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PROJECT TITLE Burlington Canal Lift Bridge (BCLB)
1157 Beach Boulevard
Skew Control and Electrical Repairs

PROJECT NUMBER R.109141.001

PROJECT DATE 2020-04-20

PWGSC Ontario
Region Project
R.109141.001

SEALS PAGE

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PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
BURLINGTON CANAL LIFT BRIDGE
Skew Control and Electrical
Repairs

SIGN-OFF SHEET

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PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Title and description of Work.
- .2 Work Covered by Contract Documents.
- .3 Contract Method.
- .4 Cost Breakdown.
- .5 General Requirements.
- .6 Work sequence.
- .7 Contractor use of premises.
- .8 Work Restrictions.
- .9 Owner occupancy.

1.2 PRECEDENCE

- .1 Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 WORK COVERED BY
CONTRACT DOCUMENTS

- .1 Work of this Contract comprises the procurement, installation and testing of a replacement and enhanced skew control system for the Burlington Canal Lift Bridge, located at 1157 Beach Blvd, Hamilton, Ontario. The scope and extent of work is as shown on the Drawings.
- .2 Work includes but is not limited to the fabrication and installation of absolute encoders on tower machinery and an inclinometer mounted on the moving structure as indicated on the Contract Drawings.
- .3 Work includes but is not limited to modifications to the existing bridge control system logic, the addition of a monitoring, alarming and trip control system algorithm, and modifications and enhancements to the existing bridge auxiliary drive form of bridge operation.

1.4 CONTRACT METHOD

1.5 COST BREAKDOWN

1.6 GENERAL
REQUIREMENTS

- .1 The contractor shall verify existing system configuration, operational status and all dimensions on site related to the Work.
- .2 Prior to beginning of the works, the Contractor shall verify existing system configuration, operational status and all dimensions, levels and site conditions and notify the Departmental Representative of error or omission.
- .3 The Contractor must take into consideration the site conditions and perform work using accepted construction practices and methods to the satisfaction of the Departmental Representative.
- .4 The Contractor shall supply necessary labors, material and equipment for the execution of the work shown on contract drawings.
- .5 During work, the Contractor is responsible for all damages caused to the existing electrical power and control system and bridge properties and shall repair said damage at no cost to the Departmental Representative. The Contractor shall keep the area of work clean and free of any debris at the end of each workday.
- .6 The Contractor shall carefully inspect the site and the bridge operating systems to view and assess features and difficulties that might affect the work. No extra charge due to a mistaken evaluation will be accepted.

1.7 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Owner's continued use of premises during construction.
- .2 Coordinate Progress Schedule and coordinate with Owner Occupancy during construction.

- .3 Construct Work in stages to provide for continuous public usage. Do not close off public usage of facilities until use of one stage of Work will provide alternate usage.
- .4 Maintain fire access/control.
- 1.8 CONTRACTOR USE OF PREMISES .1 Coordinate use of premises under direction of Owner and/or Departmental Representative on site.
- 1.9 WORK RESTRICTIONS .1 Carry out Work from Monday to Friday from 0700 hours to 1800 hours.
- 1.10 OWNER OCCUPANCY .1 Owner will occupy premises during entire construction, testing and commissioning period for execution of normal operations and other construction projects.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Title and Description.
 - .2 Administrative.
 - .3 Preconstruction Meeting.
 - .4 Progress Meeting.
- 1.2 ADMINISTRATIVE
- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
 - .2 Prepare agenda for meetings.
 - .3 Distribute written notice of each meeting 4 days in advance of meeting date to Departmental Representative.
 - .4 PWGSC shall provide a meeting space at the Burlington Canal Lift Bridge.
 - .5 Preside at meetings.
 - .6 Record the minutes of meetings. Include significant proceedings and decisions. Identify actions by parties.
 - .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.
- 1.3 PRECONSTRUCTION MEETING
- .1 Within 5 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
 - .2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance or the meeting will be held via video conference as agreed with Departmental Representative.
 - .3 Establish time and location of meeting and notify parties concerned minimum 2 days before meeting.
 - .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: contractor to provide construction schedule.
 - .3 Schedule of submission of shop drawings, samples, mock-ups, colour chips. Submit submittals in accordance with Section 01 33 00.
 - .4 Health and safety in accordance with Section 01 35 29.
 - .5 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .6 Record drawings and specifications in accordance with Sections 01 33 00 and 01 78 00.
 - .7 Maintenance manuals in accordance with Section 01 78 00.
 - .8 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.
 - .9 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .10 Appointment of inspection and testing agencies or firms.
 - .11 Insurances, transcript of policies.

1.4 PROGRESS MEETINGS

- .1 During course of Work System development, installation, testing and commissioning) and 2 weeks prior to project completion, schedule progress meetings bi-weekly.
- .2 Contractor, major Subcontractors involved in Work, Departmental Representative and Engineer are to be in attendance.
- .3 Notify parties minimum (4) days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within (2) days after meeting.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.

- .10 Review submittal schedules: expedite as required.
- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 01 45 00 - Quality Control
- 1.2 ADMINISTRATIVE .1
- .2 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .3 Do not proceed with Work affected by submittal until review is complete.
 - .4 Present shop drawings, product data, samples and mock-ups in SI Metric units.
 - .5 Where items or information is not produced in SI Metric units converted values are acceptable.
 - .6 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
 - .7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
 - .8 Verify field measurements and affected adjacent Work are coordinated.
 - .9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
 - .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
 - .11 Keep minimum one reviewed copy of each submission on site.

1.3 SHOP DRAWINGS
AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Indicate materials, methods of construction, electrical power and control installation and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of necessary programming, adjustments and sequence of operation and testing of the proposed Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow ten (10) days for Departmental Representative's review of each submission.
- .4 Adjustments made on shop drawings by the Engineer or Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .5 Make changes in shop drawings as the Engineer or Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify the Engineer or Departmental Representative in writing of revisions other than those requested.
- .6 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .7 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.

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- .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Details of developed and proposed systems, manufacture, fabrication and factory testing.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating systems.
 - .8 System software and control logic modifications and additions.
 - .9 Wiring and wiring installation diagrams.
 - .10 Single line, schematic diagrams and BOM's.
 - .11 Relationship to adjacent work.
 - .8 After Engineer and Departmental Representative's review, distribute copies.
 - .9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
 - .10 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
 - .11 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing that material, product or system are identical to material, product or system to be provided and has been tested in accordance with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
 - .12 Submit electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of

- manufacturer of product, system or material attesting that product, system or material meets specification requirements.
- .2 Certificates must be dated after award of project contract complete with project name.
- .13 Submit electronic copy of manufacturers' instructions for requirements requested in specification Sections and as requested by Departmental Representative.
- .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .14 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, an electronic copy will be returned, and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .20 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general concept.
- .1 Review does not mean that the Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review to not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.4 PROCEDURES .1 Provide procedures required as specified in the Contract documents or as directed by the Departmental Representative.

1.5 OTHER SUBMISSIONS .1 Provide all other submissions as required by law and the Contract documents.

1.6 CERTIFICATES AND TRANSCRIPTS

1.7 FEES, PERMITS AND CERTIFICATES .1 Provide authorities having jurisdiction with information requested.
.2 Pay fees and obtain certificates and permits required.
.3 Furnish certificates and permits.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 National Building Code 2015 (NBC)
 - .1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .2 National Fire Code 2015 (NFC)
 - .1 NFC 2015, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.
- .3 Province of Ontario
 - .1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
 - .2 O. Reg. 490/09, Designated Substances.
 - .3 Workplace Safety and Insurance Act, 1997.
 - .4 Municipal statutes and authorities.
- .4 Treasury Board of Canada Secretariat (TBS)
 - .1 Treasury Board, Fire Protection Standard April 1, 2010 www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17316§ion=text.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .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.
 - .3 Measures and controls to be implemented to address identified safety hazards and risks.
- .3 Provide a Rescue Plan: In accordance with current regulations for Working at Heights, provide the Owner and Departmental Representative a rescue plan for workmen in the event of an emergency.
- .4 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.1.3 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Building, Facility and Tenant's Emergency Procedures

and Evacuation Plan in place at the site. Departmental Representative will provide Building, Facility and Tenant's Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.

- .5 Contractor's and Sub-contractors' Safety Communication Plan.
- .6 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Building, Facility and procedures provided by Departmental Representative.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 3 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 3 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 Submit names of personnel and alternates responsible for site safety and health.
- .10 Submit records of Contractor's Health and Safety meetings when requested.
- .11 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.
- .12 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
- .13 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.
- .14 Submit copies of incident and accident reports.
- .15 Submit Material Safety Data Sheets (MSDS).
- .16 Submit Workplace Safety and Insurance Board (WSIB)-Experience Rating Report.

- 1.3 FILING OF NOTICE .1 File Notice of Project with Provincial authorities prior to commencement of Work.
- .2 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.
- 1.4 SAFETY ASSESSMENT .1 Perform site specific safety hazard assessment related to project.
- 1.5 MEETINGS .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.
- 1.6 REGULATORY REQUIREMENTS .1 Comply with the Acts and regulations of the Province of Ontario.
- .2 Comply with specified standards and regulations to ensure safe operations at site.
- 1.7 PROJECT/SITE CONDITIONS .1 Work at site will involve contact with:
- .1 Silica in concrete and concrete block.
- .2 Guano.
- .2 Contractor to refer to DSS report titled "Environmental Compliance Audit - Burlington Lift Bridge, 2018 prepared by Environmental Services - Ontario Region".
- .3 Contractor to review report and become familiar with the contents and conditions affecting the work.
- .4 Where removals of Designated Substances are required, Contractor to follow procedures outlined in the appropriate legislation.
- 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 either accepting or requesting improvements.
- .3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.
- .4 Contractor shall have all required Personal Protective Equipment (PPE) while working on site, in accordance with Occupational Health and Safety Act and Regulations for Construction Projects.
 - .1 Contractor shall have all required PPE been applied while working with all electrical replacement and installation.

1.9 COMPLIANCE
REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

1.10 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.
- .3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act and Regulations for Construction Projects for the Province of Ontario.
- .4 Contractor to be aware that there will be other contractors on this site during the Work. Contractor to ensure that time and spatial separation is maintained at all time, and where required will co-ordinate with Departmental Representative to ensure spatial separation is maintained.

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- 1.11 UNFORSEEN HAZARDS .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work immediately stop work and advise Departmental Representative verbally and in writing.
- .2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.
- 1.12 HEALTH AND SAFETY CO-ORDINATOR .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. In accordance with subsection 1.15.2, Health and Safety Co-Ordinator must:
- .1 Have site-related working experience specific to activities associated with abatement of lead and asbestos containing materials.
- .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 and report directly to and be under direction of Registered Occupational Hygienist, Certified Industrial Hygienist and site supervisor.
- 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 of Ontario, and in consultation with Departmental Representative:
- .1 Contractor's Safety Policy.
- .2 Constructor's Name.
- .3 Notice of Project.
- .4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
- .5 Ministry of Labour Orders and reports.
- .6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
- .7 Address and phone number of nearest Ministry of Labour office.
- .8 Material Safety Data Sheets.
- .9 Written Emergency Response Plan.

- .10 Site Specific Safety Plan.
- .11 Valid certificate of first aider on duty.
- .12 WSIB "In Case of Injury At Work" poster.
- .13 Location of toilet and cleanup facilities.

1.14 CORRECTION OF
NON-COMPLIANCE

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

1.15 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- .2 Assign responsibility and obligation to Competent Supervisor to stop or start Work when, at Competent Supervisor's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 - GENERAL

1.1 REFERENCE STANDARDS

- .1 Standard Acquisition Clauses and Conditions Manual (SACC)

1.2 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.3 ACTION AND
INFORMATIONAL SUBMITTALS

- .1 Submit information and documents in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29 - Health and Safety Requirements.
- .3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review by Departmental Representative.
- .4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .5 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .6 Include in Environmental Protection Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of person responsible for training site personnel.

- .4 Descriptions of environmental protection personnel training program.
- .5 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
- .6 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved with authorized work areas.
- .7 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .8 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .9 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .10 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

1.4 WORK ADJACENT TO WATERWAY

- .1 Construction equipment to be operated on land only.
- .2 Waterways to be kept free of waste material and debris.

1.5 POLLUTION CONTROL

- .1 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

1.6 NOTIFICATION

- .1 Departmental Representative 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 such notice, inform Departmental Representative of

proposed corrective action and take such action for approval by Departmental Representative.

- .1 Act only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative 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.

Part 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 - EXECUTION

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
- .1 Leave Work area clean at end of each day.
- .2 Ensure public waterways, storm and sanitary sewers remain free of waste generated by this project.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .4 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES AND CODES
- .1 Perform Work in accordance with National Building Code of Canada (NBC) 2015, National Fire Code of Canada (NFC) 2015 and Ontario Building Code (OBC) 2016, including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply as directed by the Departmental Representative.
 - .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.
- 1.2 HAZARDOUS MATERIAL DISCOVERY
- .1 Stop work immediately and notify Departmental Representative if materials which may contain designated substances or PCB's, other than those identified in Section 01 35 29 are discovered in course of work.
- 1.3 BUILDING SMOKING ENVIRONMENT
- .1 Comply with smoking restrictions.
- 1.4 RELICS AND ANTIQUITIES
- .1 Relics and antiquities, and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tables, and similar objects found on site shall remain the property of PWGSC. Protect such articles and request directives from Departmental Representative.
- 1.5 IAQ - INDOOR AIR QUALITY
- .1 Comply with CSA-Z204-94 (R1999), Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651-12 (R2017).
- 1.6 TAXES
- .1 Pay applicable Federal, Provincial and Municipal taxes.

- 1.7 EXAMINATION .1 Examine existing conditions and determine conditions affecting work.
- .2 Upon completion of review, provide written report identifying existing conditions that may affect the work for review.
- .3 Failure to provide report, will mean that the contractor has accepted the existing and additional claim for extra costs will not be accepted.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests

1.2 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work allow access to such Work whenever it is in progress.
- .2 The Engineer and/or shall Departmental Representative shall be provided sufficient notice of factory testing of system vendor developed control systems and be allowed to, if necessary, attend factory testing and witness and approve factory acceptance testing (FAT).
- .3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .4 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .5 The Engineer and/or Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.3 INDEPENDENT
INSPECTION AGENCIES

- .1 Contractor, as specified, should retain an Independent Inspection/Testing Agencies to conduct material and electrical installation testing and confirm material, installation and procedures meeting the specified requirements. All cost of such services shall be Contractor's responsibility.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

-
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.
- 1.4 ACCESS TO WORK .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.
- 1.5 PROCEDURES .1 Notify appropriate agency and Departmental Representative in advance of requirement for inspection and tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required as applicable for installation material, inspection and for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples if and as necessary.
- 1.6 REJECTED WORK .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative and or the Engineer, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative may deduct from Contract Amount difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

- 1.7 REPORTS
- .1 Submit four (4) copies of inspection and test reports to Departmental Representative.
 - .2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

- 1.8 TESTS
- .1 Furnish test results as may be requested.
 - .2 The cost of tests beyond those called for in Contract Documents or beyond those required by product requirements shall be appraised by Engineer and Departmental Representative and may be authorized as recoverable.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Temporary utilities.
- 1.2 SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00.
- 1.3 INSTALLATION AND REMOVAL .1 Provide temporary utilities controls in order to execute work expeditiously.
.2 Remove from site all such work after use.
- 1.4 WATER SUPPLY .1 Provide continuous supply of potable water for construction use.
.2 Arrange for connection with appropriate utility company and pay all costs for installation, maintenance and removal.
.3 Pay for utility charges at prevailing rates.
- 1.5 TEMPORARY HEATING AND VENTILATION .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
.3 Provide temporary heat and ventilation in enclosed areas as required to:
.1 Facilitate progress of Work.
.2 Protect Work and products against dampness and cold.
.3 Prevent moisture condensation on surfaces.
.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
.5 Provide adequate ventilation to meet health

regulations for safe working environment.

- .4 Maintain temperatures of minimum 10°C in areas where construction is in progress.
- .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during Work.
 - .2 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .3 Ventilate storage spaces containing hazardous or volatile materials.
 - .4 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Pay utility charges when temporary heat source is existing building equipment.
- .7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.6 TEMPORARY POWER_
AND LIGHT

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts, 30 amps.
- .2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.
- .3 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

1.7 TEMPORARY
COMMUNICATION_
FACILITIES

- .1 Provide and pay for temporary telephone, data hook up, and equipment necessary for own use and use of Departmental Representative.

1.8 FIRE
PROTECTION

- .1 Provide and maintain temporary fire protection and equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and by laws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Manufacturer's instructions.
- .3 Quality of Work, coordination and fastenings.
- .4 Existing facilities.

1.2 REFERENCES

- .1 Within text of specifications, reference may be made to reference standards.
- .2 Conform to these standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 The cost for such testing will be borne by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.3 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is a precaution against oversight or error. Remove and replace defective products at own

expense and be responsible for delays and expenses caused by rejection.

- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.5 METRIC SIZED MATERIALS

- .1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.
- .2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.
- .3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.

- .4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.
- .5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.
- 1.6 STORAGE, HANDLING AND PROTECTION
- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store all electrical equipment specified as part of the contract in an environmentally controlled storage space and in accordance with manufacturer's storage requirements.
- .3 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .4 Store products subject to damage from weather in weatherproof enclosures.
- .5 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .6 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .7 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .8 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.
- 1.7 TRANSPORTATION
- .1 Pay costs of transportation of products required in performance of Work.

1.8 MANUFACTURER'S
INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.

1.9 QUALITY
OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.10 CO-ORDINATION

- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.11 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.12 LOCATION OF

- .1 Consider location of fixtures, outlets, and mechanical

FIXTURES

and electrical items indicated as appropriate, and where they may impact the work.

- .2 Inform Engineer and Departmental Representative of conflicting installation. Install as directed.

1.13 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.14 PROTECTION OF
WORK IN PROGRESS

- .1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.15 EXISTING
UTILITIES

- .1 Where Work may affect existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and marine, pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered or otherwise interfere with the work in this Contract, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Progressive cleaning.
- .2 Final cleaning.

1.2 PROJECT
CLEANLINESS AND WASTE
REMOVAL

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Provide on-site containers for collection of waste materials and debris.
- .4 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 19.
- .5 Remove waste material and debris from site and deposit in waste container at end of each working day.
- .6 Dispose of waste materials and debris off site.
- .7 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .8 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by the Engineer and/or Departmental Representative. Do not burn waste materials on site.

- .6 Remove dirt and other disfiguration from exterior surfaces.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 CONSTRUCTION &
DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.
- .2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
 - .1 Provide facilities for collection, handling and storage of source separated wastes.
 - .2 Source separate the following waste:
 - .1 Brick and Portland cement concrete.
 - .2 Corrugated cardboard.
 - .3 Wood, not including painted or treated wood or laminated wood.
 - .4 Gypsum board, unpainted.
 - .5 Steel.
 - .6 Items indicated in Section 02 42 93, Deconstruction and Waste Products Workplan Summary.
 - .7 Electrical material, wiring and conduit/raceways.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
- .4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

1.2 WASTE PROCESSING
SITES

- .1 Province of Ontario.
 - .1 Ministry of Environment and Energy, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.
 - .2 Telephone: 800-565-4923 or 416-323-4321.
 - .3 Fax: 416-323-4682.
- .2 Recycling Council of Ontario: 215 Spadina Avenue, #225, Toronto, ON, M5T 2C7.
 - .1 Telephone: 416-657-2797 or 1-888-501-9637.
 - .2 Fax: 416-960-8053.
 - .3 Email: rco@rco.on.ca.

.4 Internet: <http://www.rco.on.ca/>.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CANADIAN
GOVERNMENTAL DEPARTMENTS
CHIEF RESPONSIBILITY FOR
THE ENVIRONMENT

.1 Government Chief Responsibility for the Environment.

Province	Address	General Inquiries	Fax
Ontario	Ministry of Environment and Energy 135 St Clair Avenue West Toronto, ON M4V 1P5 Environment Canada Toronto, ON	(416) 323-4321 (800) 565-4923 (416) 734-4494	(416) 323-4682

END OF SECTION

PART 1 - GENERAL

1.1 WASTE MANAGEMENT GOALS

- .1 Minimize amount of non-hazardous solid waste generated by the project and accomplish maximum source reduction, reuse and recycling of solid waste.

1.2 REFERENCES

- .1 Ontario Ministry of Environment and Climate Change.
 - .1 Ontario Environmental Protection Act (EPA)
 - .1 Regulation 102/94, Waste Audits and Waste Reduction Workplans.
 - .2 Regulation 103/94, Source Separation Programs.
 - .2 Canadian Construction Association (CCA)
 - .1 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.
 - .4 Public Services and Procurement Canada (PSPC)
 - .1 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.
 - .2 CRD Waste Management Market Research Report (available from PSPC's Environmental Services).
 - .3 Sustainable Development Strategy 2007-2009: Target 2.1 Environmentally Sustainable Use of Natural Resources.
 - .1 Real Property projects over \$1 million and in communities where industrial recycling is supported, implementation of CRD waste management practices will be completed, with waste materials being reused or recycled.
 - .2 Contractually ensure resources used in construction or maintenance are consumed and recovered in a sustainable manner.

1.3 DEFINITIONS

- .1 Approved/Authorized Recycling Facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.
- .2 Class III: non-hazardous waste - construction renovation and demolition waste.
- .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities.
- .4 Inert Fill: inert waste - exclusively asphalt and concrete.
- .5 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and

- reuse, maximizing diversion and potential to reduce disposal costs.
- .6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
 - .7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
 - .8 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
 - .9 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
 - .10 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
 - .11 Separate Condition: Refers to waste sorted into individual types.
 - .12 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.
 - .13 Waste Audit (WA): Detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill.
 - .14 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.
 - .15 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
 - .16 Waste Reduction Workplan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan information acquired from Waste Audit.

1.4 ACTION AND INFORMATION SUBMITTALS

- .1 Prepare and submit proof that all waste is being disposed of at a licensed landfill site or waste transfer site. A copy of the disposal waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from site.
- .2 Develop all means and methods necessary to accomplish the removals, transportation and disposal to a suitable site of any impacted elements, including recognition of any and all regulatory requirements respecting hazardous materials. This may include but not be limited to:
 - .1 Lead-based coatings where found on portions of the existing steel.

1.5 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste into waterways, storm, or sanitary sewers.
- .3 Remove materials on-site as Work progresses.

