

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 14 13 Soil Stripping and Stockpiling

**1.2 REFERENCE STANDARDS**

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3 DEFINITIONS**

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than specified depth below existing ground surface.
- .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.

**1.4 QUALITY ASSURANCE**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06-Health and Safety Requirements.

**1.5 STORAGE AND PROTECTION**

- .1 Prevent damage to natural features which are to remain.
  - .1 Repair damaged items to approval of Departmental Representative.
  - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

**Part 2 Products- NOT USED**

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Inspect site and verify with Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
  - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
  - .2 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.
- .3 Notify utility authorities before starting clearing and grubbing.

- .4 Keep roads and walks free of dirt and debris.

### **3.2 CLEARING**

- .1 Clearing includes cutting, trimming, felling, of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including brush, occurring within cleared areas.
- .2 Clear as directed by Departmental Representative, by cutting at height of not more than 300 mm above ground.

### **3.3 ISOLATED TREES**

- .1 Cut off isolated trees as directed Departmental Representative at height of not more than 300 mm above ground surface.
- .2 Grub out isolated tree stumps.
- .3 Prune individual trees as indicated.
- .4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.
- .6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

### **3.4 GRUBBING**

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m<sup>3</sup>.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

### **3.5 REMOVAL AND DISPOSAL**

- .1 Remove cleared and grubbed materials to disposal area as indicated by Departmental Representative.
- .2 Burn only in area designated by Departmental Representative. Burn under constant care of competent watchmen, at such times and so that surrounding vegetation, adjacent property or anything to remain will not be jeopardized.
- .3 Bury to approval of Departmental Representative by:
  - .1 Consolidating.
  - .2 Covering with minimum 500 mm of mineral soil.
  - .3 Finishing surface.

### **3.6 FINISHED SURFACE**

- .1 Leave ground surface in condition suitable for stripping of topsoil to approval of Departmental Representative.

**3.7 CLEANING**

- .1 Proceed in accordance with Section 01 74 00- Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, flagging tape, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 Definitions**

- .1 Topsoil: The top layer of soil containing organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .2 “Subsoil” means the portion of soil material that lies immediately beneath the Topsoil extending to root depth or “B” horizon. The upper portion of the parent material as defined by the Canadian System of Soil Classification.
- .3 “Unsuitable Organic Soils” means soils that contain organic materials and are not suitable for use as earthwork materials or as Topsoil and Subsoil. These soils would include soils that contain too much organic matter for earthwork materials, are contaminated, or do not meet the requirements.

**Part 2 PRODUCTS**

- .1 Supply all labour, materials and equipment required for topsoil stripping.

**Part 3 EXECUTION**

- .1 The Contractor shall excavate the minimum practical area of topsoil required to perform work.
- .2 Topsoil shall be stripped to a depth that will ensure complete removal of all organic materials. The topsoil shall be stockpiled in areas designated by the Departmental Representative.
- .3 Special care must be taken to avoid mixing topsoil with the underlying soil. Departmental Representative may require the Contractor to provide a separate stockpile for topsoil contaminated with common material.
- .4 Strip topsoil from the areas where common excavation and fill placement are required.
- .5 Conduct stripping and excavation operations so that undesirable mineral soil does not become mixed with topsoil or subsoil.
- .6 Suspend stripping operations during rain, snow, wet ground conditions, high winds, or other conditions that may result in contamination or loss of material.
- .7 Drain surface water away from the stripped areas to prevent ponding and infiltration in disturbed areas.
- .8 Stockpile topsoil at locations specified in the Contract Documents or as approved the Departmental Representative.
- .9 Maintain a minimum separation of 3 metres between stockpiles of differing material.
- .10 Use silt fences and other erosion control measures to prevent soil loss from the stockpiles due to wind or water erosion.
- .11 Do not interfere with drainage courses with stockpiled material. Keep stockpiles a minimum distance of 30 m from bodies of water or drainage course.
- .12 Do not stockpile material at slopes steeper than 3H:1V.

- .13 Maintain stockpiles in a condition meeting the above requirements.
- .14 Upon completion of grading operations and approval of Departmental Representative following inspection of subgrade, stockpiled topsoil shall be replaced in designated areas and as directed by Departmental Representative to rehabilitate all areas disturbed by the Contractor.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 The section outlines requires to preparing the subgrade prior to placing overlying layers.

**Part 2 Products**

- .1 Not applicable.

**Part 3 Execution**

**3.1 DISPOSAL OF MATERIAL**

- .1 All materials deemed to be in excess of requirements or unsuitable shall be disposed of appropriately by the Contractor as directed by Departmental Representative.

