

SECTION 1100 – GRADING AND TRENCHING

1101 SCOPE

This section covers the performance of all work required for grading the project in coordination with all previous work performed at the locations shown on the contract drawings.

This section covers the performance of all trenching activities for general pipeline and utility construction. Refer to the Specification Sections of City-Owned utilities (2500 – Sanitary Sewers, 2900 – Waterlines, 3000 – Fiber Optics, and 6000 – Storm Sewers) for additional requirements.

All sub-sections demarked as “General” shall also be applicable to related sub-sections.

1102 MATERIALS AND DEFINITIONS

A. General

Grading shall be defined as meaning the performance of all excavation, embankment and backfill in connection with the construction of all improvements.

B. Excavation

Excavation is defined as the removal of materials from the construction area to the lines and grades as shown on the contract drawings or to facilitate utility installation by trenching to the flowlines/centerlines identified within the contract drawings.

Unless otherwise provided for in the Special Provisions and included in the proposal, all excavation shall be unclassified excavation and the Contractor shall satisfactorily remove and dispose of all materials encountered regardless of their nature.

On those projects where rock exploration has been made, test holes have been drilled at locations and intervals as shown on the Plans or subsurface information report to determine the approximate location and depth of rock. Resistance to penetration was assumed to be “solid rock”. This information is furnished for general reference purposes only.

The Contractor must form their own opinion as to the character of materials which will be encountered from an inspection in the ground, from their own investigation of the test hole information, or from such other investigations as he may desire.

C. Embankment Fill or Backfill

Embankment Fill or Backfill, is defined as the placing and compacting of material in the construction area to the lines and grades as shown on the contract drawings.

Materials suitable for earth embankment shall be free of organic materials, trash and debris, contain less than ten (10) percent by volume of rock and gravel, contain no roots more than two (2) inches in diameter, contain no masses of moist, stiff clay, and contain no rock having a dimension greater than three (3") inches. No backfill material containing rocks, or rock excavation detritus material, shall be placed within two (2) feet of final surface.

Materials suitable for rock embankment shall be free of organic materials, trash and debris, and contain ten (10) percent or greater by volume of rock or gravel containing particles ranging in size from a minimum dimension of three (3") inches to a maximum of twenty-four (24") inches.

Material not suitable for use as embankment material shall include, but shall not be limited to, frozen material, organic material, topsoil, rubbish, brick, asphaltic concrete, cinders, other corrosive materials, and other debris and soil not containing the characteristics and moisture content to obtain the required compaction. Rock and broken concrete shall not be included in embankment material unless rock embankment is specified in the Special Provisions and the materials meet the size requirements indicated in this section.

D. Topsoil

Topsoil shall be soil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 1 1/2" in any dimension, and other extraneous or toxic matter harmful to plant growth. Topsoil may be obtained from the project site by segregating appropriate material from other material during excavation and trenching operations, or from off-site locations at no additional cost to the Owner.

E. Flowable Fill

Provide low-strength, air-entrained flowable fill (flowable mortar) mix that has adequate flow characteristics to fill all voids and complies with the following compressive strength and unit weight requirements.

3-day Compressive Strength (minimum) 20 psi

28-day Compressive Strength (maximum) 100 psi

Unit Weight (maximum) 120 pcf

Fine aggregate, cement, fly ash, water and additives used in the mix shall conform to applicable sections of the current KDOT Standard Specifications.

F. Structures

Structures, as used herein, refers to bridges, basins, drainage structures, headwalls, retaining walls, and similar construction.

Material for structure backfill shall be composed of earth only and shall contain no organic materials, broken concrete, stones, trash, or debris of any kind.

G. Pipe Embedment

Pipe embedment shall be PB-2 or SB-2 as specified in Division 1100 of the Kansas Department of Transportation (KDOT) specifications.

Refer to the Specification Sections of City-Owned utilities (2500 – Sanitary Sewers, 2900 – Waterlines, 3000 – Fiber Optics, and 6000 – Storm Sewers) for additional requirements.

H. Pipe Encasement

Concrete shall test not less than a twenty-eight (28) day compressive strength of 4000 psi and shall otherwise conform to Section 2510.3.6.

Reinforcing steel when required shall be placed as shown on the Plans and standard details.

