

DIVISION III
GENERAL CONSTRUCTION REQUIREMENTS

SECTION 32

EXCAVATION, BACKFILL, COMPACTION, AND GRADING

32.1 GENERAL

This Section covers excavation, backfill, fill, and grading associated with utility trench and structural construction. All such WORK shall be performed by the CONTRACTOR concurrently with the WORK specified in Divisions IV and V of these specifications. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, fill, compaction, grading, and slope protection required to complete the WORK shown on the DRAWINGS and specified herein. The WORK shall include, but not necessarily be limited to: pump stations, manholes, vaults, conduit, pipe, roadways and paving, all backfilling, fill and required borrow, grading, disposal of surplus and unsuitable materials, and all related WORK such as sheeting, bracing, and water handling.

32.2 SOIL BORINGS AND SUBSURFACE INVESTIGATIONS

The DEVELOPER'S ENGINEER shall examine the site and undertake subsurface investigations, including soil borings. Written reports, including any recommendations by the GEOTECHNICAL/SOILS ENGINEER, concerning said investigations shall be provided to the CITY during the plans review process. The CITY will not be responsible for presumed or existing soil conditions in the WORK area.

32.3 EXISTING UTILITIES

CONTRACTOR shall locate existing utilities in the areas of WORK. If utilities are to remain in place, the CONTRACTOR shall provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, the CONTRACTOR shall consult the owner of such piping or utility immediately for directions. Payment for damage and repair to piping or utilities shall be made in accordance with Florida Statutes. Refer to Section 30.2 for utility coordination requirements.

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32.4 MATERIALS

32.4.1 GENERAL

Materials for use as bedding and backfill, whether insitu or borrow, shall be as described under this Section. The CONTRACTOR shall, upon request by the CITY, make an appropriate sample of this material available for testing by the CITY or its designated representative.

32.4.2 STRUCTURAL FILL

Materials for structural fill shall be bedding rock or select common fill as specified herein or other suitable material as approved by the CITY.

32.4.3 COMMON FILL

Common fill shall consist of mineral soil, substantially free of clay, organic material, loam, wood, trash, and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than 6 inch in any dimension, asphalt, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additionally, common fill shall be no more than 12 percent by weight finer than the No. 200 mesh sieve unless finer material is approved for use in a specific location by the CITY.

Material falling within the above specifications, encountered during the excavation, may be stored in segregated stockpiles for reuse. All materials which, in the opinion of the CITY, is not suitable for reuse, shall be spoiled as specified herein for disposal of unsuitable materials.

32.4.4 SELECT COMMON FILL

Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than 1-1/2 inches in largest dimension, and shall be no more than 5 percent by weight finer than the No. 200 mesh sieve.

32.3.4 BEDDING ROCK

Bedding rock shall be 3/16 inch to 3/4 inch washed and graded stone (FDOT #67). This stone shall be graded so that 90 to 100 percent will pass a 3/4 inch screen and 95 to 100 percent will be retained on a No. 8 screen. No stones larger than 1 inch in any dimension shall be accepted.

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32. 5 SHEETING AND BRACING IN EXCAVATIONS

32. 5. 1 GENERAL

If required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing piping and/or foundation material from disturbance, undermining, or other damage, the CONTRACTOR shall construct, brace, and maintain cofferdams consisting of sheeting and bracing. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed. The CONTRACTOR shall comply with the Florida Trench Safety Act.

32. 5. 2 MISCELLANEOUS REQUIREMENTS

For trench sheeting for pipes, no sheeting is to be withdrawn if driven below mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the CITY. If, during the progress of the WORK, the CITY decides that additional wood sheeting should be left in place, it may direct the CONTRACTOR to do so. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the CITY for an alternate method of removal. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities, existing piping, or property. Unless otherwise approved or indicated on the Drawings or in the Specifications, all sheeting and bracing shall be removed after completion of the substructure. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specially adapted to that purpose, by watering, or otherwise as may be directed.