**3.2 SUBGRADE PREPARATION**

- .1 Field densities and moisture content tests will be taken by the Departmental Representative to ensure that the subgrade is compacted to the specified density.
- .2 Following organic stripping and excavation to achieve design grades, the exposed subgrade should be scarified to a minimum depth of 300 mm, moisture conditioned to within 2% of the optimum moisture content (OMC) and compacted to a minimum of 98% of standard proctor maximum dry density (SPMDD).
  - .1 The subgrade shall be left sufficiently high after compaction so that it can be trimmed to the final grade, and any loose material resulting from this operation removed. All depressions caused by the finishing rollers shall be removed during the final blading operation.
  - .3 Final compaction of the subgrade surface shall be done with pneumatic tire rollers. Rolling shall be continued until all loose soil is properly compacted true to within 10 mm of design elevations but not uniformly high or low. This requirement must be fulfilled before the work will be accepted.
  - .4 If excess moisture exists in the soil, the top 300 mm of the subgrade shall be dried to within 2% of the optimum moisture content as determined by the Standard Proctor Compaction Test. In order to expedite compaction, the subgrade shall be aerated. Aerating shall be carried out at the expense of the Contractor.
  - .5 If the moisture existing in the soil is insufficient for compacting to the specified density and for finishing, the Contractor shall add water. The proper moisture content shall be within 2% of the optimum moisture content, as determined by the Standard Proctor Compaction Test. The water shall be added uniformly by a pressure water sprayer.
  - .6 Trench backfill encountered in the preparation of the subgrade which has not been compacted sufficiently shall be excavated and re-compacted.
  - .7 The Contractor shall be responsible for any repair required to roadworks arising from the subsidence of trenches after the completion of the maintenance period of the underground services contractor(s).
  - .8 Inaccessible areas by large compaction equipment shall be compacted by mechanical hand tampers.

### **3.3 EXCAVATION BELOW GRADE**

- .1 When topsoil, muskeg, or other soft and unsuitable materials are encountered below the finished subgrade, which in the opinion of the Departmental Representative require removal, the area shall be sub-cut and the unsuitable material excavated, loaded and disposed of as directed by the Departmental Representative. These materials shall be replaced with suitable common excavation.
- .2 Fill material shall be placed in successive horizontal layers not exceeding 150 mm in compacted thickness. Suitable spreading and leveling equipment shall be kept in continuous operation at all times.

### **3.4 COMPACTION TESTING**

- .1 The maximum dry density of the soil shall be determined by ASTM procedure D-698 (Moisture Density Relationships of soils), to be determined for each soil type. The optimum moisture content of the soil shall be determined from the laboratory compaction curve established.
- .2 Fill material shall be placed in compacted lifts at a moisture content within  $\pm 2\%$  of the optimum moisture content.
- .3 Compact subgrade to a minimum of ninety eight percent (98%) of Standard Proctor Density in accordance with ASTM D698, unless otherwise stated in the specifications.
- .4 The field density of soils shall be determined by ASTM D-6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- .5 Compaction results shall be based on a minimum of one density test per 500 square metres of road structure per lift. Additional tests may be called for by the Departmental Representative as deemed necessary.

### **3.5 INSPECTION**

- .1 Prior to application of the subsequent layer of roadway materials, the subgrade surface shall be true to cross-section and grade, shall conform to the density specified and shall show to detailed inspection no visible subsidence or heave under the wheels of a roller having a weight of 4.5 kilograms per millimetre of tread width.
- .2 The Contractor shall supply and operate a loaded test vehicle of 8,200 kg axle load to test the subgrade for rutting, heaving and soft spots. Where proof rolling indicates areas are defective, the Contractor shall remove and replace the material with suitable compacted material. Proof rolling shall be considered incidental to the subgrade construction.
- .3 Proof rolling should be completed under the supervision of qualified technical personnel. Recommendations pertaining to the repair of soft areas shall be provided at the time of inspection but may include sub-cutting the subgrade.
- .4 Both the Departmental Representative and the Contractor shall closely observe this operation and note and mark out areas where weakness is indicated. Failures which develop in the subgrade shall be replaced at the Contractor's cost. After the repairs are completed the axle test shall be repeated until test is satisfactory.
- .5 All costs incurred during the performance of this test shall be borne by the Contractor.
- .6 Access to prepared subgrades should be restricted to avoid loosening of the prepared subgrade by site traffic before placement and compaction of the pavement structure.

