



Facilities Planning and Construction Design and Construction Standards

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Preface

The Texas Tech University System's 'Design and Construction Standards', as administrated by Facilities Planning and Construction, are intended to serve as guidelines to the Design Professional and Construction Management teams for design development and construction administration of Texas Tech University System (TTUS) Capital Projects. They communicate the minimum expectations and requirements relative to specific building systems, design provisions, general specification requirements, and administrative procedures for new facilities being constructed on Texas Tech University System (ASU, MSU, TTU, TTUHSC, and TTUHSC El Paso) campuses. Several, but not all requirements for each component Institution or Agency within the TTU System are covered. Design Professionals, Construction Managers at Risk and/or Design-Build Firms shall also refer to provisions covered in their service Agreements, as well as within the project's Basis of Design (BOD) document.

In addition, the 'Design and Construction Standards' shall also be utilized in conjunction with the approved project specific Program and Schematic Design development. In the event of conflict between this document and specific project requirements, Design Professionals, Construction Managers at Risk and/or Design-Build Firms shall contact Facilities Planning & Construction for clarification.

The guidelines within the 'Design and Construction Standards' are not intended to prohibit the use of alternative design solutions, methods, systems, products or devices not covered in this document. Offered alternatives deviating from or not covered in these standards shall be documented by the Design Professional and/or Construction Management teams and submitted to Facilities Planning & Construction for approval prior to implementation.

Throughout the 'Design and Construction Standards' there are references to manufacturer specific products. These are to be considered the 'Basis of Design' to establish the expected

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minimum quality requirements. Design Professionals are encouraged to identify and include equivalent products and/or manufacturers offering comparable products to facilitate open bidding environments.

General Requirements for Earthwork

Geotechnical Survey Services

Geotechnical Surveys are to be engaged by the Design Professional through TTUS Facilities Planning and Construction (FP&C). The Design Professional will provide a site location plan of all required borings for adequate design of the project to TTUS FP&C. TTUS Facilities Planning and Construction shall assist with coordination of geotechnical survey services and witness all borings. Geotechnical services will be paid by the Design Professional and reimbursed by Texas Tech. Protect and maintain benchmarks and survey control points from disturbance during construction. If a benchmark or survey control point must be removed, establish a similar, replacement control point using a Registered Professional Land Surveyor.

Identification of Existing Utilities

The Contractor will notify TTUS FP&C and call Texas Excavation Safety System (Dig TESS) 1-800-344-8377 or 811 at least 48-hours prior to start of work.

Existing Tree and Plantings Protection

Prevent unnecessary damage and mitigate the effects of construction to existing trees and plants located within the construction zone. Prevent direct/indirect root disturbance, root damage, trunk and crown damage. Prevent soil compaction of 'critical root zone' (the area directly beneath the drip line of the tree canopy). Vehicles shall not be parked, equipment shall not be staged, and materials shall not be stored in the critical root zone of existing trees scheduled to remain.

Provide tree protection fencing around all trees scheduled to remain. All tree limbs and root pruning shall be done at the direction of the TTU Grounds Maintenance Department or a certified arborist. If existing trees are destroyed, killed, or badly damaged, because of construction operations, the contracted construction cost will be reduced by the amount of assessed damages. Damages will be evaluated by TTU Grounds Maintenance, using

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International Shade Tree Conference Standards and the following formula: (*Measurement of a cross section of tree trunk will be made at a point 2 feet above existing grade to determine cross section area in square inches. Assessment for damage will be \$40.00 per square inch.*)

Storm Water Pollution Prevention Plan (SWPPP)

Construction at Texas Tech must remain in continuous compliance with the rules and regulations enforced by the Texas Commission on Environmental Quality (TCEQ). The University campus carries its own Municipal Separate Storm Sewer System (MS4) permit, and as such, is required to be in continual compliance.

The Texas Tech Storm Water Pollution Prevention Program requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) for any project that causes a disturbance of soil on any campus of the Texas Tech University System. The plan will incorporate measures in response to and ensure compliance with the terms of the Texas Pollution Discharge Elimination System (TPDES) General Permit for Storm Discharges from Construction Activities.

Texas Tech recognizes the construction Contractor as the Operator having day-to-day operational control of those activities at the project site which are necessary to ensure compliance with a SWPPP. Texas Tech will provide the construction Contractor with a complete and comprehensive SWPPP. The Contractor shall implement, maintain, and keep current the SWPPP. The Contractor shall comply with the Texas Commission for Environmental Quality (TCEQ) General Permit and submit to TCEQ 48-hours prior to commencement of soil disturbing work. The Contractor, as well as Texas Tech, are both required to file a Notices of Intent (NOI) to discharge from the project site being constructed on any Texas Tech campus. Display the NOI and the Construction Site Notice with appropriate information at the prime exterior site entrance to the construction site and provide a copy of the NOI to the appropriate Municipal Separate Storm Sewer System (MS4) operator. Replace the NOI with the approved TCEQ permit when received.

Prior to commencement of construction activities provide Texas Tech copies of the NOI and Construction Site Notice and provide a copy of the permit, when received. The Contractor shall always keep a copy of the SWPPP, the Construction Site Notice, the NOI, and/or the Permit at the job site. The Contractor shall update the SWPPP as necessary to reflect current and

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changing site conditions and keep maintenance logs, inspection reports, and records related to compliance with the SWPPP.

The Contractor shall conduct inspections as required by TCEQ General Permit and the SW3P and maintain inspection records at the job site. The Contractor shall submit a Notice of Change (NOC) to TCEQ when required.

Upon completion of all soil disturbing activities at the site and establishing a uniform perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on the unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures, the Contractor shall notify Texas Tech that it intends to file with TCEQ a Notice of Termination (NOT) and provide to Texas Tech a copy of the proposed NOT. When approved by Texas Tech, the Contractor shall submit the NOT to TCEQ and provide a copy Texas Tech.

Provide copies or originals of all records including the SWPPP, NOI, Permit, NOT, Construction Site Notice, inspection reports, maintenance logs and records to Texas Tech.

Refer to TTU Operating Policies and Procedure 60.07 “*Storm Water Compliance Program*” for more specifics.

Erosion, Sedimentation and Dust Control

The Contractor shall establish, construct, and maintain erosion and sediment control measures. Siltation control devices shall be installed in the locations shown on the Storm Water Pollution Prevention Plan (SWPPP) before construction begins. The erosion control structures, and Best Management Practice measures shall be maintained continually until the site is substantially stabilized in compliance with TCEQ established requirements.

The Contractor, with advice and consultation of the Design Professional, shall endeavor to reduce, mitigate, stop all sediment erosion to a level of acceptance to the Owner and Design Professional.

The Contractor shall proactively oversee and execute precautionary measures to control dust

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emissions as a result of construction activities which will include, but shall not be limited to, periodic sprinkling or wetting of the site in an attempt to reduce airborne pollution as a directive of the Clean Air Act. The Contractor has the option of using a dust palliative.

31 10 00 Site Clearing

This section covers protecting existing vegetation to remain, removing existing vegetation, clearing, and grubbing, stripping and stockpiling topsoil, stripping and stockpiling rock, removing above and below grade site improvements, disconnecting, capping, sealing and removing existing and abandoned site utilities. Burning is not permitted.

Except for materials indicated to be stockpiled or otherwise remain Owner's property at the Texas Tech request, cleared materials shall become the Contractor's property and shall be removed from the project site.

Topsoil is not to be removed from the campus without expressed approval from TTUS Facilities Planning and Construction. Remove sod and grass before stripping topsoil. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials. Topsoil is to be stockpiled for either project reuse or salvage stockpiled to Texas Tech to the location stipulated by TTU Grounds Maintenance. Except for topsoil to be stockpiled or to remain Texas Tech's property, cleared materials shall become Contractor's property and shall be removed from the site.

Before beginning any demolition work, the Contractor shall carefully survey the existing conditions and examine the Drawings and Specifications to determine the extents of the Work. The Contractor shall notify the appropriate utility providers and TTUS Facilities Planning and Construction of their intent to shut-off, impact, remove or disrupt any utility services.

The Contractor shall take all necessary precautions to insure against damage to existing conditions to remain in place. Any damage shall be repaired or replaced as approved by the Design Professional and TTUS Facilities Planning and Construction at no additional cost.

The Contractor shall carefully coordinate the Work of this section with all other Work and

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construct and maintain shoring, bracing, protection and supports, as required.

The Contractor shall be responsible for ensuring the structural integrity of existing structures as required resulting from cutting, removal or demolition activities performed under any part of this contract. The extent of demolition Work is to be shown on the Contract Drawings. Coordinate with the Program Director to determine any salvaged items to be turned over to the TTUS and clearly indicate these in the project drawings and specifications.

Remove obstructions, trees, shrubs, grass, and other vegetation for areas of new construction. Completely remove stumps, roots, obstructions, and debris in areas of new construction.

Fill depressions caused during site preparation and demolition with satisfactory soil material unless further excavation or earthwork is indicated. Place fill material in horizontal layers not exceeding 8-inch loose depth and compact each layer to a density specified by the Design Professional.

Use saw cutting methods for removal of tunnel or vault walls, floors, or roofs. Do not use impact hammers for tunnel or vault removal near tunnel sections to remain. Use saw cutting methods for removal of concrete curbs and paving.

During demolition operations and the removal of debris, ensure minimum interference with roadways, walks, and adjacent occupied or used facilities. Do not close or obstruct roadways, walks or other occupied or used facilities without permission from the Owner's Representative and Architect.

Provide alternate routes around closed or obstructed traffic ways if required by the Architect, Owner, or governing regulations. Where pedestrian and driver safety are endangered, the Contractor shall provide sufficient safety precautions.

Existing utilities are to remain in service and protected against damage during demolition operations. If existing utilities are to be interrupted, notify the Architect and Owners Representative at least 72 hours in advance. All interruptions must be approved by TTUS.

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Quality Assurance:

Conduct a preinstallation conference at the project site.

Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

Verify that flows of water redirected from construction areas or generated by construction activities do not enter or cross protection zones. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 01 56 39 Temporary Tree and Plant Protection.

Verify that utilities have been disconnected and capped before proceeding with site clearing.

Do not interrupt utilities serving facilities occupied by Texas Tech or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services.

Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

31 20 00 Earth Moving

This section includes excavation and earth moving and preparations for the following:

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- 1) Excavating and filling for rough grading the site.
- 2) Preparing subgrades for slabs-on-grade, sidewalks, pavements, turfs and grasses, and plants.
- 3) Excavating and backfilling for buildings and structures.
- 4) Drainage course for concrete slabs-on-grade.
- 5) Subbase course for concrete [walks] [pavements].
- 6) Subbase course and base course for asphalt paving.
- 7) Subsurface drainage backfill for walls and trenches.
- 8) Excavating and backfilling trenches for utilities and pits for buried utility structures.

The Design Professional shall specify proctor and density requirements for backfill and replacement of fill for construction. The Design Professional shall specify compaction requirements based on the geotechnical survey report.

TTUS FP&C shall retain an independent materials testing and inspection agency to conduct specified and special inspections required for density and compaction testing. TTUS Facilities Planning and Construction shall pay for the original tests. Areas that do not meet the specified test requirements shall be re-tested until the specifications are met. The Contractor will be responsible for all costs associated with re-testing to validate the Work has been executed in compliance with the specification requirements.

TTUS FP&C shall be contacted prior to excavation any time pavement or concrete is to be removed.

Conduct a pre-excavation conference at the Project site before starting any excavation or earth moving Work. Review methods and procedures related to earthmoving, including, but not limited to, the following:

- 1) Personnel and equipment needed to make progress and avoid delays.
- 2) Coordination of the Work with utility locate services.
- 3) Coordination of Work and equipment movement with the locations of tree and plant protection zones.
- 4) Large equipment / trucking circulation and flow for spoils piling, spoils loading, and spoils haul-off.

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- 5) Extents of utilities trenching by large equipment, air spade, and/or by hand.
- 6) Field quality control measures and safety control procedures.
- 7) Import fill requirements. If borrow (import) fill is to be used, the following soils analysis testing is required to be submitted by the earthwork Contractor. The sampled soil must be taken from the stockpile location within the pit from which the earthwork Contractor intends to source, load, and haul for Project site backfill.
 - A. **Synthetic Precipitation Leaching Procedure (SPLP)**
 - B. **RCRA (Metals 8)** – Identify presence and quantity of the following:
Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Lead (Pb), Mercury (Hg), Selenium (Se), and Silver (Ag).
 - C. **Total Petroleum Hydrocarbons (TPH)**
 - D. **Pesticides** (presence and quantity)

Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without approval from Texas Tech. Provide alternate routes around closed or obstructed traffic ways if required by Texas Tech. Do not direct vehicle or equipment exhaust towards protection zones.

MATERIALS

Provide borrow (import) soil materials when sufficient satisfactory soil materials are not available from excavations.

Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a

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1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 - 5 percent passing a No. 8 sieve.

Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.

Sand: ASTM C 33/C 33M; fine aggregate.

Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods:

- 1) Survivability: Class 2; AASHTO M 288.
- 2) Apparent Opening Size: As specified by Engineer; ASTM D 4751.
- 3) Permittivity: As specified by Engineer; ASTM D 4491.
- 4) UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:

- 1) Portland Cement: ASTM C 150/C 150M, Type I, Type II, or, Type III, contingent on site conditions and requirements.
- 2) Fly Ash: ASTM C 618, Class C or F.
- 3) Normal-Weight Aggregate: ASTM C 33/C 33M, 3/8-inch nominal maximum aggregate size.
- 4) Foaming Agent: ASTM C 869/C 869M.

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- 5) Water: ASTM C 94/C 94M.
- 6) Air-Entraining Admixture: ASTM C 260/C 260M.
- 7) Compressive Strength: 1,200 – 1,500psi.

Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

- 1) Red: Electric.
- 2) Yellow: Gas, oil, steam, and dangerous materials.
- 3) Orange: Telephone and other communications.
- 4) Blue: Water systems.
- 5) Green: Sewer systems.

PROTECTION & DEWATERING DURING EARTHWORK

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations. Protect and maintain erosion and sedimentation controls during earth-moving operations. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

EXCAVATION

Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface

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and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials. Remove rock to lines and grades indicated to permit installation of permanent Construction.

Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation. Intermittent drilling, ram hammering; or ripping of material not classified as rock excavation is earth excavation. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction.

Excavation for Structures: Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

Excavation for Walks and Pavement: Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

Excavations at Edges of Tree- and Plant-Protection Zones: Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots. Cut and protect roots according to requirements in Section 01 56 39 Temporary Tree and Plant Protection.

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Excavation for Utility Trenches: Excavate trenches to indicated gradients, lines, depths, and elevations. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

- 1) For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
- 2) For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
- 3) For flat-bottomed, multiple-duct conduit units, excavate trench bottoms and support conduit on an undisturbed subgrade.
- 4) Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

Trenches in Tree- and Plant-Protection Zones: Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut and protect roots according to requirements in Section 01 56 39 Temporary Tree and Plant Protection.

Storage of Soils: Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

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BACKFILL

Backfill: Place backfill on subgrades free of mud, frost, snow, or ice. Place and compact backfill in excavations promptly, but not before completing the following:

- 1) Construction below finish grade including, where applicable, subdrainage, damp proofing, waterproofing, and perimeter insulation.
- 2) Surveying locations of underground utilities for Record Documents.
- 3) Testing and inspecting underground utilities.
- 4) Removing concrete formwork.
- 5) Removing trash and debris.
- 6) Removing temporary shoring, bracing, and sheeting.
- 7) Installing permanent or temporary horizontal bracing on horizontally supported walls.

Utility Trench Backfill: Place backfill on subgrades free of mud, frost, snow, or ice. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 Cast-in-Place Concrete.

Trenches under Roadways: Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 30 00 Cast-in-Place Concrete.

Backfill voids with satisfactory soil while removing shoring and bracing.

COMPACTION

Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

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Compact soil materials to not less than the percentages of maximum dry unit weight according to ASTM D 698 or ASTM D 1557, as specified by the Engineer of Record.

GRADING

Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated. Provide a smooth transition between adjacent existing grades and new grades. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances. For site rough grading, slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

- 1) Turf or Unpaved Areas: Plus or minus 1 inch.
- 2) Walks: Plus or minus 1/2 inch.
- 3) Pavements: Plus or minus 1/2 inch.

Grading inside Building Lines: Finish exterior subgrades to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

QUALITY CONTROL

TTUS FP&C will engage a qualified geotechnical engineering testing agency to perform tests and inspections. Allow the testing agency to inspect and test subgrades and each fill or backfill layer/lift. Proceed with subsequent earth moving only after test results for previously completed Work comply with specification requirements.

The testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable and as specified by the Engineer of Record. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer of

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Record and Texas Tech.

Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 500 sq. ft. or less of paved area or building slab but in no case fewer than three tests.

Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 75 feet or less of wall length but no fewer than two tests.

Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 100 feet or less of trench length but no fewer than two tests and to 4 feet vertical intervals throughout the backfill. Tests taken in 4 feet intervals shall be staggered.

PROTECTION AFTER EARTHWORK IS COMPLETED

Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

DISPOSAL OF SURPLUS AND WASTER MATERIALS

Surplus soils become the property of the Earthwork Contractor. Remove surplus soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose off Owner's property.

Transport surplus satisfactory soil to designated storage areas as directed by TTUS FP&C on Owner's property. Stockpile or spread soil as directed by TTUS FP&C and institution's Grounds Maintenance department. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

31 23 19 Dewatering

Conform to the requirements of TCEQ for dewatering purposes. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer licensed in the State of Texas.

It is the Contractors responsibility to continuously monitor, record, and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

Prevent surface water from entering excavations by grading, dikes, or other means.

Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.

Remove dewatering system when no longer required for construction.

Comply with governing TCEQ regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of Work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

31 31 16 Termite Control

Effective preconstruction treatment for subterranean termite prevention requires the establishment of complete vertical and horizontal chemical barriers or approved physical barriers between wood in the structure and the termite colonies in the soil. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

Provide a continuous soil treatment zone under all new construction. Coordinate soil treatment application with excavating, grading, and concrete placement for footings, grade beams, and slabs. Treat soil under footings, grade beams, and slabs. The treatment must be applied prior to the vapor barrier being installed. To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring.

For Horizontal Chemical Barriers, applications shall be made using a low-pressure spray after grading is completed and prior to the pouring of the slab or footing to provide thorough and continuous coverage of the area being treated.

For Vertical Chemical Barriers, establish vertical barriers in areas such as around the base of foundations, plumbing lines, backfilled soil against foundation walls and other areas, which may warrant more than just a horizontal barrier.

Provide EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.

Preinstallation Conference: Conduct conference at Project site.

Toxicant shall be applied per manufacturer's label. Provide Owner with a Soil Treatment Application Report. Do not apply when weather conditions favor drift from treated area. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction. Toxicant shall not be injurious to plant life and shall be accepted by the Environmental Protection Agency and State authorities having jurisdiction, including TCEQ.

Examine substrates, areas, and conditions, with Applicator present, for compliance with

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requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

Applicator of soil treatment shall be a State of Texas licensed pest control operator in the Termite Category for a minimum of five (5) years.

Warrant building and equipment to be free from infestation by subterranean termites for a period of five (5) years from Date of Substantial Completion. Should infestation occur, provide additional treatment as required, and repair or replace damaged building or equipment to its original condition and re-implement termite control at no cost to TTUS.

31 50 00 Excavation and Support Protection

The Contractor shall call Texas Excavation Safety System (Dig TESS) 1-800-344-8377 or 811 at least 48 hours prior to start of work. The Contractor is responsible for locating and protecting all utilities including the utility tunnels. Utilities shown on the Drawings are based on the available information.

The Contractor shall maintain utility service to the existing buildings throughout construction. Any utility interruption must be approved by and coordinated with the utility Owner and TTUS. Tests shall be performed by an independent laboratory selected by the Owner. Only passing tests shall be paid for by the Owner. Test results shall be submitted to the Design Professional for review.

Engage a qualified professional engineer, as defined in Section 01 40 00 Quality Requirements, to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:

- 1) Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
- 2) Compliance with AASHTO Standard Specification for Highway Bridges or AASHTO LRFD Bridge Design Specification, Customary U.S. Units.
- 3) Compliance with requirements of authorities having jurisdiction.

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- 4) Compliance with utility company requirements.
- 5) Compliance with railroad requirements.

The Contractor shall perform all excavations to the depths shown on the Drawings or as specified. During excavation, materials suitable for backfilling shall be piled a sufficient distance from the banks of the excavation to avoid overloading and to prevent slides and cave-ins. Excavated materials not suitable or required for fill or back-fill shall be removed from the site. All excavation shall be made by open cut. No tunneling shall be done unless shown on the Drawings.

All excavations are to be performed in strict accordance with OSHA Regulations. Before commencing any trench excavation that will exceed a depth of five feet, Contractor shall provide to Texas Tech a copy of any geotechnical investigations used for preparation of detailed Drawings and Specifications regarding the safety systems to be utilized. The Contractor shall submit a trenching plan that is approved and sealed by a professional engineer registered in the State of Texas and employed by the Contractor. Said engineer cannot be anyone who is employed on this Project by Texas Tech. Receipt of the plan is a prerequisite to the start of trenching. It is the Contractor's responsibility to comply with any additional requirements resulting from any pre-bid conference relating to coordination of geotechnical investigation subjects.

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

Monitor and maintain excavation support and protection system. Prevent surface water from entering excavations by grading, dikes, or other means. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to

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ensure that damage to permanent structures is prevented.

Promptly remediate detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.