

# **Construction Specification 28 – Lime-Treated Earthfill**

## **1. Scope**

The work consists of furnishing lime, mixing lime with soil, curing, and placing the lime treated soil.

## **2. Material**

Soil material shall be obtained from the designated area(s). The selection of the material shall be as outlined in Section 12 of this specification. Soil material shall contain no frozen soil, sod, brush, roots, or other perishable material. Rock particles larger than the maximum size specified for each type of earthfill shall be removed before treatment operations.

Water shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

Hydrated lime shall meet the requirements of Material Specification [LIME 593](#).

## **3. Equipment**

All equipment necessary for the proper construction of the work shall be on the work site before the lime treatment operations start. Unless otherwise specified, mixing equipment shall include the combined use of heavy disk plows and high-speed rotary mixers. Disks shall be at least 24 inches in diameter, and rotary mixers shall be capable of mixing lifts at least 9 inches thick traveling at a minimum speed of 4 miles per hour and covering a minimum width of 6 feet.

All equipment used to convey or transport lime to or on the work site shall be covered or enclosed to avoid lime dust problems.

## **4. Site Preparation**

The contractor shall prepare, mix, and cure the lime treated earth material in the area(s) shown on the drawings.

Before lime treatment operations start, the processing area used for mixing and curing shall be stripped of topsoil and graded to a relatively smooth and uniform surface.

After the area is no longer required for mixing and curing, it shall be regraded as required, disked to a depth of 4 inches, and covered uniformly with the removed topsoil.

## **5. Lime Proportioning**

The amount of lime shall be as specified in Section 12 of this specification. Adjustment in the amount of lime may be required as the work progresses and shall be adjusted as requested and approved by the engineer.

## **6. Lime Application**

Lime shall not be applied when the temperature is below 40°F or is expected to drop below 40°F within 24 hours. Lime will not be applied during high wind conditions that hinder effective application or cause pollution by drift offsite.

Method 1 – Hydrated lime shall be uniformly applied in dry form on the soil surface at a rate that will attain the specified proportioning and lightly sprinkled with water to minimize dusting and blowing.

Method 2 – Hydrated lime shall be mixed with water to form a slurry before application to the soil surface. The slurry shall be a mixture of 1 ton lime to a minimum volume of 500 gallons of water. Agitation shall be accomplished through integral paddles, recirculating pumps, or a combination of these devices. The lime and water shall be maintained as a uniform mixture until application to the soil surface.

The slurry shall be uniformly applied to the soil surface at a rate that will attain the specified proportioning. The slurry shall be applied under pressure through spray bars.

## **7. Mixing**

The soil, lime, and water shall be mixed by disking and use of rotary mixers until a uniform mixture is obtained. During initial mixing with dry lime, a minimum of two cycles of water application followed by mixing with disks and high-speed rotary mixers shall be accomplished.

The depth of the lift for treatment shall be no greater than the depth that can be effectively mixed by the equipment. The cycle of watering and mixing shall continue until the soil, lime, and water are thoroughly processed to a uniform mixture without lumps of soil or lime. When mixing is complete, the water content of the mix shall not be less than standard optimum water for the soil-lime mixture, when tested in accordance with ASTM D 698, Procedure A.

After mixing, the lime treated layer shall be sealed to minimize evaporation loss, lime carbonation, and excessive wetting from rainfall or other sources. Sealing shall be accomplished by lightly compacting the surface of the treated layer with a pneumatic tire or smooth wheel roller or by other methods approved by the engineer.

The mixing of lime, soil, and water shall be completed within the same workday it is started.

## **8. Placement**

Lime-treated earthfill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the engineer. Earthfill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the earthfill.

Immediately before placement of lime-soil mixture, the subgrade shall be scarified and moistened to create a water content that allows suitable bonding of lime-soil mixture. Surface free water shall not be present during placement operations.

Lime-treated earthfill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not

exceed the maximum thickness specified in Section 12 or shown on the drawings. Material placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted.

During placement and compaction of the lime-soil mixture, the moisture content of the material being placed shall be maintained within the specified range. The water content of the mixture at the time of placement and compaction shall not be less than standard optimum moisture when tested in accordance with ASTM D 698, Procedure A.

## **9. Compaction**

Lime-treated earthfill shall be compacted in accordance with section 6 of Construction Specification [EARTHFILL 23](#), for the specified class.

## **10. Curing**

The lime and soil mixture shall be cured at least 72 hours unless otherwise specified in Section 12. The water content of the mixture shall be maintained at or above standard optimum water content during the curing period by sprinkling with water, remixing, and resealing.

After the required curing time has occurred and before use as earthfill, the treated material shall be thoroughly remixed. Final mixing shall be accomplished so that all nonslaked lime particles retained on the No. 4 sieve are removed. The remaining material shall have all clods reduced in size to meet the following gradation:

Minimum passing 2-inch sieve = 100 percent Minimum passing no. 4 sieve = 60 percent

## **11. Measurement and Payment**

For items of work for which specific unit prices are established in the contract bid schedule:

- 1) The quantity of lime used for lime treatment is measured to the nearest ton by actual weight.
- 2) The volume of lime stabilized earthfill within the specified zone boundaries and pay limits shown on the drawings are measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified, no deduction in volume is made for embedded conduits and appurtenances.

The pay limits for lime-treated earthfill shall be as defined below, with the further provision that lime stabilized earthfill required to fill voids resulting from overexcavation of the foundation and/or placed outside the specified lines and grades will be included in the measurement for payment only where such placement is approved by the engineer. Such approval will only be granted for the purpose of filling overexcavation that results from the removal of unsuitable material and where placement outside the lines and grades were not a result of contractor's improper construction operations as determined by the engineer.

Method 1 – The pay limits shall be as designated on the drawings.

Method 2 – The pay limits shall be the measured surface of the foundation when approved for placement of lime treated earthfill and the specified neat lines of the earthfill surface.

Method 3 – The pay limits shall be the measured surface of the foundation when approved for placement of lime treated earthfill and measured surface of the completed earthfill.

Method 4 – The pay limits shall be the specified pay limits for excavation and specified neat lines of the earthfill surface.

Method 5 – The pay limits shall be the specified pay limits for excavation and measured surface of the completed earthfill.

Method 6 – Payment for the lime treated earthfill is made at the

contract unit price for that type of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work including stripping topsoil, grading, and spreading topsoil over the processing area following completion of lime treated earthfill activities. No separate payment will be made for water applied to the foundation and used for preparing hydrated lime.

Method 7 – Payment for lime treated earthfill is made at the contract unit price for that type of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work, including stripping topsoil, grading, and spreading topsoil over the processing area following completion of lime treated earthfill activities. It does not include furnishing, transporting, and applying water to the foundation and earthfill material. Water applied to the foundation and earthfill material is measured and payment made as specified in Construction Specification [WATER FOR CONSTRUCTION 10](#).

All Methods – The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 12 of this specification.

## **12. Items of Work and Construction Details**

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