- .7 The prepared subgrade should not be left exposed for extended periods of time to avoid wetting, drying and freezing of the material.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 22 13 Rough Grading

**1.2 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .2 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).

**1.3 DEFINITIONS**

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
  - .1 Rock: solid material in excess of 1.00 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment. Frozen material not classified as rock.
  - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM C136.
    - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45
    - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of pipe embedment materials. At a request from the Departmental Representative, provide samples of proposed materials to a testing laboratory to determine moisture density curves according to ASTM D698 and for a sieve analysis conforming to ASTM C136.

## 1.5 EXISTING CONDITIONS

- .1 Examine soil report.
- .2 Buried services:
  - .1 Before commencing work establish location of buried services on and adjacent to site.
  - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
  - .3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .4 Prior to beginning excavation Work, notify Departmental Representative establish location and state of use of buried utilities and structures. Departmental Representative to clearly mark such locations to prevent disturbance during Work.
  - .5 Confirm locations of buried utilities by careful soil hydrovac methods
  - .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
  - .7 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Costs for such Work to be paid by Departmental Representative.
  - .8 Record location of maintained, re-routed and abandoned underground lines.
  - .9 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

## Part 2 Products

### 2.1 MATERIALS

- .1 Granular Backfill:
  - .1 Clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material, meeting following gradation limits:

<b>ASTM Sieve Designation</b>	<b>Percent Passing</b>
50.0 mm	100
31.5 mm	60 - 100
16.0 mm	40 - 90
4.75 mm	25 - 60
2.0 mm	25 - 50
0.425 mm	10 - 25

0.075 mm

0 - 10

.2 Common Backfill:

- .1 Approved material selected from trench excavation or other source to be used in the Final Backfill zone, unfrozen and free from cinders, ashes, sods, refuse or other deleterious materials.

The maximum size of boulders permitted in backfill will be 0.02 m<sup>3</sup> or 300 mm average diameter.

.3 Pipe Embedment Materials:

- .1 The pipe embedment zone shall be broken down into foundation, bedding, haunching, and initial backfill as identified in Figure 1 of ASTM Standard Practice D2321 and the drawing detail.
- .2 Materials for use as foundation, embedment, and backfill for all pipe material types are as classified in Table 1 of ASTM Standard Practice D2321. They include natural, manufactured, and processed aggregates and the soil types classified according to ASTM Test Method D2487.
- .3 Class I, Class II, and Class III pipe embedment materials are suitable for use in the pipe embedment zone subject to the limitations noted herein and in Table 2 of ASTM Standard Practice D2321.
- .4 Class IV-A materials should only be used in the embedment zone in special design cases, as they would not normally be construed as a desirable embedment material for flexible pipe.
- .5 Class IV-B, Class V Soils, and Frozen Materials are not recommended for embedment, and should be excluded from the final backfill except where specifically allowed by project specifications.
- .6 Material in the haunch area of the pipe, the gradation for sand within the pipe embedment zone shall be within the following limits:

.7

<b>ASTM Sieve Size</b>	<b>Percent Passing</b>
40.00 mm	100
4.75 mm	50 - 100
2.00 mm	30 - 90
0.425 mm	10 - 50
0.075 mm	0 - 12

The above material is classified as an ASTM D2321 Class II embedment material.

.4 Bedding Stone (for use in the Foundation Zone):

A suggested material for bedding stone to be used as foundation material includes screened gravel, crushed stone or crushed gravel to following gradation requirements:

<b>ASTM Sieve Size</b>	<b>Percent Passing</b>
63.0 mm	100
37.5 mm	85 - 100
25.0 mm	75 - 95

19.00 mm	50 - 75
16.00 mm	25 - 50
9.50 mm	0 - 10

**Part 3 Execution**

**3.1 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Remove trees, shrubs, vegetation, fences and other obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .3 Strip topsoil and other surface materials from within limits of excavation.

**3.2 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .3 Protect open excavations against flooding and damage due to surface run-off.
- .4 Dispose of water in manner not detrimental to public and private property, or portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

**3.3 EXCAVATION**

- .1 Advise Departmental Representative least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated by Departmental Representative.
- .3 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .4 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .5 Restrict vehicle operations directly adjacent to open trenches.
- .6 Dispose of surplus and unsuitable excavated material in approved location.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Notify Departmental Representative when bottom of excavation is reached.
- .10 Obtain Departmental Representative approval of completed excavation.

- .11 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .12 Hand trim, make firm and remove loose material and debris from excavations.

### **3.4 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

### **3.5 BACKFILLING**

- .1 Do not proceed with backfilling operations until the Departmental Representative has inspected and approved installations.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading.

