
SECTION 31 20 00
EARTH MOVING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK:

- A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:
 - 1. Site preparation.
 - 2. Excavation.
 - 3. Underpinning.
 - 4. Filling and backfilling.
 - 5. Grading.
 - 6. Soil Disposal.
 - 7. Removal of Piles.
 - 8. Clean Up.
- B. Alternate: See Section 01 23 00 – Alternates for description of work under this section affected by alternates.

1.2 DEFINITIONS:

- A. Unsuitable Materials:
 - 1. Materials from on site excavations shall not be used for any purpose; including but not limited to material for base, sub-base, bedding, or fill material.
 - 2. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 3 inches; organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D 698.
 - 3. Existing Subgrade (Except Footing Subgrade): Any visible demolition debris, topsoil, and organics are unsuitable materials and should be removed from the site prior to addition of any fill material. Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.
 - 4. Existing Subgrade (Footings Only): Same as paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to Resident Engineer's approval.
- B. Building Earthwork: Earthwork operations required in area enclosed by a line located 5 feet outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.
- C. Trench Earthwork: Trench work required for utility lines.
- D. Site Earthwork: Earthwork operations required in area outside of a line located 5 feet outside of principal building perimeter and within new construction area with exceptions noted above.
- E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum dry density obtained by laboratory test procedure. This percentage of maximum density is obtained

through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D2922.

- F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- G. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- H. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the Resident Engineer. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- I. Authorized additional excavation: Removal of additional material authorized by the Resident Engineer based on the determination by the Government's soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
- K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- M. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- N. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the spring line of the pipe.
- O. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.
- P. Drainage Material: Rock utilized for perforated drain pipes.
- Q. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- R. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- S. Contaminated soils: Soil that contains contaminants as defined and determined by the Resident Engineer or the Government's testing agency.

1.3 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

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- B. Safety requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
 - C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
 - D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.
 - E. Erosion Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, and Section 32 90 00, PLANTING.
 - F. Foundation system requirements: Section 31 62 00, DRIVEN PILES (TREATED TIMBER) and Section 31 62 01 DRIVEN PILES (STEEL PIPE).
 - G. Geotechnical engineering reports, boring logs, and existing site survey: Section 00 31 00, Information Available to Bidders.
 - H. Controlling surface water and ground water during construction: Section 31 23 19, DEWATERING.
 - I. Site demolition: Section 02 41 00, DEMOLITION.
 - J. Temporary Tree & Plant Protection: Section 01 56 39.
 - K. Existing Conditions: Section 01 11 10, Summary of Work – General.
 - L. Verify existing site conditions before start of work: SECTION 01 71 23, FIELD ENGINEERING.

1.4 CLASSIFICATION OF EXCAVATION:

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered to reach subgrade elevations indicated.
- B. Classified Excavation: Removal and disposal of all material except that material not defined as Rock.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Furnish to Resident Engineer:
 - 1. Contactor shall furnish resumes with all personnel involved in the project including Project Manager, Superintendent, and on-site Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.
 - 2. Soil samples.
 - a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.

- b. Laboratory compaction curve in accordance with ASTM D 698 or D 1557 for each on site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
- c. Test reports for compliance with ASTM D 2940 requirements for subbase material.
- d. Pre-excavation photographs and videotape in the vicinity of the existing structures to document existing site features, including surfaces finishes, cracks, or other structural blemishes that might be misconstrued as damage caused by earthwork operations.
- e. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - T99-01(2004) Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop
 - T180-01(2004) Moisture-Density Relations of Soils using a 4.54 kg (10 lb) Rammer and a 457 mm (18 inch) Drop
- C. American Society for Testing and Materials (ASTM):
 - D448-03a Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - D698-00ae1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft³ (600 kN m/m³))
 - D1556-00 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - D1557-02e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN m/m³))
 - D2167-94 (2001) Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
 - D2487-06 Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)
 - D2922-05 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - D2940-03 Standard Specifications for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- D. Society of Automotive Engineers (SAE):
 - J732-92 Specification Definitions - Loaders
 - J1179-02 Hydraulic Excavator and Backhoe Digging Forces

PART 2 – PRODUCTS

2.1 MATERIALS:

- A. General: All soil materials shall be obtained off site. Material from on site excavations shall not be used for any purpose.
- B. Fill: A select granular material, such as locally available river sand should be used as backfill and/or fill to reach desired grade. Sand fill should be non-plastic and free of debris, waste, frozen material, roots, clay lumps, and other deleterious materials having less than ten (10) percent by weight of material passing a U.S. Standard No. 200 mesh sieve (AASHTO A-3).
- C. Drainage Course: Drainage course aggregate, where indicated, shall be in accordance with Section 1003 of the Louisiana Standard Specifications for Roads and Bridges, 2006 edition and latest revisions, or here amended herein. Aggregate shall consist of naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing 1 inch sieve and not more than 8 percent passing a No. 200 sieve. Gradation shall be as follows:

<u>U.S. Sieve</u>	<u>Percent Passing</u>
1-1/2 inch	100 %
1 inch	90-100%
3/4 inch	70-100%
No. 4	35-65%
No. 40	12-32%
No. 200	5-8%

- D. Bedding Course (Storm Drains): Bedding course aggregate for storm drain improvements shall be in accordance with Section 1003 of the Louisiana Standard Specifications for Roads and Bridges, 2006 edition and latest revisions, or here amended herein. Aggregate shall be washed, evenly graded mixture of 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 to 5 percent passing a No. 8 sieve. Gradation shall be as follows:

<u>U.S. Sieve</u>	<u>Percent Passing</u>
1-1/2 inch	100 %
1 inch	90-100%
1/2 inch	25-60%
No. 4	0-10%
No. 8	0-5%
No. 200	0-1%

Bedding Course (Water Lines): Bedding course aggregate for water line improvements shall be pumped river sand. Material shall be free of debris, waste, frozen materials, clay lumps, and other deleterious materials having less than ten (10) percent by weight of material passing a U.S. Standard No. 200 mesh sieve (AASHTO A-3).

Bedding Course (Sanitary Sewer): Bedding course aggregate for sanitary sewer improvements shall be Class I Angular material (1/4 inch to 1-1/2 inch), ASTM D2321 or ASTM C33.

- E. Drainage Material: Washed, crushed stone, 3/4 inch to No. 4, per ASTM D 448.
- F. Unacceptable Fill Materials:
1. "Spillway" sand shall not be used for any purpose.
 2. Materials from Onsite excavations shall not be used for any purpose.
- G. Geotextiles:
1. Geotextile Fabric shall be Class D in accordance to with Section 1019 of the Louisiana Standard Specifications for Roads and Bridges, 2006 edition and latest revisions, or as amended herein. Geotextile fabric shall be a non-woven high strength fabric with high burst and puncture strength. It shall have woven fabric composed of at least 85% by weight, polyester, or polypropylene.
 2. The Geotextile rolls shall be furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure prior to placement. Each roll shall be labeled or tagged to provide product identification sufficient for field identification, as well as inventory and quality control purposes. Rolls shall be stored in a manner which protected them from the elements. If stored outdoors, they shall be elevated and protected with a waterproof cover.
- H. Structural Geogrid:
1. Single Layer, integrally formed Structural Geogrid: The geogrid shall conform to the physical properties listed in the attached table. The listed property values are certifiable minimum average roll values, and are equal to the mean values less one standard deviation which reflects a 95% confidence level. The minimum properties values are as follows:

<u>Physical Properties</u>	<u>Test Methods</u>	<u>Requirements (Type I)</u>
Geometry:		
Aperture shape	N/A	Triangular
Rib Pitch	Calipered	1.6 in. (Longitudinal and Diagonal)
Rib Shape	N/A	Rectangular
Mid Rib Depth	Calipered	0.04 in. (Diagonal)
Mid Rib Width	Calipered	0.05 in. (Transverse)
Characteristic:		
Material	N/A	Polypropylene
Carbon Black	ASTM 4218	0.5%
Dimensions:		
Roll Length		246 ft.
Roll width		9.8 ft.
Roll Weight		119 lb.
Load Capacity:		
Radial Stiffness at Low Strain	ASTM D6637-01	20,580 lb/ft.
Structural Integrity:		
Junction Efficiency	GRI: 662-87	93%
Aperture Stability (Tors. Rigidity)	Kinney-01	3.6 Kg-cm/deg.

