

SECTION 3

EARTHWORK AND GRADING

3.01 GENERAL.

A. Scope. This section covers excavation and grading incidental to the construction of sidewalks, alleys, roadways, channels, berms, parking lots and other earthen structures or facilities requiring the manipulation, cutting, grading, transporting, placing and compaction of soil.

B. Contractor's Responsibility. The Contractor shall assume full responsibility for satisfactory performance of the work and for the safety of the work, working personnel and the general public. Refer to Section 1 of these Standard Technical Specifications and Document 700 General Conditions of the Project Manual for further specifications of the Contractor's responsibilities.

C. Erosion and Water Pollution Control. The Contractor shall at all times maintain appropriate erosion and water pollution control as specified in Section 4, Obstructions and Incidental Construction.

3.02 STRIPPING.

A. Construction Requirements. All areas to receive embankment shall be stripped of existing organic and other undesirable material to a minimum depth of 6 inches. This material shall be disposed of in a manner approved by the Engineer.

B. Measurement and Payment. Stripping shall not be measured or paid for directly but shall be subsidiary to other items of the Contract.

3.03 TOPSOIL.

A. Construction Requirements. Topsoil shall be removed from the area within the construction limits and stockpiled separately for use in finish grading as specified in Sections 4.14 and 4.15. Stockpiles shall be prevented from generating water pollution as specified in Subsection 4.15

B. Materials. Topsoil is defined as the top 6 inches of loam that contains a good supply of humus and a high degree of fertility.

C. Measurement and Payment. Topsoil removal, stockpiling and replacement shall not be measured or paid for directly but shall be subsidiary to other items of the Contract.

3.04 CLASSIFICATION OF EXCAVATION.

A. General. The geological and soil information shown in the Contract Documents is based on studies made in the field, and represents the best information available at the time of design. With the exception of the site specific recommendations for treatment and preparation of subgrades as may be contained in a Geotechnical Report, any physical data in regard to subsoil, rock, water table

or other site conditions, which are noted on the Drawings or Reports or referred to herein, represent conditions as of the date of their determination and are for information only. Any reliance by the Contractor on such data will be at the Contractor's risk.

B. Excavation Classifications. Any excavation for the Project will be included in the following classifications of:

Structure Excavation – See Subsection 2.02 B.

Trench Excavation – See Subsection 2.02 C.

Unclassified Excavation – See Subsection 3.05.

Rock Excavation – See Subsection 3.06.

Pavement Removal – See Subsection 3.07.

These classifications shall include all materials encountered in the scope of the work. As the work is performed, the Engineer has the authority to identify and define the various classifications of excavation encountered.

3.05 UNCLASSIFIED EXCAVATION.

A. Definition. “Unclassified Excavation” consists of the excavation of any and all materials not otherwise classified encountered during the course of the work.

If rock is encountered during excavation, it shall be considered “Unclassified Excavation” unless “Rock Excavation” is included as a pay item in the Project Documents.

B. Construction Requirements. Before beginning the excavation, have all necessary traffic and pedestrian control in place, have the location of underground utilities and pipelines marked, clear and grub all vegetation, strip areas to receive embankment, and remove existing structures. Obtain all permits and clearances required and not provided by the Owner before starting work.

If the Contractor's excavation operations expose potentially historical or archaeological significant sites, any potentially hazardous materials, or utilities or pipelines in conflict with the excavation, discontinue the excavation of such sites until the Engineer determines the disposition of the discovery.

Obtain the Engineer's approval before wasting or disposing of surplus excavated material. If approved by the Engineer, use approved surplus excavated material to widen embankments, flatten slopes or as directed by the Engineer. Review flood plain information and environmental permitting for the project prior to wasting material on the project. If surplus excavation material is wasted on the project, place the material to provide a neat appearance. Do not place waste materials in a manner that is detrimental to the abutting property. Disposal of surplus excavated material shall be completed as specified in Subsection 3.13.

When embankment or subgrade materials are unstable due to naturally occurring wet or saturated conditions, including conditions caused by groundwater, rain, and standing surface water, the

Contractor shall aerate the material and, if necessary, remove the material for drying until the moisture content is acceptable. After the material has been dried to a workable condition, the Contractor shall incorporate the material into the embankment or subgrade. The Contractor shall excavate and dry such material at no additional cost to the Owner. The Contractor may use other means of drying the subgrade, such as adding fly ash or calcium chloride, as approved by the Engineer. The cost of drying subgrade by any approved method is incidental to Unclassified Excavation.

C. Unsuitable Material. Depending on the makeup and characteristics of the unclassified excavation, some material may not be suitable for use in embankment or subgrade. The Engineer will identify which material may not be used for embankment or subgrade. If excavated material is encountered that in the opinion of the Engineer is not suitable for construction of embankments or subgrades, the Engineer may request the Contractor to dispose of the material in the manner specified in Subsection 3.13.

Material that is unstable due to naturally occurring wet or saturated conditions, including conditions caused by groundwater, rain, and standing surface water, but otherwise workable after drying, as determined by the Engineer, is suitable material. Such material shall be aerated as specified in Paragraph b above at no additional cost to the Owner.

Unsuitable materials include any junk, trash debris, organic materials; soils with a high organic content such as peat or A - Horizon soils; or soils with a plastic limit lower than the optimum moisture content of the soil and cannot be compacted at optimum density.

(1) Over Excavation for Removal of Unsuitable Subgrade Materials. When the Engineer determines a material encountered in a cut subgrade below final plan elevation is unsuitable, the Contractor shall excavate the material to limits established by the Engineer and backfill with appropriate material as approved by the Engineer. The Contractor shall allow the Engineer sufficient time to measure the excavated area before backfilling.

If in the opinion of the Engineer, the volume of over excavation required to remove unsuitable material in subgrade areas is excessive, alternative means of establishing a suitable subgrade foundation shall be explored. These alternatives shall be evaluated on a case by case basis, but may include installation of geogrids; modification of the material by the addition of calcium chloride, fly ash, or lime; or construction of an aggregate subbase. If the means of establishing a suitable subgrade foundation is not included as a pay item in the Project Documents, the Contractor shall submit a price for the work to the Engineer for consideration by the Engineer and Owner. Once the price is established, a Change Order shall be written and approved prior to the Contractor proceeding with the work.