### **3.6 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 19- Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Clean and reinstate areas affected by Work as directed by Representative.
- .3 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            All other specification sections.

**1.2                MEASUREMENT PROCEDURES**

- .1            Measure bored piles in units incorporated into work.
- .2            Amount of bored pile shaft added or deducted in event actual bearings are below or above elevations indicated will be measured in cubic metres.
- .3            Bid on number and lengths of piles as indicated.
- .4            Actual number and lengths of piles installed: established by Departmental Representative from piling records.
- .5            Measure piles in metres measured from base elevation to cut-off elevation.

**1.3                REFERENCE STANDARDS**

- .1            American Society for Testing and Materials International (ASTM)
  - .1            ASTM A36/A36M, Standard Specification for Carbon Structural Steel.
  - .2            ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - .3            ASTM A252, Standard Specification for Welded and Seamless Steel Pipe Piles.
  - .4            ASTM A283/A283M, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
  - .5            ASTM A615/A615M, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  - .6            ASTM A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
  - .7            ASTM A775/A775M, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
  - .8            ASTM A929/A929M, Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe.
  - .9            ASTM A996/A996M, Standard Specification for Rail-Steel and Axle-Steel Deformed Bars or Concrete Reinforcement.
  - .10          ASTM A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- .2            American Welding Society (AWS)
  - .1            AWS D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
- .3            CSA Group (CSA)
  - .1            CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

- .2 CAN/CSA-G30.18, Billet Steel Bars for Concrete Reinforcement.
- .3 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .4 CAN/CSA S16, Limit States Design of Steel Structures.
- .5 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Quality assurance submittals:
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
  - .3 Records and reports: submit concrete tests, Mill report as described in PART 2 - SOURCE QUALITY CONTROL.
  - .4 Submit for review by Departmental Representative copies of pile installation records as described in PART 3 - FIELD QUALITY CONTROL.

#### **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.
- .2 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .3 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Concrete mixes and materials: in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .2 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00- Concrete Reinforcing
- .3 Steel core sections: to CSA-G40.20/G40.21
- .4 Steel casing: to ASTM A36/A36M.
- .5 Welding materials: to CSA W48.
- .6 Grout: in accordance with Section 03 30 00- Cast-in-Place Concrete.

#### **2.2 SOURCE QUALITY CONTROL**

- .1 Mill report to CAN/CSA-S16.

- .2 Concrete tests: to CSA-A23.1/A23.2.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

**3.2 INSTALLATION**

- .1 Bore holes to diameters and depths as indicated.
- .2 Belled piles:
  - .1 On reaching required depth excavate bell to details as indicated.
- .3 Protective steel casing:
  - .1 Where required, use steel protective casing approved by Departmental Representative.
    - .1 Ensure penetration of casing to required depths either by self mass or driving.
- .4 Check each bored shaft for toxic and explosive gases and provide appropriate protective measures for personnel working in shaft.
- .5 Dispose of excavated materials as directed by Departmental Representative.
- .6 Departmental Representative to inspect pile excavation prior to placing of concrete.
  - .1 Remove loose material, foreign matter and water as directed by Departmental Representative.
- .7 Install steel reinforcement in accordance with Section 03 20 00- Concrete Reinforcing and as indicated.
- .8 Fill pile excavations with concrete to elevations as indicated.
  - .1 Place concrete in one continuous pour in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .9 Steel protective casing may be removed at option of Contractor, unless otherwise specified.
- .10 Where steel protective casing is to be removed, provide concrete with minimum slump of 125 mm and with retarder to prevent arching or setting of concrete.
  - .1 Withdraw casing in conjunction with concrete placing, keeping bottom of casing 600 mm below level of concrete.
  - .2 Do not vibrate concrete internally.
- .11 Where steel protective casing is left in place, fill void space between casing and shaft excavation with grout.

### **3.3 DEFECTIVE PILES**

- .1 Cased concrete shaft piles rejected where:
  - .1 Soil has entered casing.
  - .2 Water has entered casing.
  - .3 Casing is damaged, out of tolerance or alignment.
- .2 Defective pile, as directed by Departmental Representative, to be cut off at elevation specified by Departmental Representative and filled with sand.
- .3 Where pile has encountered obstruction during driving before reaching its specified bearing stature:
  - .1 Payment for unused section according to PART 1 - MEASUREMENT PROCEDURES' article.

### **3.4 FIELD QUALITY CONTROL**

- .1 Field Records: maintain driving record for each shell, including elevation of bedrock, driven depth of pile, cut-off elevation of shell and protruding core.

### **3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11- Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**