Durability:

Resistance to Long-Term Degradation

EPA 9090

100%


Resistance to U.V. Degradation

ASTM D4335-05

>500 hrs.

PART 3 – EXECUTION

3.1 SITE PREPARATION:

- A. Clearing and Stripping: Clear and stripe within limits of earthwork operations. Work includes removal of visible topsoil, organics, trees, shrubs, fences, foundations, piling, incidental structures, paving, debris, trash, and other obstructions. Do not remove trees designated to remain, see Section 01 56 39 – Temporary Tree and Plant Protection. Stripping should be the minimum depth necessary to remove any vegetation, roots, and non-uniform fill. Stripping operations shall be observed by a representative of the geotechnical engineer at the time of construction. The geotechnical engineer or his representative shall determine if encountered subgrade materials are unacceptable during construction. Stumps and roots 3 inch and larger should be removed. Undisturbed stumps and roots smaller than a 3 inch diameter and located a minimum of 3 feet below subgrade or finished embankments may be left.
- B. Existing, uncharted piles should be marked and surveyed prior to filling activities. The contractor shall have a Licensed Land Surveyor provide "Asbuilt" drawings of existing pilings not shown on the documents to the Engineer and Owner, including digital files (AutoCAD format), to determine if conflicts exist with the new improvements.
- C. Stripping Topsoil: Strip topsoil and remove from site.  SEE RFI 04242 FOR REMOVAL AND CUTTING OF EXISTING PILES.
- D. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 12 inches on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from Medical Center Property.
- E. Lines and Grades: Registered Professional Land Surveyor specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.
 - 1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
 - 2. Locations of existing and proposed elevations indicated on plans, except spot elevations, are approximate from a site survey that measured spot elevations and subsequently generated existing contours and spot elevations. Proposed spot elevations and contour lines have been developed utilizing the existing conditions survey and developed contour lines and may be approximate. Contractor is responsible to notify Resident Engineer of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify Resident Engineer of any differences between existing or constructed grades, as compared to those shown on the plans.
 - 3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.
 - 4. Finish grading is specified in Section 32 90 00, PLANTING.

- F. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstruction encountered. Conform to elevations and dimensions shown with a tolerance of plus or minus 0.10 foot.
- B. Shoring, Sheet piling and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the Resident Engineer, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.
1. Design of the temporary support of excavation system is the responsibility of the Contractor.
 2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the Resident Engineer.
 3. Extend shoring and bracing to a minimum of 5 feet below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations.
 4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor shall underpin the existing foundation.
- C. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from Resident Engineer and until backfilling operations are complete. Approval by the Resident Engineer is also required before placement of the permanent work on all subgrades.
1. Excavation and dewatering shall not begin before the Erosion and Sediment Control Plan is in place.
 2. Protect excavations from becoming wet from surface water. Temporary ditches and other diversions outside excavation limits shall be installed to convey rainwater and water removed from trench excavations to collecting or runoff areas.
 3. For additional information, see Section 31 23 19, Dewatering.
- D. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the Resident Engineer.
- E. Blasting: Blasting of materials is not permitted.
- F. Proofrolling:
1. After rough grade has been established and prior to placement of fill under pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material. Proof rolling shall be observed by a representative of the geotechnical engineer at the time of construction. The geotechnical engineer or his representative shall determine if encountered subgrade materials are unacceptable.
 2. Proofrolling shall consist of at least two complete passes with one pass being in a direction perpendicular to preceding one. Remove any areas that deflect, rut, or pump excessively during proofrolling, or that fail to consolidate after successive passes to

suitable soils and replaced with compacted fill. Maintain subgrade until succeeding operation has been accomplished.

G. Pile Foundation Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Prior to driving piles, stop excavations from 6 to 12 inches above bottom of footing. After piles are driven remove loose and displaced material.
3. Over excavate subgrade 12 inches below pile cap foundations. Place 12 inches of drainage course on existing subgrades prior to forming concrete piles caps.
4. Slope grades to direct water away from excavations and to prevent ponding.

H. Non Pile Supported Structures Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Over excavate subgrade 12 inches below structure or as indicated on the drawings. Place and compact 12 inches of drainage course on existing subgrades prior to placing and/or forming new concrete structures.
3. Slope grades to direct water away from excavations and to prevent ponding.

I. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):
 - a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
 - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.
 - c. Support piping on compacted bedding material to depth indicated on the drawings.
 - d. Length of open trench in advance of piping laying shall not be greater than is authorized by Resident Engineer.
2. Sanitary and storm sewer trenches:
 - a. Trench width below a point 6 inches above top of pipe shall be 24 inches maximum for pipe up to and including 12 inches diameter, and four-thirds diameter of pipe plus 8 inches for pipe larger than 12 inches. Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
 - b. Bed bottom quadrant of pipe on granular fill as indicated on the drawings.
 - c. Place and compact backfill material as specified. Do not use unsuitable materials.

J. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by Resident Engineer as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the contractor shall obtain samples of the material, under the direction of the Resident Engineer, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. Testing of the soil shall be performed by the VA Testing Laboratory. When unsuitable material is encountered and removed, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on volume in cut section only.

1. Site Grading:

- a. Provide a smooth transition between adjacent existing grades and new grades.

- b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
 - 1) Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2) Walks: Plus or minus 1 inch.
 - 3) Pavements: Plus or minus 1 inch.
- d. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10 foot straightedge.

3.3 UNDERPINNING:

- A. Design of the underpinning system is the responsibility of the Contractor and is subject to review and approval by the Resident Engineer. Underpinning of existing building foundations, as indicated on structural drawings, or where excavation undermines existing foundations, shall be accomplished in the following manner:
 - 1. Make general excavation for new construction, where new foundations are to be below existing foundations, to elevation of new foundations (or sized stone subbase), maintaining a 45 degree sloped berm.
 - 2. For underpinning pits, underpin existing wall foundations by excavating 4 feet) wide pits to depth shown on drawings skipping 3 sections at any one time so as to maintain support for wall at all times.
 - 3. Underpin intervening sections one at a time; no adjacent sections shall be underpinned until concrete in adjacent sections shall have reached 2500 psi strength and have been dry packed with non-shrink grout to obtain positive bearing. Sheet and brace underpinning pits if soil will not stand on a vertical cut during this operation, or as required for safety of workmen. Repack any voids behind sheeting to prevent sloughing which could cause settlement of existing foundations. Contractor performing this portion of work shall have been prequalified by Resident Engineer as having previously performed successfully this type of work or will demonstrate his capability for successfully performing this work. It shall be sole responsibility of the Contractor to guard against objectionable movement or settlement and to preserve integrity of existing structures.
 - 4. The tip elevation of the underpinning pits shall be a minimum of 3 feet below the adjacent excavation elevation.
 - 5. Subgrades at the tip of the underpinning pit shall be clean, dry, and free of debris and shall be observed by the Resident Engineer prior to concrete placement.
 - 6. Concrete shall not be free fall greater than 10 feet into the pit.

3.4 FILLING AND BACKFILLING:

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use borrow materials meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by Resident Engineer.
- B. Placing: Place materials in horizontal layers not exceeding 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 and then compacted. Place backfill and fill

materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost. Each lift of compacted structural fill should be tested by a representative of the Geotechnical Engineer prior to placement of subsequent lifts.

- C. Compaction: Compact with approved tamping rollers, sheepfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 10 feet of new or existing building walls without prior approval of Resident Engineer. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 or ASTM D1557 as specified below:
1. Under proposed building structures, compact each layer of backfill or fill material to 95 percent of maximum dry density in accordance with ASTM D 1557.
 2. Under vehicular paved areas, scarify and proofroll existing subgrade and compact each layer of backfill or fill material to 95 percent of maximum dry density in accordance with ASTM D 1557.
 3. Under curbs, curbs and gutters, and sidewalks, compact each layer of backfill or fill material to 95 percent of maximum dry density in accordance with ASTM D 1557.
 4. Under landscape areas, compact each layer of backfill or fill material to 90 percent of maximum dry density in accordance with ASTM D 698.

