

SECTION 02610
SUBGRADE PREPARATION

02610.01 GENERAL

A. Description

Subgrade preparation shall include, but not necessarily be limited to, preparation, protection, and maintenance of the subgrade before construction of any succeeding courses in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Construction Stakeout; Section 01300.
2. General excavation; Section 02210.
3. Embankment; Section 02260.
4. Underdrain installation; Section 02510.
5. Spring control; Section 02511.
6. Dewatering; Section 02512.
7. Field Test Reports, GP- 6.11.

C. Quality Assurance

1. The County Engineer will inspect all materials and work to ensure compliance with the Contract Documents.
2. Quality assurance for related earthwork shall be as specified in Sections 02210.01 and 02260.01.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for all soil stabilization fabric furnished. The shop drawings shall include general product information and a tabulation of the physical properties of the fabric.

2. Certificates of Compliance

Certificates of compliance shall be submitted as specified in the "General Provisions" for the soil stabilization fabric stating that the soil stabilization fabric meets the materials requirements specified in Section 02610.02.

3. Submittals for earthwork materials for subgrade preparation shall be as specified in Section 02260.01.

02610.02 MATERIALS

A. Material Furnished by the County

The County will not furnish any materials for subgrade preparation except as is available on the site within the limits designated on the Plans by sections, gradelines, and/or contour lines.

B. Contractor's Options

The Contractor may use suitable materials obtained from General, Structure, Borrow, Trench, and other excavations for subgrade preparation.

C. Detailed Material Requirements

1. Soil Stabilization Fabric

- a. The soil stabilization fabric shall be a fabric consisting of long chain polymeric filaments or yarns, such as polypropylene, polyethylene, polyester, polyamide, or polyvinylidene-chloride, formed into a stable network.
- b. The fabric shall be inert to chemicals commonly encountered in soil and to hydrocarbons.
- c. The fabric shall be resistant to mildew, rot, and ultraviolet light exposure.
- d. The fabric shall conform to the following test criteria:

<u>Test and Method</u>	<u>Specification Limits</u>
Grab Tensile Strength ASTM D 1682 lbs. min.	115
Tensile Elongation ASTM D 1682 % min.	50
Burst Strength ASTM D 3786 psi min.	190
Trapezoidal Tear Strength ASTM D 1117 lbs. min.	45

2. Earth Materials

The earth materials to be used in the subgrade shall be acceptable soils encountered in the various classifications of excavation on the Project, including borrow excavation, or other specially designated materials which may be specified.

02610.03 EXECUTION

A. General

After roadway and site excavations and embankments have been completed and the requirements for rough subgrading as described in Section 02210.03 have been met, the subgrade shall be fine graded and compacted to a density not less than 97 percent of the maximum dry density as specified in T180. In-place soil density tests shall be performed horizontally every 500 linear feet, or fraction thereof, for each lane. Test locations shall be staggered.

- 1. In accordance with Article V, Section 5.6.B of the Road Ordinance, the subgrade on which pavement for a public road is planned must have a minimum California Bearing Ratio (C.B.R.) value of 7. Where the subgrade is less than a C.B.R. of 7, a redesign of the pavement section by a geotechnical engineer, a professional engineer, registered in the State

of Maryland will be required and submitted to the County for review and approval prior to the placement of subbase material. The appropriate number of bulk soil samples shall be obtained from the subgrade soils to conduct a C.B.R. test for a minimum of one test per subdivision or for each change in soil type encountered.

2. In accordance with Detail # R/2.47 for Pedestrian Travel Ways of the Charles County Standard Detail Manual, the subgrade soils must be compacted to a density not less than 95% of the maximum dry density. In-place soil density tests shall be performed horizontally every 1,000 linear feet, or fraction thereof for asphalt and concrete pathways.

B. Removal and Replacement of Unsuitable Material

All soft and unstable material and any other portions of subgrade which will not properly compact, or serve the purpose intended, shall be removed, disposed of, and replaced with specified material. The replacement material shall be compacted to a density of not less than 97%, under paved areas and roadway shoulders, and not less than 90%, under areas not intended to support vehicles, of the maximum dry density determined in accordance with AASHTO T 180, Method C or D as applicable.

