# STEEL PIPE PILES

## 1. GENERAL

### 1.1 Work Included

.1 Excavate and grade for equipment support at pile locations.

.2 Excavate to cutoff elevations at pile locations.

.3 Predrill through obstructions and frost.

.4 Apply grease on piles.

.5 Place piles and fill with sand slurry.

.6 Cut off pile tops at required elevations.

.7 Prepare piles for capping. Install steel cap plates.

.8 Remove all excavated materials from site or deposit on site where directed by Engineer.

### 1.2 Related Work

.1 Structural Steel: Section 05120

### 1.3 Test Reports

.1 Prior to construction and if requested, provide Engineer with two (2) copies of steel producer's certificate, in accordance with ASTM A252.

### 1.4 Qualifications

.1 If required by the Engineer, produce satisfactory proof of successful installation experience with this type of foundation, in similar conditions and with piles of similar capacities.

### 1.5 Inspections

.1 Inspection of piling work is to be performed by the Engineer.

.2 Provide free access to all portions of the work and cooperate with the Engineer.

.3 Notify the Engineer before commencing pile driving in ample time to permit scheduling inspections.

.4 Pay costs for retesting required due to defective materials or workmanship.

### 1.6 Existing Subsurface Conditions

.1 Subsurface investigation report is available for inspection at the office of the Engineer.

## 2. PRODUCTS

### 2.1 Materials

.1 Piles: seamless or welded steel pipe with straight spiral lapped body; conforming to ASTM A252, Grade 2; plain ends; diameters and wall thickness as indicated on the Drawings.

.2 All piles to be 219.1 mm dia. x 8.18 mm thick open ended A53 steel pipe.

.3 Splices: to CSA G40.21 or as indicated on drawings.

.4 Welding electrodes to CSA W48.

.5 Arctic Grade Grout: Sika Arctic 100 or approved alternate

.6 Slurry Backfill

1. Slurry mixture of clean coarse sand and fresh potable water.
2. Sand to meet following gradation limits:

| Particle Size (mm) | Finer than (%) |
|---|---|
| 10 | 100 |
| 5 | 90 – 100 |
| 2 | 70 – 100 |
| 0.4 | 15 – 60 |
| 0.075 | 0 - 10 |

3. The slurry to be free of organic and other deleterious material.

.7 6 mil polyethylene sheets.

.8 Heavy grease.

### 2.2 Fabrication

.1 Supply full length piles to reduce field splicing during installation wherever possible.

.2 Full length piles may be fabricated from piling material by splicing lengths together. Use complete joint penetration groove welds. Splice locations to be approved by the Engineer.

.3 Submit details of planned use of pile material stock to Engineer for approval prior to start of fabrication. Reuse cutoff lengths as directed by the Engineer.

.4 Allowable tolerance on axial alignment to be 0.25% as measured by a 3 m straight edge.

.5 Allowable deviation from a straight line over total length of fabricated pile to be 5 mm.

.6 Repair defective welds only on the authority of the Engineer. Welds which show evidence of having been repaired without authorization may be rejected. Do area being repaired to CSA W59A 1977.

.7 Repair damaged exterior protective coating of piles.

.8 Do welding to CSA W59.

.9 Field splices are not to be located within 2.5 metres of the underside of pile cap plate.

.10 Field splices are to be located so that no more than 50% occur at the same elevation.

**2.3 Surface Treatment**

.1 Pipe pile surfaces shall be prime painted. Surfaces to be painted shall be thoroughly cleaned in accordance with SSPCASP2, Hand Tool Cleaning. Surface shall be free of moisture and protected from adverse weather conditions until the paint is dry. Ambient temperatures shall not be less than 50°F (10°C).

.2 Shop paint shall conform with CGSBA1AGPA81, Air Drying Metal Primer, or shall be any other heavyÄduty shop primer approved by the Engineer. The dry film thickness shall be 5 mils, applied in two coats of 2.5 mils over peaks.

.3 Paint shall be kept stirred while being used, and shall be applied with brush or a suitable spray gun. Paint shall be well worked into all joints and open spaces.

**3. EXECUTION**

**3.1 Preparation**

.1 Ensure that the site conditions at each pile location are adequate to support driving equipment to properly install piles and permit load testing when required.

**3.2 Sequence**

.1 Install piles in the most practical sequence.

**3.3 Pile Design**

.1 Pile design is based on an allowable end bearing strength of 10MPa when adequately embedded into bedrock.

**3.4 Pipe Pile Installation**

.1 Confirm depth to bedrock before installing piles

.2 Ensure piles are of adequate length, including projection and embedment lengths, to minimize field splicing of sections.

