

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Subsoil materials for Finish Grading
- .2        Topsoil materials for Finish Grading.

**1.2                RELATED SECTIONS**

- .1        Section 32 92 23 - Sodding.

**1.3                REFERENCES**

- .1        AASHTO T180-01(2004) - Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and an 457 mm (18 inch) Drop.
- .2        ASTM D698-07e1 - 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>)).
- .3        ASTM D1556-07 - Test Method for Density and Weight Unit of Soil in Place by the Sand-Cone Method.
- .4        ASTM D1557-07 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- .5        ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- .6        ASTM D2487-06e1 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .7        City of Winnipeg Standard Construction Specification – CW 3110 Sub-grade, Sub-base and Base Course Construction.
- .8        City of Winnipeg Standard Construction Specification – CW 1130 Work Site Requirements.
- .9        City of Winnipeg Standard Construction Specification – CW 3540 Topsoil and Finish Grading for Establishment of Turf Areas.

**1.4                SUBMITTALS FOR REVIEW**

- .1        Section 01 33 00: Submission procedures.

**1.5                SUBMITTALS FOR INFORMATION**

- .1        Section 01 33 00: Submission procedures.
- .2        Materials Source: Submit name of imported materials source.

**1.6 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 10: Closeout Procedures.

**1.7 QUALITY ASSURANCE**

- .1 Perform Work in accordance with City of Winnipeg standards.
- .1 Maintain one (1) copy on Site.

**Part 2 Products**

**2.1 SUBSOIL MATERIALS**

- .1 Subsoil Type for Sodded Area: Conforming to Province of Manitoba standards and City of Winnipeg Standard Construction Specification – CW 3110 Sub-grade, Sub-base and Base Course Construction.
- .2 Refer to Drawings.

**2.2 TOPSOIL MATERIALS**

- .1 Topsoil for Sodded Area: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained Site; free of subsoil, clay, or impurities, plants, weeds and roots.
- .2 Topsoil Type: Conforming to Province of Manitoba standards and to City of Winnipeg Standard Construction Specification – CW 3540 Topsoil and Finish Grading for Establishment of Turf Areas.

**2.3 SOURCE QUALITY CONTROL**

- .1 Testing and Analysis of Subsoil and Topsoil Material: To City of Winnipeg Standard Construction Specification requirements.
- .2 Provide materials of each type from same source throughout the Work.

**Part 3 Execution**

**3.1 SOIL REMOVAL**

- .1 Remove lumped soil, boulders, and rock.
- .2 Stockpile excavated material in area designated on Site and remove excess material not being used, from Site.

**3.2 STOCKPILING**

- .1 Stockpile materials on Site at locations indicated designated by Contract Administrator.
- .2 Stockpile in sufficient quantities to meet Project schedule and requirements.

- .3 Separate differing materials with dividers or stockpile apart to prevent mixing.
- .4 Prevent intermixing of soil types or contamination.
- .5 Direct surface water away from stockpile Site to prevent erosion or deterioration of materials.

### **3.3 STOCKPILE CLEANUP**

- .1 To City of Winnipeg Construction Standards.
- .2 Remove stockpile, leave area in a clean and neat condition. Grade Site surface to prevent free standing surface water.

### **3.4 PREPARATION OF SUBSOIL**

- .1 City of Winnipeg Standard Construction Specification – CW 3110 Sub-grade, Sub-base and Base Course Construction.
- .2 Prepare subsoil and eliminate uneven areas and low spots.
- .3 Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- .4 Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.
- .5 If soil contaminated with petroleum products is encountered, notify City of Winnipeg and Contract Administrator immediately before proceeding with any further work.
- .6 Scarify subsoil to a depth of 100 mm (4 inches) where topsoil is to be placed. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.
- .7 Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

### **3.5 PLACING TOPSOIL**

- .1 To City of Winnipeg Standard Construction Specification – CW 3540 Topsoil and Finish Grading for Establishment of Turf Areas.
- .2 Spread topsoil to a minimum depth of 50 mm (2 inches) over area to be sodded.
- .3 Place topsoil during dry weather and on dry unfrozen subgrade.
- .4 Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- .5 Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- .6 Install edging at periphery of sodded areas in straight lines to consistent depth.
- .7 Coordinate with installation of underground sprinkler system piping and watering heads.

**3.6 PROTECTION OF FINISHED WORK**

- .1 Section 01 78 40: Protecting installed work.
- .2 Protect landscaping and other features remaining as final work.
- .3 Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 01 33 00 - Submittal Procedures.

**1.2                REFERENCES**

- .1            American Society for Testing and Materials (ASTM)
  - .1            ASTM D4791-[99], Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2            City of Winnipeg Standard Specification CW-3110.

**1.3                SAMPLES**

- .1            Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Allow continual sampling by Engineer during production.
- .3            Provide Engineer with access to source and processed material for sampling.
- .4            Install sampling facilities at discharge end of production conveyor, to allow Engineer to obtain representative samples of items being produced. Stop conveyor belt when requested by Engineer to permit full cross section sampling.
- .5            Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
- .6            Provide water, electric power and propane to laboratory trailer at production site.

**1.4                QUALITY ASSURANCE**

- .1            To the City of Winnipeg Standard Construction Specification – CW-3110.

**Part 2            Products**

**2.1                MATERIALS**

- .1            Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2            Flat and elongated particles of coarse aggregate: to ASTM D4791.
  - .1            Greatest dimension to exceed five times least dimension.
- .3            Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
  - .1            Natural sand.
  - .2            Manufactured sand.

- .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
  - .1 Crushed rock.
  - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
  - .3 Light weight aggregate, including slag and expanded shale.

## **2.2 SOURCE QUALITY CONTROL**

- .1 Inform Engineer of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .2 If, in opinion of Engineer, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise Engineer 4 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Topsoil stripping
  - .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
  - .2 Begin topsoil stripping of areas as directed by Engineer after area has been cleared of brush, weeds and grasses and removed from site.
  - .3 Strip topsoil to depths as directed by Engineer. Avoid mixing topsoil with subsoil.
  - .4 Stockpile in locations as directed by Engineer. Stockpile height not to exceed 2 m.
  - .5 Dispose of topsoil to location off site.
- .2 Aggregate source preparation
  - .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by Engineer and approved by Contract Administrator.
  - .2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.
  - .3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.

- .4 When excavation is completed dress sides of excavation to nominal [1.5:1] slope, and provide drains or ditches as required to prevent surface standing water.
- .5 Trim off and dress slopes of waste material piles and leave site in neat condition.
- .3 Processing
  - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
  - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Engineer.
  - .3 Wash aggregates, if required to meet specifications.
  - .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
- .4 Handling
  - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .5 Stockpiling
  - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Contract Administrator. Do not stockpile on completed pavement surfaces.
  - .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
  - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
  - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
  - .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
  - .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Engineer within 48 hours of rejection.
  - .7 Stockpile materials in uniform layers of thickness as follows:
    - .1 Max 1.5 m for coarse aggregate and base course materials.
    - .2 Max 1.5 m for fine aggregate and sub-base materials.
    - .3 Max 1.5 m for other materials.
  - .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
  - .9 Do not cone piles or spill material over edges of piles.
  - .10 Do not use conveying stackers.
  - .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

### **3.2 CLEANING**

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

- .2 Leave any unused aggregates in neat compact stockpiles as directed by Contract Administrator.
- .3 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 31 62 13.19 – Precast Concrete Piles.

**1.2                MEASUREMENT PROCEDURES**

- .1        Provide Lump sum price for the foundation work in accordance with the structural drawings.

**1.3                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        Sub-surface investigation report: when site conditions differ from those indicated, submit written notification to Contract Administrator and await further instructions.
- .4        Submit schedule of planned sequence of driving to for review, not less than 2 weeks prior to commencement of pile driving.
- .5        Equipment:
  - .1        Submit prior to pile installation for review by Contract Administrator, list and details of equipment for use in installation of piles.
  - .2        Impact hammers: submit manufacturer's written data as specified.
  - .3        Non-impact methods; submit characteristics to evaluate performance.
- .6        Quality assurance submittals:
  - .1        Test reports: submit 2 copies of certified test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .2        Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1        Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .2        Replace damaged piles to satisfaction of Contract Administrator.

**1.5                EXISTING CONDITIONS**

- .1        Sub-surface investigation report has been included as part of this specification. Contractor is to review the report and become familiar with the subsurface conditions.
- .2        Notify Contract Administrator in writing if subsurface conditions at site differ from those indicated and await further instructions from Contract Administrator. Do not proceed

with pile locations / sizes / extensions, etc. where not on drawings without written approval from the Contract Administrator.

## **1.6 SCHEDULING**

- .1 Provide schedule of planned sequence of driving to Contract Administrator for review, not less than two weeks prior to commencement of pile driving.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Supply or fabricate full length piles as indicated and provide equipment to handle full length piles without cutting and splicing.
- .2 Splice piles only with written approval of Contract Administrator.
  - .1 When permitted, provide details for the Contract Administrator's review.
  - .2 Design details of splice to bear dated signature stamp of professional engineer registered or licensed in Province of Manitoba, Canada.

### **2.2 EQUIPMENT**

- .1 Impact hammers: provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.
- .2 Non-impact methods of installation such as augering, jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.
- .3 Hammer:
  - .1 Drop hammers will not be permitted.
  - .2 Hammers to be capable of developing a blow at operating speed with an energy of not less than 40,000 joules per blow. Hammer is to be capable of being adjusted to deliver reduced impact. When required bearing capacity is not obtained by use of hammers complying with minimum requirements, use larger hammer only as approved by Contract Administrator. For diesel hammers, provide independent calibrated pressure gauges on hammer side of all valves. Provide calibration certificate dated within 6 months of calibration.
- .4 Leads:
  - .1 Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means to ensure support to pile while being driven. Inclined heads to be used for battered piles.
  - .2 Length: provide length of leads so that use of a follower is unnecessary.
  - .3 Swing leads:
    - .1 Not permitted.
- .5 Followers:

- .1 Obtain written approval from Contract Administrator prior to using followers. When permitted, provide followers of such size, shape, length and mass to permit driving pile in desired location to required depth and resistance. Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.
- .2 Drive applicable load test piles using similar follower.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Protection:
  - .1 Protect adjacent structures, services and work of other sections from hazards due to pile driving operations.
  - .2 Arrange sequencing of pile driving operations and methods to avoid damages to adjacent existing structures.
  - .3 When damages occur, remedy damaged items to restore to original or better condition at own expense.
- .2 Ensure that ground conditions at pile locations are adequate to support pile driving operation and load testing operation.
  - .1 Make provision for access and support of piling equipment during performance of Work.
- .3 Prebore piles to 4 metres depth, or as required by geotechnical engineer.
- .4 Drive piles within embankments only when embankment has been placed and compacted to at least bottom elevation of pile cap.
- .5 Do not drive piles until excavation has been completed.
- .6 In areas requiring fill, either place and compact fill after piles are installed or drive piles after fill has been placed and compacted to at least bottom elevation of pile cap.

#### **3.2 DESIGN LOAD CAPACITY**

- .1 Allowable design load capacity of pile at working load is as indicated on drawings.
- .2 Installation of each pile will be subject to review of Contract Administrator. Contract Administrator will be sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration or other criteria used to determine bearing capacity. Pile driving rig shall not be removed from site prior to Contract Administrator's review of final driving of all piles.
- .3 Drive each pile to final set as directed by Contract Administrator, and in accordance with Geotechnical Report.
- .4 Determine required final driving resistance using formula approved by Contract Administrator.
- .5 Drive each pile to practical refusal in glacial till.

### **3.3 APPLICATION / DRIVING**

- .1 Drive precast piles only when concrete has attained strength of 35 MPa.
- .2 Use driving caps and cushions to protect piles.
  - .1 Reinforce pile heads if necessary. Piles with damaged heads will be rejected by Contract Administrator.
- .3 Hold piles securely and accurately in position while driving.
- .4 Deliver hammer blows along axis of pile. Ensure pile is not overstressed.
- .5 Do not drive piles within 8 m of masonry or concrete which has been in place less than 7 days.
- .6 Ensure no contact between pile and structure takes place when driving batter piles adjacent to existing structures.
- .7 Do not drive batter piles until vertical piles within radius of 8m have been fully driven.
- .8 Restrike already driven piles lifted during driving of adjacent piles to confirm set.
- .9 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.
- .10 Cut off piles neatly and squarely at elevations to tolerance of plus or minus 25 mm.
  - .1 Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.
  - .2 Do not cut tendons or other reinforcement, which will be used to tie pile caps to pile.
- .11 Remove cut-off lengths from site on completion of work.

### **3.4 DRIVING TOLERANCES**

- .1 Pile heads to be within 50 mm of locations as indicated.
- .2 Piles not to be more than 2% of length out of vertical alignment.

### **3.5 OBSTRUCTIONS**

- .1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, remove obstruction.

### **3.6 DAMAGED OR DEFECTIVE PILES**

- .1 Leave rejected pile in place, place adjacent pile and modify pile cap as directed in writing by Contract Administrator.
- .2 No extra compensation will be made for additional piles and other costs due to installation of damaged or defective piles.

**3.7 PROTECTION**

- .1 Protect adjacent structures, services and work of other sections from hazards due to pile driving operations.
- .2 Arrange sequencing of pile driving operations and methods such that no damage occurs to adjacent existing structures. If damaged, remedy damaged items to restore to original or better condition at own expense.

**3.8 FIELD QUALITY CONTROL**

- .1 Independent review of piling operations shall be done by an independent inspection and testing agency under a cash allowance and retained by the City of Winnipeg.
- .2 Maintain accurate records of driving for each pile, including:
  - .1 Type and make of hammer, stroke or related energy.
  - .2 Other driving equipment including water jet, driving cap, cushion.
  - .3 Pile size and length, location of pile in pile group, location or designation of pile group.
  - .4 Sequence of driving piles in group.
  - .5 Number of blows per metre for entire length of pile and number of blows per 25mm for final sets, over the last 75 mm.
  - .6 Final tip and cut-off elevations.
  - .7 Other pertinent information such as interruption of continuous driving, pile damage.
  - .8 Record elevation taken on adjacent piles before and after driving of each pile.
- .3 Provide Contract Administrator with three copies of records.

**3.9 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**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            31 61 13 – Pile Foundations General Requirements

**1.2                MEASUREMENT PROCEDURES**

- .1            Provide Lump sum price for the foundation work in accordance with the structural drawings.

**1.3                REFERENCES**

- .1            American Society for Testing and Materials International (ASTM)
  - .1            ASTM A82/A82M-05a, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .2            ASTM A416/A416M-05, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
  - .3            ASTM A421/A421M-05, Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete.
- .2            Canadian Standards Association (CSA International)
  - .1            CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
  - .2            CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (consists of A3001, A3002, A3003, A3004 and A3005).
    - .1            CSA-A3001-03, Cementitious Materials for Use in Concrete.
  - .3            CAN/CSA-G30.18-M92(R1998), Billet-Steel Bars for Concrete Reinforcement.
  - .4            CAN/CSA-A23.4/A251, Qualification Code for Architectural and Structural Precast Concrete Products.
- .3            Precast/Prestressed Concrete Institute (PCI)
  - .1            PCI MNL-116-[1999], Quality Control for Plants and Production of Structural Precast Concrete Products, 4th Edition.

**1.4                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            Test reports: submit certified test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

## **1.5 DESIGN REQUIREMENTS**

- .1 Design loads as indicated on Structural Drawings.
- .2 Do not splice piles without Contract Administrator's permission. When permitted, provide details for Contract Administrator review. Design details of splice to bear signature and stamp of professional engineer registered or licensed in Province of Manitoba.

## **1.6 TEST REPORTS**

- .1 Upon request, submit certified copies of quality control tests related to this project as specified in CSA A251.

## **1.7 QUALITY ASSURANCE**

- .1 Manufacturer of precast concrete components: certified by CSA as meeting requirements of CSA A251.
- .2 A Contractor experienced in the related type or work and having at their disposal all necessary equipment shall perform all work.
- .3 Allowable tolerances:
  - .1 Lateral tolerances: all units shall be located so as to have a maximum lateral deviation at the top of the unit of 50 mm.
  - .2 Vertical tolerance: all piles shall be driven without varying more than 2% from the vertical.
  - .3 Pile cutoffs at elevations indicated +/- 25 mm.
  - .4 Piles not meeting these requirements will be rejected.
- .4 Drive all units to develop loads indicated on drawings to the criteria in the Geotechnical Report.
- .5 Comply with all local and provincial safety codes and regulations.

## **1.8 SITE CONDITIONS**

- .1 Visit the site to ascertain any special conditions that may affect the work.
- .2 A subsurface Geotechnical investigation report of the site has been prepared and has been included as part of this specification.
- .3 Review the Geotechnical Report to identify subsurface conditions that may be encountered.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Ensure handling and installation stresses are within safe limits.
- .4 Avoid damage to piles during handling, placing pile in leads, and during pile driving operations.

- .5 Support piles laterally during driving, but allow rotation in leads.
- .6 Where pile or projecting reinforcement orientation is essential take precautionary measures to maintain orientation during driving.
- .7 Support battered piles to prevent excessive bending stresses in pile.
- .8 Square top of pile to longitudinal axis of pile.
  - .1 Maintain axial alignment of pile hammer with that of pile.
- .9 Provide identification for points of lifting by painted stripes or lift hooks set in.
- .10 Provide identification for points of support for storage. Store all units at site in such a way as to avoid undue stresses before driving.
- .11 During delivery and storage support long piles continuously along their lengths.
- .12 All foundation units delivered to site that do not conform to terms of this specification may be rejected by Contract Administrator.

#### **1.10 PROTECTION**

- .1 Protect public and construction personnel, adjacent structures and work of other sections from hazards attributable to pile driving operations.
- .2 Protect pile surfaces from damage and spalling.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 All piles standard hexagonal, precast, prestressed, to sizes indicated on drawings by an approved supplier.
- .2 Cement: Type HS or HSb, sulphate resistant.
- .3 Concrete strength: minimum 35 MPa at the time of driving. Concrete strength at transfer of prestress: as required by manufacturer.
- .4 Prestressing steel: to ASTM A416, uncoated seven-wire stress-relieved strand, grade 270.
  - .1 Prestressing steel: free of grease, oil, wax, paint, soil, dirt, and loose rust.
  - .2 Do not use prestressing strands or wire having kinks, bends, or other defects.
- .5 Welded wire mesh: to ASTM A-185.
- .6 Spiral reinforcement: to ASTM A82, cold drawn steel wire.
- .7 Cementitious materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .8 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing 400 MPa yield.



## **2.2 Fabrication**

- .1 Fabricate precast concrete piles to lengths, cross sectional areas, reinforcement as required to meet capacities indicated.
- .2 Fabricate piles to following finish tolerances:
  - .1 Length:  $\pm 3$  mm per metre of length.
  - .2 Cross section: solid section -6 to +12 mm.
  - .3 Deviation from straight line: not more than 3 mm per metre of length, nor 12 mm in full length.
  - .4 Pile head: +/- 10 mm per metre from true right angle plane. Surface irregularities +/- 3 mm.
  - .5 Location of reinforcing steel: Main reinforcing cover: -3mm to +6 mm. Spacing of spiral +/- 12 mm.

## **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 Provide approved type of protection cap with cushion block to top of pile when driving. Cushion block material softwood such as green hemlock. Plywood not acceptable.
- .2 Do not typically splice piles. If splicing of piles should be required, only pre-manufactured cast-in splice shoes approved by the Contract Administrator will be considered.
- .3 On completion of driving, cut off pile at required elevation. Make circumferential cut with concrete saw to prevent spalling of pile below cut-off elevation. Make pile cut off absolutely horizontal.
- .4 Drive piles at locations indicated and to depth sufficient to develop required loading.
- .5 Minimum prebored depth for piles from excavation 4.0 metres.
- .6 Prebored holes to have 50 mm larger diameter than piles to be placed unless indicated otherwise on the drawings.
- .7 Remove boulders encountered in prebored holes using a core barrel or other approved method.
- .8 Remove, relocate, redrive and provide additional piles where directed when boulders or other obstructions prevent driving piles to an adequate bearing strata or within allowable tolerances in locations indicated on the drawings. Perform such work at no additional cost to the Contract.
- .9 Perform pile driving with a diesel hammer capable of delivering a rated energy of at least 40,000 joules.
- .10 Refusal criteria for driving piles shall be established by inspection at time of driving, and in accordance with the criteria in the Geotechnical Report.
- .11 Replace piles that are excessively damaged through driving or which are believed to be broken with new piles at a suitable location at no additional cost to Contract.

- .12 Piles shall be of sufficient length to allow 450 mm of strand to extend into the structure above.
- .13 If a pile or piles should be driven below required elevation to accommodate exposed strand requirements, cut off such piles 450 mm below the top of pile (except at single pile caps) and install an extension to details as supplied by the Contract Administrator at no extra cost to the Contract.
- .14 Drive all piles to required final set in competent hard glacial till deposit.
- .15 Drive piles continuously, without intermission until driven to required final set, at depth adequate to support the loads indicated on the drawings.
- .16 Observe and check pile upheaval. Redrive pile to refusal and final set any piles showing uplift after driving adjacent piles.

### **3.3 PILE CUT-OFF**

- .1 Cut-off piles with smooth, level cut using pneumatic tools, sawing, or other suitable methods approved by Contract Administrator.
- .2 Use of explosives for cutting is not permitted.
- .3 Remove cut-off sections of piles from site upon completion of work.

### **3.4 PILE RECORDS**

- .1 Keep complete and accurate record of each pile driven.
- .2 Indicate pile location, deviations from pile location, cross section shape and dimensions, original length, ground elevation, tip elevation, cut-off elevations, number of blows required for each 300 mm of penetration and number of blows for last 150 mm of penetration.
- .3 Include in record beginning and ending times of each operation during driving of pile, type and size of hammer used, rate of operation, stroke or equivalent stroke for diesel hammer, type of driving helmet, and type and dimension of hammer cushion (capblock) and pile cushion used.
- .4 Record retard data and unusual occurrences during pile driving such as re-driving, heaving, weaving, obstructions, and driving interruptions.

### **3.5 FIELD QUALITY CONTROL/VERIFICATION**

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in Part 2 - Products, by Contract Administrator and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE

### **3.6 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**