The right of the CITY to order sheeting and bracing left in place shall not be construed as creating any obligation on its part to issue such orders, and its failure to exercise its right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

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The CONTRACTOR shall construct the cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing, and cofferdams shall be adequate to withstand all pressures to which the structure will be subjected. Pumping, bracing, and other work within the cofferdam shall be done in a manner to avoid disturbing any construction already performed. Any movement or bulging which may occur shall be corrected by the CONTRACTOR at his own expense so as to provide the necessary clearances and dimensions.

32.6 DEWATERING, DRAINAGE, AND FLOTATION

32.6.1 GENERAL

The CONTRACTOR shall excavate, construct, and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. In addition, the CONTRACTOR shall not make the final 24 inches of excavation until the water level is a minimum of one foot below proposed bottom of excavation. For purposes of these specifications, "in-the-dry" is defined to be within 2 percent of the optimum moisture content of the soil. The CITY reserves the right to ask the CONTRACTOR to demonstrate that the water level is a minimum of one foot below proposed bottom of excavation before allowing the construction to proceed.

Discharge water shall be clear with no visible soil particles. Discharge from dewatering shall be disposed of in such a manner that it will not interfere with the normal drainage of the area in which the WORK is being performed, create a public nuisance, or form ponding. The operations shall not cause injury to any portion of the WORK completed, or in progress, or to the surface of streets, or to private property. The dewatering operation shall comply with the requirements of the appropriate regulatory agencies. Additionally, where private property will be involved, advance permission from the owner of record shall be obtained by the CONTRACTOR.

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32. 6. 2 ADDITIONAL REQUIREMENTS

The CONTRACTOR shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

Where well-points are required for pre-drainage of the soils prior to final excavation for some of the deeper in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline, or fill will not be floated or otherwise damaged. Well-points shall be surrounded by suitable filter sand and negligible fines shall be removed by pumping.

The CONTRACTOR shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines, and compacted fills.

Continuous pumping will be required as long as water levels are required to be below natural levels.

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32. 7. EXCAVATION

32. 7. 1 GENERAL

Excavation consists of removal, storage, and disposal of material encountered when establishing required grade elevations and in accordance with the notes shown in the Drawings.

Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures, and utilities indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of the CITY. Unauthorized excavation, as well as remedial work directed by the CITY shall be at the CONTRACTOR's expense. Such remedial work shall be performed as directed by the CITY.

If requested by the CITY, when excavation has reached required subgrade elevations, a Geotechnical/Soils Engineer shall make an inspection of conditions. If the subgrade is unsuitable, CONTRACTOR shall carry excavation deeper and replace excavated material with select common fill or bedding rock, as directed by the CITY.

If the CONTRACTOR excavates below grade through error, for his own convenience, through failure to properly dewater the excavation, or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the CITY to excavate below grade and refill the excavation using select common fill or bedding rock at his expense.

Side slopes of excavations shall comply with CITY regulations and with OSHA requirements. CONTRACTOR shall shore and brace where sloping is not possible due to space restrictions or stability of the material excavated. Sides and slopes shall be maintained in a safe condition until completion of backfilling.

CONTRACTOR shall stockpile satisfactory excavated materials at a location approved by the CITY until required for backfill and fill. When needed in the WORK, material shall be located and graded at the direction of a Geotechnical/Soils Engineer.

Stockpiles shall be placed and graded for proper drainage. All soil materials shall be located away from the edge of excavations. All surplus and/or unsuitable excavated material shall be legally disposed of by the CONTRACTOR. Any permits required for the hauling and disposing of this material shall be obtained by the CONTRACTOR prior to commencing hauling operations.

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32. 7. 2 EXCAVATION FOR STRUCTURES

All such excavations shall conform to the elevations and dimensions shown on the PLANS within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removing formwork, installation of services and other construction, inspection or as shown on the DRAWINGS. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. Bottoms shall be trimmed to required lines and grades to leave a solid base to receive concrete.

32. 7. 3 TRENCH EXCAVATION

Excavation for all trenches required for the installation of utility pipes shall be made to the depths indicated on the DRAWINGS and in such manner and widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting, and for pumping and drainage facilities.

The bottom of the excavations shall be firm and dry and in all respects acceptable to the CITY.

Excavation shall not exceed normal trench width as specified in the STANDARD DRAWINGS. Any excavation which exceeds the normal trench width shall require special backfill requirements as determined by the CITY.

Where pipes are to be laid in bedding rock, select common fill, or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is only slightly disturbed.

Where the pipes are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated shall be done manually in such a manner that will give a shaped bottom, true to grade, so that pipe can be evenly supported on undisturbed material, as specified in the STANDARD DRAWINGS. Bell holes shall be hand excavated as required. No pipe shall bear upon the bell.

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32. 8 BEDDING AND BACKFILL

32. 8. 1 GENERAL

Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the DRAWINGS or as directed by the CITY, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the CITY. If sufficient select common or common fill material is not available from excavation on site, the CONTRACTOR shall provide fill as may be required.

Fill shall be brought up in substantially level lifts starting in the deepest portion of the excavation. The entire surface of the WORK shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section.

Fill shall be placed and spread in layers by a backhoe or other approved method, unless otherwise specified. Prior to the process of placing and spreading, all materials not meeting those specified under Section 32.4 shall be removed from the fill areas. The CONTRACTOR shall assign a sufficient number of men to this WORK to insure satisfactory compliance with these requirements.

If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.

All fill materials shall be placed and compacted "in-the-dry". The CONTRACTOR shall dewater excavated areas as required to perform the work and in such a manner as to preserve the undisturbed state of the natural inorganic soils.

Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials. CONTRACTOR shall plow, strip, or break up sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with the existing surface. When existing ground surface has a density less than that specified under Section 32.9 for the particular area classification, CONTRACTOR shall break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

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Before compaction, material shall be moistened or aerated as necessary to provide the optimum moisture content. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued. The CONTRACTOR shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment, and all other materials and equipment necessary to place water in the fill in the manner specified. CONTRACTOR shall compact each layer to required percentage of maximum dry density or relative dry density in accordance with Section 32.9. Backfill or fill material shall not be placed on surfaces that are muddy, frozen, or contain frost or ice.

32. 8. 2 BEDDING AND BACKFILL FOR STRUCTURES

Bedding rock shall be used for bedding under all structures as indicated on the STANDARD DRAWINGS. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion, or loosening of this bed. Structural fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance with Section 32.9.2 of these specifications. If compaction is by rolling or ramming, material shall be wet down as required.

Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength.

In locations where pipes pass through building walls, the CONTRACTOR shall take precautions to consolidate the fill up to an elevation of at least one (1) foot above the bottom of the pipes. Structural fill in such areas shall be placed for a distance of not less than three (3) feet either side of the center line of the pipe in level layers not exceeding eight (8) inches in depth.

The surface of filled areas shall be graded to smooth true lines that strictly conform to grades indicated on the DRAWINGS. No soft spots or non-compacted areas will be allowed in the WORK.

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Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure, and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

32. 8. 3 BEDDING AND BACKFILL FOR PIPES

Bedding for pipe shall be as shown on the PLANS and detailed on the STANDARD DRAWINGS. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion, or loosening of this bed.

Backfilling over and around pipes shall begin as soon as practicable after the pipe has been laid, jointed, and inspected. All backfilling shall be prosecuted expeditiously and as detailed on the STANDARD DRAWINGS.

Any space remaining between the pipe and sides of the trench shall be carefully backfilled, spread by hand or approved mechanical device, and thoroughly compacted with a tamper as fast as placed, up to a level of one (1) foot above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with the STANDARD DRAWINGS and Section 32.9.

The remainder of the trench above the compacted backfill as just described above, shall be filled and thoroughly compacted in uniform layers not exceeding twelve (12) inches in depth. Compaction of soil backfill shall be in accordance with the STANDARD DRAWINGS and Section 32.9.

32. 8. 4. Flowable Fill

Where roadways and other improved sections are required to be open cut, 100 p.s.i. to 125 p.s.i. flowable fill shall be used in lieu of soil backfill. The flowable fill design mix shall be as follows: Cement(S.G.=3.15,80 lbs./yd.), Fine Aggregates (S.G.=2.63, 2385 lbs./yd.), Water (S.G.=1, 500 lbs./yd.), Slump of 9.5 inches, Entrained Air Content of 15 percent, Unit Weight of 109.8 lbs./cu.ft., and a Water to Cement Ratio of 6.25.

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32. 9. COMPACTION

32. 9. 1. General

The CONTRACTOR shall control soil compaction during construction to provide the percentage of maximum density specified. The CONTRACTOR shall provide the CITY copies of all soils testing reports, prepared by a GEOTECHNICAL/SOILS ENGINEER, demonstrating compliance with these SPECIFICATIONS.

When the existing trench bottom has a density less than that specified under Section 32.9.2, the CONTRACTOR shall break up the trench bottom surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

32. 9. 2 PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

Fill or undisturbed soil from the bottom of the pipe trench to 1 foot above the pipe shall be compacted to a minimum density of 95 percent of the maximum dry density as determined by AASHTO T-180.

Backfill from 1 foot above utility pipes to grade shall be compacted to a minimum density of 95 percent of the maximum dry density as determined by AASHTO T-180.

Fill under and around structures, to the extent of the excavation, shall be compacted to a minimum density of 95 percent of the maximum dry density as determined by AASHTO T-180.

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32.9.3 COMPACTION TESTS

One compaction test location shall be required for each 300 linear feet of pipe and each structure. The CITY may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of compaction tests within the trench shall be in conformance with the following schedule:

- a. One test at the spring line of the pipe.
- b. At least one test for each 12 inch layer of backfill within the pipe bedding zone for pipes 24 inches and larger.
- c. One test at an elevation of one foot above the top of the pipe.
- d. One test for each two feet of backfill placed from one foot above the top of the pipe to finished grade elevation.

If, based on GEOTECHNICAL/SOILS ENGINEER testing reports and inspection, fill which has been placed with below specified density, CONTRACTOR shall provide additional compaction and testing prior to commencing further construction.

32.10 GRADING

All areas within the limits of construction, including transition areas, shall be uniformly graded to produce a smooth uniform surface. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement. Ponding shall be prevented. After grading, the area shall be compacted to the specified depth and percentage of maximum density.

No grading shall be done in areas where there are existing pipelines that may be uncovered or damaged until such lines have been relocated.

32.11 MAINTENANCE

CONTRACTOR shall protect newly graded areas from traffic and erosion and keep them free of trash and debris. CONTRACTOR shall repair and reestablish grades in settled, eroded, and rutted areas.

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, CONTRACTOR shall scarify surface, reshape, and compact to required density prior to further construction.

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32.12 INSPECTION AND QUALITY ASSURANCE

32.12.1 INSPECTION

CONTRACTOR shall examine the areas and conditions under which excavating, filling, and grading are to be performed and not proceed with the WORK until unsatisfactory conditions have been corrected.

CONTRACTOR shall examine existing grade prior to commencement of WORK and report to the CITY if elevations of existing grade vary from elevations shown on DRAWINGS.

32.12.2 QUALITY ASSURANCE

All work shall be performed in compliance with applicable requirements of governing authorities having jurisdiction.

The CONTRACTOR, at his expense, shall engage GEOTECHNICAL/SOILS ENGINEER for quality assurance testing during earthwork operations. The GEOTECHNICAL/SOILS ENGINEER shall be subject to the approval of the CITY.

Quality assurance testing shall be performed during construction to ensure compliance with these Specifications. CONTRACTOR shall allow the GEOTECHNICAL/SOILS ENGINEER to inspect and approve fill materials and fill layers before further construction is performed. The CONTRACTOR shall give copies of all test results in a report form to the DIRECTOR to demonstrate compliance with compaction requirements stipulated in this MANUAL.