

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 31 63 19 - Bored and Socketed Piles

1.02 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this section. Include costs in items of Work that require templates.

1.03 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 252-98(2002), Standard Specification for Welded and Seamless Steel Pipe Piles.
 - .2 ASTM A 307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
 - .3 ASTM A 325M-05, Standard Specification for Structural Steel Bolts, Steel, Heat Treated 830 Mpa Minimum Tensile Strength Metric.
 - .4 ASTM A 490M-04a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3 for Structural Steel Joints Metric.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21-2004, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
 - .2 CAN/CSA-S16-01, Consolidated (Consists of the CAN/CSA-S16-01, along with S16S1-05 and Updates # 1 and # 2 to CAN/CSA-S16-01).
 - .1 CAN/CSA-S16-01, Limit States Design of Steel Structures.
 - .3 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.
 - .4 CSA W48-01(R2006), Filler Metals and Allied Materials for Metal Arc Welding.
 - .5 CSA W59-03, Welded Steel Construction (Metal Arc Welding) (metric version).
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.171-98, Inorganic Zinc Coating.
 - .2 CAN/CGSB-1.184-98, Coal Tar-Epoxy Coating.
- .4 The Master Painters Institute (MPI)/Architectural Painting Specification Manual, ASM-February 2004.
 - .1 MPI #19, Inorganic Zinc Rich Primer.
- .5 The Society for Protective Coatings (SSPC)
 - .1 SSPC-SP 5/NACE No.1-2000, White Metal Blast Cleaning Joint Surface Preparation Standard.

1.04 SYSTEM DESCRIPTION

- .1 Design Requirements: design templates to safely withstand following loads:
 - .1 Gravity loads to which template are subjected.

1.05 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.
 - .1 Include product characteristics, performance criteria, and limitations.
- .3 Submit shop drawings and indicate following items:
 - .1 Material.
 - .2 Anchorage, field control and alignment methods.
 - .3 Design parameters.
 - .4 Tolerance for driving pile.
 - .5 Removable members.

1.06 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.01 MATERIALS

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Type 300W.
- .2 Pile sleeves: to ASTM A 252, Grade 300W .
- .3 Welding materials: to CSA W48/CSA W59.
- .4 Bolts, nuts and washers: to ASTM A 307.
- .5 Protective coating: to MPI #19.

2.02 FABRICATION

- .1 Fabricate structural steel for templates: to CAN/CSA-S16 and reviewed shop drawings.
- .2 Welding: to CSA W59.
- .3 Use welding companies qualified under CSA W47.1.

3 EXECUTION

3.01 PREPARATION

- .1 Lining:
 - .1 Line inside surfaces of sleeves and pile guides with timber strips 25 mm thick or nylon roping 25 mm thick to provide protection to pile coating during driving operation.

- .1 Show full details of linings and attachment on shop drawings.
- .2 Painting:
 - .1 Prepare vertical sleeves of templates and other steel used for connection to piling for painting by blast cleaning to SSPC-SP 5/NACE No.1 and apply one coat of inorganic zinc and two coats of coal tar epoxy.
- .3 Repairs:
 - .1 Repair damaged coatings with compatible material to approval of Departmental Representative.

3.02 POSITIONING

- .1 Position and hold template in location to receive piles.
 - .1 Ensure pile positions are within tolerances specified.
- .2 Secure templates to vertical piles in accordance with shop drawings before batter piles are placed.

3.03 REMOVAL OF TEMPLATES

- .1 Avoid damage to piling when removing templates.
- .2 When instructed by Departmental Representative, remove templates from Project site.

3.04 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.

3.05 PROTECTION

- .1 Protect templates from damage.
- .2 Repair damage to templates, formwork or concrete arising from operations at no extra cost.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 31 63 19 - Bored and Socketed Piles

1.02 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 Sub-surface investigation report: when site conditions differ from those indicated, submit written notification to Departmental Representative and await further instructions.
- .4 Submit schedule of planned sequence of driving to Departmental Representative for review, as specified.
- .5 Spliced piles: when authorized, submit design details of splice complete with signature and stamp of qualified professional engineer registered or licensed in Province of New Brunswick, Canada.
- .6 Equipment:
 - .1 Submit prior to pile installation for review by Departmental Representative, 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.
- .7 Submit drivability analysis as specified, to Departmental Representative for hammer approval.
- .8 Quality assurance submittals:
 - .1 Test reports: submit 3 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.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .3 Replace damaged piles as directed by Departmental Representative.

