SECTION 1200 - SUBGRADE PREPARATION

1201 SCOPE. This section governs the performance of all work connected with subgrade preparation, prior to constructing pavements, sidewalks, drive approaches and concrete curb and gutters. This section does not include the construction of any base courses.

1202 DEFINITIONS.

A. Subgrade. Subgrade is defined as a well-graded and compacted surface, constructed as specified herein to the grades, lines, and cross-section shown, bladed and compacted to the specified density, preparatory to constructing pavements, or other improvements thereon.

B. Subgrade Preparation. Subgrade preparation is the repeated operation of fine grading and compacting the subgrade until the specified lines, grades, and cross-sections have been obtained and the materials are compacted to the specified depth and density.

1203 CONSTRUCTION REQUIREMENTS.

A. General. All underground work contemplated, including clearing, grubbing, and demolition, shall be completed in accordance with the requirements of Sections 1000 *Site Preparation* and 1100 *Grading* prior to commencement of any subgrade preparation.

Unless otherwise specified, prior to beginning any work on street subgrade the Contractor shall secure the services of a qualified testing agency to acquire samples of the material to be used for subgrade construction. These samples shall be analyzed to determine Proctor values and Atterberg limits. Copies of the analysis shall be provided to the Engineer for review at least 48 hours prior to commencing subgrade preparation.

The subgrade surface shall be brought to the specified lines, grades and cross-sections by repeatedly adding or removing material and compacting to the specified density with equipment suitable to perform these operations.

When unstable or unsuitable subgrade materials are encountered they shall be removed to the depth required to reach stable material or as directed by the Engineer. The over-excavated area shall be backfilled with suitable soil material, as defined in Section 1100 – *Grading*, or KDOT AB-3 aggregate material, as approved by the Engineer. Backfilled subgrade shall be compacted in accordance with requirements of this Section.

B. Foundation Treatment. All subgrade in rock shall be undercut as indicated on the drawings or specified in the Special Provisions. If undercut is not included in the drawings or Special Provisions, remove material and backfill with suitable soil or granular material as directed by the Engineer.

1204 CEMENT OR FLY ASH TREATED SUBGRADE.

A. General. Cement or fly ash shall be used for treatment of the subgrade section to a depth of 9 inches, unless otherwise indicated or specified. The addition of cement or fly ash applies to natural ground, fills or cuts and shall be constructed as specified and to the lines, grades and typical sections as indicated on the plans or established by the Engineer. It shall be the responsibility of the Contractor to regulate the sequence of work, to process a sufficient quantity of material to provide a full depth layer as shown on the plans, to use the proper amounts of cement or fly ash, to maintain the work, and to rework areas as necessary to meet the requirements.

When specified or indicated on the plans, the Contractor shall secure the services of a qualified testing agency to perform on site testing. A qualified field technician shall monitor placement, mixing, moisture content and in-place density. Copies of the test results shall be provided to the Engineer for review at least 48 hours prior to pavement placement. All costs incurred through the use of the testing agency shall be included in the Contractor's bid for cement or fly ash treated subgrade.

B. Materials.

1. Cement or fly ash shall comply with the applicable physical and chemical requirements of KDOT Sections 2001 (Cement) and 2005 (Fly ash) that corresponds to KDOT section 303 (Cement or Fly Ash Treated Subgrade), unless otherwise indicated on the plans. Cement or fly ash that has been partially caked or set shall not be used.

2. A certification indicating compliance to these specifications shall be attached to or be part of the scale ticket for each load delivered. The producer's representative shall sign the certification. The Contractor shall provide weigh tickets from a certified public scale to the Inspector for each load of cement or fly ash delivered to the site.

3. Potable water shall be used in the stabilized mixture.

4. The subgrade soil shall be uniform in quality and gradation, and shall be approved by the Engineer. The soil shall be free of roots, sod, weeds, and stones larger than three (3”) inches.

C. Construction Requirements.

1. Preparation of Roadbed. The subgrade shall be trimmed to finish subgrade elevations as shown on the plans. The Contractor shall allow for potential swell of material to minimize waste during final trimming. This may require the subgrade to be trimmed to slightly below proposed finished grade depending on the soil characteristics.