3.5 GRADING:

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.
- C. Slope backfill outside building away from building walls for a minimum distance of 6 feet.
- D. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.
- E. Finished grade shall be at least 6 inches below bottom line of window or other building wall openings unless greater depth is shown.
- F. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 6 inches unless otherwise shown or indicated.
- G. Finish subgrade in a condition acceptable to Resident Engineer at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.
- H. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 0.25 inches of indicated grades.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Medical Center property. Stockpile or spread soil as directed by Resident Engineer. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- C. Remove from site and dispose of excavated materials.
- D. Segregate all excavated contaminated soil designated by the Resident Engineer from all other excavated soils, and stockpile on site on two 6 mil polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 REMOVAL OF PILES:

- A. Cut and legally dispose existing wood piles in conflict with site improvements. Existing wood piles shall be cut 3 feet below utility bedding, paving subgrade, pile cap foundations, or finished grade as applicable.

3.8 CLEAN UP:

- A. Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove and legally dispose of all debris, rubbish, and excess material from Medical Center Property.

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**SECTION 31 23 19
DEWATERING****PART 1 - GENERAL****1.1 DESCRIPTION:**

- A. The work consists of the removal of surface water and ground water as necessary to permit excavation, backfill, and construction required by the contract to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

1.2 SUMMARY:

- A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:
 - 1. Implementation of the Erosion and Sedimentation Control Plan.
 - 2. Dewater excavations, including seepage and precipitation.
- B. The Contractor shall establish and maintain quality control for all dewatering operations to assure with contract requirements and maintain records of its quality control for all construction operations.
- C. The Contractor shall be responsible for providing: all materials, equipment, labor, and services necessary for care of water and erosion control. Excavation work shall not begin before the Erosion and Sedimentation Control Plan is in place.

1.3 REQUIREMENT:

- A. Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavations free of water. Operate dewatering system continuously until backfill work has been completed.
- B. Should sumps and surface pumps be inadequate to keep excavation free of water, the design and implementation of a dewatering system is the responsibility of the contractor. The design and operation of the dewatering system shall be implemented by an experienced dewatering contractor. Forced withdrawal of groundwater with deep wells is not permitted. Well point systems shall be designed and monitored with piezometers to verify that ground water levels at the property line is maintained at the same levels as measured prior to construction.
- C. Protect subgrades from softening, undermining, washout, or damage by rain or ground water accumulation. Reroute surface water runoff from excavated areas and do not allow water to accumulate in excavations. Excavated trenches shall not be used as temporary ditches.
- D. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.
- E. Maintain stability of sides and bottom of excavation.

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- F. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:
1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling.
 2. Erosion is controlled.
 3. Flooding of excavations or damage to structures does not occur.
 4. Surface water drains away from excavations.
 5. Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.
- G. Permitting Requirements: The contractor shall comply with and obtain the required State and Local permits where the work is performed.
- H. Reporting: An original and two (2) copies of records and tests, as well as the corrective action taken, shall be furnished the Resident Engineer daily. Reports of operation and inspection shall include the following data: piezometric elevations, stages, time of operation of each pump, time of operations of each wellpoint segment and/or each well, effluent discharge, sanding rates, problems encountered, proposed actions, and any other pertinent data.

1.4 RELATED WORK:

- A. Geotechnical engineering reports, boring logs, and existing site survey: Section 00 31 00, Information available to bidders.
- B. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- C. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- D. Submittal requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- E. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- F. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.11, PHYSICAL DATA.
- G. Excavation, backfilling, site grade and utilities: Section 31 20 00, EARTH MOVING.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Drawings and Design Data:
1. Submit drawings and data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation.

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2. Material shall include: location, depth and size of wellpoints, piezometers, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water from site to adequate disposal.
 3. Include a written report outlining control procedures to be adopted if dewatering problem arises.
 4. Materials submitted shall be in a format acceptable for inclusion in required permit applications to any and all regulatory agencies for which permits for discharge water from the dewatering system are required due to the discharge reaching regulated bodies of water.
- C. Inspection Reports.
- D. All required permits.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install a dewatering system to control ground and surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to keep excavations free of water.

3.2 OPERATION:

- A. The Contractor shall perform dewatering and maintain the work areas in a dry condition as long as necessary for the work under this Contract. Once an area is dewatered, it shall be maintained in a dewatered condition until all work is completed. Ground water levels shall be observed and recorded at the property line. In no case, shall the ground water table be lowered outside the property.

3.3 WATER DISPOSAL:

- A. Dispose of water removed from the excavations in such a manner as:
1. Will not endanger portions of work under construction or completed.
 2. Will cause no inconvenience to Government or to others working near site.
 3. Will comply with the stipulations of required permits for disposal of water.
 4. Will Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, lay down, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.

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- B. Excavation Dewatering:
1. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
 2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
 3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
 4. The Contractor shall utilize all necessary erosion and sediment control measures as required to avoid construction related degradation of the natural water quality.
- C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built is completed.

3.4 STANDBY EQUIPMENT:

- A. Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain de-watering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

3.5 CORRECTIVE ACTION:

- A. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), perform work necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by Contractor, at no additional cost to Government.

3.6 DAMAGES:

- A. Immediately repair damages to adjacent facilities caused by dewatering operations.

3.7 REMOVAL:

- A. Insure compliance with all conditions of regulating permits and provide such information to the Resident Engineer. Obtain written approval from Resident Engineer before discontinuing operation of dewatering system.

----- E N D -----

SECTION 31 23 23
GEO-SYNTHETIC FILL**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Lightweight, Geo-Synthetic Fill.
- B. Slab on Grade: The thickness of Geo-Synthetic Fill shall be calculated from the top of pile cap to underside of first floor slab.
- C. Above Grade: Provide Geo-Synthetic Fill where shown. See Dixie Building.

1.2 RELATED SECTIONS

- A. Cast-in-Place Concrete: Section 03 30 00 - .
- B. Dewatering: Section 01 57 19 - Temporary Environmental Controls: Dewatering as required.
- C. Excavation, preparation of, subgrade, backfilling: Section 31 20 00 - Earth Moving.
- D. Plumbing drawings showing plumbing pipes under 1st level floor slabs.

1.3 REFERENCE STANDARDS (Latest edition unless otherwise noted)

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing And Materials (ASTM):
 - 1. C 165 - Test Method for Measuring Compressive Properties of Thermal Insulation
 - 2. C 203 - Breaking Load and Flexural Properties of Block-Type Thermal Insulation
 - 3. C 303 - Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation
 - 4. C 390 - Practice for Sampling and Acceptance of Thermal Insulation lots
 - 5. D 1621 - Compressive Properties of Rigid Cellular Plastics
 - 6. D 1622 - Apparent Density of Rigid Cellular Plastics
 - 7. D 1623 - Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
 - 8. C 2863 - Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
 - 9. D 6817 - Specification for Rigid Cellular Polystyrene Geofoam
 - 10. D 7557 - Standard Practice for Sampling of Expanded Polystyrene Geofoam Specimens.

1.4 DESIGN REQUIREMENTS

- A. Geo-Synthetic Fill shall create the permanent formwork for structural concrete at Level 1. See Structural Drawings for profiles and shapes required for concrete structure. Geo-Synthetic Fill shall be contoured at the factory to the required profiles.

