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**CANADIAN COAST GUARD
CENTRAL AND ARTIC REGION**

**INTEGRATED TECHNICAL SERVICES
MARINE AND CIVIL INFRASTRUCTURE**

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Canada



A blue ink handwritten signature, likely of Eric Boucher, consisting of stylized initials and a surname.

BY: Éric Boucher, Eng., M.Sc.
REVISION: 0

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SECTION 01 33 00: SUBMITTAL PROCEDURES

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 PURPOSE

- .1 Submit all shop drawings, technical data sheets, product descriptions or samples requested in these specifications or on the drawings to the Ministry representative for comments.
- .2 Begin work only once shop drawings, technical data sheets, product samples and descriptions have been reviewed and returned by the Ministry representative.

1.2 CONTENT AND SUBMISSION OF SHOP DRAWINGS

- .1 With the Ministry representative's approval, schematic drawings ordinarily submitted by the manufacturer, characteristics indicated in its catalogues, diagrams, tables, charts, illustrations and ordinary descriptive data described in some cases in certain sections of the specifications may be used instead of shop drawings. Complete basic information with additional information specific to the project.
- .2 Submit drawings illustrating the portion of work involved, manufacturing details, layout as well as installation or assembly details set out in the related sections.
- .3 Email all shop drawings, technical data sheets or descriptions unless otherwise indicated by the Ministry representative. After review, the Ministry representative shall keep one (1) copy for his files and return a reviewed copy to the Contractor by email. Using this reviewed copy, prepare copies for the Owner and relevant subcontractors.
- .4 Deliver or email drawings to the Ministry representative's place of business and assume costs for such. When review is complete, if paper copies of the drawings are required, collect drawings at our offices, assuming all costs and using own means to do so.
- .5 Shop drawings shall be returned to the Contractor or subcontractor within ten (10) business days. The Contractor's shop drawing production time is excluded from this time frame and may not be cited as cause for delay.
- .6 Distribute copies only after receiving duly commented drawings from the Ministry representative.
- .7 Keep one complete copy of all shop drawings, samples and technical data sheets duly commented by the Ministry representative for submission to Owner upon completion of work.

1.3 VERIFICATION AND VALIDATION OF SUBMITTALS

- .1 Shop drawings and technical data sheets from a subcontractor to be submitted and received through the Contractor's representative. The latter shall stamp documents with date of receipt and keep a logbook of documents received and issued.
- .2 Ensure general coordination of drawings and follow up with suppliers. It shall also verify that the shop drawings, technical data sheets and samples are complete before submission to the Ministry representative.

- .3 Prepare submittals according to the project requirements and contract documents. Drawings shall not be approved individually. Verification shall be performed once all associated drawings have been submitted.
- .4 Verify, prior to submitting the documents:
 1. Mark details submitted on shop drawings on project drawings;
 2. Verify all existing structure dimensions or conditions on site before producing shop drawings;
 3. Clearly indicate on drawings which dimensions were taken on site;
 4. Identify applicable standards such as NSF, along with their numbers;
 5. Validate performance criteria;
 6. Validate construction methods in relation to contract documents;
 - .7 Identify catalogue numbers and other relevant related data.
- .5 Submit a transmission slip containing all of the following information, each time documents are submitted:
 1. Date, Contractor's name, complete contact information and email address;
 2. Subcontractors', suppliers' and manufacturers' names and contact information, as applicable;
 - .3 Project title and number
 4. Number for each shop drawing, technical data sheet, product description and sample submitted;
 5. Revisions of drawings submitted, as applicable.

1.4 PURPOSE OF THE REVIEW

- .1 Contractor shall be held liable for any error, omission or discrepancy contained in the submittals, even if the Ministry representative has reviewed the documentation and returned it without comment.
- .2 The purpose of the shop drawing review procedure is to provide the Ministry representative an opportunity to detect any major non-conformances or gross deviation arising from, for example, a misunderstanding or non-comprehension of project requirements. In no case shall the review constitute an exhaustive verification of the information contained therein.
- .3 The shop drawing review procedure is designed to allow the Ministry representative to assess overall compliance of the work with contract requirements. Comments and/or corrections written on shop drawings do not release Contractor of its responsibility to comply with all contract requirements nor do they imply any endorsement or approval in the event a deviation from these requirements occurs.

- .4 Only specific deviations, specified to the Ministry representative at the time the drawings are submitted, and submitted within the context of a request for equivalence may be the subject of a formal approval from the Ministry representative.
- .5 Contractor shall be held liable for any deviations from contract document requirements, even if the Owner and/or the Ministry representative has verified the submittals, unless the Ministry representative specifically expresses in writing his acceptance of certain specific deviations.

1.5 STAMP AND SIGNATURE BY A MEMBER OF THE ORDRE DES INGÉNIEURS DU QUÉBEC

- .1 Have shop drawings that represent structures and required engineering calculations to prepare them stamped and signed by an engineer who is a member in good standing of the Ordre des Ingénieurs du Québec (OIQ). For example, present structures that are to be pre-fabricated to measure according to the specific requirements of a performance specification or to drawings that do not include all Engineering details (such as flow controllers, treatment units, manholes, etc.) on drawings that have been stamped and sealed.
- .2 Drawings of objects that have been serially manufactured or fabricated, which were not necessarily designed specifically for a certain project do not require an engineer's signature. However, Contractor to provide a list of materials it plans to use, specifying, at the very least, the nature of the product (certain diameter conduit, valve, etc.), supplier, as well as type and class of material.
- .3 Assembly drawings specifying required project components but that do not necessarily require engineering calculations do not require an engineer's signature.

SECTION 01 35 29 06: HEALTH AND SAFETY

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 REFERENCES

- .1 *Canada Labour Code, Part II, Canada Occupational Health and Safety Regulations*
- .2 Canadian Standards Association (CSA)
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .4 Province of Quebec : *An Act Respecting Occupational Health and Safety*, CQLR. c S-2.1
- .5 Safety Code for the construction industry, CQLR c S-2.1, r 6.

1.2 DOCUMENTS/SAMPLES TO BE SUBMITTED

- .1 Submit the required documents and samples in accordance with Section 01 33 00 - Documents and samples to be submitted.
- .2 Submit, no later than seven (7) days after the date on which the notice to proceed was signed and before the workforce is mobilized, a health and safety plan created specifically for the work site, comprising the following elements:
 - .1 Risk/hazard assessment results for work site safety
 - .2 Results of the analysis of health and safety risks or hazards associated with each task and activity in the work plan
- .3 Submit to the Departmental Representative and the appropriate authority, on a weekly basis, a copy of the reports on the health and safety inspection conducted by the Contractor's authorized representative.
- .4 Submit copies of incident and accident reports.
- .5 The Departmental Representative will review the health and safety plan prepared by the Contractor for the work site and will submit comments within five (5) days of receipt of the document. As needed, the Contractor shall revise its health and safety plan and shall resubmit it to the Departmental Representative no later than three (3) days following receipt of the latter's comments.
- .6 The Departmental Representative's review of the final health and safety plan prepared by the Contractor for the work site shall not be interpreted as approval of this plan and shall in no way limit the Contractor's overall responsibility for health and safety during the construction work.

- .7 The Contractor shall ensure that all its employees have at their disposal and use the personal protective equipment required for the work to be done as well as safety equipment and equipment for protection against falls from heights. The Contractor shall also ensure that a height rescue kit is available on site.
- .8 It should be noted that a safety advisory is in effect within the CCG and shall be observed by the Contractor. This advisory is found in Appendix 2.
- .9 All of the Contractor's employees required to work at heights shall at least hold a current certification for movement and rescue in elevated metallic structures; proof that this certification is valid will be requested one month before on-site work begins. At least two employees shall be present on the site when such work is being carried out.

1.3 PROJECT NOTIFICATION

- .1 Before work begins, send the project notification to the appropriate provincial authorities.

1.4 RISK/HAZARD ASSESSMENT

- .1 Assess on-site safety risks/hazards associated with the performance of the work.

1.5 GENERAL REQUIREMENTS

- .1 Before starting work, draft a health and safety plan specific to this work site based on the preparatory risks/hazards assessment. Apply the plan and ensure that all its aspects are respected until all site employees have been demobilized. The health and safety plan shall take project particularities into account.
- .2 The Departmental Representative may comment in writing if the plan contains anomalies or raises concerns, and may require the submission of a revised plan that will correct those anomalies or eliminate those concerns.

1.6 RESPONSABILITY

- .1 Assume responsibility for the health and safety of those present on the site as well as for the protection of on-site assets located; in areas adjacent to the site, assume responsibility for protecting people and the environment insofar as they are affected by the work.
- .2 Comply, and enforce compliance among employees, with the safety requirements set out in the contract documents and in the applicable local, territorial, provincial and federal orders, laws and regulations, and the requirements of the health and safety plan prepared for the site.

1.7 COMPLIANCE REQUIREMENTS

- .1 Comply with the *Act respecting occupational health and safety* and the *Regulation respecting industrial and commercial establishments*, CQLR c S-2.1, r 6.
- .2 Comply with the *Occupational Health and Safety Regulations* under the *Canada Labour Code*.

1.8 UNEXPECTED RISK/HAZARDS

- .1 Should there be conditions, risks/hazards, or specific or unexpected factors affecting safety while the work is being performed, follow the procedures established with respect to the right of an employee to refuse to carry out dangerous work, in compliance with Quebec laws and regulations, and inform the Departmental Representative of this orally and in writing.

1.9 POSTING OF DOCUMENTS

- .1 Ensure that the relevant documents, articles, orders and notices are posted in plain sight on the work site, in compliance with Quebec laws and regulations and in consultation with the Departmental Representative.

1.10 CORRECTIVE MEASURES IN CASE OF NON-COMPLIANCE

- .1 Immediately take the necessary measures to rectify situations deemed non-compliant in terms of health and safety by the appropriate authority or by the Departmental Representative.
- .2 Provide the Departmental Representative with a written report on the measures taken to rectify situations of non-compliance with respect to health and safety.
- .3 The Departmental Representative may issue a stop-work order if the Contractor does not take the necessary action to correct conditions deemed non-compliant with respect to health and safety.

1.11 CARTRIDGE DEVICES

- .1 Do not use cartridge devices without written permission from the Departmental Representative.

1.12 ARRET DES TRAVAUX

- .1 Give precedence to the health and safety of the public and site personnel as well as protection of the environment over issues related to cost and schedule.

2. PRODUCTS

Not applicable.

3. EXECUTION

Not applicable.

SECTION 01 35 43: ENVIRONMENTAL PROCEDURES

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 WASTE DISPOSAL

- .1 The Contractor shall maintain, in the best possible cleanliness, the streets used to dispose of the waste, to receive materials or any other need for its construction. If required by the municipality and / or by the Ministry representative, it must install sediment collectors in the sumps affected by the work and clean the streets on a daily basis.
- .2 It is forbidden to bury waste and waste materials on site.
- .3 It is forbidden to dispose of waste materials or volatile materials such as mineral spirits and thinners for oil or paint, by pouring them into streams, storm sewers or sanitary sewers.
- .4 Collect contaminated or hazardous materials and dispose of them on site with all necessary safety precautions. Dispose in accordance with applicable municipal and provincial regulations.

1.2 DRAINAGE

- .1 It is forbidden to discharge water containing particles of suspended material into watercourses, sewerage systems or drainage systems.
- .2 Control the evacuation of water containing suspended particulate matter or other toxic substances in accordance with the requirements of municipal and provincial authorities.

1.3 POLLUTION PREVENTION

- .1 Maintain temporary facilities to prevent erosion and pollution and established under this contract.
- .2 Ensure the control of the gas fumes emitted by the equipment and installations, in accordance with the requirements of the local authorities.
- .3 Build temporary shelters to prevent sandblasting residue materials and other foreign materials from contaminating air, water and soil.
- .4 In order to minimize the nuisance to the residents of the land surrounding the site, water the dry materials and cover the waste to prevent the wind from raising dust.

1.4 BURNING OF WASTES

- .1 Fire and burning of waste on site is not permitted.

SECTION 01 45 00: QUALITY CONTROL

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 APPOINTMENT AND PAYMENT

- .1 The Owner shall appoint and pay for services from a testing laboratory except as follows, in which case the Contractor shall assume costs:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or instructions to the public;
 - .2 Inspection and testing performed exclusively for Contractor's convenience;
 - .3 Tests specified to be carried out by the Contractor under the supervision of the Ministry representative;
 - .4 Additional tests specified in paragraph 1.2.2.
- .2 Where tests or inspections by designated testing laboratory reveal work not in accordance with contract requirements, pay costs for additional tests or inspections as required by the Ministry representative to verify acceptability of corrected work.

1.2 CONTRACTOR'S RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - 1. Provide access to work for inspection and testing.
 - 2. Facilitate inspections and tests.
 - 3. Make good work disturbed by inspection and test.
 - 4. Reserve a room on the worksite for testing laboratory personnel where they may store their equipment and test samples.
- .2 Notify the Ministry representative a minimum of 48 hours in advance of operations to allow for assignment of laboratory personnel and scheduling of tests.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good work that is concealed before required inspection or testing is completed and approved by the Ministry representative.

SECTION 02 41 16: STRUCTURE DEMOLITION

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 REFERENCE CODES AND STANDARDS

- .1 Use the most recent edition of applicable reference standards, unless otherwise indicated.
- .2 Execute structural steel work to CSA S350-M1980 (R2003) « Code of Practice for Safety in Demolition of Structures », unless otherwise indicated.
- .3 Perform scaffolding work to CSA S269.2-16 « Access scaffolding for construction purposes ».

1.2 DEMOLITION PROCEDURE

- .1 Submit demolition procedures, methods, drawings and diagrams to authorities having jurisdiction upon the Ministry representative's request, clearly indicating in detail the order in which structures will be disassembled, and where falsework and underpinning has been implemented.
- .2 Undertake demolition or structural element dismantling only after receiving comments from the Ministry representative and/or relevant authorities.
- .3 Demolition, protection and falsework procedures and drawings to be stamped and signed by a professional engineer who is a member of the Ordre des Ingénieurs du Québec.
- .4 Submit a certificate testifying that these procedures and drawings were submitted and approved by the relevant authorities at the Engineer's request.
- .5 The demolition, protection and falsework drawing control procedure is designed to allow the Ministry representative to assess overall compliance of the work with provisions indicated on the drawings. Comments and/or corrections written on these drawings do not release Contractor of its obligation to comply with all contractual responsibilities, nor do they imply any endorsement or approval in the event a deviation from these requirements occurs.
- .6 The capacity of percussion equipment which may be used to partially demolish the exterior concrete walls is limited to the following requirements:
 - Manual pneumatic hammer (mass in kg): ≤ 30 kg.
 - Hydraulic hammer (joule capacity): ≤ 60 joules.

2. PRODUCTS

- .1 Scaffolding and falsework as approved in codes and standards in force.

3. EXECUTION

3.1 PREPARATORY WORK AND SAFETY MEASURES

- .1 Disconnect electrical, gas and telephone networks that feed the building and/or parts of the building to demolish, in accordance with laws and regulations from authorities having jurisdiction. Install warning signs on electrical equipment and networks that must remain live during the work to supply other buildings.
- .2 Disconnect mechanical devices and cap inlets and outlets in accordance with Owner's and the Ministry representative's requirements, as well as safety standards in force.
- .3 Keep in good condition and protect utility networks that cross the worksite and must remain in service.
- .4 Keep all emergency exits located near the work free of materials, debris or demolition equipment at all times.
- .5 Take whatever measures necessary to prevent displacement or settlement of structures, services, walkways, coverings, trees, landscaping, soil and portions of adjacent buildings. Supply and install parts necessary for protection, falsework and underpinning. Repair damaged structures and assume liability for any injuries to persons that may result from demolition work.
- .6 Support structures properly if it appears that work may constitute a hazard to users, workers, structure of the building to demolish or adjacent structures and services. Stop work and notify the Ministry representative immediately if such arises.
- .7 Install temporary reinforcement and falsework and underpin to prevent displacement or settlement of structures, if the Ministry representative deems necessary. Failure to adhere to this order in a timely manner is cause for the Ministry representative to order the work done by others, at Contractor's cost.
- .8 Assume responsibility for interior or exterior damage that this work may cause due to inclement weather, negligence, improper coordination or lack of precaution.
- .9 Prepare a file regarding existing site conditions prior to starting any demolition work required on the drawings.
- .10 Supply and install all protections and falsework required to prevent damaging existing equipment, buildings and/or services.
- .11 Supply and install waste chutes, as well as safety screens, barricades and scaffolding to protect workers and Owner's representatives on the worksite.

3.2 DEMOLITION WORK

- .1 Remove materials, services installations and other equipment that hinder refinishing or making good of existing structures, and replace as work progresses. Clear worksite of all demolition products and dispose of in accordance with regulations in force, upon completion of work.

- .2 Ensure that structures are properly supported to prevent collapse or settlement at all times. Protect portions of building not intended for demolition.
- .3 Demolish so as to create the least amount of dust possible, and wet dusty materials adequately.
- .4 Demolish masonry and concrete walls in small sections. Remove and carefully place framing elements and other heavy or large objects on the ground.
- .5 Burning or selling demolition materials on site is prohibited.
- .6 Clear worksite of all contaminated or hazardous materials, taking whatever safety measures necessary. Dispose of in accordance with regulations in force.

3.3 STRUCTURAL OVERSTRESSING

- .1 Take care not to overload existing structures beyond admissible load, taking into account their deteriorated states. Mandate an Engineer who is a member of the Ordre des Ingénieurs du Québec to assess work method, as needed.

**SECTION 03 10 00: CONCRETE FORMWORK
AND FALSEWORK**

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 REFERENCE CODES AND STANDARDS

- .1 Use the most recent edition of applicable reference standards, unless otherwise indicated.
- .2 Build concrete formwork to CSA A23.1-14 « Concrete materials and methods of concrete construction », unless otherwise prescribed.
- .3 Build falsework to CSA S269.1-16 « Falsework and formwork » unless otherwise prescribed.

1.2 FORMWORK AND FALSEWORK SHOP DRAWINGS

- .1 Submit, upon the Ministry representative's request and for informational purposes, a copy of formwork shop drawings that include falsework, calculations (design) and/or relevant installation methods, and that have been signed and sealed by an engineer in good standing with OIQ (Ordre des Ingénieurs du Québec).
- .2 Submit, upon the Ministry representative's request and for informational purposes, a copy of the statement that has been signed and sealed by an engineer in good standing with OIQ (Ordre des Ingénieurs du Québec) certifying that temporary formwork and falsework comply with drawings described in article 1.3.1.

2. PRODUCTS

2.1 MATERIALS

- .1 Wood: Plywood and wooden forms to CSA A23.1-14 « Concrete materials and methods of concrete construction ».
- .2 **Pre-fabricated formwork panels, such as Duraform** or approved equivalent, as well as coneless form ties are **prohibited** unless expressly authorized by the Engineer.
- .3 Engineer may or may not accept use of slipforming after assessing proposed mechanical methods and materials.
- .4 For all exposed surfaces, use new, high-density, faced plywood to O121. Use of Duraform-type pre-fabricated formwork panels used with 4.8 mm meranti plywood panels (commonly known as "Lauan plywood") may be acceptable, with the Ministry representative's express written authorization. Refer to architectural drawings for location of exposed surfaces.
- .5 Form oil: Chemical agent, containing compounds that react with free lime in concrete to form water-soluble soap, and that prevent the concrete from adhering to the form, such as "Releaser" made by Grace, "Cast-Off" made by ChemRex, or "Evco Super Slip" made by Euclid. Prevent oil from contacting or contaminating the reinforcing steel in any way. Ensure

product used is compatible with the type of paint that will be applied to the exposed concrete surfaces, as specified. Refer to architectural drawings and specifications.

- .6 Form ties: Removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. For exposed concrete, use snap ties complete with plastic cones. After stripping, no portion of ties shall remain within 16 mm of the surface.
- .7 Filling form tie holes: Sikatop 122 or engineer-approved equivalent.
- .8 Caulking of expansion and isolation joints: Sikaflex 2C/NS by Sika or engineer-approved equivalent.
- .9 Falsework materials: to CSA S269.1-16 « Falsework and formwork ». Identify materials with a quality indication (grade) or delivered with compliance certificates, test reports or other statement of compliance.

3. EXECUTION

3.1 FABRICATION AND ERECTION

- .1 Check elevations, column and wall alignments, as well as beam and slab camber before erecting formwork and ensure dimensions correspond to drawings. Levels should also agree with geodesic elevations when available.
- .2 Obtain Engineer's approval before framing openings in concrete slabs, beams or columns that are not indicated on structural drawings.
- .3 Obtain testing laboratory's or Engineer's approval before pouring concrete directly on ground or bedrock.
- .4 Align form joints and make watertight.
- .5 Keep form joints to minimum, complying with requirements set out in drawings and specifications regarding construction, control, isolation and expansion joints.
- .6 Locate horizontal form joints for **exposed columns** a minimum of 2400 mm above finished floor elevation.
- .7 Chases, tongues and grooves, openings, drips, corners, as well as expansion and construction joints shall comply with indications on drawings.
- .8 Comply with CSA A23.1-14 « Concrete materials and methods of concrete construction », if formwork or falsework needs to be used again.

- .9 Use 20 mm chamfer strips for all exposed edges and for edges in contact with waterproofing membrane.
- .10 Ensure sufficient camber in beam and slab forms to compensate for formwork slump. Add camber to requirements indicated on drawings, as applicable.
- .11 In certain locations, standby reinforcing steel bars are shown on the drawings. Take such details into account when preparing bid. Where needed, drill, notch or cut forms to fully accommodate details shown on drawings.
- .12 Supply the labour, equipment and materials to fabricate and erect formwork required for complete and proper execution of the work.
- .13 Implement elevations and dimensions of the structure on site as covered in this section.
- .14 Apply no-shrink grout between all steel components in contact with concrete, except where clearly identified by the Ministry representative.
- .15 Fill form tie holes.
- .16 Install all anchors, plates, supports, bolts and accessories that are to be encased in concrete structures or that are supplied and required by other trades.
- .17 Supply and install falsework and temporary bracing as required.
- .18 Clean up debris generated by work.

3.2 INSPECTION AND PREPARATION OF FORMWORK BEFORE CONCRETING

- .1 Immediately prior to concrete placement, inspect forms to ensure they are in proper position, sufficiently rigid, supported, watertight and perfectly clean, that the walls have been adequately treated, and that they are free of snow, ice and other foreign matter.
- .2 In elements where space is limited, make temporary holes or openings at the bottom of deep elements such as columns or walls to facilitate cleaning and inspection. Locate openings so as to allow use of water or compressed air to clean away debris. Fill openings to even grade with interior surface.
- .3 Use form oil for all formwork surfaces already treated. Use form oil that will not stain or affect the colour of exposed concrete surfaces. Use only necessary amount and remove any agent that may have stained the reinforcement steel. Where a surface coating was in contact with the concrete surface, check compatibility of both products; where required, use a different form oil.
- .4 Wet down all untreated formwork surfaces to prevent shrinking and wet again immediately before pouring.

3.3 TOLERANCES

- .1 Fabricate and erect formwork to produce finished concrete structure conforming to shape, dimensions, locations and levels indicated, and within tolerances stipulated in CSA A23.1-14 « Concrete materials and methods of concrete construction ».
- .2 The following tolerances apply to exposed surfaces where variance in alignment, level or plumb interfere with work of other trades, reduce strength below requirements, or affect structure function in any way:

Vertical, horizontal and surface tolerances

.1	Walls, edges, slabs, columns and construction joints: <ul style="list-style-type: none"> • Over 3 metres • Over 12 metres or more • Max. variance at standard position centre 	6 mm 20 mm 10 mm
.2	For exposed corners, edges in contact with other materials, construction joints, formwork grooves and other visible lines: <ul style="list-style-type: none"> • Over 3 metres • Over 12 metres or more • Max. variance at standard position centre 	3 mm 12 mm 6 mm
.3	Acceptable tolerances in the position and elevation of encased parts other than anchor bolts:	6 mm
.4	Acceptable tolerances in the relative position and in the elevation of anchor bolts in a same column or group in compliance with Appendix D of the Code of Standard Practice for Structural Steel, published by ICCA	3 mm
.5	Acceptable tolerances in the size and location of openings:	6 mm
.6	Acceptable tolerances in the dimensions of column and beam cross-sections and in the thickness of walls and slabs:	+ 12 mm / - 6 mm
.7	Acceptable tolerances in the layout of the reference axes for anchor bolts:	6 mm

3.4 CONSTRUCTION JOINTS AND CONTROL, OFFSET AND EXPANSION JOINTS

- .1 Create construction, control, isolation and expansion joints, as indicated on the drawings.
- .2 Clean joint surfaces to remove any alkaline laitance generated by over-vibration.
- .3 Construction joint positions and details not indicated on the drawings are subject to the Ministry representative's approval.
- .4 Caulk isolation joints using a sealer as specified in Article 2.1 of this specifications section.
- .5 **Construction joints**

- .1 Irregular construction joints are not permitted.
- .2 Horizontal construction joints in walls are not permitted.
- .3 Place construction joints where indicated on the drawings and as the Ministry representative may require, conditional to Contractor's work method, in which case construction joints are located in such way as to avoid reducing structural strength.
- .4 Create construction joints in beams and slabs for floors at one third of the span, except where a joist crosses a beam; offset isolation joint in the beam by a distance twice the width of the joist. Present detailed plan of structural slab joints to the Ministry representative for pre-approval.
- .5 Reinforcing steel shall be continuous through joint. Where necessary, joint shear strength is ensured through keyed joints formed in the concrete, special reinforcement or any other process deemed satisfactory by the Engineer.
- .6 For foundation walls (except where backfilled on both sides), slabs, walls and slabs exposed to the elements, and wherever required on the drawings, create construction joints using chamfer strips across entire length of joint, and caulk.
- .7 For columns, create construction joints in the lower section of the beams.

3.5 INSERTS (CONCRETE)

- .1 Create openings and place sleeves, ties, anchor bolts, hangers and other elements encased in concrete floors and walls as required by other trades.
- .2 Have sleeves, openings, etc. more than 100 mm x 100 mm or ϕ 100 mm in diameter and that are not indicated on the structural drawings approved by the Engineer.
- .3 Removing or displacing reinforcement to install hardware is not permitted. Where inserts cannot be encased in concrete as prescribed, obtain Ministry representative's approval for any modification.
- .4 Ensure that all indications on construction drawings relative to the location and size of sleeves, openings, etc., match the location and size of such on drawings for other trades.
- .5 Welding metal parts to reinforcing steel is strictly prohibited.

3.6 FORMWORK REMOVAL

- .1 After pouring concrete in conditions averaging 15 °C, proceed with stripping as follows, provided the curing method for exposed surfaces complies with specifications and is to the Ministry representative's satisfaction:
 - .1 Twenty-four (24) hours for walls and beam sides;
 - .2 Forty-eight (48) hours for columns;
 - .3 Twenty-eight (28) days for the underside of beams, slabs, decking and other framing members, or seven (7) days where forms are immediately replaced to Engineer's satisfaction with shoring for the remaining curing period, in accordance with standards pertaining to falsework.
 - .4 Twelve (12) hours for footings and abutments.
- .2 Provisions set out in Article 3.8.1 are for informational purposes only. Contractor remains solely liable for any breakage, settlement, as well as excessive cracking and deflexion of concrete elements due to premature formwork removal.
- .3 Install and maintain in place whatever falsework necessary until concrete components have reached sufficient strength to withstand, without excessive cracking or deflexion, their own weight as well as the service and construction loads they support.

3.7 EXPOSED CONCRETE SURFACES

- .1 All exposed concrete surfaces are indicated on the architectural drawings.
- .2 Install strips in the formwork when repairing concrete on existing exterior walls to ensure that new concreted surfaces are grooved similarly to the existing surfaces (width, thickness, spacing, length of grooves).

3.8 STRUCTURAL OVERSTRESSING

- .1 Take care not to overload existing structures beyond admissible load, taking into account their deteriorated states. Mandate an Engineer who is a member of the Ordre des Ingénieurs du Québec to assess work method, as needed.

SECTION 03 20 00: STEEL REINFORCEMENT FOR CONCRETE

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 REFERENCE CODES AND STANDARDS

- .1 Use the most recent edition of applicable reference standards, unless otherwise indicated.
- .2 Perform reinforcement work to CSA A23.1-14 « Concrete materials and methods of concrete construction », unless otherwise prescribed.

1.2 SHOP DRAWINGS

- .1 Submit a copy of reinforcing steel shop drawings to the Ministry representative at his request.
- .2 Obtain the Ministry representative's written pre-approval to substitute bars with dimensions other than those prescribed.
- .3 Bar lap lengths and extension lengths beyond critical points to CSA A23.3-14 « Design of concrete structures », unless otherwise indicated.
- .4 Clearly indicate bar dimensions, spacing, location and quantities of reinforcing steel, wire mesh, chairs, spacers and supports on shop drawings. Identify reinforcement with code marks as shown to permit correct placement without having to reference construction drawings, in accordance with the Reinforcing Steel Institute of Canada's manual. Clearly mark details presented on shop drawings on structural drawings.
- .5 As a general rule, bend all reinforcing steel to run parallel to the face of the concrete structures, as required on the drawings. Bend reinforcement at the plant, in compliance with shop drawings.

2. PRODUCTS

2.1 MATERIALS

- .1 Reinforcing steel: billet steel, grade 400 R, high adherence bars to CSA G30.18-09 (R2014) Carbon steel bars for concrete reinforcement, unless otherwise indicated.
- .2 Chairs, bolsters, bar supports and spacers: to CSA A23.1-14 « Concrete materials and methods of concrete construction » and supplement, sufficiently resistant and appropriate for reinforcing steel used. Use vinyl-covered chairs.
- .3 Mechanical splices: subject to the Ministry representative's approval.
- .4 Cold-drawn annealed steel wire ties: to CSA G30.3-M1983 (R1998) « Cold Drawn Steel Wire for Concrete Reinforcement ».

- .5 Reinforcing steel welded to inserts: grade 400 W, high adherence, light alloy, weldable steel bar, to CSA G30.18-09 (R2014) Carbon steel bars for concrete reinforcement.
- .6 Galvanized reinforcing steel: to CSA G164-18 « Hot dip galvanizing of irregularly shaped articles » unless otherwise indicated.

3. EXECUTION

3.1 SHAPING, PROTECTION, CLEANING AND PLACEMENT OF REINFORCING STEEL

- .1 Shape reinforcing steel within tolerance limits defined in the Reinforcing Steel Institute of Canada's Manual of Standard Practice.
- .2 Locations of reinforcement splices other than those shown on steel placement drawings are subject to the Ministry representative's approval.
- .3 Lay reinforcing steel on wooden pallets and protect adequately upon receipt at worksite, to prevent rusting. Clean steel of any significant traces of rust before placement, subject to the Ministry representative's approval.
- .4 Obtain the Ministry representative's approval of reinforcing steel and placement at least eighteen (18) hours prior to concrete placement.
- .5 During concrete pour, assign a person at the worksite to attend the entire operation and reposition any reinforcing steel bars and/or wire mesh displaced during pour.
- .6 **Welding of reinforcement bars shown on drawings is not authorized** unless otherwise indicated. If authorized, use grade 400 W weldable steel bars to CSA G30.18-09 (R2014) Carbon steel bars for concrete reinforcement. Use mechanical connectors only with Engineer's written approval.
- .7 Overlap wire mesh by 150 mm, unless otherwise indicated on the drawings.
- .8 Position wall and column dowels using forms or templates before concreting.
- .9 Moving a structural bar under a reinforcement bed for use as a tie rod or support rod is not authorized. In those cases, use additional bars as tie rods or support rods.
- .10 Supply materials, equipment and labour required to fabricate and install reinforcing steel specified on all drawings and/or required for complete and proper execution of work.
- .11 Supply and install all components required to support reinforcing steel and correctly maintain it in place, such as chairs, tie bars and spacers in decks, walls, slabs and beams, as well as cement bricks to support reinforcing steel and/or wire mesh required for slabs-on-grade, sills and decks.

- .12 Provide the Ministry representative, upon request, with an authentic copy of shop tests containing chemical and physical analyses of the steel supplied, at least two (2) weeks prior to starting reinforcement work.

3.2 FIELD BENDING

- .1 Field-bending of reinforcement bars is not permitted, unless otherwise indicated or as authorized by the Ministry representative.
- .2 Where authorization has been granted, bend bars without heat, applying slow, even pressure. Replace bars that develop cracks or splits, at own cost.

3.3 CONCRETE REINFORCEMENT COVER

- .1 Net minimum cover of concrete over reinforcement bars is as follows, unless otherwise indicated:

a)	Concrete surface exposed to inclement weather or backfilled:	
	• Beams, columns and footings	50 mm
	• Stirrups, fittings and spirals	40 mm
	• Slabs, walls and beams with 20M, 15M or 10M bars	30 mm
	• Slabs, walls and beams with 25M bars or greater	1.5 d_b (max. 50 mm)

3.4 HANDLING, INSTALLATION AND PROTECTION OF GALVANIZED REINFORCING STEEL

Where required on structural drawings, galvanized reinforcing steel to comply with following requirements:

- .1 Galvanized reinforcing steel: to CSA G164-18 « Hot dip galvanizing of irregularly shaped articles ».
- .2 Galvanization procedure to include chromate treatment, to Ministère des Transports du Québec's CCDG standard 5101 « Armature pour les ouvrages de béton ».
- .3 Formwork spacer bars and other spacers used in concrete elements with galvanized reinforcing steel: galvanized or manufactured from corrosion-resistant material.
- .4 Ensure equipment and supports used to transport galvanized reinforcing steel have protective contact surfaces. Protect bars from falling or being dragged on the ground. Store on worksite on protective supports and for no more than thirty (30) days.
- .5 Handle galvanized reinforcing steel with care, preventing damage to galvanization. Repair any damage to coating that occurs during manufacture, transportation or placement of reinforcing steel to ASTM A780/A780M-09 (2015) « Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings » Do likewise for cut ends, bends and all parts of mechanical reinforcement joints.

SECTION 03 30 00: CAST-IN-PLACE CONCRETE

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 REFERENCE CODES AND STANDARDS

- .1 Use the most recent edition of applicable reference standards, unless otherwise indicated.
- .2 Perform cast-in-place concrete work to CSA A23.1-14/A23.2-14 « Concrete materials and methods of concrete construction / Test methods and standard practices for concrete » and CSA A23.3-14 « Design of concrete structures ».

2. PRODUCTS

2.1 MATERIALS

- .1 Water and aggregates: to CSA A23.1-14 « Concrete materials and methods of concrete construction ».
- .2 Chemical admixtures: to ASTM C494 / C494M-17 « Standard Specification for Chemical Admixtures for Concrete ».
- .3 Concrete bonding agent: Sikatop Armatec 110, unless otherwise indicated.

2.2 SUPPLY OF CONCRETE

- .1 Clearly indicate truck number and characteristics of concrete mix on all delivery slips for premix or transit-mixed concrete.
- .2 Adding water to concrete mix during transport or at worksite is not permitted, Unless authorized in writing by the Ministry representative or testing laboratory.
- .3 Off-load concrete from trucks within two (2) hours after water and cement contact. **After this period of time, refuse concrete.** Coordinate adequate delivery of concrete to worksite with supplier. Ensure work is ready for concreting and sufficient workers are available to meet required deadline.

2.3 CONCRETE MIXES

- .1 Prepare normal-density concrete to Article 14 of CSA A23.1-14 « Concrete materials and methods of concrete construction » in order to obtain the required mix for each type of concrete specified in the drawings and specifications.
- .2 Type of concrete: unless otherwise specified on the drawings, prepare the following types of concrete:

Equipment bases (outdoor)

E-1

Type of concrete	Usual application and type of exposure (1)	Strength at 28 days (MPa)	Slump (mm)	Entrained Air (7)	Aggregate Materials Max. (mm)	Cement (3)
E-1	Hydraulic structures Exposed	35	80 ± 30	5 to 8%	20 ⁽²⁾	GUb-SF &FA (ternary)

NOTES:

- (1) Concrete exposure : To freeze/thaw cycles and/or de-icing salts (chlorides).
- (2) Aggregates : To CSA A23.2-14 « Test methods and standard practices for concrete »; provide statement certifying that aggregates are not subject to alkali-aggregate reactivity (AAR).
- (3) Type 10 SF cement : Binary cement containing 8.0 % ± 0.5% silica fume (a.k.a. type GUb-SF).
Type 10 cement : Normal cement, a.k.a. type GU.
- (4) Lean concrete : Where pumpable concrete is necessary, enrich mix (E/C) as required.
- (5) For sidewalks, curbs or exposed slabs : Provide granitic aggregates.
- (6) Slump : Basic slump is 80 mm ± 20 to which a superplasticizer is added to reach 175 mm ± 20.
- (7) Entrained air : Entrained air in concrete measured at pump outlet, as close as possible to final position of the concrete.
- .3 Upon request, provide document certifying that the mixing plant, equipment and materials used to batch concrete are to CSA A23.1-14 « Concrete materials and methods of concrete construction ».
- .4 To validate proposed mix designs, submit a document, prepared by an independent laboratory recognized by the Ministry representative, at least two (2) weeks before work begins, certifying based on tests that the mix design proposed will yield concrete to specifications and CSA A23.1-14 « Concrete materials and methods of concrete construction ». Mixes shall have undergone 7-day tests within 6 months. Average strength of six (6) samples for each mix to range between the following prescribed twenty-eight (28) day percentages:
- Gu and Gu_b – SF cements = 75% ± 10%
Gu_b – S/SF, Gu_b – F/SF and ternary = 70% ± 10%
- .5 Where required and according to inspections and field test results, correct mix designs to the Ministry representative's satisfaction and specification requirements.

- .6 Obtain the Ministry representative's approval before using chemical admixtures other than those prescribed.
- .7 Use of calcium chloride is prohibited at all times.
- .8 Where superplasticizers are added to ease concrete placement, maximum slump limited to 175 mm.
- .9 Adjust mixes when variations occur on the production side.

3. EXECUTION

3.1 CONCRETE SUPPLY AND PLACEMENT

- .1 Ensure reinforcement and inserts are not displaced during concrete placement.
- .2 Placing concrete into water requires the Ministry representative's special permission and strict compliance with his instructions.
- .3 Notify the Ministry representative or his representative twenty-four (24) hours prior to any concrete pour, specifying details regarding work involved and scheduled concreting start time.
- .4 Pour concrete from maximum height of 1.5 m; use chutes or troughs strategically placed to prevent concrete segregation.
- .5 Keep a sufficient number of vibrators on the worksite. Compact concrete using vibrators immersed in the concrete, fairly close together to obtain full consolidation. Avoid excessive vibration to prevent separation of concrete ingredients; avoid use of vibrators to force horizontal placement of concrete.
- .6 Provide equipment and labour required to perform concreting work (supply, placement, finishing, curing, joints, etc.) as specified on drawings.
- .7 Treat, finish, cure and repair all exposed concrete surfaces to Ministry representative's satisfaction.
- .8 Repair defective concrete surfaces (walls, beams, columns, etc.) to the Ministry representative's satisfaction.
- .9 Repair defective concrete floor surfaces to Architect's satisfaction.

3.2 WORKSITE CONCRETE QUALITY CONTROL

- .1 Submit samples of small and coarse aggregates and proposed mix designs to the Ministry representative fifteen (15) days prior to start of concreting work.
- .2 All testing, storage, shipping and curing methods: to CSA A23.2-14 « Test methods and standard practices for concrete ».
- .3 Independent laboratory designated and paid by Owner: take samples and perform tests at regular intervals to determine whether placed concrete complies with specified quality standards.
- .4 Keep a record of concrete pours indicating date and location of each pour, concrete characteristics, air temperature, and samples taken, even when a laboratory's services are retained.
- .5 Take three (3) cylinder samples for daily pours. If the day's pour exceeds 100 cubic metres, take three (3) additional cylinder samples for every additional 50 cubic metres of poured concrete. Store cylinders for curing period as laboratory specimens. Prepare an enclosure for this exclusive purpose.
- .6 Where concrete is prepared at the plant, perform entrained air and slump tests on concrete from each mixer. When concrete is prepared on worksite, perform entrained air and slump tests for every four (4) cubic metres of concrete poured or more often, if required by the Ministry representative.

3.3 CONSTRUCTION JOINTS

- .1 Clean surface of construction joints before beginning next concreting phase or step; remove any alkaline laitance from concrete over-vibration as well as any foreign matter.
- .2 Roughen surface of hardened concrete from prior pour and apply concrete adhesive before pouring new concrete.

3.4 SURFACE FINISH

- .1 Exterior walls: monolithic finish with steel or wood trowel.
- .2 On all wall walls that have been repaired, apply Sikagard SN100 silane based sealant from Sika Company or approved equivalent as recommended by the manufacturer.
- .3 Apply protective coating when surfaces are dry and clean, and the temperature is above 10 degrees Celsius.

3.5 DEFECTIVE CONCRETE

- .1 The Ministry representative may order demolition, replacement or repair of any defective concrete or concrete deemed non-compliant with specifications. Assume all direct and indirect costs associated with this work.

3.6 OPENINGS AND INSERTS TO BE ENCASED IN CONCRETE

- .1 Submit any proposed opening not indicated on structural drawings to the Ministry representative for approval.
- .2 Install all inserts to be encased in concrete (drains, conduits, pits, sleeves, access hatches, etc.) required for work, as specified on drawings for other disciplines.
- .3 Drill openings in existing concrete as directed by the Ministry representative and only after obtaining his authorization. Use a silicon carbide saw or diamond drill bit.
- .4 Mandate a laboratory to perform "Ferroskan" X-ray imaging to precisely locate existing rebar when structural drawings require drilling holes in a column, beam, slab or any other concrete element containing large amounts of reinforcement, in order to install anchors and/or reinforcement bars, to prevent cutting or damaging existing reinforcement when drilling. Pay laboratory's fees for such work.

3.7 CURING

- .1 As soon as concrete is placed, protect it from premature evaporation, extreme temperatures and inclement weather. Maintain concrete at near constant temperature during cement hydration and concrete hardening period. Ensure moisture loss during this time is minimal.
- .2 **Normal curing:**
Immediately after concrete placement and before concrete dries, cure concrete for a minimum of seven (7) consecutive days, according to one of the following methods:
 - a) Ponding or continuous spraying;
 - b) Geotextile membrane or absorbent material kept constantly wet.

Notes:

- a) Florseal-type liquid or other similar curing compounds may only be used with the Ministry representative's written authorization.
- b) Materials used for curing concrete to one of the following standards:

ASTM C171-16

Standard Specification for Sheet Materials for Curing Concrete

ASTM C309-11

AASHTO M182-05 (2017)

Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats”

”

.3 Curing in hot weather:

Provide continuous and uninterrupted spraying of surfaces when ambient air temperature is 25 °C or higher. Protect surfaces with geotextile membrane or absorbent material kept constantly wet.

.4 Curing in cold weather:

In freezing weather, stop using water twelve (12) hours before end of specified protection period.

.5 Accelerated strength gain

When early strength gain is desired rather than using a normal curing method and time, obtain the Ministry representative's permission.

3.8 PROTECTION AND PREPARATION IN HOT AND COLD WEATHER

- .1 Two (2) days before pouring concrete, obtain the Ministry representative's authorization for proposed method for protecting and curing concrete in adverse weather conditions.
- .2 Adequately protect freshly-placed concrete from damage caused by inclement weather and other disturbances.

**TEMPERATURE LIMITS FOR CONCRETE AT TIME OF DELIVERY
AND PLACEMENT**

THICKNESS OF ELEMENT	Concrete temperature limits at time of delivery to worksite and placement, in °C	
	Minimum	Maximum
Less than 0.3 m	10	35
Between 0.3 and 1 m	10	30
Between 1 m and 2 m	5	25
More than 2 m	5	20

.3 Protection in hot weather:

When ambient temperature is 25 °C or higher or when temperature is expected to reach 27 °C during placement (according to weather forecasts), take special precautions to maintain concrete temperature as low as possible; concrete temperature never to exceed the limits stipulated in the table entitled, *“Temperature limits for concrete at time of placement.”*

.4 Protection in cold weather:

- a) When ambient temperature is 5 °C or lower or when temperature is likely to drop to that level within twenty-four (24) hours following placement and there is a risk of premature frost (according to weather forecasts), take measures necessary to protect and heat so temperature of concrete placed is never, under any circumstance, lower than the minimum threshold stipulated in the table entitled, *“Temperature limits for concrete at time of placement.”*
- b) Before concrete is placed on any surface, remove any snow and ice. Use of calcium chloride in forms as a de-icing agent is prohibited.
- c) Implement aforementioned protection measures by building an enclosure around the concrete structure, covering concrete surface with raised tarpaulins or using a sufficient thickness of insulation as stipulated in the table entitled, *“Concrete protection and curing”* during curing period when average daily air temperature is lower than 5 °C.
- d) Maintain concrete temperature above 5 °C for the seven (7) days immediately following pour. Keep concrete temperature above freezing point at all times. To shorten this period, demonstrate that compressive strength of concrete under worksite conditions corresponds to a minimum of 70% of specified strength, and then obtain the Ministry representative’s written authorization.

CONCRETE PROTECTION AND CURING

REQUIREMENTS	Mean daily outdoor temperature	
	Smallest dimension in the element: less than 1 m	Smallest dimension in the element: greater than 1 m
Normal curing / adequate enclosure and heating or insulation	Below 0 °C	Below -5 °C
Normal curing / appropriate cover & adequate insulation	Between 0 °C and 5 °C	Between -5 °C and 5 °C
Normal curing / no protection required	Between 5 °C and 25 °C	Between 5 °C and 20 °C
Continuous water curing to minimize concrete temperature rise	Above 25 °C	Above 20 °C

SECTION 03 37 13: SHOTCRETE

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 MEASUREMENT FOR PAYMENT PURPOSES

- .1 Measurement of volume of shotcrete in cubic metres of shotcrete incorporated into work.
- .2 Measure shotcreted surfaces and thicknesses after chipping and surface preparation is complete and accepted by the Ministry representative, and prior to application of shotcrete. Only thickness of shotcrete approved by the Ministry representative will be measured for payment.
- .3 Measurement for payment excludes following elements and work:
 - .1 Testing procedures;
 - .2 Surface preparation;
 - .3 Removal, disposal and replacement of defective concrete;
 - .4 Reinforcement bars;
 - .5 Anchor bolts;
 - .6 Clean-up procedures;
 - .7 Scaffolding;
 - .8 Protective coating.

1.2 REFERENCE CODES AND STANDARDS

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO T277-15 « Standard Method of Test for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration ».
- .2 American Concrete Institute (ACI)
 - .1 ACI 506R-16 Guide to Shotcrete
 - .2 ACI 506.2-13 Specification for Shotcrete
- .3 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C42/C42M -18 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - .2 ASTM C618 - 17a Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - .3 ASTM C642 - 13 Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.
 - .4 ASTM C1116/C1116M-10a(2015) Standard Specification for Fiber-Reinforced Concrete.
 - .5 ASTM C1140/C1140M-11 Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-3.3-14 « Kerosene »

- .5 Canadian Standards Association (CSA) / CSA International
 - .1 CSA-A23.1/A23.2 – latest edition, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-G164 – latest edition, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .6 Cahier des charges et devis généraux (CCDG – latest edition) – Ministère des Transports du Québec.

1.3 DEFINITIONS

- .1 The two basic shotcreting processes are:
 - .1 Dry mix process where mix water is added at nozzle.
 - .2 Wet mix process where mix water is added before concrete enters delivery hose, and compressed air is added at nozzle.
- .2 Rebound: material that bounces off surface being shotcreted. It consists primarily of coarse particles and contains lower proportion of cement than shotcrete mix.
- .3 Overspray: shotcrete material deposited away from intended receiving surface.

1.4 WORKERS' QUALIFICATIONS

- .1 Operators of equipment for mixing and application of shotcrete: experienced in process to be used.
- .2 Operators: qualified to perform work.
- .3 Foremen: minimum two (2) years of experience as shotcrete nozzlemen, on similar projects.
- .4 Nozzlemen: minimum twelve (12) months of experience on similar applications.
- .5 Workers assigned to shotcrete work are subject to the Ministry representative's approval, for entire duration of work.
- .6 Include proposed operators' and foremen's names along with an updated resume for each person.
- .7 Assume sole responsibility for work methods used to obtain optimal results, according to best practices and to specifications set out in drawings and specifications.

1.5 PRELIMINARY TESTING PRIOR TO EXECUTION OF WORK

- .1 At least two (2) weeks before start of shotcrete work, make two (2) moulds for shotcrete samples and spray intended shotcrete mix into them. Ensure preliminary tests are performed according to work execution schedule.
- .2 Moulds: composed of 900 x 900 x 150 mm wood panels, at depth and angle similar to work. Install reinforcing steel in moulds to requirements in drawings and specifications.
- .3 These preliminary tests are required to demonstrate Contractor's ability to produce shotcrete of the required quality, using the specified team, equipment, materials, construction method and mix. Perform tests at worksite.
- .4 Cure test panels for three (3) days under conditions similar to the site and to specifications in the drawings and specifications. A laboratory mandated by the Customer will perform the following tests on both panels:
 - Compression strength at three (3) days, seven (7) days and twenty-eight (28) days: to CSA A23.2-14 « Test methods and standard practices for concrete »;
 - Spacing factor (L) test: to CSA A23.2-14 « Test methods and standard practices for concrete »;
 - Absorption and permeable void tests: to ASTM C642 - 13 Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.

1.6 INSPECTION AND TESTING DURING WORK

- .1 A laboratory retained and paid by the Customer will perform tests during construction work, according to applicable standards. Customer to assume all testing costs except tests that reveal a non-compliance.
- .2 Make four (4) test panels measuring at least 450 x 450 x 150 mm and spray concrete at the same angle as that used when completing work. Shotcrete samples the same morning as the shotcrete work requested in the drawings and specifications.
- .3 One test panel on each surface to repair for this project.
- .4 A laboratory mandated by the Customer will perform the following tests on both panels:
 - Compression strength at three (3) days, seven (7) days and twenty-eight (28) days: to CSA A23.2-14 « Test methods and standard practices for concrete »;
 - Spacing factor (L) test: to CSA A23.2-14 « Test methods and standard practices for concrete »;
- .5 The laboratory may sample cores directly from the wall of the structure in order to perform the following tests:
 - Absorption and permeable void tests: to ASTM C642 - 13 Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.

- .6 Apply shotcrete to additional panels for testing, if requested by the Ministry representative and/or laboratory.
- .7 Twenty-four (24) hours after shotcreting, the Ministry representative will test shotcreted surfaces with a hammer to find depressional areas and/or poorly adhered spots. Remove and replace shotcrete in depressional areas identified by the Ministry representative, at own cost.
- .8 Proceeding with shotcreting constitutes express acceptance that the substrate is solid and complies with drawings and specifications. An improperly prepared surface may not be used as grounds to justify refusal to repeat work as requested by the Ministry representative.
- .9 Other than aforementioned laboratory tests, shotcreted surfaces to be uniform and free of the following defects, as determined by the Ministry representative:
 - Convex surface
 - Excessive cracking
 - Areas of delamination

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from worksite and dispose of all packaging materials at appropriate recycling facilities.
- .2 Disposal of unused plasticizers, water reducing agents and air entraining admixtures into sewer systems, waterways, lakes, onto the ground or in locations where it will pose health or environmental hazard is not permitted.

2. PRODUCTS

2.1 MATERIALS

- .1 Concrete mixes and materials: to Section 03 30 00 – Cast-in-Place Concrete and as specified below.
 - .1 Shotcrete aggregate gradation: to CSA A23.1-14/A23.2-14 « Concrete materials and methods of concrete construction / Test methods and standard practices for concrete » and within limits specified.

Sieve Designation	% Passing
14 mm	100
10 mm	100
5 mm	95-100

2.5 mm	80-100
1.25 mm	50-90
0.630 mm	25-65
0.315 mm	10-35
0.160 mm	2-10

- .2 Silica fume: from production of silicon or ferro-silicon alloys containing at least 75% silicon.
 - .3 Fly ash: to ASTM C618 - 17a Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete ».
 - .4 Use of admixtures subject to approval of the Ministry representative and/or laboratory.
 - .5 Use of calcium chloride or products containing calcium chloride is not permitted.
- .2 Reinforcing steel: to Section 03 20 00 – Steel Reinforcement for Concrete.
 - .3 Steel anchors, supports and spacers: galvanized to CSA G164-18 « Hot dip galvanizing of irregularly shaped articles ».
 - .4 Mixing water: clean and free of oil, acid, silt, organic matter, alkali, salt or other impurities and to CSA A23.1-14 « Concrete materials and methods of concrete construction ».
 - .5 Synthetic fibres: structural synthetic fibres such as Tufstrand SF by Euclid or approved equivalent incorporated in the concrete mix.

2.2 EQUIPMENT

- .1 Shotcreting equipment: to aforementioned standards.
- .2 Batching equipment appropriate for mixing aggregate, water, admixtures, cement and fibres according to weight of dry materials. Measuring equipment: to CSA A23.1-14 « Concrete materials and methods of concrete construction ».
- .3 Use air supply system that delivers air at constant and sufficient air pressure during shotcreting, free of oil contamination.
- .4 Equipment capacity: sufficient to place all shotcrete for a pre-established area within no more than six (6) hours.
- .5 Provide a separate flexible compressed air hose and nozzle (blow pipe) to remove rebound, dust and splatters during the shotcreting process.
- .6 Use a pre-wetting long nozzle, where the water injection ring is at least three (3) metres before the shotcrete outlet.

- .7 Have equipment approved by the Ministry representative and keep in good working condition. Provide, during shotcreting process and at the Ministry representative's request, additional test panels and cores to demonstrate proper equipment operation.
- .8 Provide spare equipment (spraying equipment, generator, pumps, etc.) in case equipment in use breaks down, in order to complete work in a given area within the prescribed time frame, and prevent forming of cold joints. Claims for costs resulting from broken equipment are not permitted. Furthermore, assume all costs resulting from broken equipment (delays, professional fees, supervision costs, laboratory fees, demolition costs and/or costs for redoing work in certain sections of the structure, etc.).
- .9 Provide a tank containing a sufficient amount of fresh water to complete all shotcreting operations.
- .10 Provide equipment to preheat and maintain mixing water at a temperature of 20 degrees Celsius.

2.3 MIXES

- .1 Proportion concrete for dry or wet process shotcrete to: CSA A23.1-14/A23.2-14 « Concrete materials and methods of concrete construction / Test methods and standard practices for concrete », with the following properties:
 - .2 Use Gub-SF & FA type cement. (Refer to Section 03 30 00.)
 - .3 Silica fumes: maximum 15% by mass of cementitious material in the concrete.
 - .4 Synthetic fibres: 3.6 kg/m³.
 - .5 Minimum compressive strength in place as determined from cores taken from test panels to ASTM C42/C42M-18 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete », as follows:
 - .1 4 MPa at eight (8) hours.
 - .2 14 MPa at three (3) days.
 - .3 30 MPa at seven (7) days.
 - .4 35 MPa at twenty-eight (28) days.
 - .6 Minimum cement content: ratio of cement to aggregate to be 1 to 4 by mass.
 - .7 Minimum water/cementitious materials ratio: 0.40.
 - .8 Air bubble spacing factor: 300 microns.
 - .9 Curing accelerator admixture (powder form): sufficient quantity for final set time between 1.5 and 2 hours – to be adjusted with the laboratory.

- .10 Air entraining admixture (powder form): sufficient quantity for air bubble spacing factor in hardened concrete less than 300 microns – to be adjusted with the laboratory.
- .11 Rapid chloride permeability:
 - .1 Shotcrete containing silica fumes: maximum 1000 coulomb at seven (7) days.
 - .2 Latex-modified shotcrete: maximum 1500 coulomb at seven (7) days.
- .12 At least ten (10) days before starting preliminary tests, provide laboratory with mix formulas that will produce concrete that complies with these specifications, and with performance and properties to CSA A23.1-14 « Concrete materials and methods of concrete construction ».
- .13 Revise and correct concrete mix designs as required following preliminary tests, to the Engineer's and/or laboratory's satisfaction.
- .14 Obtain Ministry representative's and/or laboratory's approval before using chemical admixtures other than those prescribed in these specifications.
- .15 Use of calcium chloride is prohibited at all times.
- .16 At least ten (10) days prior to start of preliminary tests, provide laboratory with chemical analysis of cement, particle sizes, density and absorption of aggregate materials and sand, as well as technical data sheets for admixtures and synthetic fibres intended for use.
- .17 Admixtures: powder form, added to mixture during bagging operations.

3. EXECUTION

3.1 SURFACE PREPARATION

- .1 Prepare surfaces for shotcreting to ACI 506R – latest edition and install reinforcement bars and inserts as specified on drawings and specifications.
- .2 Remove unsound concrete with equipment approved by the Ministry representative and to specifications in Section 02 41 16. Remove concrete only in areas and to depths indicated on drawings and specifications.
- .3 Before beginning any shotcrete process, wash walls completely by sandblasting or other Ministry representative-approved method to remove all traces of dirt, mud, debris, oil, concrete splatter, drops or other hindrance. Project shotcrete onto wet walls. Projecting onto frozen surfaces is not permitted.
- .4 Where shotcrete is used to repair existing concrete surface, clean existing surface and reinforcement materials to be shotcreted by sandblasting or spraying with high-pressure water. Submit surface preparation techniques and methods to the Ministry representative for approval.

- .5 Clean to ensure no traces of unsound concrete, rust or other dirt remains, to the supervisor's satisfaction.
- .6 Sandblasting equipment and intensity should not damage surrounding surfaces. Take necessary precautions to protect existing work and surroundings during work.
- .7 Clean bottom of formwork using compressed air, high-pressure water jet or vacuum to remove all debris and foreign materials.
- .8 Wet surfaces to be shotcreted with fresh water for at least one (1) hour prior to shotcreting to obtain a saturated and clean surface. Remove excess water in crevices or bottom of formwork. Ensure surface is in saturated surface-dry condition when shotcrete is applied.

3.2 APPLICATION OF SHOTCRETE

- .1 Apply shotcrete to surfaces prepared to Cahier des charges et devis généraux – Infrastructures routières – Construction et réparation, édition 2018 (CCDG) du ministère des Transports du Québec.
- .2 Only apply shotcrete to surface that is free of running and standing water, ice, frost and snow.
- .3 Apply shotcrete when winds are not high, temperature is above 5 degrees Celsius and it is not raining.
- .4 Protect adjacent surfaces from shotcrete and rebound during operations and clean up material deposited.
- .5 Continuously remove rebound from surfaces during application of shotcrete.
- .6 Reuse of rebound or overspray material is not permitted. Dispose of surplus material off site in accordance with Section 01 35 43 – Environmental Protection.
- .7 Apply shotcrete to Ministry representative approved surfaces, after receiving the Ministry representative's authorization to proceed. Allow supervisor to access shotcreted surfaces at all times. Rinse surface with fresh water immediately before shotcrete application.
- .8 The Ministry representative may order work to stop, without prejudice, if he deems the nozzleman's work is unacceptable or the equipment is inappropriate or defective.
- .9 Apply shotcrete when winds are not high, temperature is between 5 °C and 35 °C and there is no risk of it falling below 5 °C in the twenty-four (24) hours following application, and it is not raining. If it rains unexpectedly, immediately cease application operations and finish shotcrete surface as quickly as possible.
- .10 Store pre-bagged concrete and mixing water in a storage area heated to 20 °C for forty-eight (48) hours before the day shotcrete application is to take place. On the day of application,

transport materials to site, taking care to maintain the bag and water tank temperatures at 20 °C.

- .11 Take whatever precautions necessary to prevent voids behind the reinforcement bars.
- .12 Use of screeded or rebound materials in a subsequent shotcrete application is not permitted.
- .13 Adequately protect previously shotcreted surfaces with polythene sheeting to prevent accumulation of shotcrete rebound and dust.
- .14 Assign a worker to continuously remove rebound from surfaces to be shotcreted using a blow pipe, throughout shotcreting process.
- .15 Install markers on surfaces to be shotcreted, indicating required finished shotcrete thickness.
- .16 Begin shotcreting in deepest areas to create an even surface before applying final layers. Apply specified thickness of shotcrete in a single layer, wherever possible. If a single operation is not plausible, obtain Ministry representative's authorization for shotcreting in successive layers and follow provisions set out in Article 3.2.21 of this section.
- .17 Apply shotcrete to build concrete surface to finished lines and tolerances indicated on drawings.
- .18 Screed and finish shotcreted surfaces with a trowel to the Engineer's satisfaction and as determined during preliminary tests. Take necessary measures during finishing and screeding to prevent breaking or delaminating the fresh concrete.
- .19 Plan shotcreting application to ensure there will be no cold joints parallel to the projection surface.
- .20 Install formwork to create a 90° angle to create vertical construction joints. When work is resumed, ensure joint is completely cleaned and wet to obtain a saturated surface-dry condition, before being subjected to a jet of compressed air.
- .21 If two or more passes of shotcrete are necessary to reach finish thickness, plan work such that the time between the two shotcrete layers does not exceed two (2) hours or the shotcrete's final set time. Depending on the temperature or how work progresses, the Ministry representative or his representative may request that the underlying surface be cured, protected and adequately cleaned prior to applying subsequent passes.

If the underlying layer has not set up, vigorously brush the surface with a stiff-bristle broom to remove loose or rebound materials prior to shotcreting the next layer. Ensure shotcrete surfaces awaiting application are in saturated surface-dry condition when next layer of shotcrete is applied. When shotcreting in successive layers, keep waiting layers wet by spraying water mist or using evaporation reducer.

- .22 Divide shotcrete work into four (4) pre-defined areas. Create vertical joints in corners. Undertake necessary measures to perform all shotcrete work in one area on the same day.

3.3 SHOTCRETE SURFACE FINISHING

- .1 Finish shotcrete surface to the Ministère des Transports du Québec's CCDG. Where there is excess material, screed concrete surface using a straightedge tool. Level and finish with a wooden trowel or mechanical finisher with a rubber surface. Finishing equipment: approved by the Ministry representative. Use of steel trowels is not permitted.
- .2 Apply shotcrete to build concrete surface to finish lines indicated on the drawings. Permissible tolerance: 10 mm below and 15 mm above. Steel parts: encased in minimum thickness of 75 mm.
- .3 Apply silane-based sealing agent such as "Sikagard SN100" by Sika or approved equivalent, as recommended by manufacturer, to walls that were repaired.
- .4 Apply protective coating to clean, dry surface when air temperature is above 10 degrees Celsius.

3.4 CURING AND PROTECTION OF SURFACES

- .1 Comply with prescriptions relating to curing and protection in hot and cold weather as set out in specifications Section 03 30 00 – Cast-in-Place Concrete.
- .2 Curing: begins immediately after shotcrete surface finishing and no more than 1.5 hours after shotcreting. Cure surfaces with water (fresh or saltwater) for seven (7) days. Use perforated spray hoses. Install hoses around the vertical part of the steel hull. Water flow should not wash off the shotcreted surface.

3.5 REPEATING REFUSED SHOTCRETE REPAIRS

- .1 Replace shotcrete refused by the Ministry representative. Repair method: identical to the shotcrete already placed unless the Ministry representative approves an alternative method.
- .2 Proceed with shotcrete repairs as follows:
 - .1 Shotcrete that has not attained initial set:
 - .1 Scrape off defective shotcrete with a trowel, remove laitance and damaged parts on the surface using a broom, taking care not to damage the concrete to remain in place, but making sure to clear the reinforcing steel such that proper adherence will take place.
 - .2 Outline repair surface with 90-degree angles.
 - .3 Apply shotcrete before initial set is attained, to requirements set forth in these specifications.

- .2 Shotcrete that has attained initial set:
 - .1 Outline the problem area with a sawcut at least 50 mm in depth. Remove defective concrete using a light-duty pneumatic hammer. (Refer to Section 02 41 16 – Structure Demolition, in these specifications.)
 - .2 Prepare shotcrete surface and apply shotcrete to requirements set forth in these specifications.

SECTION 05 12 23: STRUCTURAL STEEL FOR BUILDINGS

DISCIPLINE: STRUCTURE AND CIVIL ENGINEERING

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1. GENERAL

1.1 REFERENCE CODES AND STANDARDS

- .1 Use the most recent edition of applicable reference standards, unless otherwise indicated.
- .2 Execute structural steel work to CSA S16-14 « Design of steel structures », unless otherwise indicated.
- .3 Execute welding work to CSA W59-18 « Welded Steel Construction », unless otherwise indicated.

1.2 QUALIFICATION, CERTIFICATE OF INSPECTION AND CERTIFICATE OF COMPLIANCE

- .1 Ensure all employees assigned to perform welding work have Canadian Welding Bureau certification according to the provisions of Standard CSA W47.1-09 (R2014) "*Fusion Welding of Steel Company Certification*" for division 1 or division 2.1. Submit two (2) copies of this certificate to the Ministry representative's request.
- .2 Submit two (2) certified copies of mill test reports showing chemical and physical properties of steel to be incorporated in project, to the Ministry representative at his request.
- .3 Provide the Commission de Santé et Sécurité du Travail du Québec (C.S.S.T.) with all certificates required under the Safety Code for the Construction Industry or the Act Respecting Occupational Health and Safety, including those required to bear the signature and seal of an engineer who is a member in good standing with the Ordre des Ingénieurs du Québec.

1.3 ASSEMBLY DESIGN

- .1 Submit one (1) copy of the calculations (design) for all assemblies to the Ministry representative for comments upon request. Contractor is responsible for providing adequate assemblies in terms of dimensions, capacity and general layout, regardless of any indication to the contrary in the aforementioned reference standards.
- .2 Design all frame member assemblies for following minimum strength, unless otherwise indicated by the Ministry representative or where structural configuration entails more stress:
 - .1 BEAMS
100% of shear force under uniform load corresponding to beam flexural strength when supported laterally. In the case of composite beams, consider flexural strength of beam as 100% composite.
- .3 Splicing in members subject to tensile or bending stress is not acceptable, unless otherwise indicated beforehand by Engineer. Where authorized by the Ministry representative, identify

splices on shop drawings. Assume costs for X-ray tests. Submit X-ray test results to the Ministry representative.

1.4 SHOP DRAWINGS

- .1 Except for standard assemblies listed in CISC's H.S.C. Manual, ensure each drawing submitted bears the signature and seal of an engineer in good standing with OIQ (Ordre des Ingénieurs du Québec).
- .2 Indicate details and information necessary on all shop drawings for shaping and erection purposes, including cuts, notches, assemblies, holes, threaded anchors and welds. Use symbols recommended by the Canadian Welding Bureau to represent welds.
- .3 Submit description of work methods, erection sequence, materials and equipment for erecting structure to the Ministry representative for comments, upon request. Contractor remains exclusively responsible for construction methods, equipment and execution of the Work at all times.
- .4 Submit welding procedures for all structural components that require seam welds and rail welds to the Ministry representative for comments, upon request.
- .5 The shop drawing control procedure is designed to allow the Ministry representative to assess overall compliance of the work with contract requirements. Comments and/or corrections written on shop drawings do not release Contractor of its responsibility to comply with all contract requirements nor do they imply any endorsement or approval in the event a deviation from these requirements occurs.
- .6 The purpose of the shop drawing review procedure is to provide the Ministry representative an opportunity to detect any major non-conformance or gross deviation arising from, for example, a misunderstanding or non-comprehension of project requirements. In no case shall the review constitute an exhaustive verification of the information contained therein.

1.5 CERTIFICATE OF COMPLIANCE - CNESST

- .1 Provide the Commission des normes, de l'Équité, de la santé et sécurité du travail du Québec (CNESST) with all certificates required under the Safety Code for the Construction Industry or the Act Respecting Occupational Health and Safety, including those required to bear the signature and seal of an engineer who is a member in good standing with the Ordre des Ingénieurs du Québec. This includes certification of post anchor rod compliance with erection diagram as well as certification of erection procedure compliance when posts are anchored with less than four (4) anchor rods (ref.: Articles 3.24.10 and 3.24.11 of the *"Modifications réglementaires au Code de sécurité pour les travaux de construction et Règlement sur la santé et la sécurité au travail"*).
- .2 Design erection and verify anchor rod installation in order to provide required certifications.

2. PRODUCTS

2.1 MATERIALS

- .1 Structural steel: to CSA G40.21-13 « Structural quality steel », grade 350 W for regular I-shaped sections, grade 300 W for C-shaped steel, angle-sections and plates, grade 350 W class C or ASTM A500 / A500M – 18 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes class C for tubular sections, unless otherwise indicated on the drawings.
- .2 Anchor bolts: to ASTM A307-14e1 « Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength» unless otherwise indicated.
- .3 Bolts, nuts and washers: to ASTM F3125 / F3125M - 15a Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions».
- .4 Welds: to CSA W59-18 « Welded Steel Construction ».
- .5 All structural elements required for this project must be hot dip galvanized. Hot-dip galvanizing with a zinc layer of at least 600 g / m², conforming to CSA G164-18 « Hot dip galvanizing of irregularly shaped articles ».
- .6 No-shrink grout under base plates or other components in contact with concrete: Sikatop 212 or Engineer-approved equivalent.

3. EXECUTION

3.1 SHAPING AND MARKING

- .1 Shape steel elements to CSA S16-14 « Design of steel structures ».
- .2 Install shear studs to CSA W59-18 « Welded Steel Construction ».
- .3 Holes 11 to 27 mm in diameter required for assembly: made with a punch or any other drilling method except blow torch.
- .4 Cut edges on steel plates and frame members: smooth and free of cracks, voids and fractures.
- .5 Mark materials to CSA G40.20-13 « General requirements for rolled or welded structural quality steel ». Die-stamping is prohibited. When steel element is to remain unpainted, stamp mark in locations not from outside after erection.
- .6 Match marking for field assembly: shop mark bearing assemblies and splices for fit and match.

- .7 Supply labour, equipment, and materials required for shop drawings, site fabrication and erection of all structural steel shown on drawings and/or described in this section of these specifications.
- .8 Before completing shop drawings, validate on site all dimensions, elevations, clearances required to fabricate structural steel for erection in the existing. Information provided on drawings with regards to existing structures is not guaranteed to be accurate or complete. The Contractor is responsible for ensuring such.
- .9 Ensure temporary steel construction bracing meets codes and regulations in force.
- .10 Supply anchor bolts, mechanical and chemical anchors, base and anchor plates, and angle-sections with anchors (weldable reinforcing steel or other) to be encased in concrete, as stipulated in this section and/or shown on the drawings.
- .11 Supply and apply no-shrink grout under column base plates or beams in contact with concrete. Provide heating during placement and curing as needed.
- .12 Take care not to overload existing structures or structures under construction beyond admissible load, as indicated on the drawings.
- .13 Galvanize steel components (such as masonry lintels, anchor bolts, concrete-encased plates, steel grating, opening frames, etc.) that will be exposed to inclement weather or may come into contact with water or chemical products.

3.2 ERECTION, TOLERANCES AND WORKSITE CLEANING

- .1 Erect structural steel to CSA S16-14 « Design of steel structures » and as indicated on shop drawings. Comply with erection tolerances specified in standard CSA S16-14 « Design of steel structures » unless otherwise indicated on drawings.
- .2 Exterior welds: continuous seal welds, ground smooth.
- .3 Obtain written authorization from the Ministry representative to field cut or alter structural steel frame members.
- .4 When erection is complete, touch up bolts, rivets, welds and surfaces where paint has been burned, scratched or is missing, as indicated in Article 2.1. Degrease bolts in structure before applying finishing paint.
- .5 Mechanically drill holes that were not shop-punched but are required at the worksite for erection purposes. Use of a torch to create holes is prohibited.
- .6 Support column base plates with metal wedges to allow placement of grout to specifications indicated on drawings.

- .7 Upon completion of work, remove all surplus materials, tools, equipment, and debris and leave worksite in clean condition, to the Ministry representative's satisfaction.

3.3 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship: performed by testing laboratory designated by the Ministry representative.
- .2 Owner will pay costs of tests except where a **second inspection** is required after unsatisfactory work, which shall be at Contractor's expense.
- .3 Perform non-destructive tests on a representative sample, according to one of the following methods, as determined by the Ministry representative:
- X-ray test for butt welds and track welds
 - Magnetic particle inspection for fillet welds
 - Ultrasonic weld inspection for full penetration welds

Collaborate in testing procedures and provide any assistance testing laboratory may require, at no extra cost. When the Ministry representative deems a weld to be defective, perform **additional inspections** of welds executed by the same welder immediately before and after the defective weld. Correct work to the Ministry representative's satisfaction at no extra cost to the Owner.

- .4 Provide Ministry representative free access, at any time, to the shop and worksite to verify, examine and monitor the quality of materials and fabrication, and to take samples for testing and analysis. Provide any assistance (labour, materials, equipment) required by the Ministry representative as needed and at no extra cost.
- .5 All welds may be submitted to non-destructive testing by the laboratory.
- .6 Destructive tests may be required by the Ministry representative toward the certification of welders' qualifications and for tensile load or bend tests.
- .7 Where required by the Ministry representative, retain any specified element at the shop until Departmental Representative authorizes shipping to the worksite.
- .8 Chisel, melt and grind all defective welds until all traces of imperfection have disappeared before performing new weld.
- .9 In the case of **contact** bolted assemblies, fully tighten bolts until all surfaces involved are firmly in contact.
- .10 Ministry representative and/or laboratory may re-inspect bolts as described in the previous paragraph. If bolt tightening inspection was not carried out as required, pay cost for inspections performed by laboratory.

- .11 For hot-dip **galvanized parts**, seal parts in contact ahead of time with continuous welds. Notify the Ministry representative five (5) days prior to start of galvanization operations.
- .12 Welding a galvanized steel element is prohibited, except with Ministry representative's written authorization.

3.4 STRUCTURAL OVERSTRESSING

- .1 Take care not to overload existing structures beyond admissible load, taking into account their deteriorated states. Mandate an Engineer who is a member of the Ordre des Ingénieurs du Québec to assess work method, as needed.

APPENDIX

CONCRETE CHARACTERIZATION REPORT

ABS REPORT

**SEPTEMBER 2017
(CA-17-2035 REV 2)**