1.6 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

1.7 MEASUREMENT AND PAYMENT

- .1 There shall be no measurement for this work.
- .2 Payment will be under the Contract Lump Sum Amount and such payment shall be full compensation of all design, labour, equipment and materials necessary to complete the work.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

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Region Project	WASTE MANAGEMENT AND	Page 4
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3.2 DIVERSION OF MATERIALS

.1 On-site sale of salvaged materials is not permitted.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 As-built drawings, samples, and specifications.
- .2 Product data, materials and finishes, and related information.
- .3 Operation and maintenance data.
- .4 Spare parts, special tools and maintenance materials.
- .5 Warranties and bonds.

1.2 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two (2) weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four (4) final copies of maintenance manuals and commissioning documentation as specified, as applicable, in English.
- .5 If requested, furnish evidence as to type, source and quality of products provided.
- .6 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .7 Pay costs of transportation.

1.3 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, process flow, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.4 CONTENTS - EACH
VOLUME

- .1 Table of Contents: provide title of project;
 - .1 Date of submission; names,
 - .2 Addresses, and telephone numbers of Contractor with name of responsible parties;
 - .3 Schedule of products and systems indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Contract Document.

1.5 AS-BUILTS AND
SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Amendments and addenda.
 - .4 Change Orders and other modifications to the

Contract.

- .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.
- .3 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.6 RECORDING
ACTUAL SITE
CONDITIONS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
- .1 Field changes of dimension and detail.
 - .2 Changes made by change orders.
 - .3 Details not on original Contract Drawings.
 - .4 References to related shop drawings and modifications.
- .4 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

1.7 MATERIALS AND
FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning

agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

- .3 Additional Requirements: as specified in individual specifications sections.

1.8 MAINTENANCE
MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.9 STORAGE,
HANDLING AND
PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.10 WARRANTIES AND
BONDS

- .1 Separate each warranty or bond with index tabsheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principals.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.

- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- .1 Prior to beginning the contracted work, demonstrate the operation of the bridge in coordination with the Engineer, Departmental Representative and Bridge Master and document any deficiencies identified as the bridge operating system baseline conditions.
- .2 The bridge operating system baselining condition shall consist of dynamically testing the operation of the bridge and recording the following operating parameters;
 - .1 Phase voltages, phase currents, and power parameters (KVA, KW, KVAR, PF) at the main incoming service during bridge operation. Data for three complete operating cycles shall be provided.
 - .2 Operating voltages, currents, and power parameters (KVA, KW, KVAR, PF) for bridge machinery equipment. For momentary loads, such as brakes and locks, only voltage and current are required to be measured during the operation.
- .3 Following the completion of each stage of construction and installation of the specified systems, demonstrate to the Engineer, Departmental Representative and Bridge Master that the contractor has returned the bridge to an acceptable operating status.
- .4 Demonstrate operation and maintenance of all installed and operational equipment and systems procured and installed under this Contract to the Engineer, Department Representative and Bridge Master as specified in Section 01 91 13 GENERAL COMMISSIONING specification.
- .5 This task shall be performed by experienced and qualified contractor staff approved by the Department Representative to not only instruct maintenance personnel on the maintenance and troubleshooting of the installed equipment and systems but to also provide operations and maintenance

demonstration and training of bridge O&M personnel as specified in Section 01 91 13 GENERAL COMMISSIONING specification.

- .6 Department Representative will provide list of names and positions of personnel to receive instructions, and will coordinate personnel to receive instructions, and will coordinate their attendance at agreed-upon times. The contractor shall provide at least 7-days' notice to Department Representative of the scheduled demonstrations and training.
- .7 The demonstrations of the operation of the specified equipment and systems shall be conducted in concert with the training for Department personnel as specified in Section 26 05 00 - Common Work Results for Electrical
- .8 In addition to demonstration and training during the commissioning, the training shall also include the work necessary to mothball the relevant and contracted equipment and systems herein bridge operating systems at the end of the operating season and the work necessary at the beginning of the bridge operating season as specified in Section 01 91 13 GENERAL COMMISSIONING specification.
- .9 The contractor shall arrange all demonstration and training classes on-site at the bridge and provide all necessary material including; relevant sections of the approved O&M Manual and any other required reference material to provide a comprehensive training program for each training module. The demonstrations shall be performed on the actual installed operating equipment and systems to be maintained and actual operation of commissioned under all normal and contingency modes of operation of the bridge.
- .10 At the conclusion of each training module the contractor's instruction team shall assess and document each participant's mastery of the module by the use of a demonstration performance-based test and submit all results to the Department Representative.

1.2 QUALITY CONTROL

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Departmental Representative's personnel, and provide written report that demonstration and instructions have been completed.

- .2 Submit demonstration and training schedule as specified herein and in Section 26 05 00 - Common Work Results for Electrical including the time and date for demonstration and training of each item of equipment and each system in accordance with the training plan 30 days prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Report shall give time and date of each demonstration and training, with list of persons present.

1.3 CONDITIONS FOR
DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with the related technical specification sections and Section 01 91 13 General Commissioning (Cx).
- .2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.4 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated O&M personnel are present.

1.5 DEMONSTRATION
AND INSTRUCTIONS

- .1 In accordance with Section 01 91 13 General Commissioning (Cx) Requirements.
- .2 Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location.
- .3 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .4 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

1.6 TIME ALLOCATED
FOR INSTRUCTIONS

- .1 Ensure amount of time required for instruction of each item of equipment or system as follows:
- .2 Movable bridge skew control equipment and operating system: 8 hours of instruction.
- .3 General Electrical maintenance, modification, replacements and upgrade Systems: 8 hours of instruction.

PART 2 - PRODUCT

- .1 NOT USED

PART 3- EXECUTION

3.1 MEASUREMENT AND
PAYMENT

- .1 No measurement for payment will be made for work under this Section.
- .2 Payment for all costs associated with demonstration and training shall be included in associated cost item for the Common Work Results-Electrical.

END OF SECTION

Part 1 - GENERAL

- 1.1 RELATED SECTIONS
- Section 01 11 00 - Summary of Work
 - Section 01 31 19 - Project Meetings
 - Section 01 33 00 - Submittal Procedures
 - Section 01 35 29 - Health and Safety Requirements
 - Section 01 35 43 - Environmental Procedures
 - Section 01 41 00 - Regulatory Requirements
 - Section 01 45 00 - Quality Control
 - Section 01 51 00 - Temporary Utilities
 - Section 01 61 00 - Common Product Requirements
 - Section 01 74 00 - Cleaning
 - Section 01 74 19 - Construction Demolition Waste Management
 - Section 01 78 00 - Closeout Submittals
 - Section 01 79 00 - Demonstration and Training
 - Section 02 41 99 - Demolition
 - Section 26 05 00 - Common Work Results for Electrical
 - Section 26 05 81 - Motors, 1 to 200hp, 1 to 145kW, to 600 volts

- 1.2 ACRONYMS
- .1 Cx - Commissioning.
 - .2 O&M - Operation and Maintenance.
 - .3 PI - Product Information.
 - .4 PV - Performance Verification.
 - .5 TAB - Testing, Adjusting and Balancing of bridge and mechanical systems.

- 1.3 GENERAL REQUIREMENTS
- .1 Contractor shall develop Testing and Commissioning Plan (Cx) for the project. The Cx Plan shall include as a minimum the following components:
 - .1 Identification of Cx team members and their roles and responsibilities
 - .2 Schedule Cx activities
 - .3 Step-by-step Cx procedures for each of the systems and/or sub systems
 - .4 Formalized forms for documentation of Cx activities completed and not completed or partially completed with outstanding items
 - .5 Applicable pass/fail criteria
 - .6 Signature and/or initial block to confirm successful completion of Cx activities.
 - .7 Prepare maintenance plan for the relevant and bridge integrated electrical systems.
 - .2 Contractor shall conduct testing and commissioning of equipment, sub-system, and system per the requirements and per the Cx Plan.

- .3 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed, documented in accordance with the contract and approved.
- .4 Objectives:
 - .1 To verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent of the contract.
 - .2 To ensure appropriate documentation is compiled in accordance with the contract documents, approved and incorporated into the O&M Manual.
- .5 Effectively train O&M staff:
 - .1 Contractor shall be responsible for the overall Cx process, operating equipment and systems, troubleshooting and adjusting as required.
 - .2 Systems shall be operated at full capacity under various modes of operation including as specified and directed contingency modes of operation to determine if they function correctly and consistently at peak efficiency and functionality.
 - .3 Systems shall be interactively operated with each other as intended in accordance with Contract Documents and design criteria.
 - .4 During these checks, adjustments as necessary to be made to enhance performance to meet environmental or user requirements.
 - .5 System performance shall meet all aspect of project functional and operational requirements.
 - .6 Qualified Contractor's Cx Agent to have been responsible for the Cx of at least one moveable bridge.

1.4 COMMISSIONING
OVERVIEW

- .1 The commissioning process shall be performed in the following stages:
 - .1 Stage 1 - Contractor's field Testing
 - .2 Stage 2 - Conditional Acceptance Functional Checkout
 - .3 Stage 3 - Final Acceptance Testing
 - .4 Stage 4 - Endurance test
 - .5 Stage 5 - O&M Training

- .2 Cx activities supplement field quality and testing procedures described in relevant technical
- .3 Cx shall be conducted in concert with activities performed during other, if any, defined stage of project delivery.
- .4 Cx shall identify issues of the contracted power and control systems that they are procured, installed, constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements.
- .5 Cx activities shall include transfer of critical knowledge to the Bridge Master, facility maintenance and operational personnel.
- .6 Contractor shall provide cost as a line item for the Cx with the Endurance Testing cost component broken out separately.
 - .1 Contractor shall effectively train Department staff in every aspect of maintenance and troubleshooting of the contracted electrical and control systems.
- .7 Departmental Representative will issue Certificate of Substantial Performance after:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative and Engineer.
 - .2 Equipment, components and systems have been commissioned and endurance testing has been completed.
 - .3 O&M manuals have been provided, reviewed and any required review comments have been corrected.
 - .4 O&M training shall be performed and completed.

1.5 PRE-CX REVIEW

- .1 Before Construction/Installation:
 - .1 Review contract documents confirm by writing to Departmental Representative.
 - .2 Prior to the beginning construction/installation, the contractor shall, in conjunction with the Engineer, Departmental Representative and Bridge Master, demonstrate and baseline the operating status of the bridge. This shall consist of documenting the operating status of the bridge and any bridge operating deficiencies.
 - .3 Review aspects of design and installation pertinent to success of Cx.

- .4 Ensure adequacy of provisions for Cx.
- .2 During Construction: Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan and schedule up to date.
 - .2 Submit complete Cx plan documentation to Departmental Representative.
 - .3 Understand completely design criteria and intent and special features.
 - .4 Fully understand Cx requirements and procedures.
 - .5 Ensure that Cx team members understand their roles and responsibilities.
 - .6 Ensure installation of related components, equipment, sub-systems, systems are completed and ready for Cx.
 - .7 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
 - .8 Ensure "As-Built" system schematics are available.
- .4 Inform Engineer and Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Submit no later than 8 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft of the Cx Plan.
 - .3 Preliminary Cx schedule.
- .3 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
- .4 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.

- .5 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING
DOCUMENTATION

- .1 Departmental Representative and Engineer to review and approve Cx documentation.
- .2 Provide completed and approved Cx documentation to Departmental Representative and Engineer.

1.9 COMMISSIONING
SCHEDULE

- .1 Incorporate Cx schedule into the overall construction schedule.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.10 COMMISSIONING
MEETINGS

- .1 Contractor shall conduct Cx meetings to track and report status of the commissioning activities and schedule performance.
- .2 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .3 At 60% construction completion stage. The Contractor shall conduct a Cx scope meeting in present of the Departmental Representative and/or Engineer to review progress, discuss schedule of equipment start-up activities and prepare for Cx.
- .4 The Cx scope meeting agenda as a minimum shall include:
 - .1 Review of Cx Plan.
 - .2 Review roles and responsibilities of Contractor and subcontractors and determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
 - .3 Review current status of schedule as related to Cx activities and determine impacts. Address any potential delays and/or schedule conflicts.
 - .4 Action items to be taken to address potential issues.

- .5 Thereafter Cx meetings shall be held until project completion and as required during equipment start-up and functional testing period.
 - .6 Meeting will be chaired by Contractor's Cx Agent, who will record and distribute minutes.
 - .7 Ensure subcontractors and relevant manufacturer representatives are present at Cx meetings and as required.
- 1.11 STARTING AND TESTING
- .1 Notify Departmental Representative and Engineer at least 30 days prior to start of Cx.
 - .2 Start Cx after elements of bridge affecting start-up and performance verification of systems have been completed.
 - .3 Contractor assumes liabilities and costs for commissioning. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.
- 1.12 WITNESSING OF STARTING AND TESTING
- .1 Provide 14 days notice prior to commencement.
 - .2 Engineer and Departmental Representative to witness of start-up and testing.
 - .3 Contractor's Cx Agent shall be present at tests performed by sub-trades, suppliers and equipment manufacturers. Cx Agent shall be responsible for obtaining test reports from the sub-trades, suppliers and equipment manufacturers, and incorporate them into the final Cx report.
- 1.13 MANUFACTURER'S INVOLVEMENT
- .1 Factory testing:
 - .1 Coordinate time and location of testing.
 - .2 Provide factory acceptance test plan for approval by the Departmental Representative and Engineer as required.
 - .3 Arrange for Departmental Representative and/or Engineer to witness tests for equipment requiring factory witness testing per technical specification requirement.
 - .2 Factory acceptance test must be completed with all issues resolved, documented, and be approved by Department's Representative and Engineer before factory release of equipment shipment to the project site.

- .3 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative and Engineer.
- .4 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
- .5 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .6 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .7 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 START-UP
DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative and Engineer for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports of the installed systems and equipment.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.15 OPERATION OF
EQUIPMENT AND SYSTEMS

- .1 The contractor shall start-up and operate equipment and/or systems as directed by equipment/system manufacturer, as specified herein and the approved O&M Manual.
- .2 With assistance of manufacturer develop written maintenance program and submit to Departmental Representative for approval before implementation.

- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of substantial completion.

1.16 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.17 INSTRUMENTS/
EQUIPMENT

- .1 Submit to Departmental Representative and Engineer for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.18 COMMISSIONING
PERFORMANCE
VERIFICATION (PV)

- .1 Carry out Cx in accordance with Cx Plan:
 - .1 Under actual operating conditions, over entire operating range, in all modes of operation.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.

1.19 AUTHORITIES
HAVING JURISDICTION

- .1 Where specified, start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures to avoid duplication of tests and to facilitate expedient acceptance of facility.

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- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies certificates of approval to Departmental Representative and Engineer within 5 days of test and with Cx report.
- 1.20 CHECKS, ADJUSTMENTS AND TUNING
- .1 Perform static and operational checks as applicable and as required.
- .2 Make necessary adjustments and tunings to optimize system performance as part of the commissioning process.
- 1.21 DEFICIENCIES, FAULTS, DEFECTS
- .1 Correct deficiencies found during start-up and Cx to satisfaction of the Engineer and Departmental Representative.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified or interim corrective measures are in place for continuation of Cx in safe manner and without potential damage to equipment. Proceed with written approval from Departmental Representative and Engineer.
- 1.22 TRAINING
- .1 In accordance with Section 01 79 00.
- .2 O&M training shall be performed by the contractor as specified herein.
- 1.23 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS
- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.
- 1.24 INSTALLED INSTRUMENTATION
- .1 Use instruments installed under Contract for TAB and PV if:
- .2 Accuracy complies with these specifications.
- .3 Calibration certificates have been deposited with Departmental Representative.

1.25 PERFORMANCE
VERIFICATION
TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria as indicated in technical specifications.
 - .2 Instrument accuracy tolerances: To be of higher order of magnitude than equipment or system being tested.
 - .3 Measurement tolerances during verification: Unless otherwise specified actual values to be within +/-2% of recorded values.

1.26 DEPARTMENT
OPERATIONAL TESTING

- .1 Operational testing of equipment and systems installed under this contract by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.
- .2 The Department personnel will only perform operational testing of equipment or system after they have received, in writing, that the Stage 3- Final Acceptance Testing has been completed and correction of all outstanding deficiencies has been satisfactorily completed and the span has been opened to vehicular traffic and is fully operational for marine traffic.

Part 2 - PRODUCT

- .1 NOT USED

Part 3 - EXECUTION

3.1 GENERAL
EXECUTION

- .1 The work under this item is to demonstrate that all the bridge electrical and control specified systems have been correctly installed and function properly.
- .2 The Contractor shall provide all test equipment, safety equipment, personnel and monitoring devices necessary to show each piece of equipment has been installed, operates properly, is in proper operating condition, and integrated into the bridge power and control system. This work shall be coordinated with the electrical control system vendor and the installing Contractor and his specialty Sub-Contractors.
- .3 The Contractor or the Contractor's Representative shall be present during all test operations.

3.2 STAGE-1
CONTRACTOR'S FIELD
TESTING

- .1 The Contractor and/or his specialty Sub-Contractors shall adjust, calibrate and test all equipment, place the integrated system in service, and test the integrated system using approved test procedures.
- .2 The Contractor shall demonstrate that the completed system functions properly by performing at least 10 consecutive complete bridge operation cycles for each mode of operation including simulating bridge skew conditions as defined to prove the installed systems and described in the sequence of operation of the bridge without failure or any adjustments. The Contractor shall provide results of the Contractor's field tests, diagnostics, and calibrations including written certification to the Contracting Agency that the installed complete system has been calibrated, tested, and is ready to begin Stage 2 - Conditional Acceptance Functional Testing. The report shall also include a copy of the approved Stage 1 - Contractor's Field-Testing procedure.
- .3 Complete demonstration of system functions in a way that will not interfere with use of the adjacent waterway.

3.3 STAGE-2
CONDITIONAL
ACCEPTANCE FUNCTIONAL
CHECKOUT

- .1 Upon successful completion of Stage 1 - Contractor's Field Testing and its acceptance by the Engineer, the Contractor shall demonstrate that the completed electrical work and systems specified under this contract comply with the contract requirements. Using test procedures (submitted by the Contractor and approved by the Engineer), all physical and functional requirements of the project shall be demonstrated. The Conditional Acceptance Functional Testing, as specified, shall not commence until receipt by the Contractor of written permission from the Departmental Representative, based on the Contractor's certification of successful completion of Stage 1- Contractor's Field Testing, as specified above. The Departmental Representative may terminate this portion of the testing at any time when the system fails to perform as specified. If at any time the bridge is unable to function as intended without adjustments, repairs or other corrective actions identified as being caused and/or part of this contract work, this shall be regarded as a failure and shall result in termination of the Stage 2 Conditional Acceptance Functional Testing.
- .2 Upon a failure resulting in termination of testing by the Departmental Representative or by the Contractor, the Contractor shall commence an assessment period.

The Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the Departmental Representative. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Departmental Representative. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate portions of the Conditional Acceptance Functional Testing. Based on the Contractor's report and the test review meeting, the Contracting Agency will determine the retest date.

- .3 Upon successful completion of the conditional functional testing, the Contractor shall provide test reports and other documentation specified to the Department for approval prior to commencing the Stage 3 - Endurance Test.

3.4 Stage-3 FINAL
ACCEPTANCE TEST

- .1 Upon successful completion of Stage 2 - Contractor's Final Field Testing and its acceptance by the Engineer, the Contractor shall rectify all deficiencies uncovered during Stage 2 demonstrate that the completed electrical work and systems specified under this contract comply with the contract requirements. ~~Not that~~ if Stage - 2 was completed in accordance with the test procedure to the satisfaction of the Engineer, Departmental Representative and Bridge Master, Stage - 3 will not be necessary and the commissioning process will advance to Stage - 4. If necessary, Stage - 3 shall proceed using test procedures (submitted by the Contractor and approved by the Engineer), all physical and functional requirements of the project shall be demonstrated. The Final Acceptance Functional Testing, as specified, shall not commence until receipt by the Contractor of written permission from the Departmental Representative, based on the Contractor's certification of successful completion of Stage 2 - Contractor's Field Testing, as specified above. The Departmental Representative may terminate this portion of the testing at any time ~~if~~ when the system fails to perform as specified. If at any time the bridge is unable to function as intended without adjustments, repairs or other corrective actions identified as being caused and/or part of this contract work, this shall be regarded as a failure and shall result in termination of the Stage 3 Acceptance Final Test.

- .2 Upon a failure resulting in termination of testing by the Departmental Representative or by the Contractor, the Contractor shall commence an assessment period. The Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the Departmental Representative. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Departmental Representative. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate portions of the Conditional Acceptance Functional Testing. Based on the Contractor's report and the test review meeting, the Contracting Agency will determine the retest date.
- .3 Upon successful completion of the Final Acceptance testing, the Contractor shall provide test reports and other documentation specified to the Department for approval prior to commencing the Stage 4 - Endurance Test.

3.5 STAGE-4
ENDURANCE TEST

- .1 The endurance testing shall be performed in four (4) distinct phases as described herein.
- .2 The endurance test shall not be started until the Departmental Representative notifies the Contractor, in writing, that the Stage 2- Conditional Functional Testing has been completed and correction of all outstanding deficiencies have been satisfactorily completed.
- .3 The Contractor shall commence Phase I (Testing) of the Endurance Test upon notification from the Departmental Representative. The Departmental Representative may terminate testing at any time the system fails to perform as specified. Upon termination of testing by the Departmental Representative or by the Contractor, the Contractor shall commence an assessment period as described for Phase II. Upon successful completion of the Endurance Test, the Contractor shall provide test reports and other documentation specified to the Department prior to acceptance of the system.
- .4 Phase I (Contractor Testing):

- .1 The testing shall be conducted 2 hours per day for 2 consecutive calendar days, including holidays, and the system specified under this contract and that which affects other bridge operating systems shall operate as specified without fault or failure. The start date for the test and the opening times shall be as directed by the Engineer.
 - .2 During Phase I testing the bridge will be available for public use.
 - .3 Each day the bridge shall be operated a minimum of 3 times with the intent to perform the operations at or near the temperature extremes for that day (e.g. at 06:00 and 14:00).
 - .4 The Contractor shall make no repairs during this phase of testing unless authorized by the Departmental Representative in writing.
 - .5 If the system experiences no failures during Phase I testing, the Contractor may proceed directly to Phase III, after receipt of written permission from the Departmental Representative.
- .5 Phase II (Failure Assessment):
- .1 If Phase I is unsuccessful, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the Departmental Representative.
 - .2 The Contractor shall provide field testing report, which shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed.
 - .3 After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Departmental Representative.
 - .4 As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate portions of the Conditional Acceptance Functional Testing. Based on the Contractor's report and the test review meeting, the Departmental Representative will determine the restart date for Phase I to be repeated. If the retest is completed without any failures, the Contractor may proceed directly to Phase III after receipt by the Contractor of written permission from the. Departmental Representative.
- .6 Phase III (Hand-Over):

- .1 If Phase I is successful or there is a successful outcome to Phase II, the Contractor shall prepare a written report to the Departmental Representative.
- .2 The report shall explain in detail the number of operations performed, results of each operation, and results of all tests performed. Based on the Contractor's report, the Departmental Representative will determine whether the work will be accepted by the Departmental Representative.
- .7 Phase IV (Department Operation):
 - .1 After Phase III (Hand Over), operation of the bridge will continue normally.
 - .2 Operation parameters will be the same as those for Phase I.
 - .3 During this period, the contractor must provide the Departmental Representative with an emergency telephone number to be used for notifications in the case of a failure during this period. The number must be in operation and be answered 24 hours a day, including weekends and holidays. In the case of a failure during Phase IV the departmental representative will contact the contractor at the contact number.
 - .4 The contractor must respond to the notification, by return telephone call to the departmental representative, within one hour of notification. The contractor must then have appropriate labour, equipment and materials on site and commence repairs within 4 hours of the original notification.
 - .5 Following the original notification if the contractor does not respond to the original notification within 1 hour, or if the contractor does not arrive on site within 4 hours, then the Departmental Representative will mobilize their work crew to undertake any needed repairs. The Department will then back charge the contractor for any costs incurred, even if the contractor subsequently responds and/or arrives on site and takes part in or completes the repairs, with the monies being taken against the Phase IV Endurance Testing Allowance.
 - .6 Phase IV will be considered complete once the Departmental Representative has operated the bridge with the contractual system and equipment in-service without failure for 14 consecutive days, including holidays.

