

DIVISION 31 – EARTHWORK

31 0916.21 – PILE LOAD TESTS

- A. To be determined by project engineer.

31 1000 - SITE CLEARING

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction
- B. Utility Locator Service: Notify North Dakota One Call for area where Project is located before site clearing.
- C. Do not commence site-clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- D. Locate, identify, disconnect, and seal or cap utilities indicated.
- E. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others without permission.
- F. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
- G. Remove sod and grass before stripping topsoil.
- H. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

31 2000 - EARTH MOVING

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- B. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 1 inch in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M ; NDDOT Class 5 if receive concrete of HBP surface Class 13 if no coverage.
- D. 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 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. 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.

University of North Dakota

- F. Drainage Course: Narrowly graded mixture of washed rock; ASTM D 448; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.
- G. Filter Material: Narrowly graded mixture of natural or crushed stone and natural sand; ASTM D 448; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.
- H. Sand: ASTM C 33/C 33M; fine aggregate.
- I. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, NDDOT Type S:
- J. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, NDDOT Type R.
- K. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 2 inches wide and 4 mils thick, continuously inscribed with a description of the utility; following ND One Call requirements.
- L. Dewatering: Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- M. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
- N. 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.
- O. 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. This may be accomplished using bedding sand.
- P. Subgrade Inspection: Notify Architect when excavations have reached required subgrade.
- Q. Place and compact backfill in excavations promptly. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content. Place backfill and fill soil materials in layers not more than 6 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.
- R. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 to 98% of standard proctor density.
- S. 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.
- T. Place base course on subgrades free of mud, frost, snow, or ice.
 - 1. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698 if under pavement or concrete.

- U. Place drainage course on subgrades free of mud, frost, snow, or ice.
- V. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade to 95% of standard proctor density.

31 2200 – GRADING

- A. For general projects, rough grade level shall be twelve (12) inches below finish grade.
- B. For general projects, the final slopes of the finish grade should not exceed 3:1. If grade exceeds 3:1 see Section 32 32 00.
- C. Topsoil shall be salvaged from the construction site for reuse.
- D. Contractor provided topsoil shall be natural loam, which is fertile, friable, surface soil, reasonably free of subsoil, clay lumps, brush, weeds, rhizomes, litter, roots, stumps, stones larger than 1/2" in any dimension, construction debris, and other extraneous or toxic matter harmful to plant growth. Owner to inspect topsoil source or individual loads of topsoil prior to placement. Verify suitability of topsoil with Owner.
- E. Topsoil shall be lightly compacted when placed, but shall not be compacted to achieve grade.
- F. Topsoil shall be placed manually and roots, weeds, rocks, and foreign material shall be removed while spreading to prevent damage to existing plants.
- G. Contractor shall place topsoil to the following compacted thicknesses:

Application	Compacted Topsoil Depth
Seeded with Grass	6" minimum
Shrub Beds	18" minimum
Flower Beds	18" minimum
Planter Boxes	To within 3" of box rim

31 2300 – EXCAVATION AND FILL

- A. For general projects, earth backfill compacted to 95% minimum density as per Standard Proctor ASTM D698-91 in six (6) inch lifts.
- B. Backfill the areas affected by the new concrete work with clean black dirt that shall be free of debris and be fine graded – ready for planting and seeding.
- C. Compaction:
 1. Sub-grade shall be between 95 to 105 percent of maximum density as determined by ASTM D698 in the top 12 inches of the sub-grade.
 2. The Contractor may scarify, dry the material, or apply water as necessary to obtain the required density and stability.
 3. Material that will not compact readily shall be removed and replaced with Owner approved suitable material.

- D. Fill:
- a. Sub-grade areas that require fill to bring the elevation up to the base course shall be compacted in 6 inch lifts to 95 to 105 percent of maximum density.
 - b. No stones larger the three inches in diameter are permitted in fill as well as other objectionable material.
 - c. Fill outside the pavement areas are to be compacted to 90 percent.
 - d. Backfill the areas affected by the new concrete work with clean black dirt that shall be free of debris and be fine graded – ready for planting and seeding.
 - e. Based on project size & scope, Owner may backfill and/or restore all plantings, including the grass.
 - f. Surfaces shall be broom-cleaned of any debris or dirt when site is left.