C. Soil Stabilization Fabric

1. Where shown on the Plans, or directed by the County Engineer, soil stabilization fabric shall be installed in conjunction with subgrade preparation.
2. The subsoil shall be prepared to the lines and grades shown on the Plans. All protruding sharp objects shall be removed from the subsoil prior to placing the fabric. Where sections of the fabric adjoin one another, the sections shall be overlapped 3 feet in the direction in which the overlay material will be spread.
3. Embankment or borrow material shall be backdumped onto the fabric and spread and compacted in lifts in accordance with Section 02260.03.

D. Subgrade Control

The subgrade surface shall be brought to line and grade and shaped to the cross section indicated on the Plans. A string line and grade stakes shall be set in accordance with Section 01300.03.C.3. The finished subgrade under paved areas shall not deviate more than 1/2 inch from grade thus established, and shall be compacted and smoothed over its full width by use of an approved smooth-faced, steel-wheeled roller. In locations where rolling is not feasible, compaction by mechanical tampers or vibratory compactors will be required.

E. Bleeder Ditches

The Contractor shall at all times maintain adequate open bleeder ditches along the subgrade to keep it thoroughly drained. Bleeder ditches will not be measured or paid for separately but will be considered as incidental to the subgrade preparation.

F. Subgrade Maintenance

Maintenance of subgrade shall be the responsibility of the Contractor. The Contractor will be required to take precautionary measures to prevent damage by heavy loads or equipment. Any defects or damage shall be repaired or replaced at the Contractor's expense before placement of any succeeding courses.

1. Subgrade Restoration

Should an extended period of time expire between original preparation and final covering, all restoration shall be at the Contractor's expense.

2. Subgrade Approval

No subsequent cover or surfacing material shall be deposited upon a frozen subgrade nor until the subgrade has been accepted by the County Engineer.

G. Permanent Subgrade Underdrains

1. Where shown on the Plans, or directed, permanent subgrade underdrains shall be constructed under paved areas. Subgrade underdrains shall be constructed as specified in Section 02510.03 and shall extend through the shoulder or median from the edges of the road pavement to a side ditch, embankment slope, or other approved outlet.
2. Locations, unless otherwise specified, shall be at low points and spaced at 25 foot intervals for a distance of 125 feet on each side of the low points; then at intervals of 100 feet to within 125 feet of the summit.
3. After placing of pavement courses and before completion of the shoulder or median areas, trenches shall be cut and shaped 24 inches wide, backfilled to the underside of shoulder material and to the underside of specified topsoil thickness in the median or graded areas using selected backfill as specified in Section 02245.02. The bottom of the trench at the end adjacent to the paved area shall be at least 2 inches below subgrade wherever it is possible to provide a proper gradient and outlet for a drain at that elevation.

02610.04 METHOD OF MEASUREMENT**A. Subgrade Preparation**

RESERVED FOR FUTURE USE

B. Soil Stabilization Fabric

RESERVED FOR FUTURE USE

C. Subgrade Underdrains

RESERVED FOR FUTURE USE

02610.05 BASIS OF PAYMENT**A. General**

RESERVED FOR FUTURE USE

B. Subgrade Preparation

RESERVED FOR FUTURE USE

C. Soil Stabilization Fabric

RESERVED FOR FUTURE USE

D. Subgrade Underdrains

RESERVED FOR FUTURE

SECTION 02611

CHEMICALLY TREATED SUBGRADE

02611.01 GENERAL

A. Description

Chemically treated subgrade shall include, but not necessarily be limited to, a combination of soil and one or more chemical additives, uniformly mixed, moistened, compacted, finished, and cured in accordance with the Contract Documents.

B. Related Work Included Elsewhere

Subgrade preparation; Section 02610.

C. Quality Assurance

1. Materials

The County Engineer will inspect all materials to ensure compliance with the Contract Documents.

2. Field Tests

The requirements for in-place moisture/density testing shall be as specified in Section 02260.01.

D. Submittals

Certificates of compliance shall be submitted in accordance with the "General Provisions" for Portland cement, hydrated lime, and emulsified asphalt. The certificates shall state that the material meets the requirements specified herein.

02611.02 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for chemically treated subgrade.
2. The Contractor may obtain water from the County's potable water system, for application to the subgrade, in accordance with current County policies and procedures. The Contractor shall contact the Department of Fiscal Services, Meter Section, for requirements. A backflow prevention device must be placed in accordance with the Standard Details prior to drawing County water.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Portland Cement

Portland cement shall be as specified in Section 02651.02.

2. Hydrated Lime and Quicklime for Soil Stabilization

Hydrated lime and quicklime for soil stabilization shall meet the following requirements when tested in accordance with ASTM C25:

- a. Hydrated lime shall have a combined calcium oxide and magnesium oxide content of 65 percent minimum and meet the following gradation requirements:

<u>Sieve Size</u> <u>U.S. Standard</u>	<u>Mass Percent</u> <u>Passing</u>
3/8 inch	100
No. 30	97
No. 200	75

- b. Quicklime shall have a combined calcium oxide and magnesium oxide content of 75 percent minimum and have a fineness gradation of 100 percent passing the 3/8 inch U.S. Standard Sieve.

3. Emulsified Asphalts

Emulsified asphalts shall meet the requirements of AASHTO M 140 or M 208. When specified, an additional grade referred to as AE-BM may be used. This material shall meet the requirements of AASHTO M 140, Grade SS-1, except that the viscosity at 77°F shall be between 50 and 40 seconds. The cement mixing test will be waived. An additional requirement allowing not more than 3.0% oil distillate by volume of emulsion will apply to all emulsified asphalt grades. The sieve test requirement for field samples will be a maximum of 0.4%.

4. Water from Other Than Potable Sources

Water shall meet the pH requirements of AASHTO T 26, Method B. Water shall not smell or be discolored. Water suspected of questionable quality shall meet limits of the comparison tests with distilled water in accordance with AASHTO T 26. The chloride concentration of water used in mixing and curing of Portland cement will be determined in accordance with ASTM D 512 and shall not have a chloride concentration exceeding 1000 ppm.

02611.03 EXECUTION

Chemically treated subgrade may be constructed with any approved combination of machines or equipment that will produce results meeting requirements for soil scarification, pulverization, additive application, mixing, water application, incorporation of materials, compaction, finishing, and

curing in accordance with these Specifications.

A. Subgrade

The subgrade shall be properly graded and shaped in accordance with the lines, grades, and cross sections shown on the Plans and in accordance with Section 02610.03. Materials retained on a 3 inch sieve shall be removed and replaced with suitable material.

B. Scarification

The prepared subgrade shall be scarified to the depth and width required for subgrade treatment. The depth of scarification shall be carefully controlled and blading operations conducted in a manner to provide that the surface of the bed below the scarified material shall remain relatively undisturbed and shall be in accordance with the established cross section.

C. Gradation

As determined by the County Engineer or test, subgrade material shall be pulverized so that at completion of moist mixing 100% of dry weight shall pass a 1-inch sieve and a minimum of 80% by dry weight shall pass a No. 4 sieve exclusive of gravel, stone, or aggregate retained on these sieves.

D. Additive Quantity and Temperature Restriction

The quantity of additive will be predetermined and specified. Chemically treated subgrade shall not be constructed nor shall additives be applied when the air temperature in the shade and away from artificial heat is 50°F or less.

1. Moisture Control

The percentage of moisture in the soil at the time of application of additive shall not exceed the quantity that will permit a uniform and intimate mixture of the soil and additive during mixing operations, and it shall not exceed the specified optimum moisture content, plus or minus 2%.

2. Spreading Equipment Restrictions

Spreading equipment shall uniformly distribute the additive without excessive loss. No equipment except water trucks and equipment used for spreading and mixing shall be permitted to pass over the spread additive until it is mixed. Any additive displaced shall be replaced before mixing is started.

3. Mixing Operations

After the additive has been applied, it shall be thoroughly mixed until a uniform blend of soil and additive is obtained for the full depth of treatment. Immediately after mixing, water shall be incorporated into the mixture as required. The application of water shall be controlled so there is no excessive concentration on or near the surface of the mixture. Water supply and pressure distributing equipment shall be provided that will assure application of all mixing water within 2 hours from the time of application of additive required on the section being processed. After

all mixing water has been applied, mixing shall continue until a uniform and intimate mixture of soil, additive, and water has been obtained.

4. Addition of Lime

When lime has been added, the mixture shall be placed in a windrow or spread over the roadbed and the surface sealed with a steel wheel or pneumatic tire roller, to retard loss of moisture, and aged for a period of not less than 48 hours.

5. Addition of Portland Cement

When Portland cement is added, the mixture shall be compacted and finished in a period not to exceed 30 minutes. Also, not more than 30 minutes shall elapse between manipulation of mixture in adjacent lanes at any location except at longitudinal construction joints.

6. Addition of Bituminous Material

When bituminous material is added, the full section of the treated area shall be disced or mixed until a thoroughly uniform mixture has been produced to a uniform color and free from fat spots, balls, and uncoated particles. After final mixing, the mixture shall be brought to a single windrow along the center of the roadway until such time as the spreading and compacting operations may be continued.

E. Compaction

At the required density the percentage of moisture in the mixture shall not be more than two percentage points above or below the specified optimum moisture content of the soil and additive mixture and shall be less than that quantity which will cause the soil and additive mixture to become unstable during compaction and finishing.

1. Soil-Lime or Soil-Bituminous Density Requirements

Soil-lime or soil-bituminous mixtures shall be laid and compacted to a density of not less than 95% of maximum density determined in accordance with AASHTO T 99.

2. Soil-Portland Cement Density Requirements

Soil-Portland cement mixtures shall be compacted to a density of not less than 95% of maximum density determined in accordance with AASHTO T 134.

3. In-Place Density

In-place density tests will be made in accordance with AASHTO T 191 or T 238.

4. Surface Control

If necessary, during these operations, the surface of subgrade shall be lightly scarified and recompactd to remove any imprints or irregularities left by equipment.

F. Finishing

The finishing operation shall be completed during daylight hours and within 2 hours after

the additive has been applied. The completed subgrade shall be in accordance with the lines, grades, and typical cross sections indicated on the Plans.

G. Grade Controls

String line and grade stakes shall be set for subgrade control on each side of the proposed paving with fixed controls not to exceed 25 foot spacing. Finished subgrade shall not deviate more than ½ inch from grade thus established.

H. Curing Maintenance

The finished treated subgrade shall be kept continuously moist by use of a pressure distributor until the bituminous material is placed. Water shall be applied only by a light spray without ponding.

The surface shall be broomed with a rotary power broom to remove all loose and extraneous material before application of surface treatment.

A single surface treatment shall be applied in accordance with the requirements of Section 02644 within 24 hours after the finishing operation for the purpose of curing.

The surface treatment shall be maintained by the Contractor until the paving course above the treated subgrade has been placed or the curing period has expired, whichever is later.

Finished portions of treated subgrade that are traveled by equipment used in constructing an adjoining section shall be protected to prevent equipment from marring or damaging completed work.

I. Construction Joints Using Portland Cement As Additive

When Portland cement is used as the chemical additive, a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face at the end of each day's construction. Large wide areas shall be built in a series of parallel lanes of convenient length and width subject to the approval of the County Engineer.

J. Traffic Restrictions Using Portland Cement As Additive

Completed portions of Portland cement treated subgrade may be opened, after placement of a wearing surface in accordance with Section 02644, to local traffic and construction equipment necessary to perform this work, provided the cement modified subgrade has hardened sufficiently to prevent marring or distorting of the surface by equipment or traffic.

K. Maintenance of Chemically Treated Subgrade

The Contractor shall maintain chemically treated subgrade in good condition until all work has been completed and accepted. Maintenance shall include immediate repairs of any defects that may occur. This work shall be done by the Contractor at the Contractor's own expense and repeated as often as necessary to keep the area continuously intact. Faulty work shall be replaced for the full depth of treatment. Any low areas shall be remedied by replacing the material for the full depth of treatment rather than by adding a thin layer of treated subgrade to the completed work.

CHEMICALLY TREATED SUBGRADE

02611-6

02611.04 METHOD OF MEASUREMENT

A. Chemically Treated Subgrade

RESERVED FOR FUTURE USE

B. Chemical Additives

RESERVED FOR FUTURE USE

C. Water

RESERVED FOR FUTURE USE

02611-05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Chemically Treated Subgrade

RESERVED FOR FUTURE USE

C. Solid Chemical Additives

RESERVED FOR FUTURE USE

D. Liquid Chemical Additives

RESERVED FOR FUTURE USE