The contractor's warranty will remain in effect even if the Department performs any work on the bridge as a result of the contractor's failure to respond to a notification.

3.6 STAGE-5 O&M
TRAINING

- .1 The contractor proposed training staff shall possess at least ten years' experience of installing, maintaining and troubleshooting similar electrical systems. The experience of the proposed staff must include having performed similar functions on at least three (3) electrically powered highway bridges of which at least one (1) shall have been a tower drive vertical lift bridge.
- .2 The contractor shall submit in resume form, the experience of his maintenance team as part of his tender for Department review and approval. No maintenance shall be performed on the installed system or the bridge by any unapproved maintenance technician.
- .3 The contractor shall submit a comprehensive regular maintenance test plan to the Departmental Representative for review and approval prior to completion of the contracted system installation.
- .4 The bridge operational training shall include all normal and contingency operating scenarios for the systems specified.

3.7 MEASUREMENT AND
PAYMENT

- .1 No measurement for payment will be made for work under this Section.
- .2 Payment for all costs associated with general commissioning shall be included in associated cost item for the Common Work Results-Electrical.

END OF SECTION

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK .1 This Section covers the requirements for demolition of the envelope of the existing bridge required to install fall-arrest roof anchors, as described in the drawings.
- 1.2 REFERENCES .1 CSA International
.1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
.2 National Building Code (NBC)
.1 NBC 2015, Part 8 - Safety Measures at Construction and Demolition Sites and local authority having jurisdiction.
.3 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 SUBMITTALS .1 Submit in accordance with Section 01 33 00 and 01 74 20.
.2 10 calendar days prior to start of demolition and removals work, submit for review, drawings, diagrams or details showing sequence of disassembly work in accordance with authorities having jurisdiction.
.3 Submit for approval, a plan showing impacts, interruptions and delays to Owners operations.
.4 Submit to Departmental Representative, details of where rubble, debris and other materials are to be disposed. Include each disposal/reuse site location, operator's name and business address, type of license under which site operates, and criteria used by site to assess suitability of rubble, debris and other materials for disposal.

- 1.4 QUALITY ASSURANCE .1 Regulatory Requirements: Prepare waste audits, waste reduction work plans, source separation programs and recycling programs as required by jurisdictional authorities and update programs and implement such programs as required.
- .2 The demolition contractor must engage a registered professional engineer who holds a certificate of authorization and an appropriate level of liability insurance to prepare demolition procedures.
- 1.5 SITE CONDITIONS .1 Review "Hazardous Products Inventory - Burlington Lift Bridge, 2018" and "Asbestos and Lead Reassessment Survey - Burlington Lift Bridge, 2018" and take precautions to protect environment.
- .2 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
- .1 Proceed only after receipt of written instructions have been received from Departmental Representative.
- .3 Notify Departmental Representative before disrupting building access or services.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 GENERAL .1 Clean up rubble and debris, resulting from Work promptly and dispose at end of day or place in waste disposal bins. Empty bins on regular basis.
- .2 Stockpiling of rubble, debris, and surplus Products on Site will not be permitted.

- .3 Remove, handle and transport Products indicated to be salvaged and stored for future use. Transport Products to storage area(s) designated by Departmental Representative. Perform Work to prevent any damage to Products during removal and in storage. Products damaged during removal, will be inspected by Departmental Representative. Departmental Representative will determine extent of damage and accept or refuse Products.

3.2 EXAMINATION

- .1 Inspect bridge and site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Examine adjacent areas and other installations prior to commencement of demolition and removals.
- .3 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .4 Notify and obtain approval of utility companies before starting demolition.
- .5 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support shore up and maintain pipes and conduits encountered.
 - .1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.
 - .2 Immediately notify the Departmental Representative should uncharted utility or service be encountered and await instruction in writing regarding remedial action.

3.3 PROTECTION

- .1 Do not interfere with use of adjacent structures and Work areas. Maintain free, safe passage to and from adjacent structures and Work areas.
- .2 Take precautions to support affected structures. If safety of structure being demolished, adjacent structures or services are endangered, cease demolition operations and take necessary action to support endangered item. Immediately inform Departmental Representative. Do not resume demolition until reasons for endangering have been determined and

corrected and action taken to prevent further endangering.

- .3 Hang tarpaulins where debris and other materials are lowered. Build in around openings with wood and plywood at locations used 'for removal of debris and materials.
- .4 Supply and install adequate protection for materials to be re-used, set on ground and prevent moisture pick-up. Cover stockpiles of materials with tarpaulins.

3.4 PREPARATION

- .1 Protection of In-Place Conditions:
 - .1 Prevent movement, settlement, or damage to adjacent structures, utilities, and parts of building to remain in place.
 - .2 Keep noise, dust, and inconvenience to occupants to minimum.
 - .3 Protect building systems, services and equipment.
 - .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
 - .5 Do Work in accordance with Section 01 11 00.

3.5 DEMOLITION

- .1 Perform demolition with extreme care. Confine effects of demolition to those parts which are to be demolished.
- .2 Perform Work and prevent inconvenience to persons outside those parts which are to be demolished.
- .3 Demolish parts of structure to permit remedial Work as indicated.
- .4 Do not overload floor or wall with accumulations of material or debris or by other loads.
- .5 Perform Work to minimize dusting.
- .6 Do not sell or burn materials on Site.
- .7 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces and replace as Work progresses.
- .8 At end of day's Work, leave Work in safe condition with no part in danger of toppling or falling. Protect interiors of parts not to be demolished from exterior elements.
- .9 Drainage and sewer system protection:

- .1 Ensure that no dust, debris or slurry enters drainage and sewer system on Site.
- .2 Remove and dispose of debris and slurry promptly from Site.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.
- .3 Refer to demolition drawings and specifications for items to be salvaged for reuse.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00 - Cast-in-Place Concrete.
- .3 Section 03 37 26 - Underwater Placed Concrete.

1.2 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this Section.
- .2 Payment will be under the Contract Lump Sum amount and such payment shall be full compensation of all labour, equipment and materials necessary to complete the work.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.
 - .2 CSA O86-14, Engineering Design in Wood (Limit States Design).
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA O151-17, Canadian Softwood Plywood.
 - .5 CSA S269.1-16, Falsework & Formwork.
- .2 Council of Forest Industries of British Columbia (COFI)
 - .1 COFI Exterior Plywood for Concrete Formwork.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings for formwork and falsework in accordance with Section 01 33 00.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework and formwork drawings.
- .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.
- .5 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 and the Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

PART 2 - PRODUCTS

2.1 MATERIALS

- 1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121 and CSA O86.
 - .2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.
- .2 Form release agent: non-toxic, biodegradable, low VOC.
- .3 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal 15 to 24 mm²/s at 40°C, flashpoint minimum 150°C, open cup.
- .4 Falsework materials: to CSA S269.1.
- .5 PVC Rubber waterstops: "Greenstreak" by Sika, hot fused joints, complete with factory welded corner and intersecting pieces.

PART 3 - EXECUTION

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings and field measurements, especially in area of swing bridge.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect formwork in accordance with CSA S269.1 and COFI

Exterior Plywood for Concrete Formwork.

- .5 Fabricate and erect formwork in accordance with CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.
- .6 Align form joints and make watertight. Keep form joints to minimum.
- .7 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .9 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.
- .10 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 7 days for walls.
 - .2 7 days for footings and abutments.
- .2 Remove formwork when concrete has reached 60% of its design strength of 35 MPa, or 20 MPa, or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Re-use formwork and falsework subject to requirements of CSA A23.1/A23.2.

3.2 QUALITY OF FINISH

- .1 Grinding of the surfaces to achieve proper alignment and tolerance will generally not be accepted and the work must conform to the lines and be smooth when the forms are removed.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- .1 This section covers the requirements for concrete reinforcing.
- .2 This section also covers the requirements for reinforcing steel dowels installed using an epoxy grout.
- .3 Installation of threaded rods into existing concrete using an epoxy grout is covered under this section.
- .4 Field cutting or drilling holes in sheet piles is covered under this section.

1.2 RELATED SECTIONS

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

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 There will be no measurement for this work.
 - .2 Payment will be under the Contract Lump Sum amount and such payment shall be full compensation of all labour, equipment and materials necessary to complete the work.

1.4 REFERENCES

- .1 CSA International
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A23.3-14, Design of Concrete Structures.
 - .3 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .2 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.
- .3 ASTM International
 - .1 ASTM A165/A615M -16, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.

- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .1 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
 - .2 Detail lap lengths and bar development lengths to CSA A23.3, unless otherwise indicated.
 - .1 Provide type B tension lap splices where indicated, unless otherwise indicated.

1.6 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 and as described in PART 2 - SOURCE QUALITY CONTROL.
 - .1 Mill Test Report: provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum four (4) weeks prior to beginning reinforcing work.
 - .2 Submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel shall be Grade 400W, as specified on the Contract Drawings, unless otherwise noted.
- .3 Stainless steel reinforcing shall be type 316 LN or Duplex 2205 and have a minimum yield strength of 500 MPa, unless otherwise specified.
- .4 Dowel adhesive for reinforcing steel bars to be selected from the Ministry of Transportation of Ontario Designated Sources of Material DSM#9.30.25.
- .5 Dowel adhesive for installation of threaded rods to be selected from the Ministry of Transportation of Ontario Designated Sources of Material DSM#9.30.25.
- .6 Chairs, bolters, bar supports, spacers: to CSA A23.1/A23.2.
- .7 Mechanical splices: subject to approval of Departmental Representative.
- .8 Tie rod: ASTM A615/A615M, Grade 75 ksi.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum four (4) weeks prior to beginning reinforcing work.
- .2 Inform Departmental Representative of proposed source of material to be supplied.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 NOT USED.

3.2 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA A23.1/A23.2.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

3.5 COLD WEATHER WORK

- .1 The Contractor is advised that the work requires installation of epoxy anchors during the winter navigational shut-down period. The Contractor shall provide heating and hoarding as required to bring concrete and ambient temperatures up to the minimum temperatures recommended by the manufacturer of the epoxy adhesive. The Contractor shall also maintain these temperatures for the durations recommended by the manufacturer of the epoxy adhesive. If the manufacturer of the epoxy adhesive does not have specific recommendations for the cold weather installation, then the Contractor shall follow the requirements in Section 03 30 00 for the housing and heating.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- .1 The work of this section covers the requirements for the supply and placement of concrete and grout.
- .2 As part of the work under this section, the Contractor shall apply an anti-graffiti coating. The Contractor shall also supply the Owner with 20 litres of the product required, in the future, for graffiti removal from the coated surfaces.

1.2 Related Sections

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 37 26 - Underwater Placed Concrete.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 There shall be no separate measurement payment for the work under this Section.
 - .2 Payment will be under the Contract Lump Sum amount and such payment shall be full compensation of all labour, equipment and materials necessary to complete the work.

1.4 REFERENCES

- .1 CSA International
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06(R2016), Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .4 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.
- .2 Abrasive blast cleaning of concrete to general method and cleanliness of SSPC-SP6, Commercial Blast Cleaning (NACE No. 3).

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings: convene pre-installation meeting one (1) week prior to beginning concrete works.
 - .1 Ensure Departmental Representative specialty contractor - finishing, forming.
 - .2 Verify project requirements.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Shop Drawings:
 - .1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and necessary details of reinforcing.
 - .2 Submit drawings showing formwork and falsework design to: CSA A23.1/A23.2.
 - .3 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Provide testing results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .4 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.7 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00.
- .2 Provide Departmental Representative, minimum four (4) weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 - .1 Quality control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Departmental Representative.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
 - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packing materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- .1 Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

- .1 Cement: CAN/CSA-A3001, Type GU.
- .2 Supplementary cementing materials: to CAN/CSA-A3001.
- .3 Water: to CSA A23.1/A23.2.
- .4 Reinforcing bars: to CSA G30.18, Grade 400.
- .5 Other concrete materials: to CSA A23.1/A23.2.

2.4 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
 - .2 Provide concrete mix to meet following plastic state requirements:
 - .1 Uniformity: no segregation. Concrete shall be tested for density, air content and slump to methods listed in CSA A23.1/A23.2 to confirm batch uniformity meets requirements of Table 13 of CSA A23.1/A23.2.
 - .2 Workability: free of surface blemishes, loss of mortar, colour variations, and segregation.
 - .3 Finishability: the amount of bleeding to satisfaction of the Departmental Representative.
 - .4 Set time: to conditions of pour and to acceptance of the Departmental Representative.
 - .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: C-1.
 - .2 Compressive strength at 28 days age: 35 MPa minimum. No coarse aggregate in grouts.
 - .3 Intended application: includes but not limited to all footings, backwalls, abutment walls, wingwalls, East Pier, Pivot Pier modification, Rest Piers rehabilitation, approach slabs, concrete in site works, and all concrete items required to complete the work as specified on Contract Drawings.
 - .4 Aggregate size: 20 mm maximum.
 - .5 Volume stability: acceptable volume change range: less than 0.04% due to shrinkage, creep and freeze thaw cycle in

- accordance with CSA A23.1/A23.2
- .6 Pre-qualification: Concrete shall be prequalified by testing in accordance with CSA A23.1/A23.2-21C prior to first concrete placement.
 - .7 Maximum water to cementing materials ratio: 0.4.
 - .4 Concrete supplier's certification.
 - .5 Provide quality management plan to ensure verification of concrete quality to specified performance.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Provide Departmental Representative 24 hours notice before each concrete pour.
- .2 Place concrete reinforcing in accordance with Section 03 20 00.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
 - .3 If rubber waterstops are used, systematically and thoroughly vibrate concrete around waterstops to avoid honeycombing and voids, to ensure complete contact between waterstop and concrete.
- .4 Protect previous Work from staining.
- .5 Clean and remove stains prior to application for concrete finishes.

3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.
 - .2 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.

3.3 FINISH

- .1 Formed surfaces exposed to view: in accordance with CSA A23.1/A23.2.
- .2 Equipment pads: provide smooth troweled surface.
- .3 Pavements, walks, curbs and exposed site concrete:
 - .1 Screed to plane surfaces and use aluminum floats.
 - .2 Provide round edges and joint spacings using standard tools.
 - .3 Trowel smooth to provide lightly brushed non-slip finish.

3.3 CURING

- .1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and to CSA A23.1/A23.2.

3.8 FIELD QUALITY CONTROL

- .1 Concrete testing: to CSA A23.1/A23.2 by testing laboratory designated and paid for by Departmental Representative.

3.9 CLEANING

- .1 Clean in accordance with Section 01 74 11.
- .2 Use trigger operated spray nozzles for water hoses.
- .3 Designate cleaning area for tools to limit water use and runoff.
- .4 Cleaning of concrete equipment to be done in accordance with Section 01 35 43.
- .5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

END OF SECTION

PART 1 - GENERAL1.1 REFERENCES

- .1 Codes and standards referenced shall be the latest issued at time of project tender.
- .2 ASTM International
 - .1 ASTM C882/C882M-13a, Standard Test Method for Bond Strength of Epoxy Resin Systems Used with Concrete by Slant Shear.
 - .2 ASTM D695-15, Standard Test Method for Compressive Properties of Rigid Plastics.
- .3 CSA International
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA A23.3-14, Design of Concrete Structures.
 - .3 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by a Professional Engineer licensed in Ontario.
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of dowels, with identifying code marks to permit correct placement without reference to structural drawings.

1.3 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 and as described in PART 2 - SOURCE QUALITY CONTROL.
 - .1 Mill Test Report: provide Departmental Representative with certified copy of mill test report for reinforcing steel, minimum four (4) weeks prior to beginning reinforcing work.
 - .2 Representative proposed source of reinforcement material to be supplied.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

PART 2 - PRODUCTS2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: Grade 400W, deformed bars to CSA G30.18, unless indicated otherwise.
- .4 Plain round bars: to CSA G40.20/G40.21 Grade 400W.
- .5 Zinc-rich paint:
 - .1 High-solids compound.
 - .2 Low VOC.
 - .3 Minimum 93% zinc in dry film.
 - .4 Minimum 97% pure zinc dust.
- .6 Epoxy adhesive:
 - .1 Minimum bond strength according to ASTM C882 at 14 days: 20 MPa.
 - .2 Minimum compressive strength according to ASTM D695: 1800 MPa.

2.2 FABRICATION

- .1 Substitute different size dowel bars only if permitted in writing by Departmental Representative.
- .2 Ship bundles of dowel bars, clearly identified in accordance with bar bending details and lists.
- .3 Contractor is responsible for providing proper dowel lengths for in-situ conditions. Because the depth of concrete removals may vary from the drawings, due to the condition of the for dowels fabricated to the wrong length.

2.3 SOURCE QUALITY CONTROL

- .1 Provide Departmental Representative with certified copy of mill test report of dowel, showing physical and chemical analysis, minimum 4 weeks prior to beginning dowelling work.
- .2 Inform Departmental Representative of proposed source of material to be supplied.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Store, handle, mix, apply and cure proprietary products including epoxy adhesives in strict accordance with the manufacturer's instructions.
- .2 Clean drilled holes sufficiently to suit epoxy adhesive being used.

3.2 FIELD BENDING

- .1 Do not field bend or field weld dowel except where indicated or authorized by the Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace any dowels which develop cracks or splits.

3.3 PLACING DOWELS

- .1 Place dowels as indicated on placing drawings in accordance with CSA A23.1/A23.2.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of dowels.
- .3 Holes for dowels shall be drilled into the concrete at the location and spacing as specified in the Contract Documents. They shall be installed in such a way as to not cause delamination or other damage to the surrounding concrete.
- .5 Core drilling shall be used only if permitted according to the epoxy manufacturer's instructions.

3.4 PULL TESTING

- .1 Contractor is responsible for arranging and paying for pull testing of dowels.
- .2 The Contractor shall provide documentation of equipment calibration to the Departmental Representative minimum of 10 Days prior to any pull testing of the dowels.

- .3 The Contractor shall not install formwork or attach anything to the dowels such as steel reinforcement until the pull tests have been completed and the dowels are accepted into the work.
- .4 A lot shall consist of dowels of the same dowel type installed on a given day, in a single stage. Where a given day's production is less than 50 dowels, the day's work may be combined with the next day's production to form a single lot. The adequacy of each lot shall be determined based on sampled testing.
- .5 The Contractor shall conduct pull testing each lot within 3 Days of installation. The Departmental Representative shall be present during the testing procedure. The Departmental Representative shall randomly select 5% of the dowels in each lot, or 10 dowels, whichever is greater, for testing. The applicable pull test load as shown below must be sustained by the dowel, without displacement, for a time period of not less than one minute.
- .6 Pull test loads:
.1 15M dowel: 60 kN.
- .7 Dowels that fail the pull test by failure in the epoxy or in bond to the parent concrete shall be replaced by the Contractor at no extra cost by installing a new dowel in an adjacent location approved by the Departmental Representative. The hole shall be filled with proprietary patching material.
.1 If multiple dowels in a lot fail the pull test, additional dowels in that lot shall be tested until the adequacy of the lot can be determined, as decided by the Departmental Representative.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

END OF SECTION

PART 1 - GENERAL

1.1 ELECTRICAL WORK
DESCRIPTION

- .1 This section includes general and specific requirements for supply, service, delivery, storage, installation, testing and commissioning of electrical equipment, apparatus, appliances, materials, and accessories necessary to complete the work under the scope of the contract.
- .2 The contract and work shall be performed by a contractor with at least five (5) years of experience performing similar work on movable bridges in Ontario. The contractor shall utilize the services of his own staff and or qualified sub contractors to perform the specialist trade work as follows;
 - .1 Electrical Installation Contractor Qualifications
 - .1 The electrical work shall be performed by a contractor qualified in all aspects of power distribution, control and drive systems associated with movable heavy structures.
 - .2 The contractor shall have been involved in the construction/installation or maintenance of the electrical power and control systems of at least three (3) movable highway bridges over similar navigable waterways carrying similar highway traffic to the Burlington Canal Lift Bridge.
 - .3 The electrical contractor shall provide the services of a Master Electrician registered in the Province of Ontario to manage the electrical work as herein specified and in accordance with Electricity Act, Part VIII, 1998 and Licensing of Electrical Contractors & Master Electricians, Regulation 570/05
 - .4 The electrical contractor shall be responsible for; planning and having direct supervision of electrical work carried out on behalf of the contractor, ensuring that the electrical work is carried out in accordance with the contract requirements, including the Electrical Safety Code and the laws relating to health and safety and consumer protection, on behalf of the contractor and for other matters of a similar nature.
 - .5 In accordance with the Electricity Act Part VIII and its Regulations a license holder is responsible to conduct themselves with honesty and integrity and

in accordance with the principle of protecting consumers and to ensure that all activities are carried out in accordance with all laws including the Consumer Protection Act.

- .6 The electrical contractor shall ensure that his field staff are adequately supported to perform the scope of the work and meet the contract requirements.

.2 Mechanical Installation Contractor Qualifications

- .1 The mechanical work shall be performed by a contractor qualified in all aspects of machinery systems associated with movable heavy structures.
- .2 The contractor shall provide an Ontario qualified journeyman or millwright who has experience and has been involved in the repairs and maintenance of heavy machinery such as open gearing, bearings, couplings, and enclosed gear reducers to perform the required modifications to the existing movable bridge machinery.
- .3 The qualified journeyman or millwright shall perform the mechanical work described on the contract drawings, indicated herein and as directed by the Departmental Representative and/or the Engineer.