.3 Pile installation to be supervised by a Professional; Engineer registered in the NT/ NU

.4 Auger hole min 50 mm larger in diameter than the steel pile.

.5 Completely clean out embedment sleeve.

.6 Fill hole with Arctic Grade grout top of bedrock or to within 2m of the surface whichever is greater.

.7 Coat the upper 2 m of the steel pile or the entire shaft length above bedrock – whichever is less – with heavy grease and wrap the greased portion with 2 layers of 6 mil polyethylene sheets.

.8 Install pile, open ended, and vibrate to ensure pile end bears directly on the bedrock surface. Take care so as not to disturb shaft walls or knock excavation tailings into the hole during the pile installation.

.9 Once grout has set fill annulus with slurry backfill.

**3.5 Slurry Backfill**

.1 The annular space around the pile shall be filled with a properly mixed and placed sand slurry. Free running dry sands or gravelly sands with low water contents (6 to 15 percent) shall be used for the slurry.

.2 The backfill slurry shall be prepared in a portable concrete mixer. Mix sand with barely enough potable water to produce a slurry with a consistency of thick mud. Close control of the water content and the batching operation is necessary to ensure that the slurry slump does not exceed 6 inches (150 mm), as determined by standard concrete tests. The temperature of the slurry shall not exceed 4oC when it is placed in the hole. The use of salt water will not be allowed.

.3 Excess water near the top of pile must be removed by pumping and replaced with sand and slurry mixture.

.4 The slurry must be vibrated or rodded as it is placed to ensure good soil pile contact and eliminate bridging and voids.

.5 The slurry fill shall be continued up to the ground level.

**3.6 Defective Piles**

.1 Engineer, at his discretion, may reject any pile that is out of alignment or out of position, not at the correct elevation, or otherwise fails to meet specified requirements.

.2 Add new piles to replace rejected as directed by the Engineer at no additional cost to the Owner.

**END OF SECTION**

# CHAIN LINK FENCES AND GATES

## 1. GENERAL

### 1.1 General Requirements

.1 All requirements of the Contract apply to and govern all work of this section.

.2 Comply with the requirements of Division I.

### 1.2 References

.1 ASTM A 53-90b, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A 90-81(1991), Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

.3 CAN/CSA-A23.1-M90, Concrete Materials and Methods of Concrete Construction.

.4 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

.5 CAN/CGSB-138.1-M80, Fence, Chain Link, Fabric.

.6 CAN/CGSB-138.2-M80, Fence, Chain Link, Framework, Zinc-Coated, Steel.

.7 CAN/CGSB-138.3-M80, Fence, Chain Link - Installation.

.8 CAN/CGSB-138.4-M82, Fence, Chain Link, Gates.

.9 CAN/CGSB-1.181-92, Ready-Mixed Organic Zinc-Rich Coating.

### 1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Drawings to indicate general arrangement of posts, gates, details of connectors and gate hardware, height and fabrication standards.

## 2. PRODUCTS

### 2.1 Materials

.1 Fencing: as indicated

.1 Acceptable material- full fabric height of fence by Soldan Fence and Metals Ltd.

.2 Concrete mixes and materials:

.1 Nominal aggregate size: 20-5

.2 Compressive strength 20MPa minimum at 28 days.

.3 Chain-link fence fabric: to CAN/CGSB-138.1.

.1 50 mm mesh, 3.5mm thickness, Class A, Zinc Coated.

.2 Height of fabric: as indicated.

.4 Posts, braces, and rails to: CAN/CGSB-138.2, galvanized steel pipe.

.1 Terminal posts: 73 mm outside diameter, schedule 40 pipe.

.2 Line posts: 60 mm outside diameter, schedule 40 pipe.

.3 Rails: 42 mm outside diameter, schedule 40 pipe.

.5 Bottom tension wire: single strand, galvanized steel wire, 5mm diameter.

.6 Tie wire fasteners: single strand, galvanized steel wire conforming to requirements of fence fabric, 5.16 mm diameter.

.7 Tension bar: 5 x 20 mm minimum galvanized steel.

.8 Tension bar bands: 3 x 20 mm minimum galvanized steel.

.9 Organic zinc rich coating: to CAN/CGSB-1.181.

## 2.2 Finishes

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1 Grade 1 minimum 490g/sq.m.

.2 For pipe: 550 g/sq.m minimum to ASTM A 90.

.3 For barbed wire: to CAN/CGSB 138.2.

.4 For other fittings: to CAN/CSA-G164.