3 EXECUTION

3.01 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.

3.02 INSTALLATION

- .1 Leads: construct pile driver leads to provide free movement of hammer.
 - .1 Hold leads in position at top and bottom, with guys, stiff braces, or other means reviewed by Departmental Representative, to ensure support to pile while being driven.
 - .2 Inclined leads to be used for battered piles.
 - .3 Swing leads:
 - .1 Obtain approval from Departmental Representative prior to using swing leads.
 - .2 Firmly guy top and bottom to hold pile in position during driving operation.
 - .3 Method to be reviewed by Departmental Representative.
- .2 Followers:
 - .1 Obtain approval from Departmental Representative prior to using followers.
 - .2 Provide followers of such size, shape, length and mass to permit driving pile in desired location to required depth and resistance.
 - .3 Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.
 - .4 Drive applicable load test piles using similar follower.
- .3 Installation of each pile will be subject to review of Departmental Representative.
 - .1 Departmental Representative will be sole judge of acceptability of each pile.
 - .2 Departmental Representative to review final driving of all piles prior to removal of pile driving rig from site.
- .4 Drive each pile to practical refusal in bedrock.
 - .1 Do not overdrive to cause damage to piles in bedrock.
 - .2 Departmental Representative will determine refusal criteria for piles driven to rock based on type of pile and driving equipment.
- .5 Drive each pile to pile tip elevation as indicated on drawings.

3.03 APPLICATION / DRIVING

- .1 Use driving caps and cushions to protect piles.
 - .1 Reinforce pile heads as required.
 - .2 Piles with damaged heads as determined by [Departmental Representative will be rejected.
- .2 Hold piles securely and accurately in position while driving.
- .3 Deliver hammer blows along axis of pile.
- .4 Do not drive piles within 3 m of masonry or concrete which has been in place less than 7 days.
- .5 Restrike already driven piles lifted during driving of adjacent piles to assure set.
- .6 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.
- .7 Cut off piles neatly and squarely at elevations as indicated [to tolerance of plus or minus 50 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.
- .8 Remove cut-off lengths from site on completion of work.

3.04 DRIVING TOLERANCES

- .1 Pile heads to be within 50 mm of locations as indicated.
- .2 Piles not to be more than 0.5% of length out of vertical alignment.

3.05 OBSTRUCTIONS

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

3.06 REPAIR AND RESTORATION

- .1 Pull out rejected piles and replace with new piles.
- .2 Remove rejected pile and replace with new, and if necessary, longer pile.
- .3 Remove rejected pile and fill hole as directed by Departmental Representative.
- .4 No extra compensation will be made for removing and replacing or other work made necessary through rejection of defective piles.

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 03 20 00 - Reinforcing Steel
- .2 Section 03 30 00 - Cast-in-Place Concrete
- .3 Section 31 63 19.13 - Rock Sockets for Piles

1.02 MEASUREMENT PROCEDURES

- .1 Measurement for piles acceptably incorporated into this contract will be by the unit from base elevation to cut-off including rock-socket. Included also will be:
 - .1 Pile Shoes.
 - .2 Reinforcing Steel.
 - .3 Pipe Pile
 - .4 Grout and Cast-in-Place Concrete
 - .5 Any required welding.
 - .6 Removal of material from interior of pipe piles.
 - .7 Drilling and socketing of sockets for piles.
- .2 No payment will be made for defective piles.
- .3 Supply and Installation of Cathodic Protection will not be measured for payment but will be incidental to 1.02.1. Cathodic Protection shall be installed at the locations shown on the plans, or as directed by the Departmental Representative.

1.03 REFERENCES

- .1 ASTM International
 - .1 ASTM A 53/A 53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A 252-10, Standard Specification for Welded and Seamless Steel Pipe Piles.
 - .3 ASTM A 1008/A 1008M-11, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- .2 CSA International

- .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CSA G30.18-09, Carbon and Steel Bars for Concrete Reinforcement.
- .3 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .4 CSA S16-09, Design of Steel Structures.
- .5 CAN/CSA-S6-06, Canadian Highway Bridge Design Code.
- .6 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for piles and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
- .4 Field Quality Control Submittals:
 - .1 Maintain field driving records for each shell, including elevation of bedrock, driven depth of pile and rock socket depth, cut-off elevation of shell and protruding core.
 - .2 Provide Departmental Representative with three copies of field records.
 - .3 Submit detailed method statement and procedures for controlling and monitoring verticality and alignment of piles before starting pile installation.
 - .4 Submit mill report and results of concrete tests.

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect piles from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.01 MATERIALS

- .1 Straight seamless and welded steel pipe: to ASTM A 53, formed from flat plate to diameters and wall thickness as indicated.
- .2 High carbon steel pile shoe: to ASTM A 53, welded to bottom of first pipe shell.
- .3 Wide welded plate sleeves: to ASTM A 1008/A 1008M, and as indicated, external 300 mm forming connections between lengths of steel pipe shell formed from flat plate.
- .4 Welding materials: to CSA W59.
- .5 Concrete mixtures and materials: to CSA A23.1/A23.2 and Section 03 30 00 - Cast-in-Place Concrete.
- .6 Grout: to Section 03 30 00 - Cast-in-Place Concrete.
- .7 Reinforcing steel: to CSA G30.18 and Section 03 20 00 - Concrete Reinforcing.
- .8 Steel core sections: to CSA G40.20/G40.21, type 300 W, as indicated on the drawings.
- .9 Anodes: Sacrificial Anodes to be Renode II Anode No. Rm 37 FM as manufactured by Reynolds Metal Co.

2.02 SOURCE QUALITY CONTROL

- .1 Mill report: to CAN/CSA-S6.
- .2 Concrete tests: to CSA A23.1/A23.2.

3 EXECUTION

3.01 INSTALLATION

- .1 Drive Piles to bedrock in accordance with Section 31 61 13 - Pile Foundations, General Requirements.
- .2 Drive pile with steel head having ring inside pile with 40 mm clearance and wood cushion blocks.
- .3 Splice piles, if required, by welding piles together by shielded electric welding.
 - .1 To prevent distortion, tack opposite points first and then opposite sections.

- .2 Pipe walls thinner than 12.7 mm to be welded against a backup ring.
- .3 Ensure top member is held in vertical alignment during splicing operation.
- .4 Remove material from inside of pile by method approved by Departmental Representative.
- .5 When pile reaches bedrock, churn drill into bedrock remove churn drill and drive pile into bedrock to form seal.
- .6 Remove drilled material from rock socket in accordance with Section 31 63 19.13 - Rock Sockets for Piles.
- .7 Perform internal visual or camera inspection of pile, joints and rock socket before placing concrete as directed by Departmental Representative.
 - .1 Ensure loose material is removed, pile is free from foreign matter and there are no faults in bedrock or bearing strata directly below pile.

3.02 REINFORCING STEEL

- .1 Make reinforcement into cages sufficiently rigid enough to resist damage or displacement during handling.
 - .1 When reinforcement is made up from more than one segment, include sufficient bar length required to lap splice.
 - .2 Weld lap splicing.
- .2 Weld stirrups, lateral ties or spiral ties to main bars.
- .3 Welders to be certified by Canadian Welding Bureau (CWB) who hold welding certification required for Work.
- .4 Use spacers or rollers specifically designed to achieve accurate placement of reinforcement as approved by Departmental Representative.
 - .1 Proceed with reinforcement placement only after receipt of written approval from Departmental Representative.

3.03 CONCRETE PLACEMENT

- .1 Concrete and placement methods: to CSA A23.1/A23.2 and Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete or grout into bottom of rock socket without voids, honeycombing or other defects. Secure anchor core in position by method approved by Departmental Representative. Allow concrete or grout to set.
- .3 Complete placing of concrete to required elevation within shell as approved in writing by Departmental Representative.
- .4 Place additional concrete or grout into shell and fill remainder of shell with concrete using methods approved by Departmental Representative.
- .5 As concrete work proceeds install additional lengths of anchor core welding steel sections together or tying reinforcement bars together with approved lap lengths.

- .1 Rigidly hold new top section in vertical alignment during splicing operation.
- .6 Clean off concrete laitance accrued at top of shell.
- .7 Cut off top of shell and projecting core neatly and squarely at elevations as indicated.
- .8 Protect steel reinforcement core projecting above concrete in caisson.
- .9 When tremie concrete is used, with approval of Departmental Representative, proceed as follows:
 - .1 Clean out rock socket.
 - .2 Equalize water level inside and outside of caisson.
 - .3 Place reinforcement.
 - .4 Lower sealed tremie pipe to bottom of socket.
 - .5 Fill tremie pipe and hopper with low slump, cement rich concrete and tremie as specified in Section 03 37 26 - Underwater Placed Concrete to form an effective plug.
 - .6 Withdraw tremie pipe, allow concrete to set, pump water out, clean up all laitance and complete concreting in the dry.
 - .7 In case of losing concrete charge during tremie operations, withdraw pipe and reinforcement, remove concrete and start again.

3.04 DEFECTIVE CAISSONS

- .1 Where pile has encountered obstruction during driving prior to reaching specified bearing stratum consider it unsuitable. Payment on used sections as outlined in Measurement Procedures article in this section.

3.05 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 31 63 19 - Bored and Socketed Piles.
- .2 Section 01 35 44 - Environmental Mitigation Requirements
- .3 Section 01 33 00 - Submittal Procedures
- .4 Section 03 30 00 - Cast-in-Place Concrete
- .5 Section 05 50 00 - Metal Fabrications

1.02 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 252-98(2002), Standard Specification for Welded and Seamless Steel Pipe Piles.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.
 - .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
 - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

1.03 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 Shop Drawings:
 - .1 Indicate: reinforcing, methods of construction, operational sequence.
 - .2 Submit each drawing complete with signature and stamp of qualified professional engineer registered or licensed in Province of New Brunswick, Canada.
- .4 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 Submit for review by Departmental Representative three copies of pile driving records as described in PART 3 - FIELD QUALITY CONTROL.
 - .4 Equipment lists: submit to Departmental Representative, list of equipment for installation of anchor dowels before beginning work.
 - .1 Provide details sufficient to evaluate performance of equipment.

- .2 Include details of equipment for excavating, drilling, cleaning out piles and rock sockets, installation of anchor dowels and grouting of sockets.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition 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 quarry or facility as approved by Departmental Representative.

2 PRODUCTS

2.01 MATERIALS

- .1 Grout: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Underwater concreting: in accordance with Section 03 37 26 - Underwater Placed Concrete.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 PREPARATION/PILE CLEAN-OUT

- .1 After pile is driven to bedrock, remove overburden inside pile down to tip of pile.
 - .1 Clean out material adhering to inside surface of pile and surfaces of shear ring by high pressure water jets.
- .2 Protect open piles from intrusion of foreign materials.

3.03 INSTALLATION /SOCKETS

- .1 Secure equipment in position during drilling.
- .2 Drill sockets into sound bedrock as indicated.
- .3 Departmental Representative to determine elevation of top of sound rock and depth of socket required.
- .4 Drill socket to minimum depth as indicated.

- .5 After drilling is completed, clean out socket.
- .6 After socket has been cleaned out and inspected, allow to stand for 24 h and inspect again for intrusion of material.
 - .1 Redrive pile, as required to seal socket and repeat drilling, cleaning out and inspection process.

3.04 WELDING

- .1 Weld in accordance with CSA W59.
- .2 Welding certification of companies in accordance with CSA W47.1.

3.05 GROUTING

- .1 Grout in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Grout anchor dowels inside pipe piles, in drilled socket and up to elevation as indicated, as soon as possible after installing anchor dowels.
- .3 Use grout mix that has been demonstrated to produce required strength at temperature prevailing in socket and pile in specified time.
 - .1 Grout mix and grouting pressure to approval of Departmental Representative.
- .4 Hold pile securely in position so that it does not move during grouting and until grout has attained specified strength.
- .5 Place grout in one continuous operation to fill socket and pile up to specified level.

3.06 FIELD QUALITY CONTROL

- .1 Site Tests and inspection:
 - .1 Provide method and equipment for inspection of each pile to ensure that pile and socket are properly cleaned out.
 - .2 Co-operate with and assist Departmental Representative to inspect each pile and socket.

3.07 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