.3 Control Systems Vendor

- .1 The control systems vendor work shall be performed by a contractor qualified in all aspects of control and drive systems associated with movable heavy structures.
- .2 The control systems vendor shall have been involved in control systems hardware and software development, procurement of equipment, manufacture, testing and commissioning of at least ten (10) movable highway bridges over similar navigable waterways carrying similar highway traffic to the Burlington Canal Lift Bridge.
- .3 The control systems vendor shall provide the services of an individual who is familiar with the Burlington Canal Lift Bridge existing control system or similar bridge systems.
- .4 The control systems vendor who was responsible for the 2020 rehabilitation control system work for the bridge

(Panatrol Corporation) shall be utilized as the sub contractor to the contractor for this contract.

- .4 Civil/Structural Contractor Qualifications
 - .1 The civil/structural work shall be performed by a contractor qualified in all aspects of the specified transformer pad containment tub.
 - .2 The contractor shall provide an Ontario qualified craftsmen who are experience in the specified work
 - .3 The qualified journeyman or millwright shall perform the mechanical work described on the contract drawings, indicated herein and as directed by the Departmental Representative and/or the Engineer.
- .3 Where applicable provide supervision, labor, and assistance to manufacturer's field representatives and/or technical direction for equipment to be installed as a part of this Contract. Follow specified procedures and instructions provided by the Departmental Representative and/or the Engineer.
- .4 The bridge skew monitoring, alarm and control system shall be modified upgraded and reconfigured as part of this contract. This element of the work will be managed, supervised and directed by the Engineer and be procured, programmed, tested and commissioned by the designated control systems vendor.
- .5 The existing bridge electrical power, distribution and control systems shall be revised, repaired, replaced and upgraded as part of this contract and as specified in the contract documents.
- .6 The installation as specified under this contract shall be installed, tested and commissioned while the bridge is in service. The contractor shall coordinate his work with the Departmental Representative, the Engineer and the Bridge Master to ensure minimal disruption to bridge operations and no disruption to marine traffic.

1.2 RELATED
REQUIREMENTS

Section 01 79 00 - Demonstration and Training Section
Section 01 91 13 - General Commissioning Section
Section 26 05 21 - Wires and Cables Electrical (0-1000V)
Section

Section 26 05 26 - Grounding and Bonding for Electrical Systems Section
Section 26 05 34 - Conduits, Fastenings and Fittings Section
Section 26 05 29 - Hangers and Supports for Electrical Systems Section
Section 26 23 00 - Low-Voltage Switchgear Section
Section 26 24 16 - Panelboards Section
Section 26 24 19 - Motor Control Centre Section
Section 26 24 22 - Field Instrumentation Devices Section
Section 26 27 26 - Wiring Devices Section
Section 26 28 16.02 - Moulded Case Circuit Breakers Section
Section 26 28 23 - Safety Disconnect Switches Section
Section 26 33 53 - Uninterruptible Power Supply (UPS) Section
Section 26 50 00 - Lighting Section
Section 26 60 13 - Low-Voltage Motors Section
Section 28 23 00 - Video Surveillance Section
Section 40 20 00 - Bridge Control Sequence of Operation Section
Section 40 25 00 - Programmable Logic Controller Section

1.3 REFERENCES

.1 Definitions:

- .1 Electrical and electronic terms, unless otherwise specified or indicated, the terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
- .2 Electrical systems, existing system modifications, replacements and enhancements shall be engineered, manufactured and installed in accordance with the Canadian Electrical Code. The design and engineering of the electrical installation shall satisfy all statutory requirements of the national, Provincial and/or local authorities of Canada and Ontario. The electrical installation shall be suitable for the prevailing site conditions as specified herein. Where necessary, special attention shall be paid to the selection and installation of electrical equipment suitable for seismic conditions. Where relevant, the specific publications are referenced herein.
- .3 The skew control system monitoring, alarm and control system shall be modified upgraded and reconfigured in accordance with the contract drawings and the procurement, development, programming, testing and procurement shall be performed by the control systems vendor who was responsible for the supply Panatrol Corporation.

.4 The following reference standards documents form part of the specification to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the work.

.2 Reference Standards:

.1 CSA Group

- .1 CAN CSA-S6--14 Section 13 Movable Bridges
- .2 CSA C22.1, 2018 Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
- .3 CAN/CSA-C22.2 NO. 0-10 (R2015) - General requirements - Canadian electrical code, part II
- .4 CSA C22.2 NO. 47-13 - Air-cooled transformers (dry type)
- .5 CSA C22.2 NO. 52-17 - Underground secondary and service-entrance cables
- .6 CSA C22.2 NO. 227.2.1-14 - Liquid-tight flexible non-metallic conduit (Bi-national standard with UL 1660)
- .7 CSA C22.2 NO. 0.3-09 (R2014) - Test methods for electrical wires and cables
- .8 CSA C22.2 NO. 2420-09 (R2014) - Belowground reinforced thermosetting resin conduit (RTRC) and fittings (Bi-national standard, with UL 2420)
- .9 CAN3-C235-83 (R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 Volts.
- .10 CSC C22.2 NO. 248.8-11 (R2016) - Low-voltage fuses - Part 8: Class J fuses (Tri-national standard, with UL 248-8 and NMX-J-009/248/8-ANCE)
- .11 CSA C22.3 No. 7-06, Underground Systems, except where otherwise specified.
- .12 CAN/CSA-S6-14, Canadian Highway Bridge Design Code
- .13 CAN/CSA-S6.1-14 - Commentary on CAN/CSA-S6-14, Canadian Highway Bridge Design Code.
- .14 CAN/CSA-Z462-18, Workplace Electrical Safety.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

- .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

- .3 Heath Canada/ Workplace Hazardous materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 American Society for Testing and Materials (ASTM)
 - .1 ASTM D149 - 09(2013) -Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
- .5 Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
 - .1 ANSI/NETA ATS-2017
- .6 National Electrical Contractor Association (NECA)
 - .1 NECA 1-2015 - Standard Practice of Good Workmanship in Electrical Contracting.
- .7 National Fire Protection Agency (NFPA)
 - .1 NFPA 79-2018 - Electrical Standard for Industrial Machinery.
- .8 The Ontario Electrical Safety Code 2012, and all bulletins (Ontario)
- .9 Ontario provincial Standard Specifications
 - .1 OPSS 106 - General Specification for Electrical Work
 - .2 OPSS 602 (Nov 2017) - Construction Specification for Installation of Electrical Chambers
 - .3 OPSS 603 (Nov 2017)- Construction Specification for Installation of Duct
 - .4 OPSS 604 (Nov 2017) - Construction Specification for Installation of Cable
 - .5 OPSS 609 (Nov 2012) - Construction Specification for Grounding
 - .6 OPSS 610 (Nov 2016) - Removal of Electrical Equipment
 - .7 OPSS 614 (Nov 2012) - Construction Specification for Installation of Power Supply Equipment

1.4 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Preconstruction Submittals:
 - .1 Health and safety plan
 - .2 Work plan
 - .3 Quality Control (QC) plan
 - .4 Schedule of submittal items with dates
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all items described in these specifications and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Shop drawings:
 - .1 The Contractor shall submit copies of vendor, producer or manufacturer data for materials, devices and subsystems or standard or proprietary products. These shall include design and installation shop drawings, catalog cuts, specifications, testing requirements, and installation instructions for the following items, but not excluding other items or materials not specifically mentioned herein.
 - .2 System integration and/or engineered system shop drawings shall have applicable CSA certification for the equipment and material.
 - .3 The skew control monitoring, alarm and control system modifications, upgrades and reconfiguration drawings, Bill-of-Material schematic, wiring, termination drawings, associated PLC re-programming ladder logic diagrams and system testing plans shall be provided by the designated control systems vendor.
 - .4 Several electrical equipment items specified as part of the electrical work are to be provided for mechanical installation, followed by electrical installation under the herein specified electrical work. The dimensions of these items are critical for their installation and integration into the bridge mechanical machinery system. Their dimensions are indicated on the Mechanical Contract Drawings and have been obtained from information provided by various equipment manufacturers. The dimensions have not been obtained from manufacturer's certified drawings (certified drawings are drawings certified by the manufacturer to be dimensionally accurate and which contain enough

detail to determine if the requirements of the Contract Documents have been satisfied). The Contractor shall, as part of its procurement process, obtain certified drawings for all items that interface with the bridge mechanical machinery systems from the manufacturers and provide them to those responsible for the mechanical work in the preparation of their installation Drawings for their inclusion into the existing bridge machinery systems. The certified drawings shall be submitted in support of the developed Shop Drawings. The Contractor shall notify the Departmental Representative and Engineer of any dimension of any specified item that deviates from the Contract Drawings. These items shall consist of the following:

- .1 Tower Machinery Mounted Absolute Encoders
 - .2 North Span Lock Motor and required coupling
 - .3 Incliner
 - .4 Environmental Protection for Generator Room Battery Charger
- .5 Under no circumstance shall any of the proposed electrical power or control systems specified as part of this contract be procured, fabricated, assembled, or wired directly from the Contract Drawings. The Contractor shall prepare and submit proposals and installation shop drawings that describe to item to be procured of fabricated and how they are being integrated into the bridge existing power and control systems for Departmental Representative and Engineer review and approval. The substantially completed installation shop drawings shall include where and as applicable control and power schematics, layout, assembly, installation drawings of equipment, components terminal boxes and terminations drawings, point-to-point interconnection wirings with cable tags and termination identification for field installation.
- .6 The Contractor shall identify any constructability issues or conflicts between manufacturers' shop drawings and contract documents (drawings and specifications) during the Contractor shop drawing review and installation drawing development process. The Contractor shall also identify variations between Contract Documents and product or system limitations or functionality that may be detrimental to the successful performance or

operation of the completed work. The Contractor shall submit proposed resolutions for review and approval by the Engineer and Departmental Representative.

- .7 Comprehensive shop Bills of Material shall be included for each of the proposed item of equipment and systems and sub-systems including elements, replacements and enhancements related to the bridge electric service transformer, generator battery chargers and generator fuel system, low-voltage switchgear, span drive VFD's, motor control centres, bridge motors, existing aerial cable monitoring, control panels and associated PLC, bridge operator control console, etc. As appropriate for procured equipment, the computed shipping and operating weights of each piece of electrical equipment shall be stated on the Shop Drawings upon which it is detailed.
- .8 As specified and as applicable for the specified task, complete assembly and installation drawings shall be furnished. These drawings shall clearly indicate how the work is to be performed in the field including any foundation requirements such as that for the electric utility service transformer containment tub, mounting details, equipment clearances required for operation and maintenance, access and as required by applicable codes.
- .9 Assembly and installation drawings shall be given identifying marks and essential dimensions for locating each piece of equipment or assembled unit with respect to the bridge and as appropriate its required equipment mountings and any required foundations. Each unit shall be cross-referenced to the Shop Drawing on which it is detailed or indicated in physical and functional terms.
- .10 The Contractor shall submit electronic copies of all required shop drawings, unless otherwise directed, that include shop, assembly, installation, construction, schematic and wiring Drawings. Drawings shall be prepared for all electrical, mechanical and civil/structural work, power and control equipment including identifying the bridge existing sub systems they are proposed for and will interface with and shall describe in physical, functional, schematic and wiring terminologies the inclusion of the proposed systems into the existing bridge systems and infrastructure. The configuration of the power and control system shall be clearly described as well as, how they relate to the

existing logic associated with the bridge operating system and the required interfaces. All Installation and construction Drawings shall where applicable conform to the following:

- .1 Manufacturer's Literatures - The submittal information shall have annotation of project's equipment identification (name and/or tags) on their respective sheets. Where equipment vendor's standard product data sheets and/or drawings are furnished which cover several variations of the general class of equipment, the information shall be annotated to indicate exactly which equipment, parts, and/or accessories are being furnished. Technical data such as equipment ratings, operation parameters, performance data shall be provided for each specific piece of electrical equipment as specified.
- .2 General Arrangement Drawings - The general arrangement (GA) drawings where applicable for the scoped work shall indicate at a minimum 3 perspective views: plan view, elevation view, and side view. Additional views or sections shall be provided as required to clearly indicate the extents and features of the subject. The GA drawings as applicable based on the scoped items shall locate all equipment and shall include equipment centerlines, equipment access and maintenance space. The Contractor shall indicate any areas that require more than 1 metre of clearance around their equipment boundary on the GA drawings for access or maintenance requirements. The Contractor is responsible for consolidation of all information from their suppliers onto their GA drawings.
- .3 Physical Dimensioned Drawings - Provide physical dimensioned drawings as applicable to facilitate installation for Departmental Representative and Engineer review and understanding of the proposed installation shall be drawn to scale. Outline drawings shall depict graphically and dimensionally the configuration, profile, and limitations of parts and assemblies. Perspectives and reference points shall be indicated clearly for each view as appropriate. All details of given devices or components shall be clearly visible at the scale selected for that part, assembly or sub-assembly with the

exception of enlarged views drawn to capture small details within a part, such as those that may be used to improve clarity and prevent excessively large drawings.

- .4 Equipment Mounting - As applicable anchor bolt drawings shall provide templating dimensions in enough detail to facilitate the preparation of design drawings and to determine the sizes and types of fasteners and other installation devices required. Plans shall provide enough dimensional and configuration details to facilitate design and installation planning by the Contractor. The drawings shall also include the supplier's recommendations for installation methods and materials.
 - .5 Wiring Diagrams - Provide applicable changes and modifications to One-Line, Three-Line and schematic diagrams to show all wiring, connections and interconnections of the scoped and proposed electrical system modifications and additions to the installation, equipment or its component devices and parts. Drawings shall provide such detail as is necessary to be able to trace the electrical circuits and connections involved. The drawings must include cable numbers, conductor colors, pair/triad numbers, terminal source and designation identifications in accordance and integrated into the existing bridge electrical installation. If cables are shielded, the shields shall be shown on the drawings. All spare conductors shall be shown on the drawings.
 - .11 Submit six (6) copies of 600 x 600 mm minimum size drawings and product data to the Departmental Representative and Engineer.
 - .12 If changes are required, notify Departmental Representative and Engineer of these changes before they are made.
 - .13 Conduct field surveys to verify existing dimensions shown on the plans, prior to development of submittals. Identify field verified dimensions on submittals. Conduct field measurements and surveys as required to supplement the information provided in the plans and to provide a complete and satisfactory fitting and operational installation.
- .5 Engineering Data:
- .1 Provide proposed system hardware Shop Drawings

- .2 Provide system software and logic Shop Drawings
- .3 Provide Installation Shop Drawings
- .4 Civil/Structural Shop Drawings.
- .5 Provide all applicable bridge and system installation layout Shop Drawings
- .6 Certificates:
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and/or material is not available, submit such equipment and/or material to authority having jurisdiction for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract and as applicable.
 - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative as applicable.
- .7 Startup and Commissioning Plan and Report
 - .1 Provide Testing, Startup and Commissioning Plan
 - .2 Startup and Commissioning Report
- .8 Test Reports:
 - .1 Provide Factory Test Report for Skew Control Software Development.
 - .2 Provide Electrical Construction Field Testing and Commissioning Report for the bridge electrical modifications, replacements and enhancements to installation.
- .9 Manufacturer's Field Reports: Submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and electrical power and control testing, as described in PART 3 - EXECUTION
- .10 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.

- .2 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.
- .3 Regional Materials: submit evidence that project incorporates required percentage 50% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.5 CLOSEOUT
SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for the new or replaced electrical equipment and installation for incorporation into the existing manual.
 - .1 The Contractor shall provide individual Operation and Maintenance data for the contracted scoped items and as applicable for addition and integration into the existing bridge O&M manuals. The Departmental Representative and Engineer will review preliminary copies of the O&M data and the Contractor will incorporate the changes made into the existing bridge O&M manuals. Provide data for each system and principal item of equipment as specified in technical sections which have been specifically developed for use by bridge operation and maintenance personnel.
 - .2 Operating instructions specifically developed for the proposed skew control system and its integration into the existing bridge operating system to include following:
 - .1 System description, equipment and functional descriptions, bridge control sequence of operation changes and changes to the existing step-by-step operating procedures.
 - .2 System logic in ladder logic form.
 - .3 Wiring diagrams, control diagrams, and control sequence for the skew control system and each item of associated equipment.

- .4 Start up and shutdown procedures including proper adjustment, operation, lubrication, state of equipment during shutdown, winterize protection of equipment as applicable.
 - .5 Safety precautions.
 - .6 Procedures to be followed in event of equipment failure.
 - .7 Warranty information.
- .3 Other items of instruction as recommended by manufacturer of each item of equipment and the control systems vendor.
- .4 Final "As-Built" Drawings shall be submitted for review and approval at the completion of the project. Any field modification during construction and/or deviations from the approved Shop Drawings shall be clearly indicated. Reproducible drawings shall be made on sheets using the Project standard title block. These drawings shall be stamped "As Built", immediately above the title block.

1.6 QUALITY
ASSURANCE

- .1 Contractor Review and Acceptance of Shop Drawings:
- .2 The Contractor shall provide a Quality Assurance process for all shop drawings and calculations that are submitted. The review shall indicate completeness of the submittal and compliance with the design. Provide a cover sheet listing the preparer(s) and checker(s) name, initials, and content responsibility. The preparer and checker shall initial each sheet to establish their content responsibility. The preparer and checker shall not be the same individual.
- .3 Regulatory requirements:
- .4 Perform electrical construction, installation, programming and testing in accordance with industry acceptable practice and that complies with applicable prevailing codes.
- .5 The work shall comply with the requirements of the CSA C22.1, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations and CAN/CSA-Z462-11, Workplace Electrical Safety.
- .6 The work shall be performed by qualified personnel.

Installers shall be skilled in trade and shall have thorough knowledge of products and equipment specified to perform equipment and system installation in a safe professional manner.

- .7 All partially outdoor or outdoor electrical equipment enclosure construction, material and protective treatment shall be listed as suitable for installation in humid, salt-laden air environment.
- .8 Electrical components, equipment and systems shall satisfactorily pass all applicable factory and field tests in accordance with the relevant industry standards. Copies of all test certificates and supporting documentation shall be supplied to the Department Representative as part of submittal requirements or as requested by the Departmental Representative.
- .9 Manufacturer of equipment specified shall be recognized in industry for normally supplying this type of equipment. Manufacturer shall be ISO certified.
- .10 Materials and equipment furnished for permanent installation shall be new, unused, and undamaged. Provide the standard cataloged materials and equipment of manufacturers regularly engaged in the manufacture of the products. For material, equipment, and component lists submittals, show manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site. All equipment and materials shall be in accordance with the technical specification and other relevant industry standards.
- .11 Service conditions: Provide equipment and material suitable for intended service and installation at location indicated.
- .12 Parts shall be manufactured to industry standard sizes to facilitate maintenance and interchangeability.
- .13 Contractor shall develop detailed, step by step, testing and commissioning plan for placement of the specified electrical equipment, apparatus, and completed electrical system in service. Contractor shall execute the plan, document the performance and test results. Contractor shall take corrective

actions necessary to bring the failed and/or noncompliance test results into conformance.

- .14 Acceptance testing of electrical distribution equipment under scope of project shall conform to the specification, equipment manufacturer recommended testing and commissioning requirements, and to the latest revision of the ANSI/NETA Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems (ANSI/NETA ATS).
- .15 Material and workmanship shall conform to the requirements of the specifications. Contractor shall ensure material and workmanship quality conformed to the requirement of Specification Section 01 45 00.

1.7 DESIGN ANALYSIS
AND DOCUMENTATION

- .1 Contractor shall perform supplemental studies and/or designs per the requirements of the specification. Contractor shall submit drawings and engineering data in accordance with the submittal requirements and schedule to assure compliance with the project requirements, overall construction schedule, and the project in service date. During the design submittal process, the Contractor shall provide required design analysis.
- .2 Contractor's design shall consider economics, safety of operation, acceptable performance, reliability, interchangeability of parts, O&M familiarity, and other benefits.

1.8 DELIVERY,
STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Provide climate-controlled environment for the

storage for control equipment/assemblies during construction. Thoroughly dry out and put through special dielectric test as directed by the Departmental Representative or replace if not tested to the satisfaction of the Departmental Representative and Engineer, any apparatus that has been subjected to possible injury by water or dampness. Store and protect equipment from damage from mishandling, dropping or impact. Do not install damaged equipment.

- .2 Replace defective or damaged materials with new at no cost to the Departmental Representative.
- .4 Develop Construction Waste Management Plan related to the Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: CAN3-C235-83 (R2015) - Preferred Voltage Levels for AC Systems, 0 to 50,000 Volts
- .2 Motors, electric heating, control, lighting and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .4 Use one nameplate or label for each language.

2.2 MATERIALS,
EQUIPMENT AND
SERVICES

- .1 Provide material and equipment in accordance with Section 01 61 00.
- .2 Substitution: Electrical material and equipment specified constitute the basis of design material and equipment. The Contractor and/or control systems vendor may provide product that meet or exceed the quality, functions and performance specified from reputable and qualified manufacturers with the understanding that all design and/or method of installation changes required by the substitution shall be made by the Contractor at no additional cost to the contract. Product acceptability shall be determined at the sole discretion of the Departmental Representative and may be based on one or more of the following: quality, function, ease of maintenance, physical size, reliability, value, electrical load capacity, durability, standardized components, availability and other criteria as deemed appropriate by the Departmental Representative.
- .3 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .4 Factory assemble control panels and component assemblies.

2.3 CONDUIT RACEWAY

- .1 Provide conduit raceways if required and as indicated on contract drawings and/or as specified and required for the specified and described modifications, replacements and enhancements. Where conduit size is not indicated, provide minimum conduit size in accordance with requirements of the Canadian Electrical Code (CEC).
- .2 Where indicated on the contract drawings provide conduit type per the applicable locations:
 - .1 Indoor Applications:
 - .1 Exposed non-corrosive environment:
 - .2 Rigid Galvanized Steel Conduit (RGS)
 - .3 Exposed corrosive environment:
 - .4 Reinforced Thermosetting Resin Conduit (RTRC) or Fiberglass Conduit
 - .5 Above grade and concealed inside wall:

- .6 IMC or RGS Conduit
- .7 Embedded in concrete:
- .8 PVC Schedule 40 PVC
- .9 Connection to electrical equipment subject to vibrations:
- .10 Liquid-tight Flexible Metallic Conduit
- .11 Conduit stub-up:
- .12 Rigid Galvanized Steel Conduit (RGS)
- .2 Partially Exposed to Outdoor or Outdoor Applications:
 - .1 Exposed non-corrosive environment:
 - .2 Rigid Galvanized Steel Conduit (RGS)
 - .3 Exposed corrosive environment:
 - .4 PVC Coated- Rigid Galvanized Steel Conduit (PVC-RGS). Installer shall be certified by manufacturer to install PVC coated conduit.
 - .5 Direct Buried:
 - .6 PVC Schedule 80
 - .7 Embedded in concrete:
 - .8 PVC Schedule 40 PVC
 - .9 Under Roadway:
 - .10 Steel Reinforced, concrete encased duct bank, PVC Schedule 40 PVC ducts
 - .11 Conduit stub-up:
 - .12 Rigid Galvanized Steel Conduit (RGS)
- .3 Submersible Applications:
 - .1 Flexible fiberglass composite underwater duct with design pressure strength of three times the pressure of the installed water depth minimum.
- .3 Rigid Metal Conduit
 - .1 Rigid metal conduit shall be construct of mild steel tube with continuous welded seam in accordance with ANSI C80.1, and UL 6.
 - .2 Exterior and Interior of conduit shall have protective coating consisting of Metallic zinc applied by hot-dip galvanizing or electro-galvanizing with a final coat of transparent zinc chromate to exterior. Exterior and interior coatings applied to conduit shall afford sufficient flexibility to permit field bending without cracking or flaking.
 - .3 Thread pitch shall conform to ANSI/ASME B1.20.1. Taper shall be 3/4"/ft. (62.5 mm/m).

- .4 Each length of conduit shall have UL listing label.
 - .5 Couplings, unions, and fittings: Threaded-type, galvanized steel. Covers shall have solid gaskets and captive screw fasteners.
 - .6 Size of conduits shall be as indicated on construction drawing or as specified herein. Where size is not indicated, it shall be in accordance with the fill requirements as defined in the CEC. Unless otherwise indicated, the minimum size conduit shall be 3/4 mm.
 - .7 The RGS conduits shall be hot dipped galvanized inside and out with hot dipped galvanized threads.
 - .8 Each underground joint shall be sealed and made liquid tight.
 - .9 Stainless steel screws shall be furnished and used to attach the covers to the conduit fittings. All coated material shall be installed, patched according to the manufacturer's latest printed recommended installation and patching instructions, and as approved by the Departmental Representative.
 - .10 All conduits shall be secured to outlet boxes, junction boxes or cabinets.
 - .11 All conduit terminations shall be equipped with insulating bushings.
 - .12 Couplings, connectors and fittings used for the installation shall be of a type specifically designed and manufactured for use with the supplied plastic-coated conduit. Flexible liquid-tight conduit and connectors shall be used where final connection to equipment with rigid conduit is not practicable, such as to equipment with adjustable mountings or subject to vibration as specified above. Where used the flexible conduit runs shall be no less than 500mm in length or as approved by the Departmental Representative.
 - .13 Use solid gaskets. Ensure conduit fittings with blank covers have gaskets, except in clean, dry areas or at the lowest point of a conduit run where drainage is required.
- .4 PVC-Coated Rigid Galvanized Steel Conduit
- .1 PVC-coated raceway shall be installed as a system, which means the fittings, conduit bodies, straps, hangers, boxes, etc., are also coated.
 - .2 Exterior coating shall be a minimum of 40-mil, polyvinyl chloride (PVC) coating over exterior

- and apply urethane coating uniform and consistent to interior of conduit. Internal coating shall be nominal 2 mil thickness. Conduit threads shall be protected by urethane coating.
- .3 Use manufacturer acceptable method when threading the PVC coated conduit.
 - .4 The integrity of PVC coating shall be maintained at the threaded connection. PVC-Coated Rigid Galvanized Steel Conduit
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 - .3 Use manufacturer acceptable method when threading the PVC coated conduit.
- .6 The integrity of PVC coating shall be maintained at the threaded connection.
- .7 Reinforced Thermosetting Resin Conduit (RTRC)
- .1 Reinforced Thermosetting Resin Conduit shall be an epoxy-based resin system using anhydride-curing agent. RTRC shall be meets CSA C22.2 NO. 2420-09 (R2014) standards.

- .2 Conduit shall consist of continuous E-glass roving. Additives for increasing flame spread and lowering smoke density shall be halogen free.
 - .3 The conduit shall be rounded and shall be free from all defects including indentations, delamination, pinholes, foreign inclusions, and resin-starved areas. The bore of the conduit shall be smooth and uniform.
 - .4 Carbon black shall be used as ultraviolet inhibitor to protect conduit and fittings.
 - .5 Dielectric strength shall exceed 400 volts/mil when tested in accordance with ASTM D149.
 - .6 All elbows and fittings shall be manufactured from the same process, methods and chemicals as the conduit. Fittings, elbows, joints and accessories shall be as recommended by manufacturer to maintain UL listing of components and system.
 - .7 Conduit bodies shall be manufactured using compression molding process using vinyl ester resin with reinforcement glass. Bodies shall be fire resistant in accordance with CSA C22.2 NO. 2420-09 (R2014) and be halogen free.
 - .8 Minimum wall thickness of 0.09 mm for normal size 50mm -100mm (2"-4") for general application. Extra heavy wall with minimum wall thickness of 0.25 mm for normal size 76mm -203mm (3"-8") for heavy loading, long span, and/or under water crossing applications.
- .8 Liquid tight Flexible Metallic Conduit (LFMC)
- .1 Conduits to motors and other electrical vibrating equipment shall terminate in conduit fittings on the motors and equipment, the final connection being made with liquid-tight flexible conduit and suitable liquid-tight connectors.
 - .2 Flexible conduit shall be as short as possible and in no case shall not exceed a conduit run of 2m.
 - .3 Provide liquid-tight flexible metallic conduit with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.
 - .4 All fittings used for flexible metallic conduit shall be specifically designed for such conduit.
 - .5 Liquid-tight unions shall be installed where standard threaded couplings cannot be used.

- .9 Rigid Non-metallic Conduit
 - .1 Ensure rigid non-metallic conduit complies with NEMA TC 2 and NEMA TC 3 with wall thickness not less than Schedule 40.
- .10 Deflection/Expansion Fitting
 - .1 Provide deflection/expansion conduit fittings at conduit crossing between two structures at location with deflection, vibration from vehicular traffic and/or expansion. Deflection/expansion conduit fittings shall be UL listed and CSA Certified.

2.4 ENCLOSURE,
JUNCTION BOXES, AND
TERMINAL CABINETS

- .1 In general, all electrical equipment, instrumentation and wiring junction points required for the installation as described herein and on the contract drawings shall be installed in enclosures. Enclosures, junction boxes, pull boxes and terminal cabinets shall be stainless steel, NEMA 4X (or IEC type IP56 rated) as a minimum.
- .2 Enclosures, boxes, and cabinets in wet locations or subject to condensation shall include a minimum 6 mm drain hole at the low point of the enclosure.
- .3 Junction boxes pull boxes and electrical enclosures larger than 4" (100 mm) trade size in any dimension shall be of adequate strength to support mounted components without deflection during shipment and installation.
- .4 Underground boxes shall be specifically design and construct for intended installed location and be either pre-formed concrete or high strength fiberglass. Body and Cover shall be capable of withstanding, without failure, type of traffic in general area.
- .5 Electrical enclosures located in outdoor, wet, or hose down areas shall be provided with space heaters, adjustable thermostat with set point temperature indicator, and miniature circuit breaker protective device. Space heater capacity shall maintain enclosure internal temperature above dew point under specified service conditions.
- .6 Outdoor electrical enclosures with ventilating openings shall be provided with fine mesh filters and stainless-steel bug screens.

2.5 Fastening
Materials

- .1 Expansion anchors for fastening equipment to concrete surfaces shall be double, machine bolt expansion shields of stainless steel. Holes for expansion shields shall be drilled to the size recommended by the manufacturer, using carbide-tipped masonry drills.
- .2 Mounting bolts, nuts, washers and other detail parts used for fastening boxes, disconnect switches, limit switches, conduit clamps, cable support, brackets and other electrical equipment shall be bronze or stainless steel.
- .3 Bolt heads and nuts shall be hexagonal and shall be provided with medium series lock washers. Bolts that are smaller than 9.5 mm diameter shall not be used, except as may be necessary to fit the mounting holes in small limit switches, outlet boxes and similar standard devices.

2.6 Conductors

- .1 Conductors shall be soft annealed copper, stranded, Class B.
- .2 Conductor insulation except for Motor Control Center's (MCC's), control panels (CP's), and Operators Control Console and all other panels indicated herein and on the Contract Drawings shall be moisture and heat resistant cross-linked synthetic polymer, NEC Type XHHW or as otherwise herein indicated or as approved by the Engineer.
- .3 Conductor insulation for wiring in the MCC's, control panels and Operators Control Console and all other panels indicated herein and on the Contract Drawings shall be NEC Type SIS or as otherwise specified herein or as approved by the Engineer.
- .4 Conductors shall not be smaller than No. 12 AWG, or unless otherwise indicated on the Contract Drawings.
- .5 Conductors shall be coded. Each wire shall be coded so that it can be easily identified. Insulated

grounding conductors shall be colored green or green with one or more yellow stripes. Conductors for the 3-phase, A.C. Power system shall have a white neutral with black, red and blue phase conductors. Color-coding shall be throughout the thickness and length of the conductor. Painting or color marking conductors will not be permitted.

- .6 Control conductors shall be color coded with at least twenty (20) different color and trace combinations used. As far as possible, different colors shall be used in the same conduit. If more than twenty (20) conductors are used in a conduit, repetitive colors may be used which are widely separated in the bundle.
- .7 Each conductor shall be tagged at every termination and connection, and in every pull box through which the conductor passes.
- .8 Flexible cables shall be extra flexible general-purpose cables, rated 600 volts, 105 degrees Celsius to minus 40 degrees Celsius, oil, sunlight, ultraviolet, ozone, salt, chemical, and moisture resistant. The cables shall be multi-conductor sized as indicated and be Type SOW-A/SO with flexible copper conductors and stranding in accordance with Class K. The jacket shall be flame resistant and be resistant to oil, water, abrasions and mechanical abuse and of yellow color. Conductors shall be fully annealed stranded bare copper.
- .9 In-line splices of any conductors will not be permitted unless otherwise indicated herein or on the Contract Drawings or as approved by the Engineer.
- .10 Cables shall be delivered to the project site in original packaging or on factory reels, fully identified with tags or labels, indicating the manufacturer's name and date of manufacture. In addition, the name of the manufacturer, insulation type, voltage rating, and wire size shall be clearly and permanently imprinted throughout the length of each cable.

2.7 Connectors,
Terminals and Tape

- .1 Connectors, terminal lugs and fittings shall be UL 486 with the following additional requirements:
 - .1 For No. 10 AWG and smaller conductor cable shall

be pressure type tin-plated copper connectors having non-flammable and self-extinguishing insulation with temperature rating equal to that of the conductor insulation.

- .2 For No. 8 AWG to 4/0 AWG conductor cable shall be compression type tin-plated copper connectors and termination lugs having conductor insulation grip.
- .3 For 250 MCM and larger conductor cable shall be long barrel double compression type tin-plated copper connectors and terminal lugs with two-hole pads in accordance with NEMA CC1.
- .2 Bundling Straps shall be self-locking steel barb on one end, with tapered strap of self-extinguishing nylon of minus 54 to 122 degrees Celsius temperature rating. For outdoor use: ultraviolet and ozone resistant nylon strap with the above characteristics.
- .3 Insulating Tape shall consist of the following:
 - .1 Plastic tape: Vinyl plastic with rubber-based pressure sensitive adhesive, pliable at a temperature of minus 18 degrees Celsius and having the following minimum properties when tested in accordance with ASTM, D1000-77:
 - .1 Thickness: 8.5 mils
 - .2 Breaking strength: 3.6 kg per cm (width).
 - .3 Elongation: 200 percent.
 - .4 Dielectric breakdown: 10,000 volts
 - .5 Insulation resistance: 10 Meg-Ohms.
(Indirect method of electrolytic corrosion)
 - .2 Rubber Tape: Silicon rubber tape with silicon pressure sensitive adhesive and having the following minimum properties when tested in accordance with ASTM D1000-77:
 - .1 Thickness: 15 mils
 - .2 Breaking Strength: 2.3 kg per cm (width)
 - .3 Elongation: 525 percent.
 - .4 Dielectric breakdown: 13,000 volts
 - .5 Insulation resistance: 10 Meg-Ohms.
(Indirect method of electrolytic corrosion)
 - .3 Arc proof Tape: Flexible and conformable organic fabric tape, coated one side with flame-retardant flexible elastomeric, self-extinguishing, non-combustible, and having the following minimum properties when tested in accordance with ASTM D1000-77:

- .1 Thickness: 55 mils
- .2 Breaking strength: 8.9 kg per cm (width)
- .3 Thermal conductivity: 0.00478 BTU per hour per square foot per degree F watts per square meter per degree Celsius.
- .4 Electric arc: withstand 200 amperes arc for 30 seconds.

2.8 HARDWARE

- .1 Provide hardware including, but not limited to, anchor bolts, nuts, washers, expansion anchors, wire nuts needed for installation as required and specified herein.
- .2 Provide corrosive resistance hardware suitable for the environment and compatible with the electrical equipment construction and degree of environment and ingress protection.
- .3 For outdoor installation of electrical equipment, provide stainless steel hardware such as, but not limited to, anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous hardware as required and applicable for the specified installation.
- .4 Hardware smaller than 3/4" (19 mm) shall match NEMA standard size bolt holes on motors and electrical equipment.

2.9 ELECTRIC MOTORS,
EQUIPMENT AND
CONTROLS

- .1 Verify installation and coordination responsibilities related to motors, equipment and controls, as indicated on the contract drawings.
- .2 The motor shall consist of replacement the north span lock motor as specified herein and Section 26 05 00 of the specification.
- .3 Two absolute encoders to be added and driven off each tower drive machinery system located as indicated on the contract drawings.
- .4 A wireless inclinometer located on the moving structure to indicate span skew. The inclinometer to be located as indicated on the contract drawings.
- .5 Auxiliary drive control console

- 2.10 FUSES
- .1 Where fuses are specified to be added or replaced, they shall have the characteristic of the fuses they are replacing or as specified for the application on the contract drawings and in the specifications.
 - .2 Fuses shall comply with CAN/CSA-C22.2 No.248.8
- 2.11 CIRCUIT BREAKERS
- .1 Where circuit breakers are specified to be added or replaced, they shall have the characteristic of the breakers they are replacing or as specified for the application on the contract drawings and in the specifications.
 - .2 The replacement and added circuit breakers shall comply with Standard CSA C22.2 No 5-16 / UL 489,13th Edition/ ANCE NMX-J-ANCE-2016, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures as applicable and specified on the contract drawings and the specifications.
 - .3 The contractor shall perform the work as specified in Part 3 of this specification.
- 2.12 BRIDGE SKEW CONTROL, MODIFICATIONS, RECONFIGURATION AND ENHANCEMENTS
- .1 As part of the 2017 and 2018 bridge span drives, motors and control system rehabilitation, the bridge skew control was replaced. The replaced skew control has caused operational issues since it was installed.
 - .2 The intent is that the existing skew control system shall be modified, reconfigured and enhanced as part of this contract.
 - .3 The design of the modified skew control system shall follow the operating philosophy as described on the contract drawings and as herein amplified.
 - .4 The contractor shall utilize the services of the control systems vendor Panatrol, who developed the existing bridge control system, provided the control system hardware and software and tested and commissioned the existing system.
 - .5 The control system vendor in coordination with the Engineer shall utilize the existing bridge control

system design as the basis for the described modifications, reconfiguration and enhancements to eliminate the existing skew control, monitoring and alarm issues reported at the bridge.

- .6 The scope of work for the systems vendor shall be provide detailed drawings, Bills-of-Material and PLC software changes to achieve and optimize the proposed skew control design philosophy.
- .7 The control systems vendor shall work with the Engineer as an integrated team during the development process, procurement, software development, factory testing, bridge implementation, field testing, commissioning and in conjunction with the Departmental Representative and the Engineer acceptance test and provide maintenance and operational training for the completed system.
- .8 The modified skew control system shall consist of two new absolute encoders located in each tower, a new inclinometer and miscellaneous materials, panels, communications network extension and equipment.
- .9 The skew control modified system shall consist of the following requirements, implementation and operating philosophy as follows;
 - .1 The modified, reconfigured and enhanced skew control systems shall be implemented to maintain bridge operation throughout the modification work.
 - .2 Install two new absolute encoders in each machinery space. These shall be coupled to the machinery to provide a measure of span position from the rotation of each main pinion shaft. One to provide the primary function for skew control and the other absolute encoder to provide span height functionality. These encoders to be procured by the control systems vendor and installed as indicated on the mechanical contract drawings.
 - .3 As part of the final PLC configuration, the PLC shall be re-programmed to enable both new absolute encoders to be reset through PLC software at the bridge seated position for each bridge cycle of operation. This additional function will eliminate any absolute encoder count discrepancies due to rope slippage and minimize rope slippage skew errors due to accumulated errors over several bridge operating cycles. Additionally, the two new absolute encoders shall be configured through modified PLC programming to

- backcheck each other for parameter changes during the bridge operation.
- .4 Rewire the existing absolute resolvers in the north and south towers to their respective PLS (AMCI) units located in CP-8 and CP-9. The cabling to be uninterrupted continuous shielded twisted pair (STP) cables. This form of installation is essential and will eliminate EMI interference and signal corruption.
 - .5 Rewire the existing PLS (AMCI) units located in CP-8 and CP-9 to the existing splitter and to the PLC. The cabling to be uninterrupted continuous shielded twisted pair (STP) cables. This form of installation is essential and will eliminate EMI interference and signal corruption.
 - .6 As an intermediate step, the wiring between the PLS relay outputs and field limit switches in the south tower shall be modified to eliminate the series configuration to the PLC and run them as independent functions to the PLC I/O's. Note that this will require three additional PLC I/O points in CP-3. The PLC shall be modified to Re-program the PLC logic associated with the PLS (AMCI) units and their PLS limit switch relay outputs to ensure that they are individually monitored by the PLC to enable detection of a switch or device failure in the event of a fault and command an alarm on the HMI.
 - .7 The existing AMCI PLS units, as part of this final configuration shall only be used to provide indication readings to the tower panel meters of dynamic span position status to aid in the auxiliary drive control of the bridge. Note that the field limit switch connections to the PLC will remain as part of the final configuration.
 - .8 Disable and leave in place the existing PLS relay outputs and field limit switches that provides direct speed control to span drives. The drive control to be modified for the final configuration to be controlled from the PLC via the network. This shall utilize the field limit switch inputs to the PLC in conjunction with the new absolute encoder set points in the PLC to control the drives. This modification

- shall be performed in two steps to ensure uninterrupted service for the bridge. This will consist of performing the modifications of one pair of the drives at a time.
- .9 Install a temperature compensated wireless inclinometer with anti-vibration and damping features and with the required accuracy to provide meaningful output to the bridge control system as input into the PLC.
 - .10 Reconfigure the existing inclinometer wireless setup to provide stable operation and to optimize wireless communications. The Inclinometer shall be used via the PLC for span skew monitoring, as a secondary form of control, alarming and ultimate skew trip for the bridge.
 - .11 Re-tune the span motor drives to operate effectively with the new absolute encoders and their programming to provide optimal bridge control to minimize span operating skew. Modify drive acceleration and deceleration ramp times and shapes to soften the machinery impact loads and minimize the rope slippage which is a contributor to the developed skew condition.
 - .12 Bridge position limit switches shall be adjusted as necessary to conform to all above operating point changes.
 - .13 Revise PLC logic to remove "skew early warning" alarm from the PLC program. The skew early warning alarm function is not considered necessary and creates confusion for the bridge operator.
 - .14 Remove CP-3 and CP-4 existing single turn resolvers.
 - .15 The contract drawing modified auxiliary drive control system in the north and south tower machinery spaces and operators control house shall be installed to allow one operator to operate the bridge auxiliary drives from the new operator auxiliary drive control panel in the operators house or the south or north tower machinery spaces. Note that the work required to complete this modified installation shall consist of the installation of control functionality between the south and north tower machinery spaces as described on the contract drawings.

2.13 PHASE SEQUENCE
AND PHASE FAILURE
VOLTAGE RELAY

- .1 The bridge main incoming breaker and the standby generator breaker shall be provided with phase sequence/phase failure voltage relays as indicated on the contract drawings and as herein specified.
- .2 The voltage monitoring relay shall be configured to protect distribution system against possible catastrophic faults and premature equipment failure caused by voltage problems on both the incoming electric utility service and the standby generator service connected three-phase system. Voltage monitoring relay shall protect against voltage imbalance and single phasing regardless of any regenerative voltages.
- .3 The phase sequence and phase failure relay shall have the following characteristics;
 - .1 Nominal voltage; 600 volts, 60 Hz
 - .2 Output contacts; SPDT and SPNC and rated at 10A resistive 240 volts, 60 Hz.
 - .3 Dielectric Insulation Level; 1000V + (2 * nominal voltage rating) between input terminals and case or active circuitry
 - .4 Operating temperatures; -20° to 150°F (-28° to 65°C)
 - .5 Response times;
 - .1 Power up; 1-300 Seconds Adjustable.
 - .2 Restart after fault; 1-300 Seconds Adjustable.
 - .3 Release; 100 ms fixed on phase loss and phase reversal; 2 sec fixed on phase imbalance; 0.1-20 sec adjustable on undervoltage only; with an inverse time, characteristic for overvoltage.
 - .4 Mechanical life; 10,000 operations.
 - .5 Electrical Life; 10,000 operations.
 - .6 Power Consumption; 3 VA
 - .6 The phase sequence and phase failure voltage relay shall be of Eaton manufacture and be their type D65VMLS600 or Engineer approved equal.
 - .7 The phase sequence and phase failure voltage relays shall be mounted inside their respective breaker cubicles and mounted on DIN rails.
 - .8 The units shall be wired into the existing breaker trip circuits and existing Bridge Automation System (BAS) as indicated on the contract drawings.
- .4 The contractor shall perform the work as specified in Part 3 of this specification.

- .1 2.13 Electric Service Interlocks
- .5 Mechanical and electrical interlocks shall be provided between the electric utility main breaker and the generator feeder No.1 breaker in the Main Switchboard No.2.
- .6 The mechanical interlock shall consist of a retrofitted Kirk lock on each of the two breakers and be provided complete with one discrete key on a chain and the chain secured to the switchboard enclosure.
- .7 The existing breakers are of Federal Pacific Electric manufacture, their type;
- .1 Electric Utility Main; FPE 50 H3, Frame 1600 Amps.
- .2 Generator Feeder No.1; FPE 30 H3, Frame 800 Amps
- .8 The contractor shall coordinate with and procure the required Kirk Key interlock system from the switchboard manufacturer.
- .9 The electrical interlock shall consist of modifying the existing circuit breaker control circuits associated with the electric utility main breaker and the generator feeder No.1 breaker to interlock them such that both breakers can never be electrically closed simultaneously. The logic changes to ensure that if one of the two breakers is closed the other will be locked out. The logic changes shall be as described in contract drawings.
- .10 The contractor shall perform the work as specified in Part 3 of this specification.

2.14 Protection for
Battery Chargers and
Alarm Equipment

- .1 Battery charger and alarm equipment in the bridge generator room are presently exposed to water damage based on their proximity to room ventilation louvers. The intent of this work task is to either relocate or add protection to this equipment to eliminate the potential of water damage.
- .2 The contractor shall assume for tendering purposes that he shall relocate the existing two battery chargers and alarm panel to a wall mounted location where it is not subjected to the prevailing water hazard. Assume the relocation to be some 5m from their existing location and will require an additional 5m of cable and conduit to extend the existing electrical installation the described 5m.

- .3 The contractor shall perform the work as specified in Part 3 of this specification.

2.15 Generator Fuel Display Failure

- .1 The existing fuel tank display screen has failed and requires investigation and replacement.
- .2 The contractor shall employ the services of a fuel tank installation maintainer to investigate and repair the existing installation. As part of his tender, the contractor shall assume that this work will require a qualified technician at the bridge for a period of three (3) days and the installation of a new screen display in his tender.
- .3 The contractor shall perform the work as specified in Part 3 of this specification.

2.16 Switchboard and Panelboards and Equipment Labeling

- .1 The contractor shall provide and affix switchboard, panelboard and equipment labels and as applicable nameplates as directed by the Engineer.
- .2 The type and construction of the labels shall be as appropriate for the application and in accordance with the herein specified requirements.
- .3 Note that the existing span drive motor nameplates (4) are incorrect and shall be changed to include the actual design parameters of the motors. This information will be provided by the Engineer and the nameplate shall be in accordance with Section MG 1-10.40, "Nameplate Marking for Medium Single-Phase and Polyphase Induction Motors" and be of similar size and material to the existing motor nameplates. Additionally, this same motor nameplate data shall be included on a motor nameplate to be affixed on the inside of each span drive motor drive cabinet for use in re-tuning the drives by others as and when necessary.
- .4 For tendering purposes, the contractor shall assume that 20 labels will be required in each bridge tower and 30 labels will be required in the bridge operator's house. The average size of the labels shall be assumed for tendering purposes to be a Size 5 as specified herein.
- .5 The contractor shall verify all branch circuits emanating from each bridge installed panelboard as

identified on the contract drawing One-Line Diagram against existing panelboard schedules (directories) where they exist and replace with up to date directories.

- .6 Provide typewritten directories for panelboards in described with covers and directory pockets as reviewed and approved by the Engineer.
- .7 The contractor shall perform the work as specified in Part 3 of this specification.

2.17 SPAN DRIVE PRE-CHARGING CIRCUIT

- .1 The contractor shall modify the existing North West span drive pre-charging control circuit to eliminate the blowing of the identified fuses in the event of drive incoming power failure.
- .2 The pre-charging control circuit modifications shall be as described and as directed by the Engineer.
- .3 Following completion of the pre-charging circuit modifications the drive shall be tested as directed and approved by the Engineer prior the drive returned to service.
- .4 The contractor shall perform the work as specified in Part 3 of this specification.

2.18 DISTRIBUTION PANEL LOCK/LEVERS

- .1 The panel lock/levers have failed on two of the existing distribution panels (Panel A and Panel EA). Refer to the contract drawing One-Line Diagram for location.
- .2 The contractor shall replace these lock/levers and return the panels to a reliable lockable state.
- .3 The contractor shall perform the work as specified in Part 3 of this specification.

2.19 NORTH AND SOUTH BRIDGE TOWER HEATER OBSTRUCTION

- .1 As installed by others, the existing control panels in the bridge towers are obstructing the existing wall mounted electric heater panels.

- .2 The contractor shall disconnect and relocate the existing wall mounted electric heater to eliminate conflict with the tower control panels.
- .3 The work shall include extending the power circuit wiring and conduit, installing junction boxes to extend the circuits and re-installing the heater. For tendering purposes, the contractor shall assume a circuit increase of 3/4" EMT conduit with a 2-#12 AWG and 1-#12 AWG ground.
- .4 The contractor shall perform the work as specified in Part 3 of this specification.

2.20 Utility
Transformer
Containment Vessel

- .1 The contractor shall construct a containment vessel around the existing oil filled utility 1,000 kVA transformer and seal all existing bottom cable entries into the existing pad mounted utility equipment.
- .2 The work associated with the construction of the utility transformer containment vessel is specified in the relevant Sections of the specification and as indicated on the contract drawings.
- .3 The contractor shall perform the work as specified in Part 3 of this specification.

2.21 AUXILIARY DRIVE
MOTORS

- .1 The bridge is provided with a means of manually operating the bridge using auxiliary drive motors located in each bridge tower machinery area.
- .2 The present manual operation of the bridge requires bridge operating staff located in each tower and in the operators control house to operate the bridge. The intent is that the auxiliary motor control system be modified to enable manual operation of the bridge to be performed from the operators control house only.
- .3 The contractor shall modify the auxiliary motor control in each tower, and existing monitoring instrumentation and extend them to a new auxiliary control panel located in the operator's control house, all as indicated on the contract drawings.
- .4 Following the completion of the installation, the revised auxiliary drive system shall be tested by the

contractor in coordination with the Engineer, Departmental Representative and the Bridge Master to fully prove the operating system installation and its consistent and reliable operation.

- .5 The contractor shall perform the work as specified in Part 3 of this specification.

2.22 SWITCHBOARD
GROUND RELAY ALARM

- .1 The existing Switchboard No.2 is provided with an existing ground fault relay.
- .2 The contractor shall with from the output of this ground fault relay to an input of the existing bridge control system programmable logic controller (PLC) as indicated on the contract drawings.
- .3 The PLC shall be reprogrammed to accept this ground fault alarm and display it on the existing HMI as part of the work described in item 2.20 of this document.
- .4 The contractor shall perform the work as specified in Part 3 of this specification.

2.23 PROGRAMMABLE
LOGIC CONTROLLER
(PLC) RE-PROGRAMMING

- .1 The contractor shall employ the services of the control systems vendor who provided and programmed the existing bridge PLC control system; Panatrol Corporation 161 Tower Dr. Suite D, Burr Ridge, IL 60527 (630)655-4700 - Contact Mr. Bruce Krebbers.
- .2 The re-programming and additional programming shall consist of the following;
 - .1 Add programming of the modified and upgraded skew control system as specified herein and on the contract documents.
 - .2 Add programming to alarm and display electric service ground fault relay alarm.
 - .3 Make PLC software/hardware revisions to implement an operator system lock-out solution on the console (physical key or software user-login based). Coordinate design solution with the Engineer, Departmental Representative and Bridge Master.
 - .4 Perform PLC testing and software/hardware revisions to enable the "gate group raise", individual "gate raise" and "gate lower"

functions to send motor stop command / cancel sequence during operation. Coordinate programming with the Engineer, Departmental Representative and Bridge Master.

- .5 Add PLC timeout function to logout automatically out of the maintenance menu after a set time. Coordinate programming with the Engineer, Departmental Representative and Bridge Master.
 - .6 Verify and ensure that all PLC alarms logged and displayed include alarm type, cause, issue and location. Modify PLC programming and tags accordingly.
 - .7 Work with the Engineer to correct failures to elements of the traffic control system that were identified and reported in the 2018 Comprehensive Detailed Annual Inspection (CDI) report.
 - .8 Following the completion of the re-programming and additional programming the control systems vendor shall perform.
- .3 The control systems vendor shall perform the work as specified in Part 3 of this specification.

2.24 ABANDONED
ELECTRICAL CABLE AND
WIRING

- .1 The contractor shall completely remove and make safe all existing abandoned and no longer used cabling throughout the bridge facility. The removals of abandoned cabling shall be performed as specified in Part 3 of this specification.

2.25 AERIAL CABLE
VIDEO MONITORING

- .1 The contractor shall provide two (2) video cameras to be connected to spare ports of the existing bridge security CCTV system.
- .2 The video cameras shall be identical in all respects to the existing outdoor PZT cameras installed on the bridge.
- .3 The aerial cable monitoring video cameras shall be strategically mounted on the wings of the towers to monitor any oscillations of the aerial cable due to storm or wind conditions as coordinated with the Engineer and Departmental Representative.
- .4 The contractor shall perform the work as specified in Part 3 of this specification.

2.26 UNINTERUPPTABLE
POWER SUPPLY (UPS)

- .1 The existing bridge control panels CP2 and CP3 are presently provided with power conditioning units but not provide with UPS's.
- .2 It is proposed that the existing power conditioning units for CP2 and CPs shall be replaced with UPS units.
- .3 UPS output power capacity; 1000 watts/1440 VA max configurable power.
- .4 Nominal output voltage: 120 V and full load efficiency of 97%.
- .5 Output harmonic voltage distortion limited less than 5% total harmonic distortion at full load.
- .6 Output frequency 60Hz with nominal crest factor of up to 5:1 with sine wave output.
- .7 UPS output connections shall be 6x NEMA 5-15R
- .8 Input nominal voltage of 120 V at an input frequency of 60 Hz +/- 3Hz (Auto sensing).
- .9 Battery shall be maintenance-free, sealed lead-acid battery with suspended electrolyte and shall be leak proof.
- .10 Battery shall be capable of providing rated output for 15 minutes and a recharge time from discharge to full charge of 3 hours.
- .11 Interface ports with smart slot shall be provided for communications and management.
- .12 Ambient operating temperature 0 - 40 °C
- .13 The UPS shall be of APC manufacture and be their Smart-UPS RM SMT1500RM2U 1000W/1440VA 2U Rackmount LCD UPS System or Engineer approved equal.

2.27 GENERATOR ROOM
EXIT LIGHTS

- .1 The exit lights in the bridge generator room have failed and shall be replaced.
- .2 The contractor shall inspect the existing exit light and replace and install in kind.

2.28 MOTOR CONTROL
CENTRE (MCC) REPAIRS

- .1 Burnt Out MCC Indication Bulbs
 - .1 Several indication lamp bulbs on the MCC's have burnt out and require replacement.
 - .2 As part of this contract the contractor shall replace all burnt out MCC bulbs
 - .3 The contractor shall check both tower MCC's for bulb burn out but for tendering purposes, shall assume six (6) bulbs per MCC have burnt out.
- .2 Line Side Main Breaker Shield
 - .1 The North tower MCC main breaker line side shield is missing.
 - .2 The contractor shall purchase a replacement shield and install it on the main breaker in the North tower MCC.
 - .3 The MCC's are of Siemens manufacture and the main breakers are their HLD63F600, Siemens, Sentron Series, type HLD, 3P, 3PH, 600A, 600V, 65kA@480V, high interrupting capacity, bolt-on, 40° C, frame only, thermal magnetic, molded case circuit breaker.
- .3 MCC Current Transformer Shorting Blocks
 - .1 Each MCC is provided with a digital meter that is fed by potential and current transformers. The current transformers are provided with shorting blocks that presently short the CT's.
 - .2 As part of this contract, the contractor shall remove the CT shorting links and return the digital meter to service.

2.29 NORTH SPAN LOCK
MOTOR

- .1 The North span lock motor is in poor condition and shall be replaced as part of this contract. Refer to Section 26 05 81 for North span motor replacement specification.

2.30 SAFETY
DISCONNECT SWITCHES

- .1 Provide electrical equipment with heavy-duty, quick-make, quick-break type isolation switches as specified, indicated on the contract drawings and as applicable for the prevailing installation.

- .2 Replace the 800 Amp non-fused disconnect switch feeding the existing load bank and replace the existing North span lock motor non-fused disconnect switch along.
- .3 The safety disconnect switches shall be as specified in Section 26 28 23 of the specification.

2.31 WARNING SIGNS

- .1 Warning Signs: Shall be provided as applicable and indicated on the contract drawings and in accordance with requirements of the Canadian Electrical Code.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm shall be provided as indicated on the contract drawings.

2.32 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper conductors.

2.33 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates labels as follows:
 - .1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet, matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

- .3 Wording: wording on nameplates labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate or label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. XXXX" as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.

2.34 WIRING
IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.35 CONDUIT AND
CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Cover with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Prime	Auxiliary	
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.36 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .1 Paint outdoor electrical equipment "equipment green" finish.
- .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that existing conditions are acceptable for the modifications, replacements and enhancements to the electrical installation in accordance with the herein specified requirements.
- .1 Inform Departmental Representative 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 Departmental Representative.

3.2 INSTALLATION

- .1 Provide complete installation of the bridge electrical system modifications, replacements and enhancements as

specified herein and in accordance with CSA C22.1 except where specified otherwise.

- .2 Provide overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where otherwise specified.
- .3 Provide civil/structural work as specified elsewhere in the contract drawings.

3.3 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

- .1 The following shall apply to all new conduits to be installed as part of the electrical system modifications, replacements and enhancements as herein specified.
- .2 Install conduit and sleeves prior to pouring of concrete where and if applicable.
- .3 As required sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.
- .4 During the construction and installation phase, all open ends of the conduit termination shall be plugged with approved conduit stopping plugs to prevent ingress of moisture, water, and construction debris and/or aggregate.
- .5 Conduits shall be installed in practical alignment with the structure, with uniform pitch draining toward boxes with properly formed bends and securely attached to the bridge structure.
- .6 Provide deflection/expansion conduit fittings at conduit crossing between two structures at location with deflection, vibration from vehicular traffic and/or expansion. Install deflection/expansion conduit fittings per manufacturer instruction and recommendation.
- .7 Surface mounted conduits shall be supported throughout the entire route at regular intervals. The spacing between adjacent support points shall not exceed the manufacturer recommendation for their respective conduit sizes.

- .8 Where rigid steel conduit crosses an expansion joint or where significant temperature differentials are anticipated (such as outdoor raceway spans between structures, attached to bridges, on rooftops, etc.) expansion fittings shall be provided to allow relative movement to occur on either side of the expansion joint. A separate circuit protective conductor shall be installed to maintain an effective electrical continuity across the expansion joint. Provide factory installed packing ring, designed to prevent the entrance of moisture, and a pressure ring. Include a Grounding ring or a Grounding conductor for metallic expansion couplings.
- .9 An adequate number of suitably sized electrical pull boxes/junction boxes shall be provided in all conduit runs to facilitate circuit wiring installation without damage. electrical pull boxes/junction boxes shall be provided immediately after every two bends, or after a bend plus a maximum straight run of 10m, or after a maximum straight run of 15m.
- .10 Provide required penetrations in floors, walls, or roofs. Penetrations shall be as small as possible and installed in neat manner. Repair of the surrounding surfaces damaged during installation of penetrations shall be included as part of this work. Where a conduit passes through fire resistant structural elements, such as walls and floors designated as fire barriers, the penetration openings shall be properly sealed according to the appropriate degree of fire resistance of the penetrated wall and/or floor to prevent the spread of fire and smoke from one area migrating into another. In addition, where a conduit is installed in a channel, duct, ducting or shaft which pass through such elements, suitable fire-resistant barriers shall also be provided to prevent the spread of fire.
- .11 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .12 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.
- .13 Note that as appropriate and as approved by the Departmental Representative and the Engineer, the Contractor may use TECK 90 cable in lieu of cable in conduit.

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- 3.5 MOUNTING HEIGHTS .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment where applicable and indicated on the contract drawings at following heights unless indicated otherwise.
- .1 Local switches: 1400 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 In pivot pier vaulted hydraulic equipment room: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
- 3.6 FIELD QUALITY CONTROL .1 General Electrical Test Requirements
- .1 Inspection and testing shall be performed on all modified, replacement and enhanced electrical installations specified as part of the contract in accordance with the requirements of this Section. The International Electrical Testing Association (NETA) shall be referred to and adopted where appropriate. In the event of any test indicating failure to comply, that test and those preceding, the results of which may have been influenced by the fault indicated, shall be repeated after the fault has been rectified. Provide all necessary test equipment, labor, and personnel to perform the tests, as herein specified. The following tests shall be performed.
 - .2 Inspection of the Installation:
 - .3 Allow Departmental Representative access to
 - .1 Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
 - .4 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

- .5 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

- .6 Departmental Representative may order any part of Work to be examined. If, upon examination, such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

- .7 Testing of Electrical Installation:

- .8 The testing of the electrical installation shall be carried out during and following complete installation of the electrical items.
 - .1 General.
 - .2 Electrical testing shall be performed during equipment manufacture and procurement, the electrical installation process and following completion of the installation of the specified modified, replaced and enhanced equipment and installation. The electrical testing shall consist of the following:
 - .1 Factory Testing
 - .2 Field Testing
 - .3 Performance Acceptance Testing
 - .4 Endurance Testing
 - .5 Training
 - .6 Supervision of Operations

 - .3 Factory Testing
 - .1 The factory testing shall consist of proving the replacement and enhanced skew control PLC operating logic as follows:
 - .2 Simulating system operations, both normal and contingency and verifying the logic in terms of a developed "Truth Table".
 - .3 The "Truth Table" to be based on the developed and approved skew control logic functionality.
 - .4 This testing shall include proving all interlocks and permissives and the defined sequences of operation of the skew control system in terms of monitoring, alarming and trip functionality.

- .5 This task shall include the development of a comprehensive test procedure which shall identify and report on the status of each related PLC input and output for each test and sequence of operation tested.
 - .6 The simulation of operation of the bridge and providing simulated inputs into the bridge skew control system PLC logic shall be achieved with the use of a test PLC.
 - .7 The test PLC will have been programmed to provide bridge operating simulation data and accept inputs and provide outputs to prove the skew control operating functionality.
- .4 Field Testing.
- .5 The field testing shall consist of comprehensive testing of all modifications, replacements and enhancements of the electrical power and control systems associated with the bridge and as herein specified. This shall include complete field testing of the replacement and enhanced bridge skew control system.
 - .6 The field testing shall be performed while the bridge remains in service and the contractor shall coordinate his testing with the Departmental Representative and the Bridge Master.
 - .7 The Contractor shall be qualified for the defined and specified work and submit his qualifications of its electrical testing experience for Departmental Representative approval. The Contractors proposed electrical testing staff shall be experienced in the testing of electrical power, control and instrumentation systems. The Contractor shall furnish all test equipment, materials, labor and technical supervision required to perform all the tests to demonstrate that the equipment and installation comply with the requirements of the Contract Drawings and this specification. Testing procedures shall conform to applicable standards of the ANSI, IEEE, NEMA, CEC and NETA and consist of:
 - .1 Test equipment shall include, but not be limited to, the following:
 - .1 500 volts and 1,000 volt megger test sets
 - .2 Relay and metering primary injection test set

- .3 AC and DC digital and analog multi-meters
- .4 Ground ohmmeter
- .5 Multi-channel chart recorder with digital output
- .6 Power quality recorder
- .2 Continuity Test: Perform continuity test to insure correct cable connection (i.e. correct phase conductor, grounded conductor, and Grounding conductor wiring) end-to end. The continuity of all conductors installed as part of this contract, including the circuit protective conductor of every ring final circuit, shall be verified for proper installation and continuity. The wire and cable shall be isolated completely from all extraneous electrical connections at cable terminations and joints. Use switchboard feeder breakers disconnects in combination motor starters, circuit breakers in panelboards, and other disconnecting devices to isolate the circuits under test. Repair and re-verify any damages to existing or new electrical equipment resulting from improper wiring or damage caused during the installation process.
- .3 Insulation Resistance: Perform insulation resistance test on electrical switchgear, motors, and on each field-installed power and control conductor with respect to ground and adjacent conductors for the installation installed under this contract. Where applicable under this contract, general facility branch circuit load conductors serving lights and receptacle outlets, insulation resistance testing is not required. The insulation resistance of the installation shall be tested in accordance with the recommended values set by the NETA testing standards based on cable and device voltage class.
- .4 Polarity Test: Polarity test shall be performed as applicable to verify proper connection of voltage transformers, current transformers, meter, protective relay devices, electrical instruments, and proper connection to other electrical equipment installed as part of this contract.
- .5 Phasing: Conduct phase rotation tests on all three-phase circuits using a phase rotation indicating instrument. Perform

phase rotation of electrical connections to connected equipment as per the existing equipment rotation. Motor circuits shall be checked for proper rotation and motors "bumped" to verify correct machine rotation. Where applicable interconnection points between different source circuits shall be verified for proper phasing connections.

- .6 All tests shall be conducted in the presence of and with the approval of the Departmental Representative and Engineer. Any deviation from the prescribed requirements shall be corrected to the satisfaction of the Departmental Representative. The Contractor shall develop and submit comprehensive test procedures for all tests to be performed on the specified items of modified, replaced and repaired existing bridge power, control and instrumentation systems to assure all systems and sub systems are operating within their designed parameters and function as herein specified and in accordance with the manufacturer's specifications and as an integrated bridge operating system. The test procedures shall be submitted to the Departmental Representative for approval and no tests shall be performed prior to Departmental Representative approval of the procedures. The Contractor shall give the Departmental Representative written notice of the tests at least two (2) weeks in advance of testing.
- .7 The Contractor is responsible for all tests and test records. Testing shall be performed by and under the immediate supervision of the Contractor. The Contractor for each piece of equipment shall keep test records. Copies shall be furnished to the Departmental Representative for his approval.
- .8 The Contractor shall calibrate all test equipment. Tests shall be carried out in a safe and orderly manner. Care shall be taken to ensure the safety of all personnel (authorized or unauthorized) who may be exposed to equipment or wires which are energized during tests.
- .9 The Contractor shall be responsible for visual inspection of the equipment, which shall be made immediately prior to the

- testing, and/or energizing of that equipment.
- .10 The Contractor shall prepare and submit to the Departmental Representative for approval an electrical testing schedule including a detailed description of the tests to be conducted prior to carrying out any electrical tests on the system.
 - .11 No adjustments or performance acceptance tests shall be conducted on the installation until all prescribed electrical tests have been carried out and approved by the Departmental Representative.
 - .12 Field testing of the skew control system shall follow the same procedures as were developed and implemented for the factory tests following the re-programming of the bridge operating system PLC. Note that this re-programming will include the other bridge PLC monitoring, alarming and control functions specified as part of this contract.
 - .13 The PLC modifications and enhancements shall be performed by the control systems vendor and the Engineer with support from the contractor and coordinated with the Departmental Representative and the Bridge Master.
- .8 Performance Acceptance Testing.
- .1 After contracted work is completed and the above field testing is completed to the satisfaction and approval of the Departmental Representative, the Contractor shall run performance acceptance tests on the respective electrical additions, modifications, repairs to the equipment, systems and controls specified herein and described on the contract drawings.
 - .2 The performance acceptance testing shall demonstrate to the complete satisfaction of the Departmental Representative and Engineer that the contracted work meets the intended requirements of the drawings and specifications and can perform the work intended in a safe and reliable manner. These shall include but not be limited to all power, control (analog and digital) and instrumentation system modifications, replacements and enhancements to the existing bridge electrical systems. Evidence of added

- rotating instrumentation and motor binding, vibration, uneven operation or faulty operation or of the defective or out of sequence operation of the PLC system shall be cause for postponement of final acceptance.
- .3 The Contractor shall make the necessary adjustments, re-programming and/or replacements required to correct all defects which may have caused the postponement due to improper operation of the bridge and bridge machinery, monitoring, alarm and control and which had not received the approval for service from the Departmental Representative. The Departmental Representative and Engineer must witness all tests and it shall be the duty of the Contractor to submit a detailed testing schedule in advance and to coordinate with the Departmental Representative for the purpose of scheduling test dates.
- .4 The Contractor shall provide all necessary personnel for carrying out the necessary tests, including complete direction of their duties and programming of the test process. This shall include his own personnel in addition to the control systems vendor's field personnel.
- .5 On the first day of performance acceptance testing, the Contractor shall have available 6 copies of the detailed test program, arranged with suitable spaces to record all results, instrument readings, designations to correlate with index markings to be noted on the charts during the tests, pertinent comments, etc. This program shall have been submitted to the Departmental Representative and approval received before finalization of test date. Although the Contractor shall direct the testing, the right is reserved by the Departmental Representative and Engineer to call for certain notations to be made on the record copy of the test program as the tests proceed and to collaborate in the scope of interpretation of the program depending upon the results which develop.
- .6 All test instruments or other test equipment required for all the tests shall be provided by the Contractor.
- .7 Perform any adjustments and/or instrumentation calibration to satisfy the

- accuracy and repeatability of the installed systems and its operation in conjunction with the existing bridge operating system.
- .8 Perform a complete set of baselining electrical tests following the completion of the specified scope of work to confirm that the changes and installation work has not adversely affected bridge system installation or operation. The following data shall be recorded with recording meter.
- .1 Phase voltages, phase currents, and power parameters (KVA, KW, KVAR, PF) at the main incoming service during bridge operation. Data for three complete operating cycles shall be provided.
 - .2 Operating voltages, currents, and power parameters (KVA, KW, KVAR, PF) for bridge machinery equipment. For momentary loads, such as brakes and locks, only voltage and current are required to be measured during the operation.
 - .3 Adjust fully open and closed and overtravel limit switches of all devices and the bridge to operate in accordance with the approved shop drawing schematic control diagram and prevailing field conditions.
- .9 These baseline test results shall be compared with the baseline test results taken prior to the commencement of the contract work and any discrepancies will be reviewed and analyzed by the Departmental Representative and Engineer for further action. Any major discrepancies shall be rectified to the Departmental Representatives satisfaction by the contractor at no additional cost to the Department.
- .10 After completion of the performance acceptance tests, the Contractor shall submit records, adequately identified of all data recorded during the tests. The Departmental Representative shall also have the right to request different and/or additional tests when there is any disagreement relative to any test result as having established proof of acceptability and conformance to the specification.

- .11 Charts and electronic files shall be made for each test and each one uniquely identified for each test, cycle of test and movement direction of the span. The chart identifications shall coordinate with those as noted on the detailed test program. The Departmental Representative may decide during testing that certain portions of the charts need not be included in the final sets to be processed and submitted by the Contractor. All other hard copy charts, to be submitted, shall be processed by the Contractor as follows:
 - .1 Cut and trim all of the charts and reproductions so that each identified portion is separate from other portions (for example: the span opening portion of the second cycle, from closed to fully open position, would be one identified portion).
 - .2 Fold flat wise to an overall length of 280mm with the identifying chart number exposed. The identifying numbers shall contain three parts: one pertaining to the chart speed and instrument used; one part pertaining to the index system correlated to the test program; and one part to the direction of span movement.
 - .3 Make reproduction copy sets as required to accompany the report of tests. These shall be high quality reproductions of legible prints. Copies with perceptible loss of detail will not be acceptable.
 - .4 Arrange each set of charts sequentially according to the identifying numbers, separated into groups with each group corresponding to the instruments used.
- .12 Following completion and acceptance of the performance tests, the Contractor shall furnish copies of a test report to the Department. Each copy shall be suitably bound and include the following information:
 - .1 Title page, table of contents, introduction, electrical test conclusions, test program, summary

- of results, test identification numbers and charts.
- .2 The introduction shall include complete description of instruments used, current transformer ratios, and calculation of scale factors, available chart and recorder speeds used during the tests, dates tests were performed and any clarifying comments as appropriate to the full reporting of the tests.
 - .3 The test program will be a reproduction of the programs furnished by the Contractor when the tests were begun with notations as made during the tests including any recordings or chart portions not required to be included in the report.
 - .4 Summary of results shall describe the pertinent measured parameters and observable results for each test. Meaningful information shall be developed not requiring reference to the charts except for supplementary details. In other words, each test shall be described in narrative form giving recorded voltage, currents, power, speed changes and observable results pertaining to that test, including descriptions regarding acceleration, running and deceleration.
 - .5 The test identification numbers section of the report shall give the identifying number used, a list of the charts included in the report and a list of those charts which are not included.
 - .6 The charts portion of the report shall contain a pocket to enclose the reproduced charts, folded and identified as described herein.
 - .13 The original of the electronic data files and charts (complete, including those not reproduced in the report) shall be furnished to the Department.
 - .9 Endurance Testing.
 - .10 While the bridge is in service and following performance acceptance testing, the Contractor shall perform a series of endurance tests on the modifications, replacements and enhancements to

the bridge operating system. These tests shall be based on normal operation of the bridge and the control systems vendor shall arrange to record all bridge skew control and monitoring parameters over each complete operating cycle and document the successful completion of at least 15 consecutive successful operating cycles of the bridge with each bridge span drive combination.

- .11 Training.
- .12 The Contractor shall provide training sessions, manuals, and training aids to the Department staff to provide the knowledge to operate and maintain the Bridge electrical systems.
 - .1 The Contractor shall submit complete training plans and manuals for all equipment provided under this contract. The training plans shall include a proposed schedule, resumes of personnel proposed to be instructors for each class, statement of purpose, and list of the required equipment, tools, and test equipment to be utilized as part of the training session. The training manuals shall illustrate information and procedures used, and shall also be prepared specifically for use as training aids.
 - .2 The Contractor shall schedule the training sessions through the Construction Manager at a time convenient to the Department. The Contractor shall notify the Construction Manager of the proposed training sessions at least 30 days before the dates the training will be held. The Contractor shall provide on-site, hands-on training sessions as required to demonstrate actual maintenance procedures on the equipment. Training sessions shall enable a qualified service technician to troubleshoot and sustain the equipment and systems.
 - .3 The Contractor shall provide all special tools, equipment, training aids, and other materials required for the training of Department personnel. The number of special tools and other training equipment shall be adequate for the number of participants attending the training sessions.
 - .4 As a condition to Substantial Completion, the Contractor shall train the bridge

operating and maintenance (O&M) personnel in the operation, start-up and shut-down, adjustment, troubleshooting, servicing, and preventive maintenance of applicable equipment and systems installed under the Contract. The Contractor shall provide the services of manufacturers' representatives for instruction and training when special equipment and systems require the knowledge and expertise of the various manufacturers for the proper operation and servicing of such equipment and systems.

- .5 Training Manual and Student Training Material
 - .1 The Contractor shall furnish six bound copies of the Training Manual to the Department for approval 60 days prior to training. The Training Manual shall consist of material required for the instruction and training of designated Department personnel including but not limited to electricians, maintenance workers, mechanics, Departmental Representative
 - .2 The Contractor shall provide bridge operator trainers to supervise the operation of the bridge and to train the bridge operation and maintenance personnel for a period of 21 days prior to Final Acceptance Testing and approved by the Department.
 - .3 The Contractor shall provide recommended qualifications for Department personnel to be trained for bridge maintenance and operations.
 - .4 It shall also be the contractor team's responsibility to coordinate with the Department as to the location where training sessions will be held. Contractor shall give the Department a 30-day notice of scheduling the training sessions.
 - .5 Training and instruction shall be given on subjects such as troubleshooting, repair of motor controls, maintenance and adjustments of all limit switches and electrical equipment, maintenance and other items required for full bridge operation and maintenance.

- .6 The Contractor shall furnish all the required number of Student Training Material. The material shall consist of visual aid equipment such as book, booklets, and other miscellaneous items required for training.
- .13 Supervision of Operation.
- .14 The Contractor shall provide a person to supervise the operation for the first 24 canal working days of bridge operation, up to six (6) operation per day." Following this initial operation, the Contractor shall have qualified personnel on call around the clock to correct or override defects in the new equipment for a period of three months.
- .15 Refer to Section 01 91 13 Part 3 for specific Commissioning requirements during the different test stages. In particular note the requirement for 4 hours response time during Phase IV (owner operation). The schedule for span operation is to be determined by the Department after the span is completely operable. This person shall be able to operate the bridge, to supervise its operation and to make any adjustments or corrections that may be required in the electrical equipment of the bridge. He shall instruct and qualify during these operations, the employees of the Department in the operation of the bridge. Any adjustments or corrections required during these visits shall be at no additional cost to the Department.
- .9 Carry out tests in presence of Departmental Representative.
- .10 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .11 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in part 1 - QUALITY ASSURANCE.

.12 Verification requirements include:

- .1 Materials and resources.
- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local / regional materials.
- .7 Certified wood.
- .8 Low-emitting materials.

3.7 SYSTEM STARTUP

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.8 CLEANING

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

3.9 MEASUREMENT AND
PAYMENT

- .1 No measurement for payment will be made for work under this Section.
- .2 Payment for all costs associated with safety disconnect switches shall be included in associated for this common work results for electrical cost item and as described in other Sections of the Burlington Canal Lift Bridge Skew Control and Electrical Work.

END OF SECTION

PART 1 - GENERAL

1.1 WORK DESCRIPTION

- .1 This section includes general requirements for supply, service, delivery, storage, installation, testing and commissioning of a replacement span lock motor, associated brake and accessories necessary to complete the work under the scope of the contract.
- .2 provide supervision and labor, for the specified motor to be installed as a part of this Contract. Follow specified procedures and instructions provided by the Departmental Representative.
- .3 The replacement North span lock motor shall be procured, installed and tested as part of this contract.
- .4 The existing North span lock motor safety disconnect switch shall be replaced and its installation upgraded as part of this contract and as specified herein.
- .5 The installation of the replacement North span lock motor specified under this contract shall be for installation, testing and commissioning while the bridge remains in service. The contractor shall coordinate his work with the Departmental Representative and the Bridge Master to ensure minimal disruption to bridge operations and no disruption to marine traffic.

1.2 RELATED
REQUIREMENTS

- 01 33 00 SUBMITTAL PROCEDURES
- 01 45 00 QUALITY CONTROL
- 26 05 00 COMMON ELECTRICAL WORK RESULTS FOR ELECTRICAL

1.3 REFERENCES

- .1 Definitions:
 - .1 Unless otherwise specified or indicated, the terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
 - .2 The replacement span lock motor installation shall be engineered, manufactured and installed in accordance with the Canadian Electrical Code. The installation shall satisfy all statutory requirements of the national, Provincial and/or local authorities of Canada and Ontario. The electrical installation shall be suitable for the prevailing site conditions as specified. Where necessary, special attention shall be paid to the selection and installation of electrical equipment suitable for seismic conditions. Where relevant, the specific publications are referenced herein.
 - .3 The following reference standards documents form part of the specification to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the work.

- .2 Reference Standards:
 - .1 CSA Group
 - .1 CAN CSA-S6--14 Section 13 Movable Bridges
 - .2 CSA C22.1,2018 Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations
 - .3 CAN/CSA-C22.2 NO. 0-10 (R2015) - General requirements - Canadian electrical code, part II
 - .4 CSA C22.2 NO. 227.2.1-14 - Liquid-tight flexible non-metallic conduit (Bi-national standard with UL 1660)
 - .5 CSA C22.2 NO. 0.3-09 (R2014) - Test methods for electrical wires and cables
 - .6 CSA C22.2 NO. 2420-09 (R2014) - Below ground reinforced thermosetting resin conduit (RTRC) and fittings (Bi-national standard, with UL 2420)
 - .7 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 Volts
 - .8 CSA C22.2 NO. 2420-09 (R2014) - Belowground reinforced thermosetting resin conduit (RTRC) and fittings (Bi-national standard, with UL 2420)
 - .9 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 Volts

- .10 CSA C22.3 No.7-06, Underground Systems, except where otherwise specified
- .11 CAN/CSA-S6-14, Canadian Highway Bridge Design Code
- .12 CAN/CSA-S6.1-14 - Commentary on CAN/CSA-S6-14, Canadian Highway Bridge Design Code
- .13 CAN/CSA-Z462-18, Workplace Electrical Safety
- .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
- .3 Heath Canada/ Workplace Hazardous materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 American Society for Testing and Materials (ASTM)
 - .1 ASTM D149 - 09(2013) -Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
- .5 Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
 - .1 ANSI/NETA ATS-2017
- .6 National Electrical Contractor Association (NECA)
 - .1 NECA 1-2015 - Standard Practice of Good Workmanship in Electrical Contracting.
- .7 National Fire Protection Agency (NFPA)
 - .1 NFPA 79-2018 - Electrical Standard for Industrial Machinery.
- .8 The Ontario Electrical Safety Code 2012, and all bulletins (Ontario)
- .9 Ontario provincial Standard Specifications
 - .1 OPSS 106 - General Specification for Electrical Work
 - .2 OPSS 602(Nov 2017) - Construction Specification for Installation of Electrical Chambers
 - .3 OPSS 603 (Nov 2017)- Construction Specification for Installation of Duct

- .4 OPSS 604 (Nov 2017) - Construction Specification for Installation of Cable
- .5 OPSS 609 (Nov 2012) - Construction Specification for Grounding
- .6 OPSS 610 (Nov 2016) - Removal of Electrical Equipment
- .7 OPSS 614 (Nov 2012) - Construction Specification for Installation of Power Supply Equipment
- .10 ANSI/NEMA
 - .1 MG 1-2016 Motors and Generators

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Preconstruction Submittals:
 - .1 Health and safety plan
 - .2 Work plan
 - .3 Quality Control (QC) plan
 - .4 Schedule of submittal items with dates
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all items described in these specifications and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Shop Drawings:
 - .1 The Contractor shall submit copies of manufacturer data for specified span lock motor and safety disconnect switch. These shall include installation shop drawings, catalog cuts, specifications, testing requirements, and installation instructions for the replacement span lock motor and associated installation.
 - .2 The span lock motor specified is to be provided for mechanical installation, followed by electrical installation under the herein specified electrical work. The dimensions of the motor are critical for its installation and integration into the bridge span lock mechanical machinery system. The Contractor shall, as part of its procurement process, obtain certified drawings for the span lock motor that interfaces with the bridge mechanical machinery systems from the manufacturers and provide them to those responsible for the mechanical work for their inclusion into the existing bridge machinery systems. The certified drawings shall be submitted in support of the installation.

- The Contractor shall notify the Departmental Representative and Engineer of any dimension conflict or deviation that would affect the replacement work.
- .3 Under no circumstance shall the proposed span lock motor specified as part of this contract be procured, installed, or wired directly from the Contract Drawings. The Contractor shall prepare and submit proposals and installation shop drawings that describe for Departmental Representative and Engineer review and approval prior to the work being performed.
 - .4 The Contractor shall identify any constructability issues or conflicts between manufacturers' shop drawings and existing span lock motor installation during the Contractor shop drawing review and installation drawing development process. The Contractor shall also identify variations between Contract Documents and product or system limitations or functionality that may be detrimental to the successful performance or operation of the completed work. The Contractor shall submit proposed resolutions for review and approval by the Engineer and Departmental Representative.
 - .5 As specified span lock motor installation drawings shall be furnished. These drawings shall clearly indicate how the work is to be performed in the field including any mounting details, equipment clearances required for operation and maintenance, access and as required by applicable codes.
 - .6 Assembly and installation drawings shall be given identifying marks and essential dimensions for locating each piece of equipment or assembled unit with respect to the bridge and as appropriate its required equipment mountings and any required foundations. Each unit shall be cross-referenced to the Shop Drawing on which it is detailed or indicated in physical and functional terms.
 - .7 The Contractor shall submit electronic copies of all required shop drawings, unless otherwise directed, that include manufacturers data, installation, and wiring Drawings.
- .5 Engineering Data:
 - .1 Provide manufacturers data of the span lock motor and associated brake. This data shall include complete characteristics of the proposed motor
 - .2 Provide Installation Shop Drawings
 - .6 Certificates:
 - .1 Provide CSA certified equipment and material.

- .2 Where CSA certified equipment and/or material is not available, submit such equipment and/or material to authority having jurisdiction for special approval before delivery to site.
- .3 .3 Submit test results of installed replacement span lock motor.
- .4 Permits and fees: in accordance with General Conditions of contract and as applicable.
- .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative as applicable.
- .7 Startup and Commissioning Plan and Report
 - .1 Provide Startup and Commissioning Plan
 - .2 Startup and Commissioning Report
- .8 Test Reports:
 - .1 Provide Standard Motor Test Report
 - .2 Provide replacement span lock motor Field Testing and Commissioning Report.
- .9 Manufacturer's Field Reports: Submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of span lock motor replacement testing, as described in PART 3 - EXECUTION
- .10 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.
 - .2 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.
 - .3 Regional Materials: submit evidence that project incorporates required percentage 50% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.5 CLOSEOUT
SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for the replaced North span lock motor for incorporation into the existing manual.
 - .1 The Contractor shall provide individual Operation and Maintenance data for the span lock motor integration into the existing bridge O&M manuals. The Departmental Representative and Engineer will review preliminary copies of the O&M data and the Contractor will incorporate the changes made into the existing bridge O&M manuals.

1.6 QUALITY
ASSURANCE

- .1 Contractor Review and Acceptance of Shop Drawings:
- .2 The Contractor shall provide a Quality Assurance process for the replacement span lock motor, associated brake and safety disconnect switch. The review shall indicate completeness of the submittal and compliance with the specification. Provide a cover sheet listing the preparer(s) and checker(s) name, initials, and content responsibility. The preparer and checker shall initial each sheet to establish their content responsibility. The preparer and checker shall not be the same individual.
- .3 Regulatory requirements:
- .4 Perform electrical construction, installation, programming and testing in accordance with industry acceptable practice and that complies with applicable prevailing codes.
- .5 The replacement span lock motor work shall comply with the requirements of the CSA C22.1, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations and CAN/CSA-Z462-11, Workplace Electrical Safety.
- .6 Electrical work shall be performed by qualified personnel. Installers shall be skilled in trade and shall have thorough knowledge of products and equipment specified to perform equipment and system installation in a safe professional manner.
- .7 All partially outdoor or outdoor electrical equipment enclosure construction, material and protective treatment shall be listed as suitable for installation in humid, salt-laden air environment.

- .8 The span lock motor and associated brake shall satisfactorily pass all applicable factory and field tests in accordance with relevant industry standards. Copies of all test certificates and supporting documentation shall be supplied to the Department Representative as part of submittal requirements or as requested by the Departmental Representative.
- .9 Manufacturer of the specified motor shall be recognized in industry for normally supplying this type of equipment. Manufacturer shall be ISO certified.
- .10 The replacement span lock motor furnished for permanent installation shall be new, unused, and undamaged. Provide the standard cataloged information of manufacturers regularly engaged in the manufacture of the products. Show manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site. All in accordance with the technical specification and other relevant industry standards.
- .11 Service conditions: Provide span lock motor and associated brake suitable for the intended service and installation at the location indicated.
- .12 Parts shall be manufactured to industry standard sizes to facilitate maintenance and interchangeability.
- .13 Acceptance testing of the replaced span lock motor shall conform to the specification, equipment manufacturer recommended testing and commissioning requirements, and to the latest revision of the ANSI/NETA Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems (ANSI/NETA ATS).
- .14 Material and workmanship shall conform to the requirements of the specifications. Contractor shall ensure material and workmanship quality conformed to the requirement of Specification Section 01 45 00.

- .15 Material and workmanship shall conform to the requirements of the specifications. Contractor shall ensure material and workmanship quality conformed to the requirement of Specification Section 01 45 00.

1.7 DESIGN ANALYSIS
AND DOCUMENTATION

- .1 Not used.

1.8 DELIVERY,
STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Provide climate-controlled environment for the storage for motor during construction. Thoroughly dry out and put through special dielectric test as directed by the Departmental Representative or replace if not tested to the satisfaction of the Departmental Representative and Engineer, the motor if it has been subjected to possible injury by water or dampness. Store and protect equipment from damage from mishandling, dropping or impact. Do not install damaged equipment.
 - .2 Replace defective or damaged materials with new at no cost to the Departmental Representative.
- .4 Develop Construction Waste Management Plan related to the Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21.

PART 2 - PRODUCTS

- .1 This section of the specification includes the product specifications for the North span lock motor and associated brake.

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: CAN3-C235-83 (R2015) - Preferred Voltage Levels for AC Systems, 0 to 50,000 Volts
- .2 Motor and brake to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .4 Use one nameplate or label for each language.

2.2 MATERIALS, EQUIPMENT AND SERVICES

- .1 Provide replacement North span lock motor, associated brake and supporting material in accordance with Section 01 61 00.
- .2 Substitution: Electrical material and equipment specified constitute the basis of required material and equipment. The Contractor may provide product that meet or exceed the quality, functions and performance specified from reputable and qualified manufacturers with the understanding that all design and/or method of installation changes required by the substitution shall be made by the Contractor at no additional cost to the contract. Product acceptability shall be determined at the sole discretion of the Departmental Representative and may be based on one or more of the following: quality, function, ease of maintenance, physical size, reliability, value, electrical load capacity, durability, standardized components, availability and other criteria as deemed appropriate by the Departmental Representative.
- .3 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

- 2.3 CONDUIT RACEWAY .1 Provide replacement conduit raceways as necessary for the replacement span lock motor. Provide minimum conduit size in accordance with requirements of the Canadian Electrical Code (CEC)).
- .2 The replacement conduit, where found necessary due to corrosion and damage, and as directed by the Engineer and Departmental Representative, shall be replaced. For tendering purposes, the contractor shall assume the following replacements:
- .1 4M of 25mm Rigid Galvanized Steel Conduit (RGS)
 - .2 1M of 25 mm Liquid-tight Flexible Metallic Conduit
- 2.4 ENCLOSURE, JUNCTION BOXES, AND TERMINAL CABINETS .1 Not used.
- 2.5 HARDWARE .1 Provide hardware including, but not limited to, anchor bolts, nuts, washers, expansion anchors, as required for installation as required and specified herein.
- .2 Provide corrosive resistance hardware suitable for the environment and compatible with the span motor installation and degree of environment and ingress protection.
- .3 Hardware smaller than 3/4" (19 mm) shall match NEMA standard size bolt holes on motors and electrical equipment.
- 2.6 NORTH SPAN LOCK MOTOR AND BRAKE .1 The existing North span lock motor and associated brake is operational but in poor electrical and physical condition. The motor and its associated brake shall be replaced as part of the contract.
- .2 The North span lock motor and associated brake shall be replaced with a motor of the same frame size (286U), rating and nominal speed as the existing span lock motor but as herein specified.
- .3 The span lock motor shall be of the squirrel cage type and be procured specifically as a direct replacement for the existing Canadian Westinghouse motor with no requirement for additional mounting or couplings to the existing span lock machinery system. The contractor shall field inspect and confirm all details of the existing motor prior to procuring the replacement.

- .4 The motor shall be 5.0 HP, 555 RPM, 30-minute duty and be suitable for 550 volts, 3-phase, 60 Hz operation.
- .5 .5 The span lock motor shall be totally enclosed and non-ventilated with a service factor of 1.0. Insulation of windings shall be class H (super H) with special treatment consisting of impregnation with a moisture-resisting compound to retard the decrease in insulation resistance due to exposure to excessive moisture. The form of the insulation shall be developed to specifically be capable of being applied to the specified motor with no reduction in life expectancy of the winding insulation. The motor shall also be provided with an internal anti-condensation space heater sized as appropriate for the specified motor.
- .6 The locked-rotor and breakdown torques of the motors shall be as specified by NEMA, in accordance with CHBDC standard specifications for movable bridges and as herein specified.
- .7 The motor shall be built in strict accordance with NEMA standards publication MG-1. The furnished A.C. squirrel cage motor and its design and construction shall be strictly first class in all respects.
- .8 The rotor shall be balanced mechanically and electrically. Rotor and stator shall be so constructed as to be proofed against all disturbing effects incidental to normal operation and wear.
- .9 The motor shall be furnished with cast metal box, which shall be fully gasketed with bushing and threaded conduit hole, size 1" or as Engineer approved. The conduit box shall be sized in accordance with the requirements of NEMA MG 1 Part 11.
- .10 Motor must be manufactured to IEEE Marine Standards No.45. Modifications necessary to meet the requirements of these special provisions are as follows:
 - .1 All aluminum parts - chemical film (MIL-C-5541) and zinc chromate primer (MIL-P8595)
 - .2 Stainless steel shaft and hardware
 - .3 Double sealed ball bearings
 - .4 Seal all joints and eye bolt holes
 - .5 Sealed leads in terminal box
 - .6 Shaft seals
 - .7 Removable drain
 - .8 Final coat of epoxy paint
 - .9 Corrosion resistance coating - rotor and stator laminations
 - .10 Stainless steel and/or Mylar nameplate
 - .11 Super "H" insulation. Includes protection against fungus growth per MIL-V-173B

- .11 The motor frame shall be finished with a corrosion-resistant paint or coating. Exposed unpainted metal surfaces shall be of corrosion-resistant material as approved by the Engineer
- .12 The integral disc brake shall be rated for continuous operation and set for a nominal braking torque of 25 lb.ft. The solenoid shall be rated at 550-volt, 60 Hz and be powered from the motor three-phase supply. The brake shall be provided complete with a brake released limit switch and a means of manually releasing the brake
- .13 The span lock motor shall have a special extended shaft to accommodate the motor coupling and to accommodate the disc brake on the non-driven end. The non-driven end of the motor shaft shall extend a minimum of 1 1/4 inches beyond the disc brake assembly and shall be machined to a hex (1 1/8 inch across flats) for manual operation. Provide a crank for manual operation. Note that the above description is for tendering purposes. The contractor shall field measure the existing shaft and hex to ensure that the replacement is identical to the existing
- .14 The Contractor shall submit outline-dimensioned drawings, of his proposed span drive motor, mounting details, and specification, characteristics and data sheet to the Engineer for approval prior to procurement of the motor. Shop drawings submitted shall also provide dimensional tolerances, surface finishes and key-seat details. Note the developed drawings shall clearly indicate that all keys shall be retained in closed end keyways.

- 2.7 FUSES .1 Not used.
- 2.8 CIRCUIT BREAKERS .1 Not used.
- 2.9 SAFETY
DISCONNECT SWITCHES .1 The safety disconnect switches shall be as specified in Section 26 05 00 of the specification.
- 2.10 WARNING SIGNS .1 Not used.
- 2.11 WIRING
TERMINATIONS .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper conductors.

2.12 EQUIPMENT
IDENTIFICATION

.1 Not used.

2.13 WIRING
IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that existing conditions are acceptable for the replacement span lock motor electrical and mechanical installation in accordance with the herein specified requirements.
 - .1 Inform Departmental Representative 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 Departmental Representative.

3.2 INSTALLATION

- .1 Provide complete installation of the bridge electrical system modifications, replacements and enhancements as specified herein and in accordance with CSA C22.1 except where specified otherwise.

3.3 NAMEPLATES AND
LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND
CABLE INSTALLATION

- .1
 - .1 Where required the replaced conduits to be installed as part of the span lock motor replacements shall be as herein specified.
 - .2 During the construction and installation phase, all open ends of the conduit termination shall be plugged with approved conduit stopping plugs to prevent ingress of moisture, water, and construction debris and/or aggregate.
 - .3 Conduits shall be installed in practical alignment with the structure, with uniform pitch draining toward boxes with properly formed bends and securely attached to the bridge structure.

- .4 Provide deflection/expansion conduit fittings at conduit crossing between two structures at location with deflection, vibration from vehicular traffic and/or expansion. Install deflection/expansion conduit fittings per manufacturer instruction and recommendation.
- .5 Surface mounted conduits shall be supported throughout the entire route at regular intervals. The spacing between adjacent support points shall not exceed the manufacturer recommendation for their respective conduit sizes.

Where rigid steel conduit crosses an expansion joint or where significant temperature differentials are anticipated (such as outdoor raceway spans between structures, attached to bridges, on rooftops, etc.) expansion fittings shall be provided to allow relative movement to occur on either side of the expansion joint. A separate circuit protective conductor shall be installed to maintain an effective electrical continuity across the expansion joint. Provide factory installed packing ring, designed to prevent the entrance of moisture, and a pressure ring. Include a Grounding ring or a Grounding conductor for metallic expansion couplings.

3.5 MOUNTING HEIGHTS

- .1 Not used.

3.6 FIELD QUALITY CONTROL

- .1 General Requirements
 - .1 Inspection and testing shall be performed on the replacement lock motor installation specified as part of the contract in accordance with the requirements of this Section. The International Electrical Testing Association (NETA) shall be referred to and adopted where appropriate. In the event of any test indicating failure to comply, that test and those preceding, the results of which may have been influenced by the fault indicated, shall be repeated after the fault has been rectified. Provide all necessary test equipment, labor, and personnel to perform the tests, as herein specified. The following tests shall be performed.
- .2 Inspection of the Installation:
 - .1 Allow Departmental Representative access to Work.
 - .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative may order any part of Work to be examined. If, upon examination, such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

- .3 Testing of North Span Lock Installation
 - .1 The testing of the North span lock replacement motor installation shall be carried out during and following complete installation of the electrical items as directed by the Departmental Representative and the Engineer to prove the installation and operating reliability of the replaced span lock motor and associated brake.

3.7 CLEANING

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

3.8 MEASUREMENT AND PAYMENT

- .1 No measurement for payment will be made for work under this Section.
- .2 Payment for all costs associated with the replacement span lock motor shall be included in the cost for electrical cost item and as described in other Sections of the Burlington Canal Lift Bridge Skew Control and Electrical Work.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

- .1 Section 31 23 10 - Earth Excavation
- .2 Section 32 11 18 - Granular 'A'.
- .3 Section 32 11 19 - Granular 'B', Type II.

1.2 References

- .1 OPSS.PROV 206 November 2014, Grading
- .2 OPSS.PROV 314 November 2015, Untreated Granular Subbase, Base, Surface, Shoulder, and Stockpiling
- .3 Designated Sources of Materials (DSM):
<http://www.roadauthority.com/mpl/mpl.asp?MPIShortName=MTO+DSM>

1.3 Samples

- .1 Submit test results for granular gradation in accordance with Section 01 33 00.

1.4 Measurement for Payment

- .1 No measurement for payment will be made for Granular material or Rock Fill under this section.

PART 2 - PRODUCTS

2.1 Materials

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2 Use of recycled materials (RAP or RCM) on this project is not permitted.
- .3 Rock fill shall be in accordance with OPSS.PROV 206.

2.2 Source Approval

- .1 Inform Departmental Representative of proposed source of aggregates and provide test results for sampling at least 4 weeks prior to commencing production.

- .2 If, in opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Should a change of material source be proposed during work, advise Departmental Representative 2 weeks in advance of proposed change and provide documentation for testing.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 - EXECUTION

3.1 Processing

- .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
- .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified.
- .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.

3.2 Handling

- .1 Handle and transport aggregates to avoid segregation, contamination and degradation.

3.3 Stockpiling

- .1 If stockpiling is required by Contractor:
 - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
 - .2 Stockpile aggregates in sufficient quantities to meet project schedules.
 - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
 - .4 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
 - .5 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48h of rejection.
 - .6 Stockpile materials in uniform layers of thickness as follows:
 - 1. Max 1.5m for coarse aggregate and base course materials.

- 2. Max 1.5m for fine aggregate and sub-base materials.
- 3. Max 1.5m for other materials.
- .7 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .8 Do not cone piles or spill material over edges of piles.
- .9 Do not use conveying stackers.
- .10 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.
- .11 Provide silt fence barrier around perimeter of stockpile (considered incidental to work).

3.4 Aggregate Stockpile Cleanup

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water. Remove sand base and restore stockpile site at completion of the work.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

- .1 Section 31 05 16 - Aggregate Materials.

1.2 Description

- .1 The work of this section covers the requirements for all earth excavation required on this project.
- .2 Earth Excavation includes the excavation of all materials of whatever nature, including asphalt, topsoil, granular, dense tills, and frozen materials that can be ripped and excavated with heavy construction equipment.
- .3 Earth excavation shall also include sawcutting the asphalt full depth at the limits of the new approach slab. To ensure that there is a "clean" edge to which the approach slab can be cast, the initial removal shall be limited to within 150 mm of the end of the approach slab and the last 150 mm of removal (with sawcutting) shall only be done immediately before casting of the slab.
- .4 Earth excavation shall include any required shoring, bracing, and dewatering of excavation.

1.3 Measurement and Payment

- .1 No measurement for payment will be made. Include all costs for labour, materials and equipment necessary for the excavation of asphalt, granulars etc., to the limits as shown on the drawings and as directed by the Departmental Representative.
- .2 Payment will be under the Contract Combined Price Amount and such payment shall be full compensation of all labour, equipment and materials necessary to complete the work.

1.4 References

- .1 ASTM C117-17, Standard Test Method for Materials Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D422-63(2007)-e2, Standard Test Method for Particle-Size Analysis of Soils.
- .4 ASTM D1557-12e1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbs/ft²) (2,700 kN-m/m³)

- .5 ASTM D4318-17e1, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .6 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
- .7 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction.
- .8 OPSS.PROV 401 November 2015, Trenching, Backfilling and Compacting.
- .9 OPSS.PROV 1003 November 2017, Aggregates Hot Mixed, Hot Laid, Asphaltic Concrete.
- .10 OPSS.PROV 1010 April 2013, Aggregates Granular A, B, M and select subgrading materials.
- .11 Designated Sources of Materials (DSM):
<http://www.roadauthority.com/mpl/mpl.asp?MPIShortName=MTO+DSM>

1.5 Definitions

- .1 Unclassified excavation: excavation of deposits of whatever character encountered in work.
- .2 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .3 Waste material: excavated material unsuitable for use in work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.
- .5 Unsuitable materials:
 - 1. Weak and compressible materials under excavated areas.
 - 2. Frost susceptible materials under excavated areas.
 - 3. Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422, and ASTM C136/C136M-14: Sieve sizes to CAN/CGSB-8.1.

<u>Sieve Designation</u>	<u>% Passing</u>
2.000 mm	100
0.100 mm	45 - 100
0.020 mm	10 - 80
0.005 mm	0 - 45

.2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

1.6 Protection of Existing Features

- .1 Existing buried utilities and structures:
- .2 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .1 Prior to commencing excavation work, arrange with the designated utility locator to stake existing Municipal, Parks Canada and private utility locations.
 - .2 Existing utilities to be exposed in advance by hand excavation.
 - .3 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .4 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
 - .5 Record location of maintained, re-routed and abandoned underground lines.
- .3 Existing features:
 - .1 Protect existing features from damage while work is in progress. In event of damage, immediately make repair to approval of Departmental Representative.

PART 2 - PRODUCTS

2.1 Not Used

- .1 Not Used.

PART 3 - EXECUTION

3.1 Site Preparation

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Sawcut pavement neatly along limits of proposed excavation in order that surface may break evenly and cleanly. Do not complete final cut of asphalt on approaches until immediately before casting of the new approach slabs.

3.2 Stripping of Topsoil

- .1 Strip topsoil and disposal of surplus off-site. Do not mix topsoil with subsoil.

3.3 Stockpiling

- .1 Topsoil shall be disposed of off-site in locations arranged by the Contractor.
- .2 Protect fill materials from contamination.

3.4 Excavation

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Dispose of waste material (i.e., asphalt, excess or unsuitable excavated material) off site.
- .3 Do not obstruct flow of surface drainage or natural watercourses.
- .4 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .5 Notify Departmental Representative when bottom of excavation is reached.
- .6 Obtain Departmental Representative approval of completed excavation.
- .7 Remove unsuitable material to extent and depth as directed by Departmental Representative.
- .8 Correct unauthorized over-excavation as follows:
 - .1 Fill with Granulars to depths indicated on Contract Drawings, compacted to not less than 95% of Standard Proctor Maximum Dry Density.
- .9 Trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

3.5 Backfilling

- .1 Do not proceed with backfilling operations until Departmental Representative has inspected and approved installations.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

3.6 Compaction of Roadway

- .1 Compaction in accordance with OPSS MUNI 501.
- .2 Contractor shall proof roll excavated area prior to the placement of any granular material.

END OF SECTION

PART 1 - GENERAL

1.1 Measurement Procedures

- .1 Payment for the work of supplying and placing Granular 'A' shall be made under the unit price item, "Granular A" (by the tonne) and shall include the costs for all labour, equipment and material necessary to complete the work of installing Granular 'A' in accordance with these Specifications and the Contract Drawings.

1.2 Related Sections

- .1 Section 31 23 10 - Earth Excavation.
- .2 Section 31 05 17 - Aggregate Materials.

1.3 References

- .1 OPSS.PROV 501 November 2014, Compacting
- .2 OPSS.PROV 1010 April 2013, Aggregates - Base, Subbase, Select Subgrade, and Backfill Material
- .3 Designated Sources of Materials (DSM):
<http://www.roadauthority.com/mpl/mpl.asp?MPIShortName=MTO+DSM>

1.4 Delivery, Storage and Handling

- .1 Deliver and stockpile aggregates in accordance with Section 31 05 17.

PART 2 - PRODUCTS

2.1 Materials

- .1 Granular 'A' shall be in accordance with the provisions of OPSS.PROV 1010 April 2013, Aggregates - Base, Subbase, Select Subgrade, and Backfill Material. Maximum aggregate size of 19 mm.

PART 3 - EXECUTION

3.1 General

- .1 All granular material shall be placed in small lifts, not to exceed 150 mm, that can be fully compacted to 100% standard proctor density in accordance with the technical provisions of OPSS.PROV 501, Compacting.

END OF SECTION

PART 1 - GENERAL

1.1 MEASUREMENT PROCEDURES AND PAYMENT

- .1 Preparation of sub-grade for placing of topsoil will not be measured for payment and shall be included in the supply of topsoil.
- .2 Topsoil stripping will not be measured.
- .3 Measurement for payment of topsoil for the restoration of the areas disturbed by construction shall per each square metre of topsoil satisfactorily placed to the specified depth of topsoil.
- .4 Specified depth of topsoil: as shown on drawings and approved by Departmental Representative after settlement and consolidation.
- .5 Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials required to complete this work as specified.

1.2 REFERENCES

- .1 Agriculture and Agri-Food Canada
 - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
 - .1 PN1340-2005, Guidelines for Compost Quality.
- .3 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- .4 Ministry of Transportation (MTO)
 - .1 Designated Sources of Materials (DSM):
<http://www.roadauthority.com/impl/impl.asp?MPIShortName=MTO+DSM>

1.3 DEFINITIONS

- .1 Compost:
 - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
 - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
 - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth C:N ratio below 25, and contain no toxic or growth inhibiting contaminants.
 - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Quality control submittals:
 - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
 - .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALITY ASSURANCE

- .1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Topsoil: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, minimum 7% clay, and contain 2 to 10% organic matter by weight.
 - .2 Contain no toxic elements or growth inhibiting materials.
 - .3 Finished surface free from:
 - 1. Debris and stones over 25 mm diameter.
 - 2. Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 1% of soil volume.
 - .4 Consistence: friable when moist.

2.2 SOIL AMENDMENTS

- .1 Fertilizer:
 - .1 Fertility: major soil nutrients present in following amounts:
 - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.

- .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
- .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
- .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
- .6 Ph value: 6.5 to 8.0.
- .2 Peat moss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.
- .3 Sand: washed coarse silica sand, medium to coarse textured.
- .4 Organic matter: compost Category A in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .5 Use composts meeting Category B requirements for land fill reclamation and large scale industrial applications.
- .6 Limestone:
 - .1 Ground agricultural limestone.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .7 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.3 SOURCE QUALITY CONTROL

- .1 Advise Departmental Representative of sources of topsoil and manufactured topsoil to be utilized with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .4 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.
 - 1. Soil sampling, testing and analysis to be in accordance with Provincial standards.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION OF EXISTING GRADE

- .1 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .2 Remove debris, roots, branches, stones in excess of 25 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris which protrudes above surface.
 - .3 Dispose of removed material off site.
- .3 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
 - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil to following minimum depths after settlement.
 - 1. 135 mm for sodded areas.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.4 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
 - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
 - .1 Leave surfaces smooth, uniform and firm against deep footprinting.

3.5 ACCEPTANCE

- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Ministry of Transportation (MTO)
 - .1 Designated Sources of Materials (DSM):
<http://www.roadauthority.com/mpl/mpl.asp?MPIShortName=MTO+DSM>

1.2 MEASUREMENT PROCEDURES

- .1 Payment for sodding will be made at unit price bid of actual area surface measurements taken and computed by Departmental Representative for:
 - .1 Turf Grass Nursery Sod per square metre.

1.3 SUBMITTALS

- .1 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Obtain approval of samples by Department Representative.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by sod nursery certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.5 SCHEDULING

- .1 Schedule sod laying to coincide with preparation of soil surface.
- .2 Schedule sod installation when frost is not present in ground.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by the authority having jurisdiction and the Departmental Representative.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
 - .1 Turf Grass Nursery Sod types:
 - .1 Number One Named Cultivars: Nursery Sod grown from certified seed.
 - .2 Turf Grass Nursery Sod quality:
 - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
 - .3 Mowing height limit: 35 to 65 mm.
 - .4 Soil portion of sod: 6 to 15 mm in thickness.
 - .2 Water:
 - .1 Supplied and paid for by Contractor from a designated source.
 - .3 Fertilizer:
 - .1 Supply fertilizer to Canada Fertilizers Act.
 - .2 Supply in bags bearing the manufacturer's label indicating weight and guaranteed analysis.
 - .3 Fertilizer shall be in granular form, dry, free-flowing without lumps.
 - .4 Minimum analysis shall be: 16% nitrogen, 3% phosphorus and 15% potash. The guaranteed ratio shall be 3-1-2.
 - .5 The total nitrogen component of the fertilizer shall be a minimum of 30% water soluble nitrogen (controlled, slow release nitrogen) by weight.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13. If discrepancies occur, notify Department Representative and do not commence work until instructed by Department Representative.
- .2 In general, sod is to be placed in the boulevard space between the curb and the sidewalk and behind the sidewalk where the sidewalk abuts private property and landscaped areas.

- .3 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .4 Fine grade surface free of humps and hollows to smooth, even grade, and elevations indicated, to tolerance of plus or minus 8b mm, for Turf Grass Nursery Sod.
- .5 Remove and dispose of weeds; debris; stones of 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

3.2 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.
- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod as directed by Department Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.
- .4 Areas to be sodded include, but not limited to, the following:
 - .1 Boulevard area between sidewalk and curb;
 - .2 Area immediately behind sidewalk against private property;
 - .3 Area around the Bridge Control Building.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

- .1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.
- .2 Start laying sod at bottom of slopes.
- .3 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1m of catch basins and drainage channels and ditches to following pattern:
 - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
 - .2 Not less than 3-6 pegs per square metre.
 - .3 Not less than 6-9 pegs per square metre in drainage structures. Adjust pattern as directed by Departmental Representative.
 - .4 Drive pegs to 20 mm above soil surface of sod sections.

3.4 FERTILIZING PROGRAM

- .1 Fertilizer shall be applied uniformly to the surface area designated for sodding a maximum of 48 hours prior to the laying of sod and at the rate specified on the bag supplied by the manufacturer.
- .2 Supply a second application of fertilizer at the start of the growing season in the year following initial placement of sod.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 50 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother grassed areas.
- .4 Maintain sodded areas weed free 95%.
- .5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles.

3.6 ACCEPTANCE

- .1 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots.
 - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
 - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
- .2 Areas sodded in the Fall of the year will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.7 MAINTENANCE DURING WARRANTY PERIOD

- .1 Perform following operations from time of acceptance until end of warranty period:
 - .1 Water sodded Turf Grass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
 - .2 Repair and re-sod dead or bare spots to satisfaction of Departmental Representative.
 - .3 Cut grass and remove clippings as directed by Departmental Representative to height as follows:
 - .1 Turf Grass Nursery Sod:
 - .1 50 mm during normal growing conditions.
 - .2 Cut grass at 2 week intervals but, as a minimum, at intervals so that approximately one third of growth is removed in single cut.
 - .3 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles.

.4 Eliminate weeds by mechanical means to extent acceptable to Departmental Representative.

3.8

CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION