



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canada

Small Craft Harbours Branch

Technical Specifications

PORT EDWARD, BC

WHARF RECONSTRUCTION

PHASE I

October, 2016



TECHNICAL SPECIFICATIONS

SECTION	TITLE
00 00 01	Technical Specification Index
01 00 00	General Requirements
01 01 00	Summary of Work
01 35 29.06	Health and Safety Requirements
00 20 60	Demolition of Structures
00 22 20	Fill and Rock Work
00 23 63	Steel Piles
00 23 64	Wood Piling
00 23 89	Soil Anchors
00 30 00	Concrete
00 51 00	Structural Steel Work
00 55 00	Metal Fabrication
00 61 00	Rough Carpentry
00 98 00	Painting

DRAWINGS	TITLE
216124-001	Existing Site Plan
216124-002	General Arrangement
216124-003	New Concrete Wharf
216124-010	Concrete Wharf – Phase I
216124-011	Concrete Wharf Phase I – Sections
216124-012	Concrete Wharf Phase I - Pile Plan
216124-013	Concrete Wharf Phase I - Pile Anchor Details
216124-014	Concrete Wharf Phase I - Steel Structure Plan
216124-015	Concrete Wharf Phase I - Steel Structure; Sections and Details; Sheet 1 of 2
216124-016	Concrete Wharf Phase I - Steel Structure; Sections and Details; Sheet 2 of 2
216124-017	Concrete Wharf Phase I - Railing and Miscellaneous Details
216124-018	Concrete Wharf Phase I - Timber Deck and Slope Protection
216124-020	Concrete Wharf Phase I - Concrete Deck; Plan, Sections and Details
216124-021	Concrete Wharf Phase I - Concrete Abutment; Plan, Sections and Details
216124-022	Concrete Wharf Phase I – Reinforcing; Plan, Sections and Details

REFERENCE DRAWINGS:**Existing Wharf:**

800591-S1of7	Site Plan
800591-S2of7	Piles and Decking Plan
800591-S3of7	Typical Sections & Construction Details
800591-S4of7	Various Concrete and Connecting Details
800591-S5of7	Fender and Ladder Details
800591-S6of7	Light Pedestal & Other Details
800591-S7of7	Travelift Support Structure; Construction Details

END OF SECTION

1 GENERAL

- .1 PWGSC's General Conditions and related contract documents form an integral part of this section.

2 MINIMUM STANDARDS

- .1 In the absence of other standards specified in the Contract Documents, all work is to conform to, or exceed, the minimum standards of the Canadian Government Specifications Boards, the Canadian Standards Association, the American Society for Testing of Materials, or the National Building Code of Canada, whichever is applicable.
- .2 All work to be done in accordance with Work Safe BC regulations.

3 INTERFERENCE WITH OPERATION

- .1 The Contractor shall obey all navigation regulations and conduct operations so as to interfere as little as possible with the use of berthing spaces, fairways and passages. Install and maintain any and all protection to navigation as may be required by any properly constituted authority or by the Engineer. During the course of construction and clean up, do not dispose of surplus, waste or demolished materials in navigable waters.
- .2 The Contractor shall upon instruction of the Owner or Engineer, promptly remove any of the Contractor's equipment located outside the specified work area and obstructing any harbour operation.

4 BARRIERS, LIGHTS AND WATCHING

- .1 The Contractor shall provide all requisite barriers, fences, warning signs, lights and watching for the protection of persons and property on or adjacent to the site.

5 SITE ACCESS

- .1 The Contractor shall make his own arrangements subject to the approval of the Engineer, for access to the site. Site access shall be coordinated with the local Harbour Authority.
- .3 The Contractor shall maintain routes of travel, the Engineer being the sole judge as to what may be deemed reasonable:
- .4 The Contractor shall erect and maintain barriers, fences, lights, warning devices, and other protective devices as may be required for prevention of theft or damage of goods and protection of the public and workers, or if so ordered by the Engineer.

6 CONSTRUCTION AREA

- .1 The Contractor shall regulate construction traffic on public areas and comply with all local ordinances in connection therewith, including load limitation and removal of debris.
- .2 The Contractor shall confine his operations on the site to those areas actually required for the work including routes and regulations approved by the Owner for haulage of materials.

7 NIGHT WORK

- .1 The Contractor shall keep proper lights each night between the hours of sunset and sunrise upon all floating plant and false-work, upon all ranges and other stakes where necessary, and upon all buoys of such size and in such locations as required by a governing authority. When work is done at night, maintain from sunset to sunrise such lights on or about the work and plant as necessary for the proper observation of the work and the efficient prosecution thereof.

8 CLEAN-UP

- .1 At all times the Contractor shall keep the site free from accumulation of waste material and debris and leave the site clean and tidy on completion.

9 TEMPORARY SERVICES

- .1 On site the Contractor shall make his own arrangements for supply of water and electricity.
- .2 The Contractor shall supply for his own use; sanitary, first aid, and all other temporary services and facilities required for the work.

10 PROGRESS REPORT

- .1 The Contractor shall keep a daily record of progress of the work available for inspection by the Engineer.
- .2 The daily record shall include particulars of weather conditions, number of workers, plant and equipment working and work performed.

11 ENGINEER'S ACCESS

- .1 The Contractor shall provide access to the work for the Engineer's inspectors and surveyors as required.

12 PERMITS AND ROYALTIES

- .1 Permits and licenses required for the Contractors work are the responsibility of the Contractor and shall be for the Contractor's account. The Contractor shall have the appropriate business license.

13 PROTECTION OF EXISTING STRUCTURES

- .1 Existing structures, adjacent marine facilities, roads, services, piping or equipment within the work area which are not to be replaced shall be properly protected from any injury or damage, direct or indirect. Any damage that is caused as a result of the operations of the Contractor shall be repaired and made good at the Contractor's expense to the satisfaction of the Engineer.

14 WEATHER

- .1 No work shall be undertaken by the Contractor when, in the opinion of the Engineer, the weather is unsuitable or unfavourable for a particular class of work. Time lost by the Contractor due to stoppage on account of adverse weather conditions may be allowed

the Contractor, at the discretion of the Engineer, as an extension of time for the completion of the work over and above the date of completion specified in the contract agreement.

15 PREVENTION OF WATER AND AIR POLLUTION

- .1 The Contractor shall comply with Federal and Provincial laws, orders and regulations concerning the control and abatement of water and air pollution.

16 SOIL DATA AND EXISTING TOPOGRAPHY

- .1 The Contractor shall notify the Engineer of any subsurface conditions at the place of the work that may differ materially from those indicated in the Contract Documents.

17 UTILITIES AND SERVICES

- .1 The Contractor shall be responsible for any damage to overhead, underwater and/or underground utilities and/or services caused by the Contractor's operations and shall repair and make good the repairs at the Contractor's own expense.
- .2 The Contractor shall be responsible, unless otherwise agreed to by the Engineer, for all temporary or construction services and utilities, and first aid facilities.

18 CARE OF FINISHED WORK

- .1 The Contractor shall protect all finished work from injury, defacement, unauthorized entry, or trespass until such time as the work described in the Contract Documents is substantially complete.

19 NOISE BY-LAWS

- .1 The Contractor shall comply with the requirements of any local or other Noise By-Laws.

END OF SECTION

1 GENERAL

- .1 PWGSC's General Conditions and related contract documents form an integral part of this section.

2 WORK INCLUDED

- .1 The work under this contract shall include the supply of equipment, labour and materials for the performance of all work as required by the Contract Documents. All replaced items, cut-offs and waste material shall be disposed by the contractor in strict accordance with provincial, local, and municipal regulations and Part 8 of the National Building Code and with the Canadian Construction Safety Code.
- .2 The work to be carried out under this contract includes the demolition and disposal of the southern part of an existing wharf and the south approach to the wharf in Port Edward and the construction of Phase I of a new concrete wharf. The work generally consists of, but is not limited to the following items:
- .1 Mobilisation/Demobilisation
- .2 Demolish the approximately 25 m long and 12 m wide southern section of the existing wharf from Pile Cap 20 to 14 and the approximately 15 m long and 5 m wide south approach to the wharf. The wharf and approach consist of pre-cast concrete deck panels supported by creosote treated timber pile caps and creosote treated vertical timber bearing and batter piles; see reference drawings 800591 S1 to S7.
- .3 Supply and install thirty-three (33) 609.6x12.7 mm and eight (8) 609.7x15.9 mm vertical steel pipe piles socketed 2 m into bedrock.
- .4 Supply and install one (1) batter 609.6x12.7 mm steel pipe piles driven to refusal.
- .5 Supply and place fill and rip rap slope protection as shown on the drawings.
- .6 Supply and install soil anchors in two (2) 609.6x12.7 mm steel pipe piles complete as shown on the drawings.
- .7 Supply and install steel pile caps and tie beams complete, as shown on the drawings.
- .8 Supply and cast reinforced concrete deck and abutment, as shown on the drawings.
- .9 Supply and install timber deck, as shown on the drawings.
- .10 Supply and install fender piles, guardrail, railing, ladders and cleats, as shown on the drawings.
- .11 Supply and install temporary railing at the south face of the remaining section of the existing wharf and at the north face of Phase I of the new wharf, as directed by the Owner.

