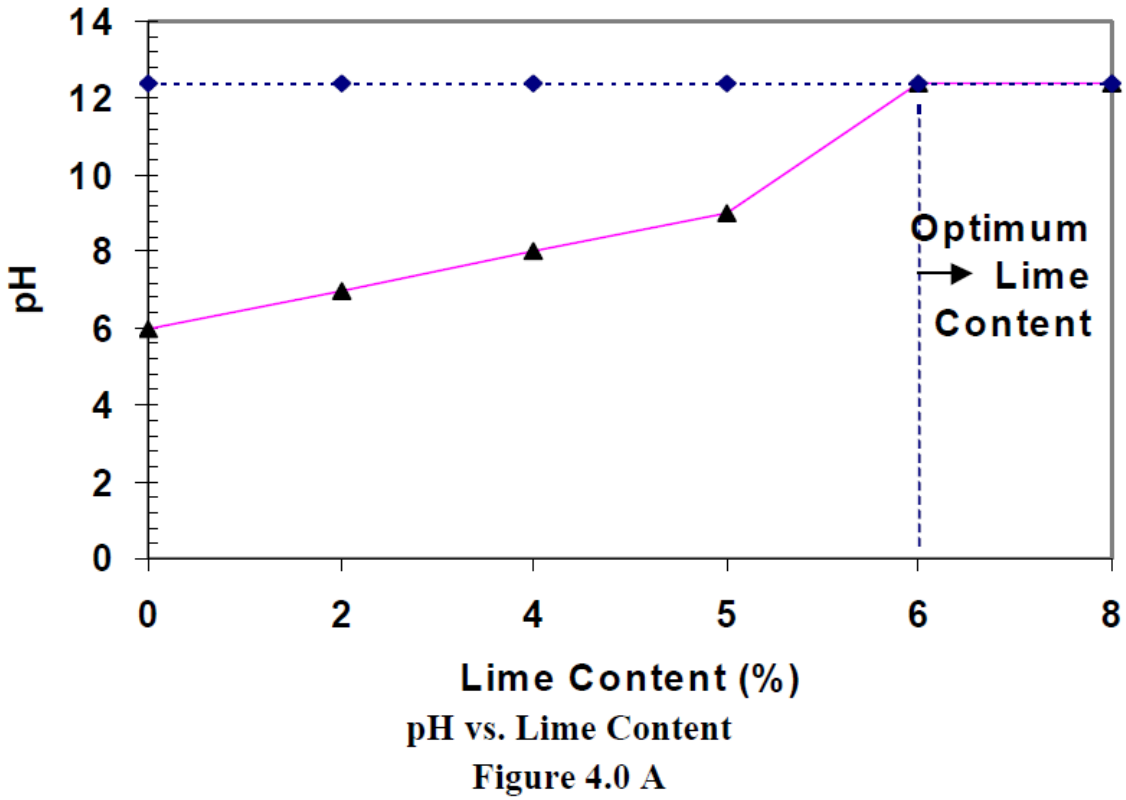
• Shake the bottles for 30 seconds every 10 minutes.

• After one hour, transfer part of the slurry to a plastic beaker and measure the pH. The pH meter must be equipped with a Hyalk electrode and standardized with a buffer solution having a pH of 12.00.

• Record the pH for each of the lime-soil mixtures. If the pH readings go to 12.40, then the lowest percent lime that gives a pH of 12.40 is the percentage required to stabilize the soil. If the pH does not go beyond 12.30 and 2 percentages of lime give the same readings, the lowest percent which gives a pH of 12.30 is the amount required to stabilize the soil. If the highest pH is 12.30 and only 1 percent lime gives a pH of 12.30, additional test bottles should be started with larger percentages of lime.

d. Atterberg limits should be performed on the soil-lime mixtures corresponding to optimum lime content as determined above.

e. Compaction shall be performed in accordance with AASHTO T 99 on the optimum lime and soil mixture to evaluate the drop in maximum dry density in relation to time (depending on the delay between the lime-soil mixing)



pH vs. Lime Content

Figure 4.0 A

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In the case of stabilization, the Unconfined Compression Test (AASHTO T 208) and California Bearing Ratio (AASHTO T 193, soaked) or resilient modulus (AASSHTO T 307) tests at 95%compaction shall be performed in addition to the above tests corresponding to optimum lime-soil mixture of various predominant soils types.