1103 CONSTRUCTION – GENERAL

A. General

During grading the work shall be performed in a manner and sequence that will provide drainage at all times. Soft spots or areas that develop during grading operations shall be removed, the area then backfilled with suitable material and compacted to obtain the required density. No additional payment will be made to the Contractor for this work.

B. Natural Obstructions

Natural obstructions, existing facilities and improvements encountered during site preparation shall be removed, relocated, reconstructed or worked around as herein specified. Care shall be used while performing site preparation work adjacent to any facilities intended to remain in place. Except as otherwise specified, the Contractor shall be responsible for any damage to existing facilities and improvements and any repairs required shall be promptly made at the Contractor's expense. Waste materials shall be disposed of in a satisfactory manner off the work site. Existing utilities damaged by the Contractor shall be restored as directed by the utility company at no additional cost to the project. Unless identified as a specific bid item, no separate or additional payment will be made for any work in connection with removal, relocation or restoration of obstructions and existing facilities.

C. Surface Obstructions

1. Fences interfering with construction, and located within public rights-of-way or utility easements or as may be allowed for in permits or agreements, may be removed by the Contractor only if the opening is provided with a temporary gate that will be maintained in a closed

position except to permit passage of equipment and vehicles. Fences within temporary construction easements may be removed by the Contractor provided that temporary fencing is installed in such a manner as to serve the purpose of the fencing removed. The contractor shall locate and record all fence corners prior to removal. All fencing removed shall be restored by the Contractor to the pre-construction condition unless otherwise specified in the Special Project Specifications. The Contractor is and shall be solely liable for the straying of any animals protected or corralled or other damage caused by any fence so removed.

2. Trees: All reasonable effort shall be made to save as many trees as possible. If trees can be saved by trimming, this shall be done in accordance with acceptable pruning practices. Trees to be removed shall be completely removed, including stump and large roots, unless such removal may result in damage to existing pipelines. In that event, trees shall be sawn off not more than four (4) inches above the ground and the stump shall be removed to twelve (12) inches below finish grade. Any tree replaced shall be outside the permanent utility easement and shall be a like species of nursery stock. (Generally, 2 to 2 ½ inch caliper).
3. Small Plants and Flowers: At least two weeks prior to the start of construction, property owners shall be notified by the contractor of the proposed starting date. The purpose of this notification is so that the property owners can remove any small plants or flowers that they, the property owners, desire to save.

D. Subsurface Obstruction

1. The Contractor shall make every reasonable effort to ascertain the existence of obstructions and shall locate obstructions prior to machine excavation where definite information is not available as to their exact location. Where such facilities are unexpectedly encountered and damaged, responsible officials and other affected parties shall be notified and arrangements made for the prompt repair and restoration of service. All utilities shall be properly supported in the excavation.
2. Private Sewer Facilities: The Contractor shall make every reasonable effort to protect private sewer facilities not shown on the Plans. When these facilities are disturbed or damaged by the work, the Contractor shall make necessary repairs to the facilities for continuous service prior to the close of the work day at no cost to the owner thereof.

1104 EXCAVATION – GENERAL

A. General

Excavation shall be performed to the lines and grades indicated on the contract drawings. All suitable material removed by excavation shall be used as far as practicable in the formation of embankments or elsewhere as indicated or specified, or as directed by the Engineer. It shall be the

responsibility of the Contractor to handle excavation in a manner such that suitable materials will be available when required. No additional compensation will be allowed for any special sequence of excavating, placing of materials, or any re-handling of materials.

Follow all OSHA safety regulations for sloping the sides of excavations and trenches, using shoring and bracing as required.

B. Dewatering

The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result. Discharge of water from dewatering operations shall conform to local and state stormwater pollution prevention regulations.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

C. Excess Materials and Haul Off

Excavated materials in excess of the amount needed to complete the grading shall be considered as excess waste material unless approved for use on site such as in embankment fill or backfill, which shall be removed from the site by and at the expense of the Contractor.

Any additional fill material required which is not available from excavation within the construction limits shall be supplied by the Contractor at no expense to the Owner unless provided for in the proposal and Special Provisions. All such material brought to the site and incorporated in the work shall be subject to the approval of the Engineer.