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- B. Plumbing Lines: Geo-Synthetic foam shall provide contoured recess in the Geo-Synthetic Fill to allow placement of plumbing piping, below the Level 1 floor slab, before the concrete is poured over the Geo-Synthetic Fill. The pipe recess shall be pitch to allow pipes to drain as indicated on Plumbing Drawings and voids left in Geo-Synthetic Fill after pipes are installed shall be filled with Geo-Synthetic Fill that will act as a formwork for the concrete. Pipes shall not be covered with concrete unless approved by Architect.
- C. Plumbing Coordination: Construction Manager shall provide or designate trade contractor to provide support for piping:
1. Piping shall be supported on Geo-Synthetic Fill while concrete is being placed. Pipes will be suspended from the concrete structure above after the concrete has cured. The soil supporting the Geo-Synthetic Fill will settle over time and pipes will then be suspended from the structure.
- D. Geo-Synthetic Fill SYSTEM shall be designed to settle with soil supporting it for slab on grade conditions.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. . Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Shop Drawings: Showing the following:
1. Profile and section view of the initial grades and Geo-Synthetic Fill.
 2. Size, type, location and orientation of all Geo-Synthetic blocks.
 3. Location and type of connectors.
 4. Ballasting or guying techniques.
 5. Placement sequence and methods.
 6. Profile and section of recess to allow installation of plumbing pipes, drain, and accessories into Geo-Synthetic blocks.
 7. Details showing method of filling voids remaining after plumbing pipes and accessories are installed.
- D. Verification Samples: For each product specified, two samples, minimum size 4 inches (102 mm) square, representing actual product.
- E. Manufacturer's Certificates: Certify products meet or exceed the following:
1. Manufacturer's test reports showing the physical properties and standards for the products specified as tested in accordance with ASTM D 7557.
 2. Manufacturer's Certificate of Compliance for the first 100 yd (376 m3) and for every 1500 yd3 (1147 m3) thereafter of Geo-Synthetic Fill before product is delivered to the site.
 3. Computer generated stress-strain data and the accompanying curves from compressive testing. Curves and/or data shall clearly indicate the stress at 1 percent strain and the modulus of elasticity.

4. Each delivery shall have the compression test data for each lot attached with the delivery paperwork.
5. Certificate of Compliance shall include current inspection reports showing that the Geo-Synthetic Fill manufacturer is in compliance with a UL follow-up service program for both flame and physical properties.

1.6 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Manufacturer with a minimum of 5 years documented experience in the manufacture of lightweight, geo-synthetic fill. Manufacturer must also have a UL classification in category BRYX. Manufacturer must also maintain a UL classification in category QORW that ensures physical properties in accordance with ASTM D 6817. Third-party certifications that only include ASTM C 578 physical properties will not be considered as an alternative equal and will be rejected.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store products in accordance the manufacturer's recommendations until ready for installation.
- B. Prevent damage to the Geo-Synthetic Fill during delivery, storage, and construction.
- C. Geo-Synthetic Fill that is anticipated to be exposed to sunlight for more than six months shall be covered with an opaque material to prevent ultraviolet light degradation. Remove material that is exposed for excessive period beyond six months.
- D. Protect the Geo-Synthetic Fill from organic solvents such as acetone, benzene, and paint thinner; petroleum based solvents such as gasoline and diesel fuel; and open flames.
- E. Geo-Synthetic Fill should be considered combustible and should not be exposed to open flame or any source of ignition.

1.8 SEQUENCING

- A. Ensure that placement drawings and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Insulfoam, A division of Carlisle Construction Materials.
 2. LANEXESS Energizer Chemistry.

2.2 MATERIALS

- A. Geo-Synthetic Fill: Geo-Synthetic Fill shall conform to ASTM D 6817. Blocks shall have a height of at least 24 inches, a width of at least 48 inches, and length of at least 96 inches. Blocks shall be within tolerances of 0.5 percent of respective height, width and length dimensions. Additional field and/or shop trimming and cutting shall be required as necessitated by the geometry of the fill being constructed.
1. Type EPS15: Physical Properties when tested in accordance with ASTM D 6817 shall be:
- a. Density shall be a minimum of 0.90 lb/ft³ when tested in accordance with ASTM D 1622.
 - b. Compressive Resistance at 1 percent deformation shall be a minimum of 3.6 psi when tested in accordance with ASTM D 1621.
 - c. Flexural Strength shall be a minimum of 25.0 psi when tested in accordance with ASTM C 203.
 - d. Elastic Modulus shall be a minimum of 360 psi when tested in accordance with ASTM C 203.
 - e. Oxygen Index shall have a minimum volume of 24.0 percent when tested in accordance with ASTM C 2863.
- B. Connectors: Connectors shall be galvanized steel multi-barbed connectors or a urethane adhesive as recommended by the manufacturer. Each connector shall have a lateral holding strength of at least 60 lbs when tested with Type EPS15 Geo-Synthetic Fill.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Clear and grub site as specified in Section 31 20 00 - Earth Moving.
- C. Dewater site as specified in Section 31 23 19 - Dewatering.
- D. Verify that the grade on which the Geo-Synthetic fill will be placed is graded to the elevations indicated on the Drawings and that the finish-grade is smooth and free from holes and protruding objects in conformance with Section 31 20 00 - Earth Moving and manufacturer's recommendations.
- E. Do not proceed with installation work until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces for uniform bearing using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Geo-Synthetic Fill shall be placed to the lines necessary to act as formwork for the cast in place-in-place concrete and grades and as directed by the Engineer. The surface of a layer of Geo-Synthetic Fill blocks to receive additional Geo-Synthetic Fill blocks shall be constructed with a variation in surface tolerance of no more than 0.05 feet (15 mm) in any 10 foot (3 m) interval.
- C. All blocks shall accurately fit relative to adjacent blocks. No gaps greater than 0.07 feet (20 mm) will be allowed on vertical joints.
- D. Finished surfaces of the Geo-Synthetic Fill immediately beneath concrete floor structure shall be constructed to within the tolerance of zero to minus 0.20 ft of the indicated grade.
- E. Blocks placed in a row in a particular layer shall be offset 2.0 feet relative to blocks placed in adjacent rows of the same layer as shown on the Drawing. In order to avoid continuous joints, each subsequent layer of blocks shall be rotated on the horizontal plane 90 degrees from the direction of placement of the previous layer placed.
- F. Provide galvanized steel multi-barbed connector plates or urethane adhesive between horizontal layers of blocks. Install a minimum of 2 connectors for each 4 feet by 8 feet area of Geo-Synthetic Fill and as shown on plans, or directed by the Resident Engineer. Press firmly into the rigid foam until the connector is flush with the surface. Position the next foam block as specified and seat firmly before placing subsequent blocks.
- G. Blocks shall be cut using a hot wire.
- H. Because of the light unit-weight of the Geo-Synthetic Fill, provide temporary weighting and/or guying as necessary until all the blocks are built into a homogeneous mass, and concrete structure is placed and cured for twenty eight days.
- I. Plumbing piping will be installed by trade contractor designated by the Construction Manager. Install Geo-Synthetic Fill over the pipes after pipes are placed and before concrete is poured.
- J. During placement of the load distribution slab over the top surface of the Geo-Synthetic Fill, it is permissible to use rebar supports to support the reinforcing steel during concrete placement.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Repair or replace damaged products before substantial completion.

END OF SECTION

SECTION 31 31 16
TERMITE CONTROL**PART 1 - GENERAL****1.1 SUMMARY****A. This Section includes the following:**

1. Soil treatment with termiticide.

1.2 RELATED WORK:**A. Plumbing: Division 22****1.3 PERFORMANCE REQUIREMENTS**

- A. Service Life of Soil Treatment:** Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

1.4 SUBMITTALS**A. Product Data:** For termiticide.

1. Include the EPA-Registered Label for termiticide products.

B. Product Certificates: For termite control products, signed by product manufacturer.**C. Qualification Data:** For Installer of termite control products.**D. Soil Treatment Application Report:** After application of termiticide is completed, submit report for Owner's record information, including the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Warranty: Special warranty specified in this Section.**1.5 QUALITY ASSURANCE****A. Installer Qualifications:** A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.**B. Regulatory Requirements:** Formulate and apply termiticides according to the EPA-Registered Label.

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- C. Source Limitations: Obtain termite control products through one source.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.7 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, and terms for agreement period; and terms for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Termiticides:

- a. Aventis Environmental Science USA LP; Termidor.
- b. Bayer Corporation; Premise 75.
- c. Dow AgroSciences LLC; Dursban TC Equity.
- d. FMC Corporation, Agricultural Products Group; Baseline, 800-321-1362.
- e. Syngenta; Demon TC.