D. Bid Item, Measurement and Payment.

(1) Bid Item:

UNCLASSIFIED EXCAVATION

Unit: Cubic Yard (nearest C.Y.)

(2) Measurement. The completed and accepted percentage of plan quantity for "Unclassified Excavation" shall be considered the measured quantity unless the Contractor requests, and it is agreed upon in writing before the start of the project, that 1) another method of quantity determination will be followed or 2) the plan quantity is questionable

and further quantity determination is needed. If another method of quantity determination is followed, all pay requests must accurately reflect the quantities to date. No payment for back quantities will be allowed. If rock is encountered, it shall not be measured separately unless the pay item "Rock Excavation" is included in the Project Documents.

If over excavation is completed to remove unsuitable material, or for any other reason, and such over excavation was requested or approved by the Engineer, measurement of the volume of over excavation will be made by the average end area method. Trapezoidal end areas and the distance between end areas shall be measured to the nearest 0.1 foot as can be reasonably accomplished with a 100 foot cloth tape and level. The volume in cubic feet thus computed shall then be converted to cubic yards and rounded to the nearest cubic yard. The measured volume of this computed quantity will be added to the completed and accepted quantity of "Unclassified Excavation".

(3) Payment. The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per cubic yard for "Unclassified Excavation", which payment shall be full compensation for all excavation, hauling, grading, stockpiling, trimming, wasting, disposal, and drying the materials as specified; and for all equipment, tools, labor, and incidentals necessary to complete the work.

3.06 ROCK EXCAVATION.

A. Rock. Rock is defined as all sedimentary, igneous and metamorphic rock which is naturally in place and is firm, rigid and un-weathered. Rock also includes boulders or other detached stone with a volume of 2 cubic yards or more.

If rock is encountered during excavation, it shall be considered "Unclassified Excavation" unless "Rock Excavation" is included as a pay item in the Project Documents.

B. Construction Requirements. Rock encountered during excavation shall be removed to allow the construction of the Project to the lines and grades shown in the Contract Documents. Over breakage and backfill over breakage shall not be measured or paid for except for that required in the top 1 foot of the subgrade. Rock encountered in cut subgrades shall be removed to a depth of 1 foot below the top of the subgrade and fill material placed and compacted as provided herein. The Contractor shall waste or dispose of the excavated rock material in the manner specified in Subsection 3.13. Where fill or embankment heights are greater than four feet above the existing ground, and only when approved by the engineer, the Contractor may incorporate rock excavated from the project into the embankment as specified in Subsection 3.09.

C. Bid Item, Measurement and Payment.

(1) Bid Item:

ROCK EXCAVATION Unit: Cubic Yard (nearest 1 C.Y.)

(2) Measurement. Unless "Rock Excavation" is included as a pay item in the Contract Documents, the excavation of rock will be measured as "Unclassified Excavation."

When “Rock Excavations” is included as a pay item in the Contract Documents, measurement will be of volume of rock actually removed. Rock encountered in two or more ledges with interlaying strata of soil, clay, gravel or shale not more than 12 inches in thickness between each ledge will be classified as solid rock from the top of the top ledge to the bottom of the bottom ledge of rock. Plan quantity for Rock Excavation is estimated and shall not be used as measured quantity.

When included as a pay item in the Contract Documents, the volume of Rock Excavation shall be computed using the average end area method with dimensions measured to the nearest 0.1 foot and individual volumes computed in cubic feet, summed, and converted to cubic yards. The Engineer shall determine the location of and interval between the end areas measured. The Contractor shall coordinate with the Engineer to allow sufficient time to measure the volume of rock excavated and shall assist the Engineer in making measurements of the volume of rock excavated upon the Engineer’s request.

(3) Payment. The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit prices per cubic yard for “Rock Excavation” when shown as a pay item in the Contract Documents, which payment shall be full compensation for all excavation, trimming, disposal of surplus materials; and the furnishing of all equipment, tools, labor, and incidentals necessary to complete the work.

3.07 PAVEMENT REMOVAL.

A. Pavement Defined. For the purpose of removal work, “pavement” shall include any thickness of Portland cement concrete pavement, Portland cement base course, concrete curb and gutter, concrete sidewalk, bituminous mix material over six inches in thickness, and all bituminous mix material laid upon these materials.

B. Protection. Should the Contractor's construction equipment damage any pavement surface, whether new or existing, the Contractor shall be responsible for the repair and / or replacement of the damaged pavement surface, at their expense, as directed by the Engineer.

C. Construction Requirements. Before beginning the pavement removal, have all necessary traffic and pedestrian control in place. Have the location of underground utilities and pipelines marked. Verify the depth of underground utilities and use caution when removing pavement over utilities to avoid damage thereto. Check the area for drainage structures or other structures which could be damaged by the pavement removal process. Prevent adjacent structures from being damaged by vibration. Obtain all permits and clearances required and not provided by the Owner.

The Contractor shall remove pavement to the limits shown on the plans. Where pavement to be removed abuts pavement to remain, before the pavement is removed, the line separating the two areas shall be saw-cut to the full depth of the pavement. For concrete pavement, entire concrete panels must be removed unless otherwise directed by the Engineer.

Where paved areas of streets, alleys, parking lots, or driveways, are being trenched through and not otherwise planned for replacement with the Project, the existing pavement shall be removed to the limits required to permit safe trench excavation as specified in Section 2, Trench and Structure Excavation, Backfill and Compaction. For concrete pavement, entire concrete panels must be removed and replaced unless otherwise directed by the Engineer. After the backfill is completed

sufficient pavement shall be saw-cut and removed to provide a minimum shoulder width of 9 inches on undisturbed soil on each side of the trench. Saw-cutting is incidental to Pavement Removal.

The Contractor shall waste or dispose of the excavated pavement material in the manner specified in Subsection 3.13. Broken pavement shall not be incorporated into the Project without the specific written approval of the Engineer and in such case, the broken concrete shall be completely absent of wire mesh and reinforcing steel.

D. Bid Item, Measurement and Payment.

(1) Bid Item:

PAVEMENT REMOVAL

Unit: Square Yard (nearest S.Y.)

(2) Measurement. Measurement of “Pavement Removal” will be by the square yard. The area of individual removal locations will be determined by measuring the individual locations dimensions to the nearest 0.1 foot, and computing the location’s area in square feet. For each Contractor Pay Application, the individual areas will be summed in square feet, converted to square yards and rounded to the nearest square yard.

When mutually agreed by the Contractor and the Engineer, plan quantity for “Pavement Removal” may be accepted as the measured quantity

(3) Payment. The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per square yard for “Pavement Removal”, which payment shall be full compensation for all excavation, hauling, wasting, disposal, and saw-cutting as specified; and for all equipment, tools, labor, and incidentals necessary to complete the work.

3.08 SUPPLEMENTARY BORROW MATERIAL.

A. General. If the volume of suitable excavated materials from the Project site is not sufficient to complete the embankment or subgrade, the Contractor shall provide supplementary borrow material. The Contractor shall notify the Engineer 24 hours in advance of importing borrow material to the Project.

B. Materials. The Contractor shall obtain the Engineer’s approval of the supplementary material prior to transporting any supplementary material to the site. Supplementary Borrow Material shall be entirely imperishable, uniform in texture, and capable of being compacted to the requirements of the Contract Documents. Sand is not an approved borrow material. At the Contractor’s sole expense, a certified testing laboratory shall collect soil samples, test the soil proposed for import, and report to the Engineer the following information that shall be used as the basis of the Engineer’s evaluation for approval of the material:

1. Location of the borrow area
2. USCS classification
3. Optimum moisture content
4. Standard density
5. Standard Proctor Moisture Density curves

C. Construction Requirements. The Contractor shall provide the Engineer free access to the borrow area at any time the Engineer may request. The Contractor shall provide the Engineer with a copy of the agreement between the Contractor and the owner of the borrow area. The borrow area shall be maintained in such a manner as to prevent erosion and water pollution as specified in Section 4, Obstructions and Incidental Construction. The Contractor's haul route for importing supplemental material to the site shall be approved by the Engineer prior to the commencement of hauling operations. The Engineer will evaluate the route based upon the proposed route's existing pavement conditions, surface type and strength; the route's traffic volume and ability to safely carry increased truck volumes; and the roadside environment and adjacent land uses the route traverses. The Engineer may disapprove a route that, in their opinion, adversely impacts public infrastructure, public safety, and / or private property. The Engineer, at their discretion, and at no extra expense to the Owner, may require the Contractor to control dust during hauling operations. Paved streets and other paved areas shall be kept clean and free of mud, trash, and debris. The Contractor shall, at their cost, repair or replace any public or private property which is damaged by the Contractor's operations.

D. Bid Item, Measurement and Payment.

(1) Bid Item:

SUPPLEMENTARY BORROW MATERIAL Unit: Cubic Yard (nearest 1 CY)

(2) Measurement. "Supplementary Borrow Material" shall be measured as the volume of the compacted imported material, in place, on the project site. Plan quantity stated in the Contract Documents shall be accepted as measured quantity unless the Contractor elects to use the following "Compacted Volume per Truckload" method of measurement. Such election shall be reported to the Engineer, in writing, prior to any supplementary borrow material being transported to the Project.

Compacted Volume Per Truckload. Prior to importing supplemental material, the Engineer's Representative will observe each type of truck to be used in hauling supplemental borrow material being loaded to volumetric capacity and will follow the trucks to a scale approved by the Engineer where one loaded truck of each type will be weighed. The cost of the initial weighing of trucks shall be subsidiary to "Supplementary Borrow Material". The capacity of each type of truck will be determined, to the nearest 0.1 cubic yard, by the net weight of the load and the unit weight of compacted borrow determined by the standard density test (AASHTO T 99) run on the material. The unit weight shall be the maximum material density at the optimum moisture content as determined by AASHTO T 99. For each type of truck used, the number of truckloads of supplementary material deposited at the site shall be counted. The measured quantity of "Supplementary Borrow Material" shall then be computed as the sum of the products of the number of truckloads times the volume of material per truckload for the various types of trucks used.

The Engineer's Representative will visually compare the volume of supplementary material on trucks arriving at the site to the volume of the first weighed load. If the Engineer's Representative thinks a truck is delivering less material than the load of material used to establish load volumes, the load in question shall be weighed and the volume calculated as above. The Contractor shall pay for weighing any loads that are more than 10 percent below

the established capacity of the truck. The Owner will pay the weighing cost if the load is within 10 percent.

Contractor's failure to comply with these requirements will result in measurement being accepted as plan quantity.

(3) Payment. The amount of completed and accepted "Supplementary Borrow Material" measured as provided above, shall be paid for at Contract unit price per cubic yard, which price shall be full compensation for all excavation of material, hauling, dust control, and placing; and for the furnishing of all equipment, tools, labor, and incidentals necessary to complete the work.

3.09 EMBANKMENT.

A. Construction Requirements. Prior to proceeding with compaction of embankments requiring Type A or Type AB Compaction, a Standard Proctor Curve as determined by AASHTO T 99 (ASTM D 698) shall be obtained for each type of material to be used. Proctor curves shall be obtained from soil samples selected by a certified testing laboratory from materials excavated by the Contractor. All costs associated with the selection of soil samples and performing the necessary tests to obtain the Proctor curves shall be paid by the Contractor.

The construction of embankments shall proceed in a manner that limits erosion and the deleterious effects of rain during construction. As much as practical, the construction of ditches and other provisions for drainage shall proceed prior to the construction of embankments.

Embankment shall not be constructed on frozen ground.

The surface of the embankment foundation shall be stripped and then tilled or disked uniformly and fully to a minimum depth of 6 inches to assure a thorough bond between the original surface and the new embankment. This tilled or disked layer shall be adjusted to the required moisture content and compacted to the designated type of compaction with this work considered subsidiary to other items in the Contract Documents.

Fill material shall be deposited in loose layers not more than 6 inches thick, and compacted. Areas outside of the subgrade, as defined in Subsection 3.10, shall receive Type AB Compaction. Areas within the subgrade shall receive Type A Compaction. The requirements of the various types of compaction are specified in Subsection 2.09. Compacting operations shall include blading each lift of embankment material to insure uniformity. Water shall be added or removed, if necessary, in order to obtain the required moisture content of the soil involved.

When an embankment is placed against a hillside or an existing embankment with slopes steeper than 4:1, the existing slope shall be benched in sufficient width to permit the placement and compaction of embankment material in 6 inch horizontal lifts.

Where fill or embankment heights are greater than four feet above the existing ground, and only when approved by the Engineer, the Contractor may incorporate rock excavated from the project into the embankment. When approved, the rock shall be placed at the bottom of the embankment in a uniform horizontal layer not exceeding 2 feet in thickness and in a location that will be covered by at least 2 feet of soil upon the completion of the embankment. The rock will be carefully placed so

that all large stones are well distributed and the voids completely filled with smaller stones, soil, or gravel, to form a solid embankment.

Compaction equipment selected by the Contractor to construct an embankment, fill, or subgrade must be of such a design and size necessary to achieve the density requirements specified. Recommendations for compaction equipment may be found in Subsection 2.09 D.

During construction of embankments, soil density tests shall be taken by the Engineer or their representative. When results indicate that compaction does not meet the requirements of these Specifications, the embankment material shall be replaced or recompacted as necessary to meet the specified requirements at no additional expense to the Owner. Additional tests shall be performed on recompacted areas to assure compliance with the requirements.

B. Materials. Embankment materials in areas outside the subgrade shall be approved excavated materials selected from the site or approved supplementary borrow material. Material shall be unfrozen; free of debris, organic material, and rocks (except as provided for above) or clods larger than three inches in any dimension, and; capable of being compacted to the requirements of the Contract Documents. Suitable subgrade materials are specified in Section 3.05.

C. Bid Item, Measurement and Payment.

(1) Bid Item:

EMBANKMENT

Unit: Cubic Yard (nearest 1 C.Y.)

(2) Measurement. The construction of embankments shall not be measured or paid for directly but shall be considered subsidiary to “Unclassified Excavation” if the embankment materials are excavated from the project site or “Supplementary Borrow Material” if the embankment materials are imported into the site unless “Embankment” is listed as a pay item in the Contract Documents.

When listed as a pay item in the Contract Documents, “Embankment” shall be measured as the compacted volume in place on the Project in Cubic Yards. The completed and accepted percentage of plan quantity for “Embankment” shall be considered measured quantity unless the Contractor requests, and it is agreed upon in writing before the start of the project, that 1) another method of quantity determination will be followed or 2) the plan quantity is questionable and further quantity determination is needed. If another method of quantity determination is followed, all pay requests must accurately reflect the quantities to date. No payment for back quantities will be allowed.

(3) Payment. When listed as a pay item in the Contract Documents, the amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per cubic yard for “Embankment”, which payment shall be full compensation for all hauling, grading, placing, and drying the of materials as specified; and for all equipment, tools, labor, and incidentals necessary to complete the work.

3.10 SUBGRADE PREPARATION.

A. Subgrade Defined. Subgrade is defined as the area upon which curb and gutter or any pavement is to be placed. The subgrade preparation limits for streets extend one foot on each side beyond the back of curb or edge of pavement, whichever is appropriate. Subgrade limits for drive entrances and sidewalks extend to the edge of the entrance or walk. The thickness of the subgrade is as specified in the Geotechnical Report, Project Drawings, or other Contract Documents.

B. Geotechnical Report. Prior to construction plan approval and before a street project will be released for construction, the City/County Engineer will require three (3) approved copies of a geotechnical report, sealed by a Kansas licensed Professional Engineer or a Kansas licensed Geologist. The geotechnical report shall provide site-specific recommendations for the construction of Public Streets and must be submitted for all street or road functional classifications (principal arterials, minor arterials, collectors, sub-collectors and locals). The geotechnical report shall be a part of the Contract Documents.

At a minimum, the following items must be addressed in the report:

(1) Suitable subgrade material shall be defined as entirely imperishable with that portion passing the No. 40 Sieve having a liquid limit not exceeding 40 and a plasticity index not exceeding 25 when tested in accordance with ASTM D 4318. The liquid limit is the water content of the soil at the change between the liquid and the plastic states and shall be tested in accordance with ASTM D 4318. The plastic limit is the water content at the boundary between the plastic and semi-solid states as stated in ASTM D 4318-83. The plasticity index is the numerical difference between the liquid limit and the plastic limit. If the on-site soils do not meet these requirements, the geotechnical report must specify how the on-site soils will be modified to achieve these requirements. As an alternative, the geotechnical engineer may specify alternative liquid limits and/or plastic indices for consideration, provided adequate justification is given.

(2) The report must identify the soils to be used for fill (excluding any material being brought onsite). The report must contain an evaluation of the soils proposed to be used. The evaluation must include all the following as a minimum:

- Sieve analysis
- SCS classification
- Atterberg limits
- Maximum dry density (ASTM D 698)
- Optimum moisture content
- Moisture density curve (Standard Proctor)

(3) The geotechnical report must also indicate the methods to be used for placement and compaction of the subgrade. The subgrade for all streets shall be treated with fly ash, lime, aggregate base, or other approved material. The geotechnical report shall detail the treatment, placement, incorporation and compaction procedures to be used. Details not specifically covered in the geotechnical report shall conform to the requirements of the KDOT Standard Specifications and the requirements specified herein.

C. Construction Requirements.

(1) All Locations. The Contractor is responsible for regulating the sequence of work, processing a sufficient quantity of subgrade treatment material, providing full depth as specified on the plans, using proper amounts of fly ash, lime or approved material, maintaining the work, and reworking areas necessary to meet the requirements of the Construction Documents.

After compaction and trimming, the subgrade shall be maintained and if, in the opinion of the Engineer, it becomes excessively dry or wet the Contractor will be required to apply water or aerate and re-compact the subgrade. This work will be subsidiary to the pay item "Subgrade Preparation."

The elevation and cross section of the surface shall be thoroughly checked by the Contractor immediately prior to placing pavement on the subgrade. All high places shall be removed and low places filled with suitable material and rolled or tamped until smooth and firm. The use of water on dry subgrade may be required. The water shall be uniformly applied at a controlled rate. The prepared subgrade must support the weight of vehicles and equipment without producing ruts in the surface.

(2) Streets. Subgrade shall be constructed to the requirements of the Geotechnical Report and Project Drawings.

Subgrade shall be trimmed with a rotary style trimmer referencing a taut string line. Other methods for trimming, may be submitted for approval by the Engineer.

The subgrade shall be completed and checked not less than 100 feet in advance of the paving operation. If hauling over the completed subgrade results in ruts or other objectionable irregularities, the Contractor shall restore it to a satisfactory condition. If the subgrade cannot be restored to satisfactory condition, paving shall be stopped.

(3) Alleys and Drive Entrances. The subgrade shall be tilled or disked to a depth of at least 6 inches and the loosened material compacted to the required crown and elevation. Subgrade shall be compacted to the requirements of Type A Compaction as defined in Subsection 2.09. If the soil is unstable at the specified moisture range, the moisture may be varied to the point at which it is stable as determined by the Engineer.

(4) Sidewalks. The subgrade shall be tilled, disced, or scarified to a depth of at least 6 inches and the loosened material compacted to the required slope and elevation. Subgrade shall be compacted to the requirements of Type AB Compaction as defined in Subsection 2.09. If the soil is unstable at the specified moisture range, the moisture may be varied to the point at which it is stable as determined by the Engineer.

D. Measurement and Payment. Subgrade Preparation shall not be measured or paid for directly but shall be subsidiary to other items of the Contract.

3.11 SUBGRADE TREATMENT

A. Subgrade Treatment Defined. Subgrade treatment includes the addition, mixing and manipulation of specified amounts of fly ash, cement, lime, calcium chloride, or other specified additive along with specified amounts of water into the roadbed subgrade followed by compaction, trimming and curing.

B. Construction Requirements. Subgrade treatment shall be performed in areas designated on the drawings or geotechnical report. Subgrade treatment shall extend to one foot past the back of curb or edge of pavement unless specified otherwise in the Contract Documents.

It is the Contractor's responsibility that the full depth of subgrade treatment shown on the Drawings is provided. If it is necessary to provide stabilization deeper than what is shown on the Drawings to maintain the minimum required depth after final trimming, the additional material and labor costs are the responsibility of the Contractor.

If the compacted subgrade is subjected to rain, areas of standing water shall be bladed off and reworked as deemed necessary by the Engineer and at no additional cost to the Owner.

The Contractor must take measures to limit the amount of dusting generated during the application of additives and mixing operations. If unsatisfactory dusting occurs, the Engineer will require the Contractor to take corrective measures.

Unless otherwise specified in the Project Documents, the Contractor shall retain a certified testing laboratory to test the on-site materials and specified additive content to establish the optimum moisture content.

If any of the following requirements for subgrade treatment are not satisfied, the Contractor shall reprocess, recompact and refinish the deficient areas until satisfactory and at no cost to the Owner.

C. Fly Ash, Cement, or Calcium Chloride Treated Subgrade.

(1) Materials. The Contractor shall submit supplier certifications that the material supplied meets the specified requirements.

i. Fly Ash. Fly Ash shall comply with the Physical requirements of ASTM D 5239, paragraph 6.4, and the chemical requirements of ASTM C 618, table 1, for Class C fly ash. Store and handle fly ash in closed waterproof containers before distribution on the subgrade. Partially caked or set fly ash shall not be accepted.

ii. Cement. Cement shall be Type I, IP, I(PM), IS, I(SM), or II cement as designated by and meeting the requirements of ASTM 150.

iii. Calcium Chloride. Calcium chloride shall be one of the types listed below as designated by and meeting the requirements of AASHTO M 144.

(1) Type S (Flake, Pellet or Granule)

(a) Grade 1 (77% CaCl_2)

(b) Grade 2 (90 CaCl_2)

(2) Type L (Liquid)

(2) Equipment.

i. Mixing. The Contractor shall use equipment with a recycling or mixing drum and with an automatic water proportioning system. Other equipment must be approved by the Engineer.

ii. Compaction. The Contractor shall use a vibratory roller having a minimum operating weight of 12 tons, with a minimum centrifugal force of 24 tons for the initial compaction of the mixture and a rubber-tired or smooth-wheeled roller to complete the compaction of the surface.

(3) Construction Requirements: The Contractor shall incorporate the additive and water into the subgrade to the specified depth.

i. Preparation of the Subgrade and Distribution of Additive. Before incorporating the additive into the subgrade, the Contractor shall blade the roadway to allow uniform distribution of the additive and distribute the additive in a manner that

minimizes loss of the material. Additive shall not be applied if conditions are such that the material is lost due to wind or rain. Additive that was not properly handled and stored in weatherproof containers shall not be used.

ii. Mixing. The Contractor shall mix the subgrade, additive and water until a homogeneous, friable mixture is achieved. Mixing shall be completed within 30 minutes of adding water to the additive and subgrade. The mixing operation shall not be allowed until the ambient air temperature and surface temperature is 40 degrees F and rising.

iii. Moisture Content. Moisture content immediately before compaction of the treated subgrade shall be not more than 3 percentage points above or below optimum. If the moisture content of the mixture exceeds the optimum moisture content by more than 3 percentage points, the Contractor shall apply additional additive to lower the moisture content at no additional cost to the Owner. The Contractor shall distribute the mixture as needed to maintain the optimum moisture content during the compaction operations.

iv. Compaction. The Contractor shall retain a certified testing laboratory to determine the dry density of the combined materials and provide the information to the Engineer. The coordination with the testing lab, and the cost and responsibility associated with collecting soil samples and performing the testing shall be borne by the Contractor.

When the thickness is greater than eight inches, compact multiple lifts of equal thickness with a maximum lift thickness of eight inches.

The Contractor shall compact the treated subgrade to a minimum of 95% of the combined materials dry density.

The compacted subgrade shall have uniform density and remain stable under construction traffic. The Contractor shall complete the compaction operations within 2 hours of incorporating the additive into the subgrade

v. Finishing. After compacting the treated subgrade, the Contractor shall trim the surface to the specified lines and grades with a rotary style trimmer referencing a taut string line. Other methods for trimming may be submitted for approval by the Engineer. In small irregular areas, the subgrade shall be finished by wetting, blading and rolling. The trimmed surface of the treated subgrade shall be re-compacted with a smooth-wheel or a pneumatic-tire roller. If necessary during the final rolling, the Contractor shall lightly scarify and blade the surface to eliminate equipment imprints.

vi. Thickness. The thickness of the fly ash treated subgrade shall be determined by depth tests or cores taken at intervals so that each test shall represent no more than 1,000 square yards. The depth tests or cores shall be provided by the contractor at no cost and shall be reviewed onsite by the Engineer. Where the thickness is deficient by more than ½ inch, the Contractor shall correct such areas in a manner satisfactory to the Engineer. The Contractor shall replace, at their expense, the soil/fly ash material where borings are taken for test purposes.

vii. Commencement of Paving or Surfacing. The Contractor may proceed with construction of aggregate base, surfacing or paving 24 hours (three days for Projects outside the City limits) after final rolling provided the Engineer has approved the treated subgrade and also provided that the subgrade supports construction equipment without rutting or pumping. Under special circumstances, the minimum cure period may be reduced if approved by the Engineer. Proof rolling shall be accomplished with a loaded tandem dump truck carrying a minimum loaded weight of 25 tons, with three cycles of loading over three separate paths.

viii. Protecting Fly Ash, Cement, or Calcium Chloride Treated Subgrade. The Contractor shall protect the finished subgrade against drying for 7 days after completion, or until the subgrade is covered with a base or surfacing if covered before 7 days. The finished subgrade shall be protected from drying by spraying with water to maintain a continuous moist condition.

The Contractor may apply an asphalt prime coat instead of keeping the finished surface moist with water. If this option is chosen, SS-1, CSS-1 or MC-250 shall be applied at the rate of 0.22 gallons per square yard to achieve a minimum of 0.13 gallons per square yard residue. Multiple light applications may be necessary to obtain the specified rate of application without run-off.

ix. Weather Limitations. The Contractor shall cover the finished treated subgrade with the specified first lift of aggregate base or surfacing before it is subjected to freezing. If the finished treated subgrade is not covered with a lift of surfacing or aggregate base and is subjected to freezing, the Contractor shall rework the subgrade to the extent established by the Engineer and at no additional cost to the Owner.

D. Lime Treated Subgrade.

(1) Materials: Lime shall be hydrated or pebble quick lime. Hydrated lime shall be any hydrated lime product consisting of hydrated lime and insoluble inert material and complying with the following:

Available Lime Index as Calcium Hydroxide, %, min	90
Residue retained on a No. 30 sieve, %, max.	1
Residue retained on a No. 200 sieve, %, max.	20

Pebble quick lime shall meet the requirements of AASHTO M 216. Maximum particle size shall be 3/8".

Hydrated lime for treating soil or soil-aggregate may be manufactured at the jobsite by slaking pebble quick lime. Use equipment specifically manufactured for this purpose and approved by the Engineer.

The Contractor shall submit supplier certifications that the material supplied meets the specified requirements.

(2) Equipment.

i. Scarification. The Contractor shall perform the scarification with positive depth control equipment. A plow or disc shall not be used for the scarification. The Engineer may approve the use of a positive depth controlled motor grader scarifier on a performance basis.

ii. Applying Hydrated Lime Slurry. The Contractor shall use equipment that applies lime slurry through a system of spray bars and nozzles and that can regulate the amount of lime slurry from each nozzle so that the specified amount of lime is placed on the soil and provide the correct quantity of lime without adding an undue quantity of excess moisture to the mixture.

iii. Applying Pebble Quick Lime. The Contractor shall use equipment and methods that will allow the distribution of the pebble quick lime at a uniform rate over the surface to be treated. The Engineer shall approve such equipment and methods on a performance basis.

iv. Mixing. The Contractor shall mix soil, lime and water using equipment with positive depth control that can maintain cutting or mixing heads in a fixed position relative to the wheels or tracks of the machine carrying the head

(3) Construction Requirements: The Contractor shall mix soil, lime, and water either in-place or off-site in a borrow area.

i. Preparation and Maintenance of the Subgrade or Off-Site Borrow Area. Before applying the lime treatment, the Contractor shall use automatic grade controlled equipment to trim the surface of the subgrade or borrow area to the specified lines and grades. In irregular areas, the subgrade or borrow area shall be trimmed by wetting, blading and rolling. Borrow areas shall be trimmed to the profile established by the Contractor. The Contractor shall uniformly compact the trimmed subgrade or borrow area and maintain the subgrade or borrow area as prepared. The Contractor shall provide proper drainage at all times and correct defects that develop in the subgrade or borrow area.

ii Scarification. When the lime is not applied through a mixing chamber to the prepared in-place subgrade or off-site borrow area, the Contractor shall scarify the

prepared area to a minimum depth of 4 inches and a maximum depth of approximately 1 inch less than the specified depth of lime treatment. The Contractor shall determine the depth of lime treatment for off-site areas.

iii. Application Rate of Lime. The application rate of lime is based on the weight of soil being treated and is shown in the Contract Documents. If the application rate is not shown in the Contract Documents, lime shall be applied at a rate of 5% of the weight of soil.

The Contractor shall retain, at the Contractor's expense, a certified testing laboratory to determine the concentration strength of lime and rate of application to obtain the percent of lime specified in the Contract Documents and advise the Engineer accordingly.

iv. Application of Hydrated Lime Slurry. The Contractor shall apply hydrated lime to the scarified areas as slurry and regulate the amount of lime slurry from each nozzle and the speed of the delivery vehicle so that the specified amount of lime is placed on the soil. The concentration of the hydrated lime slurry shall allow the application of the correct quantity of lime without adding an undue quantity of excess moisture to the mixture. The application and mixing of the hydrated lime slurry shall result in a uniform lime concentration.

Hydrated lime slurry shall be applied the same day it is produced. The Contractor shall continuously agitate the hydrated lime after the batch is made. If the liming operation is interrupted, the Contractor shall continue agitating the hydrated lime in storage. If the interruption will be lengthy, the Contractor has the option to cease mixing. In either case, prior to resuming liming operations, the Contractor shall re-test the concentration and adjust the rate of application accordingly. The Engineer will verify the results.

v. Application of Pebble Quick Lime. The pebble quick lime shall be applied at a uniform rate over the entire area to be treated.

vi. Adding Water. The Contractor shall add water, as necessary, to facilitate mixing of the lime and soil. During the initial mixing operation, water shall be added to obtain a minimum moisture content of 8% above the optimum moisture content of the raw soil being treated. The Engineer will measure the moisture content immediately after the mixing is completed, and before sealing or compacting.

vii. Preliminary Mixing. The Contractor shall mix the lime, soil and water to the dimensions specified in the Contract Documents. For off-site borrow areas, the Contractor shall determine the depth and width. Mixing shall involve a minimum of 2 passes with the mixer traveling in the primary direction. Mixing shall continue until 95% of the mixture passes the 2 inch sieve as determined by the Engineer.

viii. Aging. Seal the mixture to prevent moisture loss by lightly rolling with a pneumatic-tired roller. Blade the surface to shed water.

(1) Material Mixed In-Place. Maintain the mixture in the sealed condition for a minimum of 24 hours prior to commencing final mixing.

(2) Material Mixed in a Borrow Area. Maintain the mixture in the sealed condition a minimum of 24 hours or until the mixture is ready to be used.

The Contractor shall keep the surface moist by spraying with water. If the final mixing is not performed within 14 days of the preliminary mixing, the Contractor shall add 1% lime by weight of raw soil, in the final mixing operation. If the Contractor knows the final mixing will not be performed within 14 days, the Contractor may reduce the rate of lime applied in the initial application by 1%, and add that 1% in the final mixing.

ix. Final Mixing. After the initial mixing and aging (24 hours) is completed, the Contractor shall re-mix the mixture to the specified depth ($\pm \frac{1}{2}$ inch) and width, until 95% of the mixture passes the $\frac{1}{2}$ inch sieve and 40% passes the No. 4 sieve as determined by the Engineer. Periodic mixing over an interval of time is allowed to facilitate the breakdown in particle size. The Contractor shall bring the mixture to the moisture content required for compaction.

x. Compaction of the Mixture. When the material is mixed in-place, the Contractor shall compact the material after completing the required final mixing. When the material is mixed off-site, the Contractor shall excavate and haul the material to the project site, place the material on the prepared and trimmed surface, and compact the material. The Contractor shall compact the mixture such that, in the opinion of the Engineer, no further consolidation is gained by continued rolling. Moisture content at the time of compaction shall be no more than 3 percentage points above or below optimum and shall be maintained throughout the compaction operations. The Contractor shall blade the mixture to eliminate surface irregularities during the compaction operations. When the completed thickness is greater than eight inches, compaction shall occur in multiple lifts.

xi. Finishing. After compacting the lime treated subgrade, the Contractor shall trim the surface to the specified lines and grades with a rotary style trimmer referencing a taut string line. Other methods for trimming must be approved by the Engineer. In small irregular areas, the subgrade shall be finished by wetting, blading and rolling. The trimmed surface of the treated subgrade shall be re-compacted with a smooth-wheel or a pneumatic-tire roller. If necessary during the final rolling, the Contractor shall lightly scarify and blade the surface to eliminate equipment imprints.

xii. Curing and Protecting Lime Treated Subgrade. After the compacted mixture is finished, cure the lime treated subgrade for 7 days by keeping the finished surface moist with water to prevent drying. Do not allow vehicles or equipment (other than watering equipment) on the finished lime treated subgrade during the curing period.

At the Contractor's option, apply an asphalt prime coat instead of keeping the finished surface moist with water. If asphalt prime coat is used, apply SS-1, CSS-1 or MC-250 at the rate of 0.22 gallons per square yard to achieve a minimum of 0.13

gallons per square yard residue. Multiple light applications may be necessary to obtain the specified rate of application without run-off.

When a bituminous base course or aggregate base is to be constructed upon the lime treated subgrade, the Engineer may reduce the curing period to when the lime treated subgrade gains sufficient strength to support the construction and hauling equipment. When a bituminous base or aggregate base course is constructed on the lime treated subgrade, the first lift of the base or subbase is considered the curing medium. Repair any damage to the lime treated subgrade due to construction of the base course or subbase.

xiii. Seasonal Limitations. The Contractor shall not perform lime treatment operations if the ambient air temperature is below 40°F, or the soil is frozen.

(1) Projects with Rigid Pavement. The Contractor shall cover the finished lime treated subgrade with base or pavement before it is subjected to freezing. If the lime treated subgrade is not covered by base or pavement and is subjected to freezing, the Contractor shall re-compact the lime treated subgrade before placing any pavement. The Engineer will determine the extent of the re-compaction which shall be completed at no additional cost to the Owner.

(2) Projects with Flexible Pavement. The Contractor shall cover the finished lime treated subgrade with the specified lift of asphalt or aggregate base before it is subjected to freezing. If lime treated subgrade is not covered with a lift of HMA or aggregate base and is subjected to freezing, the Contractor shall add additional lime and re-compact the lime treated subgrade before placing any pavement. The Engineer will determine (by laboratory or field tests) the additional quantity of lime to add, if any, and the extent of the re-compaction which shall be completed at no additional cost to the Owner.

E. Bid Item, Measurement and Payment.

(1) Bid Item:

(*) SUBGRADE TREATMENT ()** Unit: Square Yard (nearest 1 S.Y.)

* Specified thickness of subgrade treatment in inches

** Type of subgrade treatment, i.e. Fly Ash, Cement, Lime, or Calcium Chloride

(2) Measurement. “Subgrade Treatment” shall be measured by the area treated for each of the various thicknesses and types of subgrade treatment. The area of individual treatment locations will be determined by measuring the individual location's dimensions to the nearest 0.1 foot, and computing the location’s area in square feet. For each Contractor Pay Application, the individual areas will be summed in square feet, converted to square yards and rounded to the nearest square yard.

When mutually agreed by the Contractor and the Engineer, plan quantity for “Subgrade Treatment” may be accepted as the measured quantity.

(3) Payment. The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per square yard for each of the various thicknesses and types of “Subgrade Treatment”, which payment shall be full compensation for all materials, application, mixing, compaction, trimming, curing and protecting as specified; and for all equipment, tools, labor, and incidentals necessary to complete the work.

3.12 AGGREGATE BASE – TYPE AB-3.

A. Materials. Materials shall comply with the requirements for AB-3 as specified in Section 1104 of the KDOT Standard Specifications, except the allowable gradation limits will be as shown in the table below.

Sieve Size	% Retained
1-1/2”	0-5
3/4”	15-30
No. 4	45-60
No. 8	55-70
No. 40	70-85
No. 200	85-95

The Contractor shall retain a certified testing laboratory to determine the standard proctor, gradation and plasticity index of the material to be supplied and submit the information to the Engineer prior to construction of the aggregate base. The Engineer shall also receive a certification with each load stating that the AB-3 material is from a KDOT approved stockpile.

B. Construction Requirements.

(1) Subgrade Preparation and Trimming. Subgrade shall be watered, scarified, and bladed and compacted to meet 95% compaction requirements within a moisture range of +/-3% of optimum moisture. Subgrade shall be proof rolled with a loaded tandem-axle dump truck carrying a minimum weight of 25 tons. Soft or unsuitable areas **identified** during the proof rolling operation shall be excavated and replaced with approved material. Excavation of the subgrade shall be paid for as “Unclassified Excavation”. Installation and compaction of approved material shall be paid for as the specific material. **[For Shawnee County Administered projects only – excavation of the subgrade and installation and compaction of approved materials shall not be paid for direct but considered subsidiary to other items of the contract.]**

(2) Mixing and Moisture Content. Aggregate shall be delivered or mixed onsite to a uniform condition with a moisture content at **+3% of optimum moisture.**

(3) Placement. Aggregate shall be placed to the depth and thickness shown on the plans or as directed by the Engineer. Maximum compacted lift thickness of any one lift shall be 8 inches. Material shall not be placed on frozen subgrade.

(4) Compaction. The Contractor shall compact the aggregate base to a minimum density of 95% of the standard density at a moisture content of +/-3% of the optimum moisture.

(5) Curing. Aggregate base shall be protected from traffic, including construction traffic, for a minimum of 3 days unless otherwise approved by the Engineer. Aggregate base shall

support a loaded tandem axle dump truck carrying a minimum weight of 25 tons before placement of pavement.

(6) Finishing. Upon completion of the curing period, the aggregate base shall be trimmed with a rotary style trimmer referencing a taut string line. Other methods for trimming must be approved by the Engineer. Aggregate base shall be compacted after trimming with a steel-drum or pneumatic-tire roller. This requirement shall not apply where aggregate base is used as a final surface.

(7) Re-use of Trimmings. If contractor plans on re-using AB-3 trimmings, then the stock pile shall be tested for gradation and moisture content.

C. Bid Item, Measurement and Payment.

(1) Bid Items.

(*) AGGREGATE BASE – TYPE AB-3 Unit: Square Yard (nearest 1 S. Y.)

AGGREGATE BASE –TYPE AB-3 Unit: Ton (nearest 0.1 Ton)

* Specified thickness in inches

(2) Measurement. Measurement of the various thicknesses of “(*)” Aggregate Base – Type AB-3” shall be by the in place area constructed. Horizontal dimensions of individual areas of the various thicknesses of Aggregate Base - Type AB-3 shall be measured to the nearest 0.1 foot with the sum of the areas thus measured, converted and rounded to the nearest square yard for each pay request. When the thickness of the Aggregate Base is not specified in the project documents or when used to repair subgrade for pavement patches, it shall be measured by the ton using load tickets or and assumed unit weight of 156 pcf.

(3) Payment. The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price for each of the various thicknesses of “(*)” Aggregate Base – Type AB-3” or the unit price per ton when no thickness is specified. Such prices shall be full compensation for all hauling, placing, grading compaction, trimming and curing as specified; and for all labor, equipment, materials, tools, and incidentals necessary to complete the work.

3.13 DISPOSAL OF EXCESS MATERIAL.

A. General. Unless otherwise specified in the Drawings or in the Contract Documents, any excess excavated material, structures, pavements, rocks, trash, debris and vegetation, or any other item designated to be removed shall be disposed of by the Contractor. Such disposal shall be at no additional cost to the Owner unless materials with special disposal requirements not normally found in similar work are encountered. If material requiring special disposal is encountered, the Engineer must be notified immediately for agreement that the material requires special disposal. If the means of special disposal is not included as a pay item in the Project Documents, the Contractor shall submit a price for the work to the Engineer for consideration by the Engineer and Owner. Once the price is established, a Change Order shall be written and approved prior to the Contractor proceeding with the work.

Disposal of all materials shall be accomplished in accordance with all Federal, State and local ordinances and regulations.

The Contractor shall not dispose of any excavated material until certain there is sufficient material to complete all necessary project embankments and the Engineer approves such disposal. If suitable excavated material is disposed of, approved borrow material shall be provided at the Contractor's expense.

B. Measurement and Payment. Disposal of Excess Material shall not be measured or paid for directly but shall be subsidiary to other items of the Contract.

END OF SECTION