END OF SECTION

Part 1 General**1.1 RELATED SECTIONS**

- .1 Section 01 11 00 – SUMMARY OF WORK
- .2 Section 01 35 43 – ENVIRONMENTAL PROCEDURES

1.2 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of British Columbia
 - .1 Workers Compensation Act, RSBC 1996 - Updated 2012.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operations.
- .3 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental

Representative 5 days after receipt of comments from Departmental Representative.

- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with 3 weeks of contract award. Contractor to submit written acknowledgement to CSST along with Ouverture de Chantier Notice.
- .3 Work zone locations include:
 - .1 Port Edward Small Craft Harbour.
- .4 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.5 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.7 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Port Edward Small Craft Harbour Authority

1.8 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Workers Compensation Act, B.C. Reg.
- .2 Comply with R.S.Q., c. S-2.1, an Act respecting Health and Safety, and c. S-2.1, r.4 Safety Code for the Construction Industry.
- .3 Comply with Occupational Health and Safety Regulations, 1996.
- .4 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .5 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of the Province having jurisdiction and advise Departmental Representative verbally and in writing.
- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise the Health and Safety co-ordinator and follow procedures in accordance with Acts and Regulations of the Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.12 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with.

- .2 Have working knowledge of occupational safety and health regulations.
- .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
- .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

1.13 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of the Province having jurisdiction, and in consultation with Departmental Representative.

1.14 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

1 GENERAL

- .1 PWGSC's General Conditions and related contract documents form an integral part of this section.
- .2 Where existing works are to be removed, they shall be removed and salvaged or disposed of to the satisfaction of the Engineer.
- .3 The Contractor shall furnish all labour, materials, tools, plant and services required incidental to the completion to the full extent of the drawings and specifications for the execution of all demolition salvage and protection work specified herein.
- .4 Demolition and disposal shall be carried out in strict accordance with provincial, local, and municipal regulations and Part 8 of the National Building Code and with the Canadian Construction Safety Code.
- .5 Demolition shall be carried out in accordance with the construction schedule as approved by the Owner.

2 REMOVAL OF DEMOLISHED MATERIAL

- .1 All material, which are not to be salvaged for the Owner, shall become the Contractor's property and the Contractor must remove it from the site.
- .2 It shall be the Engineer's decision as to which material shall be salvaged and which materials shall be disposed of.
- .3 Timber piles shall be completely removed where possible. If it is not possible to remove a pile, the pile shall be broken off below ground level. The contractor shall record location and length of piles being extracted. This information may be used to confirm the actual surface elevation of bedrock.

3 SALVAGE

- .1 Material to be salvaged for the Owner shall be stored as directed by the Engineer.
- .2 Two cleats and two ladders installed on the south part of the wharf that is to be demolished shall be salvaged for possible reinstallation on the new wharf.

4 PROTECTION

- .1 The Contractor shall protect the remaining structural elements and adjacent structures against damage from falling debris or other causes.
- .2 The Contractor shall take precautions to guard against movement or settlement of adjacent structures and remaining structural elements, provide and place shoring or bracing as required, and be responsible for the safety and support of such structures, be liable for any damage or injury caused thereby or resulting therefore. If at any time safety of any adjacent structure appears to be endangered; the Contractor shall cease operations and notify the Engineer.

END OF SECTION

1 GENERAL

- .1 PWGSC's General Conditions and related contract documents form an integral part of this section.

2 MATERIALS

- .1 Gravel Fill: Gravel fill or quarry tailing comprising well graded granular material with continuous gradation, free of any deleterious material, and conforming to the following grading requirements:

U.S. Standard Sieve Size	Percent Passing by Weight
150 mm Screen	100
75 mm Screen	40 - 70
38 mm Screen	25 - 50
19 mm Screen	20 - 35
4.75 mm Screen	10 - 20
1.18 mm Screen	0 - 10

- .2 Road Base: Well graded crushed rock, gravel, sand and fines with continuous gradation, free of any deleterious material, having a maximum diameter of 50 mm (2") and gradation conforming to the following requirements:

U.S. Standard Sieve Size	Percent Passing by Weight
50 mm Screen	100
37.5 mm Screen	80 - 100
19 mm Screen	50 - 100
9.5 mm Screen	35 - 75
4.75 mm Screen	25 - 55
2.36 mm Screen	20 - 40
1.18 mm Screen	15 - 30
0.300 mm Screen	5 - 15
0.075 mm Screen	0 - 5

- .2 Filter Rock: Well graded quarry rock with continuous gradation, free of any deleterious material, having a maximum diameter of 75 mm (3") and gradation conforming to the following requirements:

U.S. Standard Sieve Size	Percent Passing by Weight
75 mm Screen	100
37.5 mm Screen	70 - 100
19 mm Screen	40 - 90
4.75 mm Screen	5 - 25
2.0 mm Screen	0

- .3 Rip Rap: Hard, durable abrasion-resistant quarry rock, free from seams, cracks or other structural defects, with specific gravity not less than 2.65, and free from organics, sand, silt, clay and debris. The quarry rock shall be angular in shape with ratio of maximum to minimum dimensions generally not exceeding 3.

Gradation:

Maximum diameter $D_{100\%} = 600$ mm (24").

Not more than 50% by weight with a diameter smaller than $D_{50\%} = 300$ mm (12").

Not more than 15% by weight with a diameter smaller than $D_{15\%} = 75$ mm (3").

- .4 The Contractor shall when and as directed by the Engineer break down into fractions a sample of a representative volume compared to the material. The Contractor shall carry out the necessary weighing of the fractions.
- .5 Material, which does not meet the Specifications and hence is rejected by the Engineer shall be promptly removed from the site and satisfactorily substituted by the Contractor.

3 EXECUTION

- .1 Remove all debris, logs etc. from areas that will be covered by the new fill and slope protection.
- .2 Placement of Gravel Fill: Place fill material in uniform layers not exceeding 500 mm loose thickness. Fill above mean water level (+ 3.8 m) shall be compacted to a minimum of 97% density Standard Proctor up to grade indicated. Compact each layer before placing succeeding layer.
- .3 Placement of Road Base: Place road base in a uniform layer and compacted to a minimum of 99% density Standard Proctor up to grade indicated.
- .4 Placement of Filter Rock: The Contractor shall place the filter rock in a uniform layer to the lines and grades shown on the drawings.
- .5 Placement of Rip Rap: The Contractor shall place the rip rap in random pattern to the thicknesses as shown on the drawings. Reasonable effort shall be made in the placing to ensure good contact between individual rocks. Rip rap rocks placed in a loose pattern will not be accepted.
- .6 Material which does not meet the Specifications and hence is rejected by the Engineer shall be promptly removed from the site and satisfactorily substituted by the Contractor.

END OF SECTION

1 GENERAL

- .1 PWGSC's General Conditions and related contract documents form an integral part of this section.

2 MATERIALS

- .1 Steel pipe piles shall have minimum yield strength of 310 MPa meeting the requirements of the latest edition of at least one of the following specifications:

- a) ASTM A252 Grade 3
- b) API 5L Grade X46
- c) CSA Z245.1-M with the following provisions:

i) Chemical analysis of material shall show the copper content.

ii) All welds shall be full strength and shall satisfy the requirements of either ASTM A53 or CSA Z245.1-M.

iii) Flattening tests for ductility shall be conducted in accordance with the procedure and frequency stipulated in CSA Standard Z245.1-M or ASTM Standard A53.

iv) Unless longitudinal welds are certified as conforming to the requirements of ASTM A53, CSA Z245.1-M or API 5L to the satisfaction of the Engineer, welds shall be 100 percent inspected by ultrasonic or electromagnetic inspection according to the requirements of ASTM A53. This inspection shall be conducted at the Contractor's expense.

v) The Contractor shall bear the expense of repairing and re-inspecting all rejected welds.

vi) Allowable tolerance on dimensions shall meet the requirements of CSA Z245.1-M.

