

## LithTec™ Treated Full Depth Lithification Installation and Performance Specifications

1. **OBJECTIVE:** Installation of LITHTEC™ shall consist of constructing a mixture of soil, and/or soil amendments, and/or asphalt, and all versions of LITHTEC™ and water for the optimization and recycling of pre-existing roadway materials. The work shall be performed in conformity with the lines, grades thickness, and typical cross sections shown on the road design plans. When the specified amount of LITHTEC™ and water are blended and compacted as specified, it shall result in the LITHTEC™ transforming low performing soil to a hard, less permeable layer with increased load bearing capacity and increased ductility. The majority of the reaction shall occur within twenty-four (24) hours and should continue to strengthen over time. The resulting matrix shall be permanent and durable with reduced volume change characteristics, and result in a structural layer that is both strong and flexible.
2. **CONTRACTOR QUALIFICATION:** The contractor shall (a) have had a minimum of two (2) years' experience in cement and/or lime soil stabilization or modification or be capable of demonstrating sufficient technical expertise in cement and/or lime soil stabilization or modification; and (b) have successfully completed similar projects to the satisfaction of their clients.
3. **MATERIALS:** Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.
  - 3.1 **ROADWAY MATERIAL SAMPLING:** Roadway materials to be utilized must be sampled and/or gathered at cross sections provided by the engineer. Sampled roadway materials must be taken at a consistent depth as specified by the engineer. A minimum of ninety-five pounds of actual roadway material per project and/or a minimum of 95 pounds per 3 miles of linear roadway are to be obtained for testing. *See 4, Testing Specifications.*
4. **TESTING SPECIFICATIONS:** A battery of testing shall be completed per project and/or per 3 miles of linear roadway. The battery of testing shall include: Sieve Analysis (AASHTO T-27), Liquid Limit (AASHTO T-89), Plastic Limit (AASHTO T-90), Treated Moisture Density Relations of Soils (AASHTO T-99, T-180, ASTM D1557), Treated California Bearing ratio (AASHTO T-193-13, ASTM D1883), Treated Unconfined Compression Strength (AASHTO T-208-15, ASTM D2166M-16), Treated Modulus Derivative (AASHTO T-208) or Resilient Modulus (AASHTO T-307).
5. **CUSTOMIZATION OF DRY LITHTEC™ MIXTURE:** Based upon the soil classification (AASHTO T-27, AASHTO T-89, AASHTO T-99, T-180, ASTM D1557) of materials sampled on the roadway (*See 3.1*) a custom mixture shall be designed and made up of cementitious materials, and/or pozzolanic materials, and/or organic or inorganic compounds designed to optimize the structural potential of a given roadway material and to meet Lab Performance Testing Requirements (*See 6*) and Field Performance Testing Requirements (*See 16*) as specified.
6. **LAB PERFORMANCE TESTING REQUIREMENTS:** Treated California Bearing Ratio (AASHTO T-193-13, ASTM D1883) tests shall be performed and must exceed a minimum of a 150 CBR Value with a minimum shrink/swell value of .15%. Treated Unconfined Compression Strength (AASHTO T-208-15, ASTM D2166M-16) test shall be performed and must exceed a minimum

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of a 400 psi with a strain at failure to meet or exceed a minimum of .8%. Treated Modulus Derivative (AASHTO T-208) or Resilient Modulus (ASSHTO T-307) tests shall be performed and must exceed a minimum of a 500,000,000 psi.

7. **WATER:** Water furnished must be free of industrial waste and other objectionable materials.
8. **LithTec™ CONTENT:** A qualified engineer shall designate the percentage of LITHTEC™ by dry weight of the soil to satisfy the criteria requirement for the project. The LITHTEC™ specified dosage by dry weight obtained from the Maximum Dry Density per AASHTO T-99 or AASHTO T-180 is required for all mix designs, as may be specified by a qualified engineer.
9. **EQUIPMENT:** Appropriate machinery, tools, and equipment necessary for proper execution of the work are required. Among other applicable equipment, pulverization and spreader equipment are required as follows:
  - 9.1 **PULVERIZATION EQUIPMENT:** Pulverization equipment that cuts and pulverizes material uniformly to the calibrated proper depth with cutters that will plane to a uniform surface over the entire width of the cut, provides a visible indication of the depth of cut at all times, and uniformly mixes the materials is required.
  - 9.2 **SPREADER EQUIPMENT:** Calibrated spreader equipment to apply the LITHTEC™ at the percentage rate specified is required. Griffin could help add to this aspect.
10. **CONSTRUCTION:** Construct each layer uniformly, free of loose or segregated areas and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.
11. **PREPARATION OF SUBGRADE OR EXISTING BASE FOR TREATMENT:** Before treating, remove or pulverize existing asphalt and/or concrete pavement in accordance with the plans. When amendment materials are required to be mixed with existing subgrade, subbase, or base: deliver, place, and spread the new material in the required amount. Manipulate and thoroughly mix all materials that will be included in the lift for treatment.
12. **APPLICATION OF LITHTEC™:** Uniformly apply LITHTEC™ using dry placement unless otherwise shown on the plans. Start LITHTEC™ application only when the air temperature is at least 35°F and rising or is at least 40°F. The temperature shall be taken in the shade and away from artificial heat. Suspend application when it is determined that weather conditions are unsuitable.
13. **DRY PLACEMENT:** Before applying LITHTEC™, bring the prepared area to be treated to the approximate Optimum Moisture Content obtained per AASHTO T-99 or TxDOT Tex-113-E, as may be specified by qualified engineer. Minimize dust and scattering of LITHTEC™ by wind. Do not apply LITHTEC™ when wind conditions cause blowing to LITHTEC™, as it may become dangerous to traffic or objectionable to adjacent property owners.

