GIBSONS WHARF RECONSTRUCTION

SPECIFICATIONS

TENDER DOCUMENTS

DRAWINGS

SHEET NO.	PROJECT TITLE	SHEET TITLE
G-001	Gibsons Harbour Reconstruction	Cover Sheet
G-004	Gibsons Harbour Reconstruction	Summary Sheet
G-101	Gibsons Harbour Reconstruction	Site Plan
G-102	Gibsons Harbour Reconstruction	General Arrangement
G-103	Gibsons Harbour Reconstruction	Existing Conditions – Pile Plan and Elevation
G-901	Gibsons Harbour Reconstruction	Existing Condition – Photographs (1 of 2)
G-902	Gibsons Harbour Reconstruction	Existing Condition – Photographs (2 of 2)
S-101	Gibsons Harbour Reconstruction	Pile and Bracing Defects Plan
S-102	Gibsons Harbour Reconstruction	Pile Cap and Stringer Plan
S-103	Gibsons Harbour Reconstruction	Asphalt and Drainage
S-501	Gibsons Harbour Reconstruction	Pile Footing Repair
S-502	Gibsons Harbour Reconstruction	Timber Breakwater Gap Safety Plate Repair Plan
S-503	Gibsons Harbour Reconstruction	Safety Plate Detail

REFERENCE DRAWINGS

SHEET NO.	PROJECT TITLE	SHEET TITLE	CLIENT REF.	PROJECT NO.
1 OF 3	Gibsons B.C	Wharf and Float Repairs	73-G3	88625
2 OF 3	Gibsons B.C	Wharf and Float Repairs	73-G3	88625
3 OF 3	Gibsons B.C	Wharf and Float Repairs	73-G3	88625
1 OF 2	Gibsons Wharf Repairs	Plans and Sections	74-G1	89008
2 OF 2	Gibsons Wharf Repairs	Plans and Details	74-G1	89008
1 OF 2	Gibsons Harbour	Site Plan	-	001
2 OF 2	Gibsons Harbour	Wharf Plan and Sections	-	002
1 OF 3	Gibson’s Landing B.C Wharf Repairs	Layout Plan	M6-G18	C-492
2 OF 3	Gibson’s Landing B.C Wharf Repairs	Concrete Panels	M6-G18	C-492
3 OF 3	Gibson’s Landing B.C Wharf Repairs	Miscellaneous Details	M6-G18	C-492
1 OF 1	Gibson’s Landing B.C	Wharf Repairs	M6-G22	C77-2

SIGNATURES

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*****END OF SECTION*****

1 GENERAL

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

2 TIMING REQUIREMENTS

.1 All off-site work may commence immediately upon award.

.2 No mobilization of crew or equipment to project site for Mandatory work before **December 1, 2020**

.3 All Mandatory Work Items including clean-up and demobilization must be completed by **March 20, 2021**.

.4 All Option Work Items including clean-up and demobilization must be completed by the later of, 3 weeks after completion of all Mandatory Work Items, or 5 weeks after award of Option Work Items.

.5 Underwater works shall be conducted in consultation with local DFO officer due to fish habitat/herring conservation window, unless otherwise approved by the Fisheries Protection Program, Fisheries and Oceans.

3 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.

4 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.

5 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.

6 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.

7 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 the operations on the site to those areas actually required for the work including routes and regulations approved by the Owner for haulage of materials.

8 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.

9 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.

10 TEMPORARY SERVICES

.1 On site the Contractor shall make its own arrangements for supply of water and electricity.

.2 The Contractor shall supply for its own use; sanitary, first aid, and all other temporary services and facilities required for the work.

11 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.

12 ENGINEER'S ACCESS

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

13 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.

14 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.

15 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.

16 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.

17 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.

18 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.

19 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.

20 NOISE BY-LAWS

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

21 CONSTRUCTION WORK SCHEDULE

.1 The Contractor shall provide to the Owner a Bar Chart (GANTT Chart) schedule of all works to be completed in the contract within 10 days of contract award, and within 5 days of owners request for updated schedules during construction should there be any approved change orders or extension of time.

.2 The Contractor shall work whatever shifts required in order to ensure the work meet regulatory windows and is completed by the completion date of the contract.

.3 The Contractor shall normally perform all work within the hours of daylight except in instances where the Contractor has requested and received approval for shift changes.

22 CO-OPERATION WITH HARBOUR AUTHORITY AND OTHERS

.1 The contractor will give the owner a minimum 48 hours notice for work that may interrupt access to any part of the harbour. The contractor shall maintain a minimum 10m clear width of channel for passage of recreational boaters at all times. Provide and locate necessary buoys or markers to indicate temporary channel for passage.

.2 The site shall be left in a safe condition at the completion of each work day.

.3 The Contractor should work together with the Harbour Authority and Engineer's Representative to set up risk management plan for the project. This aims to identify risk of individual work item, streamline communications and minimize the associated risk to safety and operation in the harbour. The plan may include but not limited to revision of schedule and methodology, close monitoring of weather condition, navigation management during construction. Failure to implement the risk management plan may cause liability to the Contractor for damages of the harbour property during construction.

.4 The cost for use of any Harbour Authority services are those of the Contractor and the cost of any such services should be included in the cost of this tender.

***** 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 Mandatory Work Items:

Mandatory work to be carried out under this contract includes the reconstruction of wharf and approach structures (Wharf 401,402,and 403) with the exception of pile replacements and some minor works (refer to section 2.3 Optional Work Items). Mandatory work generally consists of, but is not limited to the following items:

.1 **Mobilisation / demobilisation for all Mandatory Work Items**
The lump sum cost of mobilisation / demobilisation for all Mandatory Work items shall include supply of materials, equipment, tools, services, labour and all things necessary to complete the following:
- .1 Moving all crew, equipment, and materials on and off the site as required for the completion of Mandatory Work Items.
- .2 Site clean-up of Mandatory Work Items after completion of the work.
- .3 Any overhead costs not identified in other Mandatory Work items.

.2 **Supply and Paint Handrail Sections**
The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:
- .1 Payment will be made on the basis of per linear meter of timber handrail section painted.
- .2 Handrail sections to include posts, handrail, top rail, mid-rail, guardrail and risers according to drawing.
- .3 Paint handrail sections according to Section 09 97 19.
- .4 Services that need to be detached to complete works must be reattached.
- .5 Submit product data and application procedure to Engineer for review and approval.

.3 **Supply, Remove and Replace Asphalt Surfacing with New Asphalt**
The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:
- .1 Payment will be made on the basis of per square meter area of asphalt replaced.
- .2 Contractor to supply and install new asphalt according to division 32.
- .3 Superstructure or services that need to be detached to complete works must be reattached.

.4 Submit asphalt mix and application procedure to Engineer for review and approval.
.5 Disposal of existing removed asphalt.

.4 **Repair Concrete Wharf Decking**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per linear meter of gaps filled between concrete deck panels.
.2 Contractor to supply and install foam backing rod in gaps of concrete panels, and apply sikasil 728 (or approved equivalent). Only gaps that are longitudinal to pile caps are to be filled.
.3 Follow manufacturers instructions for sealant application.
.4 Superstructure or services that need to be detached to complete works must be reattached.
.5 Submit product data and application procedure to Engineer for review and approval.

.5 **Supply, Remove and Replace Treated Timber Stringers**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per linear meter of stringer supplied and replaced as identified on drawing.
.2 Contractor to supply all hardware new for installation according to Section 05 12 33.
.3 Cut into lengths and field treat timber according to Section 06 05 73.
.4 Disposal of existing removed stringer and associated hardware.
.5 Submit shop drawing, product data, connection detail, and installation procedure to Engineer for review and approval.

.6 **Supply, Remove and Replace Treated Timber Pile-Caps**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per linear meter of pile-cap supplied and replaced as identified on drawing.
.2 Contractor to supply all hardware new for installation according to Section 05 12 33.
.3 Cut into lengths and field treat timber according to Section 06 05 73.
.4 Disposal of existing removed pile-cap and associated hardware.
.5 Submit shop drawing, product data, connection detail, and installation procedure to Engineer for review and approval.

.7 **Repair Treated Timber Pile-Cap**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per pile-cap unit repaired as identified on drawing.
.2 Re-center pile—cap onto pile at bent 49 pile L, and install new drift pin.
.3 Contractor to supply all hardware new for installation according to Section 05 12 33.
.4 Cut into lengths and field treat timber according to Section 06 05 73.
.5 Disposal of existing treated timber cut-offs pile-cap and associated hardware.

.6 Submit shop drawing, product data, connection detail, and installation procedure to Engineer for review and approval.

.8 **Supply, Remove and Replace Treated Timber Cross-Bracings**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per cross-bracing unit supplied and replaced as identified on drawing.
.2 Contractor to supply all hardware new for installation according to Section 05 12 33. Use minimum 25mm(1") diameter galvanized bolt.
.3 Cut into lengths and field treat timber according to Section 06 05 73.
.4 Fill old bolt holes with tight fitting treated plug and cover with 0.8mm thick copper patch plate, secure with 38mm long copper or silicon bronze nails at 30mm o/c all around.
.5 Disposal of existing removed bracing and associated hardware.
.6 Submit shop drawing, product data, connection detail, and installation procedure to Engineer for review and approval.

.9 **Supply, Remove and Replace Treated Timber Horizontal Bracings**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per horizontal bracing unit supplied and replaced as identified on drawing.
.2 Contractor to supply all hardware new for installation according to Section 05 12 33. Use minimum 25mm(1") diameter galvanized bolt.
.3 Cut into lengths and field treat timber according to Section 06 05 73.
.4 Fill old bolt holes with tight fitting treated plug and cover with 0.8mm thick copper patch plate, secure with 38mm long copper or silicon bronze nails at 30mm o/c all around.
.5 Disposal of existing removed bracing and associated hardware.
.6 Submit shop drawing, product data, connection detail, and installation procedure to Engineer for review and approval.

.10 **Repair Treated Timber Bracing**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per bracing unit repaired as identified on drawing at bent 25 pile D.
.2 Contractor to supply all hardware new for installation according to Section 05 12 33. Use minimum 25mm(1") diameter galvanized bolt.
.3 Cut into lengths and field treat timber according to Section 06 05 73.
.4 Fill old bolt holes with tight fitting treated plug and cover with 0.8mm thick copper patch plate, secure with 38mm long copper or silicon bronze nails at 30mm o/c all around.
.5 Disposal of existing removed bracing and associated hardware.
.6 Submit shop drawing, product data, connection detail, and installation procedure to Engineer for review and approval.

.11 **Repair Treated Timber Bearing Pile Wrapping**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per pile unit repaired as identified on drawing.

.2 Contractor to supply all hardware new for installation according to Section 05 12 33.
.3 Cut into lengths and field treat timber according to Section 06 05 73.
.4 Apply stainless steel bands to secure loose pile wrappings.
.5 Disposal of any treated timber cut-offs and associated hardware.
.6 Submit installation procedure to Engineer for review and approval.

.12 **Repair Concrete Pile Footing**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per pile footing unit repaired as identified on drawing.
.2 Contractor to supply all hardware new for installation according to Section 05 12 33.
.3 Drill and insert epoxy grouted dowels into existing footing to fix new steel reinforcement, and form new footing as per drawings. Clean existing concrete footing of all marine growth and debris to ensure bonding.
.4 Submit product data, and installation procedure to Engineer for review and approval.

.13 **Fill Repair Under Concrete Pile Footing**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per pile footing unit repaired as identified on drawing.
.2 Expose and clean rock around the concrete footing.
.3 Supply and place filter rock in voids in foundation perimeter.
.4 Submit fill material gradation to Engineer for review and approval.

.14 **Remove and Dispose of Existing Treated Timber Ramp Section**

The lump sum cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of completing the removal and disposal of treated timber ramp structure including all treated timber piles, bracing, pile-caps, stingers and decking between bents 40 to 41, and pile lines A to D.
.2 Disposal of existing removed treated timbers and associated hardware.

.15 **Supply and Install New Treated Timber Pile-Cap**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per linear meter of pile-cap supplied and installed as identified on drawing.
.2 Contractor to supply all hardware new for installation according to Section 05 12 33.
.3 Cut into lengths and field treat timber according to Section 06 05 73.
.4 Submit product data, and installation procedure to Engineer for review and approval.

.16 **Supply and Install New Pre-cast Concrete Deck Panel**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of each concrete deck panel supplied and installed as identified on drawing.

.2 Contractor to supply all hardware new for installation according to Section 05 12 33.

.3 Submit product data, and installation procedure to Engineer for review and approval.

.3 <u>Optional Work Items:</u>

Optional work that may be carried out under this contract includes pile replacements and minor works related to handrails and wave wall cover plates. Optional work generally consists of, but is not limited to the following items:

.1 **Mobilisation / demobilisation for all Optional Work Items**

The lump sum cost of mobilisation / demobilisation for all Optional Work items shall include supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Moving all crew, equipment, and materials on and off the site as required for the completion of Optional Work Items.

.2 Site clean-up of Optional Work Items after completion of the work.

.3 Any overhead costs not identified in other Optional Work items.

.2 **Supply, Remove and Replace Treated Timber Bearing Piles**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per bearing pile unit supplied and replaced as identified on drawing.

.2 Contractor to install pile according to Section 31 09 16.

.3 Contractor to supply all hardware new for installation according to Section 05 12 33.

.4 Cut into lengths and field treat timber according to Section 06 05 73.

.5 Disposal of existing removed pile and associated hardware.

.6 Submit product data, and installation procedure to Engineer for review and approval.

.3 **Supply and Install New Treated Timber Bearing Piles**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per bearing pile unit supplied and installed as identified on drawing.

.2 Contractor to install pile according to Section 31 09 16.

.3 Contractor to supply all hardware new for installation according to Section 05 12 33.

.4 Cut into lengths and field treat timber according to Section 06 05 73.

.5 Submit product data, and installation procedure to Engineer for review and approval.

.4 **Supply, Remove and Replace Handrail Sections**

The unit cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of per linear meter of timber handrail section replaced.

.2 Handrail sections to include posts, handrail, top rail, mid-rail, guardrail and risers according to drawing.

.3 Contractor to supply new ACZA treated timber members for assembly of handrail sections according to Section 06 05 73.

.4 Contractor to supply all hardware new to install handrail sections according to Section 05 12 33.

.5 Disposal of existing removed handrail sections and associated hardware.

.6 Submit shop drawing, product data, connection detail, and installation procedure to Engineer for review and approval.

.5 **Supply and Install New Wave Wall Cover Plates**

The lump sum cost for this item shall include the supply of materials, equipment, tools, services, labour and all things necessary to complete the following:

.1 Payment will be made on the basis of supplying and installing all new wave wall cover plates as identified on drawing.

.2 Cover plates must be hot dip galvanized.

.3 Contractor to supply all hardware new for installation according to Section 05 12 33.

.4 Field drill slotted holes for ease of installation.

.4 Submit product data, and installation procedure to Engineer for review and approval.

***** END OF SECTION *****

Part 1 General

1.1 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 2006.

.2 Occupational Health and Safety Act, S.N.S. [1996].

1.2 SUBMITTALS

.1 Make submittals 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 operation found in work plan.

.3 Risk Management and Safety Procedure for possible events including but not limited to storm, fire, and fall.

.3 Submit one copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.

.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 if requested.

.7 Departmental Representative may 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 within 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 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

.10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

.1 Schedule and administer Health and Safety meeting prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

.1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.7 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Harbour Manager.

.2 Departmental Representative.

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.

.2 Comply with Occupational Health and Safety Regulations.

.3 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 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 dredging and material transportation.

.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.

.5 Be on site during execution of Work.

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 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 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Departmental Representative.

1.16 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.

***** END OF SECTION *****

1 General

1.1 RELATED REQUIREMENTS

.1 Not used

1.2 REFERENCES

.1 Not used

1.3 IN WATER WORKS

.1 Construction equipment is to be operated on land or from a floating barge.

.2 Waterways are to be kept free of excavated fill, waste material and debris.

.3 Do not skid logs or construction materials across foreshore areas.

1.4 NOTIFICATION

.1 Engineer will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of written notification from Engineer Contractor will propose corrective action and take such action after receipt of written approval by the Engineer.

.3 Engineer will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

2 Products

2.1 NOT USED

3 Execution

3.1 PROJECT SCHEDULING

.1 Juvenile salmon emerge from the local rivers and can be found along the shoreline in the spring. In addition, most herring spawn between March 15th and May 1st. In late summer and early fall, adult salmon return to their native streams. For those reasons, DFO prefers works to be performed between November 30th and February 15th (DFO for Area 4 – Lower Skeena). However, it is common for many marine construction projects that do not involve dredging to be extended to March 31st and begin construction August 1st. Therefore, it is proposed that any in water works be performed between August 1st and March 31st.

.2 The Contractor shall provide 5 days notice to the Environmental Monitor prior to any in water works or other works that occur below the high water mark.

.3 Works generating exposed sediments shall not be scheduled during extreme rainfall events unless appropriate sediment erosion control systems are in place such that no release of sediment into the marine environment will occur.

3.2 SITE PREPARATION

.1 During site preparation and construction, a number of materials may be removed from the site. Mitigation measures that shall be employed during these works include:

.1 Where a risk of debris entering the water exists, a containment boom will be deployed to capture any debris.

.2 All debris will be collected and removed from the site at an appropriate upland disposal facility.

.3 The site shall be left in a clean condition each day.

.4 Works shall be conducted in a safe manner to ensure the safety of both work crews and the public. The Contractor must have a Safety Plan in place.

.5 Proper marking of the site shall be in place to ensure that all areas being demolished are clearly visible.