- .2 The minimum length of a pile section used in the fabrication of piles shall be 3.0 m.

- .3 Welded pipe splices shall have full strength welds.

- .4 The Contractor shall provide necessary certification from a certifier acceptable to the Engineer to demonstrate that the material meets the above standards.

3 HANDLING PILES

- .1 Piling shall be handled and stored so as to avoid over stressing or injury, and any piles bent or damaged, or in any way made defective in the opinion of the Owner or Engineer, shall be made good to his satisfaction or replaced.

4 FABRICATION

- .1 Welding practice and qualifications of fabricators and erectors of welded construction shall conform to the requirements of CSA Standards W47, W48, and W59, latest editions.
- .2 Piles shall be spliced to the required lengths in a workshop or similar suitable place that will ensure good quality splices.
- .3 Lengths to be joined shall be manipulated in jigs so that only down-hand welding is employed.
- .4 The splice shall be complete joint penetration welds and shall develop the full strength of the pile section. Splices shall be made in a manner that will ensure good alignment of the spliced parts. The number of splices shall be held to a minimum.
- .5 The longitudinal welds of pipe pile lengths to be joined shall be staggered 90 degrees.
- .6 The end profile of a pile section to be butt welded shall not have a deviation of more than 1.0 - 1.6 mm from a plane perpendicular to the axis of the pile.
- .7 Maximum deviation of the line of the pile at the splices shall be 3 mm when measured with a 3.0 m straight edge.
- .8 All pile splices shall be 100 percent inspected and tested. This inspection shall be conducted at the Contractor's expense.
- .9 Inspections of pile splices shall be by non-destructive ultrasonic tests in accordance with the requirements of AWS D1.1; dynamic. The test results shall be made available to the Engineer. If the inspection of a weld should indicate poor alignment of the pile sections, insufficient penetration of the weld, lack of fusion, slag inclusions, porosity or any such defects, the Contractor shall take the necessary corrective measures to provide a full strength weld to the satisfaction of the Engineer. The cost of correcting defective welds and re-testing shall be borne by the Contractor.

5 INSTALLATION OF STEEL PILES

- .1 Piles shall be installed in accordance with Best Management Practice for Pile Driving and Related Operations – BC Marine and Pile Driving Contractors Association – November; 2003.
- .2 All piles except batter pile D7/1.6 shall be socketed 2 m into bedrock. Batter pile D7/1.6 shall be driven to refusal. All piles may be installed with a vibratory hammer. However, all pile shall be drive to refusal with a standard air, diesel, hydraulic or drop hammer capable of providing an effective impact energy of at least 100 kNm (~74,000 ft-lb) or as approved by the Engineer.

All piles including piles socketed into bedrock shall be driven to a final set equivalent to 12 blows per 25 mm (1") for a hammer with effective impact energy of 100 kNm (~74,000 ft-lb).
- .3 All pile driving equipment shall be in good mechanical condition and shall be capable of delivering the manufacturer's rated energy output and shall be operated in accordance with the manufacturer's instructions.
- .4 Pile driver leads shall be constructed in a manner which affords freedom of movement of the hammer and they shall be held in position by guys, stiff braces or by attaching to

cranes or derricks so as to ensure proper support for the pile during driving. Hammer blows at all times shall be in direct line with the axis of the pile.

- .5 Steel piles shall be driven without excessive deformation of the head of the pile. The head of the pile shall be cut square and a driving cap shall be provided to hold the axis of the pile in line with the axis of the hammer.
- .6 The driving cap shall fit continuously over the top of the pile and shall project about 150 mm down over/into the pile and shall be such that the pile is held properly in line with the leads. A cushion of hardwood, fibre, plywood or other suitable material shall be placed between the driving cap and the hammer. The cushion shall be replaced if so directed by the Engineer.
- .7 Piles shall be driven in the positions shown on the drawings. Piles shall be driven and installed within a tolerance of +/- 50 mm in location and within 0.5% from the specified axial alignment. The Engineer may reject piles driven out of alignment or damaged in any way after inspection. Cost of remedial measures decided by the Engineer shall be borne by the Contractor.
- .8 The surface elevation of the bedrock may vary significantly from place to place and actual pile tip elevations may differ from the estimated tip elevations provided on the pile plan. All piles shall be supplied with a minimum length of 2 m in excess of the length derived from the estimated tip elevation presented on the pile plan. The Contractor shall during pile installation be prepared to interchange a pile with another pile having a more suitable pile length at locations where the actual bedrock elevation is significantly different from the estimated elevation.

6 STEEL PILE CUTTING SHOES

- .1 The batter pile to be driven to refusal but not socketed into bedrock shall have an outside cutting shoes.

7 CUT OFFS

- .1 After driving, piles shall be cut off at the elevations shown on the plans. In driving, sufficient length above cut off shall be allowed so that no part of the head of the pile damaged or deformed during driving remains in the work.
- .2 Piles shall be cut in a flat plane. A suitable guide shall be used to aid in cutting piles so that the cut off plane is within specified butt weld splice tolerances. If a satisfactory hand-held cut cannot be obtained, the Contractor shall cut the pile with an automatic cutter.

8 PILE DRIVING RECORDS

- .1 The Contractor shall maintain an accurate record of pile driving. The Contractor shall submit a copy of the record to the Engineer. The Contractor shall co-operate with the Engineer in maintaining these records. The Contractor shall record for each pile:

- | | |
|-------------------------------|--|
| - Pile number and location | - Cut off elevation |
| - Date and time driven | - Penetration in overburden and in bedrock |
| - Length of pile driven | - Tip elevation |
| - Type of pile driving hammer | - Final set and hammer energy |

9 TEMPORARY RESTRAINT OF DRIVEN PILES

- .1 The Contractor shall furnish sufficient labour and materials to adequately secure the piles of any given group against motion relative to others in the group.
- .2 Temporary restraints once erected and approved shall be maintained in good order until completion of the structure.

10 CORROSION PROTECTION

- .1 The outside surface of the pipe piles shall be painted. Painting shall be in accordance with the requirements of Section 00 98 00 – Painting.

END OF SECTION

1 GENERAL

- .1 PWGSC's General Conditions and related contract documents form an integral part of this section.
- .2 All work to be in accordance with Best Management Practices (BMP) for the use of treated wood in aquatic environments.

2 MATERIAL

- .1 Pile Material
 - .1.1 All timber piles shall be round Douglas Fir with a minimum butt diameter of 305 mm (12") and shall comply in quality with the requirements of Canadian Standard CAN/CSA 056, latest revision.
- .2 Fasteners
 - .2.1 All bolts, nuts, washers, drift pins, spikes and nails shall be hot dip galvanised in accordance with Specification CAN/CSA G164-M.
 - .2.2 Bolt holes in timber piles shall be bored to provide driving fit. Holes for drift pins shall be 2 mm undersize and longer than the drift pins. Hole sizes of lag screws are to be as specified in Standard CAN/CSA 086.1-M, latest edition.
 - .2.3 Unless otherwise specified, connection bolts, lag screws or drift bolts shall be placed through the centre of the timber piles and shall not be less than seven times the bolt diameter from the end of the timber pile.
 - .2.4 Plate washers shall be used under the heads and nuts of all bolts against timber piles.
 - .2.5 All bolts to meet the requirements of Standard ASTM - A307.
 - .2.6 Nails, spikes and staples to meet the requirements of Standard CAN/CSA B111-M.

3 PROTECTION

- .1 Avoid dropping, bruising or breaking of wood fibres.
- .2 Avoid breaking surfaces of treated piles.
- .3 Do not damage surfaces of treated piles below cut-off elevation by boring holes or driving nails or spikes into them to support temporary material or staging. Support staging in rope slings carried over tops of piles or by attaching to pile clamps of approved design.
- .4 Treat cuts, breaks or abrasions on surfaces of treated piles, bolt holes and field cuts in accordance with Standard CAN/CSA 080-M.

4 EXECUTION

- .1 Preparation
 - .1.1 Protect pile heads during driving and closely fit driving heads to top of pile. Where necessary protect pile heads by means of heavy steel straps or wrought iron rings.