31 2316 – TRENCHING AND ROCK REMOVAL

- A. All underground plumbing pipe shall be bedded in accordance with drawing 68.01 from the City of Grand Forks Engineering Department (Pipe Bedding Details), found at the end of section 31 2316. Unless otherwise noted, all underground pipes (with the exception of PVC pipe) shall be installed on Class B Bedding. All PVC pipe shall be installed on PVC Pipe Bedding according to type of pipe and depth of cover as follows:
1. PVC sewer and water pipe with less than 21 feet of cover - bedding shall be Special Class I gravel. The material shall consist of sound, durable particles of gravel and sand, with which may be included limited amounts of fine soil particles as binding material. It shall not contain sod, roots, plants and other organic matter, or any other objectionable materials.
 2. All PVC pipe with more than 21 feet of cover - bedding shall be dry mix concrete. This item shall consist of a mixture of Class 4 gravel and cement without the addition of water in accordance with the requirements of this specification. This specification applies to the production of low-grade concrete for bedding or backfill purposes of underground piping work other than structured parts of manholes or similar structures. Dry mixed concrete may be used only where specifically designated on the plans or typical details or when directed by UND Facilities Management.
- B. The trench shall be initially backfilled with clean friable earth, free from large rocks, stones, or deleterious materials, to a height of six (6) inches above the top of the pipe in 6-inch layers. Each layer shall be reasonably level and uniform and shall be thoroughly compacted with mechanical tampers to a density of at least 90% of maximum dry density.
- C. Pipe bedding requirements may conflict with initial backfill requirements in which case the bedding requirements will govern.
- D. The remainder of the trench may be backfilled by any method or means the Contractor wishes to employ, provided that they shall not damage the pipe and further provided that the backfill must be compacted to the specified densities for the classes of backfill.
- E. When Class AA or Class A backfill is specified, the Contractor shall transport to another site all excess materials excavated from the trench and shall dispose of them to the satisfaction of UND Facilities

University of North Dakota

Management. Granular materials (sand and gravel) shall be compacted to the required densities in layers of 12 (twelve) inches, maximum thickness to within two feet of the bottom of the subbase.

- F. The top two feet shall consist of clay compacted in eight inch lifts to a minimum of 95% of standard proctor at two to six percent over optimum moisture. All other backfill material shall be compacted to the required densities in layers of eight (8) inches, maximum thickness.
- G. After the pipe has been inspected, the trench shall be backfilled and compacted to produce a uniform density as shown by Table 21.07 (Required Min. Density) of drawing 68.01 from the City of Grand Forks Engineering Department- Pipe Bedding Details, found at the end of section 31 2316.
- H. Maximum dry density for backfill shall be established as 100 pounds per cubic foot. Optimum moisture is approximately 23 percent.
- I. At the time of compaction, the moisture content shall be between 90 percent and 105 percent of optimum moisture. If the moisture content of the materials is not within the permissible range, or is such that the required density cannot be obtained, the Contractor shall dry the material, or add water, as may be necessary to meet the requirements. Drying the material or applying water will be considered incidental work and no direct compensation will be made therefore.
- J. Laying of underground pipe shall be accomplished to line, grade in the trench only after it has been dewatered, and the foundation and bedding has been prepared. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surface. No attempt shall be made to make joints under water and the trench must be kept dry until the joint is completed.
- K. The Contractor, for the safe and convenient prosecution of the work, shall use proper implements, tools, and equipment. All pipe and fittings shall be carefully lowered into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment in such manner as to prevent damage to the pipe. Under no circumstance shall pipe be dropped or dumped into the trench.
- L. Before lowering and while suspended, the pipe shall be inspected for defects. Any defective, damaged or unsound pipe shall be rejected. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench and it shall be kept clean by approved means during and after laying. Care shall be taken to prevent dirt from entering the joint space. When pipe laying is not in progress, the open ends of the pipe shall be closed by approved means and no trench water shall be permitted to enter the pipe.
- M. No valve or other control on the existing water system shall be operated for any purpose by the Contractor without approval by the UND Plumbing Shop, and all consumers affected are notified.
- N. Cutting pipe for inserting valve fittings or closure pieces shall be done in a neat and skillful manner without damage to the pipe.
- O. When any railroad is crossed, all precautionary construction measures required by the railroad officials shall be followed.
- P. The Owner reserves the right to limit the amount of trench opened in advance of pipe laying and the amount of pipe laid in advance of backfilling.
- Q. Pipe shall be installed by boring and/or pushing methods under streets, alleys, highways, railways, and other locations as shown on the plans, standard plates, or as directed by UND Facilities Management.
- R. When specified on the plans, proposal, or special provisions, the Contractor shall bore and push a casing pipe that shall be a Class IV reinforced concrete pipe. Should the Contractor elect to use a steel casing

University of North Dakota

pipe, it shall conform to the requirements of the railroad company or receive prior approval of UND Facilities Management.

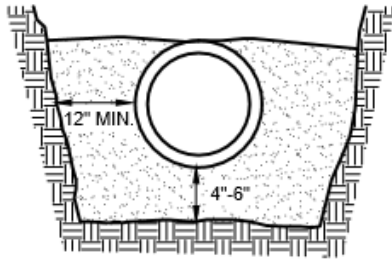
- S. When casing pipe is required, the carrier pipe to be installed shall be supported on skids securely attached to the pipe by means of stainless steel straps at points recommended by the pipe manufacturer or as directed by UND Facilities Management.
- T. Skids shall be placed to eliminate any horizontal or vertical movement of the carrier pipe inside the casing pipe. Carrier pipe shall have joints within one foot of the end of the casing pipe. The skids shall be of such size as to prevent the pipe joints or couplings from snagging on the inside of the casing while being pulled into the casing and to support the carrier pipe so that it will not rest on its joints or couplings in the final installed position in the casing. The skids on the bottom portion of the casing pipe may be lubricated to facilitate insertion of the carrier pipe.
- U. After installation of the carrier pipe and before backfilling, the ends of the casing pipe shall be sealed to prevent entrance of backfill or other foreign material into the casing but shall not be sealed so tightly as to prevent the escape of liquids from the casing in the event of failure of the carrier pipe.

TABLE 21.07 - REQUIRED MIN. DENSITY

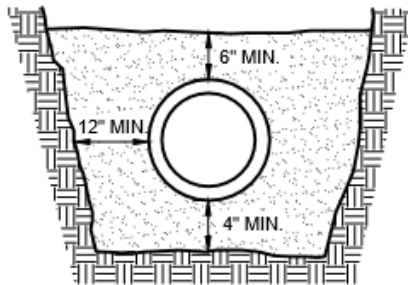
		BACKFILL CLASSES							
		AA*	A*	B	C	D	E	F	FF
DEPTH ZONE	X	100	100	100	95	90	85	80	NONE
	Y	100	90	90	90	85	80	80	NONE

* ALL GRANULAR MATERIAL - SEE SPEC. 21.07

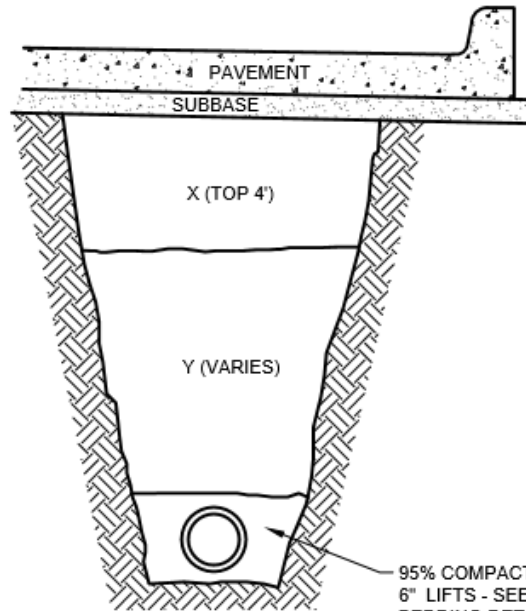
* ON ALL STREET CROSSINGS, GRANULAR BACKFILL WITH A 3' CLAY CAP SHALL BE INSTALLED. CLAY SHALL BE COMPACTED TO A MINIMUM OF 95% OF STANDARD PROCTOR AT 2-6% OVER OPTIMUM MOISTURE.



RCP BEDDING
 CLASS 6 BEDDING AT 95% DENSITY TO TOP OF PIPE




PVC PIPE BEDDING
 SPECIALLY PREPARED CLASS 1 BEDDING FOR SAN. SEWER ONLY @ 95% DENSITY.
 CLASS 6 BEDDING FOR WATERMAIN @ 95% DENSITY.



95% COMPACTION IN 6" LIFTS - SEE BEDDING DETAIL

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	DATE: 3/28/15	<h1>BACKFILL</h1>	CITY ENGINEER ALLEN GRASSER	DRAWN BY: MPY
			SCALE: NTS	STD. PLATE 68.01

31 2319 – DEWATERING

- A. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
- B. 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.

31 5000 - EXCAVATION SUPPORT AND PROTECTION

- A. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
- B. Provide, design, by ND registered professional engineer, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.
- C. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures.

31 6213.19 – PRECAST CONCRETE PILES

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, of same type, brand, and source. Supplement with Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL-116, ASTM C 33/C 33M, with coarse aggregates complying with Class 4S. Provide aggregates from single source.
- C. A minimum compressive strength of 5000 psi at 28 days unless otherwise indicated by need.
- D. Concrete shall be air-entrained, with air content between 3 and 7 percent.
- E. Prestress tendons for piles by either pretensioning or post-tensioning methods. Comply with PCI MNL-116.
- F. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.

31 6216.16 - STEEL H PILES

- A. Fabricate and assemble piles in shop to greatest extent possible.
- B. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.

31 6219 - TIMBER PILES

- A. Not to be used without prior approval from UND Facilities Management.

31 6223.13 – CONCRETE-FILLED STEEL PILES

- A. Portland Cement: ASTM C 150/C 150M, Type I or II. Supplement with Fly Ash; ASTM C 618 Class F.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded, 3/4-inch maximum aggregate size. Provide aggregates from a single source.
- C. A minimum compressive strength of 4000 psi at 28 days unless otherwise indicated by need.
- D. Concrete shall be air-entrained, with air content between 3 and 7 percent.
- E. Fabricate and assemble piles in shop to greatest extent possible.

31 6316 - AUGER CAST GROUT PILES

- A. Portland Cement: ASTM C 150/C 150M, Type II. Supplement with Fly Ash: ASTM C 618, Class F.
- B. Fine Aggregate: ASTM C 33/C 33M with 100 percent passing a No. 8 sieve, free of materials with deleterious reactivity to alkali in cement. Provide aggregate from single source.
- C. Fluidifier: ASTM C 937, with expansion of less than 4 percent.
- D. A minimum compressive strength of 4000 psi at 28 days unless otherwise indicated by need.

31 6329 - DRILLED CONCRETE PIERS AND SHAFTS

- A. Portland Cement: ASTM C 150/C 150M, Type II. Supplement with Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregate: ASTM C 33/C 33M, graded, 3/4-inch-nominal maximum coarse-aggregate size. Provide aggregate from a single source.
 - 1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type II; clean natural sand, ASTM C 404; and water to result in grout with a minimum 28-day compressive strength of 1000 psi, of consistency required for application.
- D. Steel Pipe Casings: ASTM A 283/A 283M, Grade C, or ASTM A 36/A 36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1/D1.1M.
- E. Corrugated-Steel Pipe Casings: ASTM A 929/A 929M, steel sheet, zinc coated.
- F. Slurry: Pulverized bentonite mixed with water to form stable colloidal suspension; complying with ACI 336.1 for density, viscosity, sand content, and pH.
- G. A minimum compressive strength of 4000 psi at 28 days unless otherwise indicated by need.

H. Do not air entrain concrete.

End of Division