2.2 SOIL TREATMENT

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
 - 1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
 - 1. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 - 2. Crawlspace: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
 - 3. Masonry: Treat voids.
 - 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

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- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
 - D. Post warning signs in areas of application.
 - E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

--- E N D ---

SECTION 31 62 00
DRIVEN PILES (TREATED TIMBER)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies materials and installation required for the construction of impact driven treated timber piles.

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subsurface investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.3 CONTRACT BASIS

- A. Contract price for piles will be based upon length of piles shown. Length of piles will be measured from tip to point of cutoff.
 - 1. Adjustment of contract price shall be based upon total length of piles placed and not on length of individual piles placed. When total length of completed piles is greater or less than length shown, contract price adjustment will be made in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable.
 - 2. No payment will be made for withdrawn, broken or rejected piles, piles out of tolerance, or for portion of pile remaining above cutoff point.
 - 3. Contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable, when artificial materials that are not shown are encountered.

1.4 TOLERANCES

- A. Install piling with a maximum variation of 75 mm (3 inches) of center of any pile from location shown. Piles shall not be out of plumb more than 2 percent.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing piles similar in material, design, and extent indicated for this Project, whose work has resulted in a history of successful in-service performance.
- B. Pre-installation Conference: Contractor shall conduct conference at Project site prior to pile installation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent physical damage.

1.7 PROJECT CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile driving.
- B. Site Information: Contractor is responsible for evaluating and implementing the information provided in the geotechnical report prepared for the Project.

1.8 DESIGN MODIFICATIONS

- A. Where piles are installed exceeding specified tolerances for plumb or location, the foundation design will be analyzed by the Resident Engineer and if necessary redesigned by the Resident Engineer. The costs for analysis, redesign, and remediation shall be responsibility of Contractor.
- B. Additional piles and reinforced concrete modifications necessitated by redesign shall be furnished and installed, at no additional cost to the Government.

1.9 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: For each type of pile product, accessory, and paint indicated.
- C. Shop Drawings: Show fabrication and installation details for piles, including driving points, splices, field-cut holes, and pile caps.
 - 1. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 2. Include design mixes, qualification data, material test reports, material certifications, pile driving equipment information.
- D. Hammer: Include type, make, maximum rated energy, and rated energy per blow of hammer; weight of striking part of hammer; weight of drive cap; details, type, and structural properties of hammer cushion.
- E. Certificates: Preservative treatment of timber piles. For each type of preservative-treated timber product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards. For waterborne-treated products include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
- F. Warranty of chemical treatment manufacturer for each type of treatment.

1.10 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
D25-99(2005).....Standard Specification for Round Timber Piles
D1143-81(1994)e1.....Standard Test Method for Piles Under Static Axial Compressive Load
E329-05be1Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
E548-94e1Standard Guide for General Criteria Used for Evaluating Laboratory Competence
- C. American Wood-Preservers Association (AWPA):
C1-03All Timber Products - Preservative Treatment by Pressure Processes
C3-03Piles - Preservative Treatment by Pressure Processes
M4-06Standard for the Care of Preservative Treated Wood Products

PART 2 - PRODUCTS

2.1 PILES

- A. General: Piles shall derive capacity through a combination of friction and end bearing with a 16 ton capacity. Piles shall be treated timber piles. Submit dimensioned details of type proposed for installation, for approval by Resident Engineer before delivery of any material to project site.
- B. Timber Piles: Timber piles shall be in one piece with an approximate uniform taper from butt to tip and shall conform to all requirements of ASTM D25. Timber piles shall be unused, clean, and peeled round timber piles treated in accordance with AWPA C1 and C3. Piles shall be fresh-headed and shaped to fit driving head.
1. Saw off tops of timber piles in a horizontal plane. Cutoffs and damaged pile surfaces shall be treated as specified in AWPA M4.
 2. Spud piles or bored holes may be used to penetrate highly resistant strata laying near surface.
 3. Contractor shall submit a signed certificate stating that preservative treatment of timber piles delivered to site complies with structural and environmental requirements. Certificate shall contain name and address of contractor, project locations, quantity of piles and date or dates of shipments, name of preservative used and retention in pounds per cubic foot of wood treated. Provide .80pcf min. CCA treatment.
 4. Tip Diameter = 7" minimum. Butt diameter = 12" minimum measured 3'-0" from end.
 5. Hammer: Single-acting air hammer delivering 15,000 ft. lbs of energy per blow.

PART 3 - EXECUTION

3.1 GENERAL

- A. It shall be Contractor's responsibility to furnish the specified type of pile.

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- B. Survey: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and levels and stake pile locations.
 - 1. After all piles are driven and installed, Registered Professional Land Surveyor or Registered Civil Engineer shall make field survey of completed piling work. Submit drawing to Resident Engineer showing actual pile locations with respect to planned pile locations and indicating plumbness of piles.
 - C. Reports: Submit a report in quadruplicate to Resident Engineer, for each pile, detailing diameter or cross section, length, make and model of hammer, driving time, blows per minute, number of blows per 300 mm (blows per foot) throughout entire pile length, number of blows for each 25 mm (blows for each inch) during final 150 mm (6 inches) of penetration, and any other pertinent information.

3.2 DRIVING EQUIPMENT

- A. Pile Hammer: Single-acting air hammer delivering 15,000 ft. lbs of energy per blow.
- B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap recommended by hammer manufacturer for type of pile.
- C. Leads: Use fixed or rigid-type pile-driver leads that will hold full length of pile firmly in position and in axial alignment with hammer. Extend leads to within 600 mm (24 inches) of elevation at which pile enters ground.

3.3 ALLOWABLE LOAD ON PILES

- A. The treated timber pile load test program is specified within Work Package 8 (WP-*) to verify a 16 ton design capacity.
- B. Additional costs of load test to evaluate installation discrepancies are the responsibility of the Contractor.

3.4 INSTALLATION

- A. Order of Driving: Install piles in such an order and with sufficient spacing to insure against distortion or injury to piles already in place.
 - 1. Hammer capacity shall be 15000 foot pounds energy per blow.
 - 2. Drive piles to a tip elevation of (-) 58.00 feet (N.A.V.D. 88), or to refusal, whichever occurs first. Piles will be considered driven to refusal when 30 blows/foot is reached.
 - 3. Before starting to drive piles, hammer data, including cap-block arrangement, weight and length of stroke of striking parts of hammer, number of operating blows per minute, piston area, and effective piston pressure to be maintained shall be submitted to Resident Engineer for approval.
 - 4. Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 150 to 300 mm (6 to 12 inches) above bottom of footing or pile cap.
 - 5. Provide a proper anvil and cushion to prevent pile butt damage.
 - 6. Cap or cushion block shall consist of one solid block of hardwood of proper shape and dimensions to fit hammer. Grain of the block shall be parallel to the axis of pile. If laminated materials are used, strength of such materials shall be equal to or greater than

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- hardwood. Continuous or frequent introduction of materials to cushion the hammer blows will not be permitted.
7. Do not use wood chips, small blocks, shavings, or similar materials to cushion hammer blow.
 8. No piles shall be driven through overburden without prior approval of Resident Engineer.
 9. Steel spud piles (7" max diameter, 10 ft. max. depth) may be used only when approved by Resident Engineer and shall be performed at no additional cost to the Government. Methods employed shall be subject to Resident Engineer's approval.
 10. Jetting: Not Permitted.
 11. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
 12. Piles shall be driven continuously (one at a time) to required tip elevation or refusal.
- B. Using data obtained from the Work Package (WP-8) Load Test Program the Engineer-of-Record shall give direction for pile installation.
- C. Make no penetration measurements for purpose of determining resistance to driving when pile heads are damaged to extent that may effect measured penetration nor immediately after a fresh cushion block has been inserted under striking part of hammer. Make measurements with minimum interruption of driving.
- D. If, during driving of any pile, previously driven piles show signs of heaving, redrive disturbed piles to their original driving resistance, at no additional cost to the Government.
- E. Remove soil that heaves during or after driving to maintain grades. Do not place concrete in empty casing until all driving and redriving has been completed within radius in which driving of adjacent pile casings may result in heaving.
- F. Withdraw damaged or defective piles and piles that exceed driving tolerances and install new piles within driving tolerances. Fill holes left by withdrawn piles as directed by Resident Engineer.
1. Rejected piles may be abandoned and cut off as directed by Resident Engineer.
 2. Leave rejected piles in place and install new piles in locations as directed by Resident Engineer.
 3. Fill holes left by withdrawn piles that will not be filled by new piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 1800 mm (72 inches).
- G. Cut off tops of piles square with pile axis and at required elevations. Brushcoat apply preservative treatment at cut-offs in accordance with AWWA-M4.

3.5 DISPOSAL

- A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

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SECTION 31 62 16
PRECAST CONCRETE PILES**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies materials and installation required for the construction of impact driven precast concrete foundation piles.
- B. Provide all labor, materials, equipment and services required to furnish, install and test precast concrete piles of capacity and size indicated in the drawings.
 - 1. Supply, hauling and handling of all precast concrete piles.
 - 2. Surveying for layout of piles and for "as driven" final pile locations.
 - 3. Excavation for obstructions and backfilling with granular fill, as required, for installation of the piles.
 - 4. Pre-drilling, as required, to advance the piles through obstructions.
 - 5. Driving of all piles, as shown on the drawings with lengths as indicated.
 - 6. Supply and install all splice hardware and dowels for connections to the foundation structure.
 - 7. Cutting off piles to the required elevations and disposal of all excess piles and pile cut-off materials.
 - 8. All other work normally related to the above of specified under this Section.
 - 9. Procurement of all permits, other than permits already secured or to be secured by the Government or by other contractors and the payment of all fees in connection therewith, for the performance of the work under this Section.

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete, including materials, reinforcing steel, and mixes: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Precast Structural Concrete: Section 03 41 33, PRECAST STRUCTURAL CONCRETE.
- D. Earthwork: Section 31 20 00, EARTH MOVING.
- E. Subsurface investigation: Section 00 31 00, INFORMATION AVAILABLE TO BIDDERS.

1.3 CONTRACT BASIS

- A. Contract price for piles will be based upon length of piles shown. Length of piles will be measured from tip to point of cutoff.
 - 1. Adjustment of contract price shall be based upon total length of additional piles placed when pre-approved by Resident Engineer of individual piles placed. Contract price adjustment will be made in accordance with the Add and Deduct Unit cost quoted in the Contract.
 - 2. No payment will be made for withdrawn, broken or rejected piles, piles out of tolerance, or for portion of pile remaining above cutoff point.
 - 3. The definition of pile refusal shall be determined when a pile driving depth cannot be advanced more than 1'-0" with 180 hammer blows. If this condition occurs, the Geotechnical Engineer and Structural Engineer shall be notified. A Pile Driving Analyzer (PDA) test will be run to determine the load value of the pile having reached depth of refusal before any additional piles are driven within one cluster.

1.4 TOLERANCES

- A. Refer to Section 3.9 for Tolerances.

1.5 QUALITY ASSURANCE

- A. Pile Source Qualifications: Minimum of five years continuous experience producing piles similar in material, design, and extent indicated for this Project, whose work has resulted in a history of successful in-service performance and who is an active member of Prestressed Concrete Institute and participant in its Plant Certification Program:
 - 1. Where welding is required, it shall be performed by operators currently qualified and certified according to AWS D1.1.
- B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1077 and ASTM E329 for testing indicated, as documented according to ASTM E548 shall be engaged by the Veterans Administration.
 - a. Provide qualified professional engineer to prepare pile-driving records.
- C. Requirements of regulatory agencies; Perform work in compliance with applicable requirements of governing authorities having jurisdiction, including regulations governing notices to adjacent property owners, lights and barricades, OSHA regulations and environmental protection requirements.
- D. Pre-installation Conference: Contractor shall conduct conference at Project site prior to pile installation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent physical damage:

1.7 PROJECT CONDITIONS

- A. Site and Subsurface Conditions:
 - 1. Obtain subsurface investigation data as directed by Section 00 31 00 of the Specifications. The contractor shall thoroughly review and understand the information on subsurface conditions, and foundation recommendations, prior to submitting bid for work.
 - 2. Available soil samples recovered from borings may be examined at the office of Professional Services Industries, Inc. (PSI) located at 724 Central Avenue, Jefferson, Louisiana. The boring information shall be considered to represent the conditions at the respective locations of the test borings at the time the test borings were made. Variations from the conditions disclosed by the borings should be authenticated by the contractor in planning and estimating the work.
 - 3. Contractor is responsible for evaluating and implementing the information provided in the geotechnical report prepared for the project. With the available geotechnical information, it is expressly understood that neither the Government, nor the Architect and his/her consultants will be responsible for interpretations or conclusions drawn there from by the contractor.
- B. Protect structures, underground utilities, and other construction from damage caused by pile driving.
- C. Contractor must adhere to the vibration tolerance and monitoring plan developed for this Project.

1.8 DESIGN MODIFICATIONS

- A. Where piles are installed exceeding specified tolerances for plumb or location, the foundation design will be analyzed by the Resident Engineer and if necessary redesigned by the Resident Engineer. The costs for analysis, redesign, and remediation shall be responsibility of Contractor.
- B. Additional piles and pile cap modifications necessitated by redesign shall be furnished and installed, at no additional cost to the Government.

1.9 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Shop drawings showing sizes, tip details, joint or splice details, reinforcing, pick up points and other items pertinent to pile design. The submittal shall include general installation plan enabling unique identification of each pile.
 - 2. Details of equipment and procedures for predrilling.
 - 3. A tabular summary of anticipated pile lengths at each column location or other point of support.
- C. Manufacturer's literature, including technical and performance literature for pile driving hammer, cushions, and other equipment for piles.
- D. Concrete mix design for piles.
- E. Provide Mill Test on all steel products
- F. With each delivery of piles, results of concrete strength tests conducted on samples cured in the same environment as the piles. No piles will be accepted unless accompanied by concrete strength data at the time of delivery.
- G. As-driven Pile Location Data:
 - 1. Submit pile location within two days after individual pile or pile cluster is completed.
 - 2. At the completion of pile driving for each building, submit final as-driven pile location plan, certified by a Registered Land Surveyor or Registered Professional Engineer.
- H. Daily Reports (Driving Log): Daily reports for all piles shall be submitted by the Pile Contractor during pile driving. Reports shall be distributed to the Resident Engineer, Geotechnical Engineer, and Architect. Daily reports shall contain, as a minimum, the following information:
 - 1. Project Name.
 - 2. Name of Contractor.
 - 3. Identification mark.
 - 4. Date and time of driving.
 - 5. Type and size of hammer used.
 - 6. Description of hammer and pile cushion.
 - 7. Pile type and size.
 - 8. Rate of operation of pile driving equipment.
 - 9. Pre-drilling depth, size of pre-drilling bit.
 - 10. Continuous record of number of blows per each foot of penetration
 - 11. Elevation of point.
 - 12. Elevation of butt – before and after cut-off.
 - 13. Measured heave.
 - 14. Re-driving and reseating, if required, giving final tip elevation and blow count per inch.
 - 15. Ground elevation.
 - 16. Horizontal deviation from plan location.

17. Plumbness deviation.
18. Nature and location of obstructions.
19. Location of deg legs, crimping or buckling.
20. Unusual occurrences during drilling or driving.

1.10 APPLICABLE PUBLICATIONS

A. Codes and Standards:

1. International Building Code (IBC) 2006 with the City of New Orleans, Louisiana, amendments.
2. Prestressed Concrete Institute (PCI):
MNL-116-99..... Manual for Quality Controls for Plants and Production of Structural Precast Concrete C Products
MNL-120-04.....PCI Design Manual, 6th Edition

B. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only.