## 3. EXECUTION

### 3.1 Grading

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

### 3.2 Erection Of Fence

.1 Erect fence along lines as indicated by Engineer and in accordance with CAN/CGSB-138.3.

.2 Excavate post holes to dimensions indicated by methods approved by Engineer.

.3 Space line posts 3 m apart, measured parallel to ground surface.

.4 Space straining posts at equal intervals not exceeding 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 150 m.

.5 Install additional straining posts at sharp changes in grade and where directed by Engineer .

.6 Install corner post where change in alignment exceeds 15 degrees.

.7 Install end posts at end of fence and at buildings. Install gate posts on both sides of gate openings.

.8 Place concrete in post holes then embed posts into concrete to depths indicated. Extend concrete 50mm above ground level and slope to drain away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 Do not install fence fabric until concrete has cured a minimum of 5 days.

.10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface. Install braces on both sides of corner and straining posts in similar manner.

.11 Install caps.

.12 Install top rail between posts and fasten securely to posts and secure waterproof caps.

.13 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300mm intervals. Knuckled selvedge at top. Barbed at bottom.

.15 Secure fabric to top rails and bottom tension wire with tie wires at 450mm intervals; 300mm intervals for line posts. Give tie wires minimum two twists.

## 3.3 Installation Of Gates

.1 Install gates in locations as indicated.

.2 Level ground between gate posts and set gate bottom approximately 40mm above ground surface.

.3 Install gate stops where indicated.

## 3.4 Touch-Up

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas. Pre-treat damaged surfaces according to manufacturer's instructions for zinc-rich paint.

## 3.5 Cleaning

.1 Clean and trim areas disturbed by operations. Dispose of surplus material as directed by the Engineer.

**END OF SECTION**

# DIVISION 3

# CONCRETE

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## DIVISION 3 - CONCRETE

# CONCRETE FORMWORK

## 1. GENERAL

### 1.1 Work Included

.1 Forms for all concrete.

.2 Wood forms for all cast-in-place concrete.

.3 Shoring, bracing and anchorage.

.4 Form openings for other trades.

.5 Coordinate installation of concrete accessories.

.6 Set anchor bolts, anchors, sleeves, frames and other items supplied by other trades.

.7 Clean erected formwork prior to concrete placement.

.8 Remove forms and supporting falsework.

### 1.2 Related Work

| | | |
|---|---|---|
| .1 | Concrete reinforcement: | Section 03200 |
| .2 | Concrete accessories: | Section 03250 |
| .3 | Concrete: | Section 03300 |

### 1.3 Design Standards

.1 Design and detail forms and supporting falsework in accordance with the National Building Code of Canada, CAN/CSA-A23.1-LATEST, CSA S269.1, ACI 347 and applicable construction safety regulations.

.2 Design for suspended formwork and scaffolding or shoring to be performed by a Professional Engineer licensed in NT/NU.

### 1.4 Quality Assurance

.1 Construct and erect concrete formwork in accordance with CAN/CSA-A23.1-LATEST, CSA S269.1, ACI 347 and all applicable construction safety regulations for the place of work.

### 1.5 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300.

.2 Clearly indicate sizes, methods of construction, materials, arrangement of joints, ties and shores, schedule of erection and stripping, restoring, etc.

## 2. PRODUCTS

### 2.1 Exposed Surfaces

.1 Square-edged, smooth surfaced panels true in plane, free of holes, surface markings or defects.

### 2.2 Unexposed Surfaces

.1 Plywood or other material, suitable to retain concrete without leakage or distortion.

### 2.3 Wood Materials

.1 Plywood: Douglas Fir, conforming to CSA O121-M or Spruce, conforming to CSA O151-M, sheathing. Sound undamaged sheets with clean true edges.

.2 Lumber: conforming to CSA O141-M.

.3 Nails, Spikes and Staples: galvanized or phosphatized; conforming to CSA B111.

.4 Where formwork cannot be recovered after concrete casting and will be in contact with reservoir water, the wood shall consist of untreated solid boards (no laminates, plywood, pwf, etc.) and shall not contain any coating or chemical treatment of any kind, to ensure water quality is not affected.

### 2.4 Accessories

.1 Form Ties: removable metal type, minimum working strength of 13 kN when assembled; free of defects that will leave holes deeper than 25 mm from concrete surface. Use plastic cone snap type or screw type on exposed surfaces. Wire ties are not permitted.

.2 Form Release Agent: colourless oil which will not stain concrete. Use non-toxic form oil that is approved for use in potable water reservoir construction. Product shall be compatible with specified waterproofing products.

.3 Corner or Chamfer Fillets: extruded plastic or mill finished pine, 20 mm width, maximum possible lengths, mitre ends.

.4 Void Form: Expanded polystyrene – low density maximum designed to collapse and crush under soil expansion yet sufficiently strong to support wet concrete at time of casting.

## 3. EXECUTION

### 3.1 Examination

.1 Before starting this work, examine work done by others which affects this work.

.2 Notify the Engineer of any conditions which would prejudice proper completion of this work.

.3 Commencement of work implies acceptance of existing conditions.

### 3.2 Erection

.1 Verify lines, levels and centres before proceeding with formwork. Ensure dimensions agree with drawings.

.2 Construct formwork and falsework to meet design and regulatory requirements, and to produce finished concrete conforming to surfaces, shapes, lines and dimensions indicated on drawings.

.3 Arrange and assemble formwork to permit removal without damage to concrete.

.4 Align joints and make watertight, to prevent leakage of cement paste and disfiguration of concrete. Keep form joints to a minimum. Tape as necessary.

.5 Arrange forms to allow removal without removal of principal shores, where these are required to remain in place.

.6 Obtain Engineer's approval before framing openings in concrete slabs, not indicated on drawings.

.7 Provide 20 mm chamfer on all internal and external corners and edges of exposed concrete unless shown otherwise.

.8 Form chases, slots, openings, drips and recesses as detailed on drawings.

.9 Set screeds with top edge level to required elevations.

.10 Check and readjust formwork to required lines and levels during placing of concrete.

### 3.3 Tolerance

.1 Construct formwork to produce concrete with dimensions, lines and levels within tolerances specified in ACI 347.

## 3.4 Inserts/Embedded Items/Openings

.1 Provide formed openings where required for pipes, conduits, sleeves and other work to be embedded in and passing through concrete members.

.2 Accurately locate and set in place items which are to be cast directly into concrete.

.3 Coordinate work of other Sections and co-operate with trades involved in forming openings, slots, recesses, chases, and setting sleeves, bolts, anchors and other inserts.

.4 Coordinate installation of concrete accessories specified in Section 03250 and/or as shown on drawings or specified in other Divisions of the Specification.

.5 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

.6 Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so no leakage occurs and to provide uniform surface on exposed concrete.

## 3.5 Field Quality Control

.1 Inspect and check complete formwork, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties and parts are secure.

.2 Allow Engineer to review formwork prior to re-use. Formwork may be re-used if approved by the Engineer.

.3 Cleaning

.4 Clean forms as erection proceeds, to remove foreign matter. Remove cuttings, shavings and debris from within forms. Clean with compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

.5 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

## 3.6 Formwork Preparation

.1 Apply form release agent in accordance with manufacturer's recommendations, prior to placing reinforcing steel, anchoring devices and embedded parts.

.2 Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces moist prior to placing concrete.

## 3.7 Form Removal

.1 Notify Engineer prior to removing formwork.

.2 Do not remove forms and falsework until concrete has gained sufficient strength to carry its own weight, plus construction loads and design loads which are liable to be imposed. Verify strength of concrete by compression tests to satisfaction of Engineer.

.3 Remove falsework progressively, in accordance with regulatory requirements and ensure that no shock loads or imbalanced loads are imposed on structure.

.4 Loosen forms carefully without damaging concrete surfaces. Do not apply tools to exposed concrete surfaces.

.5 Leave forms loosely in place for protection until curing requirements are complete.

**END OF SECTION**

# CONCRETE REINFORCEMENT

## 1. GENERAL

### 1.1 Work Included

.1 Reinforcing steel bars for cast-in-place concrete, complete with tie wire.

.2 Support chairs, bar supports and spacers for reinforcing.

### 1.2 Quality Assurance

.1 Perform concrete reinforcing work in accordance with CAN/CSA-A23.1-LATEST.

### 1.3 Shop Drawings

.1 Submit bar lists and placing drawings in accordance with Section 01300.

.2 Clearly indicate bar sizes, spacings, locations and quantities of reinforcing steel.

### 1.4 Delivery and Storage

.1 Deliver, handle and store reinforcement in a manner to prevent damage and contamination.

.2 Deliver bars in bundles, clearly identified in relation to bar lists.

## 2. PRODUCTS

### 2.1 Reinforcing Materials

.1 Reinforcing Steel: 400 MPa yield grade; deformed billet steel bars conforming to CSA G30.18-M-92; plain finish.

### 2.2 Accessory Materials

.1 Tie Wire: minimum 1.6 mm annealed type.

.2 Chairs, Bolsters, Bar Supports, Spacers: adequately sized for strength and support of reinforcing steel during construction.

## 3. EXECUTION

### 3.1 Examination

.1 Before starting this work, examine work done by others which affects this work.

.2 Notify the Engineer of any conditions which would prejudice proper completion of this work.

.3 Commencement of work implies acceptance of existing conditions.

## 3.2 Fabrication

.1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1-LATEST, and drawings.

.2 Locate reinforcing splices not indicated on drawings at points of minimum stress.

.3 Fabricate within the following tolerances:

.1 Sheared length: ±25 mm.

.2 Depth of truss bars: plus 0, minus 10 mm.

.3 Stirrups, ties and spirals: ±10 mm.

.4 Other bends: ±25 mm.

.4 Weld reinforcing bars in accordance with CSA W186.

.5 All bending shall be done cold with a suitable machine accurately producing all lengths, depths and radii shown on the bending details.

.6 After initial fabrication, reinforcing steel shall not be rebent or straightened unless so indicated on the drawings.

.7 Heating of reinforcing steel will not be permitted.

## 3.3 Installation

.1 Place reinforcing steel in accordance with reviewed placing drawings and CAN/CSA-A23.1-LATEST. Chair slab reinforcing sufficiently such that specified position is maintained, but not further apart than 1.2 m in either direction.

.2 Adequately support reinforcing, and secure against displacement within tolerances permitted.

.3 SPEC NOTE: Select from following clauses to suit.

.4 Place reinforcing steel to provide concrete cover required by CAN/CSA-A23.1-LATEST.

.5 Place reinforcing steel to provide concrete cover as follows unless noted otherwise on the drawings:

| Item | Coverage (mm) |
|---|---|
| Slabs and Toppings | 40 |
| Curbs | 40 |

.6 Maintain alignment as follows:

| Item | Tolerances Plus or Minus |
|---|---|
| Slabs | 5 mm |
| Other Structural Members | 10 mm |
| Rebar Bends and Ends | 50 mm |

.7 Do not disturb or damage vapour barrier while placing reinforcing steel.

## 3.4 Cleaning

.1 Ensure concrete reinforcing is clean and free from oil and deleterious matter.

.2 Remove all loose scale, loose rust and other deleterious matter from surfaces of reinforcing.

**END OF SECTION**

# CONCRETE ACCESSORIES

## 1. GENERAL

### 1.1 Work Included

.1 Anchored inserts.

.2 Joint sealants.

.3 Vapour barrier.

### 1.2 Related Work

.1 Concrete formwork: Section 03100

.2 Concrete: Section 03300

## 2. PRODUCTS

### 2.1 anchors/inserts

.1 Epoxy inserts: designs are based on Hilti HAS & HY150 epoxy. Use cold weather grade if application temperature is below 10°C.

.2 Mechanical inserts: designs are based on Hilti Kwik Bolts.

### 2.2 Sealants

.1 Polyurethane Sealant (Horizontal Joint): withstand a maximum of 25% joint movement, Sikaflex 12-SL, PRC 6006, Vulkem 45.

.2 Polyurethane Sealant (Vertical Joint): withstand a maximum of 25% joint movement, Sikaflex la, PRC 270, Vulkem 116.

.3 Interior Saw Cut Joint or Control Joint Sealant: catalyst cured epoxy rubber, Sternson Loadflex, Sealtight Bondflex, Concrete Chemicals 903B Flexible Sealant, Allied Coatings AC-1210 Flexible Epoxy Sealant.

.4 Primers: as supplied by sealant manufacturers.

### 2.3 Vapour Barrier

.1 Vapour Barrier: 0.15 mm clear polyethylene film, unreinforced, with self-adhesive polyethylene tape for joints, suitable for use below grade.

## 3. EXECUTION

### 3.1 Examination

.1 Before starting this work, examine work done by others which affects this work.

.2 Notify the Engineer of any conditions which would prejudice proper completion of this work.

.3 Commencement of work implies acceptance of existing conditions.

### 3.2 Installation

.1 Coordinate work of this Section with other construction.

.2 Install all concrete accessories in accordance with drawings and manufacturer's recommendations; straight, level, and plumb.

.3 Ensure embedded items are not disturbed during concrete placement.

.4 When installing seals, clean contact surfaces free from dirt, water, oil, rust, frost, and any other loose foreign matter. When recommended by manufacturer, prime contact surfaces of concrete.

.5 Install protective boards over joint covers when potentially damaging construction activities are not complete.

**END OF SECTION**