

SECTION 1200 - SUBGRADE PREPARATION

1201 SCOPE. This section governs all labor, equipment, tools and materials, and the performance of all work associated with subgrade preparation. The subgrade shall provide a foundation for streets, alleys, parking areas, sidewalks, drive approaches and concrete and gutter. 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 conforming to the lines, grades, cross-section and density specified on the approved plans, upon which pavement or curb and gutter will be placed.
- B. Subgrade Preparation. Subgrade preparation is the operation of fine grading and compacting the subgrade in accordance with the specified lines, grades, cross-sections and density specified on the approved plans.

1203 CONSTRUCTION REQUIREMENTS.

- A. General. All underground work, including clearing, grubbing and demolition, shall be completed in accordance with the applicable sections of these Technical Specifications prior to commencement of any subgrade preparation.

Prior to beginning any work on the 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, liquid limits and plasticity index. Copies of the analysis shall be provided to the City Engineer for review prior to commencing any subgrade preparation.

Pavement subgrades shall be modified with class "C" fly ash or replaced with AB-3 in accordance with these Technical Specifications.

- B. Foundation Treatment. Unless otherwise specified or shown on the approved plans, the soil below subgrade in cut sections shall be scarified, broken up, adjusted to a moisture content within the designated moisture range and compacted as specified on the approved plans.

When the depth of compaction in cut sections is shown to be more than nine (9) inches, material shall be removed to within nine (9) inches of the subgrade surface. The layer of material left in place shall be scarified, broken up, adjusted to satisfactory moisture content, and compacted as specified on the approved plans. This process shall be repeated until the cut section is compacted to the grade and density indicated on the approved plans.

All roadway excavation in rock (e.g., shale, sandstone, limestone) shall be undercut to a depth no less than nine (9) inches below the subgrade surface for the full width of the roadway and backfilled with suitable soil or AB-3. Undercut shall be unclassified excavation.

1204 MOISTURE CONTENT REQUIREMENTS. The moisture content of the soil at the time of compaction shall be uniform and within the acceptable moisture range designated on the approved plans or as directed by the City Engineer.

When the moisture content of the soil is not satisfactory to the City Engineer, water shall be added or the material aerated, whichever is needed, to adjust the soil to the proper moisture content. In no case shall water be added without the consent of the City Engineer.

If Type B compaction is specified, the moisture content shall be sufficient to produce a uniform mixture. Acceptable Type B compaction is achieved when the tamping feet of a sheepsfoot roller “walk out” of the soil and rides on top of the lift being compacted.

Moisture content shall conform with KDOT Table 205-2: Soil Moisture Content Requirements and as recommended by a Geotechnical Engineer.

1205 COMPACTION REQUIREMENTS. Roadway embankment fill materials shall be placed in horizontal layers not exceeding eight (8) inches, unless otherwise approved by the City Engineer. Each layer shall be compacted as specified before the next later is placed. Effective spreading equipment shall be used on each layer to obtain uniform thickness prior to compaction.

A. Pavements. The subgrade for pavements shall be compacted to a density of at least ninety-five (95) percent of the maximum standard Proctor test for a depth of at least nine (9) inches below the finished subgrade elevation.

Subgrade for curbs and pavements shall be compacted using sheepsfoot rollers. The roller may be self-propelled or machine drawn. The sheepsfoot roller shall be fully loaded with liquid or solid ballast to produce adequate compactive energy to the tamping foot. The roller shall have a minimum drum diameter of thirty (30) inches and minimum tamping foot length of six (6) inches.

Compaction of low plasticity or non-plastic, fine-grained material shall be considered adequate when the tamping feet “walk out”, provided the entire weight of the roller is supported on the tamping feet.

Sand and gravel which cannot be compacted satisfactorily with a sheepsfoot roller shall be rolled with a pneumatic-tired roller. Each lift shall be rolled until no further consolidation is evident.

B. Sidewalks. In areas not requiring fill, the subgrade for sidewalk pavements shall be compacted to a density equivalent to the density of the immediately surrounding soil. In areas where fill is required, the subgrade shall be compacted to ninety-five (95) percent of the maximum dry density as determined by ASTM D698.

C. Drive Approaches and Concrete Curb & Gutter. The subgrade for drive approaches and concrete curb and gutter shall be compacted to the same requirements as stated above in part *a. Pavements.*

1206 PROTECTION AND MAINTENANCE OF SUBGRADE. Any settlement, erosion or other damage to the subgrade that occurs prior to the acceptance of the work shall be repaired to the specific lines, grades, cross-sections, and density indicated on the approved plans, and shall be approved by the City Engineer.