.6 No heavy machinery shall be permitted to enter the water unless appropriate mitigation measures are identified by the Contractor and authorized by the Engineer in writing.

.7 A spill kit will be on site at all times.

.8 The Contractor will have a Spill Management Plan and will carry out that plan in the event of a spill.

.9 Water quality conditions resulting from these works shall not exceed water quality criteria in Part 5.

.10 The works shall not generate vibrations (pressure waves) that exceed 30 kPa in the marine environment.

.11 Saw dust and particles shall be cleaned up daily so as to prevent their release into the marine environment.

.12 The Contractor shall create an Environmental Management Plan.

3.3 MATERIALS

.1 All rip rap shall be inspected by the Contractor to ensure that it is free of excess fines prior to use.

.2 The Contractor to ensure that any fill material used does not result in acid leachate or is not from a source that can reasonably be suspected of causing acid leachate.

.3 The Contractor shall only use fill material from sources that have not been used for Industrial or Commercial purposes unless a Phase I ESA has concluded that the materials are not likely to be contaminated.

3.4 CONSTRUCTION

.1 Conduct works in a manner that complies with the law and avoids, mitigates or lessens potential impacts to aquatic and riparian habitats, water quality and quantity, fish and wildlife populations, and public safety and property.

.2 Enforce good housekeeping, worker's compensation board, and relevant codes and by-laws, for site services and conditions.

.3 Rip rap or infill materials will be placed during periods of low tide wherever possible.

.4 If the water quality requirements identified in Section 3.5 cannot be met, a 4.5m tall silt curtain will be required around the area being filled.

.5 The Contractor shall inspect equipment to ensure it is in good working order, clean and free of leaks.

.6 Heavy equipment is to be kept out of the water. This is defined as the tracks of the machines out of the water itself.

.7 Clearly survey and mark infill boundaries onsite prior to construction to ensure the correct areas are worked on.

.8 All stockpiled materials shall be placed away from any drainage or the high water mark wherever possible.

.9 All stock piled materials shall remain covered with polyethylene or tarps during any rainfall event, or, after 3 days of dry weather if no rainfall has occurred.

.10 Public roadways must be kept clean. Daily cleaning will be required if any observed sedimentation has occurred.

.11 Perform all works within the project footprint only.

.12 The Contractor shall develop a Sediment and Erosion Control Plan to ensure any stock piled materials or exposed sediments to not generate unnecessary sediment laden waters.

.13 Plan project to minimize exposure of fines to tide cycles which will generate plume during high tides.

.14 Have an Environmental Monitor onsite when there is potential for juvenile salmon to be onsite as defined by the DFO Fisheries Window typically after March 15th.

.15 Where practical, remove invertebrates from the project footprint to an adjacent site of equal habitat conditions.

.16 Following Best Management Practices for Pile Driving.

.17 Use a vibratory hammer if driving conditions permit.

.18 Employ bubble curtain if required.

.19 Preventing grounding of barges or equipment on foreshore.

4 Environmental Impact Mitigation

4.1 SEDIMENT CONTROL DEVICES

.1 A silt curtain will be deployed at the discretion of the Environmental Monitor in consultation with Small Craft Harbours based on water quality readings. If water quality is not an issue, as defined below in Part 5, no silt curtain will be deployed.

.2 Gravel pads shall be placed where trucks pull out onto paved areas.

.3 Sand bags shall be placed beside catchment basins during the works to collect any sediment.

.4 Any upland works shall be isolated from the marine environment with the use of a silt fence if that surface slopes towards the High Water Mark.

5 Water Quality

5.1 WATER QUALITY TESTING

.1 Turbidity shall not exceed 8 NTU above background located at any point outside of the Small Craft Harbour water lot as measured by the Environmental Monitor.

6 Spill Response Plan

6.1 EQUIPMENT AND SUPPLIES

.1 At a minimum, the following equipment and supplies shall be onsite during any construction activities:

.1 Absorbent pads
.2 Spill booms
.3 Clearly marked spill kit
.4 Gloves
.5 Hard copy of this Spill Response Plan

6.2 TRAINING

.1 All personnel on the project must have been trained to use the equipment and supplies listed above and be familiar with these spill response procedures to ensure a spill is avoided and immediate action is taken in the event of a spill.

6.3 PLANNING

.1 The Contractor shall ensure that when planning the project:

.1 Only equipment that is free of leaks are used on the project
.2 The equipment is of sufficient size and capable of performing the work without becoming overloaded.
.3 All equipment is inspected prior to daily use
.4 All equipment and work surfaces are in a clean condition.
.5 The location of the spill kit has clearly been communicated to all work crew members.
.6 Ensure that a skiff is available to perform cleanup.

6.4 CLEAN UP PROCEDURE

.1 In the event of a spill, the Contractor shall perform the following immediately:

.1 Stop the source of the spill. If the spill is from a machine in or near the marine environment, remove it to a contained upland area.
.2 Contain the spill by deploying the spill booms from a skiff if in water.
.3 Use absorbent pads to collect the spilled material.
.4 Collect photographs of both the site impacted and the equipment that failed.
.5 Report the findings to a designate as determined by Small Craft Harbours.
.6 Document the events, including:

.1 Name of Contractor personnel(s) present and contact phone number;
.2 Name and telephone number of the person who caused the spill;
.3 Location and time of the spill;
.4 Type and quantity of the substance spilled;
.5 Cause and effect of the spill;
.6 Details of action taken or proposed;
.7 Description of the spill location and surrounding area;
.8 Names of agencies on scene; and
.9 Names of other persons or agencies advised concerning the spill.

.2 If the spill exceeds the values in B.C. Reg. 63/88 below, the following must be contacted:

B.C. Ministry of Environment Environmental Emergency:	1-800-663-3456
Marine Spill Reporting:	1-800-OILS-911
Canadian Coast Guard:	1-800-889-8852
Gibsons Landing Harbour Authority:	1-604-886-8017
Small Craft Harbours – Andrew Cornell:	1-604-666-6724
Fisheries and Oceans Canada:	1-250-627-3499

6.5 SPILL REPORTING REGULATION

.1 If the spill exceeds any of the following, it must be reported to the provincial government

B.C. Reg. 63/88.

Item	Column 1 Substance spilled	Column 2 Specified amount
1	Class 1, Explosives as defined in section 2.9 of the Federal Regulations	Any quantity that could pose a danger to public safety or 50 kg
2	Class 2.1, Flammable Gases, other than natural gas, as defined in section 2.14 (a) of the Federal Regulations	10 kg
3	Class 2.2 Non-Flammable and Non-Toxic Gases as defined in section 2.14 (b) of the Federal Regulations	10 kg
4	Class 2.3, Toxic Gases as defined in section 2.14 (c) of the Federal Regulations	5 kg
5	Class 3, Flammable Liquids as defined in section 2.18 of the Federal Regulations	100 L
6	Class 4, Flammable Solids as defined in section 2.20 of the Federal Regulations	25 kg
7	Class 5.1, Oxidizing Substances as defined in section 2.24 (a) of the Federal Regulations	50 kg or 50 L
8	Class 5.2, Organic Peroxides as defined in section 2.24 (b) of the	1 kg or 1 L

	Federal Regulations	
9	Class 6.1, Toxic Substances as defined in section 2.27 (a) of the Federal Regulations	5 kg or 5 L
10	Class 6.2, Infectious Substances as defined in section 2.27 (b) of the Federal Regulations	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
11	Class 7, Radioactive Materials as defined in section 2.37 of the Federal Regulations	Any quantity that could pose a danger to public safety and an emission level greater than the emission level established in section 20 of the "Packaging and Transport of Nuclear Substances Regulations"
12	Class 8, Corrosives as defined in section 2.40 of the Federal Regulations	5 kg or 5 L
13	Class 9, Miscellaneous Products, Substances or Organisms as defined in section 2.43 of the Federal Regulations	25 kg or 25 L
14	waste containing dioxin as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
15	leachable toxic waste as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
16	waste containing polycyclic aromatic hydrocarbons as defined in section 1 of the hazardous Waste Regulation	5 kg or 5 L
17	waste asbestos as defined in section 1 of the Hazardous Waste Regulation	50 kg
18	waste oil as defined in section 1 of the Hazardous Waste Regulation	100 L
19	waste containing a pest control product as defined in section 1 of the Hazardous Waste Regulation	5 kg or 5 L
20	PCB Wastes as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
21	waste containing tetrachloroethylene as defined in section 1 of the Hazardous Waste Regulation	50 kg or 50 L
22	biomedical waste as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
23	A hazardous waste as defined in section 1 of the Hazardous Waste Regulation and not covered under	25 kg or 25 L

	items 1 – 22	
24	A substance, not covered by items 1 to 23, that can cause pollution	200 kg or 200 L
25	Natural gas	10 kg, if there is a breakage in a pipeline or fitting operated above 100 psi that results in a sudden and uncontrolled release of natural gas

7 Environmental Monitoring

7.1 QUALIFICATION OF THE ENVIRONMENTAL MONITOR

.1 Appropriate qualifications for the Environmental Monitor shall include knowledge and experience relating to:

.1 Local marine biology and ecology,

.2 Experience and background in the limitations and abilities of the equipment performing the project,

.3 The potential adverse environmental effects of the Project,

.4 Measures that can be employed to mitigate known and unknown adverse environmental effects that are likely to occur, and,

.5 Relevant legislation, guidelines, and best management practices.

7.2 ROLE OF THE ENVIRONMENTAL MONITOR

.2 The Environmental Monitor will:

.1 Have written authority from the Proponent to modify or halt any construction activity as required to minimize impacts to fish or fish habitat,

.2 Explain the conditions of any permits including authorizations, letters of advice or aquatic environment effects determinations to each contractor prior to that contractor starting work at the project site,

.3 Monitor the project for compliance with the conditions of any permits including authorizations, letters of advice or aquatic environment effects determinations, guidelines, and best management practices,

.4 Direct project construction works as necessary to ensure compliance with any permits including authorizations, letters of advice or aquatic environment effects determinations, guidelines, and best management practices. This includes stopping or altering project works and directing works to avoid or mitigate adverse environmental effects, and,

.5 Provide written reports describing the findings of the monitoring program.

.6 Note: the Environmental Monitor does not have the authority to change the Project or the terms or conditions of any permits including authorizations, letters of advice or aquatic environment effects determinations.

7.3 TIMING OF MONITORING

.1 The Environmental Monitor will be onsite whenever there are works with the potential to adversely affect the aquatic environment or, at any time during the course of the project when there is the potential for adverse impacts to fish or fish habitat or the potential deposit of a deleterious substance into the aquatic environment.

7.4 MONITORING SPECIFICS

.1 The monitoring will include the following:

.1 The works undertaken each day and wildlife present,

.2 Assessment of the effect of the project on the project environment, including observation, photography and physical measurements,

.3 Assessment of compliance with the conditions of any permits including authorizations, letters of advice or aquatic environment effects determinations, guidelines, and best management practices, and,

.4 Identification of any significant environmental issues and impacts and details of specific mitigation measures put in place to address those issues and impacts.

7.5 CONSTRUCTION MONITORING

.1 The monitor will create written daily monitoring reports describing the findings for each day the monitor is onsite including:

.1 A summary of the works and activities carried out or undertaken that day,

.2 Commentary on the works and activities conducted from a fish and fish habitat perspective,

.3 Identification of any potential issues or impacts to fish or fish habitat that arose or occurred, and details of specific mitigatory measures put in place to address these issues and impacts.

.2 The monitor will keep the daily reports on file to be provided upon request. In addition to the daily monitoring reports, the monitor will provide a written summary monitoring report for the project works.

7.6 SPECIES AT RISK MONITORING

.1 Species at risk that have the potential to be in the general area of the site include:

.1 Northern Resident Killer Whale

.2 Fin Whale

.3 Bigg's Killer Whale

.4 Northern Abalone

.2 A 1km buffer zone will be established around the project site, if any cetaceans are observed within 1km during pile driving, work will be stopped until 30 minutes after they have left the safety zone. A 500m safety zone around the project site will be established for all other marine mammals, within which their behaviour will be observed and reported to the Environmental Monitor immediately. If the animal is deemed to be at risk or in distress, works will be stopped until the animal is considered no longer at risk or has left the buffer zone.

.3 An Environmental Monitor will be onsite whenever the project is producing in water pressure waves in excess of 30 kPa or when a plume occurs that is expected to exceed the perimeter of the project water lot boundary. When on site, the Environmental Monitor shall use binoculars during the day and a hydrophone during the night to monitor the presence of any cetaceans in the area during periods of the work likely to impact cetaceans.

.4 The Environmental Monitor shall be empowered in writing by the Contractor to stop work in the event that any species at risk are observed at or near the site within the Safety Zone.

.5 If a species at risk is observed, information on the species observed, location, behaviour, and duration on site, shall be recorded. The report will include a description of the Contractor's activities, the times that work stopped and started, and if the works appeared to have an impact on the species at risk.

8 Pile Works

8.1 PILE DRIVING BEST PRACTICES

.1 Have a preconstruction meeting to go over environmental requirements.

.2 Machinery is to arrive on site in a clean, washed condition and be free of fluid leaks.

.3 All equipment is maintained in good proper running order to prevent leaking or spilling of potentially hazardous or toxic products.

.4 Wash, refuel and service machinery and store fuel and other materials for the machinery at least 30 metres away from the water in order to prevent any deleterious substance from entering the water.

.5 Any water-based equipment or machinery (for example, clamshell dredge or pile driver on a barge) moored or used during the Project must not ground on the intertidal foreshore or subtidal seabed. The only exception to this condition is that use may be made of vertical spuds or other anchors to hold the water-based machinery or equipment in place.

.6 Storage of fuels and petroleum products will comply with safe operating procedures, including containment facilities in case of a spill.

.7 Pile cut-offs, waste or any miscellaneous unused materials must be recovered for either disposal in a designated facility or placed in storage.

.8 On site emergency spill equipment available whenever working near or on the water.

.9 Position water borne equipment in a manner that will prevent damage to identified fish habitat.

.10 Report any incidents of habitat damage to the Environmental Monitor or DFO. to ensure that appropriate action (restoration) is taken.

.11 If fish spawn in the area or on equipment all work should stop and the Environmental Monitor or DFO notified.

.12 Work in least risk timing windows for fish and employ silt or bubble curtains to prevent harm to fish or fish habitat.

.13 Environmental monitoring of pressure waves is not required if appropriate vibratory hammer equipment is employed.

.14 For any extraction of existing piles, reasonable efforts are to be applied to remove the entire length of the pile from the intertidal foreshore or subtidal seabed.

.15 If pile driving is results in pressure waves above 30 kpa bubble curtains or other mitigation measures should be employed to reduce or pressure wave values or maintain marine life at a distance where pressure waves do not exceed 30 kpa.

.16 Follow any project plans including Environmental Management, Water Quality Monitoring, Environmental Monitoring, Spill Prevention and Emergency Response Plan.

.17 Best Practices are guidelines only.

.18 All permits, authorizations, laws and regulations take precedence over this document.

8.2 PILE REMOVAL BEST PRACTICES

.1 Measures should be implemented to control turbidity and sediments re-entering the water column during pile removal, and to dispose of removed piles and debris.

.2 Existing pilings within the project footprint should be extracted using direct pull and/or vibratory techniques in accordance with the following resource protection measures.

.3 Vibratory extraction is the preferred method of piling removal and should be used where available and feasible depending on piling condition and substrate type. Vibration reduces friction between the pile and substrate to avoid disturbing large amounts of sediment. Typically little or no sediment remains attached to the pile during vibratory withdrawal.

.4 When appropriate for the substrate type and structural integrity of the piling, a crane or excavator may be used to pull the pilings out of the sediment. To the extent practicable, pilings should be removed in their entirety; however, no jetting, excavation, or other significant disturbance of the sediment should occur to facilitate piling removal.

.5 Work should be done during low water/low tide to the extent possible. Individual piles should be removed slowly to ensure sediment disturbance and resulting turbidity in the water column is minimized. All sediment and contaminants associated with removed piles should be contained during handling and transport to prevent re-introduction to the water. No effort should be made to remove sediment or other material from chemically treated piles, either in or over the water.

.6 In the event that the pile breaks at or near the existing mudline and cannot be removed, the pile should be cut off at least 1 foot below the mudline. For creosote treated piles, the remaining stump should be covered with clean sediment. Any other holes remaining after piling removal should not be filled.

.7 All floating surface debris should be collected and disposed of along with the piling. All wooden piling treated with preservatives, together with associated sediments, and debris from piling removal should be permanently removed from the water and disposed of at a facility approved for collection of hazardous waste.

.8 Extracted piles and debris should be placed in a lined stockpile area or directly loaded into transport container or vehicle.

.9 Appropriate controls should be used to prevent runoff from leaving the stockpile and entering surface water or ground water. Steel pipe piling may be recycled or reused if the piling condition is suitable for reuse.

.10 Best Management Practices are guidelines only.

.11 All permits, authorizations, laws and regulations take precedence over this document.

9 Concrete Works

9.1 CONCRETE USE BEST PRACTICES

.1 Ensure that all works involving the use of concrete, cement, mortars, and/or other Portland cement or lime-containing construction materials will not deposit (directly or indirectly) sediments, debris, concrete, leachate concrete fines, wash or contact water into or about any watercourse.

.2 Cast in place concrete must remain isolated from water inside sealed formed structures until cured (approximately 48-72 hours), as concrete leachate is highly toxic to fish and other aquatic life.

.3 Ensure a carbon dioxide (CO_2) tank with regulator, hose and gas diffuser (bubbler) is readily available during concrete work to neutralize pH levels should a spill occur. Staff must be trained in its proper use.