D. Unsuitable Materials

During excavation and grading operations if materials are encountered which are determined as being unsuitable or unstable by the Engineer they shall be removed to the depth required to reach stable material. The area involved shall then be backfilled with suitable material as determined by the Engineer and compacted to obtain the required density. Suitable material may include suitable soils or aggregate materials such as KDOT AB-3 material that are well graded with a nominal maximum aggregate size of 1 ½".

E. Undercutting

All roadway excavation in rock or shale 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.

1105 EXCAVATION - TRENCHING

A. General

1. Refer to the Specification Sections of City-Owned utilities (2500 – Sanitary Sewers, 2900 – Waterlines, 3000 – Fiber Optics, and 6000 – Storm Sewers) for additional requirements.
2. Sidewalks, curb and gutter, drainage structures and similar obstructions shall be tunneled under if tunneling is best suited. Otherwise the obstruction shall be cut in straight lines or removed to the nearest construction joint if located within five feet of the center-line of the trench. In no case shall the joint or line of cut be less than one foot outside the edge of the trench. Surface obstructions removed to permit construction shall be reconstructed as specified and to the dimensions, lines and grades of original construction.
3. All utility trenching excavation work shall be accomplished under supervision of a person experienced with the materials and procedures, which will provide protection to existing improvements, including utilities and the proposed waterline. A currently certified competent person shall be present during all excavation operations according to OSHA regulations.
4. Contractor shall have a trench safety plan for the trench conditions to be encountered on the project. The trench safety plan shall be available on the job site at all times it shall be designed by a licensed professional engineer should conditions warrant.
5. When pipe is to be installed in embankment or fill, the embankment shall be built up to a plane at least 18 inches above the top of the pipe prior to the excavation of the sewer trench.
6. Except where tunneling, horizontal directional drilling, or boring and jacking is specified and shown on the Plans, all trench excavation shall be open cut from the surface. Excavations for pipelines shall be accomplished by the open-cut method (trenching) except as specified or approved by the Engineer. Trenching shall be with a minimum inconvenience and disturbance to the general public.
7. Contractor may perform excavation by tunneling and/or trenchless methods as set forth herein at no additional cost to the project provided prior written approval for each such location is obtained from the Engineer.

B. Trench Length

The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. One block or four hundred (400) feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction unless otherwise approved by the Engineer. The Contractor shall backfill all open trench by the end of the day's work, except that which is necessary for inspection or immediate continuation of the following day's work. All open areas shall be fenced.

C. Trench Width

1. Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment. However, the limiting trench widths below an elevation 6 inches above the top of the installed pipe shall be limited to:
 - a. A minimum width of 22 inches or the pipe's outside diameter plus 12 inches (whichever is smaller)
 - b. A maximum width of the pipe's outside diameter plus 24 inches.
2. When the side clearance exceeds 12 inches, it shall be the Contractor's responsibility, at no additional cost to the project, to provide bedding adequate to develop the required lateral support for the pipe and/or provide a pipe of sufficient strength class to accommodate the loading conditions as approved by the Engineer.
3. The maximum allowable widths may be exceeded at manholes, bore pits, service connections, other structures and in unstable earth material. Where the maximum trench width is exceeded the Contractor shall provide the appropriate strength class of pipe embedment to provide safe support strength to the pipeline.
4. When, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing tables, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the expense of the Contractor.

D. Trench Depth

1. All trenches shall be excavated to depths required for proper pipe embedment. Overdepth excavation shall be required when the subgrade is unstable. Overdepth excavations shall be backfilled with granular pipe embedment material unless otherwise directed by the Engineer.
2. Trench bottoms which become soft, mucky, or otherwise unstable during construction operations shall be stabilized, by and at the expense of the Contractor, with one or more layers of crushed rock or other suitable material, where and as necessary to provide a firm and stable base for granular fill pipe foundation material to be placed thereon. Not more than one-half inch (1/2") depth of mud or muck shall

be allowed to remain on the stabilized trench bottom when the granular fill pipe foundation material is installed.