- .1.2 Protect treated piles to avoid breaking through the treated surface. Cant hooks and rafting dogs may be used only in the end of piles. No spikes shall be driven into the piles below high-water level. All cuts or breaks in the surfaces of creosote treated piles shall be treated with one coat of approved mastic.
- .1.3 Bolt holes with a final position at an elevation above high water level shall be filled with CCA preservative and the bolts shall be dipped in CCA preservative concentrate before the bolts are placed. Bolt holes with a final position at an elevation below high water level shall be filled with approved mastic before the bolts are placed.
- .1.4 Where timber piles have to be cut for plate washers, the cut surface shall be treated with two coats of CCA preservative and a further coat of mastic before washers are placed.
- .2 Installation
- .2.1 Piles shall be installed in accordance with Best Management Practice for Pile Driving and Related Operations – BC Marine and Pile Driving Contractors Association – November; 2003.
- .2.2 Piles shall be driven with standard equipment; vibrator, air, steam, diesel or drop hammer approved by the Engineer. Piles shall be driven tip down.
- .2.3 Prior to any pile driving, the Contractor shall inform the Engineer about the equipment he intends to use. Based on the type and size of hammer, the Engineer will determine the final set requirements.
- .2.4 Piles shall be driven to refusal or to a minimum penetration of 4 m.
- .2.5 Piles shall be installed with a maximum deviation of 100 mm at the seabed from the given location and not more than 0.5% off alignment.
- .2.6 Timber piles shall be driven in such a way that they are not broken or split. The heads of piles shall be sniped and the tips shall be fresh if the driving is hard in the opinion of the Engineer. A ring or wire mesh shall be used to prevent the head from splitting during hard driving. If the rings or wire mesh do not prevent splitting, steel tension bands 30 mm by 1 mm shall be used. These materials are to be supplied by the Contractor. After driving, the piles shall be cut off at the elevation shown on the drawings.
- .2.7 Any pile which is split or otherwise damaged below the cut-off elevation or is driven out of position or location, so that in the opinion of the Engineer it is unfit for the use for which it is intended, shall be removed and replaced with a sound pile, at the Contractor's expense.
- .3 Treatment of Pile Tops
- .3.1 The tops of all piles shall be treated with two separate coats of CCA preservative and one coat of approved mastic at least 5 mm thick.
- .3.2 In addition, the tops of all piles shall be covered with a sheet of 1 mm annealed corrosion-resistant aluminium cut 150 mm larger than the diameter of the pile top. The overhanging edges shall be crimped and turned down and secured to the piles with eight aluminium roofing nails and shall not be cut to facilitate fitting.

END OF SECTION

1 MATERIALS

- .1 Anchors shall be Dywidag Threadbars as supplied by Dywidag-Systems International or approved equal in accordance with the drawings and specifications.
- .2 Anchor bar shall be Hot-rolled Reinforcing Threadbars conforming to the requirements of CSA Standard CSA G30.1892 Grade 517/690 MPa.
- .3 The anchorage at the loading head shall be compatible with the post-tension system used and capable of developing at least 95% of the guaranteed minimum ultimate tensile strength of the anchor material.
- .4 Steel anchor casing shall be used inside the piles. The inside diameter shall be sufficient for drilling and installing the anchors. Steel pipe casings with a minimum wall thickness of 5 mm or approved equivalent shall be used.
- .5 Grout shall consist of non-shrink cement grout. The grout shall develop a minimum compressive strength of 30 MPa after 7 days and a minimum compressive strength of 40 MPa after 28 days. The grout mix design shall be submitted to the Engineer for approval at least fourteen days prior to placing.

2 INSTALLATION OF ANCHOR CASING

- .1 Steel pipe anchor casing shall be installed in each pile with anchors. The tip of the casing shall be advanced to a minimum of 1 m below the tip of the pile in the bedrock and the top of the casing shall reach to the pile cap. The casing shall be left in place and the space between the casing and the anchor threadbars shall be filled with grout after testing and lock-off of the anchors.

3 DRILLING

- .1 Anchor holes shall be located and drilled to the depth as shown on the drawings.
- .2 Depending on the site conditions it may be required to inject grout into the soil around the tip of the casing in order to prevent cave-in of the drill hole if an open drill hole is used below the casing.
- .3 The Contractor shall keep a record of the drilling procedures and time, which shall be made available to the Owner and Engineer.

4 INSTALLATION OF ANCHORS

- .1 The Owner and Engineer shall be notified a minimum of 48 hours prior to installation of anchors.
- .2 The anchor threadbars shall have a protective sheathing from the tip of the permanent anchor casing to the top of the pile cap. The anchor threadbars shall have no protective coating or sheathing in the bond zone below the permanent anchor casing.
- .3 All equipment and procedure used for the fabrication, handling and installation of the anchors shall be such that it will not damage the anchor threadbars or grout tubes.
- .4 Grout tubes shall be checked with water or compressed air to ensure that they are clear.
- .5 The anchor bonded length shown on the drawings shall be considered to be the minimum bonded length, and shall be located within the bond zone of the anchor stratum.

- .6 The Contractor shall maintain a record showing the anchor type and installation and grouting date for each anchor.

5 GROUTING

- .1 The grouting equipment shall be capable of continuous mechanical mixing to produce a grout free of lumps and un-dispersed cement. A manifold system with a series of valve and calibrated pressure gauges shall permit continuous circulation and pumping of grout with accurate control of grout pressure.
- .2 The primary grout shall be pumped into the anchor hole through a grout pipe provided for that purpose until the hole is filled to the top of the anchorage zone. The grout shall always be injected at the lowest point on the bond length. Provisions shall be made for determining the level of the top of primary grout to assure adequate anchorage.
- .3 The free stressing length shall be flushed out to remove the grout above the bond length with specially provided flushing tubes.
- .4 After grouting, the anchors shall remain in an undisturbed condition until the necessary grout strengths have been achieved.
- .5 The secondary grouting of the upper part of the anchor inside the anchor casing shall be performed after testing and lock-off.

6 STRESSING AND ACCEPTANCE TESTING

- .1 All stressing equipment must be in good condition with the specifications of the manufacturer and must, at all times, be maintained in good condition. The Owner and Engineer shall be notified a minimum of 48 hours prior to acceptance testing.
- .2 Accurately calibrated load cells shall be employed to measure the load at all anchors. The pump, jack and all stressing equipment shall be calibrated in order to verify the load cell reading. All calibration shall be conducted by an approved laboratory with the necessary equipment and shall be certified. If any incident occurs during transportation, handling or stressing which may have caused damage, the equipment shall be re-calibrated.
- .3 Anchor stressing shall not be carried out until the grout has reached its specified strength.
- .4 Anchors shall be stressed for acceptance as specified before locking off at the transfer load as specified on the drawings.
- .5 All acceptance test data shall be recorded and made available to the Owner and Engineer upon request.
- .6 Load versus displacement data for each test shall be plotted on a load extension graph. Two boundary lines defined as follows shall be plotted on the graph before the start of testing. The upper boundary line shall correspond to the theoretical elastic elongation equivalent to the free anchor length plus 50% of the bond length. The lower boundary line shall correspond to the theoretical elastic elongation equivalent to the free anchor length.
- .7 Anchor displacement for creep testing under constant loading shall be plotted as displacement in millimetres versus the log of time in minutes.

.8 Acceptance testing shall be conducted as follows:

An initial load, T_o , equivalent to 10% of the design test load, T_t , shall be applied to remove any slack from the anchor bars and stressing equipment. At this time, the zero reading for the anchor displacement measurements shall be made. The anchor shall then be stressed in a single operation to $1.0 \times T_t$ and maintained at that load for a minimum of 20 minutes. Displacement occurring at 1, 2, 3, 5, 10, 15 and 20 minutes after attaining this test load shall be plotted as specified above. The anchor shall then be unloaded to T_o in order to determine the permanent displacement. Acceptance criteria are met when the slope of creep displacement versus log time plot is less than 1.2 millimetres per log cycle, and the elastic extension curve lies between the two boundary lines plotted on the load-extension graph specified above. If acceptance criteria are met, the anchor shall be restressed to $0.8 \times T_t$ and then distressed to P_t , the transfer lock-off load specified on the drawings.

END OF SECTION

1 GENERAL

- .1 All work shall be carried out in conformance with CSA Standard CAN3.A23.1-M.

2 MATERIALS

- .1 Cement to CAN/CSA-A3001, Type GU.
- .2 Supplementary cementing materials: with 10% Type F fly ash replacement and 5% Type SF Silica Fume, by mass of total cementitious materials to CAN/CSA A3001. Total supplementary cementing materials not to exceed 15% by mass of total cementitious material.
- .3 Water: to CSA-A23.1/A23.2.
- .4 Reinforcing steel: to CAN/CSA-G30.18, bare or galvanized bars with silica fume.
- .5 Hardware and miscellaneous materials: to CSA-A23.1/A23.2.
- .6 Forms: to CSA-A23.4.
- .7 Air entrainment admixtures: to ASTM C260.
- .8 Fine aggregate shall conform to Clause 5.3 CSA Standard CAN3.A23.1-M.
- .9 Coarse aggregate shall conform to Clause 5.4 CSA Standard CAN3.A23.1-M group 1. Max aggregate size to be 19 mm (3/4").
- .10 Water shall be clean and free from injurious amounts of oil, alkali, organic matter and deleterious materials.

3 CONCRETE MIXES

- .1 Concrete to meet performance criteria in accordance with CAN/CSA-A23.1/A23.2.
- .2 Durability and class of exposure: C-1.
- .3 Minimum compressive strength at 28 days: 35 MPa.
- .4 Intended application: continuous water submersion and splash zone (frequent wetting and drying cycles).
- .5 Maximum water cement ratio shall be 0.40.
- .6 Air content shall be between 5% and 8%.
- .7 Set retarding admixtures shall not be used unless approved by the Engineer.
- .8 The concrete mix design shall be submitted to the Engineer for approval prior to placing concrete. The mix design including admixtures shall not be changed without prior approval of the Engineer.

4 PLACING, FINISHING AND CURING CONCRETE

- .1 All concrete shall be placed in accordance with the requirements of Clause 19 CSA Standard CAN3.A23.1-M and as indicated on the drawings.

- .2 All concrete shall be placed continuously between start of placement and a control joint. Control joint locations shall be proposed by the contractor and are subject to prior approval by the Engineer. Joint surfaces of cured concrete shall be roughened and thoroughly cleaned.
- .3 Accurate records shall be maintained for all cast-in-place concrete including date of placement, location, quantity, temperature and test samples taken.
- .4 The Engineer shall be notified prior to commencement of concrete placement as specified in Clause 6.0.
- .5 All defective concrete shall be removed and replaced as directed by the Engineer.
- .6 Concrete shall be vibrated adequately by means of mechanical vibrators. Rock pockets and honeycombing shall not be accepted.
- .7 Surface texture: non-skid finish on top, steel trowel or form finish on sides and bottom.
- .8 Cold and hot weather concrete work shall be carried out in conformance with Clause 21 of CSA Standard CAN3.A23.1-M. Procedures for this work shall be submitted to the Engineer for approval.
- .9 All concrete shall be protected and cured in accordance with CSA Standard CAN3.A23.1-M.

5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with CSA-A23.4.

6 INSPECTION AND TESTING

- .1 Provide the Engineer with certified copies of quality control tests related to this project as specified in CSA-A23.4 and CSA-G279.
- .2 Provide records from in-house quality control programme based upon plant certification requirements for inspection and review.
- .3 Upon request, provide Consultant with certified copy of mill test report of reinforcing steel supplied, showing physical and chemical analysis.
- .4 The Engineer shall be notified 24 hours prior to placement of concrete.
- .5 Unless noted otherwise an inspection and testing firm appointed and paid for by the Contractor will collect and test a minimum of 3 concrete cylinders per concrete batch. One concrete cylinder shall be tested after 7 days. The remaining 2 cylinders shall be tested after 28 days. The test results shall be made available to the Engineer.
- .6 The Contractor shall permit the testing firm free access to all portions of the work and shall co-operate with the testing firm in carrying out the work.

END OF SECTION

1 WORKMANSHIP

- .1 All fabrication and erection of structural steel shall comply with CSA Standard CAN3-S16.1, latest revision.

2 MATERIALS

- .1 Hollow structural steel sections shall conform to CSA Standard G40.20/G40.21-M, Class "C", Grade 350W.
- .2 All other rolled sections and miscellaneous plate shall be grade 300W, unless noted otherwise on the drawings, in conformance with CSA Standard G40.20/G40.21-M.
- .3 All structural steel members shall be made of the size and weight shown on the drawings unless written approval for any change is first obtained from the Engineer.
- .4 Bolts, washers and nuts shall conform to ASTM specification A325.

3 WELDING

- .1 Welding practice and qualifications of welders and erectors of welded construction shall conform to the requirements of CSA Standards W47, W48, and W59 latest editions. The metallurgy of weld metal shall be similar to the parent material.
- .2 Unless noted otherwise, all welds shall develop the full strength of the connected members, and shall be continuous seal welds with a minimum 6 mm leg length.
- .3 Where on the drawings it is called for double sided welding; the welding details called for on the near side shall be duplicated on the far side if not called up otherwise.

4 INSPECTION

- .1 The Contractor shall furnish all facilities for inspecting and testing the weight, dimensions and quality of workmanship at the shop where the material is fabricated.
- .2 The Engineer shall be notified well in advance of the start of work, in order to allow sufficient time for inspection of material and workmanship.

5 SHOP DRAWINGS

- .1 The Contractor shall prepare and submit shop drawings.
- .2 The Contractor shall submit three prints or an electronic copy in PDF of the shop drawings for the Engineer's review prior to commencing fabrication. If shop drawings are not to the Engineer's satisfaction, they will be returned with the notation "Resubmit". Drawings that have been returned with the notation "Reviewed" would allow fabrication to commence.
- .3 The review of shop drawings will be for size and arrangement of members and strength of connections. Any errors in dimensions shown on the shop drawings shall be the responsibility of the Contractor.

- .4 Upon completion of the project, all reviewed shop drawings shall be submitted to the owner along with the As-Built marked drawings. In addition, diskettes containing all shop drawings in AutoCAD format shall be submitted.

6 COATINGS

- .1 Except as noted below, all structural and miscellaneous steel shall be painted in accordance with the requirements of Section 00 98 00 – Painting.
- .2 All bolts, inserts, washers and nuts shall be hot dip galvanized in accordance with ASTM Specifications A-153 or A-123 or CSA G 164-M (minimum zinc coating 610 g/m²).
- .3 Damaged painted or galvanized surfaces shall be coated with Galvacon immediately after the damage has occurred. Final touch up of painted steel shall be as per 00 98 00 – Painting.

END OF SECTION

1 GENERAL

- .1 The Contractor shall supply all material and bolts required for the work.
- .2 This section covers the requirements for the supply, detailing, fabrication, assembly and delivery of the steelwork shown in the Drawings and Specifications.
- .3 The latest edition of, and any standard referenced by, the following standards shall apply to the work.
 - a) CSA G40.21M - Structural Quality Steel
 - b) CSA W48.1 - Mild Steel Covered Arc - Welding Procedures
 - c) CSA W59 - Welded Steel Construction
- .4 **Alternative Details**
All details shall, in general conform to those shown on the Drawings. Alternative details may be substituted to facilitate the Contractor's shop procedures and to suit his standard detailing practice, provided such alternative details comply in all respects with these Specifications and do not require an appreciable increase in weight of metal. The Contractor shall submit all proposed Alternate Details for review and acceptance by the Engineer prior to performing any of the Work or procuring any of the material for the Alternative Details.

2 WORKING DRAWINGS

- .1 Working drawings shall consist of shop detail drawings, assembly diagrams and other working drawings showing details, dimensions, sizes, material and other information necessary for the complete fabrication of the steelwork.

The Contractor shall submit shop drawings in accordance with Section 00 51 00. The Contractor shall allow a minimum of one (1) week for review of shop drawings by the Engineer.
- .2 Discrepancies or vague references shall be clarified by the Contractor before proceeding with the fabrication of metal work; otherwise errors in dimensions shall be corrected at the Contractor's expense.

3 QUALIFICATIONS AND EQUIPMENT

- .1 **Contractor**
The Contractor shall produce evidence that his plant is currently fully approved by the CWB to perform pile splices to the requirements of C.S.A. Specification W47.1 Div. 2.1 or better.

The Contractor shall also produce evidence of satisfactory experience in the fabrication of heavy structural steelwork.

The fabricator shall appoint, subject to the Engineer's approval, an employee who shall assist and be responsible to the welding engineer.

Unless such information has already been forwarded to the Owner, the Contractor shall submit to the Engineer the names of the welding engineer, welding supervisors and shop inspectors who are to be employed on the work.

.2 Operators

The Contractor shall produce evidence that all welding operators to be employed on the work are currently qualified by the CWB in the processes in which they are to be employed on the work. Such qualifications shall have been issued within two (2) years of the commencement of fabrication.