All existing pavements, curbs, curb and gutters and sidewalks shall be protected during subgrade preparation with an earth cushion, timber planking or other methodologies approved by the City Engineer. Any damage to existing improvements shall be repaired or replaced to the satisfaction of the City Engineer at the Contractor's own expense.

1207 COMPACTION TESTING AND PROOF ROLLING. At the option of the City Engineer, compaction may be required prior to the placement of pavement. The subgrade must successfully pass compaction testing by a nuclear density/moisture measuring device and proof rolling with a loaded multi axle dump truck with the ability to proof roll in a tandem axle setup carrying a minimum load of sixteen (16) tons. If as a result of the testing/proof rolling, the City Engineer determines that further compaction is required, the Contractor shall recompact the area to the specified density.

1208 SUBGRADE TREATMENT.

General: Fly ash treated subgrade shall be a uniform mixture of fly ash and pulverized material compacted to the specified moisture content, fly ash content, density and depth. The fly ash shall be spread in an approved manner at the rate specified. Care shall be taken to prevent the fly ash from flowing off the area to be treated. The fly ash shall be distributed at a uniform rate in such a manner as to minimize the scattering of fly ash by wind. Fly ash shall not be applied when wind conditions, in the opinion of the City Engineer, are such that blowing fly ash becomes objectionable to adjacent property owners or significantly reduces the amount of fly ash incorporated into the subgrade.

A. The Contractor shall secure the services of a qualified testing agency, approved by the City Engineer, to perform on site testing. The testing agency shall monitor placement, mixing, moisture content and in-place density. Copies of the test results shall be provided to the City Engineer for review prior to pavement placement. All costs incurred through the use of the testing agency shall be borne by the Contractor.

B. A sample of the fly ash intended for use on the project shall be submitted to the testing laboratory for the purpose of developing a fly ash proctor. The fly ash supplier will submit certified laboratory analysis indicating that fly ash used on the project conforms to A.S.T.M. C618, Class C, except the supplementary optional physical requirements in table 4 will not apply and the minimum calcium oxide (CaO) content of the fly ash shall be 25%. Fly ash shall be sampled and tested in accordance with A.S.T.M. C311.

Fly ash shall be stored and handled in closed waterproof containers, and fly ash that has been partially caked or set shall not be used. A certification indicating compliance to these specifications shall be provided with the scale ticket for each load delivered. The certification shall be signed by the fly ash producer or his assigned representative.

Portland Cement: Portland Cement treated base shall comply with the Fly Ash section above, except the type of Portland Cement and quantity of Portland Cement shall be as recommended by a

Professional Engineer Registered in the State of Kansas. The minimum quantity of Portland Cement shall be five (5) percent unless otherwise approved by the City Engineer.

1209 CONSTRUCTION REQUIREMENTS.

- A. Preparation of Roadbed: The subgrade shall be trimmed as near as possible to finish subgrade elevations as shown on the approved plans. The subgrade may be trimmed to an elevation slightly below the proposed finished subgrade to allow for swell, depending on the soil characteristics.
- B. Equipment: The machinery, tools, and equipment necessary for proper execution of the work shall be mobilized and approved by the City Engineer prior to beginning of subgrade preparation. Pulverization of existing subgrade and blending the additives shall be accomplished using drum-rotary type tiller equipped with an adjustable water proportioning system. Initial compaction shall be achieved using a sheepsfoot compactor having a minimum operating weight of twelve (12) tons with a minimum centrifugal force of twenty-four (24) tons. Rubber-tired or smooth-wheeled rollers shall be used for final compaction of the stabilized section. All machinery, tools and equipment used shall be maintained in satisfactory and workmanlike manner.
- C. Application: The fly ash shall be spread in an approved manner at the rate specified. Care shall be taken to prevent the fly ash from flowing off the area to be treated. The fly ash shall be distributed at a uniform rate in such a manner as to minimize the scattering of fly ash by wind. Fly ash shall not be applied when wind conditions, in the opinion of the Engineer, are such that blowing fly ash becomes objectionable to adjacent property owners or significantly reduces the amount of fly ash incorporated into the work.
- D. Moisture Control: The required moisture content shall be established by the Contractor's testing agency based on laboratory tests on the materials and specific 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 and not exceed plus or minus three (3) percentage points of the specified optimum moisture content. If the moisture content exceeds the specified limits, additional fly ash may be added to lower the moisture content at the expense of the Contractor. Lowering the moisture content by aeration following addition of fly ash shall not be allowed. If the moisture content is below the specified limits, additional water shall be added and uniformly blended with the mixture.
- E. Mixing: The pulverized subgrade material and fly ash shall be thoroughly mixed until a homogenous, friable mixture of pulverized subgrade material and fly ash meeting the specified size requirements is obtained. The subgrade material shall be pulverized through use of the specified equipment, to the depth designated on the approved plans. All clods shall be reduced in size by mixing until all particles pass through the 1" Sieve and fifty (50) percent of the particles pass through the one-half (1/2) inch sieve.
- F. Compaction: The subgrade shall be compacted immediately after mixing and confirmation that the moisture content is within the specified range. The specified compaction shall be obtained within one hour after the incorporation of the fly ash. The subgrade shall be sprinkled as necessary to maintain the specified moisture content. Compaction of the mixture shall continue until the entire depth of mixture is uniformly

compacted to the specified density.

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

The stabilized section shall be compacted to a minimum of ninety-five (95) percent of the combined materials' maximum dry density.

In addition to the requirements specified for density, the subgrade shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, the density and moisture content shall be verified by the testing agency. If the material fails to meet the density requirements, the City Engineer may require it be reworked as necessary to meet those requirements and/or require the Contractor to modify his construction methods. Additional fly ash shall be added to the areas that are reworked at no additional cost to the City, and the amount required shall be determined by the testing agency. Should the section, due to any reason or cause, lose the required stability, density and finish before the pavement 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 fly ash.

- G. **Finishing and Curing:** Following the compaction of the stabilized, the subgrade shall be trimmed to the required lines and grade using equipment with automatic controls. The surface shall then be compacted with a smooth wheel or pneumatic tired roller.

The City Engineer may waive the use of automatic 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 equipment.

Fly ash treated subgrade surfaces shall be protected against rapid drying by either of the following curing methods:

1. Maintain in a thorough and continuously moist condition by sprinkling.
2. Apply an asphaltic prime coat.

- H. **Weather Limitations:** Fly ash mixing operations shall not be performed when the ambient air temperature or soil temperature is less than 40°F. The Contractor shall be responsible for protection and quality of the fly ash modified subgrade mixture under any weather conditions.

- I. **Proofrolling:** Proof rolling with a loaded tandem dump truck carrying a minimum load of sixteen (16) tons shall be required before acceptance of finish subgrade. Subgrade failures shall be repaired by incorporating additional flyash into the subgrade, unless otherwise approved by the City Engineer.

1210 AB-3 MODIFIED AGGREGATE BASE. AB-3 Modified Aggregate Base may be used with City Engineer approval. The AB-3 Modified Aggregate Base shall be supplied in accordance with

Section 1104 of the *Kansas Department of Transportation Standard Specifications for Road and Bridge Construction*, except as otherwise modified herein:

Paragraph 1104.2 (a): Composition shall be modified so that the AB-3 Modified shall consist of 100% limestone or dolomite produced by mechanical crushing.

Table 1104-1; Gradation and Plasticity of Aggregates for Aggregate Base Construction shall be modified so the AB-3 Modified shall have the gradation shown on line AB-3; however, the plasticity index shall be between 0 and 5 with the liquid limit a maximum of 25.

Before delivery to the project site, the material shall be mixed with water in a stationary plant to obtain the moisture content as directed by the City Engineer.

1211 PAVEMENT WIDENING AND CONFINED AREAS. Commercial Grade Aggregate Base shall be utilized for all pavement widening projects less than or equal to fifteen (15) feet in width, pavement projects which are less than 5,000 square feet or as directed by the City Engineer. The thickness of the aggregate base shall be as recommended by the Design Engineer; however, the minimum thickness shall be six (6) inches.

During construction, the maximum drop off at the edge of pavement shall be four (4) inches. Any drop off exceeding four (4) inches shall be wedged at a slope of 3:1 using Commercial Grade Aggregate Base or asphalt as directed by the City Engineer. The subgrade and asphalt under the proposed curb and gutter, where applicable, shall be constructed and approved prior to removing the existing curb and gutter for pavement widening projects. All traffic control measures and drop off treatments shall conform to Table 1212-1.

Table 1212-1 - Pavement Drop Off Treatment

Condition	Treatment
Drop off is 2 inches or less and the adjacent area is not an open driving lane	None
Drop off is 2 inches or less and the adjacent area is an open driving lane	36"x36" W8-11 Uneven Lane signs shall be installed at the point of beginning with a maximum spacing of 1,000 feet
Drop off is between 2 and 4 inches	Shoulder Drop Off Signs (W8-9A and W7-3A) shall be installed at the beginning of the condition and at each intersecting roadway. Signs shall be removed or covered when not applicable. Install channelizers along the edge of pavement with spacing equal to the posted speed limit.
Drop off is greater than 4 inches	Construct a Modified AB-3 wedge and install channelizers along the edge of pavement with spacing equal to or less than the posted speed limit.