.4 Provide containment facilities for wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment.

.5 Immediately report any spills of sediments, debris, concrete fines, wash or contact water of reportable quantities to the Provincial Emergency Program Environmental Emergency Management Plan Incident Reporting Hotline 1-800-663-3456 and DFO's Observe, Record and Report Hotline 1-800-465-4336.

.6 Implement emergency mitigation and clean-up measures (such as use of CO_2 and immediate removal of the material).

.7 Monitor pH frequently within worksite and immediately downstream of the isolated worksite until the works are completed. Emergency measures should be implemented if downstream pH has changed more than 1.0 pH unit, measured to an accuracy of +/- 0.2 pH units from the background level, or is below 6.0 or above 9.0 pH units.

.8 Prevent any water that contacts deleterious uncured or partly cured concrete (during activities like exposed aggregate wash-off, wet curing, or equipment washing) from directly or indirectly entering any watercourse or stormwater system.

.9 Isolate and hold any water that contacts uncured or partly cured concrete until the pH is between 6.5 and 8.0 pH units and the turbidity is less than 25 nephelometric turbidity units (NTU), measured to an accuracy of +/- 2 NTU.

10 Cleaning

.1 Leave work area clean at end of each day

.2 Ensure public waterways, storms and sanitary sewers remain free of waste and volatile materials disposal.

.3 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment to the approval of the Engineer.

***** END OF SECTION *****

1 GENERAL

1.1 Description

.1 This Section covers formwork for all concrete components of the work.

1.2 Related Sections

.1	Section 03 20 00	Concrete Reinforcing
.2	Section 03 30 00	Cast-in-Place Concrete
.3	Section 03 41 00	Precast Concrete
.4	Section 03 60 00	Grouting

1.3 References

.1 ANSI/ACI-347, Concrete Formwork, Recommended Practice for.

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

.3 CAN/CSA-O86.1, Engineering Design in Wood.

.4 CAN/CSA-O86.1S1, Supplement No. 1 to CAN3-O86.1-09 Engineering Design in Wood.

.5 CSA O121-M, Douglas Fir Plywood.

.6 CSA-S269.1-M92, Falsework for Construction Purposes.

.7 CSA-S269.2-M87, Access Scaffolding for Construction Purposes.

.8 CSA-S269.3-M92, Concrete Formwork.

.9 CSA O151-M, Canadian Softwood Plywood.

.10 CSA O437 Series, Standards for OSB and Waferboard.

.11 COFI Exterior Plywood for Concrete Formwork, Council of Forest Industries of British Columbia

1.4 Definitions – Not Used

1.5 Delivery, Storage, and Handling

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials off ground, in dry locations, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect formwork from damages.

.3 Replace defective or damaged materials with new.

2 PRODUCTS

2.1 Formwork Materials

.1 Formwork lumber: plywood and wood formwork materials to CAN/CSA-O86.1-09, CAN/CSA-O86.1S1.

.2 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of tie devices leaving holes larger than 25 mm diameter in concrete surface. The portion which remains embedded in the concrete shall have a minimum cover of 50 mm after patching.

.3 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.

.4 Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal 15 to 24 mm2/S at 40° C, flashpoint minimum 150° C, open cup.

.5 Falsework materials: to CSA S269.1-M92 (R2003).

3 EXECUTION

3.1 Fabrication and Erection

.1 Verify lines, levels and plumb walls before proceeding with formwork and ensure dimensions agree with drawings.

.2 Obtain Engineer’s approval for use of earth forms.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Construct falsework in accordance with CSA S269.1-M92 (R2003) and COFI Exterior Plywood for Concrete Formwork.

.5 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.

.6 Obtain Engineer's permission before framing openings not indicated in concrete joists, beams or columns.

.7 Align form joints and make watertight. Keep form joints to minimum.

.8 Use 25 mm chamfer strips on external corners of beams, joints and columns, except where indicated otherwise on the Drawings.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Line forms for the following surfaces:

.1 Concrete Footings.

Do not stagger joints of form lining material. Align joints to obtain uniform pattern.

.11 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

.12 Re-use of formwork and falsework is subject to requirements of CAN/CSAA23.1.

.13 Slip-forming to be approved by Engineer subject to evaluation of procedures and mechanical equipment proposed for use.

.14 Formwork and falsework shall be designed and fabricated in accordance with WorkSafeBC regulations.

.15 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

3.2 Removal and Reshoring

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 7 days for Timber Pile Concrete Footings.

.2 Concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1. Do not strip forms until the concrete has achieved a minimum strength of 10MPa.

.3 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 500 mm apart.

.5 Re use formwork and falsework subject to requirements of CAN/CSA A23.1.

***** END OF SECTION *****

1 GENERAL

1.1 Related Sections

.1	Section 03 10 00	Concrete Forming and Accessories
.2	Section 03 30 00	Cast-in-Place Concrete
.3	Section 03 41 00	Precast Concrete

1.2 References (Latest Versions of the Following References)

.1	CSA A23.1	Concrete Materials and Methods of Concrete Construction
.2	CSA A23.2	Method of Test for Concrete
.3	CSA A23.3	Design of Concrete Structures
.4	CSA G30.3	Cold-Drawn Steel Wire for Concrete Reinforcement
.5	CSA G30.14	Deformed Steel Wire for Concrete Reinforcement
.6	CSA G30.15	Welded Deformed Steel Wire Fabric for Concrete Reinforcement
.7	CAN/CSA-G30.18	Billet-Steel Bars for Concrete Reinforcement
.8	CAN/CSA-G40-21	Structural Quality Steels
.9	CAN/CSA-S6	Design of Highway Bridges
.10	CSA W186	Welding of Reinforcing Bars in Reinforced Concrete Construction
.11	ACI 315	Details and Detailing of Concrete Reinforcement

1.3 Submittals

.1 Submit Shop Drawings for reinforcement of cast-in-place and precast concrete.

.2 Shop Drawings shall indicate placing of reinforcement and:

- .1 Bar bending details
- .2 Lists
- .3 Placing drawings

.4 Indicate sizes, spacing, quantities and locations of reinforcement, couplers and splices, with identifying code marks to permit correct placement without reference to Construction Drawings. Indicate sizes, spacing and locations of chairs, spacers and hangers.

.5 The review of submittals by the engineer shall not in any way relieve the contractor from the responsibility for the proper fitting, finishing, quality, quantities, and erection of the works in accordance with the requirements of the contract documents for errors/omissions in the contactor's submittals, or from the responsibility of furnishing materials and workmanship not specifically indicated or specified but required and necessary to properly complete the works. Without restricting generality of the foregoing requirements, the contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction, installation, and for coordination of the works of all subtrades.

.6 Bar schedules shall detail each type of bar and provide a total weight, computed from the theoretical mass specified in CAN/CSA – G30.18.

.7 Detail lap lengths to CAN/CSA – A23.3.

.8 Provide Class B tension lap splices unless otherwise indicated.

.3 Submit manufacturer's product literature and test data for mechanical couplers to be incorporated in the Work.

1.4 Quality Control Submittals

.1 Submit a certified copy of each mill test report for all reinforcing steel supplied, showing physical and chemical analyses, minimum five 5 weeks prior to commencing fabrication.

.2 Inform the Consultant of proposed source(s) of reinforcement material.

1.5 Delivery, Storage and Handling

.1 Ship reinforcing steel in bundles with identifying tags or markings. Take necessary precautions to maintain identification after the bundles are broken.

.2 Store reinforcing steel above ground on platforms, skids, or racks and protect from prolonged exposure to weather.

.3 Ship prestressing steel accompanied by test certificates and identification. Store prestressing steel with identifying tags and protect from corrosion due to humidity, contamination, or electrolytic action.

.4 Replace defective or damaged materials with new.

2 PRODUCTS

2.1 Materials

.1 Reinforcing Steel: billet-steel deformed bars to CAN/CSA-G30.18 Grade 400R, unless bearing identifying marks indicating size and grade.

.2 Prestressing Strands: low-relaxation, 7-wire strands to CSA G279, Grade 1860.

.3 Cold-Drawn Steel Wire Ties: to CSA G30.3.

.4 Deformed Steel Wire: to CSA G30.14.

.5 Welded Steel Wire Fabric: to CSA G30.5.

.6 Welded Deformed Steel Wire Fabric: to CSA G30.15.

.7 Plain Round Bars: to CAN/CSA-G40.21.

.8 Weldable Reinforcing Steel: to Grade 400W.

.9 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.10 Tie wire: 1.5 mm diameter annealed wire

.11 Mechanical splices: subject to approval of Consultant

.12 Reinforcing steel shall be billet steel deformed bars to CAN/CSA – G30.18. Grade.

2.2 Accessories

.1 Chairs, Bolsters, Bar Supports, Spacers: to CSA A23.1. Support devices contacting surfaces to be exposed to earth or weather shall be non-corroding.

.2 Mechanical Couplers: capable of developing 125% of the tensile strength of the coupled reinforcing steel, as proven by laboratory tests, Bar-Lock (MBT) couplers, sizes as indicated.

.3 Use non-corroding, non-conductive bar supports and coated tie wire with epoxy-coated reinforcing bars.

2.3 Fabrication

.1 Fabricate reinforcing in accordance with CSA A23.1, Clause 6.6.

.2 Design and detail lap lengths and bar development lengths to CAN/CSA-S6 unless otherwise indicated.

.3 Obtain the Consultant’s approval for locations of reinforcement splices other than shown on the Construction Drawings.

.4 Where indicated, weld reinforcement in accordance with CSA W186.

.5 Verify as-built foundation dimensions and elevations at the Site before cutting and bending reinforcement for foundations, grade beams and pedestals.

3 EXECUTION

3.1 Placing of Reinforcement

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1 and A23.4. Ensure materials, before being placed, are free of loose scaly rust, dirt, oil, paint or other bond-breaking coating.

.2 Prior to placing concrete, obtain the Consultant's approval of reinforcing steel and position.

.3 Provide minimum concrete cover for reinforcement in accordance with CSA A23.1 Clause 6.6 unless indicated otherwise on the Construction Drawings.

3.2 Prestressing

.1 Stress in strands immediately before transfer as indicated on the Construction Drawings.

3.3 Field Bending

.1 Do not field bend reinforcement except where indicated or authorized by the Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars which develop cracks or splits.

3.4 Tolerances

.1 Tolerances for placing reinforcing steel shall be in accordance with CSA A23.1 Clause 6.6.8.

*****END OF SECTION*****

1 GENERAL

1.1 Summary

.1 This Section describes the requirements for all cast-in-place concrete to be furnished and installed in the Work.

1.2 Related Sections

.1	Section 03 10 00	Concrete Forming and Accessories
.2	Section 03 20 00	Concrete Reinforcing
.3	Section 03 60 00	Grouting

1.3 References

.1	CSA-A23.1	Concrete Materials and Methods of Concrete Construction
.2	CSA-A23.2	Methods of Test for Concrete
.3	CSA-A23.3	Design of Concrete Structures
.4	CSA-A3000	Cementitous Materials Compendium
.5	CSA A283	Qualification Code for Concrete Testing Laboratories
.6	CSA-S269.3	Concrete Formwork
.7	ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
.8	ASTM C403/C403M	Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
.9	ASTM C494/C494M	Standard Specification for Chemical Admixtures for Concrete
.10	ASTM C1017/C1017M	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
.11	ASTM C1202	Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
.12	ACI 305R/306R	Hot/Cold Weather Concreting
.13	ACI 309R	Guide for Consolidation of Concrete

.14 Additional material and testing standards listed in Clause 2 of CSA-A23.1.

1.4 Definitions

.1 "Permeability" referred to in this Section shall mean chloride permeability of concrete when tested using ASTM C1202-97 procedures at 56 days of moist curing.

1.5 Submittals

.1 Submit for approval notification of the proposed independent testing agency.

.2 Submit concrete mix designs to the Consultant for review 14 days prior to placement. The submittal shall include complete details of mix proportions.

.3 Submit for approval copies of placement procedures at least 14 days prior to placing.

.4 Submit copies of all test results directly to the Consultant from the testing agency for review. Test results shall be submitted on the day the tests are completed. Submission of test results will not relieve the Contractor from his obligation to interpret the test results and make necessary corrections or adjustments to his construction procedures or mix designs.

.5 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken

.6 At least four 4 weeks prior to commencing the Work of this Section, submit a statement from the concrete supplier identifying the proposed source of aggregate and certifying that the proposed aggregate/cement combination will not produce deleterious expansion due to alkali-aggregate reaction. The statement shall reference and accompany recent test results that substantiate the statement.

.7 Submit to the Consultant for review, details of falsework for supporting the concrete formwork and precast and pour sequences, at least 14 days prior to installing any falsework. Such review by the Consultant is for general conformance to the design of the structures and shall in no way relieve the Contractor of his responsibilities with respect to design of such falsework.

1.6 Quality Control Submittals

.1 Provide certification that Construction Equipment and Materials including aggregates to be used in concrete comply with requirements of CSA-A23.1.

.2 Submit test results based on trial mixes showing that concrete mix designs will produce concrete meeting the requirements of this Section and that strength will comply with CSA-A23.1.

.3 Submit manufacturer's datasheets and printed instructions for joint sealant and primer proposed for use in the Work.

.4 Concrete hauling time: provide for review by Consultant deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching.

1.7 Quality Control

.1 Perform all concrete work in accordance with the requirements of CSA A23.1 and A23.4.

.2 Concrete inspection and testing shall be carried out by a qualified independent agency approved by the Consultant. Cost of testing will be considered incidental to the Work of this Section.

1.8 Site Conditions

.1 Placing concrete during rain or weather events that could damage concrete is prohibited.

.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.

.3 Cold weather protection:

.1 Maintain protection equipment, in readiness on Site.

.2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.

.3 Placing concrete upon or against surface at temperature below 5°C is prohibited.

.4 Hot weather protection:

.1 Protect concrete from direct sunlight when ambient temperature above 27°C.

.2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.

.5 Protect from drying.

2 PRODUCTS

2.1 Concrete Materials

.1 Portland Cement: Type MS to CSA A3001. Type GU (10) Portland Cement to CSA Standard A3001 may be used if tri-calcium aluminate (C_3A) content is between 4% and 8%, and total alkali content is not greater than 0.60% sodium oxide equivalent.

.2 Supplementary Cementing Materials: Type F or Cl Fly Ash and Type SF Silica Fume to CSA-A23.5.

.3 Water: to CAN/CSA-A23.1-M.

.4 Aggregates: to CAN/CSA-A23.1-M, normal density.

.5 Air Entraining Admixtures: to CAN/CSA-A23.1-M (Which refers to ASTM C260).

.6 Chemical Admixtures: to CAN/CSA-A23.1-M (Which refers to ASTM C494). Consultant to approve type and use of accelerating or set retarding admixtures during cold and hot weather placing. Calcium chloride shall not be used. Chemical admixtures in exposure class C-1 concrete shall be free of chloride ions.

.7 Super Plasticizing Admixtures: to ASTM C1017.

.8 Curing Compound: TO CAN/CSA-A23.1-M white, or to ASTM C309, type 1-1-chlorinated rubber type 1-D with fugitive dye.

.9 Concrete mix shall be proportioned to provide a workable mix without segregation or bleeding.

2.2 Formwork Materials

.1 Refer to: Section 03 10 00 – Concrete Forming and Accessories

2.3 Other Materials

.1 Embedments and Inserts: to Section 05 50 00 - Metal Fabrications.

.2 Joint Sealant: Install foam backing rods in vertical joints of concrete panels. Apply Sikasil 728, or approved equal, to seal gaps. Only fill vertical joints running along the pile caps. Follow manufacturer's instructions for sealant application.

.3 Primer for Joint Sealant: as recommended by sealant manufacturer.

.4 Premoulded Joint Filler: resilient bituminous impregnated fibreboard to ASTM D1751. Sternson Flexcell or approved equal. Sponge rubber to ASTM D1752, Type I, flexible grade. Self-expanding cork to ASTM, Type II or III.

.5 Bonding Agent: Styrene butadiene emulsion polymer, 48% solids. Target Polymer Bonding Agent or approved equal.

.6 Grout for Steel Reinforcement Dowelled Horizontally into Existing Concrete: Sikadur 31 Hi-mod gel; HILTI HIT RE500 or approved equal.

2.4 Concrete Mixes

.1 Select concrete mix proportions in accordance with CSA-A23.1 Alternative 1 given the following properties for tremie concrete infill in steel pipe piles and concrete abutment:

.1 Cement: Portland Cement with fly ash measuring 20% by mass of total cementitious materials. Silica flume may be deleted if approved by the Consultant.

.2 Minimum Compressive Strength at 28 Days: 35 MPa.

.3 Maximum Water/Cementing Materials Ratio: 0.40.

.4 Exposure Class: C-1.

.5 Nominal Maximum Size of Coarse Aggregate: 20 mm.

.6 Slump at time and point of discharge: 75 mm, ±20 mm.

.7 Air Content: 5% to 8%. Spacing factor to comply with CSA A23.1, Clauses 4.3.3.2 and Clauses 4.3.3.3.

.8 Super Plasticizing Admixture: to ASTM C1017.

.9 Permeability: maximum 1,000 coulombs at 56 days.

.10 Water/Cement Ratio (By Weight): 0.40

.2 The concentration of corrosion-inducing chemicals from all sources in the concrete mix, expressed as a percentage of the mass of the total cementitious materials, shall not exceed the following limits when tested according to the noted methods.