2. Equipment. The machinery, tools, and equipment appropriate and necessary for proper execution of the work shall be on the project prior to beginning of construction operations. Pulverization of existing subgrade and blending of the mixture shall be accomplished by use of a drum-rotary type tiller equipped with an adjustable water proportioning system. Initial compaction shall be achieved using a self-propelled sheepsfoot vibratory compactor roller having a minimum operating weight of 12 tons, with a minimum centrifugal force of 24 tons, and adequate to achieve the required results. Rubber-tired or smooth-wheeled rollers shall be used for final surface compaction of the stabilized section. All machinery, tools and equipment used shall be maintained in satisfactory and workmanlike manner.

3. Storage. Cement or fly ash shall be stored and handled in closed weatherproof containers until immediately before distribution. Cement or fly ash exposed to moisture prior to mixing with recycled material shall be discarded. Temporary storage (less than 12 hours) of cement or fly ash in open pits will be allowed provided cement or fly ash is protected from rain and groundwater.

4. Application. Cement shall be added to the subgrade at a rate of 5% based on dry unit weight and fly ash shall be added to the subgrade at a rate of 16% based on dry unit weight, unless approved geotechnical studies indicate different rates. The cement or fly ash shall be spread in an approved manner. Care shall be taken to prevent the cement or fly ash from flowing off the area to be treated. The cement or fly ash shall be distributed at a uniform rate in such a manner as to minimize the scattering of cement or fly ash by wind. Cement or fly ash shall not be applied when wind conditions, in the opinion of the Engineer, are such that blowing cement or fly ash becomes objectionable to adjacent property owners or significantly reduces the amount of cement or fly ash incorporated into the work.

Mixing operations shall commence within one (1) hour after distribution of the cement or fly ash and will proceed until all material has been mixed. No cement or fly ash shall be placed on roadway that can not be incorporated within the weather limitation.

5. Moisture Control. The required moisture content will be established by the Contractor's testing agency based on laboratory tests on the materials and specific cement or fly ash content to be used for the treatment. Water shall be introduced directly into the rotary mixing drum during the tilling procedure. Final moisture content of the mix, immediately prior to compaction shall be uniform. If the moisture content is too high or low to achieve required compaction results, additional cement or fly ash may be added to lower the moisture content or additional water shall be added and uniformly blended with the mixture. Additional cement or fly ash added to lower the moisture content shall be at the expense of the Contractor.

6. Mixing. The pulverized subgrade material and cement or fly ash shall be thoroughly mixed and the mixing continued until a homogenous, friable mixture of pulverized subgrade material and cement or fly ash meeting the specified size requirements is obtained. The subgrade material shall be pulverized through use of the specified equipment. Depth of pulverization shall be as designated on the plans. All clods shall be reduced in size by mixing until the pulverized subgrade material- cement or fly ash mixture meets the following size requirement when tested.

Sieve Size	Percent Retained
1"	0
½"	50

7. Compaction. Compaction of the mixture shall begin immediately after mixing and confirmation that the moisture content is within the specified range. The specified compaction shall be obtained within 1 hour after the incorporation of the cement or fly ash. Compaction of the mixture shall continue until the entire depth of mixture is uniformly compacted to the specified density. See equipment requirements.

   All non-uniform (too-wet, too dry or insufficiently treated) areas, which appear, shall be corrected immediately by scarifying the areas affected, adding material as required and reshaping and recompacting.

   The stabilized section shall be compacted in compliance with Section 1108.

After each section is completed, tests will be made by the Engineer or authorized representative. If the material fails to meet the density requirements, the Engineer may require it be reworked as necessary to meet those requirements and/or require the Contractor to change their construction methods to obtain required density on the next section. Additional cement or fly ash will be added to the areas that are reworked at no additional cost to the owner, and the Engineer or authorized representative shall determine the amount required. Should the section, due to any reason or cause, lose the required stability, density and finish before the surface is placed or the work is accepted, it shall be reprocessed, recompacted and refinished at the sole expense of the Contractor. Reprocessing shall follow the same patterns as the initial stabilization including the addition of cement or fly ash.

8. Finishing and Curing. Following the compaction of the stabilized section the surface shall be protected from rapid drying by maintaining a continuous moist condition by sprinkling for a period of not less than seventy-two (72) hours or until overlying pavement is placed. Other options for maintaining moisture may be submitted in writing for approval by the Engineer. Prior to paving, the treated section will be trimmed to the required lines and grade by means of equipment, which is automatically controlled with regard to grade. The surface shall then be compacted with a smooth wheel or pneumatic tired roller and proof rolled. If ruts or other damage to the treated section is apparent during trimming, compaction and proof rolling operations, all work will cease and not recommence for at least 24 hours.

   The Engineer may waive the use of automatically controlled equipment on projects containing narrow or irregular dimensions where operation of the automated equipment is impractical. Finishing of these areas may be as set forth above or the surface will be lightly scarified during finishing operations and bladed to a uniform grade and cross section to eliminate any imprints left by the equipment. Restrict construction traffic from operating on the treated subgrade until it can withstand the loads without damage or deformation.

9. Weather Limitations. Cement or fly ash mixing operations shall not be performed when the subgrade is frozen. Mixing operation shall not be allowed until the ambient air temperature and surface temperature is forty (40) degrees F and rising. The Contractor shall be responsible for protection and quality of the cement or fly ash modified subgrade mixture under any weather conditions including

but not limited to protecting the treated subgrade from freezing throughout the protection period.

1205 MOISTURE AND COMPACTION CONTROL REQUIREMENTS. The moisture content of the soil at the time of compaction and compaction control requirements shall conform to the requirements of Section 1108.

1206 COMPACTION REQUIREMENTS.

A. Beneath Street Pavements and Commercial Driveway Apron Approaches. The subgrade shall be compacted to a minimum density of 95% of standard proctor maximum density for the material used as determined by ASTM D698. Material, as approved by the Engineer, shall be compacted to a depth of nine (9") inches below the finished subgrade elevation for street pavements and to a depth of six (6") inches below the finished subgrade elevation for commercial driveway apron approaches or as indicated on the plans, whichever is greater.

B. Beneath Multi-Use or Shared-Use Paths, Residential Driveway Apron Approaches, and Sidewalks. For multi-use or shared-use paths, the subgrade shall be compacted to a minimum density of 95% of standard proctor maximum density for the material used as determined by ASTM D698. Material, as approved by the Engineer, shall be compacted to a depth of six (6") inches below the finished subgrade elevation for multi-use or shared-use paths or as indicated on the plans, whichever is greater. The top six (6") inches of the subgrade for residential driveway apron approaches and sidewalks shall be clean, leveled with an approved material, and compacted such that no further consolidation is evident after additional rolling or tamping or as indicated on the plans, whichever is greater.

C. Beneath Curb or Curb and Gutter. For curb or curb and gutter installed directly on the subgrade rather than on a lift of pavement, the subgrade shall be clean, leveled with an approved material, and compacted such that no further consolidation is evident after additional rolling or tamping, to the same density as the subgrade for the adjacent pavement if no leveling material is required, or as indicated on the plans, whichever is greater.

1207 PROTECTION AND MAINTENANCE OF SUBGRADE. The newly finished subgrade shall be protected from action of the elements. Any settlement or washing that occurs prior to the acceptance of the work shall be repaired and the specific lines, grades, and cross-section reestablished.

1208 COMPACTION TESTING AND PROOF ROLLING. Compaction testing will be required prior to placement of pavements. The subgrade must

successfully pass compaction testing by a nuclear or low-activity nuclear density/moisture measuring device or other accepted method and proof rolling. Proof rolling shall be accomplished with a loaded tandem dump truck carrying a minimum loaded weight of twenty-five (25) tons (gross weight) with three cycles of loading over three separate paths. Proof rolling must be completed a minimum of 24 hours before paving operations. If as a result of the testing/proof rolling the Engineer determines that further compaction is required, the Contractor shall revise methods or procedures as necessary to obtain density and stability.