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14. **MIXING:** Thoroughly mix the material and LITHTEC™ using approved equipment. Mix until a homogeneous mixture is obtained. Sprinkle the treated materials during the mixing operation, as directed, to maintain Optimum Moisture Content as specified by the plans. Spread and shape the completed mixture in a uniform layer. After mixing, the roadway mixture shall be sampled and tested to insure it is in accordance with the LITHTEC™ Material Specification.
15. **COMPACTION:** Roll with approved compaction equipment, as directed. Compact the mixture in one lift using density control unless otherwise shown on the plans. Complete compaction shall be achieved within four (4) hours after the application of LITHTEC™. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least one-half the width of the roller unit. On steep sloped curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between two (2) and six (6) MPH, as directed. Areas that lose required stability, compaction, or finish shall be removed and replaced with LITHTEC™ treated mixture at the Contractor's expense. Correct irregularities, depressions and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and recompacting.
16. **FIELD PERFORMANCE TESTING REQUIREMENTS:**
  - 16.1 **OPTIMUM MOISTURE CONTENT:** Sprinkle or aerate the treated area, sprinkling to adjust the moisture content during compaction so that it is within a range of 1.5 percentage points above or below Treated Optimum Moisture Content gathered from Treated Moisture Density Relations of Soils (AASHTO T-99, AASHTO T-180, ASTM D1557) as specified by the plans (i.e., if Optimum Moisture Content is 14, then the range would be 12.5 to 15.5).
  - 16.2 **DENSITY:** Compact to at least ninety-five percent (95%) of the Maximum Dry Density determined in accordance with AASHTO T-99 or TxDOT Tex-113-E, as may be specified by the qualified engineer. Remove material that does not meet density requirements. Remove areas that lose required stability, compaction, or finish. Replace with LITHTEC™ treated mixture and compact and test in accordance with density control methods.
  - 16.3 **STIFFNESS:** Lightweight Deflectometer Tests shall be performed at a minimum of 3 tests per 800 square yards of treated material. The aggregate average of the stiffness readings taken per 800 square yards of treated material must meet the minimum of 90% of the Treated Unconfined Compression test (AASHTO T-208-15, ASTM D2166M-16) elastic modulus at 4 hours and at 24 hours from the finished treated section.
17. **QUALITY CONTROL:** All irregularities, depressions, or weak spots which develop shall be corrected immediately, while treated soil is still moist, by scarifying the areas affected, adding or removing material as required, and reshaping and re-compacting. The surface of the LITHTEC™ treated layer/lift shall be maintained in a smooth condition, free from undulations and ruts, until other work is placed there upon or the work is accepted. Compaction and

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finishing shall be done in such a manner as to produce a smooth dense surface free of compaction planes, cracks, ridges or loose materials. Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion, shall be smooth and shall conform with the typical section as specified by the customer's project engineer and to the established lines and grades. Should the material, due to any reason or cause, lose the required stability, density, and finish before the next course is placed or the work is accepted, it shall be re-compacted and refinished. Failure to perform quality control as specified will be considered default of contract and non-compliant with proper installation.

**17.1 LITHTEC™ RANDOM SAMPLING AND QUALITY CONTROL TESTING:** Enough of the OPC materials should be sampled at random post spreading for each 800 square yard section to complete a full battery of testing as specified in the event of a failure, *see* 6. Random samples taken from the quantity of LITHTEC™ materials collected should be tested to ensure consistency of blended materials as specified by the engineer.

18. **FINISHING:** Immediately after completing compaction, clip, skin, or tight blade the surface of the LITHTEC™ treated material to a depth of approximately 1/4 inch. Remove loosened material and dispose of it at an approved location. Roll the clipped surface immediately with a pneumatic-tire roller until a smooth surface is attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the sections, lines and grades as specified by the plans.
19. **CURING:** After proper compaction, allow the LITHTEC™ treated section to cure for (a) twenty-four (24) hours when installing another layer/lift or surface course (i.e., chip seal, asphalt or concrete); or (b) at least two (2) days, by sprinkling with water in accordance with plan or by maintaining the moisture content during the respective curing period at no lower than 1.5% percentage points below the Optimum Moisture Content (i.e., if Optimum Moisture Content is 14, then the range would be 12.5 to 15.5). Do not allow equipment on the LITHTEC™ treated layer/lift during curing except as required for sprinkling, unless otherwise approved. Prior to placing a surface course (e.g. asphalt, chip seal, etc.) lightly broom fines off the road to allow for direct adhesion to the curing LITHTEC™ base lift.
20. **MAINTENANCE:** The contractor shall maintain, at their own expense, the entire LITHTEC™ treated section in good condition from the start of work until all the work has been completed on the section.
21. **MEASUREMENT:** The quantity of LITHTEC™ treated soils shall be measured by the square yard, measured in place, treated, compacted to the proper depth, and verified to be in accordance with the plan.