.1	Chlorides:	0.10%	(ASTM D512)
.2	Fluorides:	0.10%	(ASTM D1179)
.3	Sulphites:	0.13%	(ASTM D1339)
.4	Nitrates:	0.17%	(ASTM D3867)

.3 Do not change concrete mix without prior approval of the Consultant. Should a change in material source be proposed, new mix design will be required for approval by the Consultant.

.4 The concentration of corrosion-inducing chemicals from all sources in the concrete mix, expressed as a percentage of the mass of the total cementitious materials, shall not exceed the following limits when tested according to the noted methods:

.1	Chlorides:	0.10%	(ASTM D512)
.2	Fluorides:	0.10%	(ASTM D1179)
.3	Sulphites:	0.13%	(ASTM D1339)
.4	Nitrates:	0.17%	(ASTM D3867)

.5 Do not change concrete mix without prior approval of the Consultant. Should change in material source be proposed, new mix design to be approved by the Consultant.

2.5 Concrete Production

.1 Measure, batch and mix concrete in accordance with CSA-A23.1 Clause 8.1.7.

.2 Before unloading concrete at the Site, furnish the Consultant with a delivery ticket for each batch of concrete in accordance with CSA-A23.1 Clause 8.6.5.

3 EXECUTION

3.1 General

.1 Prior to any concrete repair work, pre-wash the existing surface to be repaired with a high strength pressure washer that has a minimum pressure of 3000psi and 2.5GPM, to ensure proper adhesion of new concrete to the old surface.

.2 Prior to placing concrete, ensure that all reinforcing and other items to be embedded in concrete are in place, properly oriented, located, and secured. Verify that concrete may be placed to the lines and elevations shown on the Construction Drawings with all required clearances and cover for reinforcement. Ensure that forms are clean and absolutely all debris has been removed.

.3 Obtain the Consultant's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

.4 Prior to placing concrete, obtain the Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.5 Maintain accurate records of poured concrete items to indicate date, location of pour, quantity, air temperature and any Contractor's test samples taken.

3.2 Formwork

.1 Construct and erect formwork in accordance with CSA-S269.3.

.2 Assemble forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1, Clause 6.4.

.3 Construct forms with temporary ports or openings at the bottom of units deeper than 1 m to facilitate cleaning and inspection.

.4 Align form joints and make watertight. Use minimum number of form joints.

.5 Clean formwork in accordance with CSA-A23.1 before placing concrete.

.6 Leave formwork in place until concrete has attained 75% of the design compressive strength.

3.3 Preparation

.1 Check locations and sizes of sleeves and openings shown on the Construction Drawings with architectural, structural, mechanical and electrical Drawings.

.2 Set sleeves, anchor bolts and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm not indicated on Construction Drawings must be approved by the Consultant.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Consultant before placing of concrete. This shall be considered as incidental to the Work and at no cost to the Consultant.

.4 No work shall commence until approval by engineer for concrete materials and mix design.

3.4 Placing of Concrete - General

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 Handle, deposit, and consolidate concrete in accordance with CSA-A23.1, Clause 7 and ACI A309R. Take care not to disturb forms or reinforcing steel when depositing and consolidating concrete.

.3 Ensure that spare internal vibrators and external form vibrators are on hand during placing of concrete.

.4 Unless specified otherwise, where fresh concrete will be placed against hardened concrete, bond the fresh concrete to the hardened concrete in accordance with CSA-A23.1, Clause 7.2.2.

3.5 Construction Joints

.1 Make construction joints in accordance with CSA-A23.1, Clause 7.2.1.

.2 Locate construction joints as approved by the Consultant.

3.6 Joint Sealant

.1 Install joint sealant in accordance with the manufacturer’s printed instructions.

3.7 Finishing Unformed Surfaces

.1 Top Surface of Exposed Exterior Concrete:

.1 Initial Finishing: immediately after placing concrete, screed the surface to the indicated grade and work the surface with a bull float, or with a darby and highway straight edge, in accordance with CSA-A23.1 Clause 7.6.3. Complete initial finishing before any bleeding or free water is present on the concrete surface.

.2 Begin final finishing operations after the bleed water has disappeared and the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface. Do not add water to facilitate finishing. Carry out final finishing operations in accordance with CSA-A23.1 Clause 7.6.4.

.3 Unless noted otherwise, exterior surfaces shall receive a light broom finish, with broom striations approximately 1 mm deep.

.2 Finished surfaces shall conform to the slopes specified on the Construction Drawings.

3.8 Finishing Formed Surfaces

.1 Finished formed surfaces in accordance with CSA-A23.1, Clause 7.6 and as specified below.

.2 Formed surfaces which may ultimately serve as forms for additional concrete pour or which will remain unexposed:

.1 The surface may contain shear keys, reinforcing steel, anchor bolts, or other embedment's as indicated on the Construction Drawings.

.2 Repair Rock pockets in excess of 20 mm deep and fill tie holes. Remove fins and ridges from concrete surfaces.

.3 Clean the surface of laitance, dirt, excess water, and other detritus material prior to applying waterproofing treatment or placing additional concrete.

3.9 Curing and Protection

.1 Cure and protect concrete in accordance with CSA-A23.1, Clause 7.7.

3.10 Tolerances

.1 Tolerances for concrete work as built shall conform to CSA-A23.1., Clause 6.4 unless indicated otherwise.

.2 Finish tolerances for concrete topping shall meet the requirements for the conventional (non-slip) Class B surface of CSA-A23.1, Clause 7.6.1, Table 21.

.3 The flatness of the topping surface will be determined by the straightedge method as outlined in CSA-A23.1, Clause 7.6.1.2.

3.11 Field Quality Control

.1 Inspection and testing of concrete and concrete materials in accordance with CSA-A23.1 will be carried out by an independent testing laboratory approved by the Consultant and paid for by the Contractor.

.2 Testing shall be carried out in accordance with CSA-A23.1, however, as a minimum the following testing shall be carried out:

.1 One “test” per batch of any mix.

.2 One “test per day of concrete placement regardless of the total quantity placed that day.

A “test” shall consist of a slump test, an air entrainment test, and samples collected for compression testing.

.3 Pumped concrete will be sampled both at the truck discharge and at the point of final placement to determine if any changes in the slump, air content or other significant mix characteristics occur. The concrete at the forms shall meet all the requirements of this Section.

.4 Additional Test cylinders shall be taken during cold weather concreting. Cure cylinders on job Site under same conditions as concrete which they represent.

*****END OF SECTION*****

1 GENERAL

1.1 Description

.1 This Section covers the requirements for manufacture and installation of precast concrete units for the wharf deck panels.

1.2 Submittals

.1 Submit shop drawings, for the Engineer's review. Indicate the following items:

.1 Concrete Reinforcing, as stipulated by Section 03 20 00

.2 Setting and erection procedures for the concrete panels on the reconstructed slope section.

.2 The review of submittals by the engineer shall not in any way relieve the contractor from the responsibility for the proper fitting, finishing, quality, quantities, and erection of the works in accordance with the requirements of the contract documents for errors/omissions in the contactor's submittals, or from the responsibility of furnishing materials and workmanship not specifically indicated or specified but required and necessary to properly complete the works. Without restricting generality of the foregoing requirements, the contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction, installation, and for coordination of the works of all subtrades.

.3 Each drawing or procedure document submitted shall bear the stamp and signature of a qualified Professional Engineer registered in the Province of British Columbia.

.4 Submit concrete mix designs and test results based on trial mixes showing that concrete meets the specification.

.5 Submit statement from concrete supplier identifying the proposed source of the aggregate and certifying that the proposed aggregate/cement combination will not produce deleterious expansion due to alkali-aggregate reaction.

1.3 Related Sections

.1 Section 03 10 00 Concrete Forming and Accessories

.2 Section 03 20 00 Concrete Reinforcing

.3 Section 03 30 00 Cast-in-Place Concrete

1.4 Performance Requirements

.1 Tolerance of precast elements to CSA-A23.4.

1.5 Qualifications

.1 Fabricate and erect precast concrete elements by manufacturing plant certified in appropriate category according to CSA-A23.4

.2 Precast concrete manufacturer certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting Bid and to verify as part of Bid that plant has current certification in appropriate category, structural.

.3 Only precast elements fabricated in certified plants acceptable and plant certification maintained for duration of fabrication, erection until warranty expires.

.4 Welding companies certified to CSA-W47.1.

1.6 Warranty

.1 Warrant precast element not to spall or show visible evidence of corrosion of embedded steel and cracking, except for normal hairline shrinkage cracks for 5 years.

1.7 References

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

.2 CAN/CSA-A23.2, Methods of Test for Concrete

.3 CAN/CSA-A23.4, Precast Concrete – Materials and Construction

.4 CAN/CSA-A251, Qualification Code for Architectural and Structural Precast Concrete Products

.5 ASTM C1202, Standard Test Method for Electrical Indication of Concrete's ability to Resist Chloride ion Penetration.

.6 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for use in producing flowing concrete.

2 PRODUCTS

2.1 Materials

.1 Concrete mixes and materials: to Section 03 30 00 (Cast-in-Place Concrete).

.2 Reinforcing steel: to Section 03 20 00 (Concrete Reinforcing)

2.2 Fabrication

.1 Manufacture units in accordance with CSA-A23.4.

.2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast in location not exposed in finished work.

.3 Cast members in accurate rigid molds designed to withstand high frequency vibration. Set reinforcing anchors and auxiliary items to indicated on shop drawings. Cast in anchors, blocking and inserts supplied by other Sections as required to accommodate their work. Vibrate concrete during casting for full thickness. Provide necessary holes and sinkages for flashings, anchors, and cramps. Maintain even and uniform appearance.

.4 Anchors, lifting hooks, shear bars, spacers and other inserts or fittings required for a complete and rigid installation. Each to conform to requirements of local codes. Lift hooks adequately sized to safely handle panels according to member dimension and weight. Conceal anchors and inserts where practical.

.5 Shop prime anchors and steel inserts after fabrication and touch up primer on anchors after welding. Do not apply primer to embedded portion of anchor or inserts.

.6 For concrete panel fabrication refer to Public Works of Canada Drawing set: Gibson's Landing, B.C. Wharf Repairs Concrete Panels.

3 EXECUTION

3.1 General

.1 Manufacture units in accordance with CAN/CSA-A23.1, CAN/CSA-A23.4 and CAN/CSA-A-251. Manufacturing tolerances of precast elements shall be in accordance with CAN/CSA-A23.4, Clause 12.

.2 Fabricate steel embedments in accordance with Section 05 50 00 – Metal Fabrications. Install all embedded anchor inserts as indicated on the Drawings.

.3 Place and support steel reinforcement for precast panels as shown on the Drawings and to Section 03 20 00 (Concrete Reinforcement).

.4 For longitudinal, at pile cap location, gap-fillings:

.1 Insert foam backing rod in gaps of concrete panels and apply Sikasil 728 SL, or equivalent approved by Consultant, to seal gaps. Fill gaps running longitudinally at pile cap locations, see drawings.

.2 Follow manufacturers instructions for sealant application.

3.2 Erection

.1 Precast concrete work in accordance with CSA-A23.4

.2 Erect precast elements within allowable tolerances as specified

.3 Set elevations and alignment between units to within allowable tolerances before connecting units.

.4 Fasten precast units in place as indicated on approved shop drawings.

3.3 Plant Finishing and Curing

.1 All unformed concrete surfaces shall be finished in accordance with CSA-A23.1, Clause 7.7.

.2 The top surface of all units shall have a broom finish.

*****END OF SECTION*****

1 GENERAL

1.1 Summary

.1 This Section describes the requirements for grout.

1.2 Related Sections

.1	Section 03 10 00	Concrete Forming and Accessories
.2	Section 03 20 00	Concrete Reinforcing
.3	Section 03 30 00	Cast-in-Place Concrete
.4	Section 03 30 00	Cast-in-Place Concrete

1.3 Reference

.1	CAN/CSA-A23.1	Concrete Materials and Methods of Concrete Construction
.2	CAN/CSA-A23.2	Methods of Test for Concrete

.3 Additional material and testing standards listed in Clause 1.5 of CAN/CSA-A23.1.

1.4 Submittals

.1 For each type of grout proposed for use in the Work, submit manufacturer's product datasheets and printed instructions to the Consultant for review.

.2 Provide certification that grout will comply with the requirements of this Section.

.3 Submit procedures for installing anchor grout to the Consultant for review and approval.

2 PRODUCTS

2.1 Grout

.1 Grout shall comply with the requirements presented in the following table when mixed to a flowable consistency and tested according to the noted procedures.

.2 The following grouts are pre-approved:

.1 Universal Construction (Non-Shrink) Grout or approved equal.

Property	Test Procedure[1]	Requirements
Flow, seconds	CAN/CSA A23.2.1B	20 - 25
Plastic Expansion, %	CAN/CSA A23.2.1B	0.0 - 3.0
Bleeding, %	CAN/CSA A23.2.1B	≤ 1.0
Compressive Strength, MPa 24 hours 8 days	CAN/CSA A23.2.1B	 20 45
Boiled Absorption, 7 days, %	ASTM C642 on Cast Cubes	≤15.0
Height Change, %	ASTM C827	0.0 - 4.0
Freeze - Thaw Durability, %	ASTM C666 Procedure A	DF > 80

Note: Tests conducted with grout at temperature of placement.

.3 Unless noted otherwise, drilled in anchors and rebars shall be grouted using Hilti HIT HY200, per manufacturer's instruction.

3 EXECUTION

3.1 Placing of Grout – General

.1 Grout under base plates and in grout pockets using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.

*****END OF SECTION*****

1 GENERAL

1.1 Description

This Section describes the requirements for all structural steel components.

1.2 Definitions – Not Used

1.3 Submittals

.1 Clearly indicates materials, grades, dimensions, finishes, connection and support details.

.2 Submit shop drawings of the Special Conditions and Description of the Work.

.3 Shop drawings of items designed by the Contractor shall bear the seal of a qualified professional engineer registered in the Province of British Columbia.

.4 The review of submittals by the engineer shall not in any way relieve the contractor from the responsibility for the proper fitting, finishing, quality, quantities, and erection of the works in accordance with the requirements of the contract documents for errors/omissions in the contactor's submittals, or from the responsibility of furnishing materials and workmanship not specifically indicated or specified but required and necessary to properly complete the works. Without restricting generality of the foregoing requirements, the contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction, installation, and for coordination of the works of all subtrades.

.5 Prior to commencing the work of this Section, if required by the Owner and the Engineer, submit two certified copies of mill reports covering chemical and physical properties of steel to be used in the Work.

1.4 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

.2 Section 03 60 00 Grouting

.3 Section 05 50 00 Metal Fabrication

1.5 References (Latest Versions of the Following References)

.1 American Association for State Highway and Transportation Officials (AASHTO)

.1 AASHTO Standard Specifications for Highway Bridges.

.2 ASTM International

.1 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength Metric.

.2 ASTM A490M, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints.

.3 CSA Group CSA

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA S6, Canadian Highway Bridge Design Code.

.4 CSA S16, Design of Steel Structures.

.5 CSA S269.1-1975(R2003), Falsework for Construction Purposes.

.6 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.7 CSA W59-03(R2008), Welded Steel Construction, (Metal Arc Welding).

1.6 Quality Control

.1 Welding practice and qualifications of fabricators shall conform to CSA W47.1 and W59.

.2 Welding inspection of the Work of this Section shall be carried out by a qualified independent agency approved by the Owner and paid for by the Contractor in Accordance with W59 Clause 7.

.3 Welds to be 100% visually inspected and spot magnetic particle or ultrasonic testing on 10% of weld length or for a series of several shorter and similar welds testing may be performed on 10% of the number of such similar welds.

1.7 Field Measurements

.1 Verify dimensions of existing structures which would affect the Work for this Section prior to commencing fabrication.

1.8 Submittals

.1 See Section 05 50 00 Metal Fabrications

2 PRODUCTS

2.1 Materials

.1 Structural steel: to CSA G40.20/G40.21, grade and types as indicated.

.2 Leave atmospheric corrosive resistant steel and connections material in unpainted, include bolts, nuts, washers and weld deposits of compatible weathering characteristics.

.3 High strength bolts, nuts and washers: to ASTM A325M. Bolts to ASTM A490M approved by Consultant.

.4 Anchor bolts, washers and nuts: to CSA G40.20/G40.21, grade galvanized 300W.

.5 All structural steel to be hot-dipped galvanized.

.6 Welding electrodes: to CSA W48 series.

.7 Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of 600g/m^2.

2.2 Fabrication

.1 See Section 05 50 00 Metal Fabrications

3 EXECUTION

3.1 Installation

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for structural steel installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 Protection

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

3.3 Preparation

.1 Clean steel surfaces as directed by Consultant when staining or defacing occurs.

.2 Verify location of substructure units and location of anchor bolts before erection of structural steel; report discrepancies to Consultant.

.3 Restrict drifting during assembly to minimum required to bring parts into position without enlarging or distorting holes, and without distorting, kinking or sharply bending metal of any unit.

.1 Enlarge holes if necessary, by reaming only after receipt of written approval from Consultant.

.2 Ensure reamed holes are 2mm maximum larger than bolt size used.

.4 Fabricate and install bearings as indicated.

.5 Place anchor bolts at elevations and locations indicated.

3.4 Installation

.1 Do falsework in accordance to CSA S269.1.

.2 Do fabrication and erection of structural steel in accordance with CAN/CSA S6, Design of Highway Bridges.

.3 Do welding in shop unless otherwise permitted by Consultant.

.4 Weld only at locations indicated.

.5 High strength bolting: in accordance with CAN/CSA S6. Use 'turn-of-nut' tightening method.

.6 Finish: members true to line, free from twists, bends, open joints, sharp corners and sharp edges.

.7 Allowable tolerance for bolt holes:

.1 Matching holes for rivets and bolts to line up so that dowel 2mm less in diameter than hole passes freely through assembled members at right angles to such members.

.2 Finish holes not more than 2mm in diameter larger than diameter of rivet or bolt unless otherwise specified Consultant.

.3 Center-to-center distance between any two holes of group to vary by not more than 1mm from dimensioned distance between such holes.

.8 For installation of new hot-dipped galvanized steel platers over timber wave wall:

.1 Remove and dispose of current timer pallets. Install hot-dipped galvanized steel plates into place and insure plate is held against the bottom timber member and concrete wall firmly.

*****END OF SECTION*****

1 GENERAL

1.1 Description

This Section describes the requirements for miscellaneous steel fabrications, inserts, and anchor bolts.

1.2 Definitions – Not Used

1.3 Submittals

.1 Clearly indicates materials, grades, dimensions, finishes, connection and support details.

.2 Submit shop drawings of the Special Conditions and Description of the Work.

.3 Shop drawings of items designed by the Contractor shall bear the seal of a qualified professional engineer registered in the Province of British Columbia.

.4 Submit fabrication drawings for all steelwork prior to commencing fabrication. Consultant's review of fabrication drawings will be to ascertain compliance with the design concept only and shall not relieve the fabricator of responsibilities under his contract.

.5 Prior to commencing the work of this Section, if required by the Owner and the Engineer, submit two certified copies of mill reports covering chemical and physical properties of steel to be used in the Work.

1.4 Related Sections

.1	Section 03 10 00	Concrete Forming and Accessories
.2	Section 03 20 00	Concrete Reinforcing
.3	Section 03 30 00	Cast-in-Place Concrete
.4	Section 03 60 00	Grouting
.5	Section 05 12 33	Structural Steel

1.5 References (Latest Versions of the Following References)

.1 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures,

.2 CSA W48 Series, Welding Materials

.3 CSA W59, Welded Steel Construction (Metal Arc Welding)

.4 CAN/CSA-G40.21, Structural Quality Steels

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

.6 ASTM A53-88a, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

.7 ASTM A307-89, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

.8 ASTM A325/A325M, Specifications for High-Strength Bolts for Structural Steel Joints

1.6 Quality Control

.1 Welding practice and qualifications of fabricators shall conform to CSA W47.1 and W59.

.2 Welding inspection of the Work of this Section shall be carried out by a qualified independent agency approved by the Owner and paid for by the Contractor in Accordance with W59 Clause 7.

.3 Welds to be 100% visually inspected and spot magnetic particle or ultrasonic testing on 10% of weld length or for a series of several shorter and similar welds testing may be performed on 10% of the number of such similar welds.

1.7 Field Measurements

.1 Verify dimensions of existing structures which would affect the Work for this Section prior to commencing fabrication.

2 PRODUCTS

2.1 Materials

.1 All structural steelwork shall conform to CSA S16

.2 Structural steel fabricator and erector shall be certified under CSA W47.1 and regulation to Div. 2.1

.3 Rolled Steel Sections and Plates: to CAN/CSA-G40.21, Grade 300W, unless noted otherwise.

.4 Steel Pipe: to ASTM A53, Grade B.

.5 Structural Bolts, Nuts and Washers: to ASTM A325M Type 1 plain.

.6 Stainless Steel: to ASTM A167 Type 316.

.7 Bolts for Anchor Bolts, unless noted otherwise: to ASTM A307 galvanized.

.8 Anchors installed into Hardened Concrete, unless noted otherwise: Hilti HY200 Adhesive anchors, standard embedment Type 316 stainless.

.9 Chain as indicated on the Drawings.

.10 Grouting: to Section 03 60 00.

2.2 Fabrication

.1 Fabricate Work Square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Where possible, fit and shop assemble Work, ready for erection or installation.

.3 Close all hollow sections and pipe with end plates and seal airtight with welds.

.4 Do not use intermittent welds. File or grind exposed welds smooth and flush. Seal weld all joints unless restricted otherwise by W59.

.5 Weld in a manner to avoid distortion or damage to the members.

2.3 Corrosion Protection

.1 Unless noted otherwise, all metal fabrications including embedded concrete hardware, bull rail brackets, anchor bolts, connection bolts, and any other items as indicated on the Construction Drawings, shall be hot-dip galvanized after fabrication in accordance with CAN/CSA G164. Minimum thickness of zinc is 110 microns.

3 EXECUTION

3.1 Installation

.1 Installed work shall be square, plumb, straight and true, accurately fitted, with tight joints and intersections.

.2 Anchor work: Install Hilti anchors in strict accordance with the manufacturer's instructions.

.3 Make field connections using high strength bolts, welding or as shown on the Drawings.

.4 At completion of installation, touch-up connections, welds and burned or damaged surfaces with approved compatible zinc-rich primer.

.5 Replace any material or fabrication which is found to be defective or not in accordance with the Drawings and Specifications, at no cost to the Owner.

3.2 Protection

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

*****END OF SECTION*****

1 GENERAL

1.1 Related Sections

.1 Section 06 13 23 Heavy Timber Construction

.2 Section 31 62 19 Timber Piles

1.2 References

.1 American Wood-Preservers' Association (AWPA)

- .1 AWPA M2-19, Standard for Inspection of Treated Wood Products.
- .2 AWPA M4-15, Standard for the Care of Preservative-Treated Wood Products.

.2 Canada Green Building Council (CaGBC)

- .1 LEED Canada Version 4.1, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.

.3 Canadian Standards Association (CSA International)

- .1 CSA O80 Series 15, Wood Preservation.
- .2 CSA O80.20-1.1-M97(R2002), This Standard applies to the fire-retardant treatment of lumber by pressure processes.
- .3 CSA O80.27-1.1-M97(R2002), This Standard covers the fire-retardant treatment of Douglas Fir, hardwood, softwood, and Poplar plywood by pressure processes.
- .4 CSA O80.201-M89, These Standard covers hydrocarbon solvents for preparing solutions of preservatives.
- .5 CSA O322-02, Procedure for Certification of Pressure-Treated Wood Materials for Use in Preserved Wood Foundations.

.4 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

- .1 SCAQMD Rule 1113-04, Architectural Coatings.

.5 Recommendations for the Design and Operation of Wood Preservation Facilities (2013); Environment Canada, The pest Management Regulatory Agency of Health Canada, and Wood Preservation Canada

1.3 Submittals

.1 Submit product data to Engineer for review and approval.

.2 Quality assurance submittals:

.1 For products treated with preservatives by pressure impregnation submit following information certified by authorized signing officer of treatment plant:

.1 Information listed in AWPA M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWPA M2 applicable to specified treatment.

.2 Moisture content after drying following treatment with water-borne preservative.

.3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.

1.4 Quality Assurance

.1 Plant inspection of products treated with preservative by pressure impregnation will be carried out by designated testing laboratory to AWPA M2, and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2.

.2 Each piece of lumber and plywood for preserved wood foundations to be identified by CSA O322 certified stamp.

.3 Inspection and testing of materials will be carried out by a Testing Laboratory designated by Engineer.

.4 The owner may carry out testing of materials, including core sampling at the treatment plant. Data will be made available to the contractor for information only.

1.5 Delivery, Storage, and Handling

.1 Take delivery of material and handle and store with care until materials are used in the work

2 PRODUCTS

2.1 Materials

.1 Preservation treatment, inspection and re-treatment shall be in accordance with CSA Standard 080.

.2 Preservation treatment, inspection and re-treatment shall be in accordance with CSA Standard 080 and “Best Management Practices for the use of Treated Wood in Aquatic Environments”.

.3 All timber shall be treated with Creosote, ACZA, CCA (Chromated Copper Arsenate) as indicated on drawings.

.4 Treated timber that will be in contact with seawater shall be allowed to air-dry for 45 days prior to contact with seawater.

.5 Incise all treated timber 75mm and over before treatment.

.6 All sawn lumber shall be properly air-dried and seasoned, containing not more than 20% moisture.

.7 All timber at or above deck level such as deck planks, guards, bull rails, handrails, or posts shall be salt-treated. All timber and pilings below deck level, except rub boards, shall be creosote treated.

.8 All treated timbers to be treated to Canadian Institute of Treated Wood's Best Management Practices for Use of Wood in Aquatic Environments.

3 EXECUTION

3.1 Application: Preservative

.1 Creosote Treated Materials

.1 All creosote treated materials to be treated in accordance with Recommendations for the Design and Operation of Wood Preservation Facilities to a net retention of: 225kg/m³

.2 Pile tops shall be treated with 2 coats of creosote, mastic and aluminum caps

.2 Salt Treated Materials

.1 All timber to be treated with water borne salts to be treated in accordance with CSA Standard 080 with ACZA to 6.4kg/m³ and a depth of penetration of 10mm as specified in CSA 080

3.2 Application: Field Treatment

.1 Comply with AWPA M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2.

.2 All salt treated members that are modified (cut or drilled) shall be field treated with two coats of copper naphthenate or pentachlorophenol.

.3 When field treating by brushing, spraying, dipping, or soaking do so in such a manner that the preservative does not drip into the water or ground.

.4 Ensure the creosote or other preservatives are properly stored and protected in case of spillage.

.5 Remove chemical deposits on treated wood to receive applied finish.

3.3 Handling of Treated Timber

.1 Carefully handle treated timber to avoid breaking the treated surface. Avoid bruising or breaking of wood fibres.

.2 Do not use cant hooks and rafting dogs on timbers. Drive no spikes into timbers except to tack the timber in their final position; if spikes are so used they shall be fully driven and left in.

.3 Treat cuts, breaks and abrasions on surfaces of salt treated timbers with two separate coats of salt preservative treatment. Treat bolts holes through salt treated timbers with two coats of salt concentrated and dip the bolts in salt concentrate before installation.

.4 Unless specifically noted on the Construction Drawings, do not cut treated timbers to facilitate fitting after treatment.

*****END OF SECTION*****

1 GENERAL

1.1 Summary

.1 This Section describes the requirements for sawn timber and timber connections.

1.2 Related Sections

.1	Section 06 05 73	Wood Treatment
.2	Section 31 62 19	Timber Piles
.3	Section 31 63 20	Pile Driving
.4	Section 05 12 33	Structural Steel
.5	Section 09 97 19	Painting

1.3 References

.1	NBCC 2015	National Building Code of Canada
.2	CAN/CSA-086.1	Engineering Design in Wood (Limit States Design)
.3	CAN/CSA-080 Series	Wood Preservation
.4	ASTM A307-88a	Carbon Steel Bolts and Studs
.5	CSA G164	Hot-Dip Galvanizing of Irregularly Shaped Articles
.6	CSA 0121	Douglas Fir Plywood
.7	CSA B11	Wire Nails, Spikes and Staples
.8	CSA B34	Miscellaneous Bolts and Screws

.9 National Lumber Grades Authority (Canada) (NLGA) Standards Grading Rules for Canadian Lumber, 1987

1.4 Quality Assurance

.1 Lumber grades shall conform to the requirements of the NLGA Standard Grading Rules.

.2 All timber Work shall be in accordance with CAN/CSA-86.1.

.3 Preservation treatment, inspection, and re-treatment shall be in accordance with CSA Standards 080.

1.5 Submittals

.1 Submit shop drawings showing timber grades, dimensions, replacement locations, preservative treatment, connection, and support details.

.2 The review of submittals by the engineer shall not in any way relieve the contractor from the responsibility for the proper fitting, finishing, quality, quantities, and erection of the works in accordance with the requirements of the contract documents for errors/omissions in the contactor's submittals, or from the responsibility of furnishing materials and workmanship not specifically indicated or specified but required and necessary to properly complete the works. Without restricting generality of the foregoing requirements, the contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction, installation, and for coordination of the works of all subtrades.

2 PRODUCT

2.1 General

.1 All timber work shall be in accordance with CAN/CSA-086.1. Lumber Grade shall conform to the requirements of the NLGA Standard Grading Rules.

2.2 Sawn Timber

.1 All sawn timber shall be Coastal Douglas Fir, No. 1 structural grade or better, and unless specified otherwise, shall be properly air-dried and seasoned, containing not more than 20% moisture.

.2 Lumber grades shall conform to the requirements of the NLGA, Standards Grading Rules for Canadian Lumber, latest revision.

.3 Field cuts to new timbers shall not be permitted except with the written permission of the Consultant. Replace those new timbers that are field cut without the permission of the Consultant.

.4 All materials shall be dressed as indicated on the Construction Drawings.

.5 All shims for filling gaps shall be sawn timber, not plywood.

2.3 Connections

.1 Bolts, nuts, and washers through timber shall conform to ASTM A307.

.2 Drift pins shall conform to CSA G40.21 Grade 260W.

.3 All spikes, nails, and staples to conform to CSA Standard B111.

.4 All lags screws to conform to CSA Standards B34.

.5 Hot-dip galvanize all miscellaneous metal and fasteners in accordance with CSA Standard G164 unless noted otherwise.

.6 Unless noted otherwise, use plate washers under heads and nuts of all bolts bearing on timber; plate washers against piles shall be curved.

3 EXECUTION

3.1 Workmanship

.1 All structural timber used in the Work shall be carefully and accurately placed in accordance with the Construction Drawings. Joints shall be carefully cut to ensure even and uniform bearing on supporting members.

3.2 Timber Connections

.1 New bolt holes in timber shall be bored to provide a driving fit. Holes for drift pins shall be 1.5 mm under size and longer than drift pins. Hole sizes for lag screws are to be as given in CAN/CSA-O86.

.2 Unless specified otherwise, place connecting bolts, pins or spikes in the centre of the timbers and not less that seven times the fastener diameter from the end of the timber.

.3 Completely fill all unused bolt holes, nail holes or drift holes in timber which are removed and reinstalled, with mastic.

.4 All bolts to be hot-dipped galvanized

.5 Unless noted otherwise the size of plate washers used shall be as follows:

Bolt Diameter	Thickness	Plate Size
M20	10 mm	100 x 100
M24	12 mm	125 x 125
M30	12 mm	150 x 150

3.3 Execution

.1 For stringer replacement:

.1 Remove and stockpile decking for reuse after stringer replacement. After decking is removed and stringer is in place, install a drift pin to secure the stringer to the pile caps. Splice stringers together to form continuous span.

.2 For pile cap replacement:

.1 Remove and stockpile decking for reuse after pile cap replacement. After decking is removed and pile cap is in place, install a drift pin to secure the pile cap to the pile.

.3 For pile cap repair:

.1 Re-center pile cap onto pile and install new drift pin to prevent pile cap from moving again.

.4 For bracing repair:

.1 Remove and dispose of damaged brace. Supply treated brace of equal size. Use minimum 25mm (1in) diameter galvanized bolt. For exposed old bolt locations, fill with tight fitting treated plug and cover with 0.8mm thick copper patch plate, secure with 38m long copper or silicon bronze nails at 30mm o/c all around.

.5 For bearing pile replacement:

.1 Supply and install treated wooden pile. Install new pile before demolishing existing pile. Contractor to confirm size and length of pile.

.6 For bearing pile wrapping repair:

.1 Apply stainless steel bands at top, middle, and centre of pile to secure loose pile wrappings. See Section 05 12 33 Structural Steel.

.7 For bearing pile foundation repair:

.1 For spalling and loss of section repair:

.1 Clean existing concrete footing of all marine growth and debris to ensure bond. Drill and insert epoxy grouted dowels into existing footing to fix new steel reinforcement. Form new footing. See drawing, if dimensions are different on site or repair procedure not viable, for special situations, notify Consultant.

.2 For undermining section repair:

.1 Expose and clean rock around the concrete footing. Place filter stone in voids at foundation perimeter.

.8 For sloped timber section:

.1 Remove and stockpile pile caps and piles for potential re-use. Inspect prior to re-use and notify Consultant of condition for approval.

.2 For pile installation:

.1 Supply and install treated wooden pile. Install new pile before demolishing existing pile. Contractor to confirm size and length of pile.

.3 For pile cap installation:

.1 After decking is removed and pile cap is in place, refer to Public Works of Canada drawing set: Gibson's Landing, B.C. Wharf Repairs Concrete Panels, to see pile cap to concrete panel assembly

.9 For handrail re-painting refer to Section 09 97 19 Painting

.10 For handrail replacement:

.1 Remove and dispose of damaged railings. Supply treated railings of equal. For painting refer to Section 09 97 19 Painting.

*****END OF SECTION*****

1 GENERAL

1.1 Summary

.1 This section includes the requirements for surface preparation, painting and touch up of miscellaneous metal items.

.2 Testing and inspection shall be in accordance with this Section.

1.2 References

.1 Steel Structures Painting Council (SSPC) Painting Manual Volumes I and II, latest edition.

1.3 Quality Control

.1 Establish and implement a program of quality control as described in these Specifications. All coatings inspection shall be carried out to the minimum level specified in Subsection 3.4 - Inspection.

.2 All work specified under this Contract is subject to inspection at any time by independent inspectors implementing the Consultant's quality assurance program.

.3 The cost of the Quality Control Program will be borne by the Contractor.

1.4 Submittals

.1 Submit the following to the Consultant in prior to commencing the Work of this Section:

.1 Manufacturers' datasheets and printed instructions for coating materials proposed for use in the Work, including procedures for touch-up and repair of defective coatings.

.2 Detailed descriptions of the procedures to be followed.

.3 Name and location of painting facility or facilities.

1.5 Delivery, Storage and Handling

.1 Deliver materials to the point of application in factory-sealed containers which clearly indicate the paint manufacturer's name, the type, colour, identification number and expiry date of the contents, and instructions for use.

.2 Manufacturer's datasheets and complete printed instructions are to accompany each shipment of material to the point of application.

.3 Store all coating materials in areas with ambient temperatures within the range specified by the paint manufacturer's current datasheet.

.4 Adhere to all applicable safety regulations and manufacturer's recommendations in storing, mixing and handling coating products.

1.6 Environmental Requirements

.1 Do not paint when ambient temperature is below 5 deg. C or above 35 deg. C, or when steel temperature is less than 3 deg. C above the dew point.

.2 Apply paint in an enclosed, well-ventilated area. Carry out field coatings and repairs only when the air temperature and relative humidity are within paint manufacturer's permissible range and will reasonably remain so during the curing time.

.3 No paint chips or debris to be deposited into the water as required by Fisheries Act.

2 PRODUCTS

2.1 Materials

.1 Use one of the following high solids epoxy paint systems:

.1 Ameron Amerlock 400 / Sigmacover 400

.2 Jotun Valspar Jotamastic 87

.3 Hempel Hempadur 4515

.4 International Intergard FP Universal Epoxy

.5 Sigma Colturiet TCP 7476

.6 Carboline Carboguard 691 with one top coat of Carbothane 133 HB Polyurethane for pile sections above water line.

.2 Use same or compatible coating system recommended by manufacturer for field painting and field touch-up of shop coating damaged during transportation or handling.

.3 Obtain all coating materials from a single manufacturer and ensure that all products used are fully compatible within each coating systems.

.4 No additives to coating systems will be permitted unless recommended by the paint system manufacturer.

2.2 Colours

.1 The colour for the finish coating shall be provided by the Harbour Authority, unless otherwise noted.

2.3 Coating System

.1 Unless otherwise approved, steel to be painted shall be coated as follows:

.1 Application: two 200-micron coats.

.2 Touch-Up: wire brush to metal and two 200-micron coats.

3 EXECUTION

3.1 Surface Preparation

.1 Drop cloths to be installed below surfaces prior to commencement of painting.

.1 No paint chips or debris to be deposited into the water as required by the Fisheries Act.

.2 Perform all Work in strict accordance with the Specifications and the coating manufacturer's current product datasheets. All phases of the Work shall be available to the Consultant for observation or inspection at any time.

.3 Remove any oil or grease from surface to be coated in accordance with SSPC-SP1.

.4 Dry abrasive blast steel surfaces to SSPC-SP10, in accordance with the paint manufacturer's recommendations. Where blast cleaning is not possible, with Consultant's written permission, hand or power tool clean in accordance with SSPC specifications. Steel surface profile shall be in accordance with the paint manufacturer's recommendations. When blasting is completed, remove dust by oil free air blast, brush, or vacuum prior to application of coating.

.5 Prevent contamination of the cleaned surfaces by oil or other impurities during or after cleaning.

3.2 Application

.1 Prepare and mix paint components strictly in accordance with the manufacturer's printed directions.

.2 Apply epoxy paint to prepared surfaces using airless spray. Where spray application is not possible, with Consultant's written permission, paint may be applied by brush or roller. Total dry film thickness shall be a minimum 400 microns.

.3 Apply paint within two hours of cleaning and before any visible rusting or contamination occurs. If two coats are used, allow manufacturer's recommended curing time between coats.

3.3 Field Touch-Up

.1 Touch-up and repair all abrasions, cuts, scuffs, and other defects in coatings and field coat all connections, welds and uncoated areas as required to provide a complete, continuous integral coating system on all steel surfaces specified to be painted.

.2 Apply field coatings in accordance with the manufacturer's recommendations.

.3 Protect adjacent Work by masking or using protective sheets as required during field coating operations. Remove masking as soon as practicable after application of coatings.

3.4 Inspection

.1 Employ a qualified inspection agency approved by the Consultant to continuously inspect the work and prepare daily inspection and progress reports. All reports shall be submitted weekly to the Consultant. These reports shall be submitted for both shop and site applied coatings. The inspections shall include but shall not be limited to:

.1 Coating thickness measurements at random locations on a minimum of 40% of all steel members.

.2 Identification of runs, sags, holidays pinholes or shadowing caused by insufficient application methods.

.3 Inspection for evidence of poor coverage at plate edges, lap joints, crevices, pockets, corners.

.4 Inspection for damage to shop coat due to handling before the coating is sufficiently cured, or other contributory cause.

.2 The Contractor's inspectors shall clearly define on the inspection reports the areas inspected. The inspection reports shall be written so that they clearly relate to identifiable surfaces (i.e. structural steel part numbers). The Contractor's inspectors shall recommend any corrective remedy for a problem and indicate the corrective action to be taken by the Contractor.

.3 If any of the areas covered in the reports are contrary to the Specifications or are found to be in error, repair or recoat defective areas at no cost to the Owner.

.4 Make good coated surfaces rejected by the Consultant. Small affected areas may be touched up; large affected areas or where insufficient dry film thickness has been attained shall involve the application of another complete shop coat at the Contractor's expense. Remove runs, sags or coating damaged in handling by scraper prior to further application of coatings.

.5 Do not proceed with the next step in the coating system sequence (i.e. surface preparation, priming, tie coat, top coat) until the previous work has been inspected and approved.

.6 Check compliance with governing specifications by the Contractor's inspectors during the course of application of the coating system.

.7 Inspect all cleaned surfaces prior to the application of coating.

3.5 Handling

.1 After paint has been applied, take special precautions in handling and shipping to prevent damage to the coating. Use wood softeners to prevent all metal to metal contact between pieces. Load and secure the steel to prevent movement while in transit. Use wood softeners also when stacking steel for storage at the site and provide wood blocking between the steel and the ground surface.

3.6 Field Touch Up and Field Coatings

.1 Field coatings including touch up and repair of all abrasions, cuts, scuffs, and other defects in shop coatings shall provide a complete, continuous integral coating system on all steel surfaces in accordance with these Specifications. Field coatings shall include all connections, welds and uncoated areas.

.2 Carry out field coating operations only when air temperature and relative humidity are within paint manufacturer's permissible range and will reasonably remain so during film drying time.

.3 Protect adjacent work of the trades by masking or using protective sheets as required during field coating operations.

*****END OF SECTION*****

1 GENERAL

1.1 Related Sections

.1 Section 06 13 23 Heavy Timber Construction

.2 Section 31 62 19 Timber Piles

1.2 References

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

.3 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.

.4 ASTM D25-99(2005), Standard Specification for Round Timber Piles.

.2 American Wood-Preservers' Association (AWPA)

.1 AWPA C1, All Timber Products - Preservative Treatment by Pressure Processes.

.2 AWPA C3, Piles - Preservative Treatment by Pressure Processes.

.3 AWPA M4, Standard for the Care of Preservative-Treated Wood Products.

.4 AWPA M6, Brands Used in Forest Products.

.3 Canadian Standards Association (CSA International)

.1 CSA B111 1974(R2003), Wire Nails, Spikes and Staples.

.2 CAN/CSA G164 M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN3 O56 M79(R2006), Round Wood Piles (Metric version).

.4 CSA O80 Series 97(R2002), Wood Preservation.

.1 CSA O80.18 97(R2002), Pressure Treated Piles and Timbers in Marine Construction

1.3 Action and Informational Submittals

.1 Product Data: submit manufacturer's printed product literature, specifications and datasheet.

.1 Include product characteristics, performance criteria, and limitations.

.2 Submit shop drawings and indicate following items:

.1 Material.

.2 Anchorage, field control and alignment methods.

.3 Design parameters.

.4 Tolerance for driving pile.

.5 Removable members.

.3 Submit details of proposed pile driving equipment, methods, and schedules to the engineer for review a minimum of 10 days prior to mobilization of pile driving equipment. Provide copies of driving records with survey data to check vertical alignment.

1.4 Waste Management and Disposal

.1 Dispose of unused paint or coating material at official hazardous material collections site as approved by Regulatory Agencies

.2 Do not dispose of unused paint or coating material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

1.5 Review of Information by Contractor

.1 The Contractor shall review all information pertinent to the work, visit the site and carry out all necessary examinations and shall make independent interpretations of all available information regarding the requirements, limitations, and constraints of the Work and the conditions under which the Work will be performed.

.2 The Contractor shall promptly notify the Engineer of any ambiguity, inconsistency, or error in the Contract documents that may be discovered.

1.6 Permits

.1 The Contractor is responsible for the supply of electricity and water for the performance of all offshore work and supply of water for the performance of all onshore work, necessary for, or incidental to, the pile installation and associated works in accordance with this specification and the Drawings.

1.7 Health and Safety

.1 The Contractor is responsible for the safety of the Contractor's personnel and the protection of health of such personnel from hazards associated with the Work covered herein.

1.8 Records and As-Built Drawings

.1 The Contractor shall maintain at the site the following records and update these daily for each pile installed:

.1 Identification and location with respect to the project coordinate system.

.2 Type and make of hammer, stroke and related energy.

.3 Other driving equipment including cushion block type and thickness, etc.

.4 Pile size, length pitched in the leads and splice lengths, location of pile.

.5 Date and time of completion.

.6 Initial and final positions, including vertical or battered alignment for the completed pile.

.7 Elevation of ground surface immediately before and after completion of pile installation.

.8 Drive resistance in terms of blow counts per each 0.3 m of penetration for entire length of pile and for each 25 mm of the final 0.15 m of penetration with the associated drive height.

.9 Impact rate at least every 5 m of penetration including at final set.

.10 Elevation of the pile tip and the final set achieved.

.11 Length of the soil plug inside the pile at various stages of pile driving (e.g. during splicing).

.12 Any special measures adopted including clean-out and depth of soil plug at the start and finish of clean-out.

.13 Any unusual conditions encountered, and methods employed for dealing with them.

.2 The above records and any results of monitoring programs shall be submitted to the Engineer on a daily basis.

.3 The Contractor shall prepare and provide the Owner with "as-built" drawings indicating the final locations of the piles.

2 PRODUCTS

2.1 Materials

.1 Use materials in accordance with Section 31 62 19 – Timber Piles.

3 EXECUTION

3.1 General

.1 Install each pile to achieve a minimum pile tip elevation as shown on the Drawings.

.2 Installation of each pile will be subject to the approval of the Engineer, who will be sole judge of acceptability of each pile with respect to final driving resistance or depth of penetration.

.3 Do not remove the pile driving rig(s) from the Site until the Engineer has approved the installation of all piles.

3.2 Equipment Requirements

.1 The Contractor will provide a suitable piling hammer to install the guide piles in accordance with the specifications. The specifications for the piling hammer will be sent at least two weeks before commencement of piling driving to the Engineer for review and approval.

.2 Use pile installation equipment that has been approved by the Consultant.

3.3 Preparation

.1 Protect public and construction personnel, adjacent structures and Work of other Contractors, from hazards attributable to pile driving operations.

.2 Exercise care when driving piles adjacent to existing structures to ensure no contact between pile and structure takes place.

.3 Use grease pencil to clearly mark each pile with its number and its overall length. In addition, clearly mark each pile at intervals of 305 mm along its full length prior to driving. As a minimum, label every fifth mark with the appropriate value from pile tip. Remove all exposed pile markings after driving upon the Engineer's approval.

3.4 Pile Driving

.1 Drive all piles continuously to final penetration. If driving is interrupted before final penetration is reached, do not take the record for final penetration until at least 0.305 m of penetration has been obtained after resumption of driving.

.2 Piles must be driven to meet minimum penetration depth as specified on the Drawings. Target pile set criteria will be provided by the Engineer following review and approval of the Contractor's equipment. Set criteria will vary based on hammer energy and efficiency, cushion length and condition, pile length and ground conditions. Set criteria may be adjusted from time to time based on the Engineer's assessment of the localized ground conditions and general equipment performance.

.3 Ensure that the leads of the pile driving equipment do not exert lateral forces on the piles during driving. No adjustment of a possible misalignment will be permitted during driving, except at the very initial stage.

.4 Hold piles securely and accurately in position while driving. Deliver hammer blows in direct axis of pile. Reinforce pile heads if necessary.

.5 Sequence the driving of piles on sloping ground in a manner that minimizes the movement of piles after driving.

.6 Re-drive piles which heave during driving of adjacent piles.

.7 Support all piles laterally, to the satisfaction of the Engineer, to prevent damage to the piles until the formwork or pilecaps provide adequate lateral support.

.8 If conditions are encountered which make it difficult to drive a pile in the location shown and to a depth consistent with the surrounding piles and to attain the required capacity, employ all reasonable means to advance the pile. Reasonable means include, but are not limited to, additional tip reinforcement, spudding and the use of a churn drill, or other drilling techniques, alternating with driving. Blasting will be permitted only with prior authorization of Owner and the Engineer. The Contractor will be reimbursed for additional work done under direction from the Engineer.

.9 Unless otherwise directed by the Engineer, terminate any special installation techniques at least 3 m prior to reaching the estimated penetration and as required to achieve pile capacity. Complete installation using conventional methods.

3.5 Tolerances

.1 Pile heads shall be within 75 mm of locations indicated.

.2 Piles shall not be more than 1/150 of length out of alignment.

.3 Tolerances listed above shall be met after all piles are driven.

3.6 Damaged or Defective Piles

.1 The integrity of the piles shall remain at all times the responsibility of the Contractor. Should any pile be damaged by overdriving or by pile installation techniques or other causes including attempting to pass an obstruction or be out of position as a result of improper survey or driving practice, drive an extra pile or piles in its place as directed by the Engineer. No extra compensation will be made for removing and replacing piles, driving extra piles or other work made necessary through rejection of a defective or damaged pile. The cost of supplying such extra piles shall be borne by the Contractor.

.2 If, in the judgment of the Engineer, the Contractor is unable to properly complete installation of any pile by resorting to the reasonable methods described above and in Clause 3.4.8, the Engineer may order an additional pile or piles to be installed. Piles abandoned or installed out of place or alignment because of obstructions, as determined by the Engineer, will be paid for as completed piles. Such abandoned piles may be removed if required by the Engineer and their removal paid for in accordance with the provisions of the Contract.

3.7 Cleaning

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.8 Protection

.1 Take all necessary precautions, including the provision of suitable screening fences or barriers to protect public, existing structures, facilities, and services from damage due to the pile installation and associated works.

.2 Complete pile driving in conformance with Best Management Practices for Pile Driving and Related Operations - BC Marine and Pile Driving Contractors Association (BCMPDCA) (draft dated March 2003).

*****END OF SECTION*****

1 GENERAL

1.1 Summary

.1 This Section describes the requirements for the repair of undermined concrete footing sections

1.2 Related Sections

.1 Section 31 37 00 Riprap

.2 Section 31 32 19 Geotextile Soil Stabilization

1.3 References

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).

.5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).

.6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 CSA Group (CSA)

.1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.2 CSA-A3001, Cementitious Materials for Use in Concrete.

.3 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.4 Measurement Procedure

.1 Excavated materials will be measured in cubic metres in their original location.

.1 Common excavation quantities measured will be actual volume removed within following limits:

.1 Width for excavation for structures as indicated.

.2 Rock quantities measured will be actual volume removed within following limits:

.1 Width for excavation for structures to be bounded by vertical planes up to 500mm outside of and parallel to neat lines of footings as indicated.

.2 Depth from rock surface elevations immediately prior to excavation, to elevation as indicated.

.3 Where design elevation is less than 300mm below original rock surface, depth will be considered to be 300mm below original rock surface.

1.5 Existing Conditions

.1 Buried services:

.1 Before commencing work establish location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, notify applicable authorities having jurisdiction and Consultant established location and state of use of buried utilities and structures. Consultant and/or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.

2 PRODUCTS

2.1 Material

.1 Refer to Section 31 37 00 Riprap

.2 Refer to Section 31 32 19 Geotextile Soil Stabilization

3 EXECUTION

3.1 Preparation/Protection

.1 Keep excavations clean, free of standing water, and loose soil.

.2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Consultant approval.

.3 The contractor shall be responsible for accuracy of the work, set out controls for undertaking the work, provide and maintain all necessary position fixing, distance measuring, depth control equipment, and other equipment as normally required for accurate excavating control.

3.2 Stripping of Top Layer

.1 Begin top layer stripping of areas as indicated.

.2 Strip top layer to depths as indicated.

.3 Stockpile in locations as directed by Consultant.

.4 Stockpile height not to exceed 2 m and should be protected from erosion.

.5 Dispose of unused material off site.

.1 Excavated materials covered by the work under this section are to be stockpiled or disposed off-site in an environmentally acceptable manner in accordance with the Environmental Authorization Permit and in accordance with any other permits or authorizations obtained by the contractor.

3.3 Stockpiling

.1 Stockpile fill materials in areas designated by Consultant.

.2 Stockpile granular materials in manner to prevent segregation.

.3 Protect fill materials from contamination.

.1 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

.4 Any foreign material adhering to or combined with the material as a result of stockpiling shall be removed prior to placement to the satisfaction of the engineer.

.5 The contractor shall not stockpile imported riprap on the existing parking areas, embankment slopes, or foreshore that causes traffic disruptions, settlements to existing parking area, damage to structures within the property, and that is harmful to the environment.

.1 In the event that the contractor causes such damage, then they shall be responsible for all necessary repairs at no cost to the owner.

3.4 Dewatering and Heave Prevention

.1 Keep excavations free of water while Work is in progress.

.2 Provide for approval Consultant's details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.5 Excavation

.1 Notify Consultant when bottom of excavation is reached.

.2 Obtain Consultant approval of completed excavation.

.3 Correct unauthorized over-excavation by backfilling and compacting as approved by Consultant.

.1 No separate quantity adjustment will be made for unauthorized over -excavation beyond the neat line excavation limits.

.4 Hand-trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.5 Excavate to lines, grades, elevations, and dimensions as indicated on the drawings.

.6 Earth bottoms of excavation to be undisturbed soil or fill, level, free from loose, soft, or organic matter. Remove unsuitable material from excavation to extent and depth as directed by Consultant.

.7 The contractor shall maintain the excavation in an acceptable state until placement of the slope protection materials and riprap commences. Material that sloughs or ravels down the slope of the excavation shall be removed at the contractors' cost.

3.6 Tolerances

.1 The maximum permissible variations in elevation from the specified grade and side slopes for excavations, measured vertically, shall be +0.0m and -0.3m.

3.7 Restoration

.1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects as approved by the engineer.

*****END OF SECTION*****

1 GENERAL

1.1 Summary

.1 This Section describes the requirements for the Geotextile layer for undermining pile foundation repair

1.2 Related Sections

.1	Section 31 23 33	Excavating, Trenching, and Backfilling
.2	Section 31 37 00	Riprap

1.3 References

.1 ASTM International

.1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM D4491-99a(2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

.3 ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

.4 ASTM D4716, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

.5 ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 11.2, Textile Test Methods - Bursting Strength – Ball Burst Test.

.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.

.3 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.

.4 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.

.5 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.

.6 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

.7 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

.3 CSA Group

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.4 Delivery, Storage and Handling

.1 Storage and Handling Requirements:

.1 Store materials indoors, in dry location, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect geotextiles from direct sunlight and UV rays.

.3 Replace defective or damaged materials with new.

2 PRODUCTS

2.1 Materials

.1 Geotextile shall be Nilex (Amoco) 4553 (also referred to as Nilex Type C34), or approved equal by Consultant, unless indicated otherwise on drawings.

.2 Securing pins and washers to CAN/CSA G420.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600g/m² to CAN/CSA G164.

3 EXECUTION

3.1 Manufacturing Instructions

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

3.2 Installation

.1 Geotextile shall be placed in accordance with the manufacturers installation procedures and as indicated on the drawings.

.2 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated by the Consultant.

.3 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

.4 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

.5 Overlap each successive strip of geotextile 750mm over previously laid strip.

.6 Pin successive strips of geotextile with as indicated.

.7 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.8 After installation, cover with overlying layer within 4 hours of placement.

.9 Replace damaged or deteriorated geotextile to approval of Consultant.

.10 Place and compact soil layers in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

*****END OF SECTION*****

1 GENERAL

1.1 Summary

.1 This Section describes the requirements for the riprap installation for undermining pile foundation repairs

1.2 Related Sections

.1	Section 31 23 33	Excavating, Trenching, and Backfilling
.2	Section 31 32 19	Geotextile Soil Stabilization

1.3 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.

.2 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.2 Canadian Standards Association (CSA)

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

.2 CAN/CSA-A3000, Cementitions Materials Compendium

2 PRODUCTS

2.1 Materials

.1 Stone shall be quarried rock, hard, sound, and shall not disintegrate from action of atmosphere, water, handling or placing.

.2 Stone shall be free from cracks, blast fractures, bedding, seams, and other defects that would tend to increase its deterioration from natural causes.

.1 Inspections for cracks, fractures, seams, and defects shall be made by visual examination.

.2 If, by visual examination, it is determined that 10% or more of the stone produced contains hairline cracks, then all stone produced by the means and measures which caused the fractures shall be rejected.

.1 A hairline crack that is defined as being detrimental shall have a minimum width of 4mm and shall be continuous for one-third the dimension of at least two sides of the stone.

.3 All stone shall be durable material as approved by the consultant.

.1 Stone shall be of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used

.4 The stone shall be clean and adequately free from all foreign matter.

.5 The maximum dimension of any piece of riprap rock in slope protection shall not be more than 2½ times its least dimension

.6 Any randomly selected sample of slope protection rock shall meet all of the requirements stipulated in the following table when tested in accordance with the specified standard procedures:

.1 Slope Protection Rock Properties

Test	Requirements	Test Standards
Specific Gravity	> 2.65	ASTM C-127
Water Absoption	< 2%	ASTM C-127
Compressive Strength	> 100MPa	ASTM D-2938
LA Abrasion Resistance (500 Cycles)	< 30%	ASTM C-535
Sulphate Soundness	< 5%	ASTM C-88
Particle Shape	L/D < 2.5	ASTM D-3398

.7 Filter stone and riprap shall consist of imported quarried rock and shall comply with gradation limits given in tables 4 and 5 respectively.

.8 at least fourteen days prior to commencing placement of slope protection, the contractor shall at his cost identify the proposed source(s) and submit to the engineer for review:

.1 Qualification test data confirming that the proposed material(s) meet or exceed the requirements of this specification.

.2 Access for qualification sampling by the engineer; the Consultant may, at his discretion, collect qualification samples from the proposed source(s) and carry out independent tests, all at no cost to the contractor;

.3 Evidence that quality and adequate material quantities are available from the proposed source(s);

.4 Evidence that adequate rates of production and delivery can be consistently maintained.

.9 The Consultant will, within seven days of receiving the above submission, advise the contractor of the acceptability of the proposed materials and procedures.

.10 During placement, the engineer may at his discretion inspect the slope protection for conformance to the specification.

.1 This quality assurance inspection may include sampling and testing at no cost to the contractor, unless material does not conform, whereon the testing shall be at the contractor's expense.

.2 Failure of a sample to meet any one of the specified gradations and physical properties constitutes an unacceptable material and such material may be subject to rejection by the engineer.

.11 During the course of the work, should the contractor propose to obtain slope protection from an additional source, or should the rock from an approved quarry appear different in any way from the quarry samples tested, the contractor shall have a sample from each additional source tested, or existing sources retested, as described above at the contractor's expense.

.12 Filter stone and riprap shall consist of imported quarried rock and shall comply with gradation limits given in the following two tables, respectively.

.1 Filter Stone for 25kg Riprap

Class of Riprap (kg)	*Nominal Thickness if Riprap (mm)	Rock Gradation Percentage Larger than Given Rock Mass (kg)		
		85%	50%	15%
10	350	1	10	30

.2 Class for 25kg Riprap

Class of Riprap (kg)	*Nominal Thickness if Riprap (mm)	Rock Gradation Percentage Larger than Given Rock Mass (kg)		
		85%	50%	15%
25	450	3	25	75

3 EXECUTION

3.1 Placing

.1 Place geotextile on prepared surface in accordance with Section 31 32 19.16- Geotextile soil stabilization and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.

.1 The underlying surface shall be trimmed and covered with geotextile prior to placing any slope protection. Any loss of material or flattening of the slopes during the work due to wave action or other cause shall be corrected promptly. Existing profile shall be approved by the Consultant prior to placing slope protection.

.2 Place riprap to thickness and details as indicated.

.3 Place stones in manner approved by Consultant to secure surface and create a stable mass.

.1 Place slope protection as required upon approval from the Consultant. Use methods to ensure that the finer one-third of the gradation is evenly distributed throughout the layer and over the surface being covered.

.2 Begin placement of slope protection at the toe of the slope and continue working up the slope. Place the rock in two layers in such a manner as to create frim bedding and interlocking of individual pieces to obtain a tightly packed structure. The finished surface shall be densely packed by placing suitable sized rocks within voids so that riprap is well keyed and uniform.

.3 Fill voids, re-work rocks not properly embedded, and remove protuberances to the satisfaction of the Consultant. Remove and replace that portion of any layer I which material becomes segregated during spreading.

.4 Ensure the slope protection does not extend beyond the neat line limits as shown on the drawings.

.5 Place slope protection on the slopes expeditiously after completion of excavation and fill placement to avoid losses due to environment and/or wave conditions.

.4 Hand placing:

.1 Use larger stones for lower courses and as headers for subsequent courses.

.2 Stagger vertical joints and fill voids with rock spalls or cobbles.

.3 Finish surface evenly, free of large openings and neat in appearance.

3.2 Tolerances

.1 All rock materials shall be placed to the lines, grades, and elevations indicated on the drawings. The maximum permissible variation in elevation from the prescribed line, measured vertically at completion of placement, shall be +0.0m and -0.1m

.2 The maximum permissible variation in the finished thickness of slope protection layers, when measured as the perpendicular dimension between the top and bottom surface planes, shall be +/- 15% of the layer thickness as indicated on the drawings.

.3 The final surface shall be surveyed, and the contractor shall correct any deficiencies to the specified limits and satisfaction of the Consultant.

*****END OF SECTION*****

1 GENERAL

1.1 Summary

.1 This Section describes the requirements for the supply and installation of timber piles

1.2 Related Sections

.1	Section 06 05 73	Wood Treatment
.2	Section 06 13 23	Heavy Timber Construction
.3	Section 31 09 16	Pile Driving

1.3 References

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- .3 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
- .4 ASTM D25- 99(2005), Standard Specification for Round Timber Piles.

.2 American Wood-Preservers' Association (AWPA)

- .1 AWPA C1, All Timber Products - Preservative Treatment by Pressure Processes.
- .2 AWPA C3, Piles - Preservative Treatment by Pressure Processes.
- .3 AWPA M4, Standard for the Care of Preservative-Treated Wood Products.
- .4 AWPA M6, Brands Used in Forest Products.

.3 Canadian Standards Association (CSA International)

- .1 CSA B111 1974(R2003), Wire Nails, Spikes and Staples.
- .2 CAN/CSA G164 M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CAN3 O56 M79(R2006), Round Wood Piles (Metric version).

.4 CSA O80 Series 97(R2002), Wood Preservation.

.1 CSA O80.18 97(R2002), Pressure Treated Piles and Timbers in Marine Construction

1.4 Measurement Procedure

.1 Consider shoes, cap plates, straps and preservative treatment incidental to supply of piles.

.2 Method 1:

.1 Measure supply of piles in metres delivered to site, in lengths as indicated on drawings.

.2 Measure installation of piles in number of piles and lengths actually driven and approved by Engineer including those for test purposes.

.3 Method 2:

.1 Measure supply and installation of piles in metres of pile approved by Engineer and incorporated into Work.

.4 Mobilization of equipment paid as lump sum item

.5 Engineer will establish actual number and lengths of piles installed from driving records.

.6 Unit of Measurement for piles: in metres measured from tip elevation to cut off elevation at pile cap.

1.5 Submittals

.1 Submit installation procedures to Consultant for review and approval.

.2 Product Data: submit manufacturer's printed product literature, specifications and datasheet.

.3 Submit method of planned pile protection to Engineer for review, as specified.

.4 Spliced piles: when authorized, submit design details of splice complete with signature and stamp of qualified professional engineer registered or licensed in British Columbia, Canada.

.5 Equipment: submit prior to pile installation for approval by Engineer, list and details of equipment for use in installation of piles.

.6 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.6 Waste Management and Disposal

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Ensure emptied containers are sealed and stored safely.

.3 Do not dispose of preservative treated wood through incineration.

.4 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.

.5 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill as approved by Regulatory Agencies.

.6 Dispose of unused wood preservative material at official hazardous material collections site.

.7 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.

2 PRODUCTS

2.1 Materials

.1 Round wood piles:

.1 To CSA 056 and be unused, clean peeled, uniformly tapered, one piece from butt to tip.

.2 Order diameter and length of piles as indicated on drawings.

.2 Pile species: Coastal Douglas Fir

.3 Pile caps and brace timbers: pressure treated in accordance with Section 06 05 73 Wood Treatment.

.4 Piles one-piece splices not permitted.

.5 Splices permitted with approval of Engineer.

.1 Submit detail for review.

.6 Engineer will be sole judge of quality and dimension of piles.

2.2 Equipment

.1 Pile hammer: select and use pile hammer of sufficient weight and energy to suitably install specified pile without damage into soils expected to be encountered.

2.3 Preservative Treatment

.1 Preservative Treatment in accordance with Section 06 05 73 – Wood Treatment.

2.4 Accessories

.1 Wire nails, spikes, staples: to CSA B111.

.2 Bolts, nuts and washers: to ASTM A307.

.3 Hot dip galvanize bolts, nuts and washers and unless otherwise specified, staples, cable clamps, pipe sleeves, spikes and nails: to CAN/CSA-G164.

.1 Other hardware to be galvanized to ASTM A123/A123M.

3 EXECUTION

3.1 Manufacturing Instructions

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

3.2 Protection

.1 Avoid dropping, bruising or breaking of wood fibers.

.2 Avoid breaking surfaces of treated piles.

.3 Do not damage surfaces of treated piles below cutoff elevation.

.4 Treat cuts, breaks or abrasions on surfaces of treated piles, bolt holes and field cuts in accordance with CSA O80 Series.

3.3 Wood Preservation

.1 Treat wood piles with wood preservative treatment in accordance with Section 06 05 73 Wood Treatment.

3.4 Preparation

.1 Select piles in each bent for uniformity of size and straightness to facilitate placing of brace timbers.

.2 Submit details of proposed method of pile head and toe protection during driving to Engineer for approval.

3.5 Installation

.1 Install piles in accordance with Section 31 63 20 Pile Driving

.2 Protection: treat end cut offs and bolt holes with preservative.

3.6 Bracing

.1 Install bracing as indicated.

3.7 Application / Driving

.1 Place driving helmet and cushion block combination capable of protecting pile head between top of pile and ram to prevent impact damage to pile.

.2 Replace block if it is damaged, split, highly compressed, charred or burned or has become spongy or deteriorated, with a new block.

.3 Block helmet: uniformly transmit energy to pile and minimum loss of energy.

3.8 Jetting of Piles (Not Used)

3.9 Pre-Augering or Spudding (Not Used)

3.10 Tolerances of Driving

.1 See Section 31 63 20 Pile Driving

.2 Redesign of pile caps or additional work required due to improper location of piles is responsibility of Contractor as reviewed by Engineer.

.3 Redrive heaved piles to required tip elevation.

.4 Remove and replace damage piles, mislocated piles, driven out of alignment piles and provide additional piles, driven as directed.

*****END OF SECTION*****

1 GENERAL

1.1 Related Sections

.1 Section 31 12 16 Asphalt Paving

.2 Section 32 12 13.23 Asphalt Prime Coats

.3 Section 32 12 13.16 Asphalt Tack Coats

1.2 References

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for each type of abrasives and solvent used on project.

2 PRODUCTS

2.1 Material

.1 Abrasives and solvents used for removal of paint, oil, grease, rubber deposits: proprietary products specially designed for pavement cleaning, subject to approval by Consultant.

3 EXECUTION

3.1 Removing Pavement Markings

.1 Remove rubber tire deposits and paint markings, in areas as directed by Consultant, by sand or water blasting, rotary grinding, heater planing or other method approved in writing by Consultant.

.2 Exercise care to avoid dislodging of coarse aggregate particles, excessive removal of fines, damage to bituminous binder or damage to joint and crack sealers.

.3 Do not heat pavement surfaces above 120 degrees C, when using heater planning equipment.

3.2 Pavement Surface Cleaning

.1 Remove sealing compound which has protruded excessively, where directed by Departmental Representative.

.2 Dispose of removed material as directed by Consultant.

.3 Remove dust, contaminants, loose and foreign materials, oil and grease, in areas as directed by and by method approved in writing by Consultant.

.5 Use rotary power brooms supplemented by hand brooming.

*****END OF SECTION*****

1 GENERAL

1.1 Related Sections

.1 Section 32 01 11 Pavement Cleaning and Marking Removal

.2 Section 32 12 13.23 Asphalt Prime Coats

.3 Section 32 12 16 Asphalt Paving

1.2 References

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M081-92-UL, Standard Specification for Cutback Asphalt (Rapid-Curing Type).

.2 ASTM International

.1 ASTM D140/D140M, Standard Practice for Sampling Bituminous Materials.

.2 ASTM D633, Standard Volume Correction Table for Road Tar.

.3 ASTM D1250, Standard Guide for Use of the Petroleum Measurement Tables.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations.

.2 LEED Canada-NC, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.

.3 LEED Canada-CI Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.

.4 LEED Canada-EB: O&M, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt tack coat and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit summary report within 7 days minimum of date of application and include information as follows:

.1 Total area tack coated.

.2 Quantity of tack coat used.

.3 Mean application rate.

.4 Actual product quantity used when using equipment on pressure distributors.

.5 Dipstick measurements or electronic printouts are acceptable.

2 PRODUCTS

2.1 Materials

.1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1.

3 EXECUTION

3.1 Equipment

.1 Equipment required for Work of this Section to be in satisfactory working condition and maintained for duration of Work.

.2 Pressure distributor:

.1 Designed, equipped, maintained and operated so that asphalt material can be:

.1 Maintained at even temperature.

.2 Applied uniformly on variable widths of surface up to 5m.

.3 Applied at readily determined and controlled rates from 0.2 to 5.4L/m^2.

.4 Distribute in uniform spray without atomization at temperature required.

.3 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.4 Equipped with pump having flow meter graduated in units of 5L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

.5 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.6 Equipped with accurate volume measuring device or calibrated tank.

.7 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

.8 Cleaned if previously used with incompatible asphalt material.

3.2 Application

.1 Apply asphalt tack coat only on clean and dry surface.

.2 Dilute asphalt emulsion with water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Consultant.

.3 Apply asphalt tack coat evenly to pavement surface at rate at rate as required but do not exceed 0.7L/m^2 when diluted with water at 1:1 ratio.

.4 Apply only on clean, dry surface.

.5 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

.6 Apply asphalt tack coat only when air temperature greater than 5 degrees C and when rain is not forecast within 2 hours minimum of application.

.7 Evenly distribute localized excessive deposits of tack coat by brooming.

.8 Where traffic is to be maintained, treat no more than one half of width of surface in one application.

.9 Keep traffic off tacked areas until asphalt tack coat has set.

.10 Re-tack contaminated or disturbed areas.

.11 Permit asphalt tack coat to cure before placing asphalt pavement.

.12 Inspect tack coat application to ensure uniformity.

.13 Re-spray areas of insufficient or non-uniform tack coat coverage as directed by Consultant.

*****END OF SECTION*****

1 GENERAL

1.1 Related Sections

.1 Section 32 01 11 Pavement Cleaning and Marking Removal

.2 Section 32 12 16 Asphalt Paving

.3 Section 32 12 13.16 Asphalt Tack Coats

1.2 References

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D140/D140M, Standard Practice for Sampling Bituminous Materials.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations.

.2 LEED Canada-NC, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.

.3 LEED Canada-CI Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.

.4 LEED Canada-EB: O&M, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-16.1, Cutback Asphalts for Road Purposes.

.2 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt prime coat and include product characteristics, performance criteria, physical size, finish and limitations.

2 PRODUCTS

2.1 Materials

.1 Asphalt material: to CAN/CGSB-16.1 grade: RM-20, MC-70, or CAN/CGSB-16.2 grade: SS-1

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.2 Sand blotter: clean granular material passing 4.75mm sieve and free from organic matter or other deleterious materials.

2.2 Equipment

.1 See Section 32 12 13.160020 Asphalt Tack Coats

3 EXECUTION

3.1 Examination

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt prime coat installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 Application

.1 Proceed with application of tack coat only after receipt of written approval of granular base surface from Consultant.

.2 Cutback asphalt:

.1 Heat asphalt prime to 60 to 70 degrees C for pumping and spraying in accordance with manufacturer’s instructions.

.2 Apply asphalt prime to granular base at rate as required but do not exceed 2L/m^2.

.3 Apply on damp surface unless otherwise directed by Consultant.

.3 Emulsified asphalt:

.1 Dilute asphalt emulsion with clean water at 1:1 ratio for application.

.2 Apply diluted asphalt emulsion at rate as required but do not exceed 5L/m^2.

.3 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Consultant.

.4 Apply asphalt prime only on unfrozen surface.

.5 Apply asphalt tack coat only when air temperature is greater than 5 degrees C and when rain is not forecast within 2 hours minimum of application.

.6 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt prime material.

.7 Where traffic is to be maintained, treat no more than one-half width of surface in one application.

.8 Prevent overlap at junction of applications.

.9 Do not prime surfaces that will be visible when paving is complete.

.10 Apply additional material to areas not sufficiently covered as directed by Consultant.

.11 Keep traffic off primed areas until asphalt prime has cured.

.12 Permit prime to cure before placing asphalt paving.

3.3 Use of Sand Blotter

.1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.

.2 Sweep and remove excess blotter material.

*****END OF SECTION*****

1 GENERAL

1.1 Related Sections

.1	Section 31 23 33.	Excavating, Trenching, and Backfilling
.2	Section 32 01 11	Pavement Cleaning and Marking Removal
.3	Section 32 12 13.23	Asphalt Prime Coats
.4	Section 32 12 13.16	Asphalt Tack Coats

1.2 References

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.

.2 ASTM C117 Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.

.3 ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.

.4 ASTM C127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.

.5 ASTM C128-07a, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.

.6 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.8 ASTM C207-, Standard Specification for Hydrated Lime for Masonry Purposes.

.9 ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

.10 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.11 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

.12 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.2 American Association of State Highway and Transportation Officials (AASHTO).

.1 AASHTO M320, Standard Specification for Performance Graded Asphalt Binder.

.2 AASHTO R29, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.

.3 AASHTO T245, Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.

.3 Asphalt Institute (AI)

.1 AI MS-2-1994 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

.5 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 Action and Informational Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C 4 weeks prior to beginning Work.

.3 Samples:

.1 Inform Consultant of proposed source of aggregates and provide access for sampling 4 weeks prior to beginning Work.

.2 Submit samples of following materials proposed for use 4 weeks prior to beginning Work.

.1 One 5L container of asphalt cement.

.2 1 kg of hydrated lime.

.5 Certificates:

.1 Certification to be marked on pipe.

.6 Test and Evaluation Reports:

.1 Submit manufacturer's test data and certification that asphalt cement meets specification requirements.

.2 Submit manufacturer's test data and certification that hydrated lime meets specified requirements.

.3 Submit asphalt concrete mix design and trial mix test results to Consultant for approval.

.4 Submit printed record of mix temperatures at end of each day.

1.4 Delivery, Storage, and Handling

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Deliver and stockpile aggregates in accordance with Section 31 23 33 Excavating, Trenching, and Backfilling. Stockpile minimum 50% of total amount of aggregate required before beginning asphalt mixing operation.

.3 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.

.4 Stockpile fine aggregate separately from coarse aggregate, although separate stockpiles for more than two mix components are permitted.

.5 Provide approved storage, heating tanks and pumping facilities for asphalt cement.

.6 Submit to Consultant copies of freight and waybills for asphalt cement as shipments are received.

.1 Departmental Representative and Consultant reserves right to check weights as material is received.

.7 Stockpile crushed RAP separately in accordance as where directed by Departmental Representative or Consultant.

.8 Protect and cover stockpiles of crushed RAP from rain to approval of Consultant.

2 PRODUCTS

2.1 Materials

.1 Performance graded asphalt cement: to CAN/CGSB-1.3-M90, Grade 80-100

.2 RAP:

.1 Crushed and screened to ensure 100% of RAP material passes 37.5mm screen before mixing.

.2 Aggregates: in accordance with requirements as follows:

.1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material, and other deleterious materials.

.2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117.

.3 Table:

Sieve Designation	% Passing		
	Lower Course	Surface Course	Sheet Asphalt
200 mm	-	-	-
75 mm	-	-	-
50 mm	-	-	-
38.1 mm	-	-	-
25 mm	100	-	-
19 mm	-	-	-
12.5 mm	70-85	100	-
9.5 mm	-	-	100
4.75 mm	40-65	55-75	85-100
2.00 mm	30-50	35-55	80-95
0.425 mm	15-30	15-30	40-70
0.180 mm	5-20	5-20	10-35
0.075 mm	3-8	3-8	4-14

.4 Coarse aggregate: aggregate retained on 4.75mm sieve and fine aggregate is aggregate passing 4.75mm sieve when tested to ASTM C136.

.5 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75mm sieve and stockpile separately from coarse aggregate.

.6 Separate stockpiles for coarse and fine aggregates not required for sheet asphalt.

.7 Do not use aggregates having known polishing characteristics in mixes for surface courses.

.8 Sand equivalent: ASTM D2419. Min: 40.

.9 Magnesium Sulphate soundness: to ASTM C88. Max % loss by mass after 5 cycles:

.1 Coarse aggregate surface course: 15%.

.2 Coarse aggregate lower course: 15%.

.3 Fine aggregate, surface course: 18%.

.4 Fine aggregate, lower course: 18%.

.10 Los Angeles degradation: Grading B, to ASTM C131. Max % loss by mass:

.1 Coarse aggregate, surface course: 25%.

.2 Coarse aggregate, lower course: 35%.

.11 Absorption: to ASTM C127. Max % by mass:

.1 Coarse aggregate, surface course: 1.75%.

.2 Coarse aggregate, lower course: 2.00%.

.12 Loss by washing: to ASTM C117. Max % passing 0.075 mm sieve:

.1 Coarse aggregate, surface course: 1.5%.

.2 Coarse aggregate, lower course: 2.0%.

.13 Lightweight particles: to ASTM C123. Max % by mass less than 1.95 relative density:

.1 Surface course: 1.5%.

.2 Lower course: 3.0%.

.14 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5): Max % by mass:

.1 Coarse aggregate, surface course: 10%.

.2 Coarse aggregate, lower course: 10%.

.15 Crushed fragments: at least 60% of particles by mass within each of following sieve designation ranges, to have 2 minimum freshly fractured face. Material to be divided into ranges, using methods of ASTM C136 and ASTM C117.

Passing		Retained on
25mm	to	12.5mm
12.5mm	to	4.75mm

.16 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

.4 Mineral filler:

.1 Ensure finely ground particles of limestone, hydrated lime, Portland cement or non-plastic mineral matter approved by Consultant are thoroughly dry and free from lumps.

.2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by Consultant to improve mix properties.

.3 Ensure mineral filler is dry and free flowing when added to aggregate.

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2.2 Equipment

.1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers:

.1 Drum diameter: 1200mm minimum.

.2 Amplitude of vibration (machine setting): 0.5mm maximum for lifts less than 40 mm thick.

.4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.4 Use only trucks which can be weighed in single operation on scales supplied.

.5 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Consultant, may be used instead of tamping irons.

.3 Straight edges, 3m in length, to test finished surface.

2.3 Mix Design

.1 Mix design to be approved in writing by Consultant.

.2 Mix to contain maximum 20% by mass of RAP without a special mix design. Consultant may approve higher proportion of RAP if Contractor demonstrates ability to produce mix meeting requirements of specification.

.3 Design of mix: by Marshall method to requirements below.

.1 Compaction blows on each face of test specimens: 75.

.2 Mix physical requirements:

Property	Airfield Pavements	Roads	Sheet Asphalt
Marshall Stability at 60 degrees C, kN min	7.0	5.5 surface course/4.5 lower course	3.0
Flow Value mm	2-4	2-4	2-5
Air Voids in Mixture, %	3-5	3-5 surface course/2-6 lower course	3-5
Voids in Mineral Aggregate, % min	15 surface course/13 lower course	15 surface course/13 lower course	16
Index of Retained Stability % minimum	75	75	75

.3 Measure physical requirements as follows:

.1 Marshall load and flow value: to AASHTO T245.

.2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127 and ASTM C128. Make allowance for volume of asphalt absorbed into pores of aggregate.

.3 Air voids: to ASTM D3203.

.4 Index of Retained Stability: measure in accordance with Marshall Imersion Test (ASTM D159).

.5 Do not change job-mix without prior approval of Consultant. When change in material source proposed, new job-mix formula will be provided to be reviewed and approved by Consultant.

3 EXECUTION

3.1 Plant and Mixing Requirements

.1 Batch and continuous mixing plants:

.1 To ASTM D995.

.2 Heat asphalt cement and aggregate to mixing temperature. Do not heat asphalt cement above 160 degrees C.

.3 Before mixing, dry aggregates to moisture content not greater than 0.5% by mass or to lesser moisture content if required to meet mix design requirements.

.4 Contractor will monitor temperature of completed mix at plant and at paver after considering hauling and placing conditions.

.5 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.

.1 Do not load frozen materials into bins.

.6 Feed cold aggregates to plant in proportions to ensure continuous operations.

.7 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.

.8 Store hot screened aggregates in manner to minimize segregation and temperature loss.

.9 Where RAP is to be incorporated into mix:

.1 Feed from separate cold feed bin specially designed to minimize consolidation of material. Provide 37.5mm scalping screen on cold feed to remove oversized pieces of RAP.

.2 Ensure positive and accurate control of RAP cold feed by use of hydraulic motor or electric clutch and equip with anti-rollback device to prevent material from sliding backward on feed belt.

.3 Combine RAP and new aggregates in proportions as specified. Dry mix thoroughly, until uniform temperature within plus or minus 5 degrees C of mix temperature is achieved prior to adding new asphalt cement. Do not add new asphalt cement where temperature of dried mix material is above 160 degrees C.

.10 Maintain temperature of materials within 5 degrees C of specified mix temperature during mixing.

.11 Mixing time:

.1 In batch plants, dry mix for not less than 10s. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.

.2 In continuous mixing plants, mixing time as required but not less than 45s.

.2 Dryer drum mixing plant:

.1 To ASTM D995.

.2 Where RAP is to be incorporated into mix, dryer drum mixer is to be designed to prevent direct contact of RAP with burner flame or with exhaust gases hotter than 180 degrees C.

.3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.

.4 Feed RAP from separate cold feed bin designed to minimize reconsolidation of material.

.5 Meter total flow of aggregate and RAP using electronic weigh belt system with indicator that can be monitored by plant operator and which is interlocked with asphalt pump to ensure proportions of aggregate and RAP and asphalt entering mixer remain constant.

.6 Allow for easy calibration of weighing systems for aggregates and RAP without having material enter mixer.

.7 Make provision for conveniently sampling full flow of materials from cold feed.

.8 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate and RAP from cold feed prior to entering drum.

.9 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.

.10 Accomplish heating and mixing of asphalt mix in a drum dryer-mixer. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with a printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures at end of each week, if required.

.11 Ensure mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer is 0.5% maximum.

.3 Temporary storage of hot mix:

.1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.

.2 Do not store asphalt mix in storage bins in excess of 12 hours.

.4 Mixing tolerances:

.1 Permissible variation in aggregate gradation from job mix (percent of total mass).

.1 4.75 mm sieve and larger, 5.5

.2 2.36 mm sieve, 4.5

.3 0.600 mm sieve, 3.5

.4 0.150 mm sieve, 2.5

.5 0.075 mm sieve, 1/5

.2 Permissible variation of asphalt cement from job mix: 0.3%.

.3 Permissible variation of mix temperature at discharge from plant: 5 degrees C.

3.2 Preparation

.1 When paving over existing asphalt surface, clean pavement surface in accordance with Section 32 01 11.01- Pavement Cleaning and Marking Removal. When levelling course is not required, patch and correct depressions and other irregularities to approval of Consultant before beginning paving operations.

.2 Adjust existing castings to new elevations and protect from asphaltic mix.

.3 Apply tack coat and prime coat in accordance with Section 32 12 13.23- Asphalt Prime Coats and Section 32 12 13.16- Asphalt Tack Coats prior to paving.

.4 Prior to laying mix, clean surfaces of loose and foreign material.

3.3 Transportation of Mix

.1 Transport mix to job site in vehicles cleaned of foreign material.

.2 Paint or spray truck beds with limewater, soap or detergent solution, or non-petroleum based commercial product, at least daily or as required.

.3 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.

.4 Schedule delivery of material for placing in daylight, unless Consultant approves artificial light for night placing.

.5 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.

.6 Do not dribble mix into trucks.

.7 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.

.8 Deliver loads continuously in covered vehicles and immediately spread and compact.

.9 Deliver and place mixes at temperature within range. Temperature of mix upon placement shall not be less than 125 degrees C.

3.4 Placing

.1 Obtain Consultant's approval of existing surface, tack coat, prime coat, and base prior to placing asphalt.

.2 Place asphalt concrete to thicknesses, grades and lines as indicated.

.3 Placing conditions:

.1 Place asphalt mixtures only when air temperature is 5 degrees C minimum.

.2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.

.3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

.4 Place asphalt concrete in compacted lifts of thickness as indicated.

.1 Levelling course(s) to thicknesses required but not exceeding 100mm.

.2 Lower course in layers not to exceed 100mm each.

.3 Surface course in layers of maximum 60mm each.

.5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.

.6 Spread and strike off mixture with self-propelled mechanical finisher.

.1 Construct longitudinal joints and edges true to line markings.

.2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30m apart.

.3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.

.4 Correct irregularities in alignment left by paver by trimming directly behind machine.

.5 Correct irregularities in surface of pavement course directly behind paver. Remove excess material forming high spots using shovel or lute. Fill and smooth indented areas with hot mix.

.6 Do not throw surplus material on freshly screeded surfaces.

.7 When hand spreading is used:

.1 Distribute material uniformly without broad casting material.

.2 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.

.3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.

.4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt. Control temperature to avoid burning material. Do not use tools at higher temperature than temperature of mix being placed.

3.5 Compacting

.1 Roll asphalt continuously using established rolling pattern to a density of not less than 97% of 75 blow Marshall density in accordance with ASTM D1559 with no individual test less than 95%.

.2 General:

.1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.

.2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5km/h for static steel-wheeled. Do not exceed 8km/h for pneumatic tired rollers.

.4 Use static compaction for levelling coarse less than 25 mm thick.

.5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 20 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.

.6 Overlap successive passes of roller by minimum of 200mm and vary pass lengths.

.7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.

.8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.

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1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.

.11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.

.12 Where rolling causes displacement of material loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.3 Breakdown rolling:

.1 Begin breakdown rolling with immediately following rolling of transverse and longitudinal joint and edges.

.2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.

.3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections.

.4 Use only experienced roller operators.

.4 Intermediate rolling:

.1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.

.2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.

.5 Finish rolling:

.1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.

.2 Conduct rolling operations in close sequence.

3.6 Joints

.1 General:

.1 Remove surplus material from surface of previously laid strip.

.1 Do not deposit on surface of freshly laid strip.

.2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.

.3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.

.2 Transverse joints:

.1 Offset transverse joint in succeeding lifts by at least 600mm.

.2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.

.3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.

.3 Longitudinal joints:

.1 Offset longitudinal joints in succeeding lifts by at least 150mm.

.2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane. If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.

.3 Overlap previously laid strip with spreader by 100mm.

.4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.

.5 Roll longitudinal joints directly behind paving operation.

.6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 100 to 150 mm extending onto previously placed and compacted lane.

.4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix.

.1 Place and compact joint to ensure joint is smooth and without visible breaks in grade.

.2 Locate feather joints as indicated.

.5 Construct butt joints as indicated.

3.7 Finish Tolerances

.1 Finished asphalt surface to be within 6mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 6mm when checked with 3m straight edge placed in any direction.

.3 Water ponding not permitted

3.8 Defective Work

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.

.1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.

.2 Repair areas showing checking, rippling, or segregation.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

*****END OF SECTION*****