Expired welding certificates are not acceptable for qualification; ONLY current valid qualifications will be recognized by the Owner.

The Contractor shall also produce evidence relative to each operator, that he has been executing satisfactory welding in the required processes within the six (6) month period previous to the award of this contract.

.3 Welding Equipment

All equipment to be used in the work shall be in good working order and shall be subject to the inspection of the Engineer.

.4 Welding Procedures

The Contractor shall submit copies of the welding procedures which he intends to use for examination and approval by the Engineer.

Such procedures shall be accompanied by documentary proof that they have been qualified previously by the Canadian Welding Bureau at the plant where the work is to be carried out.

The procedures shall include the following information: joint type, welding process, welding position, base metal specification, welding consumable specification and size, preheat requirements, amperage and voltage requirements, speed, polarity, and welding equipment, including a description of travel for automatic welding.

4 MATERIALS

.1 Structural Steel

Steel shall conform to the requirements as called for on the drawings.

Prior to fabrication, the Contractor shall supply to the Engineer, manufacturer's mill certificates giving details of all chemical and physical properties of the steel to be used in the work.

Steel shall be supplied free of surface defects and internal discontinuities, with due regard for the end use of the steel in the contract.

Edges of all plates will be subject to inspection by the Engineer. Any discontinuities will be explored and may be accepted, subject to ASTM A435.

The Engineer shall be supplied with a record of all observed discontinuities.

Repairs to defective plates shall not proceed until approval of the proposed repair has been given by the Engineer.

.2 Welding Consumables

Welding consumables for all processes shall be certified by the manufacturer as complying with the requirements of the following specification:

- a) Manual, shielded metal arc welding - All electrodes for manual shielded metal arc welding shall conform to A.W.S. Specifications A.5.1 classification E7018.

- b) Gas, metal arc welding - All electrodes used in the gas, metal arc welding process shall be composite electrodes conforming to A.W.S. Specification A.5.18, classification E70T-9. The use of micra wire will not be permitted.
- c) Shielding gas shall be welding grade carbon dioxide with a guaranteed dew point of -45⁰C.
- d) Submerged arc welding - Welding electrodes and fluxes used in the submerged arc welding process shall conform to A.W.S. Specification A.5.17 and shall produce a weld to classification F72 - EM 12 K or approved equivalent.

.3 Bolts

Bolts, nuts and washers shall be hot-dip galvanized and shall conform to the requirements of ASTM Specification A325, Type I of North American or European manufacture only.

5 MATERIAL STORAGE

.1 Steel

Structural material, either plain or fabricated, shall be stored at the Contractor's shop or elsewhere, above the ground upon platforms, skids, or other supports. It shall be kept free from dirt and other foreign matter, and shall be protected as far as practical from corrosion. Long members shall be supported on skids placed near enough together to prevent injury from deflection.

Prior to fabrication, all steel shall be marked for identification by the heat number and specification by a marking system approved by the Engineer.

.2 Welding Consumables

All electrodes having low hydrogen coverings shall be dried for at least two (2) hours between 230⁰C and 260⁰C before they are used. Electrodes shall be stored immediately after drying in storage ovens held at a temperature of at least 120⁰C. Electrodes that are not used within four (4) hours after removal from a drying or storage oven shall be re-dried before use. Electrodes which have been wet shall not be used.

Electrode wire used in submerged arc welding and gas metal arc welding shall be stored in the original container at room temperature and kept free of moisture, oil, dirt or other contaminants.

Flux used for submerged arc welding shall be dry and free of contamination from dirt, mill scale, oil or other foreign material. Fused flux shall not be used on the work.

Gas for gas metal arc welding shall be stored in marked steel bottles and shall not be subjected to temperatures in excess of 50⁰C nor temperatures of less than 0⁰C.

6 PREPARATION OF MATERIAL

.1 Straightening Material

Prior to being used in fabrication, all structural steel shall be straight and free from kinks or bends. If straightening is necessary, it shall be done by methods that will not injure the metal. The steel shall not be heated unless permission is given by the Engineer. Sharp kinks and bends will be cause for rejection of the steel.

.2 Edge Preparation for Welding

The edges of plates or sections which are to be welded together shall be prepared by sawing, shearing, flame-cutting, machining, chipping or arc air gouging to the details shown on the shop drawings.

Surfaces and edges to be welded shall be smooth, uniform and free from fins, tears, cracks and other defects which would adversely affect the quality or strength of the weld. Surfaces to be welded shall also be free from loose scale, slag, rust, grease, moisture or other material that will prevent proper welding. Mill scale that withstands vigorous wire brushing, a light film of drying oil or a thin rust inhibitive coating may remain except that all mill scale shall be removed from the surfaces on which flange-to-web welds are to be made by submerged arc welding or by shielded metal arc welding with low hydrogen electrodes. Surfaces within 50 mm of any weld location shall be free from any paint or other material that would prevent proper welding or produce objectionable fumes while welding.

Edges of material thicker than specified in the following list shall be trimmed if and as required to produce a satisfactory welding edge wherever a weld among the edges to carry calculated stress:

- Sheared edges of material thicker than 12 mm
- Rolled edges of plates (other than Universal Mill Plates thicker than 10 mm)
- Toes of angles or rolled shapes (other than wide flange section thicker than 16 mm)
- Universal Mill Plates or edges of wide flange section thicker than 25 mm.

Edges may be prepared by oxygen cutting, provided a smooth and regular surface free from cracks and notches is secured, and providing that an accurate profile is secured by the use of a mechanical guide. Free hand cutting shall be done only where approved by the Engineer.

In all oxygen cutting, the cutting flame shall be so adjusted and manipulated as to avoid cutting beyond (inside) the prescribed lines. Roughness of cut surfaces shall not be greater than that defined by the United States Standards Institute surface roughness value of 1,000 U.S.A.I.B46.1, Surface Texture). Roughness exceeding this value shall be removed by machining or grinding.

.3 Edge Preparation (non-welded edges)

Steel may be cut to size by sawing, shearing, flame cutting or machining. All steel after cutting shall be marked by a method agreed to by the Engineer so that its specification may be immediately identified.

Sheared edges of plates more than 16 mm in thickness shall be planed to a depth of 6 mm.

Special attention shall be given to the cutting of flange plates. Occasional gouges not in excess of 6 mm deep will be accepted in areas of low stress at the discretion of the Engineer. The repair or removal of such gouges shall be to the Engineer's instructions.

Corners of all exposed flame cut or sheared plates including flanges, gusset plates, etc. shall be ground to a minimum 1.5mm 45 degree bevel to facilitate painting. Re-entrant flame cuts shall be filleted to a radius of not less than 20 mm.

7 FABRICATION

- .1 **Marking**
Prior to fabrication, all steel shall be marked for identification by heat number and specification by a marking system approved by the Engineer.

- .2 **Bolt Holes**
All holes for high tensile bolts shall be either punched, sub-punched and reamed, or drilled, and shall be of a nominal diameter not more than 2 mm in excess of the nominal bolt diameter.

Punched holes shall be clean cut, without torn or ragged edges. The diameter of the die shall not exceed the diameter of the punch by more than 2 mm. If a punched hole must be enlarged to admit a bolt, it shall be reamed.

Reamed holes shall be cylindrical and perpendicular to the member. Where practicable, reamers shall be directed by mechanical means. Reaming shall be done with twist drills. Drilling shall be done with twist drills. Burrs on the outside surfaces shall be removed. Poor matching of holes will be cause of rejection.

Allowable tolerance for bolt holes:

- .1 Matching holes for bolts to register so that a gauge 2 mm less in diameter than hole will pass freely through assembled members at right angles to such members.
- .2 Unless otherwise shown drill all bolt holes 1.6 mm larger than nominal bolt diameter.
- .3 Centre-to-centre distance between two holes of a group of holes to vary by not more than 2 mm from dimensioned distance between such holes.
- .4 Centre-to-centre distance between any group of holes to vary not more than following in Table 1:

Centre to Centre distance in metres	Tolerance in plus or minus mm
less than 10	1
10 to 20	2
20 to 30	3

- .5 Do not correct mis-punched or mis-drilled members without Engineer's approval.
- .3 **Pin Holes**
All holes for pins shall be drilled and reamed to a diameter tolerance of 0.5 mm. Burrs on the outside surface shall be ground flush.
- .4 **High Strength Bolts**
Installation of high strength bolts shall be in accordance with the latest edition of the AASHTO Specification Section 10.17.4.

Sufficient bolts, nuts and washers shall be furnished to complete the entire structure with an ample surplus to replace all bolts damaged or lost.

Holes in the girder field splices shall be sub-punched and, unless otherwise specified, reamed while assembled in the shop. The assembly, including camber, alignment and accuracy of holes shall be approved by the Engineer before reaming is recommended.

- .5 **Butt Joints**
Except as called for on the drawings, butt joints will not be permitted. The Contractor may submit an alternative butt joint design provided that such design has been pre-qualified under CSA Standard W59.

- .6 Assembly and Welding Sequences
If requested by the Engineer, the Contractor shall supply full details of the proposed assembly and welding sequence of any particular weld.
- .7 Shop splices
.1 Locate to Engineer's approval.
.2 Use complete joint penetration groove welds finished flush. Details of butt joints to CSA W59. Use only as approved by Engineer.
- .8 Nylon Washers
Machining of washers shall be to the manufacturer's recommendations.

Installation shall be done without use of driving of components to fit. Minor adjustments in face-to-face tolerances of hinge components may be compensated for by planning thickness of washer. If greater than 6.0 mm is to be removed (or added) the steel components shall be corrected.

The Contractor shall supply to the Owner, spares of all sizes of fabricated washers as called for the drawings at the completion of the project.
- .9 Bent Plates
When bending plates, the plates shall be so taken from the stock plates that the bend line will be at right angles to the direction of rolling. The radius of the bend measured inside shall be not less than the thickness of the plate. Before bending, the corners of the plate shall be rounded to a radius of 2 mm throughout that portion of the plate at which bending is to occur.
- .10 Dimensional Tolerances
The dimensions of the completed steelwork shall comply with the appropriate dimensional tolerances as specified in CSA Standard W59 Welded Steel Construction.
- .11 Shipping
Structural members shall be loaded on trucks, cars or barges in such a manner that they can be transported and unloaded at their destination without being excessively stressed, deformed or otherwise damaged.

8.0 WELDING

- .1 General
Welding shall be done by the manual, shielded metal arc, gas shielded metal arc or submerged arc processes in accordance with the approved procedures and A.W.S. D1.1 Section 4, Technique.

All Welding shall be done under cover and, in the case of gas metal arc welding, shall be done in an area free from wind or draft.

Butt welds shall be extended beyond the edges of the parts to be joined by means of start and run-off tabs providing sufficient thickness to avoid the weld burning through and with a joint preparation similar to that on the main material. For manual shielded metal arc welding, the width of the tabs shall be not less than the thickness of the thicker part being joined or 75 mm, whichever is greater. For submerged arc welding, the width of the tabs shall be not less than 75 mm. Each weld pass shall be carried far enough beyond the edge of the parts being joined to ensure sound welds in the joint. Tabs shall be removed upon completion and cooling of the weld without damage to the parent plate, and the end of the weld made smooth and flush with the edges of the abutting parts.

In gas metal arc welding, the equipment shall be capable of sustaining a gas flow rate of from 0.85 to 1.25 m³/h.

.2 Preheat and Interpass Temperatures

No welding shall be done when the temperature of the base metal is lower than - 20⁰C. At temperatures below 0⁰C, the steel shall be preheated to a temperature of at least 10⁰C in excess of that stated in Table 2.

Preheat shall be applied to all steel to be welded so that the steel within 75 mm of the weld is heated to the temperature shown in Table 2.

Preheat shall be applied in such a manner that moisture from the heating equipment does not penetrate the joint.

For all welding processes, preheat and interpass temperatures shall be maintained during welding, at temperatures not less than stated in Table2.

THICKNESS OF THICKEST PART AT POINT OF WELDING	TEMP.
Less than 20mm	none
20mm to 35mm	21°C
40mm to 60mm	66°C
Over 60mm	107°C

Table 2: Minimum preheat and interpass temperatures

Preheat temperatures above the minimum shown in Table 2 may be required for highly restrained joints if designated by the Engineer.

Preheat temperature shall in no case exceed 200⁰C but there shall be no limit on interpass temperature.

Preheat requirements for tack welds shall be as in Table 2, except that where single pass tack welds are used and are to be incorporated and consumed in a weld made by the submerged arc and the gas metal arc processes, preheat is unnecessary.

.3 Assembly

The shop assembly of the various components of the weld shall be executed in accordance with A.W.S. D1.1, Subsections 3.3 and 3.4.

Tack welding shall be done by qualified operators, using the smallest size weld required to hold the components of the assembly together. Tack welds shall not be less than 100 mm in length and shall be incorporated in the final weld.

Tack welds shall be made with 5 mm maximum size electrodes and shall be subject to the preheat requirement of the Preheat Clauses.

.4 Welding

- .1 When CAN/CSA-G40.21 grade 350A steel is specified, deposited weld metal to have a Charpy V-Notch value not lower than that of steel.
- .2 Do welding in shop unless otherwise permitted by Engineer.
- .3 Do not weld at locations where weld is not indicated.
- .4 All welds are to be continuous over the entire length of the joint unless otherwise specified.
- .5 Use minimum 6mm fillet weld unless otherwise shown.

.5 Quality and Details of Welds

The quality and details of welds shall be in accordance CSA Standard W59, Clause 12 unless noted otherwise or as specified by the Engineer. Fender panels, mooring structures, walkways, stairs and ladders shall be in accordance with Clause 11.

Undercut at the tow of the flange to web fillet weld will not be allowed except in regions of low stress at the discretion of the Engineer.

9.0 QUALITY ASSURANCE

.1 Inspection

All materials, welding procedures, shop drawings, and steelwork fabrication will be inspected by the Engineer to ascertain compliance with the Owner's Specifications and Drawings.

All phases of fabrication including cutting to size of plates, edge preparation of welded joints, weld assembly and welding will be subject to visual examination by the Engineer.

At his discretion and at the Owner's expense, the Engineer will appoint a testing agent to test any completed or partially completed weld by non-destructive testing methods. Generally, fillet welds will be tested by the dry powder magnetic particle method and butt welds by ultrasonic testing, but this does not preclude the use of another method of testing deemed necessary by the Engineer.

It is desirable that the inspection of welds is carried out as soon as possible after the completion of welding.

The Contractor shall be prepared to move and support the pieces being inspected so that, in general, the inspection can be done on the flat and so that a minimum of 1.25 m of headroom is available.

The Engineer will attempt to schedule non-destructive testing operations so as not to interfere with the progress of the work. However, the Contractor is expected to cooperate with the Engineer and the testing agency in the satisfactory expedition of inspection procedures. The Contractor shall furnish all facilities for access by the testing agency for inspection and testing. The Contractor shall ensure all slag and other residue is removed from the weld when it is completed and ready for weld inspection. Slag removal by the testing agency will be paid for by the Contractor. A minimum of 72 hours notice of any inspection stage being reached shall be given to the Engineer by the Contractor.

.2 Unacceptable Work

Any work found to be unacceptable, shall be corrected in accordance CSA Standard W59. The Contractor shall bear the cost of re-inspection of welds after defects are repaired.

No repair shall be made until agreed to by the Engineer.

10.0 COATINGS

Except as noted below, all structural steel shall be painted in accordance with the requirements of Section 00 98 00 – Painting.

Bolts, washers and nuts shall be hot dip galvanized in accordance with ASTM Specifications A-153 or A-123 or CSA G 164-M (minimum zinc coating 610 g/m²).

The Contractor is advised to handle all painted materials delicately to prevent paint damage. Nylon slings are to be used at all times when lifting lugs are not available.

Touch up all damaged surfaces immediately upon delivery and supply 2 gallons of paint for field touch-up of any damaged paint surface during the installation as per 00 98 00 – Painting.

END OF SECTION

1 SCOPE OF WORK

- .1 DFO's General Conditions and related contract documents form an integral part of this section.
- .2 All work shall be carried out in accordance with Specification CAN/CSA 086.1-M, latest revision and in accordance with Best Management Practices (BMP) for the use of treated wood in aquatic environments.
- .3 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

2 PRODUCT

- .1 Lumber Material
 - .1.1 Lumber grades shall conform to the requirements of the N.L.G.A. Standard Grading Rules for Canadian Lumber, latest revision.
 - .1.2 All lumber shall be D.Fir-L(N), No. 2 Structural grade or better as called for on the drawings.
 - .1.3 All lumber, unless specified otherwise, shall be properly air dried and seasoned, containing not more than 19% moisture.
- .2 Fasteners
 - .2.1 All bolts, nuts and washers shall be hot dip galvanized in accordance with Specification CAN/CSA G164-M.
 - .2.2 Bolt holes in timber shall be bored to provide driving fit. Holes for drift bolts shall be 2 mm undersize and longer than the drift bolts.
 - .2.3 All bolts to meet the requirements of Standard ASTM - A307.
 - .2.4 Deck planks shall be fastened with two 150 mm long galvanized nails at each contact with one nail at each side of the plank.
- .3 Wood Preservative
 - .3.1 All preservative treatment, inspection and re-treatment shall be in accordance with Specification CAN/CSA 080-M, latest edition.
 - .3.2 All lumber shall be given a CCA or ACZA preservative treatment in accordance with the Best Management Practices.
 - .3.3 All treated timbers shall be incised before treatment.

3 EXECUTION

- .1 All timber, which has been given a preservative treatment, shall be carefully handled to avoid breaking through the treated surfaces. Cant hooks and rafting dogs shall not be used on timbers. No spikes shall be driven into timbers except to tack the timbers in their final position. If spikes are used, they shall be fully driven and left in.

- .2 Bolt holes and countersunk holes shall be filled with CCA or ACZA preservative and the bolts shall be dipped in CCA or ACZA preservative concentrate before the bolts are placed. Bolt holes with a final position at an elevation below water level shall be filled with approved mastic before the bolts are placed.
- .3 All structural timber used in the work shall be carefully and accurately placed in accordance with the drawings.

END OF SECTION

1 SCOPE OF WORK

- .1 All ferrous surfaces except galvanised components are to be painted.

2 APPLICABLE CODES

- .1 All work contained in this section shall comply with the latest edition of the following standards:
- | | |
|--------------|---|
| CGSB | Standards of the Canadian General Standards Board |
| SSPC-SP1 | Solvent Cleaning (degreasing) |
| SSPC-SP2 | Hand Tool Cleaning |
| SSPC-SP7 | Brush-off Blast Cleaning |
| SSPC-SP10 | Near White Blast Cleaning |
| SSPC-SP11 | Power Tool Cleaning to Bare Metal |
| SSPC-GUIDE 6 | Debris Containment |
| ASTM-03276 | Recommended Practice Guide for Paint Inspection |
| ASTM-D3359 | Method for Measuring Adhesion by Tape Test |
| Work Safe BC | Occupational Health and Safety Regulations
BC Waste Management Act (SWEP) |
| SSPC-PA2 | Procedure for Determining Conformance to Dry Coating
Thickness Requirement |

3 SURFACE PREPARATION

- .1 All steel surfaces to be painted shall be prepared in accordance with the SSPC Manual Volume II and the paint manufacturer's specifications.
- .2 Degrease according to SSPC-SP1 Solvent Cleaning. Remove all weld splatter and grind all welds and sharp edges. Blast clean to SSPC-SP10, Near White Metal Standard.
- .3 Minimum allowable motor anchor pattern is 50 microns (2 mils). Shape of surface profile shall be jagged and irregular, as opposed to peened.
- .4 If chloride substrates measurements are required by Engineer, the chloride concentration shall be less than $3\mu\text{g}/\text{cm}^2$ measured by Chlor-Rid test.
- .5 The surface finish shall be approved by a representative of the Owner or the paint manufacturer before application of any coatings.

4 PAINT APPLICATION

- .1 Coatings shall be applied in accordance with the manufacturer's specifications. All blast cleaning and shop painting shall be carried out under cover in an area protected from weather and other detrimental effects.
- .2 Paint application should commence prior to any presence of rust bloom and within 8 hrs following abrasive blasting.
- .3 Paint manufacturers recommendation for application parameters shall be consulted to identify minimum and maximum temperatures, relative humidity and dewpoint restrictions and pot life. Consult paint manufacturer for further information.

5 PAINT SYSTEM

- .1 All dry film thickness (DFT) shall be stated in Mils (thousands of an inch). The equivalent measurement and conversions are as follows:

One thousandth of an inch (1 mil) = 25 microns

The detailed requirements of the paint schedule are given below.

- .2 Stripe coats shall be applied to all welds, lap joints, plate edges, corners, sharp edges and any other areas where spray application of the overall coating system may result in low dry film thickness.
- .3 The following paint systems shall be used for painting of steel pipe support piles and for all structural and miscellaneous steel except galvanized components:

- .3.1 Steel pipe piles:

Coat No.	Type	Binder	Product Name	Dry Film Thickness
1	Primer	Modified Epoxy	Interzone 954	12 mils
2	Stripe Coat	Modified Epoxy	Interzone 954	5 mils
3	Topcoat	Modified Epoxy	Interzone 954	12 mils
-	-	-	-	24 mils minimum

Note: Finished coating system Dry Film Thickness shall be a minimum of 24 Mils (600 microns) at each spot measurement. Stripe coat not included.

- .3.2 Pile caps and miscellaneous steel

Coat No.	Type	Binder	Product Name	Dry Film Thickness
1	Primer	Zinc-Rich Epoxy	Interzinc 52	2.5 mils
2	Mid Coat	Polyamide Epoxy	Interseal 670HS	7 mils
2	Stripe Coat	Polyamide Epoxy	Interseal 670HS	5 mils
3	Topcoat	Polyamide Epoxy	Interseal 670HS	7 mils
-	-	-	-	16.5 mils minimum

Note: Finished coating system Dry Film Thickness shall be a minimum of 16.5 Mils (412 microns) at each spot measurement. Stripe coat not included.

- .4 Topcoat to be a light grey colour (colour code RAL 7035).
- .4.1 Additional 2 mils colour top coat of Interthane 990 shall be applied to handrails and guardrails. Handrails to have a red colour topcoat (RAL 3000) and guardrails to have a safety yellow colour topcoat (RAL 1003).
- .5 All bolts, washers and nuts shall be hot dip galvanised in accordance with ASTM Specifications A-153 or A-123, or CSA Specification G 164-M (minimum zinc coating 610 g/m²).

6 WORKMANSHIP

- .1 The Contractor shall complete a daily reporting account for Shop/Field Quality Assurance.

- .2 An Engineer's Representative may request on site monitoring during paint preparation.
- .3 Each coat, including stripe coat shall be of contrasting colors and mixed in full proportions.
- .4 The preparation of surfaces to be painted and the application of the paints shall be as specified above.
- .5 Coating shall take place as soon as practicable after inspection of cleaning, but, in any event, within eight hours and before any visible or detrimental rusting or contamination occurs.
- .6 All coating material shall be applied by airless spray unless otherwise allowed or specified by the manufacturer. Spray painting equipment shall be of ample capacity and suitable for the work and shall at all times be kept clean and in good working order. Air lines shall be equipped with water traps to positively remove condensed moisture.
- .7 No thinner shall be added to any paint in excess of the paint manufacturer's recommendations.
- .8 Prior to spray application of primer, all crevices, appurtenances, and re-entrant surfaces which would otherwise be difficult to coat by spraying, together with all weld areas shall be brushed (stripe) in order to ensure a continuous film on all surfaces, and then painted as specified.
- .9 Newly coated surfaces will be inspected when the coating has thoroughly dried and immediately before the coated member is to be removed from the paint shop for shipment. The coated surfaces may be rejected if any of the following defects are apparent, and the Engineer or his representative, in his judgement, believes the coating performance and life will be impaired by these conditions:
 - a. Inadequate dry film thickness (DFT).
 - b. Runs, sags, holidays or shadowing caused by inefficient application methods.
 - c. Evidence of poor coverage at plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 - d. Damage to shop coat due to handling before the coating is sufficiently cured or any other contributory cause.
- .10 Coated surfaces rejected by the Engineer shall be made good by the Contractor at his own expense. The Contractor shall submit to the Engineer his proposed method of repair to the damaged surfaces.
- .11 Damage to adjacent property, vehicles, pedestrians and other portions of the structure due to the painting operations shall be made good without additional expenses to the Owner. No paint, equipment, scaffolding, et cetera shall obstruct traffic or pedestrians, except by written permission of the Owner's Representative, in which case proper warning signs, barricades, et cetera shall be placed, maintained and removed without additional expense to the Owner.
- .12 Field touch up painting shall be carried out in accordance with the paint manufacturer's specifications.
- .13 The Contractor shall provide sufficient paint for field touch-up of any damaged paint surface.

- .14 Only nylon ropes or rubber covered slings may be used for handling steel in either the Contractors shop during loading or shipment or during unloading and erection at the site. Where coatings are damaged during handling/erection, these areas shall be marked and recorded for remedial actions.

END OF SECTION