C. American Society for Testing and Materials (ASTM):

- A27/A27M-05Standard Specification for Steel Castings, Carbon, for General Application
- A36/A36M-05Standard Specification for Carbon Structural Steel
- A82/A82M-05aStandard Specification for Steel Wire, Plain, for Concrete Reinforcement
- A148/A148M-05Standard Specification for Steel Castings, High Strength, for Structural Purposes
- A416/A416M-06Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
- A496/A496M-05Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
- A615/A615M-06Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- A706/A706M-06aStandard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
- C33-03Standard Specification for Concrete Aggregates
- C1077-06Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
- D4945-00Standard Test Method for High-Strain Dynamic Testing of Piles
- E329-05be1Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
- E548-94e1Standard Guide for General Criteria Used for Evaluating Laboratory Competence

D. American Concrete Institute (ACI):

- 315-99Manual of Standard Practice for Detailing Reinforced Concrete Structures

PART 2 - PRODUCTS

2.1 PILES

- #### A. General:
- Piles shall be friction piles with an allowable compression load capacity shown on Drawings. In addition, piles shall have an allowable tension load capacity of 30 tons and an allowable moment capacity of 100 ft. kips. This moment could act concurrently with either axial

load. Piles covered by this Section shall be prestressed concrete piles manufactured as described herein below.

1. Produce precast, prestressed concrete piles to comply with the requirements of IBC 2006, paragraph 1809.2.3, PCI MNL-116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."
2. Prestressed concrete shall conform to MNL-120 and MNL-116, except as specified.
3. Prestressed concrete piles shall be 14 inches square.
4. Reinforcement:
 - a. Reinforcing Bars: ASTM A615/A615M, Grade 60 or 75 as listed on the drawings and schedules, deformed.
 - b. Low-Alloy-Steel Reinforcing Bars where welding is required: ASTM A706/a706m.
 - c. Plain Steel Wire: ASTM A82/A82M.
 - d. Deformed-Steel Wire: ASTM A496/A496M.
 - e. Epoxy-Coated Steel Wire: ASTM A884/A884M, Class A coated.

B. Prestressed Concrete Piles:

1. Produce precast prestressed concrete piles to comply with PCI MNL-116 "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."
2. Prestressed concrete shall conform to MNL-120 and MNL-116, except as specified.
3. Prestressed concrete piles shall be 14 inches square.
4. Reinforcement:
 - a. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.
 - b. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M.
 - 1) Steel Reinforcement: ASTM A615/A615M, Grade 60, deformed.
 - c. Plain Steel Wire: ASTM A82/A82M.
 - d. Deformed-Steel Wire: ASTM A496/A496M.
 - e. Epoxy Coated Steel Wire: ASTM A884/A884M, Class A coated.
5. Concrete for prestressed concrete piles shall develop a minimum ultimate compressive strength of 7,000 psi at 28 days. Concrete mix shall contain at least 7.5 sacks of cement per cubic yard and no more than 5.0 gallons of water per sack of cement, including surface moisture in aggregates. Maximum aggregate size shall be 1 inch. Slump range shall be 2 to 4 inches. Concrete may be steam cured.
6. Prestressing reinforcement shall be 7-wire stress relieved strands, 1/2 inch in diameter, having an ultimate tensile strength of 250,000 psi and shall conform to requirements of ASTM A416/A416M. Spiral reinforcement shall be reinforcing steel, ASTM A615/A615M, or cold drawn wire, W4.0 type, ASTM A82/A82M.
7. Pile Accessories:
 - a. Pile Splices: Manufactured from carbon-steel plates or castings and capable of developing axial strength of continuous pile as per the Contract requirements shown on the Design Drawings. Splices shall also be capable of developing the moment and shear forces per paragraph 1808.2.7 of IBC 2006.
8. A 10'-0" long 3" diameter corrugated galvanized pipe sheath shall be cast into the tops of all upper pile sections centered on the geometric centroid of the cross-section and parallel to the long direction of the pile. This sheath is intended to be used for grouting a dowel for pile-to-cap (pile cap) attachment where required by the Contract Documents. A minimum of 4'-6" of the 3" corrugated sheath shall remain after each top pile section of each individual pile is driven and cut off. Reinforcing bar will be grouted into each pile for attachment to pile caps and/or grade beams, see drawings for size of rebar, size varies depending on location.
9. Compressive cylinder strength at transfer of prestressing force shall be at least 3,500 psi. Initial tension in 1/2 inch strands, before release, shall not exceed 0.8 f pu. Provide lifting devices on piles to minimize stress due to handling.

10. The Resident Engineer reserves right to inspect, either part-time or full-time, operations at prestress plant.
11. It shall be the contractor's responsibility to assure that the driving stresses in the pile do not exceed $0.85 f'_c$ -effective prestress in compression and $3\sqrt{f'_c}$ + effective prestress in tension.
12. Provide splice details for compression as well as tension splices.

PART 3 - EXECUTION

3.1 GENERAL

- A. Survey: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Division 01, shall establish lines and levels and stake pile locations. The contractor shall be responsible for the maintenance and protection of the baseline and the benchmark, and all pile location stakes.
 1. After all piles are driven and installed a Registered Professional Land Surveyor or Registered Civil Engineer shall make field survey of completed piling work. Submit drawing to Resident Engineer showing actual pile locations with respect to planned pile locations, indicating plumbness of piles, and the elevation of the top of each pile.
 2. The elevation of the tops of each pile is to be documented after all piles are driven within a cluster. If the elevation on any pile has changed by more than 1 inch, the Soils Engineer shall be notified immediately with the results of the survey. Re-drive heaved piles to original depth at no additional cost.

3.2 DRIVING EQUIPMENT

- A. Piles shall be installed with approved modern equipment. The proposed pile installation equipment, methods and controls shall be subject to approval of the Resident Engineer based upon a review by the Geotechnical Engineer. Resident Engineer's approval shall be secured before the start of installation.
- B. Pile Hammer: Air-, steam-, or diesel-powered type capable of developing ultimate pile capacity indicated considering length and weight of pile and character of subsurface material anticipated. Driving hammers having a rated energy in the range of 30,000 to 40,000 foot-pounds are believed to be satisfactory per the Geotechnical Engineer.
- C. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide and adequately maintain hammer cushion and steel driving cap recommended by hammer manufacturer for type of pile.
- D. Leads: Use fixed or rigid-type pile-driver leads that will hold full length of pile firmly in position and in axial alignment with hammer. Extend leads to within 24 inches of elevation at which pile enters ground.
- E. The use of followers will not be permitted unless authorized in writing by the Geotechnical Engineer. **See RFI #3725. Use of a follower is acceptable.**

3.3 ALLOWABLE LOAD ON PILES

- A. Maximum axial capacity of vertical pile shall be allowable axial load applied concentrically in direction of its axis. Structural strength of piles shall be limited by allowable unit stresses specified.
- C. Maximum allowable capacity of piles shall be:
 1. 133 tons for 140 lf long piles
 2. Building 8 slab and grade beam support piles is 100 tons.

3.4 INSTALLATION

- A. Order of Driving: Install piles in such an order and with sufficient spacing to insure against distortion or injury to piles already in place.
 - 1. Before starting to drive piles, hammer data, including cap-block arrangement, weight and length of stroke of striking parts of hammer, number of operating blows per minute, piston area, and effective piston pressure to be maintained shall be submitted to Resident Engineer for approval.
 - 2. Do not start production pile-driving operations until site surcharge work has been completed and excess soil removed.
 - 3. Provide a proper anvil and cushion to prevent pile butt damage.
 - 4. Cap or cushion block shall consist of one solid block of hardwood of proper shape and dimensions to fit hammer. Grain of the block shall be parallel to the axis of pile. If laminated materials are used, strength of such materials shall be equal to or greater than hardwood. Continuous or frequent introduction of materials to cushion the hammer blows will not be permitted.
 - 5. Do not use wood chips, small blocks, shavings, or similar materials to cushion hammer blow.
 - 6. No piles shall be driven through overburden.
 - 7. Pre-drilling to facilitate driving the piles below the shallow sand layer will be required. Pre-drilling should be performed with a "fish tail" bit no larger than 10 inch. Final 50 feet of pile penetration shall be obtained with hammer alone. Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.
 - 8. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
 - 9. Driving piles within a cluster from the interior out is recommended.
- B. Driven pile lengths shall be determined from the lengths shown on the drawings and/or schedule measured from existing grade elevation prior to placement of fill, plus 6 inches to lengths call for on the drawings. Penetration of all piles in a group should not vary more than 10 lineal feet in total of the pile lengths call for in each cluster, unless approved by Geotechnical Engineer and Resident Engineer.
- C. Make no penetration measurements for purpose of determining resistance to driving neither when pile heads are damaged to extent that may effect measured penetration nor immediately after a fresh cushion block has been inserted under striking part of hammer. Make measurements with minimum interruption of driving.
- D. If, during driving of any pile, previously driven piles show signs of heaving, redrive disturbed piles to their original driving resistance, at no additional cost to the Government.
- E. Remove soil that heaves during or after driving to maintain slab subgrades.
- F. Withdraw damaged or defective piles and piles that exceed driving tolerances and install new piles within driving tolerances. Fill holes left by withdrawn piles as directed by Resident Engineer.
 - 1. Rejected piles may be abandoned and cut off as directed by Resident Engineer.
 - 2. Leave rejected piles in place and install new piles in locations as directed by Resident Engineer.
 - 3. Fill holes left by withdrawn piles that will not be filled by new piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches.
- G. Cut off tops of piles square with pile axis and at required elevations. All piles shall extend into the pile caps 6 inches. This operation shall not cause damage to the pile, reinforcement or

embedded sheath for dowel grouting. A minimum of 4'-6" dowel sleeve shall remain at the top of every precast concrete pile for installation of dowel rod for pile cap embedment.

3.5 OBSTRUCTIONS

- A. This Contractor is advised that while the site preparation included demolition and removal of existing buildings and foundation elements, among other things, the remnants of the same plus abandoned utilities and existing piles may be encountered during new pile installation.
- B. Known existing piles are shown on the Survey Plan. The existing piles known to be in conflict with piles or pile caps are called out to be removed under Spec Section 31 20 00 and EWP #1. Other piles could be left in place and/or cut off at least two (2) feet below the new pile-supported foundation.
 - 1. Holes left from extraction of existing piles shall be backfilled with structural fill to grade. Existing piles shall only be extracted as necessary to permit the installation of new piles.
 - 2. Predrilled holes abandoned because of obstructions shall be immediately backfilled with sand to grade.
- C. Where obstructions hinder the required pile installation, the Contractor shall use all usual methods, including pre-drilling, spudding and excavation to advance piles to the required bearing stratum. Jetting will not be permitted. Where such usual methods have not been employed, piles abandoned because of encountering obstructions before reaching the required bearing strata and the driving criteria shall be either cut at cut-off at least two (2) feet below the underside of the pile cap or pulled out. Piles so abandoned shall be considered as non-conforming piles and shall not be measured for payment. Contractor shall fill with soil any open holes created by the pulled out piles.
- D. The Contractor will be reimbursed for additional work associated with the obstruction removal only in the following two cases: where advancement past obstructions which are more than 10 feet below the cut-off elevation cannot be conducted using spudding or pre-drilling and must be removed using excavation, or at any depth where obstructions are greater than two cubic yard in volume. Reimbursement for such work shall be made on time and material basis. In addition, any piles abandoned due to such obstructions shall be paid for on the basis of pile length installed below cut-off elevation. No reimbursement for the removal of any obstruction shall be made, unless approval for such work, including agreement for extra compensation for such, has been approved by the Resident Engineer in advance of execution of the work.
- E. The contractor shall make reference to the soil boring logs and available plans showing the site conditions. This contractor is advised that while the site preparation included demolition and removal of existing buildings and foundation elements, among other things, the remnants of the same plus abandoned utilities and existing piles may be encountered during new pile installation.

3.6 PRE-DRILLING

- A. Per the geotechnical report, medium dense to dense sand was encountered at depths ranging between 50 and 120 feet in the majority of borings through the project area. Driving of piles into the upper dense sand layer could be met with high and erratic driving resistance. Therefore, predrilling to facilitate driving of piles below the shallow sand layer will be required. Pre-drilling should be performed with a bit not larger than 10 inch "fish tail" bit, pre-drilled hole shall not be larger than 10 inch diameter at the surface and shall be terminated such that the last 50 lf of each pile is driven through under pre-drilled pilot hole measured from existing grade.

B. For short piles supporting grade level structural slab.

1. Garage Slab support piles are not to be pre-drilled.
2. Slab support piles in all other buildings pre-drill 100 lf depth,

3.7 SPLICING AND CUTTING OFF

- A. A maximum of one splice per pile will be permitted using the splicing system approved by the Resident Engineer and the Methods recommended by the manufacturer. No splices will be permitted within 40 feet of the pile tip or within 20 feet of the pile top.
- B. The strength of all splices shall be in accordance with paragraph 2.1.B.7.b of this Specification Section, above.
- C. Piles may be spliced in the leads. The sections of piles to be spliced shall be secured in alignment such that there is no eccentricity between the axis of the two (2) spliced lengths. Or angle between them, after the pile has been completed.
- D. Pile tops shall be cut off square within one inch of the elevations shown on the Contract Drawings. The pile cut-offs shall become the property of the contractor and shall be removed from the site. Exercise due care to prevent any damage to anchorage device cast into pile at top (see paragraph 2.1.B.8 of this Specification Section, above).
- E. When piles are driven below the design cut-off grade, due to unexpected penetration, a limited number of build-ups will be permitted in accordance with designs provided by the contractor and approved by the Resident Engineer. Build-up costs shall be the responsibility of the contractor.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Veterans Administration will engage a qualified independent testing agency, approved by the Resident Engineer, to perform field quality-control testing.
- B. High-strain dynamic monitoring (PDA) shall be performed and reported according to ASTM D4945 during initial driving and during restriking on 6 percent of all **precast concrete** piles.

3.9 TOLERANCES AND CRITERIA FOR ACCEPTANCE

A. Vertical Piles:

1. Plan Location: +/- 3 inches from location indicated for piles in a group, or **+/- 1 inch** from location indicated for individual piles, measured at the cut-off elevation.
2. Plumbness: Deviation from plumb shall not exceed 2 percent of the pile length or one-half the edge-to-edge pile spacing, whichever is less.
3. Cutoff: Pile shall be cut off level to within +0 inch or -1 inch of the specified elevation.

- B. Plan Location of Pile Groups: The maximum dimension of the group shall be considered the maximum distance between centerlines of piles located at opposite ends of the group measured along principal axes of a group in each orthogonal direction, shall not deviate from the indicated location by more than 2 percent of the maximum dimension.

See RFI #3725. +/- 3 inch is acceptable.

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- C. Piles that are damaged below cut-off elevation during driving will be rejected. If upon comparing pile performance during driving with other driven piles, and based upon his/her knowledge of subsurface conditions, the Geotechnical Engineer determines that a pile has been unacceptably damaged, maybe reject.
 - D. Piles indicating sudden or peculiar decrease in penetration resistance during driving will be assumed to be broken and will be rejected unless the Geotechnical Engineer's review of available data indicates that sudden decrease in driving resistance is due to natural, subsurface conditions and continued acceptable driving behavior is observed.
 - E. Except as specified under "Obstructions" above, piles that are rejected because of damage, miss location, or misalignment, or failure to meet driving criteria, shall be cut off below the limits of the structure and abandoned, and additional piles shall be driven as directed by the Structural Engineer and Geotechnical Engineer.
 - F. The contractor shall provide an accurate survey to the Resident Engineer, as specified. If installed piles exceed the specified tolerances, the Structural Engineer will then analytically determine the total loads individual piles, based upon this survey. If the load on any pile exceeds 110 percent of the specified load capacity, corrections shall be made by adding piles, or other procedures in accordance with information provided to the Resident Engineer by the Structural Engineer and Geotechnical Engineer, the Pile Contractor will be required to add additional piles to correct the incorrect spacing at no additional cost to the Government.
 - G. The installation of replacement piles and other corrective measures shall in all cases be in accordance with direction provided by the Resident Engineer.

3.10 DISPOSAL

- A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION