

SECTION 31 23 16 EXCAVATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavating for footings and foundations, slabs and other concrete facilities and trenches.
- B. Disposal of unsuitable excavated material.
- C. Protecting existing facilities, utilities and structures affected by excavation.
- D. Shoring, cribbing, dewatering and related work.

1.2 RELATED SECTIONS

- A. Section 31 05 13 - Common Fill
- B. Section 31 23 23 - Backfilling
- C. Section 31 23 26 - Compaction
- D. Section 31 41 00 - Shoring

1.3 PROTECTION

- A. Protect trees and other features to remain as a portion of final landscaping.
- B. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from equipment and vehicular traffic.
- C. Protect above and below grade utilities which are to remain. Contact utility companies to repair damage to utilities. CONTRACTOR shall pay all cost of repairs to damaged utilities.
- D. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- E. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- F. Protect subgrade from desiccation, flooding and freezing.
- G. Do not fill adjacent to structures until Excavation is checked by ENGINEER.
- H. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become over-stressed or moved from alignment.
- I. Do not disturb or damage foundation perimeter drainage, foundation, damp-proofing, foundation waterproofing and protective cover, or utilities in trenches.
- J. Grade excavation top perimeter to prevent surface water runoff into excavation.

1.4 DEFINITIONS

- A. Extra Excavation: Upper limit of Excavation is proposed excavation limit. Lower and lateral limits are as authorized by ENGINEER.
- B. Classified Excavation: The excavation of specified materials.
- C. Incidental Excavation: Excavation done for CONTRACTOR's benefit, excavation error, dewatering of Excavation, sough, or over-break.
- D. Unclassified Excavation: The excavation of all materials encountered regardless of the nature, size, or manner in which they are removed. Presence of isolated

boulders or rock fragments will not be sufficient cause to change classification or surrounding materials.

1.5 STORAGE AND HANDLING

- A. Movement of construction machinery over Work at any stage of construction is solely at CONTRACTOR's own risk.
- B. Stockpile imported material to cause a minimum of inconvenience to public and provide for emergency services as necessary.
- C. Provide free flow of storm water in all gutters, conduits, and natural water courses.
- D. Remove excavated material from site.

1.6 SITE CONDITIONS

- A. Prior to excavation, photograph existing surfaces and structures near which work will take place in order to determine, after construction is completed, whether any damage to existing improvements occurred prior construction operations.
- B. Perform Incidental Excavation at no additional cost to OWNER.
- C. Slope, shore, sheet, brace or otherwise support excavations over 4 feet deep in accordance with Section 31 41 00. When soil conditions are unstable, excavations shallower than 4 feet deep must also be sloped, supported or shored.
- D. Keep excavation free from surface and ground water. If groundwater table is within the intended construction operations area, dewater Excavations. Discharge pumped groundwater to storm drain lines indicated in drawings. Contractor shall obtain a permit from Taylorsville City and follow all restrictions associated with the permit.
- E. Unsuitable Weather Limitations: Do not place, spread, or roll any fill material during unsuitable weather conditions. Do not resume operations until moisture content of material is satisfactory.
- F. Weather Softened Sub-grade: Remove and replace at no additional cost to Owner.
- G. Protection of Graded Areas: Protect from traffic and erosion. Keep free of trash and debris. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- H. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded and rutted areas.

PART 2 – PRODUCTS

2.1 MATERIALS FOR OVER EXCAVATED AREAS

- A. Select Fill: In accordance with Section 31 05 13

PART 3 – EXECUTION

3.1 PREPARATION FOR EXCAVATION

- A. Notify Engineer prior to starting any excavation.
- B. Use white paint and mark the proposed excavation area.
- C. Identify requires lines, levels, contours, and datum.
- D. Identify known underground utilities. Call Blue Stakes of Utah at least 24 hours in advance to have utilities staked and marked.
- E. Identify and flag surface and aerial utilities.
- F. Maintain and protect existing utilities remaining which pass through work area.