3. The trench in earth shall have a flat bottom the full width of the trench and shall be excavated to the grade to which the pipe is to be laid. The surface shall be graded to provide uniform bearing and continuous support for each pipe at every point along its entire length.
4. All rock excavation shall be carried to a minimum of 6 inches below the bottom of the pipe. Pipe embedment material shall be used to restore the trench bottom to the desired elevation and grade and to provide a uniform bearing and continuous support for the pipe along its entire length. Care shall be exercised to prevent any portion of the pipe from coming to bear on solid rock or boulders.

E. Trench Walls, Sheet piling, Shoring, and Bracing

1. Undercutting of trench walls is not permitted
2. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced and shored, as necessary, to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheet piling, bracing and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances.
3. Trench sheet piling shall not be pulled before backfilling unless the pipe strength is sufficient, in the opinion of the Design Engineer, to carry trench loads based on trench width to the back of sheet piling. Sheet piling shall not be pulled after backfilling. When ordered by the Design Engineer, sheet piling shall be left permanently in the trench. Payment for such sheet piling will be made in accordance with the contract provisions for extra work.
4. When trench sheet piling is left in place, such sheet piling shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheet piling may be removed after pipe embedment has been completed.
5. All shoring, bracing or blocking shall be furnished and installed as necessary to preserve and maintain exposed excavation faces, to protect existing improvements, to protect the proposed pipeline and to provide for safety.
6. Shoring or other methods for support of trench walls is the responsibility of the Contractor and shall be accomplished by methods that will not adversely affect pipeline alignment, grade and/or structural integrity. All excavation shall be in accordance with OSHA CFR 1926-(P).
7. All bracing, sheet piling and/or shoring installed below a horizontal plane six (6) inches above top of proposed pipe shall not be disturbed or

removed after pipe and/or pipe embedment has been installed unless otherwise specified. The bottom skids of a trench shield shall not extend lower than six (6) inches above top of proposed pipe.

F. Compliance

1. In the event hazardous wastes as defined by the Resource Conservation and Recovery Act of 1976 (PL94-580) are encountered, work shall be halted and the Engineer shall be notified. Work shall be resumed only after the Contractor has notified the proper authorities and permission has been given by the governing authority to resume construction activities. Regulation of removal, handling and disposal of hazardous wastes is the responsibility of Federal and State agencies.
2. Installation shall comply with all applicable State and Country Health and Environment Departments requirements.

G. Blasting

When blasting is permitted by Lawrence-Douglas County Fire and Medical Services, the Contractor shall use the utmost care to protect life and property. The Contractor shall comply with all laws, ordinances, and the applicable safety code requirements and regulations relative to the handling, storage and use of explosives and protection of life and property, and he shall be responsible for all damage thereto caused by their or their subcontractor's operations.

The Contractor shall provide insurance as required by the General Provisions and Covenants and Special Project Specifications before performing any blasting. The governing agency shall be notified at least 24 hours before blasting operations begin.

No blasting of any kind for rock excavations or any other purpose will be allowed within areas noted as such on the Plans.

H. Mechanical Excavation

The use of mechanical equipment will not be permitted in locations where its operations would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, alternate excavating methods shall be used

Mechanical equipment used for trench excavation shall be of the type, design, and construction and shall be so operated that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from the bottom of the trench, and that trench alignment will be centered in the trench with adequate clearance between the pipe and the sidewalls of the trench. Undercutting the trench to obtain sidewall clearance will not be permitted.

All mechanical trenching equipment, its operating conditions, and the manner of its operations shall be subject at all times to the approval of the Engineer.

I. Crossings

Stream crossings shall be made in accordance with these specifications and as shown on the Plans.

The trench width shall be as required for proper pipe installation and the trench depth shall be as required to give minimum cover shown on the Plans. Pipe encasement, where required, shall be in accordance with the specifications and placed as indicated on the Plans

The Contractor shall make highway and railroad crossings in accordance with these specifications, the Special Project Specifications and as shown on the Plans.

All construction or work performed and all operations of the Contractor, their employees, or subcontractors within the limits of highway or railroad right-of-ways shall be in conformance with all the requirements and regulations of the authority having jurisdiction of said right-of-ways.

The Contractor shall pay all fees and obtain all permits to make the crossings unless otherwise directed.

