

SECTION 02220

STRUCTURE EXCAVATION AND BACKFILL

PART 1 - GENERAL

1. STANDARD SPECIFICATIONS

A. The following is a list of standard specifications with accompanying abbreviations used in this specification section:

- (1) American Association of State Highway and Transportation Officials Standard Specifications - AASHTO.

2. QUALITY ASSURANCE

A. See Specification Section 02250 for compaction control and testing.

B. The Owner's Representative shall be the sole and final judge of the suitability of all materials.

C. Materials in questions, pending test results, shall not be used in the work. The Contractor shall remove all materials that fail to meet the requirements of the specifications, whether in stockpiles or in place.

D. Fills, embankments, backfills, or subgrades which do not meet the specification requirements shall be removed or recompacted until the requirements are satisfied.

3. PROTECTION

A. Protection of Existing Improvements:

- (1) Protection shall be provided to prevent damage to existing improvements indicated to remain in place on the Owner's property and adjoining properties.
- (2) Damaged improvements shall be restored to their original condition, as acceptable to parties having jurisdiction.
- (3) Land areas outside the limits of permanent work performed under this contract shall be preserved in their present location. The Contractor shall confine his construction activities to areas defined for work on the drawings or specifically assigned by the Owner's Representative for his use.

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B. Protection of Existing Structures:

- (1) The Contractor shall verify all existing utility locations either shown or not shown on the drawings.
- (2) The Contractor shall immediately notify the Owner's Representative and applicable utility company of any damages to existing utilities.
- (3) Repairs to damaged utilities shall be made in accordance with the requirements of the Owner's Representative and applicable utility company at no extra cost to the Owner.
- (4) The Contractor shall coordinate with the Owner and the applicable utility company for shut-off of or connection to active utilities. Existing utility services shall not be interrupted except as authorized in writing by the Owner's Representative.

C. Protection of Work Site:

- (1) Provide barricades or other type protectors necessary to warn and prevent unauthorized personnel from entering work sites.

4. JOB CONDITIONS

A. Classification of Excavation:

- (1) No classification shall be made to differentiate the various surface and subsurface conditions the Contractor may encounter during his performance under this contract.
- (2) It is the Contractor's sole responsibility to verify the site surface and subsurface conditions.

B. Dewatering:

- (1) Excavation and embankment shall be performed in such manner that the area of the site and the area immediately surrounding the site will be continually and effectively drained by gravity or temporary pumps.
- (2) Water shall not be permitted to accumulate in excavations or other areas of the site.
- (3) The excavation shall be drained by methods which prevent the softening of subgrades and embankments.

PART 2 - PRODUCTS

1. SUITABLE MATERIALS

A. Suitable materials for fill and backfill include materials that are free of debris, roots, organic or frozen materials and stones having a maximum dimension of four (4) inches in the upper six (6) inches of fill or six (6) inches in the remainder of the fill.

B. Otherwise suitable material which is unsuitable due to excess moisture content will not be classified as unsuitable material unless it cannot be dried by manipulation, aeration, or blending with other materials to the satisfaction of the Owner's Representative.

C. Unsuitable materials shall include those materials that are determined by the Owner's Representative to be inadequate for providing a stable slope, fill, subgrade or foundation for the structure.

D. Expansive clay soils shall be classified as unsuitable unless treated or mixed in a manner approved by the Owner's Representative.

PART 3 - EXECUTION

1. EXCAVATION

A. Excavation, regardless of material encountered, shall conform to the dimensions and elevations indicated on the drawings for each building and structure, and shall include trenching for utility and foundation drainage systems to a point five (5) feet beyond the building line of each building and structure.

B. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where the concrete for walls and footings is authorized by the Owner's Representative to be deposited directly against excavated surfaces.

C. Suitable excavated material shall be transported to and placed in fill areas within the limits of the work.

D. Unsuitable materials encountered within the limits of the work shall be excavated below grade and replaced with suitable material as directed by the Owner's Representative, except that concrete footings shall be increased in thickness to the bottom of the over-depth excavations and over-break in rock excavation.

E. Excavation to final grade shall not be made until just before concrete is to be placed.

F. **Waste Material:**

- (1) No excavated material shall be wasted without the authorization of the Owner's Representative.
- (2) Surplus excavated material and unsuitable material shall be disposed of by the Contractor at his own expense and responsibility in the waste area designated by the Owner.
- (3) Material authorized to be wasted shall be disposed of in such manner as not to obstruct the flow characteristics of any stream or to impair the efficiency or appearance of any structure.

G. No excavated material shall be deposited in a manner that may endanger a partly finished structure by direct pressure or by overloading banks contiguous to the operations or that may otherwise be detrimental to the completed work.

2. **PREPARATION OF GROUND SURFACE FOR FILL**

A. Areas upon which fills are to be placed shall be cleared and grubbed before the fill is started.

B. Sloped ground surfaces steeper than one (1) vertical to four (4) horizontal on which fill is to be placed shall be plowed, stepped or benched, or broken up as directed by the Owner's Representative, in such a manner that the fill material will bond with the existing surface.

C. When surfaces on which fills are to be placed do not meet the specified density requirements, the ground surface shall be broken-up, pulverized and compacted to the specified density.

D. When surfaces on which fills are to be placed do not meet the specified moisture content requirements, the ground shall be wetted, aerated or dried to the specified moisture content.

E. When the subgrade is part fill and part excavation, the excavated portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill, unless directed otherwise by the Owner's Representative.

3. FILL AND BACKFILL

A. Fills and backfills shall conform to the dimensions and elevations indicated on the drawings for each building and structure.

B. Placing Fill and Backfill:

- (1) Suitable material shall be placed in successive horizontal uniformly spread layers of loose material not more than six (6) inches thick, except that in areas not accessible or permitted for the use of self-propelled rollers or vibrators, the loose layer shall be four (4) inches thick.
- (2) Fills and backfills shall not be placed in wet or frozen areas.

C. Backfill:

- (1) Backfill shall not begin until construction below finish grade has been completed, underground utility systems have been inspected and tested, forms removed, and the excavation cleaned of trash and debris.
- (2) Fine aggregate backfill shall be placed to the dimensions and elevations indicated on the drawings.
- (3) Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing, the area remaining shall be compacted by power-driven hand tampers suitable for the material being compacted.
- (4) Backfill shall be placed carefully around pipes to avoid damage to coatings.
- (5) Backfill shall not be placed against foundation walls prior to seven (7) days after placement of the walls.
- (6) As far as practicable, backfill shall be brought up evenly on each side of wall and sloped to drain away from the wall.
- (7) Where fill or backfill is to be placed and compacted against structure walls, the walls shall be supported laterally as necessary to prevent damaging or displacing the walls. Any wall so damaged as a result of the Contractor's operation shall be completely and promptly replaced.

STRUCTURE EXCAVATION AND BACKFILL

4. COMPACTION UNDER STRUCTURES

A. Cohesionless Soils:

- (1) Each lift of fills, embankments and backfills supporting equipment slabs, building slabs-on-grade and other structures shall be compacted to not less than 95 percent relative density.
- (2) Poorly graded gravels (GP) and sands (SW or SP) shall be placed fully saturated to prevent bulking.
- (3) Well grade gravels (GW) shall be placed at the optimum moisture content.

B. Other Soils:

- (1) Each lift of fills, embankments, and backfills and the top six (6) inches of soil in cuts supporting equipment slabs, building slabs-on-grade and other structures shall be compacted to not less than 105 percent of maximum dry density.
- (2) Each lift shall be compacted at a moisture content one (1) percent to three (3) percent above optimum moisture.

C. The barrier shall be constructed to the thickness shown on the drawings in layers not exceeding six (6) inches in compacted thickness.

D. Each layer shall be compacted to the required density with a minimum of two passes of a plate-type vibratory compactor.

6. FINISH GRADING

A. Excavated and filled sections and adjacent transition areas shall be uniformly smoothly graded. The finished surfaces shall be reasonably smooth, compacted, and free from irregular surface changes.

B. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified.

C. The surface of fills or excavated areas for slabs-on-grade shall not vary more than 0.05 foot from the established grade.

D. Other finished surfaces shall not vary more than 0.15 foot from the established grade and cross section and shall be free of depressed areas where water would pond.

SECTION 02250

COMPACTION CONTROL AND TESTING

PART 1 - GENERAL

1. WORK INCLUDED IN THIS SECTION

- A. Laboratory and field soil tests.
- B. Required compaction of soils.

2. STANDARD SPECIFICATIONS

A. The following is a list of standard specifications with the accompanying abbreviations used in this specification section:

- (1) American Association of State Highway and Transportation Officials Standard Specifications - AASHTO.
- (2) American Society for Testing and Materials Standards - ASTM

3. DEFINITIONS

A. Cohesionless Soils:

- (1) Cohesionless soils shall be clean, free-draining, coarse-grained soils for which impact compaction will not produce a well-defined moisture-density relationship curve.
- (2) **Soils** shall include variously graded sands and gravels which may contain small percentages of granular and no-cohesive fines. The portion passing the No. 200 sieve shall be limited to 12% and shall be non-plastic.
- (3) Cohesive soils shall be classified according to ASTM D 2487 as GW, GP, SW or SP.

4. QUALITY ASSURANCE

A. Laboratory Tests:

- (1) Moisture - density relations of soils (compaction test) - AASHTO T 99, Method A.

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- (2) Relative density of cohesionless soils - ASTM D 2049.
- (3) Liquid limit of soils - AASHTO T 89.
- (4) Plastic limit and plasticity index of soils - AASHTO T 90.
- (5) Particle size analysis of soils (gradation test) - AASHTO T 88.

B. Field Tests:

- (1) Density of soil in-place by the sand-cone method - AASHTO T 191.
- (2) Density of soil in-place by the rubber-balloon method - AASHTO T 205.
- (3) Density of soil and soil-aggregate in place by nuclear methods - AASHTO T 238.
- (4) Moisture content of soil and soil-aggregate in place by nuclear methods - AASHTO T 239.

C. Laboratory Tests Required:

- (1) The following tests shall be performed for each principal type of material or combination of materials encountered or utilized.
 - (a) Compaction test (0% relative density and 100% relative density tests) for cohesionless soils.
 - (b) Liquid limit test.
 - (c) Plastic limit test (and determination of plasticity index).
 - (d) Gradation test.
 - (e) **Compaction test for cohesive soils shall be standard proctor ASTM D-698.**
- (2) The tests listed above shall be performed on additional samples as directed by the Owner's Representative.
- (3) Results of these tests shall be the basis of control for compaction.

D. Field Tests Required:

- (1) Structure Excavation, Filling and Backfilling:
 - (a) One (1) in-place moisture-density test (relative density test for cohesionless soils) per 600 square yards per lift, but no more than 10 tests per lift.
 - (b) One (1) in-place moisture-density test (relative density test for cohesionless soils) per 60 square yards per lift in sub-areas enclosed by interior grade beams or interior stem walls prior to placement of fill, but not less than one (1) test per lift.
 - (c) **Three density tests per 60 square yards per lift at building pad.**
- (2) **Trench Excavation and Backfilling:**
 - (a) One (1) in-place moisture-density test (relative density test for cohesionless soils) per 100 linear feet of trench per lift under pave areas.
 - (b) One (1) in-place moisture-density test (relative density test for cohesionless soils) per 300 linear feet of trench per lift under grassed or non-traffic areas.
- (3) **Excavation, Filling and Raw Subgrade Preparation Under Paved Areas:**
 - (a) One (1) in-place moisture-density test (relative density test for cohesionless soils) per 2,000 square yards per lift.
- (4) **Excavation, Filling and Raw Subgrade Preparation Under Paved Areas:**
 - (a) One (1) in-place moisture-density test (relative density test for cohesionless soils) per 3,000 square yards per lift.
- (5) **Excavation and Filling for Dam Embankment:**
 - (a) One (1) in-place moisture density test per 2,000 square yards per lift.
- (6) Additional in-place moisture-density tests and relative density shall be performed as directed by the Owner's Representative.

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- D. Samples for laboratory and field tests shall be taken at locations designated by the Owner's Representative.
- E. Nuclear methods for determining in-place density and moisture may be used for only 80% of the required tests. The remaining tests shall be correlation check tests of the nuclear test results by use of the sand-cone method or rubber-balloon method.

PART 3 - EXECUTION

1. COMPACTION UNDER STRUCTURES

A. Cohesionless Soils:

- (1) Each lift of fills, embankments and backfills supporting equipment slabs, building slabs-on-grade and other structures shall be compacted to not less than 75 percent relative density.
- (2) Poorly graded gravel (GP) and sands (SW or SP) shall be placed fully saturated to prevent bulking.
- (3) Well graded gravels (GW) shall be placed at the optimum moisture content.

B. Other Soils:

- (1) Each lift of fills, embankment and backfills and the top six (6) inches of soil in cuts supporting equipment slabs, building slabs-on-grade, and other structures shall be compacted to not less than 105 percent of maximum dry density.
- (2) Each lift shall be compacted at a moisture content one (1) percent to three (3) percent above optimum moisture.

2. TRENCH COMPACTION

A. Cohesionless Soils:

See Part 3, Paragraph 1.1.A.

B. Other Soils:

- (1) Under equipment slabs, building slabs-on-grade and other structures: See Part 3, Paragraph 1.B.1.

- (2) Under pavements, driveways, curbs, gutters, steps, sidewalks, and similar use areas (including adjacent shoulder areas): Each lift shall be compacted to not less than 95 percent of maximum dry density up to the elevations at which the requirements for pavement subgrade compaction control.
- (3) Under grassed or landscaped areas: Each lift shall be compacted to not less than 95 percent of maximum dry density.
- (4) Each lift shall be compacted at a moisture content One (1) percent to four (4) percent above optimum moisture.

3. OVER-ALL COMPACTION

A. Cohesionless Soils:

See Part 3, Paragraph 1.1.A.

B. Other Soils:

- (1) Under pavements, driveways, curbs, gutters, steps, sidewalks, and similar use areas (including adjacent shoulder areas): Each lift shall be compacted to not less than 95 percent of maximum dry density up to the elevations at which the requirements for pavement subgrade compaction control.
- (2) Under grassed or landscaped areas: Each lift (except topsoil) shall be compacted to not less than 90 percent of maximum dry density.
- (3) Each lift shall be compacted at a moisture content one (1) percent below to four (4) percent above optimum moisture.

4. PAVEMENT SUBGRADE COMPACTION

A. Cohesionless Soils:

See Part 3, Paragraph 1.1.A.

B. Other Soils:

- (1) The top twelve (12) inches of subgrade in fill areas and the top six (6) inches of subgrade in cut areas under pavements, driveways, curbs, gutters, steps and similar use areas (including adjacent shoulder areas): Each lift shall be compacted to not less than 100 percent of maximum dry density.

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- (2) The top six (6) inches of subgrade under sidewalks and similar use areas: Each lift shall be compacted to not less than 95 percent of maximum dry density.
- (3) Each lift shall be compacted at a moisture content one (1) percent to three (3) percent above optimum moisture.

5. COMPACTION DEFICIENCIES

- A. The Owner's Representative shall be the final judge of suitability of all compaction.
- B. Apparent negligence or carelessness during any portion of the earthwork operations will require that additional tests be performed on that portion of the work.
- C. Fills, embankments, backfills or subgrades which do not meet the specification requirements shall be removed or recompact until the requirements are satisfied.

SECTION 02486

SODDING AND FERTILIZING

PART 1 - GENERAL

Bermuda grass sodding and fertilizing shall be done in accordance with Sections 230 and 232 of the Standard Specifications for Highway construction, 1988 Edition, Oklahoma State Highway Commission, except that paragraph pertaining to payment shall not apply. This project includes providing and installing 100 square yard of sod.

PART 2 - PRODUCTS

1. MATERIALS

Viable Bermuda grass sod shall conform to requirements of Section 735 of the Standard Specifications for Highway Construction, 1988 Edition, Oklahoma State Highway Commission.

2. FERTILIZER

Fertilizer shall be grade 10-20-10 (NPK) except that an alternate grade may be used provided the rate is adjusted to yield the same amount of plant food per unit area. Fertilizer shall be applied at the rate of 300 pounds per acre, and it shall be furnished and applied in accordance with the requirements of Section 234 of the Standard Specifications.

PART 3 - EXECUTION

1. SODDIG

Before any sod is installed all grading, topsoil, and dressing shall have been completed to the satisfaction of the Engineer. After sodding is complete the entire area shall be given one application of commercial fertilizer having a designation of 10-20-10. After the fertilizer has been applied, the entire treated area shall be thoroughly sprinkled as directed by the Engineer.

If there is not sufficient moisture available after sodding to insure a suitable growth, the Contractor shall continue to water as directed by the Engineer until final acceptance of the project. If erosion takes place after planting and before final acceptance, the Contractor shall fill the areas so eroded to grade and re-sod, as required.

SODDING AND FERTILIZING

The seasonal periods during which sodding shall be performed shall be April, May, June, July, August, September or as directed by the Engineer. Regardless of the dates specified, the work shall be suspended during prevailing weather that would likely cause unsatisfactory results.

3. MAINTENANCE

The Contractor shall maintain the sod at his own expense until final acceptance of the work done under this contract. Maintenance shall consist of preserving, protecting, watering, replacing, and such other work as may be necessary to keep the work in a satisfactory condition.

The Contractor shall be responsible for satisfactory growth of the sod, and until final acceptance as hereinbefore stipulated, shall water and mow the grass at such intervals as will insure a living and growing grass at the time of acceptance.

SECTION 02610

PIPE AND FITTINGS - GENERAL

PART 1 - GENERAL

1. WORK INCLUDED IN THIS SECTION

A. The requirements of this section shall apply to all exterior, underground piping installation.

2. PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall inspect materials delivered to and unloaded at the site.

B. The Contractor shall reject damaged or defective materials, and such pipes or appurtenances that do not conform to the specified requirements, remove them from the site, and replace with new materials at no additional cost to the Owner.

C. The Contractor shall store materials that may be damaged due to exposure in a protected area, at no additional cost to the Owner.

PART 2 - MATERIALS

1. All underground fittings 2" - 12" shall be ductile iron, AWWA C153, Class 350, with mechanical joint by mechanical joint ends, unless otherwise noted.

2. All underground fittings greater than 12" shall be ductile iron, AWWA C110, Class 250, with mechanical joint by mechanical joint ends, unless otherwise noted.

3. All piping is specified in Section 02622 and Section 02624.

PART 3 - EXECUTION

1. PIPE INSTALLATION

A. All required joints shall be complete with all joint accessories as specified, and shall be stored in a manner approved by the manufacturer.

B. Cutting of pipe for inseting fittings or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe and so as to leave a smooth end at right angles to the axis of the pipe. Field-cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured. Cut pipe shall be re-marked before joint assembly to assure that the spigot end is inserted to the full depth of the joint.

PIPE FITTINGS - GENERAL

C. Pipe and appurtenances shall be protected during handling against impact shocks and free fall. Under no circumstances shall pipe or appurtenances be dropped or dumped into the trench or onto the ground.

D. All pipe and appurtenances shall be unloaded as near to their point of installation as possible. Locate pipe and fittings on the opposite site of excavated material. If trench has not been excavated, locate pipe and fittings in such position that they will not interfere with the operation of trenching equipment.

E. Do not string out pipe or fittings in advance of installation in areas where damage to them may result due to construction equipment or activities.

F. All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. Damaged or defective pipe or fittings shall be laid aside for inspection by the Owner's Representative, who will decide if corrective repair is possible, or if replacement is necessary. Any corrective repair work shall be subject to the Owner's Representative's approval. No pipe or fitting which the Owner's Representative has rejected or is known to be defective shall be laid. Any rejected or defective item shall be removed and replaced at the Contractor's expense.

G. Prior to lowering pipe and fittings into the trench, the interior portions shall be cleared of all dirt and superfluous materials. All lumps, blisters and excess coating shall be removed from the joint end of each pipe and fitting. Jointing portions of each pipe shall be thoroughly cleaned to remove oil, grit, and other foreign matter.

H. Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least six (6) inches below and on all sides of pipe, fittings, and appurtenances.

I. Every precaution shall be taken to prevent foreign material from entering the pipe and fittings while being placed in the line. If the pipe laying crew cannot put the pipe or fittings into the trench and in place without getting earth into it, the Contractor shall, before lowering pipe into the trench, place a heavy, tightly woven canvas bag of suitable size over each end. During laying operation, no materials shall be placed in the pipe.

J. Pipe and fittings shall be carefully lowered into the trench, piece by piece, by means of mechanical equipment or the necessary manpower in such a manner as to prevent any damage. If damage occurs, the Owner's Representative will decide if corrective repair is possible or if replacement is necessary. Any corrective repair shall be subject to the Owner's Representative's approval.

PIPE FITTINGS - GENERAL

K. Maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall be five (5) degrees unless a lesser amount is recommended by the manufacturer.

L. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to offset conditions that might tend to move the pipe off line and grade. No pipe shall be brought into position until the preceding length has been secured in place.

M. At times when work is not in progress, open ends of the pipe fittings shall be securely closed.