3.2 EXCAVATION

- A. Carefully excavate soils in vicinity of buried utility marks placed by Blue Stakes.
- B. Where soil has been softened or eroded by flooding or hardened by drying during unfavorable weather, rework all damaged areas or replace with approved material at no additional cost to owner.
- C. Notify ENGINEER of unexpected subsurface conditions.
- D. Protect excavation walls as required. If conditions permit, slope excavation sides to maintain a safe and clean working area. Remove loose materials.
- E. Where ENGINEER deems subgrade material susceptible to frost heave or otherwise unsatisfactory, excavate additional depth.
- F. Excavate required subsoil for building, structures, foundations, construction operations, or similar work.
- G. If unsuitable material is encountered at the bottom of the excavation, over-excavate as directed by the Engineer, and backfill with suitable materials.
- H. Correct unauthorized excavation at no cost to the Owner.
- I. Remove and dispose of all excavated material.

3.3 TRENCH EXCAVATIONS

- A. Grade bottom of trenches to provide uniform bearing surface.
- B. If necessary, make bellholes and depressions required to complete joining of pipe or box.
- C. Limit trench excavations to the dimensions suitable for worker access per pipe manufacturer's recommendations. Provide enough space for compaction equipment. Notify ENGINEER if excavation operations exceed any indicated line and grade limits.

3.4 EXTRA EXCAVATION

- A. If unstable material is encountered at the bottom or face of any excavation, do not perform extra excavation without written consent.
- B. Correct excavations beyond the specified lines and grades by filling and compacting the resulting voids with acceptable fill.
- C. Volume of Excavation within any specified pay limit will be determined by the method average end areas in the original position.

3.5 TOLERANCES

- A. Grading: Top surface of subgrade = plus or minus one inch.

3.6 REPAIR OF DAMAGED FOUNDATIONS

- A. Restore any damaged structure to its original strength or condition and re-backfill.

-END OF SECTION-

SECTION 31 23 23 BACKFILLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Backfilling under footings and foundations, slabs and other concrete facilities and trenches.
- B. Structural backfill materials and requirements.
- C. Trench backfill materials and requirements,
- D. Surface restoration requirements.

1.2 PROTECTION

- A. Protect trees and other features to remain as a portion of final landscaping.
- B. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from equipment and vehicular traffic.
- C. Protect above and below grade utilities which are to remain. Contact utility companies to repair damage to utilities. CONTRACTOR shall pay all cost of repairs to damaged utilities.
- D. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work
- E. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- F. Protect subgrade from dessication, flooding and freezing.
- G. Do not fill adjacent to structures until Excavation is checked by ENGINEER.
- H. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become over-stressed or moved from alignment.
- I. Do not disturb or damage foundation perimeter drainage, foundation, damp-proofing, foundation waterproofing and protective cover, or utilities in trenches.
- J. Grade excavation top perimeter to prevent surface water runoff into excavation.

1.3 SUBMITTALS

- A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
 - 1. Subgrade material
 - 2. Each type of fill to be used
- B. Upon ENGINEER's request, submit a written quality control Inspections and Testing report describing source and field quality control activities performed by CONTRACTOR and its fill Supplier.

1.4 DEFINITIONS

- A. Common Fill: Fill or borrow materials which are naturally occurring, screened or graded and to meet a specific gradation including sewer rock, untreated base course, and pea gravel.

- B. Select Fill: Fill or borrow materials which are naturally occurring, screened or graded, or mixed to meet a specific gradation or classification including borrow, granular borrow, granular backfill borrow, and sand.
- C. Bedding: That surface of the Excavation or portion of the Pipe Zone below the pipe.
- D. Pipe Zone: That zone in a backfilling operation which supports, and surrounds the pipe barrel, and extends to 1 foot above the top of the pipe barrel.

1.5 QUALITY ASSURANCE

- A. Do not change material sources or aggregate without ENGINEER's knowledge.
- B. Reject backfill material that does not comply with requirements specified in this section.

1.6 STORAGE AND HANDLING

- A. Safely stockpile backfill materials.
- B. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.
- C. Stockpile imported material to cause a minimum of inconvenience to public and provide for emergency services as necessary.
- D. Provide free flow of storm water in all gutters, conduits, and natural water courses.

1.7 PROTECTION

- A. During installation or repair, plug end of pipe or fitting except when installing next section of pipe or fitting.
- B. Avoid displacement of and injury to Work while compacting or operating equipment.
- C. Movement of construction machinery over Work at any stage of construction is solely at CONTRACTOR's own risk.

1.8 SITE CONDITIONS

- A. Do not place, spread or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to OWNER.
- B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded and rutted areas.
- C. Reshape and compact damaged structural section to required density.
- D. Restore any damaged structure to its original strength and condition.
- E. Replace contaminated backfill at no cost to OWNER.

1.9 ACCEPTANCE

- A. General:
 - 1. Native material may NOT be used as backfill. All excavated native material shall be removed from site.
 - 2. For material acceptance refer to
 - a. Common Fill, Section 31 05 13

B. Structure Backfilling: One test per lot.

Table 1: Lot Size for Structural Backfilling Operations		
Structure Type	Test Criteria	Lot Size
Strip Footings	Standard (a)	Subgrade: 200 lineal feet
	Modified (a)	Crushed aggregate base: 200 lineal feet per lift
Common Fill	Standard (a)	Subgrade: 2225 lineal feet
	Modified (a)	Crushed aggregate base: Each 225 square feet per lift
Embankments	Standard (a)	Fill: 625 square feet per lift
Miscellaneous small structures (e.g. Manholes, drainage boxes, etc.)	Standard (a)	Subgrade: Each footprint area Fill: Each lift
	Modified (a)	Crushed Aggregate Base: Each Lift
Notes		
(a) Proctor Density, Section 31 23 26		
(b) Lift Thickness before compaction, 6 inches.		

C. Trench Backfilling: One test per lot.

Table 2: Lot Size for Trench Backfilling Operation		
Material	Test Criteria	Lot Size
Subgrade	Standard (a)	200 lineal feet
Common Fill	Standard (a)	200 lineal feet per lift
		25 square feet of footing area per lift
Crushed Aggregate Base	Modified (a)	200 lineal feet per lift
		25 square feet of footing area per lift
Flowable Fill	Strength (b)	50 cubic yards
Notes		
(a) Proctor Density, Section 31 23 26		
(b) Compressive strength, Section 21 23 26		
(c) Lift Thickness above the pipe zone before compaction, 6 inches.		

1.10 WARRANTY

- A. Restore incidentals damaged by settlement at no additional cost to OWNER.
- B. Any settlement noted in Trench backfill or in structures built over the Trench backfill will be considered to be caused by improper compaction methods and shall be corrected at no cost to OWNER.

PART 2 – PRODUCTS

2.1 BACKFILL MATERIALS

- A. Select Fill: In accordance with Section 31 05 13
- B. Slag or asphalt bearing material not allowed.

2.2 ACCESSORIES

- A. Water:
 - 1. Make arrangements for sources of water during construction and make arrangements for delivery of water to site.
 - 2. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from utility company.
- B. Geotextile Fabric: Section 31 05 19

PART 3 – EXECUTION

3.1 PREPARATION

- A. Verify that:
 - 1. Stockpiled fill meets gradation requirements.
 - 2. Foundation walls are braced to support surcharge forces imposed by backfilling operations, areas to be backfilled are free of debris, snow, ice or water.
 - 3. Ground surface is not frozen.
- B. Compact the top 8 inches of the subgrade surfaces to density requirements for the fill material to be placed over the subgrade.
- C. Excavate soft areas of subgrade not readily capable of in-situ compaction. Backfill with granular borrow and compact to density with granular borrow and compact to density equal to requirements for subsequent backfill material. CONTRACTOR shall not proceed with over excavation without the approval of the ENGINEER.
- D. Avoid injuring and displacement of pipe and structures while compacting soil or operating equipment next to pipeline.
- E. Place and compact select fill materials in continuous lifts not exceeding 6 inches depth, unless specifically allowed.
- F. Place and compact common fill material in continuous lifts not exceeding 8 inches in depth.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.

- H. Backfill against supported foundation walls. Backfill simultaneously on each side of unsupported foundation walls, where possible.
- I. Slope grade away from structure at a minimum of 3 inches in 10 feet, unless otherwise noted.
- J. Make smooth changes in grade. Blend slopes into level areas.
- K. Use any surplus fill material on site.
- L. Leave any allowed stockpile areas in neat, evenly graded condition, as directed by the Engineer.
- M. Backfill utility trenches according to drawing details.

3.2 PROTECTION

- A. Protect existing trees, shrubs, lawns, existing structures, fences, roads, sidewalks, paving, curb and gutter and other features.

3.3 LAYOUT

- A. Maintain all benchmarks, control monuments and stakes, whether newly established or previously existing. Protect from damage and dislocation.
- B. If discrepancy is found between Contract Documents and site, ENGINEER shall make such minor adjustments in the Work as necessary to accomplish the intent of Contract Documents without increasing the Cost of the Work to CONTRACTOR or OWNER.

3.4 FOUNDATIONS AND SLABS ON GRADE

- A. Place backfill materials in lifts not exceeding 6 inches after compaction.
- B. Do not backfill against walls until concrete has obtained its 28-day design strength. Backfill against foundation walls simultaneously on each side.
- C. Fill unauthorized excavations with material acceptable to the ENGINEER at no additional cost to OWNER.
- D. Do not damage adjacent structures or service lines.

3.5 GENERAL TRENCH BACKFILLING

- A. Protect subgrade from dessication, flooding and freezing.
- B. Do not damage corrosion protection on pipe.
- C. Repair or replace damaged pipe at not additional cost to OWNER.
- D. Withdraw sheathing, shoring, piles and similar supports as backfilling progresses. Backfill and compact all holes left by removals.
- E. Provide sufficient water quality facilities to protect downstream fish and wildlife and to meet State water quality requirements.
- F. Water settling of trench back fill is not permitted. "Jetting" of trench backfill is prohibited.

3.6 PIPE ZONE

- A. Maintain uniform foundation along barrel of pipe with sufficient relief for joint connections.
- B. Do not permit free fall of backfill material which may damage pipe, pipe finish, or pipe alignment

- C. Except where piping must remain exposed for tests, fill pipe zone as soon as possible.

3.7 TRENCH ABOVE PIPE ZONE

- A. Maximum lift thickness before compaction is 6 inches.
- B. Fill unauthorized excavations with material acceptable to ENGINEER at no additional cost to owner.
- C. Do not damage adjacent structures or service lines.
- D. Install continuous plastic line marker directly over buried lines 18 inches below finished grade.
- E. Any changes in trench backfilling method shall be approved by ENGINEER.

3.8 TOLERANCES

- A. Finished grade of backfilling shall be plus or minus 0.5 inch.

3.9 REPAIR OF DAMAGED FOUNDATIONS

- A. Restore any damaged structure to its original strength or condition and re-backfill.

3.10 COMPACTION SCHEDULES

- A. Locations, fill material to be used, compacted thickness of each fill, and compaction expressed as a percentage of maximum density ASTM D 698 are as follows:
 1. Under Footings: Compact granular borrow in 6-inch lifts to 98 percent.
 2. Interior Slab-On-Grade: Compact granular borrow to thickness indicated in 6-inch lifts to 98 percent.
 3. Exterior Side of Foundation Walls and Retaining Walls: Subsoils or select fill, each 6-inch lift compacted to 92 percent.
 4. Interior side of Foundation Walls and Retaining Walls: Subsoils or select fill, each 6-inch lift compacted to 98 percent.
 5. Miscellaneous Structures: Backfill with granular borrow compacted to 96 percent.
 6. Trenches: 95 percent or greater of a Standard Proctor Density.

3.11 CLEANING

- A. Remove stockpiles from the site. Grade site to prevent free standing surface water.

-END OF SECTION-

SECTION 31 23 26 COMPACTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compaction of granular fill materials for footings and foundations, slabs and other concrete facilities and trenches.

1.2 REFERENCES

- A. AASHTO T180 – Moisture-Density Relations of Soils Using a 10lb (4.54 Kg) Rammer and an 18 Inch (457 mm) Drop
- B. ASTM D 698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5lb (2.49 Kg) Rammer and 12 inch (304.8) Drop
- C. ASTM D 1556 – Test Method for Density Relations of Soil in Place by the Sand-Cone Method
- D. ASTM D 1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop
- E. ASTM D 2167 – Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- F. ASTM D 2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- G. ASTM D 3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures

1.3 PROTECTION

- A. Protect trees and other features to remain as a portion of final landscaping.
- B. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from equipment and vehicular traffic.
- C. Protect above and below grade utilities which are to remain. Contact utility companies to repair damage to utilities. CONTRACTOR shall pay all cost of repairs to damaged utilities.
- D. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- E. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- F. Protect subgrade from dessication, flooding and freezing
- G. Do not fill adjacent to structures until Excavation is checked by ENGINEER.
- H. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become over-stressed or moved from alignment.
- I. Do not disturb or damage foundation perimeter drainage, foundation, damp-proofing, foundation waterproofing and protective cover, or utilities in trenches.
- J. Grade excavation top perimeter to prevent surface water runoff into excavation.

1.4 SUBMITTALS

- A. Submit samples in accordance with Section 01 00 00.
- B. Submit 50lb samples of each type of fill to Engineer in airtight containers.
- C. Submit maximum laboratory dry density and optimum laboratory moisture content for:
 - 1. Subgrade material
 - 2. Each type of fill to be used
- D. Upon ENGINEER's request, submit a written quality control Inspections and Testing report describing source and field quality control activities performed by CONTRACTOR and its fill Supplier.

1.5 DEFINITIONS

- A. A-1 Soil: Defined as ASTM D 3282.
- B. Modified Proctor Density: The maximum laboratory density, as defined in and determined by ASTM D 1557 using procedure A, B, or C as applicable.
- C. Relative Density (or Relative Compaction): The ratio of field dry density to the maximum laboratory density expressed as a percentage.
- D. Standard Proctor Density: The maximum laboratory density, as defined in and determined by ASTM D 698 using procedure A, B or C as applicable.

1.6 QUALITY ASSURANCE

- A. Use a laboratory that follows and complies with ASTM D 3740.

PART 2 – PRODUCTS-Not Used

PART 3 – EXECUTION

3.1 COMPACTION

- A. Moisten or dewater backfill material to obtain optimum moisture for compaction.
- B. Correct deficient compaction conditions. Replace or repair materials and damaged facilities.
- C. When no density compactive effort is specified, compact the entire area to eliminate unstable zones.

3.2 FIELD QUALITY CONTROL

- A. Testing: Perform control testing of materials. Perform additional testing at no additional cost to OWNER.
 - 1. Because of changes in source materials or proportions requested by CONTRACTOR.
 - 2. Because of failure of materials to meet specification requirements.
 - 3. For other testing services needed or required by CONTRACTOR.
- B. Report: For each material tested, record the following
 - 1. Vertical and horizontal location of the test
 - 2. Optimum laboratory moisture content.

3. Field moisture content.
 4. Maximum laboratory dry density.
 5. Field density.
 6. Percent Compaction Results
 7. Certification of test results by testing agency.
- C. Optimum Soil Density: Use ASTM D 2216 and the following industry standards.
1. For A-1 Soils: Use test method C of ASTM D 1557 (Modified Proctor)
 2. For all other soils: Use test method C of ASTM D 698 (Standard Proctor)
- D. Field Density:
1. Use ASTM D 3017 and test method C of ASTM D 2922 for shallow depth nuclear testing.
 2. No density determinations are required on any material containing more than 65 percent material retained on the number 10 sieve or more than 60 percent material retained on the number 4 sieve. In lieu of reporting densities in such cases, report the sieve analysis to document the material type.

3.3 COMPACTION TESTING

- A. If tests indicate work does not meet specified compaction requirements, remove work, replace and retest at no cost to the Owner.

3.4 SCHEDULES

- A. Locations, fill material to be used, compacted thickness of each fill, and compaction expressed as a percentage of maximum density ASTM D 698 are as follows:
1. Under Footings: Compact granular borrow in 6-inch lifts to 98 percent.
 2. Interior Slab-On-Grade: Compact granular borrow to thickness indicated in 6-inch lifts to 98 percent.
 3. Exterior Side of Foundation Walls and Retaining Walls: Subsoils or select fill, each 6-inch lift compacted to 92 percent.
 4. Miscellaneous Structures: Backfill with granular borrow compacted to 96 percent.
 5. Trenches: 96 percent or greater of a Standard Proctor Density.

-END OF SECTION-