J. General Utility Separation Requirements

1. Horizontal Separation

A minimum of five (5) feet of horizontal separation, as measured from outside walls of the pipe, shall be required between all utilities, excluding sanitary sewer, and potable waterlines.

2. Vertical Separation

A minimum of two (2) foot of vertical separation, as measured from the outside walls of the pipe, shall be required between all utilities and potable waterlines.

K. Pipe Embedment

Embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.

After each pipe has been graded, aligned, and placed in final position on the bedding material and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

L. Pipe Encasement

After initial set of concrete, one (1) foot of backfill material should be placed over the conduit or concrete. The backfill above this point shall not be placed nor sheeting removed until at least forty-eight (48) hours after placement of the concrete. Time requirements may be adjusted by the Engineer to obtain structural integrity.

1106 EMBANKMENT – FILL

Embankments shall be formed with suitable materials, as herein defined, procured from excavations made on the project site, or from Contractor furnished borrow pits as required to complete the grading work. Embankment construction shall not be performed when material contains frost, is frozen, or a blanket of snow prevents proper compaction.

The existing surface upon which embankment material is to be placed shall have all unstable and unsuitable material removed to the depths shown, or as directed by the Engineer, before starting the embankment work.

Earth embankment shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of material shall not exceed eight (8") inches in thickness (loose measurement) and shall be compacted as specified in paragraph 1108 before the next layer is placed thereon. As the compaction of each layer progresses, continuous blading will be required to level the surface and to ensure uniform compaction.

Successive horizontal layers of rock embankment not exceeding two (2') feet in depth shall be made by placing larger stones uniformly over the embankment area. Small stone fragments, sand, earth, or gravel shall be placed between the larger stones to fill all voids. Each layer shall be thoroughly compacted before the next layer is placed.

No rock greater than three (3) inches in its longest axis shall be placed within two (2) feet of the final embankment surface and only earth used in this layer unless otherwise indicated or specified.

1107 BACKFILL – GENERAL

A. General

Backfill shall not be placed when material contains frost, is frozen, or a blanket of snow prevents proper compaction. Backfill shall not contain waste material, organic material, or debris of any kind. The method of placement and compaction, and the type of equipment used shall be at the discretion of the Contractor subject to being appropriate for the material and obtaining the specified densities for the location.

The top portion of the backfill within right-of-way areas shall be finished with at least six (6") inches of topsoil.

Whenever, in the opinion of the Engineer, the material excavated from the trenches is not suitable for backfilling, or there is a deficiency of material suitable for backfilling, the Contractor shall provide suitable material. The Contractor shall remove all excess excavated materials and shall dispose of them at locations provided by the Contractor.

B. Structures

1. Backfill around and outside of structures shall be deposited in layers not to exceed eight (8) inches in uncompacted thickness. Compaction of structure backfill by rolling will be permitted provided the desired compaction is obtained and damage to the structure is prevented. Compaction of structure backfill by inundation with water will not be permitted. No tamped, rolled, or otherwise mechanically compacted backfill shall be deposited or compacted in water.
2. Backfill around structures shall be compacted to the extent necessary to prevent future settlement, by tamping or other means acceptable to the Engineer.
3. No backfill shall be placed over or around any structure until the concrete or mortar has attained a minimum strength of 2000 psi and can sufficiently support the loads imposed by the backfill without damage.
4. The Contractor shall use utmost care to avoid any wedging action between the side of the excavation and the structure that would cause any movement of the structure. Any damage caused by premature or unbalanced backfill or by the use of equipment on or near a structure will be the responsibility of the Contractor.
5. No rock larger than six (6) inches maximum dimension shall be placed within one (1) foot of the exterior surface of any structure.
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1108 BACKFILL - TRENCHES

A. Flowable Fill

1. Location

Trench backfill shall be flowable fill for:

- All trenches crossing or within 2' of existing or proposed streets, curbs, shared use paths, sidewalks, and other public pavement.
- All portions of trenches running parallel to and within two (2) feet of the back of curb or other public pavement.
- All portions of trenches within public alleys. Flowable fill placed within gravel alleys shall be topped with six (6) to twelve (12) inches of suitable compacted aggregate material such as KDOT AB-3 or as approved by the Engineer.

All other trench backfill shall be either flowable fill or compacted earth meeting the definition of earth embankment (1102C) as indicated on the drawings and standard details, or as specified in the Special Provisions.

2. Installation

Flowable fill (flowable mortar) shall be placed so all voids in the excavation or around the structure are filled. Filling operations shall proceed simultaneously on both sides of pipe or conduit so that the two fills are kept at approximately the same elevation at all times. Place flowable fill around structures in lifts to prevent the buildup of excess hydrostatic pressure. Weather limitations for flowable fill shall be the same as for concrete.

No flowable fill shall be covered or accepted until a minimum compressive strength has been attained, as demonstrated by failure to deform or crush underfoot. The flowable fill shall be removed and replaced with an acceptable material, as approved by the Engineer, at the expense of the Contractor if the flowable fill does not harden to required strength. Acceptance of the flowable fill shall be based on visual inspection.

1109 COMPACTION

A. Moisture Control Requirements

The moisture content of the soil at the time of compaction shall be as indicated on the drawings or in the Special Provisions. If no moisture content requirements are provided, moisture content shall be above optimum moisture content percentage of the standard proctor for the soil as determined by ASTM D698 and as necessary to obtain the density specified.

When the moisture content of the soil is not satisfactory to the Engineer, water shall be added or the material aerated, whichever is needed to adjust the soil to the proper moisture content. Moisture content shall be distributed uniformly and water for correction of moisture content shall be added sufficiently in advance that proper moisture distribution and compaction will be obtained. In no case, shall water be added without the consent of the Engineer.

All work involved in either adding moisture to, or removing moisture from soils shall be considered incidental to the completion of the grading operation.

B. Compaction Control Requirements

Earth embankment/fill and backfill materials shall be placed in horizontal layers not exceeding eight (8") inches unless otherwise specified or approved by the Engineer and compacted as specified below before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compaction.

- Subgrade for Embankments. Compact to a minimum of 95% of standard proctor maximum density as determined by ASTM D698.
- Embankments/Fills. Compact to a minimum of 95% of the standard proctor maximum density for the material used as determined by ASTM D698.
- Backfill. Unless otherwise specified, compact to a minimum of 95% of the standard proctor maximum density for the material used as determined by ASTM D698.
- All fill or backfill material placed behind the curb and gutter or beneath and either side of sidewalks within the right-of-way shall be compacted such that no further consolidation is evident after additional rolling or tamping.
- Structure Backfill. Compact to a minimum of 90% of standard proctor maximum density as determined by ASTM D698. Backfill around and outside of structures that will ultimately lie under proposed pavements shall be compacted to the requirements of SECTION 1200 "Subgrade Preparation."

1110 FINAL GRADING

After embankments and backfills are completed, all areas on the site of the work, which are to be graded, shall be brought to grade at the indicated elevations, slopes, and contours, including shoulder, berm, and sidewalk spaces. The graded surface shall be made free of rock, concrete, and brick, or fragments thereof, or rubbish. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and conforming to the lines and grades shown on the plans. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. The Contractor shall repair any damaged surface and shall not use any equipment that will leave a marred surface.

Topsoil shall be placed to a minimum depth of six (6) inches in all areas indicated or specified to be seeded or sodded. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by scarifying to a depth of two (2") inches to permit bonding of the topsoil to the underlying surface. Placement of all topsoil should be done in a manner so that roadway surfaces, sidewalks, manholes, valve boxes, and other utility structures or facilities are not covered by material being placed.

1111 CLEANUP

Cleanup shall follow the work progressively and final cleanup shall follow immediately behind the finishing. The Contractor shall remove from the site of the work all debris, equipment, tools, discarded materials and other construction items. The entire right-of-way or easement shall be left in a finished and neat

condition. Cleanup shall be considered a subsidiary obligation of the grading work.

In the event the Contractor does not promptly comply with the terms of such instructions, the city may have the defective work corrected or the rejected work removed and replaced. All direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by the Contractor. The Contractor will also bear the expenses of repairing work of others destroyed or damaged by the correction, removal or replacement of defective work.

1112 SETTLEMENT

The Contractor shall be responsible for all settlement of backfill, fills, and embankments, which may occur within one year after final acceptance of the contract under which the work was performed. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer.