

OPERATIONAL CONSTRAINT - Illumination for Night Work

Special Provision

Floodlighting used for night work operations shall be adjusted so as to not interfere with the vision of drivers on the affected or opposing lane and also so as to not be directed towards residences adjacent to the construction site.

OPERATIONAL CONSTRAINT (ENVIRONMENTAL) - Erosion and Sedimentation Control

Special Provision

Install appropriate erosion and sediment control measures prior to starting work.

The time interval between commencement and completion of any work that disturbs earth surfaces shall be a maximum of 20 calendar days. Commencement of such work shall be considered to have occurred when the original stabilizing ground cover has been removed, including grubbing, or has been covered with fill material. Completion of such work shall be considered to have occurred when the cover material (seed and mulch, seed and erosion control blanket, sod, rip-rap, etc.) has been applied.

Where the timing of the operation results in a conflict with the application requirements of the specified cover, the Contractor shall determine appropriate interim measures that afford temporary protection until such a time as final cover can be applied.

These timing constraints apply regardless of timing of Contract award.

Run-off from construction materials and any stockpiles shall be contained and discharged so as to prevent entry of sediment to watercourses.

The Contractor shall prepare a Plan for the control of erosion and sediment and shall accept responsibility for the adequacy of the Plan. Prior to the commencement of any excavation or grading work, the Contractor will provide the Contract Administrator with a copy of the Plan for their review.

The Contractor shall be solely responsible for controlling erosion and sediment including, but not limited to, the implementation, inspection, maintenance and removal of erosion and sediment control measures according to OPSS 803, 804 and 805. Slope stabilization prior to removal of erosion control measures shall be in accordance with OPSS 803, 804 and 805

The Contractor shall immediately make changes if erosion and sediment control measures prove inadequate. If dewatering is required, effluent shall be discharged so as to prevent entry of sediment to watercourses by use of an appropriate filtration system. Direct discharge will not be permitted.

Materials may include, but are not limited to, silt fence barriers, fiber role dams, straw bale barriers, turbidity curtains, flow checks, seeding and cover and others as identified in OPSS 803, 804 and OPSS 805. In addition, alternative materials or methods are acceptable provided they meet industry standards and protect the environment from the impact of erosion and sedimentation.

Where dewatering is required, and where culverts are cleaned by hydraulic means, effluent shall be discharged to prevent entry of sediment to watercourses.

OPERATIONAL CONSTRAINT (ENVIRONMENTAL) - Concrete/Structure, Structure Repair/Construction, and Concrete Sawcutting Erosion and Sedimentation Control

Special Provision

This special provision describes the requirements for control measures during removal of concrete/structure, structure repair/construction, and concrete sawcutting.

The requirements of this special provision are in addition to those specified elsewhere in the Contract.

For materials resulting from concrete/structure removal, and materials resulting from structures repair/construction, the Contractor shall take such measures and provide such protection system or systems to ensure that such materials do not:

- (a) fall into or enter the watercourse;
- (b) cause damage to any portion of the structure not designated for removal.

For concrete sawcutting, the Contractor shall take such measures and provide such protection system or systems to:

- (a) contain any effluent until it is disposed of; and
- (b) minimize the escape of dust such that no visible dust reaches the watercourse, wetlands adjacent, or property outside the right-of-way limits.

The following work shall not commence until the Contract Administrator has given permission to proceed in writing.

- (a) removal of concrete/structure and imposition of construction loading on existing structure;
- (b) structure repair/construction; and
- (c) concrete sawcutting.

The Contractor shall give the Contract Administrator written notice a minimum of 14 calendar days prior to the date that permission is required to proceed with any of the above-specified work operations. The notice shall include six copies of written descriptions, stamped drawings and schedules that provide the following:

- (a) the sequence and method of control measures during:
 - (i) removal of concrete/structure;
 - (ii) structure repair/construction; and
 - (iii) concrete sawcutting.
- (b) the details of any construction loads imposed on the existing structure by the control measures.

Permission to proceed with the above will be provided if the Contract Administrator determines that the details of the notice meet the requirements of this special provision.

Where loads are imposed on the existing structure, the drawings will be stamped by the Authority with the words: "Checked only for loads imposed on the bridge, not checked for design of scaffolds and work platforms".

Dust from concrete sawcutting and all other excess materials resulting from concrete removal and concrete repair/construction shall be managed as specified elsewhere in the Contract.

All material from concrete sawcutting and all other excess materials resulting from concrete/structure removal and structure repair/construction shall be managed as specified elsewhere in the Contract.

At the conclusion of the work, the control measures shall be removed from the right-of-way.

OPERATIONAL CONSTRAINT (ENVIRONMENTAL) – Management of Effluent Concrete

Special Provision

SCOPE

This special provision describes the requirements for management of effluent resulting from concrete cutting/grinding, that either:

(a) runs off the concrete surfaces that are cut/ground, or off any immediately adjacent road surface, before such runoff can dry/ evaporate on the concrete or immediately adjacent road surface;

or

(b) accumulates/ponds on the concrete that is cut/ground, on any road surface, or in any other location.

These requirements are in addition to those specified elsewhere in the contract and do not relieve the Contractor of obligations imposed by the Contractor's Certificate of Approval for a Waste Management System.

DEFINITIONS

Construction Area: Means the road allowance, right-of-way, and property with a boundary common to the road allowance or right-of-way within the contract limits.

Effluent: Means liquid that is a direct result of concrete cutting or grinding. Effluent includes any stormwater, or surface drainage that becomes mixed with this material. Effluent is classified as liquid industrial waste Class 146 (L).

Manifest: means a Regulation 347 Form 1 manifest.

Receiving Site: means certified waste processing facility, and certified waste disposal site.

SUBMISSION AND DESIGN REQUIREMENTS

Where the Contractor's operations will result in effluent from concrete cutting or grinding, that is as specified in the scope of this special provision, written agreement of the operator of the receiving site to accept the effluent, shall be submitted to the Contract Administrator a minimum of two weeks prior to commencement of the work.

At the completion of the work, a copy of a release signed by the same receiving site operator or property owner shall be provided to the Contract Administrator.

A copy of the contractor's Certificate of Approval for a Waste Management System shall be provided to the Contract Administrator prior to the commencement of the work.

CONSTRUCTION

General

Effluent from concrete cutting and grinding operations, as specified in Section 1 of this special provision, shall be captured and contained for management in compliance with this special provision.

It is the Contractor's responsibility to obtain any approvals, releases, and agreements, and conditions of same, that are required to implement the Contractor's strategy for the management of effluent.

Effluent resulting from concrete cutting and grinding operations shall be transported to one of the following receiving sites:

- (a) a waste disposal site with a Certificate of Approval for a Waste Disposal Site valid for liquid industrial waste Class 146 (L);
- (b) a waste processing facility with Certificate of Approval for a Waste Disposal Site (Processing) valid for liquid industrial waste Class 146 (L).

For each shipment of effluent from the construction area to any certified receiving site:

- (a) the carrier shall have a Certificate of Approval for a Waste Management System valid for liquid industrial waste Class 146 (L), and shall comply with Sections 4.2 and 4.3 of this special provision; and
- (b) the shipment shall be manifested as specified in Section 4.4 of this special provision.

Carrier Certification

The carrier shall have a Certificate of Approval as specified in Sections 4.1 of this special provision. Responsibilities of certified carriers shall include, but not be limited to, the following:

- a) transportation of waste materials produced by the work in accordance with the Certificate of Approval;
- b) carrier responsibilities for waste materials including, but not restricted to, manifesting of liquid industrial waste.

Certificate of Approval

The contractors Certificate of Approval for a Waste Management System and the receivers Certificate of Approval for a Waste Disposal Site shall be valid for all of the following:

- (a) the entire period of the work;
- (b) the entire area within the limits of the work and the entire haul route; and
- (c) the equipment to be utilized; and
- (d) waste classification 146 (L).

Manifesting

Manifesting shall be as specified in Section Construction General of this special provision. The carrier shall present a Regulation 347 Form 1 manifest for "Part A" completion by the Contract Administrator. The Contract Administrator shall be notified a minimum of two weeks prior to the first shipment requiring manifesting, and a minimum of 24 hours notice prior to each subsequent shipment requiring manifesting.

OPERATIONAL CONSTRAINT – Confirmation of Utilities

Special Provision

Prior to the construction, the Contractor shall confirm the location of the existing utilities and confirm existing storm sewer invert elevation's where proposed storm sewer will connect with the existing storm sewer.

OPERATIONAL CONSTRAINT – Roadway Drainage

Special Provision

The Contractor shall ensure that positive roadway surface drainage is provided for when the pavement removal operation leaves the surface pavement below the adjacent existing lanes, shoulders or curb and gutter.

The Contractor shall ensure that all existing drainage facilities remain operational and free of construction debris during the progress of the work until the completion of construction.

All costs associated with drainage shall be borne by the Contractor, at no additional cost to the Owner.

AMENDMENT TO OPSS 180, NOVEMBER 2016

Special Provision No. ENVR0014

October 2021

Compliance With Ontario Regulation (O. Reg.) 406/19 for On-Site and Excess Soil Management

180.02 REFERENCES

Section 180.02 of OPSS 180 is amended by the addition of the following:

Ontario Ministry of Transportation Publications

MTO Forms:

PH-CC-181	Site Selection Notification for Temporary Stockpiling Excess Materials Managed Through Re-use
PH-CC-182	Site Selection Notification for Excess Material Managed as Disposable Fill and Excess Soil
PH-CC-183	Property Owner's Release
PH-CC-185	Excess Soil Quantity and Quality Report

Provincial Statutes

- O. Reg. 406/19: On-Site and Excess Soil Management, under the Environmental Protection Act, R.S.O. 1990, c. E.19
- O. Reg. 153/04: Records of Site Condition - Part XV.1 of the Act, under Environmental Protection Act, R.S.O. 1990, c. E.19

Ministry of the Environment, Conservation and Parks Publications

Rules for Soil Management and Excess Soil Quality Standards

180.03 DEFINITIONS

Section 180.03 of OPSS 180 is amended by the addition of the following definitions:

Excess Soil means as defined in O. Reg. 406/19.

Excess Soil Standards means as defined in O. Reg. 406/19.

Liquid soil means as defined in O. Reg. 406/19.

MOECC means MECP (Ministry of the Environment, Conservation and Parks).

Property Owner means the owner or operator of a re-use site, Class 2 soil management site, a landfill site, dump, or a local waste transfer facility.

Rock means as defined in O. Reg. 406/19.

Rock Block means rock as defined in OPSS 206.

Reuse Site means as defined in O. Reg. 406/19.

Salt-Impacted Excess Soil means a type of excess soil as described in the Rules for Soil Management and Excess Soil Quality Standards.

180.04 DESIGN AND SUBMISSION REQUIREMENTS

180.04.01 Submission Requirements

180.04.01.01 Notification of Site Selection, and Property Owner Release

Clause 180.04.01.01 of OPSS 180 is deleted in its entirety and replaced with the following:

180.04.01.01.01 General

The qualifications of the Contractor's qualified person retained to oversee the management of excess soil according to O. Reg. 406/19 shall be submitted to the Contract Administrator for information purposes only.

When testing is required, the Contractor shall be responsible for sampling, delivery, and testing according to O.Reg. 406/19 and O.Reg. 153/04. The Contractor shall also be responsible for any sampling and testing requirements imposed by a property owner as a condition of accepting excess soil, at no additional cost to the Owner.

180.04.01.01.02 Excess Material Managed as Disposable Fill and Excess Soil

MTO form PH-CC-182, Site Selection Notification for Excess Material Managed as Disposable Fill and Excess Soil shall be completed when excess material is managed as disposable fill or beneficial re-use of excess soil.

180.04.01.01.03 Temporary Stockpiling Excess Materials Managed Through Re-Use

MTO form PH-CC-181, Site Selection Notification for Temporary Stockpiling Excess Materials Managed Through Re-Use shall be completed when temporary stockpiling of excess materials are managed through re-use.

Subsection 180.04.01 of OPSS 180 is further amended by the addition of the following clauses:

180.04.01.08 Excess Soil Documentation and Tracking

A minimum of 14 Days prior to commencing the removal of excess soil from the Working Area, the following excess soil documentation shall be submitted to the Contract Administrator for each reuse site that is subject to the requirements of O. Reg. 406/19 and Rules for Soil Management and Excess Soil Quality Standards for information purposes only:

- a) Where the excess soil is intended to be deposited for the purposes of final placement:
 - i. The location of the reuse site (the municipal address and/or the geographic coordinates of the centroid of the reuse site measured using a global positioning system receiver and projected on the Universal Transverse Mercator (UTM) coordinate system).

- ii. A description of the property use of the reuse site and any characteristics associated with the reuse site or nearby properties (including, but not limited to, sensitive receptors) that may affect the excess soil quality standards applicable to the reuse site.
 - iii. A description of the undertaking or the beneficial purpose for which the excess soil is to be used.
- b) The estimated quantity of excess soil, including any salt impacted quantities, to be managed at the reuse site and that are necessary for the identified beneficial purpose.
- c) The applicable excess soil quality standards for the reuse site, as determined according to:
 - i. The excess soil standards, and/or;
 - ii. The site-specific excess soil quality standards developed for the reuse site by the Contractor's qualified person by using the Beneficial Reuse Assessment Tool (BRAT), an indication that this is the case and the name and contact information of the Contractor's qualified person who developed the site-specific excess soil quality standards.
- d) Documentation showing that appropriate property owner consultation and disclosure has taken place and confirmation of the property owner's / operator's written permission to accept the excess soil.
- e) Completed copies of MTO form PH-CC-181, Site Selection Notification for Temporary Stockpiling Excess Materials Managed Through Re-Use and/or MTO form PH-CC-182, Site Selection Notification for Excess Material Managed as Disposable Fill and Excess Soil. Any change to the reuse site location shall require re-submission of newly completed forms.
- f) If the reuse site is or will be governed by a site-specific instrument, identify the instrument, attach a copy of the identified instrument, the public body responsible for issuing the instrument and any other information relevant to the reuse of excess soil at that site.
- g) Confirm if a notice to be filed on Registry is required according to O. Reg. 406/19.
- h) When an excess soil tracking is required, a description of the excess soil tracking system that will be applied, according to the Rules for Soil Management and Excess Soil Quality Standards, to track each load of excess soil during its transportation and deposit at a reuse site.
- i) An excess soil destination assessment report, prepared by the Contractor's qualified person according to the Soil Rules if required as per O. Reg. 406/19. This report shall be based on the results of any required assessment of past uses of the Working Area, any required soil characterization report and any information gathered in respect of the potential sites at which the excess soil may be deposited.]
- j) The excess soil documentation shall also include the following information from the site where excess soil originated:
 - i. A sampling and analysis plan and a soil characterization report, prepared by the Contractor's qualified person according to the Rules for Soil Management and Excess Soil Quality Standards when required according to O. Reg. 406/19

180.04.01.09 Notice to be Filed in the Registry

If a notice to be filed on Registry is required according to O. Reg. 406/19, information under Schedule 1 of O. Reg. 406/19 shall be completed. The Registry shall be updated as soon as there are any changes of

the information originally input to the Registry. Complete the Registry within 30 Days after the final load of excess soil for final placement of the work has been deposited at the reuse site and if as soon as there are any changes to the information originally added to the notice on the Registry. The Contract Administrator shall be notified in writing each time a notice is filed. The registration of the Working Area on the Registry shall be at no additional cost to the Owner.

180.07 CONSTRUCTION

Subsection 180.07.01 of OPSS 180 is deleted in its entirety and replaced by the following:

180.07.01 Conditions on Management of Excess Material

180.07.01.01 General

A Contractor's qualified person shall be retained to oversee the management of excess soil according to O. Reg. 406/19.

Management of excess material shall be as described in Tables 1, 2 and 3, unless an instrument is in place issued by MECP.

When an excess material is a mixture of materials, it shall be managed in compliance with the most stringent conditions associated with any of the constituent excess material.

When excess material includes asbestos waste, the asbestos waste shall be managed as specified in the Contract Documents.

Excess materials shall not be permitted in waterbodies, and environmentally sensitive areas as identified in the Contract Documents, except when re-used as specified in the Contract documents.

The Contract Administrator shall be notified 48 hours prior to any excess soil transferred from one location to another.

180.07.01.02 Excess Soil Within Environmentally Sensitive Area

Excess soil shall only be finally placed within an environmentally sensitive area if the excess soil meets Table 1 according to excess soil quality standards of the Rules for Soil Management and Excess Soil Quality Standards.

180.07.01.03 Temporary Stockpile for Re-Use

Unless an instrument is in place that specifies alternative storage rules for temporary stockpiling of excess soil, excess soil storage at the Working Area, at a Class 2 soil management site, at a local waste transfer facility or a reuse site before it is finally placed shall only be located:

- a) A minimum of 30 m away from waterbodies.
- b) A minimum of 10 m away from the property line (boundary), unless any of the following apply:
 - i. 500 m³ or less of soil will be stored at any one time.
 - ii. Storage will be for a period of time of less than 1 week.

- iii. The storage location has a physical barrier (e.g., concrete wall) between the soil and property boundary.
 - iv. The storage is taking place on the MTO right of way with written permission from the Contract Administrator.
 - v. Residences located within a minimum distance separation according to Table 2.
- c) A minimum of 2 m above the ground water table.
 - d) A minimum of 100 m from water wells.

Additional requirements for management of liquid soil shall be according to Section C of Part 1 of the Rules for Soil Management and Excess Soil Quality Standards.

180.07.01.04 Salt-Impacted Excess Soil

Salt-impacted excess soil shall be managed according to the requirements specified in the Rules for Soil Management and Excess Soil Quality Standards.

Salt-impacted excess soil may only be placed:

- a) Where it is reasonable to expect that the soil will be affected by the same chemicals as a result of continued application of a substance for the safety of vehicular or pedestrian traffic under conditions of snow or ice; or
- b) At an industrial or commercial property use where non-potable excess soil quality standards would be applicable; or
- c) At least 1.5 m below the surface of the soil.

Salt-Impacted Excess Soil shall not be finally placed:

- a) Within 30 m of a waterbody;
- b) Within 100 m of a potable water well or area with an intended property use that may require a potable water well; or
- c) On lands that will be used for growing crops or pasturing livestock unless the excess soil is placed 1.5 m or greater below the soil surface.

Section 180.07 of OPSS 180 is amended by the addition of the following subsections:

180.07.08 Excess Earth Quantity Report

A completed MTO form PH-CC-185, Excess Soil Quantity and Quality Report, shall be submitted to the Contract Administrator a minimum of 3 Business Days prior to all regularly scheduled site meetings, for information purposes only. The submittal shall account for all excess earth managed as disposable fill, by stockpiling, and by re-use. Revisions shall be highlighted. The form shall confirm the submission date of the corresponding Site Selection Notification and Property Owner Release forms to the Contract Administrator.

If an excess soil tracking system is required as identified in the Excess Soil Documentation and Tracking clause it shall be completed according to the Rules for Soil Management, Excess Soil Quality Standards. The Contractor shall provide the Contract Administrator access to the excess soil tracking system upon request.

A final completed MTO Form PH-C-CC-185, Excess Soil Quantity and Quality Report, shall be submitted to the Contract Administrator prior to Contract Completion, for information purposes only.

180.07.09 Verification of Deposit of Excess Soil

Within 14 Days of the deposit of the final load of excess soil from the Working Area at the reuse site, a report shall be submitted to the Contract Administrator including the following:

- a) All records generated as part of the Excess Soil Documentation and Tracking clause.
- b) Verification that the excess soil has been placed at the correct reuse site(s) with the appropriate quality and quantity of excess soil for the beneficial purpose identified in the Excess Soil Documentation and Tracking clause, for information purposes only.
- c) Completed copy of form PH-CC-183, Property Owner's Release showing the property owner of the reuse site has consented in writing to the deposit of the excess soil at the reuse site.
- d) Any applicable amendments to the sampling and analysis plan shall be identified in the report.

Table 1 of OPSS 180 is deleted in its entirety and replaced by the following Table:

**Table 1
Excess Material Management Conditions**

Excess Material Description	Subsection in This Specification				
	Conditions on Management by Re-Use	Conditions on Management as Disposable Fill	Conditions on Management by Open Burning	Conditions on Management by Disposal as Non-Hazardous Solid Industrial or Commercial Waste	Conditions on Management by Stockpiling
Earth	Yes	Yes	n/a	Yes	Yes
Excess Soil	Yes	Yes	n/a	Yes	Yes
Swamp Material	Yes	Yes Table 2	n/a	Yes	Yes Table 2
Aggregate	Yes	Yes	n/a	Yes	Yes
Rock Block	Yes	Yes	n/a	Yes	Yes
Bituminous Pavement	Yes Table 2	Not Permitted	n/a	Yes	Yes
Concrete	Yes Table 2	Not Permitted	n/a	Yes	Yes
Masonry	Yes Table 2	Not Permitted	n/a	Yes	Yes
Manufactured Wood	Yes	Not Permitted	Not Permitted	Yes	Yes Table 2
Natural Wood	Yes	Yes Table 2	Yes	Yes	Yes Table 2
Debris from Open Fires	n/a	Yes Table 2	n/a	Yes	Yes Table 2
Metal/Plastic Polystyrene Products	Yes	Not Permitted	Not Permitted	Yes	Yes
Subject Waste	Subject waste shall be managed as specified in the subsection for Conditions on Management by Disposal as Subject Waste.				
Materials Suspected of Being Contaminated	When excess materials that were not generated by the Contractor's operations and are not specified in the Contract Documents, are suspected of being contaminated, direction on their management shall be obtained from the Owner.				
Other Materials	Excess materials that are not listed above shall be managed as specified in the subsection for Conditions on Management by Disposal as Non-Hazardous Solid Industrial or Commercial Waste, unless prior alternative management conditions are approved in writing by the MECP.				

AMENDMENT TO OPSS 1151, APRIL 2021

Special Provision No. 111F06

October 2021

1151.04 DESIGN AND SUBMISSION REQUIREMENTS

1151.04.01 Design Requirements

1151.04.01.01 General

Clause 1151.04.01.01 of OPSS 1151 is amended by the addition of the following:

For HMA in this Contract, the mix properties, the compaction effort, and the aggregate properties specified in the Contract Documents shall conform to the requirements for the traffic category specified in Table A. The use of a mix designed with a traffic category different than specified in Table A shall not be permitted.

The asphalt cement (AC) added to the hot mix types shall be performance graded asphalt cement (PGAC) as specified in Table A. For bidding purposes only, the percentage by mass of asphalt cement, AC_{BID} contained in the various HMA mix types shall be as specified in Table A.

OPSS 1151 is amended with the addition of the following Table:

**TABLE A
HMA Mix Design Criteria**

HMA Type	Location in Contract	Traffic Category	PGAC Grade	AC_{BID} % (Note 1)
SP 12.5 FC2	All Surface Course Layers	E	70-28	5.2%
SP 19.0	All Binder Course Layers	E	70-28	4.8%

Notes:

1. For SMA Mix Types a minimum AC Content is specified in Table 5 based on combined aggregate bulk relative density.

**GENERAL REQUIREMENTS OF SAMPLES FOR QUALITY ASSURANCE, REFEREE
AND OTHER TESTING BY THE OWNER OR THE OWNER'S AGENT**

Special Provision No. 199F57

May 2023

Scope

This Special Provision covers the minimum requirements for the handling, identification, and delivery of samples to a laboratory for quality assurance, referee and other testing by the Owner or the Owner's agent.

Sampling and Identification

All samples shall be obtained and packaged by the Contractor, in the presence of the Contract Administrator or a designated representative. All samples shall be provided with a unique number by the Contract Administrator for identification purposes.

Sampling, handling, and storage of samples shall be as specified in the Contract Documents. Notwithstanding, the Owner may take samples for its own purposes at any time from any location. The Contractor shall furnish all reasonable assistance to the Owner and shall require its Subcontractors and suppliers to do the same.

The Contractor shall supply sample containers and all relevant Safety Data Sheets. All containers used for samples of materials controlled under the Workplace Hazardous Materials Information System shall be appropriate for the materials and shall be labelled and accompanied with the relevant Safety Data Sheets.

The Contractor shall package all samples to minimize risk of damage or contamination during transport. Once packaging is complete, the Contractor shall inspect all samples and confirm each sample and packaging is acceptable to the Contract Administrator for delivery.

After inspecting and determining that each sample is acceptable for delivery, the Contractor shall enter the sample data information. Upon the Contractor submitting the sample data information, the Contractor accepts responsibility that the information entered is accurate.

The Contractor shall place bags or containers of samples into clear polyethylene security bags supplied by the Owner when instructed by the Contract Administrator. At this point, the Contract Administrator shall take possession of, and assume responsibility for the samples. The Contract Administrator or their representative may apply security seals.

The Contractor shall be responsible for all costs associated with obtaining new samples if the original samples did not conform to the sampling requirements (e.g., weight and size) and were deemed unsuitable for testing by the laboratory or the Owner.

Sample Delivery by the Contractor

The Contractor shall be responsible for the delivery of concrete cylinders for strength and grout cubes for strength determination, and bridge bearing pads, to the laboratory designated by the Owner. All other samples shall be delivered by the Contract Administrator.

Samples delivered by the Contractor shall be within the time limits and locations specified in the Contract Documents. The Contractor shall normally deliver samples during normal business hours. Normal business hours are deemed to be from 8:00 a.m. to 5:00 p.m., each Business Day. Where a sample has to be delivered outside these hours, the Contractor shall give the laboratory one full Business Day notice.

If the time limits and/or locations for delivering samples are not specified in the Contract Documents, then the sample shall be delivered by the Contractor no later than 1.0 Business Day(s) from the date of sampling to the regional quality assurance laboratory located within a 100 km radius of the Contract limits.

For all samples delivered by the Contractor, the Contractor shall maintain a record of the date and time of delivery, and the printed name and signature of the authorized individual receiving the sample. The Contractor shall sign the laboratory's records to confirm the date and time of delivery.

The Contractor shall be responsible for all costs associated with obtaining new samples if the original samples delivered by the Contractor are lost or deemed unsuitable for testing by the laboratory or the Owner.

The regional quality assurance laboratory shall be designated by the Owner.

EARTH EXCAVATION, GRADING OR THE OWNER'S AGENT

Special Provision No. 206F06

September 2017

Amendment to OPSS 206, November 2014

206.07.03.01 Earth Excavation - Grading

206.07.03.01.01 General

Clause 206.07.03.01.01 of OPSS 206 is amended by the addition of the following paragraph:

The work shall also include the excavation of pavement, treated base, concrete base, prime, surface treatment, and mulch pavements, including any buried layers of these materials.

206.09.01.01 Earth Excavation, Grading

Clause 206.09.01.01 of OPSS 206 is amended by the addition of the following paragraph:

Where the work of earth excavation, grading includes the removal of pavement, treated base, concrete base, prime, surface treatment, and mulch pavements, including any buried layers of these materials, the measurement for payment of earth excavation, grading shall include the volume of these materials.

CONCRETE CURB AND GUTTER

Special Provision No. 353S02

July 2007

OPSS 353, September 1996 Construction Specification for Concrete Curb and Gutter Systems is amended as follows:

353.05.01 Concrete

Subsection 353.05.01 of OPSS 353 is deleted and replaced with the following:

Concrete shall be according to OPSS 1350 and the following:

Minimum specified 28-Day compressive strength:	30 MPa,
Coarse aggregate:	19 mm nominal maximum size.

353.07.08.03 Concrete Curing

Clause 353.07.08.03 of OPSS 353 is deleted and replaced with the following:

Formed and slipformed concrete shall be cured according to OPSS 904. The use of white pigmented curing compound is permitted except that curing with curing compound shall not be used on any construction joint or when cold weather concreting is in effect.

353.07.13 Field Sampling and Testing of Concrete

Subsection 353.07.13 of OPSS 353 is deleted and replaced with the following:

Field sampling and testing of concrete shall be according to OPSS 1350.

PAVEMENT MARKING, PAVEMENT MARKING DURABLE

Special Provision No. 710S01

September 2011

710.07.09 Application

Subsection 710.07.09 of OPSS 710 is amended by the addition of the following:

710.07.09.09 Application of Stop Lines

The Contractor shall coordinate the application of the required pavement markings and the entering into service of the traffic signals, as specified elsewhere in the Contract Documents and in accordance with the signed PH-M-125 drawing. The application of all pavement markings for stop lines, pedestrian crosswalks, lane designation markings, for the major approaches shall be completed on the same day, prior to the traffic signals being put into service. The application of the above noted pavement markings on the minor approaches and all edge lines must be completed within a 48 hour window prior to the traffic signals being put into service.

PAVEMENT MARKING OBLITERATING - BY GRINDING

Special Provision No. 710S04

September 2011

Removing and Obliterating Pavement Markings

Amendment to OPSS 710, November 2010

710.02 REFERENCES

Section 710.02 of OPSS 710 is amended by the addition of the following, under:

Ontario Ministry of Transportation Publications

Designated Sources for Materials (DSM)

710.06 EQUIPMENT

Section 710.06 of OPSS 710 is amended by the addition of the following subsection:

710.06.04 Removal Equipment

Pavement markings shall be removed by grinding using equipment as specified in the DSM listing for Line Removal Systems, Pavement Markings.

710.07 CONSTRUCTION

710.07.03 Pavement Marking Obliterating

Subsection 710.07.03 of OPSS 710 is amended by the addition of the following:

The removal shall exceed the width and length of the marking to be removed by a minimum of 10 mm.

The depth of the removal shall be the minimum required to totally remove the existing pavement markings, to a normal depth, typically averaging 3 mm.

The Contractor's operation shall be carried out in accordance with approved methods as specified in the DSM listing for Line Removal Systems, Pavement Markings, so as to control any dust or effluent generated by the operation.

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A.
- B. Concrete Formwork: Section 031100.
- C. Steel Concrete Reinforcement: Section 032100.

1.02 REFERENCES

- A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of American Concrete Institute (ACI) and American Society for Testing and Materials (ASTM) documents.
 - 1. ACI 117-10: Specifications for Tolerances in Concrete Construction and Materials
 - 2. ACI 301-16: Specification for Structural Concrete for Buildings.
 - 3. ACI 302.1R-15: Guide for Concrete Floor and Slab Construction.
 - 4. ACI 304.2R-96: Placing Concrete by Pumping Methods.
 - 5. ACI 305R-10: Guide for Hot Weather Concreting.
 - 6. ACI 306R-10: Guide to Cold Weather Concreting.
 - 7. ACI 308.1-11: Standard Specification for Curing Concrete.
 - 8. ACI 318 -14 Building Code Requirements for Structural Concrete.
 - 9. ACI 360R-10: Guide to Design of Slabs on Grade
 - 10. ASTM C 94/C 94M – 11b: Standard Specification for Ready- Mixed Concrete.
 - 11. ASTM C 494/C 494M - 11: Standard Specification for Chemical Admixtures for Concrete.

1.03 DEFINITIONS

- A. ACI 301, Section 1.2 - Definitions:
 - 1. Add the following definitions:
 - a. Cementitious Material: Cementitious materials include cement, ground blast furnace slag and fly ash.
 - b. Corrosion Inhibitor Admixture: A liquid admixture, calcium nitrite that inhibits corrosion of concrete-embedded steel in the presence of chloride ions.
 - c. Pumped Concrete: Concrete that is conveyed by pumping pressure through rigid pipe or flexible hose.
 - d. Water-to-Cementitious Ratio (w/c): A ratio representing quantity in pounds of free moisture available for cement

hydration divided by quantity of cementitious materials in pounds per cubic yard concrete.

2. Cast in Place Concrete shall be understood to include all admixtures, steel reinforcement, and formwork.

1.04 SUBMITTALS

- A. Submittals Package: Submit product data for design mix(es) and materials for concrete specified below at the same time as a package.
- B. Product Data:
 1. Mix Design: Submit proposed concrete design mix(es) together with name and location of batching plant at least 28 days prior to the start of concrete work.
 - a. Include test results of proposed concrete proportions based on previous field experience or laboratory trial batches in accordance with ACI 301, Section 4.
 - b. Pumped Concrete: Include test results of proposed design mix(es) tested under actual field conditions with the maximum horizontal run and vertical lift required for this project.
 2. Portland Cement: Brand and manufacturer's name.
 3. Fly Ash: Name and location of source, and DOT test numbers.
 4. Air-entraining Admixture: Brand and manufacturer's name.
 5. Water-reducing Admixture: Brand and manufacturer's name.
 6. High Range Water-reducing Admixture (Superplasticizer): Brand and manufacturer's name.
 7. Corrosion Inhibitor Admixture: Brand and manufacturer's name.
 8. Accelerating Admixture: Brand and manufacturer's name.
 9. Aggregates: Name and location of source, and DOT test numbers.
 10. Chemical Curing and Anti-Spalling Compound: Brand and manufacturer's name, and application instructions.
 11. Bonding Agent (Adhesive): Brand and manufacturer's name, and preparation and application instructions.
 12. Expansion Joint Fillers: Brand and manufacturer's name.
- C. Quality Control Submittals:
 1. Batching Plant Records: At the end of each day of placing concrete, furnish the Director's Representative with a legible copy of all batch records for the concrete placed.
 2. Concrete Pumping Equipment Data: Include manufacturer's name and model of principal components, type of pump, and type and diameter of pipe/hose.
 3. Minutes of the previous pre-installation conference.

1.05 QUALITY ASSURANCE

- A. Qualifications of Crew Pumping Concrete: Workers pumping concrete shall have had at least one year of experience pumping concrete.

- B. Concrete batching plants shall be currently approved as concrete suppliers by the New York State Department of Transportation.
- C. Truck mixers for concrete shall be currently approved by the New York State Department of Transportation.
- D. Pumping equipment for pumped concrete shall be subject to the approval of the Director.
- E. Fly ash supplier shall be on the New York State Department of Transportation's current "Approved List of Suppliers of Fly Ash".
- F. Source Quality Control: The Director reserves the right to inspect and approve the following items, at his own discretion, either with his own forces or with a designated inspection agency:
 - 1. Batching and mixing facilities and equipment.
 - 2. Sources of materials.
- G. ACI 301, Section 1.4 Reference standards and cited publications:
 - 1. Add the following to the list of ASTM Standards:
 - a. C 311-11a Standard Methods of Sampling and Testing Fly Ash or Natural Pozzolans For Use As A Mineral Admixture in Portland Cement Concrete.
- H. Pre-Construction Conference: A minimum of 14 days prior to the initial submission of shop drawings, a conference will be held by the Director's Representative at the Site for the purpose of reviewing the Contract Documents, and discussing the requirements and procedures for submittals and for the Work. The conference shall be attended by the Contractor, the concrete supplier representative, and the reinforcement fabricator's project coordinator.
 - 1. If resilient flooring is to be placed on slab-on-grade, the meeting will also include discussion of curing procedures and moisture mitigation measures.
- I. Prepare a 4'x4' (min) section of sample shield wall showing the formed finish specified for review and approval by the owner. The panel shall be constructed with the same concrete submitted in the mix design for the wall, and shall have the same finish coatings as specified for the shield wall. The thickness need not be greater than 6" for the mock up panel.

1.06 DELIVERY

- A. ASTM C 94/C 94M, Article 14 - Batch Ticket Information: In addition to the information required by Paragraph 14.1, also include the following:
 - 1. Type and brand, and amount of cement.
 - 2. Weights of fine and coarse aggregates.
 - 3. Class and brand, and amount of fly ash (if any).

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cement: ASTM C 150, Type I or II Portland cement.
- B. Water: Potable
- C. Air-entraining Admixture: ASTM C 260, and on the New York State Department of Transportation's current "Approved List".
- D. Water-reducing Admixture: ASTM C 494/C 494M, Type A, and on the New York State Department of Transportation's current "Approved List".
- E. High Range Water-reducing Admixture (Superplasticizer): ASTM C 494/C 494M, Type F, and on the New York State Department of Transportation's current "Approved List".
- F. Corrosion-Inhibiting Admixture: ASTM C 494/C 494M, for use in resisting corrosion of steel reinforcement.
 - 1. DCI Corrosion Inhibitor by W. R. Grace & Co., - Conn., 62 Whittemore Ave., Cambridge, MA 02140, (617) 876-1400 and MasterLife CNI by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.
 - 2. DCI - S Corrosion Inhibitor by W. R. Grace & Co., - Conn., 62 Whittemore Ave., Cambridge, MA 02140, (617) 876-1400.
- G. Retarding Admixture: ASTM C 494, Type D, Water-reducing and retarding, for use in hot weather concreting, and on the New York State Department of Transportation's current "Approved List".
- H. Accelerating Admixture: Non-corrosive admixture, containing no chloride, complying with ASTM C 494, Type C or E, and on the New York State Department of Transportation's current "Approved List".
- I. Fly Ash: ASTM C 618, including Table 1 (except for footnote A), Class F except that loss on ignition shall not exceed 4.0 percent.
- J. ACI 301, Section 4.2.1.2 - Aggregates:
 - 1. Add the following paragraph:
 - a. Fine aggregate for pumped concrete shall meet the requirements of ASTM C 33, except 15 to 30 percent shall pass the No. 50 sieve and 5 to 10 percent shall pass the No. 100 sieve. The fineness modulus of the fine aggregate for pumped concrete shall not vary more than 0.20 from the average value used in proportioning.
- L. Chemical Curing and Anti-Spalling Compound: ASTM C-309, Type 1D, Class B, with a minimum 18 percent total solids content. No thinning of material allowed.
 - 1. SureCure Emulsion, Kaufman Products, Inc. 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.
 - 2. Cure & Seal by Symons Corp., 200 East Touhy Ave., PO Box 5018, Des Plaines, IL 60017-5018, (847) 298-3200.

3. MasterKure CC 180 WB by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.
 4. Cure & Seal 25 UV (J-22 UV) by Dayton Superior Corp., 1125 Byers Rd.,, Miamisburg, OH 45342, (800) 745-3700.
 5. Acrylseal HS by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.
- M. Chemical Hardener (Dustproofing): Colorless aqueous solution of magnesium-zinc fluosilicate.
1. MasterKure HD 300WB by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.
 2. Surfhard by The Euclid Chemical Co., 19218 Redwood Rd., Cleveland, OH 44110, (216) 531-9222.
 3. Liqui-Hard by W.R. Meadows, Inc., PO Box 543, Elgin, IL 60121, (847) 683-4500.
 4. FluoHard by L & M Construction Chemicals, Inc., 14851 Calhoun Rd., Omaha, NE 68152, (402) 453-6600.
 5. Armortop by Anti Hydro International, Inc., 265 Badger Ave., Newark, NJ 07108, (800) 777-1773.
 6. Diamond by Kaufman Products , Inc., 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.
- N. Type 1 Expansion Joint Filler: Preformed, resilient, nonextruding cork units complying with ASTM D 1752, Type II.
- Q. Epoxy Bonding Agent (Adhesive): 100 percent solids epoxy-resin-base bonding compound, complying with ASTM C 881, Types I, II, IV and V, Grade 2 (horizontal areas) or Grade 3 (overhead/vertical areas), and Class B (40-60 degrees Fahrenheit) or Class C (60 degree Fahrenheit and above).
1. SurePoxy HM Series by Kaufman Products, Inc., 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.
 2. Sikadur Hi-Mod 32 by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071, (800) 933-7452.
 3. MasterEmaco ADH 327 RS by by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.
- R. Emery Aggregate: Natural emery, crushed, polyhedral in shape, with not more than 10 percent flat or elongated pieces, properly screened, graded and packaged in the manufacturer's plant, and delivered to the Site in sealed, labeled packages.
1. Emerundum by Anti Hydro International, Inc., 265 Badger Ave., Newark, NJ 07108, (800) 777-1773.
 2. Non-Slip Aggregate by Setcon Industries, Inc., 5 Mathews Ave., Riverdale, NJ 07457-1020, (201) 283-0500.
 3. MasterTop 120SR by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.

2.02 PROPORTIONING OF MIXES

- A. Cast-in-place concrete shall be air-entrained normal weight concrete.

1. Normal weight concrete, except as otherwise specified, shall have a minimum compressive strength as required by ACI 318-14 Table 19.3.2.1. "Requirements for concrete by exposure class". Slump: Maximum 4 inches; minimum 2 inches before the addition of any water-reducing admixtures or high-range water-reducing admixtures (superplasticizers) at the Site.
 2. Optional Material: Fly ash may be substituted for (Portland) cement in normal weight and lightweight concrete up to a maximum of 15 percent by weight of the required minimum (Portland) cement. If fly ash is incorporated in a concrete design mix, make necessary adjustments to the design mix to compensate for the use of fly ash as a partial replacement for (Portland) cement.
 - a. Adjustments shall include the required increase in air-entraining admixture to provide the specified air content.
 - b. Lower early strength of the concrete shall be considered in deciding when to remove formwork.
- B. Slump for Pumped Concrete: When a water-reducing admixture is not used, maximum slump shall be 4 inches. When a water-reducing admixture is used, maximum slump shall be 6 inches and when a high-range water-reducing admixture (superplasticizers) is used, maximum slump shall be 8 inches.
- C. Design Air Content: Design air content for concrete shall be according to ACI 318-14 Table 19.3.2.1 "Requirements for concrete by exposure class", and ACI 318-14 Table 19.3.3.1 "Total air content for concrete exposed to cycles of freezing and thawing" with an allowable tolerance of plus or minus 1.5 percent for total air content, except as otherwise specified. Use air-entraining admixture, not air-entrained cement.
- D. Water-Cement Ratio: Cast-in-place concrete shall have a maximum water-cement ratio as required by ACI 318-14 Table 19.3.2.1 "Requirements for concrete by exposure class".
- E. ACI 301, Section 4.2.2.3: Change article to read as follows:
1. 4.2.2.3 - Size of Coarse Aggregates:
 - a. 4.2.2.3.a Normal Weight Concrete: Coarse aggregates shall conform to gradation requirements for various sizes as tabulated in Table No. 2 of ASTM C 33. The sizes of coarse aggregates for various classes of Work shall be as follows with all percentages being determined by weight.
 - b. 4.2.2.3.b For concrete floors, floor and roof slabs, reinforced beams and girders, columns and piles, concrete encasing underground electric conduits, and concrete in which the space between restricting objects is 2 inches or less, the coarse aggregate shall be Size No. 67.
 - c. 4.2.2.3.c For other concrete Work having a minimum cross-sectional dimension of not more than 6 inches, the coarse aggregate shall be a well graded mixture of No. 67 and No. 57, provided that not more than 50 percent nor less than 30 percent

shall be Size No. 67 and not more than 70 percent nor less than 50 percent shall be Size No. 57.

- d. 4.2.2.3.d For other concrete Work having a minimum cross-sectional dimension greater than 6 inches and not more than 12 inches, the coarse aggregate shall consist of a mixture of No. 67, No. 57 and No. 467, providing that not more than 25 percent nor less than 10 percent shall be Size No. 67 and not more than 40 percent shall be Size No. 467.
- e. 4.2.2.3.e For other concrete Work having a minimum cross-sectional dimension of more than 12 inches, the coarse aggregate shall consist of a mixture of No. 67, No. 57 and No. 357, providing not more than 25 percent nor less than 10 percent shall be Size No. 67 and not more than 40 percent shall be Size No. 357.

- G. Application Rate for Corrosion-Inhibiting Admixture: The application rate for the corrosion-inhibiting admixture shall be 4 gallons per cubic yard of concrete for all concrete placements adjacent to travel lanes or at the salt barn.
- H. Admixtures: Do not use admixtures in concrete unless specified or approved in writing by the Engineer.
- I. ACI 301, Section 4.1.2.1 - Mixture Proportions:
 - 1. Add the following to paragraph 4.1.2.1:
 - a. Proposed design mix(es) for pumped concrete and the pumping equipment shall have been tested under actual field conditions with the maximum horizontal run and vertical lift required for this project.

2.03 JOINTS

- A. ACI 301, Section 5.3.2.6 - Construction joints and other bonded joints:
 - 1. Delete the following subparagraphs:
 - a. Use an acceptable surface retarder in accordance with manufacturer's recommendations;
 - b. Roughen the surface in an acceptable manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, or damaged concrete at the surface; or
 - 2. Add the following in place of the above subparagraph:
 - a. The use of cement grout.
- B. ACI 301, Section 10.2.5 – Isolation-joint filler materials:
 - 1. Add the following paragraphs:
 - a. Except as otherwise shown on the Drawings, expansion joints shall be as follows:
 - b. In joints required to receive a sealant, the joint filler shall be 1/2-inch-thick and recessed as required to form a caulking slot.
 - c. In joints not required to receive a sealant, the joint filler shall be 1/2-inch-thick and extend through the full cross-section of the

- concrete.
- d. Tool edges of concrete with 1/8-inch radius edging tool.

2.04 PRODUCTION OF CONCRETE

- A. Provide ready-mixed concrete, either central-mixed or truck-mixed, unless otherwise approved in writing by the Director.
- B. ACI 301, Section 5.3.2.1 Weather considerations
 - 1. Delete paragraph under 5.3.2.1.c - Hot Weather, and add the following:
 - a. 5.3.2.1.c Provide adequate controls to insure that the temperature of the concrete when placed does not exceed 90 degrees F., and make every effort to place it at a lower temperature. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set or cold joints. Ingredients may be cooled before mixing by shading the aggregates, fog spraying the coarse aggregate, chilling the mixing water or other approved means. Mixing water may be chilled with flake ice or well-crushed ice of a size that will melt completely during mixing, providing the water equivalent of the ice is calculated into the total amount of mixing water.
- C. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.
 - 1. In cold weather, comply with ACI 306R.
 - a. When air temperature is below 40 degrees F (4 degrees C) heat the mixing water and, if necessary, the aggregates to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees C) at point of placement. If the mixing water is heated, do not exceed a temperature of 140 degrees F at the time it is added to the cement and aggregates.
 - 2. In hot weather, comply with ACI 305R.
 - a. When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Do not use items of aluminum for mixing, chuting, conveying, forming or finishing concrete, except magnesium alloy tools may be used for finishing.
- B. Check items of aluminum required to be embedded in the concrete and ensure that they are coated, painted or otherwise isolated in an approved manner.
- C. Install waterstops in accordance with manufacturer's printed instructions.

- D. Hardened concrete, reinforcement, forms, and earth which will be in contact with fresh concrete shall be free from frost at the time of concrete placement.
- E. Do not deposit concrete in water. Keep excavations free of water by pumping or by other approved methods.
- F. Prior to placement of concrete, remove all hardened concrete spillage and foreign materials from the space to be occupied by the concrete.

3.02 ADMIXTURE ADDITIONS AT THE SITE

- A. Site additions shall be limited to high-range water-reducers, non-chloride accelerators, and corrosion inhibitors. Comply with manufacturers' printed instructions for discharge of admixtures shall be furnished.
- B. High-Range Water-Reducers:
 - 1. Concrete shall arrive at a slump of 2 to 4 inches (50 to 100 mm). Water additions at the Site shall be limited to comply with water-to-cementitious ratio requirements.
 - 2. Following addition of high-range water-reduced concrete, a minimum of 70 revolutions or 5 minutes of mixing shall be completed to assure a consistent mixture.
- C. All concrete with other admixture additions shall mix a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.

3.03 PLACING

- A. ACI 301, Section 5.3.2.3 Conveying equipment:
 - 1. Add the following paragraphs:
 - a. 5.3.2.3.d When pumping concrete, the lubricating mortar for the delivery line shall not be discharged into an area of concrete placement.
 - b. 5.3.2.3.e The inside diameter of the delivery lines for pumped concrete shall be the greater of either a minimum of 5 inches or 3 times the maximum size of coarse aggregate.
- B. ACI 301, Section 5.3.2.2 - Conveying:
 - 1. Add the following paragraph:
 - a. Operation of truck mixers and agitators and discharge limitations shall conform to the requirements of ASTM C 94.
- C. ACI 301, Section 5.3.2.4 - Depositing:
 - 1. Add the following paragraph:
 - a. Do not allow concrete to free fall more than 4 feet.

3.04 REPAIRING SURFACE DEFECTS

- A. ACI 301, Section 5.3.7 – Repair of surface defects:

1. Add the following paragraph:
 - a. 5.3.7.1.a Finish patched areas to match the texture of the surrounding surface.

- B. ACI 301, Section 5.3.7.2 - Repair of tie holes:
 1. Delete last sentence in 5.3.7.2 and replace with the following:
 - a. The patch mixture shall consist of a mixture of dry-pack mortar, consisting of one-part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for placing and handling. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

3.05 FINISHING FORMED SURFACES

- A. Finish Schedule: Except where indicated otherwise on the Drawings, provide the finishes below:
 1. Rough Form Finish for concrete surfaces not exposed to view.
 2. Smooth Rubbed Finish for exterior concrete surfaces exposed to view.

- B. ACI 301, Section 5.3.3.3 - As-cast Finishes:
 1. Add the following to paragraph 5.3.3.3:
 - a. Fins shall be completely removed on surfaces to receive waterproofing.

3.06 SLABS

- A. Slabs On Grade: Provide key type joints unless otherwise shown. Tool exposed joints.

- B. ACI 301, Section 5.3.4 – Finishing unformed surfaces:
 1. Add the following paragraph to section 5.3.4.1 Placement:
 - a. Provide monolithic finishes on concrete floors and slabs without the addition of mortar or other filler material. Finish surfaces in true planes, true to line, with particular care taken during screeding to maintain an excess of concrete in front of the screed so as to prevent low spots. Screed and darby concrete to true planes while plastic and before free water rises to the surface. Do not perform finishing operations during the time free water (bleeding) is on the surface.

- C. Finish Schedule: Except where indicated otherwise on the Drawings, provide the finishes below:
 1. Floated Finish for:
 - a. Treads and platforms of exterior steps and stairs.

- b. Slabs and fill over which waterproofing, roofing, vapor barrier, insulation, terrazzo, or resin bound flooring is required.
 - 2. Troweled Finish for:
 - a. Interior slabs that are to be exposed to view.
 - 3. Broom or Belt Finish for:
 - a. Exterior slabs. Texture as approved by the Director's Representative.
 - 4. Scratched Finish for:
 - 5. Integral Emery Aggregate Surfacing with Floated Finish for:
 - a. Pedestrian ramps.
- D. ACI 302.1R Chapter 10.2 - Tools for jointing; Saw-cutting.
 - 1. Add the following paragraph:
 - a. Early-entry dry-cut saws are preferred in place of conventional wet-cut saws.
- E. ACI 302.1R Chapter 10.3
 - 1. Add the following to Conventional wet-cut saw cutting:
 - a. Begin saw-cutting as soon as the saw will not dislodge the aggregate or ravel the edge of the saw-cut, but in no case longer than 12 hours after the slab is placed. Saw-cut leaving a clean, sharp edge in the pattern shown on the Contract Documents. Provide sufficient personnel and equipment to complete saw-cutting operations within 18 hours after the slab is placed.
- F. Exposed surfaces with fibrous reinforcement: After curing of the concrete, remove any protruding fibers in a manner which will not harm the parent concrete.
- G. Floor flatness and levelness tolerances: For flatness and levelness tolerances of floor slabs refer to the slab on grade notes in the structural drawings.
 - 1. When flatness or levelness tolerances are not met then the floor shall be ground or scarified and repoured to meet specifications.

3.07 CURING AND PROTECTION

- A. Hot Weather Concreting: Comply with ACI 305R whenever the atmospheric temperature or the form surface temperature is at or above 90 degrees F., or climatic conditions of wind and/or low humidity will cause premature drying of the concrete.
- B. Curing Temperature: Maintain the temperature of the concrete at 50 degrees F. or above during the curing period. Keep the concrete temperature as uniform as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceeds 5 degrees F. in any one hour and 50 degrees F. in any 24-hour period.
- C. Curing and Moisture Mitigation for Resilient Flooring:
 - 1. Acceptable curing and drying conditions include a minimum ambient temperature of 70 degrees F and a maximum relative humidity of 50%.

- a. Air movement at 15 mph.
2. Do not cure slabs by adding water; ponding or wet burlap method.
3. Do not use curing compounds or cure-and-seal materials unless such use is approved in writing by the adhesive and floor covering manufacturers. The curing product manufacturer's conformance to ASTM C 1315 is not a substitute for the adhesive and floor covering manufacturer's approval.
4. Cure the slab by covering with waterproof paper, plastic sheets, or a combination of the two for 3 to 7 days.

3.08 CHEMICAL HARDENER (DUSTPROOFING)

- A. Apply chemical hardener to all troweled finished interior floors which are to be left exposed.
- B. Do not apply chemical hardener until concrete has cured the number of days recommended in manufacturer's instructions.
- C. Prepare surfaces and apply chemical hardener in accordance with manufacturer's printed instructions and recommendations.

3.09 FIELD QUALITY CONTROL

- A. ACI 301, Section 1.6.3.2 - Testing Services:
 1. Add the following paragraph:
 - a. Strength Tests for Pumped Concrete: Prepare strength test specimens and make strength tests from concrete samples obtained at the truck discharge chute and at the end of the pump delivery line.
- B. ACI 301, Section 1.6.2.3 – Tests required of Contractor's testing agency:
 1. Add the following paragraph:
 - a. Make available to the Director's Representatives whatever test samples are required to make tests. Furnish shipping boxes for compression test cylinders.
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to the State and as accepted by the Director. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Director's Representative before using in the work.
- D. Test results will be reported in writing to the Director's Representative, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

- E. Nondestructive Testing: Impact hammer, Windsor probe, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- F. Additional Tests: The owner may make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Director's Representative. The testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Pay for such tests when unacceptable concrete is verified, including all inspection and Engineering fees when non-conforming work is verified.

END OF SECTION

SECTION 033400

CONTROLLED LOW STRENGTH MATERIAL

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Cast-In-Place Concrete: Section 033000.

1.02 REFERENCES

- A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of Specifications for Structural Concrete for Buildings ACI 301-89 of the American Concrete Institute.

1.03 DEFINITIONS (Amendments to ACI 301, Chapter 1):

- A. Controlled Low Strength Material (CLSM) Fill can also be called by different names including but not limited to: Flowable Fill, Controlled Density Fill, Flowable Fly Ash and Fly Ash Slurry.

1.04 SUBMITTALS

- A. Submittals Package: Submit product data for design mix and materials for CLSM specified below at the same time as a package.
- B. Product Data:
 - 1. CLSM design mix with name and location of batching plant.
 - 2. Portland Cement: Brand and manufacturer's name.
 - 3. Fly Ash: Name and location of source, and DOT test numbers.
 - 4. Air-entraining Admixture: Brand and manufacturer's name.
 - 5. Water-reducing Admixture: Brand and manufacturer's name.
- C. Quality Control Submittals:
 - 1. Certificates: Affidavit required under Quality Assurance Article.

1.05 QUALITY ASSURANCE

- A. Furnish and place a Controlled Low Strength Material (CLSM) as shown on plans or as directed by Director's Representative, in writing. Provide CLSM containing cement and water. At the Contractor's option, it may contain fly ash, aggregate, or chemical admixtures in any proportions such that the final product will meet the strength and flow consistency requirements included in this specification.
- B. CLSM batching plant shall be currently approved as a concrete supplier by the New York State Department of Transportation and shall have a minimum of 1 year experience in the production of similar products.

- C. Fly ash supplier shall be currently approved as a fly ash supplier by the New York State Department of Transportation.
- D. Source Quality Control: The Director reserves the right to inspect and approve the following items, at his own discretion, either with his own forces or with a designated inspection agency:
 - 1. Batching and mixing facilities and equipment.
 - 2. Sources of materials.

1.06 STORAGE

- A. Store materials so as to insure the preservation of their quality and fitness for the Work. Materials, even though accepted prior to storage, are subject to inspection and shall meet the requirements of the Contract before their use in the Work.

PART 2 PRODUCTS

2.01 MATERIALS (Amendments to ACI 301, Chapter 2):

- A. Cement: ASTM C 150, Type I or II Portland cement.
- B. Water: Potable.
- C. ACI 301, Article 2.4 - Aggregates:
 - 1. Add the following paragraph:
 - 2.4.1.1 The aggregate for CLSM shall meet the requirement of ASTM C 33, except 100% passing the ¾” sieve and a maximum of 20% passing the No. 200 sieve.
- D. Fly Ash: ASTM C 618, including Table 1A (except for footnote A), Class F except that loss on ignition shall not exceed 4.0 percent.
- E. Chemical Admixtures:
 - 1. Darafill by W. R. Grace and Co., 62 Whittemore Avenue, Cambridge, MA 02140, (617) 876-1400, www.graceconstruction.com.
 - 2. Eucon Easy Fill by the Euclid Chemical Company, 19218 Redwood Road, Cleveland, OH 44110, (800) 321-7628, www.euclidchemical.com.
 - 3. Rheocell Rheofill by Master Builders Technologies, 23700 Chagrin Boulevard, Cleveland, Ohio 44122-5554, (800) 628-9990, www.masterbuilders.com.
 - 4. Sika Lightcrete Powder, Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071, (201) 933-8800, www.sikaconstruction.com.
- F. Water-reducing Admixture: ASTM C 494, Type A and on New York State Department of Transportation’s current “approved List”.
- G. Air Entrainment Admixture: ASTM C 260 and on New York State Department of

Transportation's current "Approved List".

2.02 CLSM MIXTURE

- A. CLSM, Hand Tool Excavatable: Provide mix with compressive strength of 100 psi or less when measured 28 days from placement. Minimum air content at time of placement shall be 20%.
- B. In the absence of one year strength data, the cementitious content shall be a minimum of 150 lbs./cy, the minimum air content shall be 20%, and fresh unit weight shall be a maximum of 115 lbs./ft³, except where specified.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Examine conditions of substrates and other conditions under which work is to be performed and notify the State, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.
- B. Keep excavations free of water. Do not deposit CLSM in water.
- C. Hardened CLSM, forms, and earth which will be in contact with fresh CLSM shall be free from frost at the time of CLSM placement.
- D. Prior to placement of CLSM, remove all foreign materials from the space to be occupied by the CLSM.

3.02 APPLICATION OF CLSM

- A. Secure tanks to prevent displacement during placement.

3.03 PROTECTION

- A. Protect CLSM from traffic until sufficient strength has been achieved for further construction operations.

3.04 FINISHING

- A. Provide a floated finish to the exposed portion of the CLSM.

END OF SECTION

SECTION 051200

STRUCTURAL STEEL

PART 1 GENERAL

1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Anchor Bolts: Installed under Section 033000.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Steel Joists: Section 052119.
- B. Steel Decks: Section 053100.

1.03 REFERENCES

- A. Except as shown or specified otherwise, the Work of this Section shall meet the requirements of the following:
 - 1. Standard Practice: Fabrication and erection practices shall comply with the "Code of Standard Practice for Steel Buildings and Bridges", AISC 303-16, by the American Institute of Steel Construction (AISC Code).
 - 3. Welding: "Structural Welding Code - Steel, AWS D1.1", by the American Welding Society (AWS Code).
 - 4. High-Strength Bolting: "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts", by the Engineering Foundation's Research Council on Structural Connections (Specification for Structural Joints).
 - 5. Cleaning Steel: Comply with the appropriate specifications (SSPC SP-X) by the Steel Structures Painting Council.

1.04 DEFINITIONS

- A. AISC Manual: Where reference is made to the AISC Manual, it shall mean the Manual of Steel Construction, Fifteenth Edition, of the American Institute of Steel Construction.

1.05 REQUIREMENTS FOR CONNECTIONS

- A. General:
 - 1. Size connections for the loads indicated on the Drawings. If the loads are not indicated, use a connection whose capacity is half the total uniform load capacity shown in the "Allowable uniform loads in kips for beams laterally supported" tables in the AISC Manual for the given shape, span, and steel specification of the beam in question, unless otherwise indicated.
 - 2. All bolted connections shall have a minimum of two bolts.

- B. Shop Connections: Welded or high strength bolted, unless otherwise indicated. Field connections required to be welded or fully-tensioned high-strength bolted shall meet the same requirements when fabricated in the shop.
- C. Field Connections:
1. The following field connections shall be welded or fully-tensioned high strength bolted as indicated on the Drawings or, when not indicated, shall be either welded or fully-tensioned high strength bolted at the Contractor's option:
 - a. Column bracing.
- D. Standard Beam Connections:
1. Unless otherwise shown on the Drawings or required in the Specifications, all beam connections shall be framed in accordance with Part 4 of the AISC Manual, with sizes and lengths of angles and welds and with fasteners spacings as shown therein.
 2. Standard beam connections shown on the Drawings shall be fabricated as detailed. Substitutions will not be approved.
- E. High-Strength Bolted Connections: Amend the Specification for Structural Joints as follows:
1. In Item 3(b) of the specification, change the second sentence to read "Burrs shall be removed."
 2. In Item 3(c) of the specification, delete the last two sentences, and add the following sentence: "Flame cut surfaces shall be ground smooth."
 3. In Item 7(b)(1) of the specification, add the following to the last sentence: ", except that oversize holes shall not be used in connections with galvanized faying surfaces."
 4. In Item 7(b)(2) of the specification, add the following to the last sentence: ", except that short slotted holes shall not be used in connections with galvanized faying surfaces when the force on the joint is in a direction other than normal to the axis of the slot."
 5. In Item 7(b)(3) of the specification, add the following to the last sentence: ", except that long slotted holes shall not be used in connections with galvanized faying surfaces when the force on the joint is in a direction other than normal to the axis of the slot."
 6. Change Item 7(c)(3) of the specification to read as follows: "All fully-tensioned high-strength bolts shall have a hardened washer under the element (nut or bolt head) turned in tightening, regardless of the method of tightening."
 7. In Item 8(b) of the specification, change the first sentence to read: "A tension measuring device shall be required at all work sites where high-strength bolts are being installed."
 8. In Item 8(c) of the specification, delete the second and third sentences and add the following sentence: " The snug-tight condition is defined as the tightness attained by either a few impacts of an impact wrench or the full effort of a worker with an ordinary spud wrench that brings the connected plies into firm contact."
 9. Change the last sentence in Item 8(c) to read "Unless otherwise required in the Specifications, bolts required to be fully-tensioned shall be

identified on the Drawings. All other bolts need only be tightened to the snug tight condition."

10. In Item 9(b) of the specification, delete "Arbitration" from the heading. Also change the first paragraph to read: "When high-strength bolts have been installed by any of the tightening methods in Item 8(d), the following inspection procedure shall be used."
 11. In Item 9(c) of the specification, delete "arbitration" from the last sentence.
 12. In Item 9 of the specification, the inspection of bolt tightening shall be as specified under Item 9(b). Furnish the calibration device and the inspection torque wrench, and make them available, upon request, to representatives of the State or designated inspection laboratory during the entire period when steel is being fabricated and erected. The inspection torque wrench shall be capable of indicating that the job inspecting torque has been reached by a second method in addition to direct observation of the wrench dial. The inspection wrench calibration and the bolt tightening inspection shall be performed by the Contractor, and shall be witnessed by a representative of the Director or the designated inspection laboratory.
- F. Design, Fabrication and Erection (Amendments to the AISC Specification):
1. In Item A6. of the specification, change "American Welding Society" to "American Welding Society (Latest Adoption Date)". Delete the date from all referenced AWS Codes.
 2. In Item J1.8. of the specification, change the last sentence to read: "Weld access holes and beam copes in other shapes shall be ground smooth, but need not be inspected by dye penetrant or magnetic particle methods."
 3. In Item J1.8. of the specification, delete "or with A307 bolts" from the second paragraph.
 4. In Item J2. of the specification, change the introductory sentence to read: "All provisions of the American Welding Society Structural Welding Code-Steel, AWS D1.1, except Sections 2.3.2.4, 2.5, 8.13.1 and 9, apply to work performed under this Specification."
 5. In Item J3.2.c of the specification, change the first sentence to two sentences as follows: "Oversized holes are permitted in any or all plys of slip-critical connections, except those with galvanized faying surfaces. Oversized holes shall not be used in slip-critical connections with galvanized faying surfaces, or in bearing-type connections."
 6. In Item J3.2.d. of the specification, change the second sentence to two sentences as follows: "Short-slotted holes are permitted without regard to direction of loading in slip-critical connections, except those with galvanized faying surfaces. The length of the slot shall be normal to the direction of the load in slip-critical connections with galvanized faying surfaces and in bearing-type connections."
 7. In Item J3.2.e of the specification, change the second sentence to two sentences as follows: "Long-slotted holes are permitted without regard to direction of loading in slip-critical connections, except those with galvanized faying surfaces. The length of the slot shall be normal to the direction of the load in slip-critical connections with galvanized faying surfaces and in bearing-type connections."

8. In Item M2.2. of the specification, delete the first two paragraphs.
 9. In Item M2.5. of the specification, change the second sentence of the fifth paragraph to read: "Burrs shall be removed."
 10. Delete Item M4.5. of the specification in its entirety.
 11. In Item M5.4. of the specification, delete "Slip-critical" from the heading and delete "slip-critical" from the first sentence.
- G. Fabrication and Erection (Amendments to the AISC Code):
1. In Item 4.1. of the code, delete the last sentence of the first paragraph.
 2. In Item 5.1. of the code, change the first paragraph to read: "Contract Drawings are not considered released for construction. Orders for materials may be placed only after approval of erection drawings or written approval of the Director."

1.06 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for all structural steel. Machine duplicated copies of Contract Drawings will not be accepted as shop drawings. Shop drawings shall be standard 24 by 36 inch size sheets. The fabricator's name, address, and telephone number shall be indicated in the title block on each drawing.
1. Include anchor bolt and base plate plans, erection drawings, and detail drawings for all members.
 2. Indicate shop and field welds by standard AWS welding symbols in accordance with AWS A2.4.
 3. All shop drawings shall be checked by the detailer before submission. Failure to submit checked shop drawings will be cause for their disapproval without review.
 4. Changes initiated by the detailer or fabricator to previously reviewed shop drawings shall be resubmitted.
 5. When shop drawings are marked "Approved as Noted", promptly resubmit copies of corrected shop drawings for formal approval and record.
 6. Contract Drawings are not considered released for construction. Orders for materials may be placed only after approval of erection drawings or written approval of the Director.
- B. Product Data:
1. Shop Paint: Manufacturer's name and printed product literature, including storage and application instructions.
- C. Quality Control Submittals:
1. Certificates: Copy of certificates required under Quality Assurance Article.
 2. Fabricator's Qualifications Data:
 - a. Firm's name, business address and telephone number.
 - b. Summary of their quality control programs.
 3. Erector's Qualifications Data:
 - a. Firm's name, business address and telephone number.
 - b. Summary of their quality control programs.

1.07 QUALITY ASSURANCE

- A. Certification: Affidavit by the structural steel manufacturer certifying that steel material meets the contract requirements.
 - 1. Submit evidence of steel material compliance with this Specification. Evidence shall consist of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement.
- B. Qualifications:
 - 1. Fabricator: The fabricator of the structural steel shall be regularly engaged in the fabrication of structural steel for a minimum of 5 years, and shall be subject to the approval of the Owner.
 - a. AISC Quality Certified Fabricators (latest list issued) are approved.
 - 2. Erector: The structural steel erector shall be regularly engaged in the erection of structural steel for a minimum of 5 years, and shall be subject to the approval of the Owner.
- D. Inspection: Shop and field quality assurance inspection may be made by the State. If quality assurance inspection is made by the Owner, it shall not relieve the fabricator and erector of responsibility for their own quality control programs.
- E. Galvanizing: Stamp galvanized items with galvanizer's name, weight of coating, and applicable ASTM number.

1.08 WELDING PROCESS

- A. Use only shielded metal arc, submerged-arc, gas metal arc, or flux cored arc welding.

1.09 WELDING PROCEDURE QUALIFICATION

- A. Shielded metal arc, submerged arc, gas metal arc, or flux cored arc welding procedures which conform to the provisions of the AWS Code shall be considered to be prequalified.
- B. The welding procedures requiring qualification shall conform to the requirements of AWS D1.1.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of anchor bolts and other anchorage devices to be built into other construction to avoid delay.
- B. Upon delivery to the site, promptly cover and protect steel items (which are not required to receive shop paint) from rusting.
- C. Store shop paint in accordance with paint manufacturer's printed instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. See structural steel notes for material specifications.
- b. Weld Filler Metal:
 - 1. General: Weld filler metal shall be in accordance with Table 4.1.1 of the AWS Code, except as follows:
 - a. Only electrode and flux combinations complying with AWS Classifications F7AX-EXXX or F7AX-EXXX-a, (a = B2, Ni1, Ni2, Ni3 or W), shall be used for submerged arc welding.
 - b. Only electrode and shielding gas combinations complying with AWS Classifications E 7XT-1 or E 7XT-5 shall be used for flux cored arc welding.
 - 2. Weld filler metal for shielded metal arc, submerged arc, gas metal arc, and flux cored arc welding which conforms to AWS Specifications A5.1 or A5.5 shall be considered to be prequalified.
- H. Cold Galvanizing Compound: Single component compound giving 93 percent pure zinc in the dried film, and meeting the requirements of DOD-P-21035A.
- I. Shop Paint (General): Steel primer selected from the following:
 - 1. TNEMEC 10-99 (Red), 10-99G (Green) or 10-1009 (Gray).
 - 2. Rust-Oleum 769.
 - 3. Valspar 13-R-53.
 - 4. Sherwin-Williams "Kromik".
- J. Shop Paint for Galvanized Steel: FS TT-P-641, Type II.
- K. Bedding Mortar:
 - 1. Cement Grout: Portland cement complying with ASTM C 150, Type I or III, and clean uniformly graded natural sand complying with ASTM C 404, size No. 2; mixed at a ratio (by volume) of 1.0 part cement to 3.0 parts sand, with only the minimum amount of water required for placement and hydration.

2.02 FABRICATION

- A. Do not commence fabrication until the fabricator has been approved and the fabrication schedule has been coordinated with the designated Quality Assurance inspection agency (independent inspection laboratory or the Owner).
 - 1. Give the Director's Representative one week advance notice of the commencement of fabrication.
- B. Progress shop fabrication from "Approved" or "Approved as Noted" detail drawings only.
 - 1. When detail drawings are "Approved as Noted", progress fabrication in strict accordance with notes thereon.

2. Fabrication progressed from "DISAPPROVED" or "RETURNED FOR CORRECTION" detail drawings will be rejected. The contractor shall have no claim against the Owner for any costs or delays due to rejection of items fabricated from "DISAPPROVED" or "RETURNED FOR CORRECTION" detail drawings.
- C. Finish column ends at base plates and at load carrying cap plates to a true plane square to the column, with a maximum American National Standards Institute surface roughness value of 500 microinches. Provide drain holes as required for galvanizing.
- D. Pipe and Tube Columns: Shop weld a closure plate to top of columns to form a watertight closure.
- E. Loose Lintels: Furnish lintels of length to have 6 inches minimum bearing at each end.
- F. Make provisions for connections of other Work, including all cutting and punching of structural members where required by the Drawings, or for which information is furnished prior to approval of the shop drawings.
- G. Prepare material in accordance with Section 3 of the AWS Code. Do not use gas or air carbon-arc cutting to cut or enlarge bolt holes.
- H. Galvanizing: Unless otherwise specified or noted, items indicated to be galvanized shall receive a zinc coating by the hot-dip process, after fabrication, complying with the following:
 1. ASTM A 123 for plain and fabricated material.
 2. ASTM A 153 for iron and steel hardware.
- I. Cleaning Steel: Thoroughly clean all structural steel. Remove oil, grease, and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning". Remove loose mill scale, loose rust, weld slag and spatter, and other detrimental material in accordance with SSPC SP-2 "Hand Tool Cleaning", SSPC SP-3 "Power Tool Cleaning", or SSPC SP-7 "Brush-Off Blast Cleaning".

2.04 SHOP PAINTING

- A. Thoroughly clean all structural steel. Remove oil, grease, and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning". Remove loose mill scale, loose rust, weld slag and spatter, and other detrimental material in accordance with SSPC SP-2 "Hand Tool Cleaning", SSPC SP-3 "Power Tool Cleaning", SSPC SP-6 "Commercial Blast Clean" or SSPC SP-7 "Brush-Off Blast Cleaning, or SSPC SP-10 "Near-White Blast Cleaning".
- C. Galvanized Items:
 1. Galvanized items which are to be finish painted under Section 099101 shall be rinsed in hot alkali or in an acid solution and then in clear water.

2. Welded and abraded galvanized surfaces shall be wire brushed and repaired with a coating of cold galvanizing compound applied in accordance with compound manufacturer's instructions.
- D. Apply one coat of shop paint to all steel surfaces except as follows:
1. Do not paint steel members designated "NP" on the Drawings.
 2. Paint steel surfaces scheduled to be painted that are inaccessible after assembly, except surfaces in contact, with two coats of shop paint before assembly.
 3. Do not paint steel surfaces to be field welded, contact surfaces of high-strength bolted slip-critical connections, steel to be encased in cast-in-place concrete, steel receiving sprayed-on fireproofing, and the top flange of beams and girders in composite construction.
- E. Apply paint and compound to the following minimum thickness per coat:
1. Shop Paint (General): 4.0 mils wet film.
 2. Shop Paint for Galvanized Steel: 3.0 mils wet film.
 3. Cold Galvanizing Compound: 2.0 mils dry film.

PART 3 EXECUTION

3.01 ERECTION

- A. Erect steel in accordance with the AISC Specification, the AISC Code, the AWS Code and the Specification for Structural Joints, except as otherwise specified.
- B. Prepare and place shrink-resistant grout in accordance with grout manufacturer's printed instructions.
 1. Comply with manufacturer's instructions for preparation of surfaces in contact with grout, and for curing and protection of grout.
- C. Do not use gas or air carbon-arc cutting to cut or enlarge bolt holes.
- D. Do not make corrections or alterations to fabricated steel without prior written approval by the Director's Representative.

3.02 SCHEDULE OF GALVANIZED STRUCTURAL STEEL

- A. In addition to items indicated on the Drawings, hot-dip galvanize structural steel members as indicated below:
 1. All exterior exposed steel.
 2. All loose lintels in exterior walls.
 3. Nuts, washers, and the top 12 inches of exterior anchor bolts.

END OF SECTION

SECTION 052119

OPEN WEB STEEL JOISTS, K-SERIES

PART 1 GENERAL

1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Anchorage devices required to be built into masonry/concrete construction shall be installed under the Work of the applicable masonry/concrete section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Field Painting: Section 099101.

1.03 REFERENCES

- A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of the following:
 - 1. Design, Fabrication, and Erection: "Standard Specifications for Open Web Steel Joists, K-Series", by the Steel Joist Institute (SJI Specifications).
 - a. Change the second sentence of Paragraph 4.4 (c) to read "The magnitude and location of the design loads to be supported and the deflection requirements shall be clearly indicated on the Contract Drawings. The proper bracing shall be shown by the manufacturer on the erection drawings."
 - b. Change the following subparagraphs of Paragraph 4.5 (a) to read as listed:
 - 1) c) "Thorough fusion shall exist between weld and base metal for the full length of the weld; such fusion shall be verified by visual inspection."
 - 1) d) "Unfilled weld craters are not acceptable and shall be repaired."
 - 1) f) "The sum of surface (piping) porosity diameters shall not exceed 1/16 inch in any 1 inch of weld length."
 - 1) g) Delete.
 - c. Change the second and third sentences of Paragraph 5.3 (a) to read "The ends of K-Series Joists shall extend a distance of not less than 5 inches over masonry or concrete supports and be attached to a steel bearing plate. This plate shall be located not less than 1 inch from the face of the wall and shall be not less than 6 inches wide perpendicular to the length of the joists."
 - d. In Paragraph 5.4 (c), change "following table" to "preceding table".
 - 2. Standard Practice: "Recommended Code of Standard Practice for Steel Joists and Joist Girders", by the Steel Joist Institute (SJI Code).
 - 3. High Strength Bolting: "Specification for Structural Joints using ASTM A325 or A490 Bolts", by the Engineering Foundation's Research Council

on Riveted and Bolted Structural Joints (Specification for Structural Joints).

1.04 SUBMITTALS

- A. Shop Drawings: Show application to project. Include the following:
 - 1. Erection drawings, end bearing and anchorage details, bracing details, and (if required) details of extended ends and ceiling extensions.
 - 2. Details for connection of other related work (if any), except do not show steel deck.

- B. Quality Control Submittals:
 - 1. Certificates: Copy of certificate required under Quality Assurance Article.
 - 2. Joist Delivery Schedule.
 - 3. Test Reports: Copy of test report required under Quality Assurance Article-
 - 4. Manufacturer's Qualifications Data:
 - a. Firm's name, business address and telephone number.
 - b. Copy of firm's membership in the Steel Joint Institute.
 - 5. Welder's Qualifications Data:
 - a. Name of each person who will be performing the Work and their employer's name, business address and telephone number.
 - b. Copy of AWS certification for type of welding required.

1.05 QUALITY ASSURANCE

- A. Test Reports:
 - 1. Mill Test Reports: Certified reports of steel component compliance with the requirements of applicable ASTM specifications, or of 2.01 A. 4.

- B. Certificates:
 - 1. Certification of joist manufacturer's compliance with inspection program provisions of the SJI Specifications.
 - 2. Affidavit by the structural steel manufacturer certifying that structural steel items meet the contract requirements.
 - a. Submit evidence of steel material compliance with this Specification. Evidence shall consist of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement.

- C. Qualifications:
 - 1. Manufacturer: Manufacturer shall be-a member of the Steel Joist Institute.
 - 2. Welders: Welding shall be performed only by welders, welding operators, and tackers who have been qualified as prescribed in the SJI Specifications to perform the type of welding required.

1.06 INSPECTION

- A. Manufacturer's Quality Control Shop Inspection: Ensure joist manufacturer's compliance with inspection program provisions of the SJI Specifications.
- B. Additional Inspection by the State: The Owner reserves the right to make additional field Quality Assurance inspections, performed by an independent testing laboratory or by the State, to insure the quality of material and workmanship. Such Quality Assurance inspection will be performed at no cost to the Contractor. Insure free and easy access for inspection personnel at all times work is in progress in the field.
 - 1. If Quality Assurance inspection is made by the State, it shall not relieve the Contractor of responsibility for Quality Control inspection.
 - 2. Inform the Director's Representative promptly of any proposed changes in joist delivery schedule, prior to actual change of schedule, for proper coordination of the State's inspection schedule.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel joists in a manner to avoid overstressing or other damage. Comply with requirements in the SJI Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel for Chord and Web Sections: Structural steel conforming to one of the following:
 - 1. ASTM A242.
 - 2. ASTM A441.
 - 3. ASTM A572, Grade 50.
 - 4. Electric furnace produced steel meeting all requirements of ASTM A36, except that the chemical composition shall be adjusted during production to give minimum physical properties of 50 ksi yield point and 70 ksi tensile strength.
- B. Steel for Bracing and Detail Material Not Proportioned for Calculated Stress: Structural steel conforming to one of the following:
 - 1. ASTM A36, or any of those listed under A. above.
- C. High-Strength Threaded Fasteners: ASTM A325 heavy hex structural bolts, nuts, and hardened washers.
- D. Shop Paint: Standard shop paint complying with the SJI Specifications.
- E. Bedding Mortar:
 - 1. Cement Grout: Portland cement complying with ASTM C 150, Type I or III, and clean uniformly graded natural sand complying with ASTM C 404, size No. 2; mixed at a ratio (by volume) of 1.0 part cement to 3.0 parts sand, with only the minimum amount of water required for placement and hydration.

3. Shrink-Resistant Grout (Non-Staining): Factory-packaged, non-ferrous mortar grouting compound selected from the following:
 - a. Masterflow 713 by Master Builders, 23700 Chagrin Blvd., Cleveland, OH 44122 (800) 227-3350.
 - b. SonogROUT by Sonneborn, Chemrex, Inc., 57-46 Flushing Ave., Maspeth, NY 11378, (800) 433-9517.
 - c. Five Star Grout by Five Star Products, Inc., 425 Stillson Rd., Fairfield, CT 06430, (800) 243-2206.
 - d. Crystex by L&M Construction Chemicals, 14851 Calhoun Rd., Omaha, NB 68152, (800) 362-3331.
 - e. Non-Corrosive, Non-Shrink Grout by A.C. Horn, Inc., Tamm Industries, 7405 Production Dr., Mentor, OH 44060, (800) 862-2667.

2.02 FABRICATION

- A. Do not fabricate Work of this Section until receipt of approved shop drawings. When drawings are "Approved as Noted", progress fabrication in conformity with the correction notes thereon and submit revised drawings for formal approval and record.
- B. Furnish joists of sizes indicated on the Drawings.
- C. Do not use connections which will interfere with bearing of steel deck on top chords.
- D. Bridging: Horizontal bridging complying with the SJI Specifications.
- E. Holes in Chord Members: Punch or drill approved holes in chord members where required for securing related work to joists. Deduct area of holes from chord area when calculating the strength of the member.
- F. Extended Ends: Furnish extended ends on joists where indicated. Use joist manufacturer's standard method complying with Steel Joist Institute requirements and load tables.
- H. Joist Ends: Manufacturer's standard ends complying with the SJI Specifications to suit type of supporting construction indicated, unless otherwise specified or shown.
- I. Anchors: Furnish bearing plates, anchor bolts, and other required devices to be built into masonry and concrete construction. Furnish templates necessary for accurate location of anchors in other Work.
 1. Furnish unfinished threaded fasteners for anchor bolts unless otherwise indicated.
- J. Header Units: Furnish header units to support tail joists at openings in floor and/or roof system not framed with steel shapes.

2.03 SHOP PAINTING

- A. Remove loose mill scale, loose rust, weld slag and other foreign material from joists, bridging and accessories after fabrication.
- B. Thoroughly clean joists, bridging and accessories. Remove oil and grease with solvent.
- C. Apply one coat of shop paint, resulting in a continuous dry film thickness of not less than 1.0 mil, to the joists, bridging and accessories.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine surfaces to receive steel joists and bracing for defects that will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.
 - 1. Verify that supports are ready to receive joists.
 - 2. Verify that there is sufficient end bearing area.

3.02 SURFACE PREPARATION

- A. Thoroughly clean surfaces that will support the Work of this Section.

3.03 INSTALLATION

- A. Install steel joists and accessories in accordance with the approved shop drawings.
- B. Erect steel joists in compliance with the SJI Specifications.
 - 1. Prepare and place shrink-resistant grout in accordance with grout manufacturer's printed instructions.
- C. Carefully place joists on supporting construction. Adjust and align in accurate location and spacing before fastening.
- D. Provide temporary bridging, connections, and anchors to ensure lateral stability during construction.
- E. Bridging: Install bridging simultaneously with joist erection, before any construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.
- F. Fastening Joists: Connect joists to supporting structure in accordance with the "End Anchorage" requirements of the SJI Specifications, unless otherwise shown or indicated.
 - 1. Fasten ends of joists resting on steel supports with a minimum of two 1/8 inch fillet welds, each 1 inch long, unless otherwise indicated.
 - 2. Provide high-strength threaded fasteners for bolted connections of steel joists to steel columns, and at other locations where shown, installed in

accordance with the Specification for Structural Joints. Provide a hardened washer under the fastener part to be turned in tightening.

END OF SECTION

SECTION 053100

FLUTED STEEL DECKS

PART 1 GENERAL

1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

None

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Field Touch-up Painting: Section 099101.

1.03 REFERENCES

- A. Comply with the following reference standards unless otherwise shown or specified:
1. Design: "Specification for the Design of Cold-Formed Steel Structural Members" by the American Iron and Steel Institute (AISI Specification).
 2. Welding: "Structural Welding Code - Sheet Steel, AWS D 1.3", by the American Welding Society (AWS Code).

1.04 SUBMITTALS

- A. Shop Drawings: Show application to project. Prepare separate drawings, coordinated with, but not superimposed on, joist drawings or structural steel erection drawings.
- B. Product Data: Manufacturer's printed specifications and installation instructions.

1.04 QUALITY ASSURANCE

- A. Certificates: Affidavit by the structural steel manufacturer certifying that structural steel items meet the contract requirements.
1. Submit evidence of steel material compliance with this Specification. Evidence shall consist of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement.

1.05 HANDLING AND STORAGE

- A. Handle and stack materials carefully in order to prevent deformation or damage. During unloading and hoisting, take extra care to prevent damage to ends and sides of individual metal deck panels. Do not place panels in direct contact with the ground. Protect panels from the elements and keep panels dry.
1. If mud, dirt, or other foreign matter is accumulated on panels, remove such accumulation completely prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fluted Deck and Metal Accessories: Sheet steel conforming to ASTM A 611 Grade C or ASTM A 653 SQ Grade 33. Before fabrication, sheet steel shall receive ASTM A653, Class G 90, hot dip zinc coating; or, except where specified or shown to be galvanized, shall receive chemical cleaning, phosphate treatment, and baked on primer. Finish shall be evenly coated with no cracking after fabrication. Accessories shall be fabricated of not lighter than 18 US Standard Gage sheet steel.
- B. Self-Drilling Fasteners: No. 12-14 x 3/4 inch, hex washer head, self-drilling fastener with pilot point.
- C. Flexible Closure Strips: Manufacturer's standard vulcanized, closed- cell, synthetic rubber closure strips.

2.02 FABRICATION

- A. Steel deck shall be formed with maximum distance of 2-5/8 inches between flutes at upper faces and a minimum distance of 2 inches at lower flute faces. Furnish units in lengths to be continuous over 3 spans wherever possible.
- B. Unless otherwise indicated or approved, fabricate deck for predetermined openings, and reinforce where required to maintain deck strength, alignment, and profile.
 - 1. Small openings, as recommended by the deck manufacturer, may be field cut.
- C. Accessories: Shop fabricated accessories, compatible with steel deck, as required to complete the Work, including, but not limited to, the following:
 - 1. Sheet metal cants beneath flashings when required for roofing over steel deck.
 - 2. Closures to close deck at ridges, valleys, and hips on roof deck slopes exceeding 1/2 inch per foot.
 - 3. Pour stops and girder fillers for concrete fill.
 - 4. Column closures, end closures, Z closures, and cover plates.
- D. Progress shop fabrication from "APPROVED" or "APPROVED AS NOTED" detail drawings only.
 - 1. When detail drawings are "APPROVED AS NOTED", progress fabrication in strict accordance with notes thereon.
 - 2. Fabrication progressed from "DISAPPROVED" or "RETURNED FOR CORRECTION" detail drawings will be rejected. The contractor shall have no claim against the State for any costs or delays due to rejection of items fabricated from "DISAPPROVED" or "RETURNED FOR CORRECTION" detail drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.
- B. Do not start installation of metal deck until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Coordinate installation sequence of metal deck with concrete encasement of steel beams.
- C. Steel surfaces to which materials, provided under this Section, are to be welded, shall be free of paint, ice, water, oil, dirt, rust and other materials detrimental to welding.
- D. Locate decking bundles to prevent overloading of supporting members

3.02 INSTALLATION

- A. Install the Work of this Section in accordance with the manufacturer's printed instructions except where shown or specified otherwise.
 - 1. Welding shall comply with the AWS Code.
 - 2. Perform welding free of sharp points.
- B. Place deck units on supporting steel framework and adjust to final position with ends bearing on supporting members and flutes in straight and true alignment through entire length of run before being permanently fastened. Do not stretch or contract side lap interlocks. Install temporary shoring before placing single span deck panels when required to meet manufacturer's recommendations.
- C. End Bearing: Install deck units over supporting framing with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. Non-Composite Deck End Joints: Lapped 2 inches minimum.
 - 2. Composite Deck End Joints: Butted.
- D. Deck Fastening: Fasten deck units at ends and intermediate supports with arc spot welds (puddle welds) not less than 3/4 inch diameter, at 12 inches on centers, along the supporting members, unless more stringent requirements are indicated on the drawings. Weld the first and last deck flutes. Use welding washers for all deck lighter than 20 gage. Deck units may be fastened to steel supports 0.18 inches or less in thickness (cold-formed metal framing) with No.12-14 x 3/4 inch self-drilling fasteners at 12 inches on center at ends and intermediate supports.
- E. Side lap fastening: Fasten side laps at intervals not exceeding 36 inches, using one of the following methods, unless more stringent requirements are indicated on the drawings or required by the fire resistance ratings indicated on the drawings:
 - 1. Mechanically fasten with self-drilling No.12 diameter or larger carbon steel screws.
 - 2. Mechanically button punch.

- F. Perimeter Edge Fastening: Weld starting and finishing side edges in bearing to supporting members at 36 inches on centers maximum, unless more stringent requirements are indicated on the drawings or required by the fire resistance ratings indicated on the drawings.
- G. Neatly field cut required openings, other than shop fabricated openings, after installation in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

None

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Structural Steel: Section 051200.

1.03 REFERENCES

A. Except as shown or specified otherwise, the Work of this Section shall meet the requirements of the following:

1. General Standard: "Specification for the Design of Cold-Formed Steel Structural Members" by the American Iron and Steel Institute (AISI Specification).
2. Welding: "Structural Welding Code - Sheet Steel, AWS D1.3" by the American Welding Society (AWS Code).

B. Organizations:

1. AISI: American Iron and Steel Institute, 1140 Connecticut Ave., NW, Suite 705, Washington, D.C. 20036, (202) 452-7100, www.steel.org.
2. AWS: American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126, (800) 443-9353, www.aws.org.
3. ASTM: ASTM International, 100 Barr Harbor Dr., PO Box C700, West Conshohocken, PA, 19428-2959, (610) 832-9500, www.astm.org.
4. SSPC: The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh PA 15222-4656, (877) 281-7772, www.sspc.org.

1.04 SYSTEM DESCRIPTION

A. Type of Metal Framing: Load carrying, formed steel framing.

1.05 SUBMITTALS

A. Shop Drawings: Erection and fabrication drawings for all load carrying metal framing and accessories. Show plans and elevations at not less than 1/4 inch to 1'-0" scale, and details at not less than 1-1/2 inch to 1'-0" scale.

1. Include the following in an early submission:
 - a. Erection drawings indicating sizes and locations of all metal framing members.
 - b. Anchor bolt plan showing anchor bolts, if any, to be placed in cast-in-place concrete Work.

- c. Show plans and elevations at not less than 1/4 inch to 1'-0" scale, and details at not less than 1-1/2 inch to 1'-0" scale.
 - 2. Do not submit fabrication drawings, other than for anchor bolts, until after approval of the erection drawings.
 - 3. When shop drawings are marked "Approved as Noted", promptly resubmit copies of corrected shop drawings for formal approval and record.
- B. Product Data: Manufacturer's printed specifications and installation instructions for each type of metal framing and accessory, including data required to show compliance with the Drawings and Specifications.
- C. Quality Control Submittals:
- 1. Certificates: Affidavit required under Quality Assurance Article.

1.06 QUALITY ASSURANCE

- A. Certification: Affidavit certifying that sheet steel complies with specified quality, grade, and zinc-coating.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver metal framing to the Site in manufacturer's unopened containers or bundles, identified with brand, type, and gage.
- B. Protect metal framing from damage and rusting. Store off the ground in dry, ventilated space.
- C. Store and handle metal framing in a manner that will not cause distortion.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Framing (including Studs, Tracks, Joists, Perimeter Channel, and Rafters):
 - 1. Members of 12, 14, and 16 Gage Steel: Galvanized, structural quality sheet steel; ASTM A653, Grade D (minimum yield 50 ksi).
 - 2. Members of 18 and 20 Gage Steel: Galvanized, structural quality sheet steel; ASTM A653, Grade A (minimum yield 33 ksi).
- B. Accessories and Fasteners:
 - 1. Bracing, Bridging, Strapping, Reinforcement, Stiffeners, Plates, Gussets, Clip Angles, and Hangers: Unless otherwise indicated, metal framing manufacturer's standard products formed from ASTM A653 galvanized, structural quality sheet steel. Thickness and grade shall be determined by application requirements, with a minimum thickness of 20 gage and a minimum yield of 33 ksi.

2. Power-Actuated Fasteners: Low velocity, powder activated, threaded studs complying with ASTM E 1190 and zinc coated in accordance with ASTM B633, Type III, Classification 5.
 - a. Minimum Stud Size: 1/4-20 thread, 0.145 inch dia shank, with 1/4-20 nut and 5/8 inch outside dia washer.
 - b. Stud Material: ASTM A510 1060 or 1065 steel.
 - c. Minimum Core Hardness: 51-56 Rockwell C.
 - d. Minimum Tensile Strength: 285,000 psi.
 - e. Minimum Shear Strength: 182,000 psi.
 3. Self-Drilling Fasteners: Cadmium plated, No. 12-14 x 3/4 inch, hex washer head, self-drilling, self-tapping fastener with pilot point.
- C. Galvanizing: Hot-dip process complying with ASTM A653, Coating Designation G 60.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.02 FABRICATION

- A. Fabricate metal framing in accordance with “Approved” or “Approved as Noted” fabrication drawings only.
 1. When fabrication drawings are “Approved as Noted”, progress fabrication in strict accordance with the marks and notes thereon.
- B. Pre-fabricated panels shall be not more than 1/8 inch out of square within the length of the panel, and shall be in compliance with the tolerances specified in Part 3.
- C. Repairing Galvanizing: Clean shop welded and abraded surfaces, and repair them with a 2 mil (dry) minimum thick coating of galvanizing repair paint. Comply with paint manufacturer’s application instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine surfaces to receive metal framing for defects that will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 SURFACE PREPARATION

- A. Clean surfaces that support the Work of this Section.

3.03 INSTALLATION

- A. Install metal framing and accessories in accordance with approved shop drawings, and with the metal framing manufacturer's printed installation instructions.
- B. Provide temporary bracing to ensure stability of the structure during construction.
- C. Repairing Galvanizing: Clean field welded and abraded surfaces, and repair them with a 2 mil (dry) minimum thick coating of galvanizing repair paint. Comply with paint manufacturer's application instructions.
- D. Tolerances:
 - 1. Vertical Alignment (Plumbness) of Studs: Within 1/960th (1/8 inch in 10 feet) of the height.
 - 2. Horizontal Alignment (Levelness) of Walls: Within 1/960th (1/8 inch in 10 feet) of their respective lengths.
 - 3. Spacing of Studs: Not more than + 1/8 inch from the designed spacing, providing that the cumulative error does not exceed the requirements of the finishing materials.
- E. Installation of Runner Tracks:
 - 1. Install continuous bottom and top tracks of size and gage shown. Align track accurately and, unless otherwise shown, attach to supporting structure with power-driven fasteners at 16 inches oc. Install fasteners at corners and ends of tracks.
 - 2. At track butt joints, securely attach abutting pieces of track to a common structural element, or splice them with a welded butt joint.
- F. Installation of Studs:
 - 1. Install studs of size and gage shown. Space studs 16 inches maximum oc, unless otherwise shown.
 - 2. Install additional studs at wall corners and intersections, adjacent to wall openings, at wall ends, and at both sides of control joints (if any).
 - 3. Install full length studs, without splices, between runner tracks.
 - 4. Plumb and align studs and, unless otherwise shown, provide positive attachment to runner tracks using self-drilling fasteners or welds on both flanges of studs.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

PART 1 GENERAL

1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Anchor Bolts: Installed under Section 033000 or 033001.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Structural Steel: Section 051200.
- B. Field Painting: Section 099101.

1.03 REFERENCES

- A. Except as shown or specified otherwise, the Work of this Section shall meet the requirements of the following:
 - 1. Design, Fabrication, and Erection: "Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design" adopted by the American Institute of Steel Construction, June 1, 1989 (AISC Specification).
 - a. Design and Fabrication of Cold-Formed Shapes: "Specification for the Design of Cold-Formed Steel Structural Members", by the American Iron and Steel Institute (AISI Specification).
 - 2. Welding: "Structural Welding Code - Steel, AWS D1.1", or "Structural Welding Code - Sheet Steel, AWS D1.3", by the American Welding Society (AWS Codes).
- B. Organizations:
 - 1. AISC: American Institute of Steel Construction, One East Wacker Dr., Suite 700, Chicago, IL 60601-1802, 866-275-2472, www.aisc.org.
 - 2. AISI: American Iron and Steel Institute, 1140 Connecticut Ave., NW, Suite 705, Washington, D.C. 20036, (202) 452-7100, www.steel.org.
 - 3. AWS: American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126, (800) 443-9353, www.aws.org.
 - 4. ANSI: American National Standards Institute, 1819 L Street, NW, 6th Floor, Washington, DC 20036, (202) 293-8020, www.ansi.org.
 - 5. ASME: ASME International, 3 Park Ave., New York, NY 10016-5990, (800) 843-2763, www.asme.org.
 - 6. ASTM: ASTM International, 100 Barr Harbor Dr., PO Box C700, West Conshohocken, PA, 19428-2959, (610) 832-9500, www.astm.org.
 - 7. MPI: The Master Painters Institute Inc., 2808 Ingleton Ave., Burnaby, BC, V5C 6G7, (888) 674-8937, www.specifypaint.com.
 - 8. SSPC: The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh PA 15222-4656, (877) 281-7772, www.sspc.org.

1.04 SUBMITTALS

- A. Shop Drawings: Show application to project. Furnish setting drawings and templates for installation of bolts and anchors in other Work. Indicate shop and field welds by standard AWS welding symbols in accordance with AWS A2.4.
- B. Product Data: Catalog sheets, specifications, and installation instructions for each fabricated item specified, except submit data for fasteners only when directed.
- C. Quality Control Submittals:
 - 1. Certificates: Copy of certificates required under Quality Assurance Article.

1.05 QUALITY ASSURANCE

- A. Certificates:
 - 1. Affidavit by the structural steel manufacturer certifying that structural steel items meet the contract requirements.
 - a. Submit evidence of steel material compliance with this Specification. Evidence shall consist of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement.
- B. Galvanizing: Stamp galvanized items with galvanizer's name, weight of coating, and applicable ASTM number.

1.06 DELIVERY AND STORAGE

- A. Coordinate delivery of items to be built into other construction to avoid delay.
- B. Promptly cover and protect steel items delivered to the Site.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Wide Flange Structural Steel: ASTM A992, except as specified or shown otherwise.
- B. M and S-Shapes, Channels and Angles: ASTM A 36 or ASTM A 572, Grade 50.
- C. Steel Plates to be Bent or Cold-Formed: ASTM A 283, Grade C.
- D. Steel Bars and Bar-Size Shapes: ASTM A 675, Grade 70; or ASTM A 36.
- E. Hot-Rolled Carbon Steel Sheet and Strip: ASTM A 569, pickled and oiled.
- F. Cold-Rolled Carbon Steel Sheet: ASTM A 366, oiled.

- G. Galvanized Steel Sheet: ASTM A 526, with G90 hot-dip process zinc coating complying with ASTM A653.
- H. Steel Hollow Structural Sections (Round, Square, or Rectangular): ASTM A 500, Grade B; or ASTM A 500, Grade C.
- I. Cold-Drawn Steel Tubing: ASTM A 512, buttwelded, cold-finished carbon steel tubing, sink drawn and stress relieved.
- J. Steel Pipe: ASTM A 53, type as selected, Grade A; black finish unless galvanizing is required; standard weight (Schedule 40), unless otherwise shown or specified.
- K. Stainless Steel: Type 302/304; ASTM A 666 for plate, sheet and strip; ASTM A 276 for bars and shapes; ASTM A 269 for tubing.
- L. Anchors: Except where shown or specified, select anchors of type, size, style, grade, and class required for secure installation of metal fabrications. For exterior use and where built into exterior walls, anchors shall be galvanized or of corrosive-resistant materials.
 - 1. Threaded-Type Concrete Inserts: Galvanized ferrous casting, internally threaded to receive 3/4 inch diameter machine bolt; either malleable iron or cast steel.
 - 2. Wedge-Type Concrete Inserts: Galvanized box-type ferrous casting, designed to accept 3/4 inch diameter bolt having special wedge-shaped head; either malleable iron or cast steel.
 - a. Bolts: Carbon steel bolts having special wedge-shaped heads, nuts, washers and shims.
 - 3. Slotted-Type Concrete Inserts: Galvanized 1/8 inch thick pressed steel plate complying with ASTM A 283; box-type welded construction with slot designed to receive 3/4 inch diameter square head bolt and with knockout cover.
 - 4. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent test agency.
 - a. Carbon Steel: Zinc-Plated; ASTM B 633, Class Fe/Zn 5.
 - b. Stainless Steel: Bolts, Alloy Group 1 or 2; ASTM F593, Nuts; ASTM F 594.
- S. Fasteners: Except where shown or specified, select fasteners of type, size, style, grade, and class required for secure installation of metal fabrications. For exterior use and where built into exterior walls, fasteners shall be galvanized.
 - 1. Standard Bolts and Nuts: ASTM A 307, Grade A, regular hexagon head.
 - 2. Stainless Steel Fasteners: ASTM A 666; Type 302/304 for interior Work; Type 316 for exterior Work; Phillips flathead (countersunk) screws and bolts for exposed Work unless otherwise specified.
 - 3. Eyebolts: ASTM A 489.

4. Machine Bolts: ASME B18.5 or ASME B18.9, Type, Class, and Form as required.
 5. Machine Screws: ASME B18.6.3.
 6. Lag Screws: ASME B18.2.1.
 7. Wood Screws: Flat head, ASME B18.6.1.
 8. Plain Washers: Round, ASME B18.22.1.
 9. Lock Washers: Helical, spring type, ASME B18.21.1.
 10. Toggle Bolts: Spring Wing Type; Wing AISI 1010, Trunion Nut AISI1010 or Zamac Alloy, Bolt Carbon Steel ANSI B18.6.3.
- T. Shop Paint (General): Universal shop primer; fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- U. Shop Paint for Galvanized Steel: Epoxy zinc-rich primer; complying with MPI#20 and compatible with topcoat.
- V. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- W. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- X. Bedding Mortar:
1. Cement Grout: Portland cement complying with ASTM C 150, Type I or III, and clean uniformly graded natural sand complying with ASTM C 404, size No. 2; mixed at a ratio (by volume) of 1.0 part cement to 3.0 parts sand, with only the minimum amount of water required for placement and hydration.
 3. Shrink-Resistant Grout (Non-Staining): Factory-packaged, non-ferrous mortar grouting compound selected from the following:
 - a. Masterflow 713 by Master Builders, 23700 Chagrin Blvd., Cleveland, OH 44122 (800) 227-3350.
 - b. SonogROUT by Sonneborn, Chemrex, Inc., 57-46 Flushing Ave., Maspeth, NY 11378, (800) 433-9517.
 - c. Five Star Grout by Five Star Products, Inc., 425 Stillson Rd., Fairfield, CT 06430, (800) 243-2206.
 - d. Crystex by L&M Construction Chemicals, 14851 Calhoun Rd., Omaha, NB 68152, (800) 362-3331.
 - e. Non-Corrosive, Non-Shrink Grout by A.C. Horn, Inc., Tamm Industries, 7405 Production Dr., Mentor, OH 44060, (800) 862-2667.

2.02 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Fabricate metal framing and supports to support related items required by the Work. Fabricate of welded construction unless otherwise indicated. Preassemble to largest extent possible.

- B. When required to be built into other Work, equip units with integral anchors spaced not more than 24 inches on center.
- C. Galvanize exterior steel framing and supports.

2.03 MISCELLANEOUS STEEL TRIM

- A. Fabricate trim of shapes, sizes, and profiles shown, with continuously welded joints and smooth exposed edges, unless otherwise indicated or approved. Use concealed field splices wherever possible. Furnish necessary cutouts, fittings, and anchorages.
- B. Galvanize exterior steel trim.

2.04 LOOSE BEARING PLATES

- A. Steel plates fabricated flat, free from warp or twist, and of required thickness and bearing area. Drill plates as required for anchor bolts and for grouting access. Furnish bearing plates where shown and where required for steel items bearing on masonry or concrete construction.

2.05 LOOSE LINTELS

- A. Not used

2.06 STEEL PIPE RAILINGS AND HANDRAILS

- A. Not used.

2.07 SAFETY NOSINGS

- A. Nosings: Cast, abrasive non-slip type, of profiles indicated, extending full length of concrete treads or other concrete edges to be protected unless otherwise indicated. Equip each nosing with integrally cast, welded, or riveted anchors located not more than 4 inches from each end of nosing and intermediate anchors spaced not over 15 inches oc. Abrasive grain shall be integrally cast into the wearing surface.

FILL IN BLANK SPACE IN SUBPARAGRAPH BELOW WITH CAST IRON, CAST ALUMINUM, CAST BRONZE, OR CAST NICKEL-BRONZE AS REQUIRED. DELETE UNDERLINE BEFORE ENTERING THE INFORMATION.

1. Metal: cast bronze.
2. Tread Nosing Units: 4 inches wide x 5/16 inch thick, with 1 inch minimum deep protective front lip.
3. Curb Bar Nosing Units: 2-1/2 x 2-1/2 x 1/2 inch thick.
4. Surface Design: Cross-hatched abrasive.

2.08 FABRICATION

- A. Use materials of size and thickness indicated. If not indicated, use material of required size and thickness to produce adequate strength and durability for the

intended use of the finished product. Furnish suitable, compatible anchors and fasteners to support assembly.

- B. Fabricate items to be exposed to view of material entirely free of surface blemish, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove surface blemishes by grinding or by welding and grinding prior to cleaning, treating, and finishing. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown.
- C. Joints: Fabricate accurately for close fit. Weld exposed joints continuously unless otherwise indicated or approved. Dress exposed welds flush and smooth.
- D. Connections: Form exposed connections with flush, smooth, hairline joints. Use concealed fasteners wherever possible. Use Phillips flathead (countersunk) bolts or screws for exposed fasteners, unless otherwise shown or specified.
 - 1. Furnish flat washer under connections requiring raised bolt heads.
 - 2. Furnish lock washer under nuts when through-bolting occurs.
- E. Punch, reinforce, drill, and tap metal Work as required to receive hardware and other appurtenant items.
- F. Galvanizing:
 - 1. In addition to specific items specified or noted to be galvanized, galvanize items attached to, embedded in, or supporting exterior masonry (including interior wythe of exterior masonry walls) and concrete Work.
 - 2. Unless otherwise specified or noted, items indicated to be galvanized shall receive a zinc coating by the hot-dip process, after fabrication, complying with the following:
 - a. ASTM A 123 for plain and fabricated material, and assembled products.
 - b. ASTM A 153 for iron and steel hardware.
- G. Shop Painting:
 - 1. Cleaning Steel: Thoroughly clean all steel surfaces. Remove oil, grease, and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning". Remove loose mill scale, loose rust, weld slag and spatter, and other detrimental material in accordance with SSPC SP-2 "Hand Tool Cleaning", SSPC SP-3 "Power Tool Cleaning", or SSPC SP-7 "Brush-Off Blast Cleaning".
 - 2. Galvanized Items:
 - a. Galvanized items which are to be finish painted under Section 099101 shall be rinsed in hot alkali or in an acid solution and then in clear water.
 - b. Welded and abraded areas of galvanized surfaces shall be wire brushed and repaired with a coating of cold galvanizing compound.
 - 3. Apply one coat of shop paint to all steel surfaces except as follows:
 - a. Do not shop paint steel surfaces to be field welded and steel to be encased in cast-in-place concrete.

- b. Apply 2 coats of shop paint, before assembly, to steel surfaces inaccessible after assembly or erection, except surfaces in contact.
 - c. Do not paint galvanized items which are not to be finished painted under Section 099101.
4. Apply paint and compound on dry surfaces in accordance with the manufacturer's printed instructions, and to the following minimum thickness per coat:
- a. Shop Paint (General): 4.0 mils wet film.
 - b. Shop Paint for Galvanized Steel: 3.0 mils wet film.
 - c. Cold Galvanizing Compound: 2.0 mils dry film.

PART 3 EXECUTION

3.01 PREPARATION

- A. Temporarily brace and secure items which are to be built into concrete, masonry, or similar construction.
- B. Isolate non-ferrous metal surfaces to be permanently fastened in contact with ferrous metal surfaces, concrete, or masonry by coating non-ferrous metal surface with bituminous mastic, prior to installation.

3.02 INSTALLATION

- A. Fit and set fabricated metal Work accurately in location, alignment, and elevation. Securely fasten in place. Cut off exposed threaded portion of bolts flush with nut.
- B. Set loose items on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar or grout.
- C. Attached Work: Fasten to concrete and solid masonry with expansion anchors and to hollow masonry with toggle bolts in cells, unless otherwise indicated. Drill holes for fasteners to exact required size using power tools.
- D. Railings: Adjust railings prior to securing in place to insure alignment and proper matching at joints. Plumb posts in each direction. Secure posts and rail ends to construction as follows:
 - 1. Anchor rail ends to concrete and masonry with round steel flanges. Weld flanges to rail ends, and anchor into the wall construction with expansion anchors.
 - 2. Anchor rail ends to steel with steel oval or round flanges. Weld flanges to rail ends, and weld or bolt to the steel supporting members.

END OF SECTION

SECTION 133419

PRE-ENGINEERED METAL BUILDING

PART 1 GENERAL

1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Anchor Bolts: Installed under the work of 033001.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Cast-In-Place Concrete: Section 033001.

1.03 REFERENCES

- A. Reference Standards: Comply with the following as applicable:
 1. Design, Fabrication and Erection: "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" and the "Code of Standard Practice For Steel Buildings and Bridges" by the American Institute of Steel Construction (AISC Specification and Code).
 2. Design and Fabrication of Cold-formed Steel Structural Members: "Specification for the Design of Cold-Formed Steel Structural Members" by the American Iron and Steel Institute (AISI Specification).
 3. Welding: Comply with the provisions of the "Structural Welding Code - Steel, AWS D1.1" or the "Structural Welding Code - Sheet Steel, AWS D1.3", by the American Welding Society (AWS Codes).
 4. High-Strength Bolting: Provide high strength bolting in accordance with the "Specification for Structural Joints Using ASTM A325 or A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation on 12/31/2009 except as follows:
 - a. Item 1(c): Wind connections and all other connections transferring moment shall be included among the connections limited to friction-type.
 - b. Item 5(b): All high strength bolts shall have a hardened washer under the element (nut or bolt head) turned in tightening, regardless of the method of tightening.
 - c. Item 6: The inspection of bolt tightening shall be as specified under Item 6(d). Furnish the calibration device and the inspection torque wrench, and make them available, upon request, to representatives of the State or designated inspection laboratory during the entire period when steel is being fabricated and erected. The inspection torque wrench shall be capable of indicating that the job inspecting torque has been reached by a second method in addition to direct observation of the wrench dial. The inspection wrench calibration and the bolt tightening inspection shall be performed by the Contractor and shall be witnessed by a representative of the Director or the designated inspection laboratory.

5. Pedestrian Doors and Frames: Comply with applicable requirements of Steel Door Institute's "Recommended Specifications for Standard Steel Doors and Frames" (SDI-100).
6. Clevises, Turnbuckles, and Sleeve Nuts: Comply with the "Steel Construction Manual" by The American Institute of Steel Construction (AISC Manual).
7. Gages:
 - a. Sheet Steel: U.S. Standard.
 - b. Steel Wire: U.S. Steel Wire Gage.

1.04 DESIGN REQUIREMENTS

- A. Design Criteria: Except as shown or specified otherwise, building design shall conform to the Metal Building Manufacturers Association's (MBMA) "Design Practices" and "Code of Standard Practice", and with the following criteria:
 1. Design Loading: As noted on the Structural Design Loads table, sheet SG001, and as appropriate for the prefabricated structure.
 2. Design load reductions based on tributary loaded area shall not be used.
 3. Building Size: As indicated on the Drawings.
 4. Grounding: Building shall be grounded.
- B. General Description: The prefabricated building will be a replacement structure for the existing salt storage enclosure, which will be demolished. The new structure shall have plan dimensions and cross sections as indicated on the plans, and open on one side with the exception of the utility bay. The foundations will be provided as shown based on expected building loads. Provide a complete building enclosure including framing, siding panels, roofing panels, and doors as shown on the plans.

Final design loadings, prepared and sealed by a Professional Engineer licensed in the Province of Ontario, shall be submitted to the EoR. These reactions will be used to confirm the suitability of the foundation. Minor modifications to the foundation geometry or reinforcement are expected. The bases of these columns are to be designed as pinned, the foundation providing only axial and shear resistance.

Colors and exterior panel profiles shall be selected by the owner from the manufacturer's standard palette.

1.05 SUBMITTALS

- A. Shop Drawings: Drawings shall show specific application to this Project; signed and sealed by a licensed Professional Engineer in the Province of Ontario, for the structural framing and exterior wall and roofing panels. Submit all required drawings in one submission, except as noted.
 1. Erection Drawings: Manufacturer's complete erection drawings. Indicate manufacturer's identification marking for the components.
 2. Structural Drawings:
 - a. Manufacturer's drawings showing base plate dimensions and foundation loads for all columns and/or rigid frames.

- b. Manufacturer's drawings showing anchoring details for the sill members, door jambs, and other miscellaneous items requiring connections to the concrete foundation.
- c. Manufacturer's details for any proposed wall wind bracing system other than portal frames as shown.
- d. Foundation drawings showing dimensions and elevations of all piers, walls, and footings required.
- e. Anchor bolt plan showing the location of all columns and/or rigid frames, and the location of all necessary anchor bolts or other main framing connections to the concrete foundation.
- f. Anchor bolt and tie rod details.

Note: Drawings required under 2.d., 2.e., and 2.f. shall not be submitted until the manufacturer's drawings required under 2.a., 2.b., and 2.c. have been approved.

Note: Manufacturer's standard sheets showing loads or details for a multiple range of building spans, heights, and loadings will not be accepted.

- 3. Architectural Drawings: Architectural detail drawings for all auxiliary building components and accessories, including person doors and rolling doors.

B. Product Data: Manufacturer's catalog sheets, specifications and installation instructions for the following:

- 1. Roofing panels.
- 2. Trim, exterior and interior.
- 3. Flashings.
- 4. Sealants and gaskets.
- 5. Doors – person
- 6. Doors - rolling

C. Samples:

- 1. Twelve inch square corner sections:
 - a. Roofing panel.
 - b. Siding panel
- 2. Color Samples: Manufacturer's standard colors for exterior wall and roofing panels, trim, and other factory color-coated components.

D. Quality Control Submittals:

- 1. Design Calculations: Manufacturer's design calculations, signed and sealed by a licensed Professional Engineer, for the structural framing and exterior wall and roofing panels.
 - a. The Engineer's cover letter shall state that he or she has received a set of the Contract Drawings and Specifications and that the design calculations are based on the requirements of the Contract Drawings and Specifications.

2. Certificates: Metal building manufacturer's written certification that the structure has been designed in conformance to the specified design loading and other design requirements.
- E. Contract Closeout Submittals:
1. Warranties:
 - a. Metal building manufacturer's 30 year warranty on exterior panels and related trim against paint fading, rupture, structural failure, or perforation due to atmospheric corrosion.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: The manufacturer of the pre-engineered metal building shall be regularly engaged in the design and fabrication of pre-engineered, pre-fabricated metal buildings, shall have furnished such buildings for five similar projects that have been in use for not less than five years, and shall be subject to the approval of the Owner and Engineer. The building manufacturer shall be capable of furnishing compatible auxiliary building components and accessories shown or specified.
1. If requested, furnish to the Owner and Engineer the names and addresses of five similar projects where the manufacturer's building has been in use for five years.
- B. Installer's Qualifications: The person supervising the installation of the work of this Section shall be experienced in pre-engineered metal building work, and shall have been regularly employed by a company engaged in the erection and installation of such buildings for a minimum of three years.
1. If requested, furnish to the Owner and Engineer the names and addresses of three similar projects for which the supervisor has supervised the erection and installation of pre-engineered metal buildings.
- C. Regulatory Requirements:
1. Code: Comply with the applicable provisions of the National Building Code of Canada.
- D. Inspection: Quality assurance inspection may be made by the Owner. If quality assurance inspection is made by the Owner or Owner's agent, it shall not relieve the fabricator or erector of responsibility for their own quality control program.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver building components, except structural steel, to the Site in unopened cartons, crates, or other protective containers bearing the manufacturer's labels.
- B. Components shall have manufacturer's identification marking corresponding to the marking shown on the erection drawings.
- C. Keep materials dry while in storage.

- D. Handle materials by a method which will prevent damage to components, including finishes.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Basic Materials: Except as otherwise specified or indicated on the Drawings, building components and assemblies shall be fabricated from the following applicable materials as required to produce units conforming to the design and types of fabrications required for the building.
1. Structural Steel Members: ASTM A36, A529 or A572 except as otherwise indicated.
 2. Cold-Rolled Structural Steel: ASTM A446, Grade A except higher strength grade if needed to comply with design criteria.
 3. Cold-Formed Structural Steel: ASTM A570.
 4. Structural Steel Tubing: ASTM A500, Grade B or A501.
 5. Steel Plate and Bar Stock: ASTM A529 or A572.
 6. Steel Pipe: ASTM A53, type and weight as required, Grade B.
 7. Anchor Bolts and Tie Rods: ASTM A36 or A675, Grade 70.
 8. Clevises, Turnbuckles, and Sleeve Nuts: Similar to those shown in Part 4 of the AISC Manual. The safe working loads shall be adequate for the building furnished.
 9. High Strength Bolts: ASTM F3125, grade A325 or A490.
 10. Common (Standard) Bolts: ASTM A307.
 11. Steel for Shims and Fillers: ASTM A569.
 12. Welding Materials: AWS Codes, type required for materials being welded.
 13. Covering Fasteners:
 - a. Screw Bolts: Type 300 series stainless steel capped low profile head, 200 inch lb min stripping tongue, color finish on exposed exterior surfaces matching adjacent panels/trim.
 - b. Sheet Metal Screws: Type 300 series stainless steel or ASTM A165 cadmium plated case hardened carbon steel, self-drilling or self-tapping, standard hexagonal head or hex-washer head, color finish on exposed exterior surfaces matching adjacent panels/trim.
 - c. Rivets: Aluminum, pull type, self-petalling, 1400 lb setting strength, 1650 lb shear strength, 350 lb min push out strength, color cap on exposed exterior surface matching adjacent panels/trim.
 - d. Sealing Washers: Neoprene washers, ASTM D735.
 14. Shop Primer Paint for Framing: Equal performance requirements of FS TT-P-636 or TT-P-664.
 15. Cold Galvanizing Compound: Single component compound giving 93 percent pure zinc in the dried film, and complying with DOD-P-21035A (NAVY).
 16. Bituminous Paint: Asphaltic type, SSPC - Paint 12.
 17. Bedding Mortar:

- a. Cement Grout: Portland cement complying with ASTM C150, Type I or III, and clean uniformly graded natural sand complying with ASTM C404, size No. 2; mixed at a ratio (by volume) of 1.0 part cement to 3.0 parts sand, with only the minimum amount of water required for placement and hydration.
 - b. Shrink-Resistant Grout: Factory-packaged, shrink-resistant, non-staining, non-ferrous mortar grouting compound selected from the following:
 - 1) Masterflow 713 by Master Builders.
 - 2) SonogROUT by Sonneborn.
 - 3) Five Star Grout by U.S. Grout Corporation.
 - 4) Crystex by L&M Construction Chemicals.
 - 5) Non-Corrosive, Non-Shrink Grout by A.C. Horn.
- B. Assembly and Installation Accessories: Building manufacturer's standard reinforcements, extensions, clips, brackets, miscellaneous fasteners and anchoring devices, spacers, furring strips, closures, flashings, expansion joints, thermal breaks, adhesives, and other components needed for a complete, permanently weatherproof installation. Materials shall be non-deteriorating, corrosion resistant, and compatible with adjoining materials.
- C. Connections: Fasteners shall be of size and in quantities to securely and permanently join building components, and shall be complete with necessary hardware and accessories as required for the application. Connections shall allow for expansion and contraction in accordance with the approved design. Screw bolts and rivets shall have metal-backed sealing washers. Except as otherwise indicated, provide the following fastener types for the following locations:
- 1. Roofing Panels to Structural Members: Screw bolts or rivets.
 - 2. Wall Panels to Structural Members: Screw bolts or standard bolted connection.
 - 3. Wall Panels to Wall Panels: Screw bolts, sheet metal screws or rivets.
 - 4. Interior Liner Panels to Supports: Cadmium plated steel fasteners of required type for secure attachment.
 - 5. Trim: Same fasteners as adjacent panels.
- D. Sealants, Gaskets and Closures:
- 1. Tape Sealant: Flat shaped, elastomeric, non-hardening, ribbon sealant; type recommended by building manufacturer for the particular use and conditions of application.
 - 2. Tube or Pumpable Sealant: Polybutenebutyl or acrylic terpolymer base sealant, or other type sealant recommended by building manufacturer for the particular use and conditions of application.
 - 3. Gaskets: Rubber, building manufacture's standard shapes.
 - 4. Closures: Closed cell foam or rubber material, formed to match panel profiles, sized to provide weathertightness.
- E. Galvanizing: Complying with the following requirements except where otherwise specified.
- 1. Formed Sheet Steel: ASTM A653, coating designation G-90.
 - 2. Assembled Steel Products: ASTM A123.

3. Iron and Steel Hardware: ASTM A153.
 4. Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip: ASTM A123.
- F. Color Finish: Factory applied color finish system on exposed surfaces of steel components specified to receive color finish, complying with the following requirements:
1. Surface Preparation: Galvanized steel shall be given a chemical conversion treatment conforming to Federal Government Specification MIL-C-490A, Type 1, Grade 1.
 2. Coating: After conversion treatment, metal shall be precision coated with thermosetting polymerized enamel to a dry film of one mil, plus or minus 0.2 mil, over the entire material width prior to forming of panels.
 3. Finish Pigmentation: Inorganic pigments selected for maximum durability and resistance to fading, except do not use aluminum pigment.
 4. Finish Gloss: Evenly maintained over the entire surface at 30, plus or minus 5 units, as measured on a 60 degrees Gardner photovolt meter for appearance, balance, reflectivity and durability.
 5. Colors: As selected by the Director from building manufacturer's standard colors.

2.02 PRIMARY BUILDING FRAMING

- A. Columns, roof beams, trusses, and rigid frames shall be factory fabricated, with required holes in webs and flanges accurately punched or drilled unless otherwise indicated or approved. Enlarging or gouging holes at the site will not be permitted. Base plates, splice plates, stiffener plates, and other required plates shall be shop fabricated and welded in place where applicable.
- B. Rigid Frames: Clear span, solid web framing, tapered or uniform depth, welded-up plate section columns and beams.
1. Rigid Frame Tie Rods and Anchor Bolts:
 - a. Tie rods shall be round bars, of constant diameter or with integral upset ends.
 - b. The allowable tensile stress on the unthreaded body area of tie rods, and on the tensile stress area of anchor bolt and tie rod threads shall be 22,000 psi.
 - c. Tie rods shall not be spliced by welding.
- C. Trusses: Open web framing; hot rolled sections, cold formed shapes, or built-up shapes of welded plate construction.
- D. Bracing: Wind bracing and struts, flange and knee bracing, and other bracing and support members as required by the building design; steel angles and rods recommended by building manufacturer unless otherwise indicated.
- E. Bolts for Field Assembly of Primary Building Framing and Bracing: High strength bolts.
- F. Shop Painting: Comply with the following requirements except where otherwise specified:

1. Steel framing shall be thoroughly cleaned of loose mill scale, loose rust, weld slag, and other foreign material. Oil and grease shall be removed with solvent.
 - a. Galvanized items shall be rinsed in hot alkali or in an acid solution and then in clear water. Welded and abraded galvanized surfaces shall be repaired with a 2 mil thick coating of cold galvanizing compound applied in accordance with compound manufacturer's instructions.
2. One coat of primer paint shall be applied to all steel surfaces except surfaces to be welded and contact surfaces of high strength bolted connections.
3. Finish coat of paint to be selected by owner, supplied and applied as part of the bid price.

2.03 SECONDARY BUILDING FRAMING

- A. Purlins: Cold formed steel shapes, or cold formed open web welded trusses.
- B. Girts: Cold formed steel shapes.
- C. Shop Painting: Comply with the requirements specified for Primary Building Framing.

2.04 ROOFING PANELS

- A. General:
 1. Roofing panels shall include all related components and accessories necessary for a complete roof system.
 2. Metal sheets shall be prefinished (coil coated) to the greatest extent possible prior to forming and panel fabrication.
 3. Panels shall be fabricated in maximum lengths possible as necessary to minimize end laps.
- B. Description:
 1. Type: Precision roll formed metal sheet.
 2. Seam Design (Sidejoint): Rib lap.
 3. Cross Section Profile: Standing seam
 4. Minimum Panel Thickness: 20 ga.
 5. Attachment to Supporting Members: Self-drilling, exposed screw bolts.
 6. Sidejoint Sealant: Factory or field applied.
- C. Materials:
 1. Panel Sheet: 20 gage galvanized steel.
- D. Coatings and Finishes:
 1. G90 galvanized coating designation, and color finish.
 2.
 - a. Front Surface: G90 galvanized coating designation, and panel manufacturer's standard rust-inhibitive back surface finish used with specified front surface color finish.

- E. Roof System Trim, Flashing, and Accessories: Materials shall be the same materials used for the panels, unless otherwise indicated or required by the application. Configurations shall be the standard with the building manufacturer for the specified roofing panels, unless otherwise indicated. Coatings and finishes shall match roofing panels, except building manufacturer's standard finishes (as required by application) may be furnished on special use accessories.

2.05 FABRICATION

- A. Tolerances: Conform to tolerances set forth in MBMA Code of Standard Practice, except as follows:
 - 1. Alignment and fit-up of welded joints shall conform to the "Structural Welding Code - Steel" (AWS D1.1).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine surfaces to receive the metal building for defects that will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Protect factory applied finishes from damage during erection.
- B. Clean surfaces to receive the work of this Section.

3.03 ERECTION AND INSTALLATION

- A. General: Erect and install the metal building and appurtenances in accordance with the manufacturer's printed instructions except as otherwise specified or required by the Reference Standards. Install the work of this Section so the structure is secure, and exposed materials are free of visible dents, scratches, tool marks, cuts, and other imperfections. Install building systems free of rattles, wind whistles, and noise due to thermal movement.
- B. Framing Erection:
 - 1. Provide temporary bracing to securely hold members in proper position until permanent bracing is fastened in place.
 - 2. Erect primary and secondary structural members in their designed positions, and fasten each securely in place.
 - a. Prepare, place, and cure shrink-resistant grout in accordance with grout manufacturer's printed instructions.
 - 3. Do not field cut or alter structural members without approval of the Engineer.

4. After erection, touch-up welded and abraded surfaces, bare spots, and field bolts with shop primer paint.
 - a. For galvanized items, first repair galvanized coating with a 2 mil thick coating of cold galvanizing compound applied in accordance with compound manufacturer's instructions.
- C. Roofing System:
 1. Assemble and anchor panels in place, in straight alignment, with provision for necessary thermal and structural movement. Locate panel end laps over supports. Lap panel ends minimum 6 inches. Fasten panels to each structural support.
 2. Seal longitudinal joints and transverse end laps.
 - a. Seal longitudinal joints with electrically operated seaming machine.
 3. Flash and seal roof covering at ridges, hips, rakes, eaves, and junctions with all related building components and accessories so that the roof is watertight.
- D. Related Building Components: Install related components including person doors and rolling doors in their designed locations, fitted with required accessories. Securely fasten items to structural supports. Adjust and lubricate operative units for smooth and easy operation. Seal components watertight at junctions with wall and roof systems.
- E. Tolerances: Conform to tolerances set forth in MBMA Code of Standard Practice, except as follows:
 1. Alignment and fit-up of welded joints shall conform to the "Structural Welding Code - Steel" (AWS D1.1).

3.04 ADJUSTING

- A. Restore minor visual damage to factory applied finishes in a manner to match the appearance and performance of the original finish, or remove the damaged parts and replace them with undamaged parts.

3.05 CLEANING

- A. Remove strippable protective coatings after completion of work liable to damage the finish. Comply with manufacturer's recommendations for coating removal.
- B. Clean exposed exterior and interior surfaces of exterior wall panels. Remove any residue from strippable coatings. Comply with panel manufacturer's printed recommendations for cleaning.

END OF SECTION

SECTION 133420
PREFABRICATED PRECAST CONCRETE BUILDING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

Under this item, Contractor shall furnish and install a PRECAST CONCRETE BUILDING as shown in the Contract Documents and as directed by the Engineer including all required electrical service penetrations, doors, hardware, roofing, integral exterior finishes, split unit HVAC, and lighting within the building. Information on the PRECAST CONCRETE BUILDING material and installation shall be as depicted in the Contract Documents.

- A. Related Sections include the following:
1. Section 03300 “Cast-in-Place Concrete” for installing connection anchors and reinforcing steel in concrete and structural topping.
 2. Section 05120 “Structural Steel” for furnishing and installing connections attached to structural-steel framing.
 3. Section 05500 “Metal Fabrications” for furnishing and installing loose hardware items.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide structural precast concrete members and connections capable of withstanding design loads indicated within limits and under conditions indicated on Drawings.
- B. Sloped Roof: Roof panel shall slope ½” from front to back in 10 foot direction. The roof shall extend a minimum of 2 ½” beyond the wall panel on each side and have a turndown design which extends ½” below the top edge of the wall panels to prevent water migration into the building along top of wall panels. Roof shall also have an integral architectural ribbed edge.
- C. Roof, floor, and wall panels must each be produced as single component monolithic panels. No roof, floor, or vertical wall joints will be allowed, except at corners. Wall panels shall be set on top of floor panel. Floor panel must have ½” step-down around the entire perimeter to prevent water migration into the building along the bottom of wall panels.
- D. Doors and Frames: Shall comply with Steel Door Institute “Recommended Specifications for Standard Steel Doors and Frames” (SDI-100) and as herein specified. The buildings shall be equipped with double 3’-0” x 6’-8” x 1-3/4”, 18-gauge galvanized/insulated 16-gauge galvanized frames. Doors and frames shall be painted one coat of rust inhibitive primer and one

finish coat of enamel paint; color shall as selected by the owner from the manufacturer's standard palette.

- E. The exterior faces of the structure shall be textured and colored to match the shield walls, or as otherwise acceptable to the owner.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years after completion of structure.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength. Concrete shall have a 28 day compressive strength not less than 5000psi, and shall be air entrained.
- C. Shop (Erection) Drawings:
 - 1. Detail fabrication and installation of structural precast concrete units including connections at member ends and to each adjoining member.
 - 2. Indicate locations, plan views, elevations, dimensions, shapes, and cross sections of each unit, openings, support conditions and types of reinforcement, including special reinforcement.
 - 3. Indicate aesthetic intent including joints, rustications or reveals, and extent and location of each surface finish.
 - 4. Indicate welded connections by AWS standard symbols. Show size, length, and type of each weld.
 - 5. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
 - 6. Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 7. Include and locate openings larger than 10 in (250 mm). Where additional structural support is required for openings include header design.
 - 8. Coordinate and indicate openings and inserts required by other trades.
 - 9. Indicate location of each structural precast concrete member by same identification mark placed on unit.
 - 10. Indicate relationship of structural precast concrete members to adjacent materials.
 - 11. Indicate locations and details of joint treatment.
 - 12. Indicate areas receiving toppings and magnitude of topping thickness.
 - 13. Indicate estimated cambers for floor slabs receiving cast-in-place topping.
 - 14. Indicate multiple wythe connection devices.
 - 15. Indicate shim sizes and grouting sequence.
- D. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, notify the Engineer and submit design calculations and Shop Drawings. Do not affect the appearance, durability or strength of members when modifying details or materials. Maintain the general design concept when altering size of members and alignment.
- E. Provide handling procedures, erection sequences, and for special conditions provide temporary bracing and shoring plan.
- F. Comprehensive engineering design signed and sealed by a qualified professional engineer responsible for its preparation licensed in the Province of Ontario.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer and fabricator and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
 - 1. Cementitious materials.
 - 2. Reinforcing materials.
 - 3. Admixtures.
 - 4. Bearing pads.
 - 5. Structural-steel shapes and hollow structural sections.
 - 6. Insulation.

1.6 QUALITY ASSURANCE

- A. Erector Qualifications: A precast concrete erector Qualified by the Precast/Prestressed Concrete Institute (PCI) prior to beginning work at the jobsite. Submit a current Certificate of Compliance furnished by PCI designating qualification in Category S1.
- B. Erector Certification: A precast concrete erector with erecting organization and all erecting crews Certified and designated, prior to beginning work at project site, by PCI's Certificate of Compliance to erect Category S1.
- C. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in producing structural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.
- D. Professional Engineer Qualifications: A professional engineer licensed in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of structural precast concrete that are similar to those indicated for this Project in material, design, and extent.
- E. Has sufficient production capacity to produce required members without delaying the Work.
- F. Certification shall be maintained throughout the production of the precast concrete units. Production shall immediately stop if at any time the fabricator's certification is revoked, regardless of the status of completion of contracted work. Production will not be allowed to re-start until the necessary corrections are made and certification has been re-established. In the event certification(s) can not be re-established in a timely manner, causing project delays, the fabricator, at no additional cost, will contract out the remainder of the units to be manufactured at a PCI certified plant.
- G. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete," applicable to types of structural precast concrete members indicated.
- H. Quality-Control Standard: For manufacturing procedures and testing requirements and quality control recommendations for types of members required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Concrete Products."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all structural precast concrete members in such quantities and at such times to assure compliance with the agreed upon project schedule and setting sequence to ensure continuity of installation.
- B. Handle and transport members in a manner to avoid excessive stresses that could cause cracking or other damage.
- C. Store units with adequate dunnage and bracing, and protect units to prevent contact with soil, staining, and to control cracking, distortion, warping or other physical damage.
- D. Unless otherwise specified or shown on Shop Drawings, store members with dunnage across full width of each bearing point.
- E. Place stored members so identification marks are clearly visible, and units can be inspected.
- F. Place dunnage of even thickness between each member.
- G. Lift and support members only at designated points indicated on the Shop Drawings.

1.8 SEQUENCING

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 – PRODUCTS

2.1 FABRICATORS

- A. Fabricators: Subject to compliance with requirements, fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Shea Concrete Products, 87 Haverhill Road, Amesbury, MA 01913, 800-696-7432.
www.sheaconcrete.com
 - b. Easi-Set Buildings, Design Concrete, Inc. Hamilton, ON Canada, 585-831-0885,
www.EasiSetBuildings.com
 - c. M&W Precast Construction Supply, 210 Durham Rd, Ottsville, PA 18942, 585-831-0885, <https://www.mwprecastsupply.com/>

2.2 FORM MATERIALS

- A. Forms: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required surface finishes.

2.3 REINFORCING MATERIALS

- A. Galvanized Reinforcing Bars: [ASTM A 615/A 615M, Grade 60 (Grade 420)] [ASTM A 706/A 706M], deformed bars, ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized and chromate wash treated after fabrication and bending.
- B. Supports: Use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or III.
 - 1. For surfaces exposed to view in finished structure, use same type, brand, and mill source throughout the precast concrete production.
- B. Supplementary Cementitious Materials
 - 1. Fly Ash: ASTM C 618, Class C or F with maximum loss on ignition of 3%.
 - 2. Silica Fume: ASTM C 1240 with optional chemical and physical requirements.
 - 3. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normalweight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse, non-reactive aggregates. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or liquid coloring admixtures, temperature stable and nonfading.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- G. Air Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. Water-Reducing and Accelerating Admixture ASTM C494/C 494M, Type E.
 - 5. High Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

7. Plasticizing Admixture for Flowable Concrete: ASTM C 1017/C 1017M.
8. Corrosion Inhibiting Admixture: ASTM C 1582/C 1582M

2.6 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M
- B. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.
- C. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M
- D. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or C.
- E. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or C (ASTM F 568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A 563/A 563M, Grade A); and flat, unhardened steel washers (ASTM F 844).
- F. High-Strength Bolts and Nuts: ASTM A193/A193M, Grade B5 or B7, ASTM A 325/ A 325M, or ASTM A 490/ A 490M, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, (ASTM A 563/A 563M) and hardened carbon-steel washers (ASTM F 436/F 436M).
- G. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust –inhibitive primer, according to SSPC-PA 1.
- H. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M, after fabrication, ASTM A 153/A 153M, or ASTM F 2329 as applicable.
 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon content and 2.5 times phosphorous content to 0.09 percent.
 2. Galvanizing Repair Paint: Zinc paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.
- I. Galvanizing Paint: Zinc paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20. Comply with manufacturer’s requirements for surface preparation.

2.7 GROUT MATERIALS

- A. Nonshrink Grout: Premixed, prepackaged ferrous and non-ferrous aggregate shrink-resistant grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application with a 30-minute working time. Water-soluble chloride ion content of grout less than 0.06 percent chloride ion by weight of cement when tested in accordance with ATM C1218/C1218M.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Limit use of fly ash to 35 percent replacement of portland cement by weight; granulated blast-furnace slag to 50 percent of portland cement by weight; and metakaolin and silica fume to 10 percent of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at structural precast concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested in accordance with ASTM C 1218/C 1218M.
- D. Normalweight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normalweight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi (34.5 Mpa) minimum.
 - 2. Release Strength: as required by design.
 - 3. Maximum Water-Cementitious Materials Ratio: 0.45.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mixture Adjustments: Concrete mixture design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.9 FORM FABRICATION

- A. Form: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations and temperature changes, and for prestressing and detensioning operations. Coat contact surfaces of forms with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain forms to provide completed structural precast concrete members of shapes, lines, and dimensions indicated in Contract Documents, within fabrication tolerances specified.

1. Edge and Corner Treatment: Uniformly chamfered or as built-in on standard forms.

2.10 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement. Do not relocate bearing plates in members unless approved by Architect.
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, hangers, and other hardware shapes for securing precast concrete members to supporting and adjacent construction.
- C. Cast-in reglets, slots, and other accessories in structural precast concrete members as required for coordination with electrical and HVAC work.
- D. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Locate and support reinforcement by plastic tipped or corrosion resistant metal or plastic chairs, runners, bolsters, spacers, hangers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.
 3. Place reinforcing steel and prestressing tendons to maintain at least $\frac{3}{4}$ in. (19 mm) minimum concrete cover. Provide cover requirements in accordance with ACI 318 (ACI 318M) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces in accordance with ACI 318 (ACI 318M) and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Reinforce structural precast concrete members to resist handling, transportation, and erection stresses, and specified in-place loads, whichever governs.
- H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete members.
 1. Place backup concrete to ensure bond with face-mixture concrete.

- J. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.
 - 1. Place self-consolidating concrete without vibration in accordance with PCI TR-6 “Interim Guidelines for the Use of Self-Consolidating Concrete.” If face and backup concrete is used, ensure adequate bond between concrete mixtures.
- K. Comply with PCI MNL 116 procedures for hot and cold-weather concrete placement.
- L. Identify pickup points of precast concrete members and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast concrete member on a surface that will not show in finished structure.
- M. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure members until compressive strength is high enough to ensure that stripping does not have an effect on the performance or appearance of final product.

2.14 FABRICATION TOLERANCES

- A. Fabricate structural precast concrete members of shapes, lines and dimensions indicated, so each finished member complies with PCI MNL 135 product tolerances as well as position tolerances for cast-in items.

2.15 FINISHES

- A. Commercial (Structural) Finishes
 - 1. Grade B Finish: Fill air pockets and holes larger than 1/4 inch (6 mm) in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch (3 mm) in width that occur in high concentration (more than one per 2 in.² [1300 mm²]). Grind smooth form offsets or fins larger than 1/8 inch (3 mm). Repair surface blemishes due to dents in forms. Discoloration is permitted at form joints.
- B. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish, float finish, if required. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. No major imperfections, honeycombing, or defects are permitted.

2.16 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements. If using self-consolidating concrete also test and inspect according to PCI TR-6 “Interim Guidelines for the Use of Self-Consolidating Concrete” and ASTM C 1611/C 1611M, ASTM C 1712, ASTM 1610/1610M, and ASTM C 1621/C 1621M.

- C. Strength of precast concrete members will be considered deficient if units fail to comply with ACI 318 (ACI 318M) concrete strength requirements.
- D. Testing: If there is evidence that strength of precast concrete members may be deficient or may not comply with ACI 318 (ACI 318M) requirements, fabricator shall employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M and ACI 318/ACI 318M.
 - 1. Test results shall be reported in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports shall include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete member(s) represented by core tests; design compressive strength; type of failure; actual compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast concrete members comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Acceptability. Structural precast concrete members that do not comply with acceptability requirements in PCI MNL 116, including concrete strength, and manufacturing tolerances, are unacceptable. Chipped, spalled or cracked members may be repaired. Replace unacceptable units with precast concrete members that comply with requirements.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Furnish loose connection hardware and anchorage devices for precast concrete members to be embedded in or attached to the building structural frame or foundation before starting that Work. Provide locations, setting diagrams, templates and instructions for the proper installation of each anchorage device.

3.2 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting precast concrete performance.
- B. Proceed with precast concrete installation only after unsatisfactory conditions have been corrected.
- C. Contractor shall notify precast concrete erector that supporting cast-in-place concrete foundation and building structural framing has attained minimum allowable design

compressive strength or supporting steel or other structure is structurally ready to receive loads from precast concrete members prior to proceeding with installation.

3.3 ERECTION

- A. Install loose clips, hangers, bearing pads, and other accessories required for connecting structural precast concrete members to supporting members and backup materials.
- B. Erect structural precast concrete level, plumb and square within the specified allowable erection tolerances. Provide temporary structural framing, shoring and bracing as required to maintain position, stability, and alignment of members until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete members are being erected. Surface weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and use plastic patchcaps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
 - 4. Unless otherwise indicated provide uniform joint widths of $\frac{3}{4}$ in. (19 mm).
- C. Connect structural precast concrete members in position by bolting, welding, grouting, or as otherwise indicated on approved Shop (Erection) Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.
 - 1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
- D. Welding: Comply with applicable AWS D1.1/D1.1M, AWS D1.4/D1.4M and AWS D1.6/D1.6M requirements for welding, welding electrodes, appearance of welds, quality of welds, and methods used in correcting welding work.
 - 1. Protect structural precast concrete members and bearing pads from damage during field welding or cutting operations and provide noncombustible shields as required.
 - 2. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS D1.1/D1.1M, D1.4/D1.4M or D1.6/D1.6M.
 - 3. Clean-weld-affected metal surfaces with chipping hammer followed by brushing or power tool cleaning and then reprime damaged painted surfaces in accordance with manufacturer's recommendations.
 - 4. For galvanized metal, clean weld affected metal surfaces with chipping hammer followed by brushing or power tool cleaning, and apply a minimum 0.004 inch (4 mil) thick coat of galvanized repair paint to galvanized surfaces in conformance with ASTM A 780/A 780M.
 - 5. Visually inspect all welds critical to precast concrete connections. Visually check all welds for completion and remove, reweld or repair all defective welds, if services of AWS-certified welding inspector are not furnished by Owner.
- E. At bolted connections, use upset threads, thread locking compound or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness at installation. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 2. For slip critical connections, one of the following methods shall be used to assure proper bolt pretension:
 - a. Turn-of-Nut – in accordance with AISC.
 - b. Calibrated Wrench – in accordance with AISC.
 - c. Twist-off Tension Control Bolt – meeting ASTM F 1852.
 - d. Direct-Tension Control Bolt – meeting ASTM F 1852.
 3. For slip critical connections, the method to be used and the inspection procedure to be used shall be approved by the Architect and coordinated with the inspection agency.
- F. Grouting or Dry-Packing Connections and Joints: Indicate joints to be grouted and any critical grouting sequences on Shop (Erection) Drawings. Grout open spaces at keyways, connections and joints where required or indicated. Provide reinforcing steel where indicated. Retain flowable grout in place until it gains sufficient strength to support itself. Fill joints completely without seepage to other surfaces. Alternatively, pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for at least 24 hours after initial set.
1. Trowel top of grout joints on roofs smooth to prevent any unevenness that might interfere with placing of, or cause damage, to insulation and roofing. Finish transitions due to different surface levels not steeper than 1 to 12.

3.4 ERECTION TOLERANCES

- A. Erect structural precast concrete members level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135. Level out variations between adjacent members by jacking, loading, or any other feasible method as recommended by the fabricator and acceptable to the Architect.
- B. Testing: Owner will engage accredited independent testing and inspecting agency to perform field tests and inspections and prepare reports.
 1. Field welds will be subject to visual inspections and dye penetrant or magnetic particle testing in accordance with ASTM E 165 or ASTM E 1444. Testing agency shall be qualified in accordance with ASTM E543.
 2. Testing agency will report test results promptly and in writing to Contractor and Architect.
- C. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Erector's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS

- A. Repairs will be permitted provided structural adequacy, serviceability and durability of members and appearance are not impaired.
- B. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
- C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- D. Remove and replace damaged structural precast concrete members when repairs do not comply with specified requirements.

3.6 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete members after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect adjacent work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 133420

Scope:

The approach canopy has cabling systems that are not associated with other items, and so this SP defines those works.

Material:

New Category 5 Ethernet outdoor wet service rated cable of the same specification used for Variable Message Sign communications service shall be placed to support camera deployment. Two such camera sites are shown on the plan.

The Category 5 outdoor wet service rated cable nominated for CBP camera service shall be run in a 21mm Hydrotite flexible conduit. One such camera is shown on the plan.

Cat 5 cable shall be terminated in RJ-45 jack at each end. The camera end shall furnish a weather tight connection. PBA cabling may terminate in a common frame with VMS communication cables.

All above communication wires and ducting shall descend the communication riser and terminate in the communication frame inside the power distribution housing. Any surge arrestors shall not be a part of this item.

New 120V utility receptacles are to be installed on 5 select columns to facilitate power washer, use, etc. They shall be of GFCI type and housed in a deep single gang PVC surface mount box. The cover for this receptacle shall be suitable for wet service in use.

Construction:

The receptacle shall be attached 1.5m above grade on the 'back' side of the post, so not seen easily by approaching vehicles.

2#12 and 1#12 insulated ground copper conductors in a 21mm PVC conduit shall exit the top of the receptacle box column and rise up to a junction box attached at the top of the column where concrete stops. At this junction box the cabling shall transition to #10 Teck90 cabling in the tray system. The cabling shall extend back to the power riser. At the power riser all TECK may be taken to the electrical panel, however we recommend a single hydrotite conduit be used from the panel up the riser to the tray elevation, and there affect a junction box to branch out to individual TECK runs in the tray.

Teck cable shall be run on tray, and secured to joists and run out to junction boxes to power the canopy illumination luminaires.

Cabling shall be consolidated as shown on the plans to go down the vertical riser conduits. This lump sum item includes all needed vertical surface mount cable to affect the project needs.

New PBA fibre linkages from the communication facilities in the Outbuilding to the Cross connect cabinets in the IT Room of the West Abutment Fibre there shall be fully tested, and fibre appearance records there updated.

Early communication of the planned communication cabinet ready status schedule to the Owner shall be made to communicate when Owner supplied Ethernet switches, UPS units and surge arrestors will be required. Time shall be allocated to allow the Owner to demonstrate proper operation to the Contractor prior to releasing materials for installation.

Test results for new fibres shall be remitted and accepted by the Owner prior to affecting any relocation of existing fibre cabling into the communication facilities in the Outbuilding. Such relocations shall be coordinated with and be set to the schedule of PBA as to acceptable cut over times and outage duration. Early coordination of this effort is key.

Following successful connection of existing data flows via new fibre cables, any portion of existing fibre cables shall be deemed ready, at the Owners acceptance, for removal. Removals shall include updating documentation of any terminal records in cross connects or other fibre appearance locations and sealing any now vacant splice closure entries.

New fibre optic connections dedicated to the use of CBP shall be tested to the cross connect location in the west abutment IT room. Following successful testing and acceptance to the test results by the Owner then CBP forces will affect a cross connect and end to end testing to the US may proceed.

Advance notice of the proposed schedule for new cable testing shall be communicated to the Owner. The Owner in turn can communicate this to CBP. Two weeks for testing shall be provided to allow CBP to arrange for end- to-end testing before the proposed facility in service date.

The PBA shall be advised when the cable plant placed on the approach canopy is tested and ready to support installation and commissioning of PBA supplied and installed CCTV cameras.

CBP forces shall be advised when the cable plant and data linkages placed to support their camera on the approach canopy is tested and ready to support installation and commissioning of CBP supplied and installed CCTV camera.

New Variable Message Signs at the approach canopy are on a new facility and may be placed at any time prior to two weeks prior to the new facility coming into service.

New Variable Message Signs at Central Ave Overpass and Duty Free Gantry sites shall not be installed until the following conditions A and B have been met:

A: The Ethernet switch and associated UPS in the associated communication cabinet shall be installed and operating to the satisfaction of the Owner. The communication linkages to the cabinets shall be established to the satisfaction of the Owner.

B: The permanent source of power shall be in service to the associated power supply cabinet

The static signs and flashers slated for removal may not be removed for more than 6 hours prior to the new signs coming into service.

If lane assignments are not per permanent operations when the signs are ready to be brought into service, the Owner shall be notified and provided 3 business days to develop suitable alternative messaging.

A two week allowance in advance of opening of the new facility shall be allowed to have all VMS in service to let the owner set up all message sets and verify their display functionality.

This Contract is bid on a lump sum basis. Any Special Provision shall be read and enforced with any included Measurement of Payment and Basis of Payment clauses ignored. Any reference to Item No.: may also be ignored.

For WSP electrical and communication plan drawings works, Ontario Provincial Standards, generally outlined by:

OPS special specifications At a minimum they shall include OPSS0106 OPSS602, OPSS603, OPSS604, OPSS 609. OPSS610, and OPSS 614, and all referenced OPSS special specifications.

OPS special provisions
and

Additionally, the following drawings at a minimum shall be valid in this project for communication and electrical use:

OPSD 2000.001, 2011.101, 2011.201, 2014.101, 2014.102, 2015.301, 2101.01, 2103.020, 2103.02, 2103.04, 2111.02, 2111.04, 2111.05, 2112.02, 2117.01, 2117.02, 2123.01 2123.02, 2302.02

MTOD: 2902.2052910.021, 2920.020. 2920.021, 2920.022, 2940.01, 2940.020, 2940.110, 2940.115, 2940.120

any referenced OPSD or MTOD drawings

For manholes, the item shall be supplied with frame, cover and adjusting rings to suit. Manholes in traffic areas shall be fitted with bolt down lids. Manholes covers do not need to be specifically marked.

OPS shall be applicable for site works outside of the following areas:

The Salt Storage Building

The PARE 3.0 Outbuilding

The New and Existing Electrical room inside the West Abutment

On and Inside of the three above structures the work shall be specified under appropriate clauses of National Master Specification.

The general NMS electrical specifications shall be read along with any other supporting NMS specifications they refer to.

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1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.1- 12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
- .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.

1.02 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.03 RELATED REQUIREMENTS

- .1 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings
- .2 26 29 03 - Control Devices

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 - Submittal Procedures].
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit for review single line electrical diagrams under plexiglass and locate in Outbuilding and West Abutment electrical room.
 - .1 Electrical distribution system in main electrical room.
 - .2 Electrical power generation access housing.
- .4 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate

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internal wiring for each item of equipment and interconnection between each item of equipment.

- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Submit 2 hard copies of ISO A1 minimum size drawings and not less than Letter size product data and digital soft copy to PBA.
- .6 If changes are required, notify PBA of these changes before they are made.
- .6 Certificates:
 - .1 Provide CSA certified equipment and materials.
 - .2 Where CSA certified equipment and/or material is not available, submit such items to authority having jurisdiction/inspection authorities 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.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to PBA.
- .7 Manufacturer's Field Reports: submit to Consultant manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.05 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
 - .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.

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- .4 Procedures to be followed in event of equipment failure.
- .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .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 in accordance with manufacturer's recommendations.
 - .2 Store and protect items from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235
- .2 Motors, electric heating, control 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.

2.02 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL

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SUBMITTALS.

- .3 Factory assemble control panels and component assemblies.

2.03 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction.
- .2 Decal signs, minimum size 175 x 250 mm.

2.04 WIRING TERMINATIONS

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

2.05 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: plastic laminate plastic sheet black face, white font in UV resistant ink 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 on nameplates and labels to be approved by PBA prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

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COMMON WORK RESULTS FOR ELECTRICAL
PAGE 5

- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

2.06 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, 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.

2.07 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code 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.

Type	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems		Green Blue

2.08 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.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are

SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL
PAGE 6

acceptable for item installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of PBA.
- .2 Inform PBA of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from PBA.

3.02 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.03 NAMEPLATES AND LABELS

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

3.04 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves if possible, prior to pouring of concrete.
 - .1 Sleeves through concrete: sized for free passage of conduit. Arrange for holes through exterior walls and roof to be flashed and made weatherproof.

3.05 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3m, and information is given before installation.
- .3 Locate light switches on latch side of doors.

3.06 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centerline 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 at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.

SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL
PAGE 7

- .2 In mechanical rooms: 1400 mm.
- .3 Panelboards: as required by Code or as indicated.

3.07 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.08 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads lighting operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers, and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Power and distribution system including phasing, voltage, grounding, and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Insulation resistance testing:
 - .1 Megger circuits, feeders, and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders, and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of PBA.
- .4 Provide instruments, meters, equipment, and personnel required to conduct tests during and at conclusion of project.
- .5 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

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COMMON WORK RESULTS FOR ELECTRICAL
PAGE 8

use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.09 SYSTEM STARTUP

- .1 Instruct PBA operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer 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.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal
- .4 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL
PAGE 1

1 GENERAL

1.01 SUMMARY

- .1 This Section includes requirements for selective demolition and removal of electrical components including removal of conduit, junction boxes, transformers, and metal clad switch gear in the west abutment existing electrical room and in the Mather arch feed end building, as well as all 5kV Teck type cable linking these sites or former sites emanating from the MCSG panels and incidentals required to complete work described in this Section.

1.02 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA S350 M1980 R2003, Code of Practice for Safety in Demolition of Structures

1.03 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .4 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.04 RELATED REQUIREMENTS

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide in accordance with Section 01 33 00 - Submittal Procedures before starting work of this Section:
 - .1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of

SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL
PAGE 2

materials prepared in accordance with Section 01 74 19 - Waste Management and Disposal

- .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste [and hazardous wastes by a landfill facility licensed to accept hazardous wastes].

1.06 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.
- .2 Scheduling: Account for PBA continued occupancy requirements during selective demolition with West Abutment

1.07 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work of this Section in accordance with all health and safety requirements.

1.08 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.
- .2 Recovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify PBA Representative if materials suspected of containing hazardous substances are encountered and perform following activities:
 - .1 Refer to Section 01 41 00 - Regulatory Requirements for directives associated with specific material types.
 - .2 Hazardous substances will be as defined in Hazardous Products Act.
 - .3 Stop work in area of suspected hazardous substances.
 - .4 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
 - .5 Hazardous substances will be removed by PBA under a separate contract or as a change to Work.
 - .6 Proceed only after written instructions have been received from PBA representative.

1.09 SALVAGE AND DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from Project site.

SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL
PAGE 3

1.10 MATERIALS

- .1 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.
- .2 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

2 EXECUTION

2.01 EXAMINATION

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; PBA will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

2.02 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
 - .2 Notify PBA and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
 - .3 Prevent debris from blocking drainage inlets.
 - .4 Protect mechanical systems that will remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the PBA and users is minimized and as follows:
 - .1 Prevent debris from endangering safe access to and egress from occupied buildings.
 - .2 Notify PBA and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

2.03 EXECUTION

- .1 Demolition and Removal: Coordinate requirements of this Section

SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL
PAGE 4

with information contained in commissioning of new power sources.

- .1 Disconnect panel feeders; maintain electrical distribution panel as is or modified per drawings ready for subsequent Work.
- .2 Remove existing electrical devices and equipment including associated conduits, boxes, wiring, and similar items.
- .3 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove tools or equipment after completion of work and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
- .4 Place weatherproof blank cover plates on any outlet boxes remaining after demolition and removal activities.
- .5 Remove existing conduits, boxes, cabling, and wiring associated with removed luminaires, electrical devices and equipment.
- .6 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
- .7 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

2.04 CLOSEOUT ACTIVITIES

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site. or alternative disposal site.

END OF SECTION

SECTION 260520
WIRE AND BOX CONNECTORS (0-1000 V)
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .3 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .4 National Electrical Manufacturers Association (NEMA)

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

1.03 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for [wire and box connectors] for incorporation into manual.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 in accordance with manufacturer's recommendations.
 - .2 Replace defective or damaged materials with new.

SECTION 260520
WIRE AND BOX CONNECTORS (0-1000 V)
PAGE 2

2 PRODUCTS

2.01 MATERIALS

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to NEMA to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors
 - .2 Clamp for copper conductor bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors/ bar.
- .4 Clamps or connectors for flexible conduit/ non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

3 EXECUTION

3.01 INSTALLATION

- .1 Remove insulation carefully from ends of conductors [and] [cables] and:
 - .1 Install mechanical pressure type connectors with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65
 - .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

SECTION 260521
WIRES AND CABLES (0-1000 V)
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CAN3-C21.1-M - Control Cable - 600V
- .2 CSAC22.2 No.38-M Thermoset insulated Wires and Cables
- .3 CSAC222 No.75-M Thermoplastic insulated Wires and Cables

1.02 RELATED REQUIREMENTS

- .1 Section:
- .2 26 05 00 - Common Work Results for Electrical
- .3 26 05 20 - Wire and Box Connectors - (0-1000 V)
- .4 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

1.03 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove for reuse and return of pallets, crates, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.01 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 14 AWG.
- .2 Copper conductors: size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE (Dry locations) or RWU90 XLPE (Wet locations), Non-Jacketed.
- .3 [Aluminum] steel reinforced, size as indicated. Type: [NS75] [NS90] Insulation: [Type NS-1 rated 300 V] [Type NSF-2 flame retardant rated 600 V].

2.02 TECK 90 CABLE

- .1 Cable: in accordance with Section [26 05 00 - Common Work Results for Electrical].
- .2 Conductors:
 - .1 Grounding conductor: copper as indicated.
 - .2 Circuit conductors: copper, size as indicated.

SECTION 260521
WIRES AND CABLES (0-1000 V)
PAGE 2

- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking.
- .6 Overall covering: thermoplastic polyvinyl chloride.
- .7 Connectors:
 - .1 Watertight, approved for TECK cable.

3 EXECUTION

3.01 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.02 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.

3.03 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

END OF SECTION

SECTION 260521
WIRES AND CABLES (0-1000 V)
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CAN3-C21.1-M - Control Cable - 600V
- .2 CSAC22.2 No.38-M Thermoset insulated Wires and Cables
- .3 CSAC222 No.75-M Thermoplastic insulated Wires and Cables

1.02 RELATED REQUIREMENTS

- .1 Section:
- .2 26 05 00 - Common Work Results for Electrical
- .3 26 05 20 - Wire and Box Connectors - (0-1000 V)
- .4 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

1.03 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove for reuse and return of pallets, crates, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.01 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 14 AWG.
- .2 Copper conductors: size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE (Dry locations) or RWU90 XLPE (Wet locations), Non-Jacketed.
- .3 [Aluminum] steel reinforced, size as indicated. Type: [NS75] [NS90] Insulation: [Type NS-1 rated 300 V] [Type NSF-2 flame retardant rated 600 V].

2.02 TECK 90 CABLE

- .1 Cable: in accordance with Section [26 05 00 - Common Work Results for Electrical].
- .2 Conductors:
 - .1 Grounding conductor: copper as indicated.
 - .2 Circuit conductors: copper, size as indicated.

SECTION 260521
WIRES AND CABLES (0-1000 V)
PAGE 2

- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking.
- .6 Overall covering: thermoplastic polyvinyl chloride.
- .7 Connectors:
 - .1 Watertight, approved for TECK cable.

3 EXECUTION

3.01 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.02 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.

3.03 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

END OF SECTION

SECTION 260522
CONNECTORS AND TERMINATIONS
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).
 - .3 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.02 RELATED REQUIREMENTS

- .1 26 05 33 - Raceway and Boxes for Electrical Systems

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.

1.04 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

1.05 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect connectors and terminations from nicks and dents.
 - .3 Replace defective or damaged materials with new.

SECTION 260522
CONNECTORS AND TERMINATIONS
PAGE 2

2 PRODUCTS

2.01 CONNECTORS AND TERMINATIONS

- .1 Copper long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for connectors and terminations installation in accordance with manufacturer's written instructions.

3.02 INSTALLATION

- .1 Install terminations in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2No.41.

END OF SECTION

SECTION 260527

GROUNDING

PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837-[02], Qualifying Permanent Connections Used in Substation Grounding.

1.02 RELATED REQUIREMENTS

- .1 This Specification over-rides the NMS/OPS NSSP. Grounding associated with Service Entry Facilities shall be paid under NMS, despite equipment being installed outside of the defined building envelope.
- .2 260500 - Common Work Results for Electrical

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Quality Assurance Submittals:
 - .1 Manufacturer's Instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

2 PRODUCTS

2.01 MATERIALS

- .1 Rod electrodes: copper clad steel, 19 mm diameter by 3 m long.
- .2 Alternately where rock is encountered: Plate electrode: copper surface area equal to 3m nominated ground rod and plated to same thickness.

SECTION 260527

GROUNDING

PAGE 2

- .3 Conductors: bare, stranded, soft annealed copper wire, size No. 4/0 AWG electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.
- .4 Conductors: bare or pvc insulated coloured green, stranded soft annealed copper wire, sized to suit Tables 16A or 16B in CEC. for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers.
- .5 Conductors: pvc insulated coloured green, stranded untinned soft annealed copper wire No. 10 AWG for grounding metre and relay cases.
- .6 Bus bars to dimensions detailed in the drawings.
- .7 Accessories: non-corroding, necessary for complete grounding system, type, size material as indicated, including:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.
- .8 Wire connectors and terminations: as indicated.

3 EXECUTION

3.01 INSTALLATION

- .1 Install continuous grounding system including, electrodes, conductors, connectors, and accessories as indicated and to requirements of local authority having jurisdiction.
- .2 Install connectors and thermit welds in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors during and after construction.
- .4 Make buried connections, and connections to electrodes, structural steel work, using copper welding by thermit process or compression press permanent mechanical connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Use bus bars for main ground bus and Table 16A or 16B sized bare copper cable for taps on risers from main ground bus to equipment.

SECTION 260527

GROUNDING

PAGE 3

- .7 Use tinned copper conductors for aluminum structures.

3.02 ELECTRODE INSTALLATION

- .1 Install ground rod/ plate electrodes. Make grounding connections to building equipment.
- .2 Make special provision for installing electrodes that will give acceptable resistance to ground value, where rock or sand terrain prevails.

3.03 EQUIPMENT GROUNDING

- .1 Install grounding connections as indicated to typical station equipment including neutral. Non-current carrying parts of: transformers, generators, motors, circuit breakers, current transformers, frames of gang-operated switches and fuse cutout bases. Raceways, pull boxes, screen guards, switchboards, potential transformers. Any exposed building metal.
- .2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.
- .3 Connect metallic piping (water, oil, air, etc.) inside station to main ground bus at several locations, including each service location within station.[Make connections to metallic water pipes outside station to assist in reduction of station ground resistance value].

3.04 NEUTRAL GROUNDING

- .1 Connect transformer neutral and distribution neutral together using 1000 V insulated conductor to one side of ground test link, the other side of the test link being connected directly to main station ground. Ensure distribution neutral and neutrals of potential transformers and service banks are bonded directly to transformer neutral and not to main station ground.
- .2 Interconnect electrodes and neutrals at each grounding installation.
- .3 Connect neutral of station service transformer to main neutral bus with tap of same size as secondary neutral.
- .4 Ground transformer tank with continuous conductor from tank ground lug through connector on ground bus to primary neutral. Connect neutral bushing at transformer to primary neutral in same manner.

3.10 SITE QUALITY CONTROL

- .1 Perform tests in accordance with Section [26 05 00 - Common Work Results for Electrical].
- .2 Engage qualified technicians and equipment to inspect grounding and perform ground resistance test before

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GROUNDING

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backfilling. Grounding system shall be 10 ohms or less to native earth potential of test rig.

- .3 Perform earth loop test and resistance tests using method appropriate to site conditions and to approval of PBA and local authority having jurisdiction.
- .4 Perform test before energizing electrical system.
- .5 Provide step-and-touch potential calculations using measured station ground resistance measurements. Submit test result and inspection certificate before energizing electrical system.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

1.02 RELATED REQUIREMENTS

- .1 Salt building Requirements: All fasteners, hangers, channel, pull boxes and anchors used in Salt Building shall be hot dip galvanized steel or furnished in stainless steel grade 304 or better or be of non-corroding construction.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.04 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
PAGE 2

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.
 - .1 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from PBA Representative.

3.02 INSTALLATION

- .1 Secure equipment to concrete or masonry with nylon shields or epoxy glued in inserts.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole [malleable iron] [steel] straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits use channels at spacing per CEC depending on material and conduit size.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
PAGE 3

- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of PBA Representative.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .13 All field cuts of galvanized materials shall be painted with zinc rich primer.

END OF SECTION

SECTION 26031
SPLITTERS, JUNCTION, PULL BOXES AND CABINETS
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.1-06, Canadian Electrical Code, Part 1, Current Edition.

1.02 RELATED REQUIREMENTS

- .1 26 05 00 - Common Work Results for Electrical

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Submittal Procedures.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

2 PRODUCTS

2.01 SPLITTERS

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: main and branch lugs and on connection blocks to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum one spare terminal on each connection or lug block sized less than 400 A.

2.02 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Surface Mounted: screw-fastened turned edge covers.

2.03 CABINETS

- .1 Construction: welded sheet steel hinged doors, handle, latch lock, with 2 keys and catch. Removable side panels secured by internal fasteners are permitted.
- .2 Communication Type: fitted with 19" rails front and back with

SECTION 26031
SPLITTERS, JUNCTION, PULL BOXES AND CABINETS
PAGE 2

doors on both front and back. RU's in height to accommodate shelf mounted or ty-rapped to rail PBA and CBP splice closures, and leave 16RU spare for potential future active communication equipment.

2.04 SPLITTER INSTALLATION

- .1 Mount plumb, true and square to building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

2.05 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in accessible locations.
- .2 Mount communication cabinets secured to wall or floor.
- .3 Install additional pull boxes as required by CSA C22.1

2.06 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase, and if applicable emergency power supported or as indicated.

END OF SECTION

SECTION 260532
OUTLET BOXES, CONDUIT BOXES AND FITTINGS
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.1-06, Canadian Electrical Code, Part 1, Current Edition.

1.02 RELATED REQUIREMENTS

- .1 Salt Building outlet boxes and conduit boxes shall be as outlined in the hangers specification, to resist the high corrosion potential

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Submittal Procedures.

2 PRODUCTS

2.01 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.02 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi-gang flush device boxes for flush installation, size as required. 102 mm square outlet boxes when more than one conduit enters one side, with extension and plaster rings as required.

2.03 CONDUIT BOXES

- .1 Cast FS FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

SECTION 260532
OUTLET BOXES, CONDUIT BOXES AND FITTINGS
PAGE 2

2.04 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to [35]mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

3 EXECUTION

3.01 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Provide correct size of openings in boxes for conduit. Do not install reducing washers.
- .3 Identify systems for outlet boxes as required.

END OF SECTION

SECTION 26 05 34
CONDUITS, FASTENINGS AND FITTINGS
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).
 - .7 Salt building conduits shall be per clauses for hangers to resist high corrosion potential.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications, and datasheets.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

2 PRODUCTS

2.01 CABLES AND REELS

- .1 Provide flexible conduit on reels or coils.
 - .1 Mark or tag each cable and outside of each reel or coil, to indicate length, any relevant voltage rating, and manufacturer's lot number and reel number.
- .2 Each coil or reel of conduit to contain only one continuous cable without splices, unless fusion spliced or fitted with

SECTION 26 05 34
CONDUITS, FASTENINGS AND FITTINGS
PAGE 2

approved couplers.

2.02 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2
- .5 Flexible metal conduit: to CSA C22.2 No. 56, steel or liquid-tight flexible metal.
- .6 RE conduit to CSA code
- .7 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

2.03 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two-hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at spacing to suit conduit size per CEC.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.04 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits. PVC may be field bent with the use of conduit ovens and formers used in the bending.
- .3 Watertight connectors and couplings for EMT.
 - .1 Setscrews are not acceptable.

2.05 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings assembly suitable for linear expansion spaced to deal with PVC /steel differential expansion.
- .2 Watertight expansion fittings suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

SECTION 26 05 34
CONDUITS, FASTENINGS AND FITTINGS
PAGE 3

2.06 FISH CORD

- .1 Polypropylene.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.02 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Use electrical metallic tubing (EMT) and support it except above 2.4 m not subject to mechanical injury].
- .3 Use rigid PVC conduit in corrosive areas.
- .4 Use liquid tight flexible metal conduit in damp, wet or corrosive locations.
- .5 Minimum conduit size for lighting and power circuits: 19 mm
- .6 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .7 Mechanically bend steel conduit over 19 mm diameter.
- .8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .9 Install fish cord in empty conduits.
- .10 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .11 Dry conduits out before installing wire.

3.03 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.

SECTION 26 05 34
CONDUITS, FASTENINGS AND FITTINGS
PAGE 4

- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.04 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

SECTION 260800
Commissioning of Electrical
PAGE 1

1 GENERAL

1.01 SUMMARY

- .1 This Section specifies the Contractor's responsibilities related to commissioning of electrical systems and their contribution to the overall commissioning work specified in the relevant Technical Sections of Division 01 of the Contract Documents.
- .2 Construction Team: Contractor is responsible for performing tests and verification activities specified in the relevant Sections of Division 26 of the Contract Documents and submitting reports to PBA.
 - .1 Subcontractors: electrical subcontractors and third-party inspection/testing agencies as applicable participate in commissioning activities in coordination with site quality control requirements for Work they are providing.
 - .2 Manufacturers: manufacturers assist verification activities and report on installation, performance, and operation of the products/ systems they supplied, as specified in the relevant Sections of Division 26.
 - .3 Contractor coordinates the work of subcontractors, [inspection/testing agencies] [and manufacturers] with the commissioning requirements of this Section.
- .3 PBA will designate a person to represent the interests of the facility related to work specified in the relevant Sections of Division 26.
 - .1 The requirements of this Section do not replace testing requirements specified in the relevant Sections of Division 26 or reporting activities to demonstrate compliance with electrical code requirements to the authorities having jurisdiction.

1.02 REFERENCE STANDARDS

- .1 CSA Group (CSA):
 - .1 CSA Z320-11, Building Commissioning
 - .2 CSA Z5000-18, Building Commissioning for Energy Using Systems

1.03 DEFINITIONS

- .1 Construction Team: the term Construction Team is used in this Section to designate inclusively the Contractor, subcontractors, manufacturers/suppliers and other support disciplines that are responsible for construction/installation of the Work specified in these specifications.

1.04 RELATED REQUIREMENTS

- .1 Construction Team - Cx Representative: Contractor to designate a person from the Construction Team to review and coordinate commissioning activities specified in this Section.

SECTION 260800
Commissioning of Electrical

PAGE 2

- .1 Representative to be Site supervisor or project manager within the Construction Team, with direct responsibilities for supervising the execution of work specified in the relevant Sections of Division 26.

- .1 Coordination: coordinate the responsibilities of the Construction Team in the Commissioning process.
- .2 Coordinate the participation of electrical subcontractors, inspection/testing agencies and manufacturers in reviewing the Cx Plan, submittals and in assisting testing and demonstration activities related to their work.
- .3 Coordinate commissioning activities with execution of the work during the course of construction to allow Cx participants and the authority having jurisdiction (AHJ) to fulfill their responsibilities for witnessing tests and reviewing installation before concealment of work.
- .3 Notification: notify the PBA of activities associated with the commissioning process.
- .4 Sequencing: perform commissioning activities in general accordance with the commissioning process described in CSA Z320[and CSA Z5000], maintaining the systematic approach to completing and obtaining acceptance for each phase of commissioning in particular with regards to static verification, start-up and functional performance testing.
 - .1 Functional Performance Testing (FPT): perform operational and performance testing by phases starting with individual components and equipment, testing of sub-systems and then proceeding to FPT of overall systems.
 - .2 Integrated Systems: only perform commissioning of integrated systems once the FPT for each individual system forming part of the integrated system has been completed.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide required information in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Electrical Cx Schedule:
 - .1 Submit proposed schedule before start of commissioning conferences indicating key activities critical to the commissioning process including:
 - .1 Inspection of electrical systems.
 - .2 Commissioning phases: static verification, start-up, functional performance testing, systems orientation, O&M manuals submissions, training sessions.
 - .3 Integrated Testing activities.

SECTION 260800
Commissioning of Electrical

PAGE 3

- .4 Review activities to be completed by other participants:
Consultant.
- .2 Review the proposed schedule through the course of the work
and notify the Consultant of modifications required.
- .3 Commissioning Forms: Contractor to review and complete forms
for documenting static verification and start-up activities
in accordance with Section 01 91 13 - General Commissioning
Requirements.
 - .1 Approved Cx Forms: CxA reviews and approves the final format
to use through the commissioning process.
 - .1 Review the forms proposed by CxA and submit comments with
proposed adjustments.
 - .2 Contractor may submit its own preferred format for review
by the CxA. This may include manufacturer provided
checklists.
 - .2 Submit completed static verification and start-up checklists
within [48] hours of completion of verification of equipment
or system.
- .4 Testing Equipment: submit a list of proposed testing equipment
for performing electrical Cx activities and related tests
in accordance with [Section 01 91 13 - General Commissioning
Requirements].
- .5 Site Quality Control Submittals: submit manufacturers certificates
and reports demonstrating compliance of Work, as specified in the
relevant Sections of Division 26.
- .6 Training Program: submit proposed training program and materials
in accordance with Section 01 91 13 - General Commissioning
Requirements.

1.06 CLOSEOUT SUBMITTALS

- .1 Submit O&M data and as-built information in accordance with
Section [01 78 00 - Closeout Submittals].
 - .1 Site Modifications: record changes to installations, system
configuration and/or controls that were made during the
commissioning process to meet the required performance of
electrical equipment and systems.

2 PRODUCTS

2.01 EQUIPMENT

- .1 Furnish special tools or equipment required for:
 - .1 Verifying or adjusting equipment/system components.

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Commissioning of Electrical

PAGE 4

- .2 Accessing equipment, enclosures or control cabinets.
- .3 Interfacing with equipment controls or integrated system diagnostics.
- .2 Furnish instruments and equipment required to perform testing and validate performance of electrical systems through the commissioning process or as specified in the relevant Sections of Division 26.

3 EXECUTION

3.01 STATIC VERIFICATION

- .1 Perform static verification of components, equipment and systems in accordance with Section 01 91 13 - General Commissioning Requirements and complete the approved Cx Forms in coordination with performing the following activities:
 - .1 Verify installation and connection of equipment, sub-systems and systems.
 - .2 Confirm accessibility to electrical equipment and components for inspection and O&M activities.
 - .3 Record equipment and systems information including: manufacturer, model number, serial number and rated capacities.
 - .4 Confirm proper location of lighting control devices as per design and to achieve intended functionality.
 - .5 Confirm completion of labelling and identification of electrical equipment.
 - .6 Confirm identification of circuits in each distribution panel including: circuit labels and a clear panel legend showing the load and a short description of each circuit.
 - .7 Confirm completion and documentation of equipment prestart-up tests, including manufacturer's factory tests.
 - .8 Confirm adequate protection of electrical systems during construction.
 - .9 Confirm electrical systems and service entrance are protected from major precipitation events and minor flooding.
 - .10 Confirm electrical cabinets and enclosures are equipped with protective covers.
- .2 Site Quality Control: CxA to conduct random verification on-site to validate the accuracy of static verification reporting. Contractor to assist the CxA on site to review selected samples representing up to 30 % of the overall installation.

3.02 START-UP

- .1 Refer to Section [01 91 13 - General Commissioning Requirements]

SECTION 260800
Commissioning of Electrical

PAGE 5

for commissioning requirements.

- .2 Perform start-up of equipment and systems in accordance with [Section 01 91 13.13 - Commissioning Plan] [Section 01 91 13 - General Commissioning Requirements] and complete the approved Cx Forms in coordination with performing the following activities:
 - .1 Initial site energization.
 - .2 Contractor/manufacturer start-up of equipment.
 - .3 Start-up of electrical systems including site electrical tests, and verification and adjustment of overload trips and other protection devices, based on the site's electrical coordination study.
 - .4 Electrical start-up of mechanical equipment including measuring voltage and amperage and verifying and adjusting overload trips and other protection devices.
 - .5 Site electrical tests including:
 - .1 Measurement of voltage and voltage drop at major equipment.
 - .2 Megger testing to confirm proper insulation resistance of electrical circuits, feeders and equipment.
 - .3 Harmonic measurements.
 - .4 Power factor measurements.
 - .5 Conducting thermographic surveys on electrical switchgear, circuit panels, and transformers while the system is under load.
 - .6 Start-up and testing of on-site power generation systems such as generator sets and renewable energy generation systems.
 - .7 Site Quality Control: PBA and the AHJ will witness start-up activities for selected equipment. Per General Commissioning Requirements.

3.03 FUNCTIONAL PERFORMANCE TESTING

- .1 Perform Functional Performance Testing (FPT) on electrical equipment and systems in accordance with 01 91 13 - General Commissioning Requirements and as directed by the Consultant.
- .2 Operate equipment as directed by Consultant to demonstrate and validate that equipment, sub-systems and systems function and perform in accordance with design requirements.
- .3 FPT activities include:
 - .1 Verify proper operation of electrical systems and equipment in the following modes of operation:
 - .1 Systems operation on normal power.
 - .2 Systems operation on emergency power.

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Commissioning of Electrical

PAGE 6

- .3 Normal operation - no alarm conditions.
- .4 Systems operation in alarm condition.
- .5 Manual operation mode.
- .6 Automatic operation mode.
- .2 Verify operation of generator and emergency power systems including:
 - .1 Performance and switching operation of generator equipment, automatic transfer switches and uninterruptible power systems.
- .2 Verify full integration of on-site power generation systems in all modes of operation.
- .3 Verify system response to the following emergency conditions:
 - .1 Full loss of grid power.
 - .2 Loss of fuel to back-up power generation systems.

3.04 SITE QUALITY CONTROL

- .1 Manufacturer's Site Services: obtain certificates and reports from manufacturer verifying compliance of Work and submit Manufacturer's Site Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Provide manufacturer's site services to complete start-up activities and assist in Functional Performance Testing as specified in the relevant Sections of Division 26.

3.05 CLOSEOUT ACTIVITIES

- .1 Corrections: Provide equipment, materials and labor as required to correct installation and/or equipment deficiencies identified through the commissioning process.

END OF SECTION

SECTION 260943
Network Lighting Controls
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CSA Group (CSA):
 - .1 CSA C22.1:18, Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, product literature and data sheets for network lighting control and include product characteristics.
- .3 Shop Drawings:
 - .1 Submit drawings.
 - .2 Indicate on drawings:
 - .1 Complete assembly.

1.03 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for network lighting controls for incorporation into manual.

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section Section 01 61 00 - Common Product Requirements.
- .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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect network lighting controls from nicks, scratches, and blemishes.

2 PRODUCTS

2.01 COMPONENTS

- .1 The Owner (PBA) will supply an Allen-Bradly SCADA module for

SECTION 260943
Network Lighting Controls
PAGE 1

installation by contractor.

- .2 Designed for controlling a lighting contactor.

2.02 ENCLOSURES

- .1 Design enclosures for wall mounting.

3 EXECUTION

3.01 INSTALLATION

- .1 Install system and components in accordance with manufacturer's instructions.
- .2 Install cables to circuit outlet boxes and connect to power circuit and network connectivity (if required).
- .3 Install enclosure and connect network interface box to power-in plug.
- .4 Connect cables to lighting control contactor.
- .5 Install lighting contactor with load cables and coil supply and power supply cables from the panel board.
- .6 Install any manual control switch kit.
- .7 Connect to central and verify central control.

3.02 SITE QUALITY CONTROL

- .1 On completion of installation, manufacturer representative shall be notified to carry out site inspection and report any inconsistencies to the PBA directed configuration. Corrections are to be implemented to comply with manufacturer's report.

3.03 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by network lighting controls installation.

END OF SECTION

SECTION 261216
DRY TYPE, MEDIUM VOLTAGE TRANSFORMERS
PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.1-[09], Canadian Electrical Code, Part 1 (21st Edition), Safety Standard for Electrical Installations.
 - .2 CSA C9-[02(R2007)], Dry-Type Transformers.
 - .3 CAN/CSA-C802.2-[06], Minimum Efficiency Values for Dry Type Transformers.
- .3 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC GL1-3- [1988], Transformer and Reactor Bushings.

1.02 RELATED REQUIREMENTS

- .1 26 05 00 - Common Work Results for Electrical

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Submittal Procedures.
- .2 PBA has pre ordered transformers. Depending on award timing, material will be FOB on site.

1.04 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers if shipped with th PBA ordered item for incorporation into manual.
- .3 Operation and maintenance instructions to include:
 - .1 Tap changing.

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: materials in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect transformers from nicks, scratches, and blemishes. Document any on acceptance from PBA.

SECTION 261216
DRY TYPE, MEDIUM VOLTAGE TRANSFORMERS
PAGE 2

.3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 MATERIALS

.1 Dry-type transformers: to CSA C9

2.02 TRANSFORMER CHARACTERISTICS - per PBA purchase

2.03 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Equipment labels: nameplate size 7, labelled ID number to match single line naming.

2.04 INSTALLATION

- .1 Locate, install and ground transformer[s] in accordance with manufacturer's instructions.
- .2 Set and secure transformers in place, rigid plumb and square.
- .3 Connect primary terminals to supply circuit.
- .4 Connect secondary terminals to secondary circuit.
- .5 Use flexible conduit to make connections to transformer.
- .6 Energize transformers and check secondary no-load voltage.
- .7 Adjust primary taps as necessary to produce rated secondary voltage at no-load.
- .8 Use torque wrench to adjust internal connections in accordance with manufacturers' recommended values.
- .9 Check transformer for dryness before putting it into service and if it has not been energized for some considerable time.

2.05 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.06 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by transformers installation.

END OF SECTION

SECTION 262414

GENERATOR

PAGE 1

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.1-09, Canadian Electrical Code, Part 1 (21st Edition), Safety Standard for Electrical Installations.
- .2 Electrical Equipment Manufacturers Association of Canada (EEMAC)

1.02 RELATED REQUIREMENTS

- .1 26 05 00 - Common Work Results for Electrical

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 - Submittal Procedures].
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for generator and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
 - .2 Indicate on drawings:
 - .1 Outline dimensions.
 - .2 Configuration of identified compartments.
 - .3 Floor anchoring method and dimensioned foundation template.
 - .4 Cable entry and exit locations.
 - .5 Schematic and wiring diagrams.
- .4 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.04 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for generator for incorporation into manual.

SECTION 262414

GENERATOR

PAGE 2

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect generator from [nicks, scratches, and blemishes].
 - .3 Replace defective or damaged materials with new.
 - .4 Packaging Waste Management: remove for reuse pallets, crates, packaging materials as specified in accordance with Section 01 74 19.- Waste Management and Disposal]

1.06 SUPPLY CHARACTERISTICS

- .1 347/600 V, 60 Hz, wye connected, 3 phase, 4 wire, grounded neutral.

1.07 WIRING IDENTIFICATION

- .1 Provide wiring identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

2 PRODUCTS

2.1 GENERATOR

- .1 Kohler KG125, 347/600V, 60 Hz, 3 Phase Natural Gas generator set equipped with a 4R12X alternator operating at 347/600 volts and is rated for Standby 125kW/156kVA. Output amperage: 151A. Complete with APM402 - DECISION-MAKER® APM402 CONTROLLER mounted on generator set.

2.2 HOUSING

- .1 Generator to be complete with Out-door enclosure providing 71.1db(A) at 7m. complete with internally mounted critical silencer, motorized intake louvers.

SECTION 262414

GENERATOR

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- .2 Housing to be complete with load-center/distribution panel servicing all heaters, lights, receptacles, and battery charger Housing to include automatic transfer switch.
- .3 All wiring to be tech cable and components are pre-wired to panel.

2.3 AUTOMATIC TRANSFER SWITCH

- .1 The automatic transfer switch shall consist of a power transfer module and a control module, interconnected to provide complete automatic operation. The automatic transfer switch shall be mechanically held and electrically operated by a single-solenoid mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double throw. The switch shall be mechanically interlocked to ensure only one of two possible positions - normal or emergency. The automatic transfer switch shall be suitable for use with emergency sources, such as an engine or turbine generator source or another utility source.
1. Transfer switch complete with bypass isolation to manually permit electrical bypass and isolation of the ATS. Bypass of the load to either the normal or emergency power source with complete isolation of the ATS must be possible regardless of ATS states.

3. EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for motor control centres installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of [Departmental Representative] [DCC Representative] [Consultant].
 - .2 Inform [Departmental Representative] [DCC Representative] [Consultant] of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [Departmental Representative] [DCC Representative] [Consultant]].

3.02 INSTALLATION

SECTION 262414

GENERATOR

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- .1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.
- .2 Make field power and control connections as indicated.
- .3 Ensure correct overload heater elements are installed.

3.03 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section [26 05 00 - Common Work Results for Electrical.
- .2 The Consultant shall observe both factory testing and onsite testing.

3.04 CLEANING

- .1 Progress Cleaning: clean in accordance with Section [01 74 00 - 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 00 - Cleaning].
- .3 Waste Management: separate waste materials for [reuse] [and] [recycling] in accordance with Section [01 74 19 - Waste Management and Disposal] [01 35 21 - LEED Requirements].
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

REMOVAL OF ELECTRICAL EQUIPMENT - Item No.

Special Provision No. 610F01M

Jan 2024

Amendment to OPSS 610, November 2016

610.07.06 Removals

This section shall be extended to include the removal of all existing surface mounted conduit systems that are part of the wiring removals. Abandon anchors, where they extend above the concrete surface shall be ground flush, and silicone sealer applied if the remaining part of the anchor is steel.

610.07.09.03 Shipping of Salvaged Electrical Equipment and Materials

Clause 610.07.09.03 of OPSS 610 is amended by the addition of the following:

Transformers designated for removal shall be removed, salvaged and transported to the site(s) specified in Table 1. All wiring and conduit systems shall be disconnected and the transformer salvaged complete with all fittings and hardware.

**TABLE 1
Salvaged Equipment and Unloading Site(s)**

Equipment	Site
Traffic Heads, relays	On site storage per PBA electrician lead hand

SURFACE MOUNTED DUCT SYSTEMS - Item No.

Special Provision No. 682S08M

Jan 2024

Amendment to OPSS 603, November 2017

603.01 SCOPE

Section 603.01 of OPSS 603 is amended by the additional text:

603.01.01 This specification covers the requirements for the installation of surface mounted ducts at the Duty Free sign gantry to facilitate the installation of 2 VMS signs to replace the existing static signs and flasher system.

603.01.02 This specification covers the requirements for the installation of surface mounted ducts at the Central Avenue overpass to facilitate the installation of 3 VMS signs to replace the existing static signs and flasher system.

603.01.03 This specification covers the requirements for the installation of surface mounted ducts at the Approach Canopy to facilitate the installation of 3 VMS signs.

603.01.04 This specification covers the requirements for the installation of surface mounted ducts inside the West Abutment from the entry wall to the new electrical room.

603.01.05 This specification covers the requirements to protect existing cables in existing surface mounted cable tray system in the existing electrical vault in the vicinity of the new Xray booths.

603.01.06 This specification covers the requirement for the ducting suspended from new and existing support structures under the deck of the bridge from the West Abutment, out to Pier 7, the main reaction block, and the Return to Canada License Plate Reader site there.

603.02 REFERENCES

Section 603.02 of OPSS 603 is amended by the addition of the following to **CSA Standards**:

C22.2 No. 211.3-96 (R2007)	Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
C22.2 No 2 136& 174	TECK90 cable
C22.2 No 2 56	Hydrotite Conduit
C22.2 No 126.1-98	Cable Tray

603.03 DEFINITIONS

603.03 shall be extended by the addition for:

Communication Junction Boxes means surface mounted boxes for use with communication wiring.

Cable Tray means steel troughs designed for the support of cables and conduits rated for support by these means. It provides spanning support in open spaces between roof joists, etc.

603.05 MATERIALS

603.05.08 Ducts and Fittings

The last two paragraphs of Subsection 603.05.08 of OPSS 603 are deleted in their entirety and replaced by the following:

For surface mounted ducts where runs of multiple ducts exceed 5.0 m in length in continuous runs, rigid ducts and fittings shall be of regular wall thickness, rigid PVC conduit.

Hanger support systems shall consist of zinc plated steel bar with tubular supports and spacers with galvanized steel hardware as specified in the Contract Documents. The support systems shall allow for appropriate sizes of duct in each horizontal layer.

For surface mounted ducts for local runs equal to or less than 5.0 m in total length, vertical runs and minor connecting ducts, ducts shall be rigid PVC conduit, non-metallic liquid tight flexible conduit and connectors, RE duct or Flexible watertight conduit or TECK cable as specified in the Contract Documents.

603.05.10 Concrete Anchors

Subsection 603.05.10 of OPSS 603 is deleted in its entirety and replaced by the following:

603.05.10 Adhesive Anchors

Adhesive anchors shall consist of two-part chemical systems using epoxy, urethane or other suitable resins having a minimum bolt pull-out strength of 55 kN when used with 125 mm deep holes for side mounting (L-bracket) and 170 mm deep holes for suspended installations and hole diameters as recommended by the manufacturer.

603.05. MATERIALS

Subsection 603.05 of OPSS 603 is extended by the following:

603.05.11 Junction Boxes

Junction boxes where of dimensions made by PVC duct manufacturer are permitted. Where contract documents call for larger boxes on large duct and cable arrangements the junction box/pull box shall be made from stainless steel material per contract details. Material shall be as specified in power supply cabinets.

603.07 CONSTRUCTION

603.07.10 Surface Mounted Duct Systems

Subsection 603.07.10 of OPSS 603 is amended by the addition of the following:

‘O’ ring expansion joints shall be installed in the ducts at each structural expansion joint and at other locations as specified in the Contract Documents. The insertion of ducts into the expansion joints shall be carried out with particular attention given to obtaining the proper insertion depth according to the manufacturer’s instructions.

At the midspan hanger support locations, the threaded rods shall be stabilized against movement by the installation of a stainless-steel brace installed according to the manufacturer’s instructions.

Final tightening of all nuts shall be done with the application of thread sealant.

Subsection 603.07 of OPSS 603 is extended with the following:

603.07.11 Protection of Existing Surface Mounted Ducts System.

The existing surface mounted cable tray system in need of protection is in an existing below grade electrical vault in the vicinity of the new Xray booths. This vault area is in the remains of the basement and crawl space of an old PBA building built in the late 1940's and believed to be demolished above grade by the 1980's. The entry to this vault is via a man hatch and ladder that descends to a decommissioned electrical room that used to feed a 1950's era Canada bound arc of customs and or toll booths. This area is about 3m deep. To the southeast of the main entry there is an old open frame 4800V to 208V electrical vault, screened off by fencing, that prior to and at the start of this project, was still in service to power the utility lights in the vault, and a sump pump. It is presently supplied by a 5kV isolation switch. The top terminals of this switch also function as a junction for 5kV cabling that extends on to the west abutments. So even when the local transformers can be taken out of service the switch needs to remain until the 5kV system is deenergized.

Behind the electrical vault the floor rises and the void space is only about 1.2m tall. It is though this space that fibre optic cables exist through the length of this void. There is also a jacketed armoured 5kV three phase power cable circa 1990 that runs the length of the space. The fibre lives on a solid bottom tray, and the power on a ventilated tray. The cable trays are supported on threaded rods or brackets that descend from the ceiling elevation. They either have concrete anchors, or clamps attached onto the steel beams that hold up the ceiling.

This 1.2m tall space extends to the southwest from the transformer well. It is about 6m wide and 20m long. There is some existing utility lighting in the area, although many of the incandescent bulbs are burned out. At its end duct enters from the direction of existing manhole 543, carrying the existing fibre optic cables that need protection.

This 1m tall space also extends to the northeast from the transformer well. It is about 6m wide and 15m long. It also has some existing lighting. At its end it transitions to a small man sized 1940's era tunnel which is about 1.5m wide and 1.8m tall. Power and fibre optic communication cables come off of their cable trays, and shall be put into split flexible duct to protect them.

This man tunnel continues to the deepest corner of the west abutment. It carries 4 100mm PVC communication ducts that were installed about 2005, on a rack arrangement low on the wall. One or more of these carries the fibre. The tunnel also carries the 5kV power cable that presently head to power the west abutment, and defunct copper multipair telephone lines that used to link to a PBA PABX site land line analog phone system. Both of these are attached to an existing rack system attached to the wall.

The existing vault interferes with the construction of new Xray shield wall footings at two locations.

The first location is in the 3m deep abandon electrical room vault. Part of it is located under where the new footings are. This will be the first stage to be concrete filled to create a level to build the new footings on. In this stage the manway ladder and existing transformer vault remain in service.

The second location is near the transition to the man tunnel. Some of the exiting ceiling and the associated steel support beams of the 1m tall void will need to be removed to let the footings be constructed. This will require interim arrangements to temporarily cover the fibre tray and move the fibre tray and power tray out of the way of the work to place the footing. The existing tray may be supported by banding it onto Unistrut chairs anchored to the floor to accomplish this support.

Following establishment of the xray shield wall footings the walls can start to be constructed. Once they are to a level above grade, they do not interfere with additional vault filling. Ultimately, the entire vault will be

filled with concrete to reduce the liability of the ceiling failing, as it has already done this once due to truck traffic loading. Obviously before the filling can be completed, we need to protect existing plant in place.

At or prior to this stage the existing fibre cables in the cable tray are to be gathered and placed in a common 100mm PVC split duct. This duct shall be joined using continuous H strips, and all end connections shall be well glued. Ty-raps shall be applied at 1m intervals to hold the H strips in place. Then the duct shall be banded or otherwise anchored at 1.5 intervals to the cable tray.

The power cable shall be tyrap banded to its cable tray ay 1m intervals.

Both cable trays shall be braced using Unistrut segment to hold them down, to resist movement when the concrete fill is poured around them.

At the end where the power cable meets ducts at the end of the tunnel, foam and tape shall be used to keep concrete from flowing into the power ducts system.

At the fibre duct connections, the split ducts shall be abutted and well anchored and taped and or foamed to endeavour to keep concrete out of the conduit junction.

At the man tunnel end, a bulkhead shall be fitted and well braced to hold back the concrete fill by other disciplines. The split duct shall be passed through the bulkhead, as well as the power cable.

Once all new duct connections are made, and the new power connections are made and the new and existing WA power panels are fed from the new 600V feed, then the 5kV cable system can be shut off.

The fibre connections may remain in service. New communication ducts from existing manhole 543 have been placed to link to the new outbuilding and on to the IT cross connect in the west abutment. This will allow the fibre connections to move over time to the new ducts and the cables traversing the man tunnel can be taken out of service. Once this is done there will no longer be any active service in the man tunnel.

Subsection 603.07 of OPSS 603 is extended with the following:

603.07.12 RE Duct Measures on Bridge

A License Plate Reader system is being placed under the bridge near the entry gate to Canada Bound the Commercial PIL liner. So duct linkages include a surface mounted ducts system to tie communications and power measure back to other infrastructure located to the West Abutment space. Most of this area is in the vicinity of a large at grade reaction block called Pier 7 back to the abutment. The surface mounted system begins as two flexible ducts that meet buried PVC ducts which run into nearby handwells located flush to grade.

The flexible Hydrotite ducts traverse vertically past the large structural pivot pin. The flexible ducts shall be secured to other ducting with stainless steel worm gear strap clamps. If they made from which is not long term UV stable, they shall be painted with compatible paint to substantially protect them from UV embrittlement.

Above this pivot pin is a nearby vertical I beam. This column rises up to an area where there is an existing electrical gear access walkway we want to join. The 2 RE ducts are to be supported rising this column with a combination of fixed and sliding anchor clamps tied to Unistrut members sections. This Unistrut member shall be oriented horizontally and shall be affixed to the existing painted column without any welding or cutting being required. Near the top and bottom of the vertical run the clamps shall fix to the ducts and mid height an expansion joint shall be placed on each duct to address expansion needs.

Past the column top fixed clamping point a 90-degree bend shall be placed to bring the ducts to the horizontal, oriented towards the west abutment. Some existing supports may exist in this walkway area, that with the Owners agreement, may be shared to support the new ducts. The tender however, until that agreement, shall budget on all new ducts supports for the 2 new RE ducts around the existing walkway. Then the ducts go through two horizontal bends to bring them into alignment with the main existing duct run and its existing supports.

The main existing duct run is what the new RE ducts will be added to in order to reach the West Abutment space. This duct run has existing supports locations at bridge floor beams, and also at existing Unistrut supports set mid span between the floor beams. New slider clamps for the new ducts will need to be added.

To address the movements of the bridge, as well as the differential expansion of the bridge and the RE ducts, a combination of fixed and expansion joints are needed. RE duct sections above grade shall be epoxy adhesive joined.

To address cable pulling needs pull boxes are specified.

To combat the slope of the bridge, cable pull boxes need to be fitted with anchor points. These anchor points shall be utilized to hold Kellems cable grips attached to the cables. In this manner the cables will not be stretched adversely as the bridge cycles through the year, and as vibration causes wires to want to shake downhill due to passing traffic. These anchors can be basket type temporarily placed tyrapped open. Alternately lace up grips are made to install after cables are placed. Cable slack shall be managed to suit all expansion joint movements and excess cable left slack upstream of anchored grips to deal with cable movements.

Any pin points from clamps for new ducts shall be immediately brought to the attention of the Owner if paint is penetrated.

Table 1 Ducts and Fittings

The table is to be extended for the following situations:

TECK90 and Hydrotite are both flexible ducts/wiring. They are suited for use in Surface Mounted duct systems anchored to sign structures, or supported on cable tray.

POWER SUPPLY CABINETS - Item No.

Special Provision No. 682S12

March 2018

REQUIREMENTS FOR POWER SUPPLY CABINETS

1. SCOPE

This Special Provision covers the requirements for the installation of power supply cabinets.

2. REFERENCES

This Special Provision refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 603	Installation of Ducts
OPSS 604	Installation of Cable
OPSS 609	Grounding

CSA Standards

C22.2 No. 5-02	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
C22.2 No. 29-M1989	Panel boards and Enclosed Panel boards
C22.2 No. 47-M90	Air Cooled Transformers (Dry Type)
C22.2 No. 94-M91	Special Purpose Enclosures; Industrial Products
C22.2 No. 211.2-06	Rigid PVC (Unplasticized) Conduit

American Society for Testing and Materials (ASTM)

A 480/A 480M-06b	Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and strip
A 666-03	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

National Electrical Manufacturers Association (NEMA):

NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum) - NEMA 4X Type
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Others:

Ontario Electrical Safety Code

3. DEFINITIONS - Not Used

4. DESIGN AND SUBMISSION REQUIREMENTS

4.1 Submission Requirements

Shop drawings and specification sheets for the power supply cabinet internal components shall be submitted to the Contract Administrator prior to ordering. Manufacturer part numbers and description of all equipment being supplied shall be included.

5. MATERIALS

5.1 Power Supply Cabinet

The power supply cabinet shall be NEMA 4X, 14-gauge stainless steel type 304 - 2B , according to applicable ASTM standards. 1220mm Height x 915mm Width x 405mm Depth, service type with hasp to accommodate a padlock.

The pedestal shall be formed 12 gauge, stainless steel type 304 - 2B to suit the power supply cabinet.

Power supply cabinet shall include the following:

- a) Moisture absorbing desiccant
- b) Vapour corrosion inhibitor.
- c) Lightning arrestor rated for the size of the service.

The splitter enclosure shall be according to C22.2 No 94.

Transformers shall be EP dry type, 600 - 240/120V manufactured according to CSA C22.2 No. 47 and CSA C22.2 No 94.

5.1.1 Breakers

Primary breakers shall be integral fused breaker, Tri-Pac or equivalent, combination interrupting rating of 200KA, 600V. The wire size from the splitter to the primary breaker shall be according to ESA standards.

Ampere rating of the breakers shall be as follows:

- a) for 5 kVA, 15A;
- b) for 10 kVA, 20A;
- c) for 15 KVA, 30A;
- d) for 25KVA, 50A.

Secondary breakers 120/240 V, shall be molded case circuit breakers complying with the standards as shown above, enclosed, with AC interrupting rating rms symmetric amperes not less than 10KA, ampere rating from 15A to 100A.

5.1.2 Panel Boards

Distribution panel board shall be according to CSA C22.2 No. 29 and CSA C22.2 No. 94.

Loadcenters designed for residential or light commercial usage are not acceptable. The main lug shall be 225A for 25KVA transformers and 100A for 15KVA or 10KVA transformers. SCCR or AC interrupting capacity rms symmetrical amperes shall be 10-22KA fully rated. It shall allow not less than 12 branch circuits.

The branch breakers shall be molded case circuit breakers in accordance with CSA C22.2 No. 5, with AC interrupting rating rms symmetric amperes not less than 10KA, ampere rating from 15A to 100A, physically fit inside the panel board.

5.2 Cables and Cable Connectors

Low voltage cables and ground wire between the power supply cabinet and the controller cabinet shall be minimum #6 AWG, RWU90 and shall be according to OPSS 604, OPSS 609 and the Ontario Electrical Safety Code.

Cables and cable connectors shall be according to OPSS 604.

5.3 Grounding Materials

Grounding materials shall be according to OPSS 609.

5.4 Conduit and Fittings

Rigid PVC conduit and fittings for the installation of pole-mounted equipment shall be according to CSA C 22.2 No. 211.2.

Non-metallic liquid-tight flexible conduits and connectors shall be according to OPSS 603.

6. EQUIPMENT - Not Used

7. CONSTRUCTION

7.1 Assembly of Power Supply Cabinets

All components within the cabinets shall be assembled using applicable code clearance rules.

7.2 Padlocks

Padlocks supplied by the Owner shall be installed on the power supply cabinet.

7.3 Cables and Fuses

Cables, terminations and connections shall be installed according to OPSS 604. Service cables, from the point of service connection to the main disconnection device shall be according to the Ontario Electrical Safety Code.

Wiring within the cabinets shall be installed in liquid tight flexible conduits.

7.4 Grounding

All pad mounted equipment shall be grounded by means of ground wire jumpers connected between the equipment ground bus and the exterior ground grid. Lightning arrestors shall have the ground cable connected securely to the equipment ground bus. The neutral bus of the main disconnection device or the secondary neutral terminal of the transformer shall be bounded to the equipment ground bus.

The system ground wire shall be connected to the equipment ground bus.

All grounding work shall be carried out according to OPSS 609.

7.5 Pre-installation Testing and Inspection

The power supply equipment shall meet the requirements of the Contract Documents.

The following components shall meet the requirements of the Contract Documents:

General Appearance	Grounding Connections	Panel boards
Insulation	Grounding and Bonding Materials	Contactors
Transformers	Enclosures Materials	Thermostats
Wires and Connectors	Cabinet Materials	Exhaust Fans
Labelling	Doors and Latching Mechanisms	Barriers/Raceways
Switches	Conduits and Tubing	Circuit Breakers

Any other components

A Request to Proceed shall be submitted to the Contract Administrator after completion of the pre-installation testing and inspection.

The next operation after the completion of the pre-installation testing and inspection shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

7.6 Proof of Performance Testing and Inspection

All components, listed under Pre-installation Testing and Inspection shall meet the requirements of Contract Documents.

In addition, the Contractor shall perform the following:

- a) Low voltage system tests on wiring of the equipment according to OPSS 604
- b) All tests on grounding of equipment according to OPSS 609.

A Request to Proceed shall be submitted to the Contract Administrator after completion of the proof of performance testing and inspection.

The next operation after the completion of the proof of performance testing and inspection shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

8. QUALITY ASSURANCE - Not Used

9. MEASUREMENT FOR PAYMENT

For measurement purposes a count shall be made of power supply cabinets installed.

Measurement shall be by Plan Quantity.

10. BASIS OF PAYMENT

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment and Materials required to do the work.

WARRANT: All ATMS Contracts with this tender item.

CONCRETE PADS - Item No.

Special Provision No. 682S14M

Jan 2024

Amendment to OPSS 616, April 2018

616.05 MATERIALS

Section 616.05 of OPSS 616 is amended by the addition of the following subsections:

616.05.11 Pea Gravel

Pea gravel shall be clean, washed, smooth stone to the following gradation:

Passing 13.2 mm sieve - 100%

Passing 2.35 mm Sieve - 0%

616.05.12 Concrete Backfill

Concrete backfill shall have a compressive strength of 3.5 MPa.

616.07 CONSTRUCTION

Section 616.07 of OPSS 616 is amended by the addition of the following subsections:

616.07.10 Construction on Slopes

Where concrete pads are installed on slopes, concrete footings shall be installed at the front and sides of the pads as specified in the Contract Drawings.

616.07.11 Miscellaneous Features

Clean pea gravel, 300 µm plastic sheeting and concrete backfill shall be installed as specified in the Contract Drawings.

616.07.12 Rigid Ducts

The installation of internal rigid PVC ducts associated with concrete pads shall be according to OPSS 603. All ducts shall be permanently marked in accordance with the identification terminology used in the construction detail drawing. The marking shall be performed using indelible ink directly on the ducts or in a manner approved by the Contract Administrator. The marking shall be visible from the front or rear doors of the cabinets to be mounted on the pads.

MTOD 2920.0200, 2920.0210, and 2920.0220 apply for duct entry into the cabinet pads. Copies shall be obtained from the Contract Administrator if the Contractor is not familiar with them. Ducts entries shown on the wiring diagrams are minimums, and these MTOD tables dictate spare conduit needs, as well as where conduits are to enter the base of the cabinet. Where reference to type 401 cabinet is made, the actual dimensions for the controller cabinets supplied in this cabinet shall be utilized.

BASE MOUNTED COMMUNICATION PEDESTALS - Item No.

Special Provision No. 682S15M

Jan 2024

1. SCOPE

This Special Provision covers the requirements for the installation of base mounted communications pedestal on a concrete footing as shown in Contract Drawings.

2. REFERENCES – Not Used

3. DEFINITIONS – Not Used

4. DESIGN AND SUBMISSION REQUIREMENTS

4.1 Submission Requirements

The Contractor shall supply the specification sheets for the Base Mounted Communication Pedestals to the Contract Administrator prior to ordering and manufacturing.

5. MATERIALS

Communications pedestals shall be constructed of 12 gauge galvanized steel with vinyl prime coat and alkyd enamel baked-on finish; colour shall be grey. Pedestals shall be supplied with dual doors on each side complete with a recessed 1/8 turn catch and stainless steel padlock hasps and hardware. Pedestal size shall be a minimum of 767 mm width x 366 mm depth x 958 mm height.

Ventilating louvers backed with aluminium insect screening shall be provided in the front and rear doors. The interior of the pedestal shall be provided with two cross-slotted equipment mounting plates.

Pedestals shall be supplied with all mounting hardware and components required for secure installation on a concrete footing.

6. EQUIPMENT – Not Used

7. CONSTRUCTION

Threaded inserts shall be installed on the pedestal footing to enable installation of the pedestal, as recommended by the manufacturer. The position shall match the pedestal mounting requirements.

Pedestals shall be installed plumb and level on a concrete footing as shown in the Contract Drawings.

Pedestals shall be identified with a laminated phenolic plastic nameplate similar to that required for cabinets as detailed elsewhere in the Contract. The Contractor shall confirm the nameplate information with the Contract Administrator prior to manufacturing the nameplates. Identification plates shall be mounted with stainless steel screws at 100 mm from the top of the pedestal, facing the roadway.

The Contractor shall install Owner supplied padlocks.

8. QUALITY ASSURANCE – Not Used

9. MEASUREMENT FOR PAYMENT

Measurement of the number of base mounted communication pedestals installed is by Plan Quantity as may be revised by Adjusted Plan Quantity.

The unit of measurement is each.

10. BASIS OF PAYMENT

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment and Materials required to do the work.

CONTROLLER CABINETS - Item No.

Special Provision No. 682S16M

Jan 2024

Amendment to OPSS 622, April 2017

622.05 MATERIALS

Section 622.05 is revised to delete the need for any input files, and output files for this contract. These cabinets will house fibre patch panels, RJ-45 patch panels, RJ-45 surge arrestors, Ethernet Switches, and optionally POE power injectors in the future if cameras are deployed. Additional equipment shelves shall be furnished to support the switch, and to allow a laptop to temporarily be sited out of the sun to be able to read the screen, when diagnosing sign mis-operations.

Section 622.05 of OPSS 622 is amended by the addition of the following subsections:

622.05.09 Components

Cabinets shall meet the requirements of the current version of the Ontario Traffic Signal Control Equipment Specifications (OTSCES) except as noted below. Cabinets may be type 332 or 334, and if they do not contain a digital thermostat such as type 401 contains then the below requirements for one do not apply.

The Specifications section of Chapter 13 of the OTSCES for the digital thermostat panels is amended as follows:

Function	Description	Preset Value
Ht	Heater turn on temperature	+10.0
Ht.HS	Heater Hysteresis value	+5.5
Fn	Fan turn on temperature	+25.0
Fn.HS	Fan hysteresis value	+5.5
HI.Ct	High cut-off temperature of critical equipment	+55.0
HI.HS	High cut-off hysteresis	+2.0
LO.Ct	Low cut-off temperature of critical equipment	-10.0
LO.HS	Low cut-off hysteresis	+2.0
HI.FL	High cut-off count; the number of times the temperature has exceeded HI.Ct to a maximum of 999	0
LO.FL	Low cut-off count; the number of times the temperature has exceeded LO.Ct to a maximum of 999	0
HI.t	Highest temperature since last reset	+99.99
LO.t	Lowest temperature since last reset	-99.99

622.05.10 Service Light

Lamps shall be 50W energy efficient rated for rough service.

The lamp shall be installed after the cabinet is mounted in the field.

622.05.11 External Cable Access Enclosure

The external cable access enclosure shall be made of 3.175 mm thick aluminum with a polyester powder coat matching the cabinet colour. The enclosure dimension shall not exceed 305 mm W x 200 mm H x 100 mm D.

The enclosure shall have three 19 mm holes to provide access for cables of 10 mm in diameter and be able to accommodate one cable with a 12.5 mm connector. Space around the access holes shall allow for the installation of liquid-tight connectors. The enclosure shall be shipped from the factory with all access holes securely plugged with rubber type fittings designed for cable entry.

The door to the enclosure shall have a stainless steel hinge on one side and be configured with an internal catch that provides access from inside the cabinet only. An external locking mechanism for the enclosure shall not be provided.

The enclosure door shall not interfere with liquid tight connectors when closed. The enclosure shall be sealed to provide a NEMA 4 rating.

622.05.12 Antenna Mount

The cabinet shall be supplied with an external antenna mount bracket suitable for mounting antennas with up to 16 mm diameter threaded bolt. The mounting bracket shall be “L” shaped with two holes and a cable slot on the top portion for the antenna and two holes on the side to secure the bracket to the cabinet. The bracket is to be stainless steel or aluminum with polyester powder coat matching the cabinet colour.

622.07 CONSTRUCTION

622.07.03 Timing of Work

Subsection 622.07.03 of OPSS 622 is amended by the addition of the following:

The controller cabinet shall be energized immediately following installation and all environmental equipment shall be operational.

622.07.04.05 Equipment Ground

Clause 622.07.04.05 of OPSS 622 is deleted and replaced with the following:

The controller cabinet ground shall be connected to the system ground at the power supply cabinet ground bus in accordance with the requirements of OPSS 609 or, the neutral cable shall be connected to the cabinet AC - terminal and kept independent of the grounding facilities.

622.07.04.06 Installation of External Cable Access Enclosure

The external cable access enclosure shall be mounted as specified in the Contract Documents

The enclosure shall be installed such that opening of the door is not obstructed by the adjacent power supply cabinet.

622.07.05.04 Identification of Equipment

Clause 622.07.05.04 of OPSS 622 is deleted in its entirety and replaced with the following:

622.07.05.04 Cabinet Identification

A laminated phenolic plastic nameplate shall be installed on the side of each cabinet facing traffic such that it can be easily seen from the roadway. Nameplates shall be 450 mm x 70 mm with 50 mm high white lettering, 8 mm letter stroke width and 6 mm spacing between letters, on a black background. Letters shall be generated by an engraving machine. Naming shall be per the Contract Administrator.

622.07.06 Quality Control

Subsection 622.07.06 of OPSS 622 is deleted and replaced with the following:

The framework of the approval process shall be as specified elsewhere in the Contract Documents.

622.07.06.01 Pre-Installation Testing

The Contractor is required to perform quality control testing on 100% of cabinets and 100% of digital thermostats prior to delivering the cabinets and thermostats. The Contractor shall test each cabinet and thermostat to confirm that it meets the requirements of the Ontario Traffic Signal Control Equipment Specifications (OTSCES).

The quality control testing and test procedures shall include, but not be limited to the following:

Visual Inspection

The Contractor shall perform detailed visual inspection to confirm that the following aspects of the cabinet are in compliance with the requirements of the Ontario Traffic Signal Control Equipment Specifications (OTSCES) as applicable for the appropriate cabinet type:

General Appearance	Trouble Lamp
Cabinet Dimensions	Insulation
Finish	Ventilation Requirements
Locks	Heating Requirements
Door Handles	Side Panel
Door Frames	
Latching Mechanism	Service Panel
Door Hinges, Pin and Bolts	Labelling
Catches	Cabinet Wiring Diagram
Louvred Vents and Filters	Power Distribution Assembly
Gaskets	Conductors
Heater Bracket	Colour Coding
Storage for Drawings	
Front Face Plate	
Fan Ventilation Area	Power Supply Front Panel
Cabinet Pedestal	

Equipment Racks
Lifting Eyes

Thermostat
Connectors and Harness
Screws

Functional Testing

The Contractor shall perform functional tests of the following components:

Trouble Lamp
24 Volt DC Power Supply (If supplied to power below systems)
Power Distribution Assembly
Fan
Heater
Main Power Disconnect
Thermostat

622.07.06.02 Proof of Performance Testing

The Contractor shall energize each cabinet and confirm proper operation of any needed 24 VDC power supply, heaters, fans, thermostats and service lights.

622.09 MEASUREMENT FOR PAYMENT

622.09.01.01 Actual Measurement

Clause 622.09.01.01 of OPSS 622 is amended by the addition of the following:

For measurement purposes, a count shall be of the number of controller cabinets installed.

622.10 BASIS OF PAYMENT

Clause 622.10.02 of OPSS 622 is amended by the addition of the following:

622.10.02.03 Controller Cabinets - Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment and Materials required to do the work.

FIBRE OPTIC COMMUNICATION CABLES, IN DUCTS - Item No.
FIBRE OPTIC COMMUNICATION CABLES, IN DUCTS (TEMPORARY) - Item No.

Special Provision No. 683S01M

Jan 2024

1. SCOPE

This Special Provision covers the requirements for the installation, splicing and testing of the fibre optic communication cables to be placed in ducts. The requirements apply to various types of fibre optic cables as defined within this Special Provision.

2. REFERENCES

This Special Provision refers to the following standards, specifications or publications:

Electronic Industries Alliance / Telecommunications Industry Association:

EIA/TIA-455-B Standard Test Procedure for Fibre Optic Fibres, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fibre Optic Components

TIA/EIA-598-B Optical Fibre Cable Color Coding

3. DEFINITIONS

For the purpose of this Special Provision, the following definitions apply:

Branch Cable means fibre optic cable interconnecting the trunk cable with communication equipment adjacent to pedestals through which the trunk cable does not pass.

Drop Cable means fibre optic cable interconnecting the trunk cable or the branch cable with the pre-terminated fibre connection module in cabinets.

Patch Cord Cable means fibre optic cable interconnecting the fibre connection module with the communication equipment in cabinets.

Trunk Cable means fibre optic cable interconnecting the head end or Main cross connect communication equipment with the roadside communication equipment.

The number prior to the designator SM means the number of single mode fibres in the cable.

4. DESIGN AND SUBMISSION REQUIREMENTS

4.1 Submission Requirements

The Contractor shall supply the specification sheets for the fibre optic communication cables including colour coding and position of fibres and buffer tubes within the trunk, branch and drop cables, connectors and terminating blocks to the Contract Administrator for review prior to ordering.

5. MATERIALS

The Contractor shall be allowed to supply different combinations of fibre optic cables to meet the requirements as specified in the Contract Documents; however, the Contractor will not be compensated for any additional lengths of cable or surplus fibres resulting from such substitutions.

5.1 Trunk Cable, Branch Cable

- 5.1.1 The trunk and branch cables shall consist of the required optical SM fibres divided into buffer tubes and housed within a protective jacket suitable for installation in outdoor underground ducts.
- 5.1.2 The cables shall be rated for operation over a temperature range of -30 to +60 °C.
- 5.1.3 The cables shall provide mechanical support and protection for the specified number of fibres.
- 5.1.4 The cables shall be able to withstand a maximum pulling tension of 2500 N during installation without any resulting damage.
- 5.1.5 The minimum static bending radius for the cables under no tension shall be 200 mm. The minimum bending radius during installation and under tension shall be 300 mm.
- 5.1.6 All interstices within the cable's outer jacket shall be filled with a compound to prevent the ingress and migration of water. The compound shall be nontoxic and dermatologically safe. Some leakage of the compound is permitted; however, there shall be no bulk flow of compound out of the cable over the specified operating temperature range which could impact on the waterproofness of the cable.
- 5.1.7 Materials used in the cables shall not produce hydrogen in a concentration large enough to cause any degradation in the transmission performance of the optical fibres.
- 5.1.8 Materials used in the cables shall not support galvanic action.
- 5.1.9 Fibres shall be bundled in buffer tubes. Each buffer tube shall contain 12 fibres.
- 5.1.10 Each individual fibre in the cables shall be identified by means of colour coding or a combination of colour and positional coding as specified in TIA/EIA-598-B.

5.2 Drop Cable

- 5.2.1 The drop cable shall consist of the required optical SM fibres housed in a protective jacket rated for outdoor installation in underground conduits. Each drop cable shall either include a pre-terminated fibre connection module complete with integrated connectors and factory terminated onto the drop cable (ie Gator Patch, etc.) or it shall be fitted to a termination panel.
- 5.2.2 The attenuation drop cable for SM fibres shall not exceed 0.4 dB/km measured at 1310 nm and 0.3 dB/km measured at 1550 nm.
- 5.2.3 The drop cable shall be suitable for operation over the temperature range of -30 to +60 °C.
- 5.2.4 The exact number of connected drop cables at each pedestal and elsewhere shall be as specified in the Contract Documents. Each drop cable shall contain a minimum of six (6) fibres or the quantity of fibres equal to the terminations on the pre-terminated connection module.

- 5.2.5 The length of drop cable in the pedestal shall be equal to that of the trunk and branch cable stored in the pedestal. Sufficient slack shall be provided in the cabinet to allow mounting the fibre connection module at the top of the cabinet with at least 1.0 m of spare cable in the cabinet.
- 5.2.6 Each pre-terminated fibre connection module shall have a minimum capacity of six (6) connectors. The connectors shall be grouped in pairs, and arranged in a step formation and supplied with protective caps or plugs for protection when not in use.
- 5.2.7 Each pre-terminated fibre connection module shall be compatible for connection to the LC style connectors of the fibre optic patch cord cables.
- 5.2.8 The pre-terminated fibre connection module shall be epoxy filled to provide a watertight unit and provide rodent protection.
- 5.2.9 Each fibre connection module shall be equipped with a mounting bracket for installation on EIA rack requiring no special tools. The fibre connection module shall be installed in the cabinet as shown on the Contract Drawings.

5.3 Fibre Optic Patch Cord Cable

- 5.3.1 The fibre optic patch cord cables shall consist of optical SM fibres housed individually in protective armoured jackets. Both ends of the cable shall be connectorized.
- 5.3.2 The attenuation of a fibre optic patch cord cable after installation, not including the connector loss, shall not exceed 0.1 dB measured at 850 nm and 1300 nm.
- 5.3.3 The fibre optic patch cord cable shall be suitable for operation over the temperature range of -30 to +60 °C.
- 5.3.4 Fibre optic patch cord cables in cabinets shall be 2.0 m in length.

5.4 Single Mode (SM) Cabled Fibre

- 5.4.1 The optical attenuation at 1310 nm shall not be greater than 0.4 dB/km for any fibre.
- 5.4.2 The optical attenuation at 1550 nm shall not be greater than 0.3 dB/km for any fibre.
- 5.4.3 The fibre attenuation shall not vary more than 0.2 dB/km over the specified cable operational temperature range.
- 5.4.4 The SM fibre shall be coated with a protective polymer to preserve the strength of the fibre. The coating shall be removable by mechanical or chemical means. The coating shall retain its colour when subject to the manufacturer's recommended fibre cleaning and splicing preparation methods.
- 5.4.5 The SM fibre shall have attenuation and bandwidth specified at two wavelength windows.
- 5.4.6 The first wavelength window shall be at and around 1310 nm.
- 5.4.7 The second wavelength window shall be at and around 1550 nm.
- 5.4.8 The zero dispersion wavelength shall be at a wavelength of 1310 ± 10 nm.

5.5 Connectors

- 5.5.1 Connectors shall all be LC style unless otherwise specified in the Contract Documents.
- 5.5.2 The connector mean loss shall not be greater than 0.5 dB with a standard deviation of not greater than 0.2 dB. The connector loss shall not vary more than 0.2 dB over the operating temperature range.
- 5.5.3 Index matching fluids or gels shall not be used.
- 5.5.4 The connector loss shall not vary more than 0.2 dB after 1000 repeated matings.
- 5.5.5 The connector shall withstand an axial load of 135 N.
- 5.5.6 The connectors shall be compatible with the optical fibre surrounding jacket and shall be installed on one end of the optical fibre according to the manufacturer's recommended materials, equipment and practices.
- 5.5.7 The connector shall be suitable for the intended environment and shall meet the following environmental conditions.
- 5.5.8 Operating temperature: -30 to +60 °C.
- 5.5.9 Connectors shall be protected by a suitably installed waterproof protection cap.

5.6 Number of Fibres

The number of SM fibre specified for each cable shall be the guaranteed number of SM fibres, (i.e. SM fibres in the cable shall comply with the specification after installation).

5.7 Fish Line

Fish line shall be nylon or polypropylene material with a minimum test strength of 400 N.

5.8 Packing and Shipment

The cable shall be supplied on reels. Each reel shall have the following information clearly labelled on it in:

- a) Customer
- b) Customer order number
- c) Reel number
- d) Destination
- e) Ship date
- f) Manufactured date
- g) Manufacturer's name
- h) Cable code
- i) Length of cable

6. EQUIPMENT

- 6.1 Where mechanical pulling means is required, a fibre optic cable puller and suitable cable routing accessories shall be used to ensure that the minimum bending radius of the cable is not exceeded.

6.2 The connection between the mechanical puller and the fibre optic cable shall be through a break-away link, designed to disconnect the winch cable from the fibre cable when the maximum pulling tension of the cable is exceeded.

7. CONSTRUCTION

7.1 General

7.1.1 Care shall be taken at all times to avoid scraping, denting, or otherwise damaging the cable before, during or after installation. Damaged cable shall be replaced by the Contractor at no additional cost to the Owner.

7.1.2 The manufacturer's recommended safe pulling tension and minimum bending radius shall not be exceeded at any time.

7.1.3 Twisted pairs shall be terminated at the termination block in each pedestal and the cabinet. The termination blocks shall be installed in pedestals external to the splice enclosures as specified in the Contract Drawings and as approved by the Contract Administrator. All connections shall be clearly identified.

7.1.4 All cable ends shall be protected from moisture ingress by using properly sealed caps.

7.2 Installation in Ducts

7.2.1 Cables shall be installed in duct in the field as specified in the Contract Drawings.

7.2.2 All duct ends shall be smoothed prior to installation of the cables to prevent scraping the cable.

7.2.3 A stiff bristle brush shall be pulled through each section of duct before pulling cable.

7.2.4 A manufacturer recommended lubricant shall be applied to the cable to reduce friction between the cable and the duct.

7.2.5 Plastic inner ducts shall be installed inside ducts when specified.

7.2.6 Drop cables shall be manually pulled from the cabinet to the pedestal to prevent the connectors from being damaged. Cable ties shall be installed to fasten all drop cables in the cabinet, and to bundle the drop cable with the trunk or branch cables entering a splice enclosure.

7.2.7 Where fibre optic cables (trunk, branch or drop) are required to be installed in inner duct, each section of inner duct shall be secured to prevent it from being pulled with the cables.

7.2.8 A cable grip ("pulling eye") shall be attached to the strength members of the cables so that no direct force is applied to the optical fibre. The cable grip shall have a swivel to prevent the cable from twisting during pulling.

7.2.9 Cable rollers and feeders and winch cable blocks shall be used to guide the cable freely into the duct and at electrical chamber locations.

7.2.10 Mechanical aids and pulling cable or ropes shall be used as required.

7.2.11 Personnel equipped with two-way communication equipment shall be stationed at appropriate locations through which the cable is to be pulled to observe and lubricate the cable.

- 7.2.12 Cable pulls shall be continuous and steady between pull points and shall not be interrupted until the entire run of cable has been pulled.
- 7.2.13 At no point shall the pulling tension exceed the maximum pulling tension or minimum bend radius of the cable as specified by the cable manufacturer.
- 7.2.14 During all mechanical pulling operations, a break-away link shall be used to limit pulling tension to the maximum pulling tension of the cable as defined by the cable manufacturer.
- 7.2.15 Cable passing through all electrical chambers and communication chambers shall be marked with a plastic cable tag with permanent printing indicating that this is a fibre optic cable.
- 7.2.16 Cable passing through electrical chambers shall be installed in 90 mm PVC split duct and shall have sufficient slack for expansion and contraction. The split duct shall be installed on the electrical chamber wall opposite the power cables and ladder rungs using galvanized steel conduit straps. The split duct shall clearly identify the contents to be fibre optic cable.
- 7.2.17 The cable shall be securely fastened in place within electrical chambers, pedestals and cabinets. For vertical conduit runs, the cable installation shall include installation of strain relief mechanism.
- 7.2.18 The cable shall be of sufficient length to allow for connection as shown on the Contract Drawings, including provision for slack, vertical runs, cable necessary for splicing, wastage and cable to allow for the removal of the splice enclosure for future splicing.
- 7.2.19 The unconnectorized end of the drop cable shall be spliced to the trunk or branch cable fibres as specified in the Contract Documents.
- 7.2.20 Immediately following installation, each trunk or branch cable entering a pedestal shall be labelled with the cable identification and direction as specified in this Special Provision.
- 7.2.21 Following installation of the cable in the ducts, all duct entrances at pedestals and cabinets shall be sealed with duct plugs to prevent the ingress of moisture, foreign materials, and rodents.
- 7.2.22 Conduit containing cables shall be sealed using a duct plug with an opening approximately the size of the cable. The duct plug may be split in the factory or the field to allow placing around the cable, and the remaining openings in the plug, as well as any spaces between the conduits, cable or plug shall be sealed with duct sealing compound. Expandable foam shall not be used to seal ducts.
- 7.2.23 At least 12 m of trunk cable, 6m on each side of the splice enclosure, and at least 6 m of branch cable shall be coiled at each pedestal.
- 7.2.24 10 m of each cable going to and coming from each pedestal shall be coiled in the first ATMS chamber on either side of the pedestal. In addition, 25 m of cable shall be left coiled in the first ATMS chamber on each side of all surface mounted conduit systems.
- 7.2.25 Where trunk cable terminations are left “dead ended”, 25 m of cable shall be left coiled.
- 7.2.26 All coiled cables shall be securely fastened in place with a minimum of four galvanized steel conduit straps.

- 7.2.27 Fish line shall be installed in all communications ducts or conduits along with fibre optic communication cables. A 2.0 m length of fish line shall be left coiled, tied and accessible in each cabinet, pedestal, electrical chamber and junction box.
- 7.2.28 At intermediate pulling points, to prevent over-tension on the cable, the cable shall be either taken up with an intermediate cable take up device as approved by the Contract Administrator, or all excess cable shall be laid out on the ground in a “figure eight” configuration before subsequent installation.
- 7.2.29 Pedestals may be removed to assist in the installation. If this option is exercised, all removed pedestals shall be reinstalled to their original condition.
- 7.2.30 Unless otherwise specified in the Contract Documents, the temporary fibre cable and associated drop cables shall be removed and delivered to the Owner at the location specified by the Contract Administrator.

7.3 Installation in the Communication Head End

At the communication head end locations, cables shall be installed from the indoor splice enclosures to the communications equipment as specified in the Contract Drawings.

7.4 Splicing

- 7.4.1 Only the splices specified in the Contract Drawings shall be allowed.
- 7.4.2 All pedestal splices shall be housed in a splice enclosure as specified in the Contract Documents. All splices in the head end buildings shall be housed in indoor splice enclosures.
- 7.4.3 The splices shall be performed by high quality fusion type splicing equipment.
- 7.4.4 The maximum loss introduced by any single mode splice shall not exceed 0.25 dB at 1310 nm and 1550 nm.
- 7.4.5 The average single mode splice loss shall not exceed 0.1 dB for any given span, with a standard deviation not greater than 0.07 dB.
- 7.4.6 Only the fibres required to be spliced to drop cables specified in the Contract Documents shall be severed and spliced. Where required, the buffer tube splitting tool recommended by the manufacturer shall be used to open the correct buffer tube. Unsevered fibres in an open buffer tube shall be coiled in the splice tray. When buffer tubes do not need to be opened, at least 3.0 m of unopened buffer tubes shall be coiled at the slack basket in the fibre optic splice enclosure and labeled with the fibre count, highway and direction.
- 7.4.7 The designated fibres of the cable for splicing to the drop cables shall be prepared following manufacturer recommended procedures. All splices shall be arranged neatly in splice trays, supported and protected with a suitable splice protector. At least 1.0 m of each fibre shall be stored in the splice tray.
- 7.4.8 Fibres that do not require splicing shall be contained within buffer tubes and the buffer tubes shall be fastened to the tray.
- 7.4.9 All opened buffer tubes routed to splice trays shall be protected with protective tubing provided with the splice enclosure or spiral wrap to protect the buffer tube.

- 7.4.10 Fibres routing between trays shall be enclosed in tubing designed for this purpose to ensure that the minimum bending radius is not exceeded, both for the completed splice, and during access to any of the splice trays.
- 7.4.11 Splicing shall be completed using a fusion splicer that tests the tensile strength of the completed splice by applying a force of not less than 200 grams.
- 7.4.12 Drop cable entrances to the splice enclosures shall adhere to the outdoor splice enclosure manufacturer's recommendations.
- 7.4.13 To reduce the overall number of splices required, the cable shall be installed in continuous lengths with a minimum average of 2 km. Runs of cable beyond the minimum requirements shall be maximized if possible. Locations for trunk cable splicing shall be approved by the Contract Administrator and documented as part of as-constructed documentation.

7.5 Fibre Connection Module

- 7.5.1 The pre-terminated fibre connection module shall be used as a fibre optic 'Patch Panel'.
- 7.5.2 Patch cord cables shall be used between the fibre connection module and communication equipment.
- 7.5.3 The unused ports of the fibre connection module shall be provided with protective caps or plugs to protect dust or unwanted material from degrading the connectors.

7.6 Labeling

- 7.6.1 The trunk, branch and twisted pair cables in the pedestal shall be labelled with permanent indelible ink on a heavy duty marking tape to indicate the following information as specified in the Contract Drawings:
 - (a) Cable type, i.e. a Trunk, Branch or a Drop Cable,
 - (b) Direction the cable is coming from or the cabinet number for the Drop Cable
- 7.6.2 Each buffer tube entering the splice tray shall be labeled with vinyl tags directly on the splice tray with the direction of the cable, and with the cable identification (Trunk, Branch or Drop).
- 7.6.3 The interface connector in the pre-terminated fibre connection module shall be labelled. The labelling scheme shall, at a minimum, include the following:
 - a) Fibre Type;
 - b) Fibre Number and Direction from the cable it comes from;
 - c) Function (Rx or Tx);
 - d) The adjacent cabinet number from where the cable comes from.

Example:

SMF 34W Tx 401CW0420SWC

7.6.4 Both ends of the fibre patch cords from the fibre connection module to the communication equipment, e.g. switch shall be labelled. The labelling scheme shall be as follows:

- a) At the switch end, the label shall indicate to which adjacent cabinet the connection is from;
- b) At the fibre connection module end, the label shall indicate Fibre Type, Fibre Number and Function.

7.7 Grounding

7.7.1 Any metallic components in the fibre optic cables shall be bonded together with a connection to the ground lug of the splice enclosures.

7.7.2 If the fibre cable has metallic components, the ground lug of the splice enclosure shall be bonded to the communications pedestal ground.

7.8 Quality Control

The Contractor is responsible for all testing and documentation required to establish approval and acceptance of installation and operation of this equipment. The framework of the approval process shall be as specified elsewhere in the Contract Documents.

- ¹ Each reel shall be tested prior to installation in ducts. Pre-Installation Testing shall include a minimum of 10% of the total fibre optic communication cable. Where 10% equates to more than one fibre, the fibres to be tested shall be located in different buffer tubes.
- ² Each length of fibre cable shall be tested after installation in ducts. Proof of Performance shall include a minimum of 10% of the single mode fibres to be connected to equipment. The Contractor shall not test the same fibres on consecutive lengths. All spare cables shall be tested. The Contractor shall record the reel number from which the cable came, the identification of the fibres measured and the attenuation in dB/km of the fibres measured.
- ³ Each optical link (fibre link terminated with optical connectors on each end) shall be tested using light source and power meter. Attenuation and continuity shall be demonstrated at 1310 nm and 1550 nm. Calibration between the light source and power meter shall be performed at the beginning of each day of testing and after every 20 optical link measurements.

Each optical fibre with at least one fibre connector shall be tested using an OTDR at 1310 nm and 1550 nm. Test results shall include the following measurements:

- a) Total length of the optical link
- b) Total attenuation of the optical link
- c) Attenuation of each splice in the optical link under test
- d) Attenuation per kilometre of the optical link under test
- e) Wavelength of the measurement
- f) Index of refraction used for the test

Test results shall include electronic copies of the OTDR attenuation profile in searchable PDF format.

When cable installed in this Contract interconnects with existing cable, the Contractor will be provided with test results for existing adjacent communications cable and shall review the results prior to interconnecting to the existing cable.

A certificate confirming the calibration of the OTDR within the past year prior to undertaking any testing shall be submitted to the Contract Administrator.

8. QUALITY ASSURANCE – Not Used

9. MEASUREMENT FOR PAYMENT

9.1 Fibre Optic Communication Cables, In Ducts

Measurement of cables shall be made horizontally in metres along the longitudinal axis of the duct trench from centre to centre of poles, electrical chambers, concrete pads and to the face of bridge structures and retaining walls.

10. BASIS OF PAYMENT

**10.1 Fibre Optic Communication Cables, In Ducts - Item
Fibre Optic Communication Cables, In Ducts (Temporary) - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment and Materials required to do the work regardless of the type or number of fibres in the cable (connecting to both new and existing trunk cable), splices, twisted pair cable, termination blocks, coils of cable, mechanical support, delivery, installation, testing and the production of all drawings, text and test results.

Progress payment for temporary fibre optic cables shall be based on the following percentages of the Contract price:

80% for supply and installation

20% for removal

SPLICE ENCLOSURES FOR FIBRE OPTIC CABLES - Item No.

Special Provision No. 683S02M

Jan 2024

1. SCOPE

This Special Provision covers the requirements for the installation of splice enclosures for fibre optic cables including splice trays and all components to complete the installation.

2. REFERENCES - Not Used

3. DEFINITIONS - Not Used

4. DESIGN AND SUBMISSION REQUIREMENTS

4.1 Submission Requirements

Specification sheets for the splice enclosures for fibre optic cables shall be submitted to the Contract Administrator for review prior to ordering.

5. MATERIALS

5.1 Splice Enclosure

- 5.1.1 The splice enclosure shall be suitable for outdoor applications with a temperature range of -40 to +70° C.
- 5.1.2 The splice enclosure shall fit into the pedestals and provide sufficient space to allow entry of fibre optic cable without exceeding the cable minimum bending radius. The enclosures shall be designed for butt splicing of the cable. The end plate shall have cable entry ports sufficient to terminate all fibre optic cables as shown on the drawings, with at least two entry ports spare for future cables.
- 5.1.3 The splice enclosure shall protect the splices from moisture and mechanical damage and shall be resistant to salt corrosion. All materials in the enclosure shall be nonreactive and shall not support galvanic cell action.
- 5.1.4 The splice enclosure shall be waterproof, re-enterable, re-sealable and shall be sealed with a gasket.
- 5.1.5 The splice enclosure shall permit selective splicing to allow one or more fibres to be cut and spliced to the drop cable without severing other fibres. At least one cable entry port shall be of sufficient width to allow the insertion of unsevered cable without exceeding the bending radius of the buffer tubes.
- 5.1.6 The splice enclosure shall have strain relief for the trunk cable to prevent accidental tension from disturbing the splices.
- 5.1.7 The enclosure shall include one (1) splice tray stacker and slack basket for full slack storage.
- 5.1.8 The splice enclosure shall be large enough to accommodate splice trays sufficient to house all fusion splices required at the location, and an additional 25% spare capacity.

5.1.9 All required strain-relief hardware, securing straps, sealing rings, grommets and sealing tape shall be included with the splice enclosure.

5.2 Splice Tray

5.2.1 The splice tray shall be compatible with the splice enclosure. The splice tray base shall be constructed of rigid plastic. The splice tray shall accommodate both loose tube and tight-buffered optical cables.

5.2.2 Each splice tray shall include splice holders to securely hold 24 heat-shrink protected single-fibre fusion splices in place. The splice trays in each enclosure and the quantity of fusion splice holders, shall be sufficient to accommodate the number of splices required in the splice specified in the Contract Documents.

5.2.3 Heat shrinkable polyethylene tubes shall be supplied to protect exposed individual fibres splices within the splice tray.

5.2.4 Vinyl labels shall be supplied to identify fibres spliced in the splice tray.

5.2.5 Each splice shall be individually mounted and mechanically protected on the splice tray.

5.2.6 Each splice tray shall have clear plastic cover which snaps or slides in place.

5.3 Closet Connector Housing

5.3.1 The 4RU 19" rack mounted closet connector rack shall be placed in existing racks in the West Abutment IT room PBA existing rack frame. All required hardware and cable training material shall be furnished.

5.3.2 The frame shall be furnished with 12 connector per insert patch panel inserts. 6 shall be furnished with the new rack, The balance of the rack shall be fitted with insert blanking plates.

5.3.3 The Contract shall also deliver 6 12 terminal inserts to be placed in an existing 4RU rack.

5.3.4 Splicing the trunk fibre to the tails on the back of the terminal shall be made in the closet connector rack shall be made, and shall include protectors, hardware, record schedules and testing as is applicable to other splicing activities in this Special Provision.

5.3.5 Terminal splicing to terminal patch fields shall be counted as a splice in the measurement of payment

6. EQUIPMENT - Not Used

7. CONSTRUCTION

7.1 Installation in Pedestals

7.1.1 The splice enclosure shall be installed in pedestals, and racks and wall mounts where splicing is required. The splice enclosure shall be securely fastened to mounting surface using cable ties.

7.1.2 The splice enclosure shall be mounted in an upright position where in field pedestals to allow the cable to enter at the bottom of the enclosure without exceeding the cable manufacturer's minimum bending radius.

- 7.1.3 The splice enclosure shall be installed such that each cable entering the splice enclosure (trunk, branch, drop and twisted pair) has the same length of cable from the end of the conduit to the splice enclosure. The cable from the end of the conduit to the base of the splice enclosure shall be at least 4.5 m in length. Each cable entering the splice enclosure shall be labeled with the fibre count, highway and direction (e.g. “36SM-HWY 403-EAST”). All cables entering the splice enclosure will be fastened together into a group of cables and neatly coiled as a group.

7.2 Aerial Installation

- 7.2.1 The splice enclosure shall be attached to the messenger cable where fibre optic cable is installed, as shown in the drawings.
- 7.2.2 A sufficient length of cable shall be coiled to enable removal of the enclosure to the ground level for splicing. The cable slack shall be securely fastened to the messenger cable such that no strain is applied to the cable and the cable manufacturer’s recommended minimum bending radius is not exceeded.

7.3 Grounding

Where the trunk or branch cable in the splice enclosure has a metallic strength member or cable sheath, the metallic components shall be bonded to the grounding lug of the splice enclosure, which in turn shall be bonded to the pedestal ground or the controller cabinet ground, as applicable.

7.4 Splice Trays

- 7.4.1 Each splice shall be individually protected with heat-shrinkable tubing and securely mounted in the splice holders on the splice tray. The number of splices in the tray shall not exceed the number of splice holders provided in the tray.
- 7.4.2 Fibres exposed for splicing within the enclosure shall be protected from mechanical damage using the fibre support tube or tubes and shall be secured within the splice trays.
- 7.4.3 Fibres shall be labelled with vinyl labels adhered to the fusion splice holder as follows:
- a) Labels shall indicate the trunk cable fiber number provided in the Contract Drawings.
 - b) At a reel end splice locations, where entire buffer tubes are spliced colour-to-colour, the first and last fiber of the buffer tube shall be labelled, with the remaining fibers splices stored in the tray using the order determined by the fiber colour code;
 - c) Where trunk fibers are spliced to drop or branch cables, each fiber fusion shall be labelled with the trunk fiber number and a direction as appropriate.
- 7.4.4 Upon completion of the splices, the splice trays shall be secured to the splice enclosure according to the installation procedure recommended by the manufacturer.

7.5 Sealing the Enclosure

- 7.5.1 The enclosure shall be sealed as recommended by the manufacturer to provide a moisture proof environment for the splices.

7.5.2 A tight salt resistant and waterproof seal shall be provided at cable entry points that will not leak upon aging. Multiple drop cables may enter a single cable entry port, however they shall be sealed to maintain the waterproof features of the enclosure.

8. QUALITY ASSURANCE - Not Used

9. MEASUREMENT FOR PAYMENT

Measurement for payment of the number of splice enclosures is by Plan Quantity.

The unit of measurement is each.

10. BASIS OF PAYMENT

10.1 Splice Enclosures for Fibre Optic Cables - Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment and Material required to do the work.

ETHERNET SWITCHES – Item No.

Special Provision No. 683S25M

Jan 2024

1. SCOPE

This Special Provision covers the requirements for the installation, of Ethernet Switches. The Ethernet switches shall be interconnected to form an Ethernet network enabling communications to Communication field equipment. The Ethernet switch hardware will be supplied by the Owner.

This item shall also include installation of Owner supplied Ethernet surge arrestors on data cables and grounding connections.

This item shall also include the installation of Owner supplied UPS assembly The Contractor shall secure the gear and make data and power and grounding connections for UPS supply and any separate battery cabinets to be co-located in cabinets with Ethernet Switches.

2. REFERENCES

This Special Provision refers to the following standards, specifications, or publications:

Institute of Electrical and Electronics Engineers:

IEEE 802.3-2005 IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

Electronic Industries Alliance / Telecommunications Industry Association:

TIA/EIA-568-B Commercial Building Wiring Standard

EIA-RS-310-D Cabinets, Racks, Panels and Associated Equipment

3. DEFINITIONS

For the purpose of this Special Provision, the following definitions apply:

Cat 5e cable: means a twisted pair cable type designed for high signal integrity. Currently defined in TIA/EIA-568-B. Provides performance of up to 100 MHz, and is frequently used for both 100 Mbit/s and gigabit Ethernet networks.

Latency: means the delay between the initiation of a network transmission by a sender and the initial receipt of that transmission by a receiver. It is typically commensurate with the distance the signal must travel, but is also affected by delays introduced in network routing, including queues, multiple routes, packet loss, etc.

MAC Address: in computer networking means a Media Access Control address (MAC address) is a unique identifier attached to most network adapters.

Rapid Spanning Tree: is an evolution of the Spanning Tree Protocol; it was introduced in the extension IEEE 802.1w, and provides for faster spanning tree convergence after a topology change. Standard IEEE 802.1D-2004 now incorporates RSTP and obsoletes STP.

SNMP: means simple network management protocol (SNMP) which forms part of the internet protocol suite as defined by the Internet Engineering Task Force (IETF). SNMP is used by network management systems to monitor network-attached devices for conditions that warrant administrative attention.

Spanning Tree: means network protocol as defined by standard IEEE Standard 802.1D.

4. DESIGN AND SUBMISSION REQUIREMENTS

4.1 Submission Requirements

The Contractor shall obtain the specification sheets from the owner for the Ethernet switches prior to planning testing.

5. MATERIALS

5.1 General

- 5.1.1 The Ethernet switches shall be capable of transmitting Ethernet packets at a rate of a gigabit per second, as defined by the IEEE 802.3-2005 in a full duplex communications mode.
- 5.1.2 The device shall continually diagnose and provide external visible indication of, but not limited to, power status, link integrity on each electrical/optical port, and data activity on each electrical/optical port.
- 5.1.3 The device shall be capable of interconnecting a minimum of 30 switches together in a ring topology with a minimum 30% load on the network.
- 5.1.4 Each device shall support spanning tree protocol and rapid spanning tree protocol as defined in IEEE 802.1d and 802.1w.
- 5.1.5 The Ethernet switches shall provide support remote network management intelligence and configuration capabilities. At a minimum, the system network management/configuration shall be achieved through a web browser or telnet terminal session. The device shall include all software and licenses required.
- 5.1.6 Switching latency of the Ethernet switches shall not exceed 10 μ s.
- 5.1.7 The device shall have a minimum mean time between failure (MTBF) of 70,000 hours.
- 5.1.8 The Ethernet switches shall be suited to EIA 480 mm rack mounting, or secured to a shelf to facilitate EIA 480 mm rack mounting. Any required shelf shall be provided with this item.
- 5.1.9 The manufacturer, model number, serial number, and firmware version of the device shall be visible on the outside casing of the device.
- 5.1.10 The devices shall be capable of supporting not less than 1024 MAC Ethernet addresses. The data held in the MAC table shall be automatically aged and managed by the switches to maintain the most current data in the limited MAC addressing table space.
- 5.1.11 The Ethernet switches shall be compliant with the IEEE 802 specification family for hardware features implemented. At a minimum, this shall include 802.3u (Fast Ethernet 100Mbps), 802.3z (Gigabit

Ethernet 1000Mbps fibre), 802.3x (Full Duplex with flow control), 802.1p (QOS Priority Queuing), 802.3q (VLAN), 802.3w (Rapid Spanning Tree), and 802.3ad (Port Trunking).

- 5.1.12 The devices shall be interoperable with other manufactured Ethernet switches while still achieving all common Ethernet standards.
- 5.1.13 The device's management functionality shall be via SNMP V2 or higher.
- 5.1.14 The Ethernet switches shall be able to restore Ethernet services if any optical path on a redundant ring is broken.
- 5.1.15 The Ethernet switch shall be able to compensate for any packet loss.

5.2 Environmental

- 5.2.1 The Ethernet switches shall be fully operational in external ambient temperatures ranging from -10 to + 50 °C and relative humidity 10 to 95% non-condensing.
- 5.2.2 The switches shall withstand a storage temperature range from -40 to +74 °C without incurring damage.

5.3 Electrical

- 5.3.1 The Ethernet switches shall be externally powered using input voltage of 115 VAC \pm 15%, 60 Hz \pm 5%.
- 5.3.2 The Ethernet switches power supply shall have no exposed power connectors.
- 5.3.3 All power supplies and electrical modules shall suppress unintended radio frequency emissions to CRTC criteria.
- 5.3.4 The ethernet switches will be powered by owner supplied UPS units placed in the communications cabinets by this item. The Contractor shall connect the power for the switch to this unit, and provide a patch cable to plug the data port of the UPS to the Ethernet switch.

5.4 Communications

5.4.1 General

- 5.4.1.1 The Ethernet switches shall interface to the fibre optic network through 2 pairs (Rx, Tx) of 1000LX singlemode optical fibre ports.
- 5.4.1.2 Optical ports shall have connectors fitted with LC or SC female optical connectors suited to 9/125µm singlemode cores.
- 5.4.1.3 The Ethernet switches shall interface to other Ethernet terminal and communication equipment via 10/100BaseTX electrical ports on the switches.
- 5.4.1.4 The devices shall support auto negotiation on all 10/100BaseTX electrical ports. All electrical ports shall be compliant with the EIA/TIA-568-A standard pinout.
- 5.4.1.5 The devices shall have an optical link budget to facilitate communications of at least 20 km distances.

5.4.1.6 The Ethernet switches optical receivers shall avoid optical saturation when two of the same devices are connected 100 m apart or greater. If optical saturation occurs on links less than 100 m apart, the Contractor shall supply optical attenuators to prevent saturation.

5.4.2 Field Switches

The field Ethernet switches, intended for placement at remote field cabinets, shall have a minimum of 6 - 10/100BaseTX electrical ports.

5.4.3 Head-end Switches

The head-end Ethernet switches, intended for placement at remote communications hubs, shall have a minimum of 12 - 10/100BaseTX electrical ports.

5.4.4 Central Switches

The central Ethernet switches, intended for placement at the TOCs communications rooms, shall have a minimum of 24 - 10/100BaseTX electrical ports.

5.5 Network Cabling

5.5.1 The Contractor shall supply interface cables and connectors required to connect the switch to the associated equipment and/or patch panels detailed in the Contract Drawings.

5.5.2 The cables shall be CAT 5e or better.

6. EQUIPMENT – Not Used

7. CONSTRUCTION

7.1 Installation and Configuration

7.1.1 Prior to installation of Ethernet switches the Contractor shall witness the owner carry out PIT bench testing of the devices in the network configuration detailed in the Contract Drawings.

7.1.2 The Ethernet switches shall be installed in locations and/or cabinets identified in the Contract Drawings.

7.1.3 The Contractor shall install the Ethernet switches as per the manufacturer recommended installation procedure.

7.1.4 The Contractor shall connect the Ethernet switches power supply cord to the output receptacles on the uninterruptible power supplies (UPS) in the controller cabinets.

7.1.5 If an external power supply component is required for the operation of the switches, means shall be provided to securely fasten the connector to prevent it from becoming accidentally dislodged.

7.1.6 The Contractor shall configure an IP address for the Ethernet switches based on the information provided by the Contract Administrator.

7.1.7 The Contractor shall configure all user names and passwords for the Ethernet switches based on the information provided by the Contract Administrator.

7.1.8 The Contractor shall install all interface cable connections between the Ethernet switches and associated equipment. All cables shall be labelled identifying the associated equipment connection.

7.1.9 The Contractor shall neatly train and organize all cables. No cables shall be installed with a radius less than the manufacturer's minimum recommended bending radius.

8. QUALITY ASSURANCE

The Owner may conduct independent testing of the Ethernet Switches supplied to verify their interoperability with other Ethernet switches already owned.

9. MEASUREMENT FOR PAYMENT

Measurement for payment of the number of Ethernet switches is by Plan Quantity, as may be revised by Adjusted Plan Quantity.

The unit of payment is each.

10. BASIS OF PAYMENT

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment and Materials required to do the work and the production of all drawings, text and test results.

VARIABLE MESSAGE SIGNS -RGB Medium Item No.
VARIABLE MESSAGE SIGNS – RGB Large Item No.

Special Provision No. 685S01M

February 2016

1. SCOPE

This Special Provision covers the requirements for the design, installation and testing of colour full matrix variable message signs (VMS), and all associated equipment.

2. REFERENCES

This Special Provision refers to the following standards, specifications or publications:

Ontario Provincial Standard Specifications, Construction:

OPSS 609 Grounding
OPSS 915 Construction Specification for Sign Support Structures

Ontario Ministry of Transportation Publications:

Designated Sources of Material (DSM)

CSA Standards:

S6-14 Canadian Highway Bridge Design Code
C22.2 No. 65-03 Wire Connectors
C22.2 No.75-M1983 Thermoplastic-Insulated Wires and Cables
C22.2 No. 35-M1987 Extra-Low-Voltage Control Circuit Cables, Low-Energy Control Cable, and
Extra-Low-Voltage Control Cable
Electrical Bulletin No. 561A Electrical Insulation Tapes

Electronic Industries Alliance / Telecommunications Industry Association:

TIA/EIA-568-B Commercial Building Wiring Standard

Institute of Electrical and Electronics Engineers:

IEEE 518 Guide for the Installation of Electrical Equipment to Minimize Electrical Noise; Inputs
to Controllers from External Sources
IEEE 802.3 IEEE Standard for Information technology - Telecommunications and information
exchange between systems - Local and metropolitan area networks - Specific
requirements Part 3: Carrier Sense Multiple Access with Collision Detection
(CSMA/CD) Access Method and Physical Layer Specifications

International Organisation for Standardization:

ISO/IEC 17025 General Requirements for Competence of Testing and Calibration Laboratories –
Standards Council of Canada

National Electrical Manufacturers Association (NEMA):

NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum) - NEMA 3R
NEMA TS 4-2005 Hardware Standards for Dynamic Message Signs (DMS) with NTCIP Requirements

Others:

Ontario Electrical Safety Code

3. DEFINITIONS

For the purpose of this Special Provision, the following definitions apply:

Cone of Vision: means the geometric figure (cone) used to define the area in which a message on a sign can be legibly viewed. It is measured in degrees. It is twice the angle from the axis of the pixel to the 50% brightness point on an LED display. The cone of vision type classification shall be as defined within NEMA standard TS4 - 2005:

Type 'b' – Horizontal angle $\pm 70^\circ$
 Vertical angle $\pm 35^\circ$

Type 'e' – Horizontal angle $\pm 60^\circ$
 Vertical angle $\pm 45^\circ$

Display Module: means a matrix of pixels. A matrix of display modules are used to make up the display area of the sign face. A display module is typically a size that can be managed by maintenance staff when display modules need to be replaced.

ITS: means Intelligent Transportation Systems

MTBF: means Mean Time Between Failures.

Pixel: means an assembly of LEDs that collectively form an image-forming unit.

VMS: means Variable Message Sign that includes support elements, sign case, display elements, photocell sensor, controller function, and all other associated mechanisms and equipment required to form an operational display.

4. DESIGN AND SUBMISSION REQUIREMENTS

4.1 Design Requirements

4.1.1 VMS Design

4.1.1.1 The structural design for the sign case, including the load on the sign face and mounting hardware, shall comply with all relevant requirements of CAN/CSA-S6.

4.1.1.2 Design of the variable message sign with all internal components shall sustain the galloping, vortex shedding, natural wind gust and truck-induced wind gust loading based on the appropriate design standards.

4.1.1.3 Design of the VMS shall meet all appropriate ice loading design standards.

4.1.1.4 The structural design of the sign and the associated mounting, undertaken by the Contractor, shall be compatible with the design of the sign support structure. The sign case shall be secured to the mounting structure as shown in the Contract Drawings.

4.1.1.6 All structural design components (including all mass calculations) shall have the design attested to by an Engineer.

4.2 Submission Requirements

4.2.1 Shop Drawings

The Contractor shall submit all designs, drawings and details to the Contract Administrator for review. The Contractor shall submit shop drawings for the following:

- a) Sign case and sign face as related to Galaxy GS6 15.85MM RGB display for the medium size of 100x100 lines x columns with nominal sign dimension of 1.74 x 1.67 x 0.13m, with a sign weight of 103kg, and maximum power of 1035w electrical demand.
- b) Sign case and sign face as related to Galaxy GS6 15.85MM RGB display for the large size of 100x150 lines x columns with nominal sign dimension of 1.74 x 12.46 x 0.13m, with a sign weight of 152kg, and maximum power of 1530w electrical demand.

5.2 Sign Case

5.2.1 The sign case shall be constructed of aluminum alloy or other approved non-ferrous, durable materials. The sign case shall provide the required protection and mechanical strength for the application.

5.2.2 The Sign case shall be designed to conform to the requirements of NEMA 3R outdoor enclosures.

5.2.7 All structural hardware components shall be stainless steel unless otherwise specified. Nylon stop nuts shall be used. The hardware components shall prevent galvanic action, corrosion, and loosening under the conditions of the highway environment. All fasteners of less than 3 mm diameter shall use Robertson heads and all larger fasteners shall use hex heads.

5.2.8 The sign case seams shall be continuous welded. Seams shall be welded with gas metal arc (MIG) or gas tungsten arc (TIG) process using bare aluminum welding electrodes. Spot welding shall not be used. Corrosion protection shall be provided between dissimilar metals.

5.2.9 The sign shall be supplied with a minimum of two (2) lifting eyes positions and optionally detachable lifting eyes to facilitate lifting of the sign without damage.

5.3 Sign Face

5.3.1 The sign face shall be protected by weather tight, dust proof, non-glare polycarbonate sheets. The polycarbonate sheeting shall be secured to the sign case as recommended by the manufacturer of the polycarbonate sheet and shall be designed with appropriate methods to withstand all applicable loads as required by CAN/CSA-S6. An aperture mask may be provided in front of the polycarbonate sheets and shall be sized and positioned to accommodate the luminance and colour output requirements of the sign.

5.3.3 Suitable segments and/or measures shall be provided to allow for the expansion and Contraction of the polycarbonate sheets. They shall be positioned, aligned and sized such that they do not block the pixels.

5.3.4 The sign case shall be designed to allow cleaning of the internal surface of the polycarbonate sheets.

5.4 Sign Display Matrix

5.4.1 The display shall be full matrix, as shown in the Contract Drawings.

5.5 Sign Display

5.5.1 General Display Properties

5.5.1.1 The sign display shall be light emitting type employing light emitting diode (LED) technology.

5.5.1.8 Failure of a pixel or display module shall not cause failure of any other pixel or module. Failure of LEDs for a single colour within a pixel shall be deemed a pixel failure.

5.5.1.9 When pixels are operating in a pulse mode, no noticeable light flicker shall be visible by a human eye. The frequency of the pulse mode shall be minimum 90 Hz.

5.5.1.10 The sign display for all colours individually and combination of colours shall be clearly legible from a distance of between 25 m and 80 m under normal plaza operating speeds from any part of the approaching lanes including the shoulders.

5.5.1.11 The sign display for all colours individually and combination of colours shall be visible from a distance of 120 m in all ambient light conditions.

5.5.1.12 The sign face may be set at an angle of 3° (degrees) from vertical if needed to ensure visibility to distances outlined above.

5.5.2 Display Module

5.5.2.1 Each display module shall be sized to be easily handled for maintenance operations and be made up of multiple pixels arranged in regular horizontal rows and vertical columns with pixel centres equivalently spaced.

5.5.2.2 Each display module shall be mounted and secured such that maintenance staff can easily remove the display module. All display modules within a single sign shall be the same size.

5.5.3 Pixels

5.5.3.1 The pixels shall be made up of a mix of the primary colour - Red, Green and Blue – LEDs, or tricolour assemblies. A nominal 16mm pixel pitch shall be used.

5.5.4 LEDs

5.5.4.1 The Contractor shall choose the LED technology for each LED colour such that the desired luminance intensities, chromaticity limits and de-rated LED driving requirements are achieved

while satisfying the end life and mean time between failures (MTBF) specified to 100,000 hours of operation.

5.5.5 Display Font

The sign shall be programmed to use fonts compatible with those already in use on the site.

5.6 Sign Photosensor System

The sign shall have photovoltaic sensor(s). If aimable, they shall be aimed per vendors instructions.

5.7 Sign Environmental System

5.7.1 The sign enclosure and the equipment housed within shall be protected from moisture, rain, snow, sun radiation, dust, dirt and salt corrosion found in a highway environment.

5.7.2 A heating system and thermal insulation shall be provided, if required, to prevent adverse effect on the equipment due to condensation.

5.7.3 A forced ventilation system shall be provided, if required, to mitigate the effects of dust ingress and for providing air movement, thermal cooling, and thermal equalization to mitigate the accumulation of condensation and formation of “hot spots”. All forced intake air shall be filtered.

5.7.6 An adequate quantity of temperature sensors shall be provided inside the sign case with associated temperature monitoring functions to prevent damage of the components due to build-up of excessive heat.

5.8 Sign Grounding Materials

Grounding wire and connectors shall meet the requirements of OPSS 609.

5.9 Sign Driving Circuitry

5.9.1 Driver boards shall be mounted integrally with the display module, and shall be dynamically re-addressable to allow them to be moved around at end of sign life to stop gap manage failures.

5.10 Sign Mounting Hardware

5.10.1 All assemblies within the sign case shall be mounted using shock, vibration and weather resistant hardware.

5.10.2 The sign structure shall be secured to the sign support structure as shown in the Contract Drawings.

5.11 VMS Controller

5.11.1 General

5.11.1.1 The VMS controller shall support the NTCIP functionality and protocols as specified elsewhere in the Contract Documents. Full and exhaustive compliance testing of the NTCIP protocols and

functionality shall be required. The sign may also be controlled using the vendor's native control protocols.

5.11.1.2 Ethernet

5.11.1.2.1 The controller shall be provided with one IEEE 802.3u 10/100Base-TX Ethernet port.

5.11.1.2.2 The Ethernet port shall have a RJ-45 female connector. The port shall meet Category 5 specifications and shall be compliant with EIA/TIA-568-B standard pin out.

5.12.7 Control of Sign Luminance

5.12.7.1 The controller shall provide means to change the brightness of the display matrix manually or automatically.

5.12.7.2 In the case of a critical photosensor system failure, the light output of the sign display elements shall be defaulted to the night range setting. Failure notification of photosensor failure, both locally and at central, shall, if the sensor is not a single unit, indicate which photosensor has failed.

5.13.8 Controller Link

The Daktronics software for the VMS control already exists in use on this site. The Ethernet communication system provided by other Contract Items provides the normal communication linkage. Diagnostic software, if not already in Owners possession will be provided to facilitate local controller cabinet diagnostic operation.

5.13.8.1 Sign to Controller Interconnect Wiring

5.13.8.2 All interconnecting cables between the controller and the sign shall be made using Cat 5 Ethernet wiring rated for installation in wet service.

5.13.8.3 The premises wiring shall match interface requirements, and either cabinet end patch panel or a short equipment jumper shall be used to connect to the Ethernet switch and sign controller port.

6. EQUIPMENT – Not Used

7. CONSTRUCTION

7.1 Timing of Work

7.1.1 The Contractor shall ensure that controller cabinet Ethernet switches are connected and functioning before installing the variable message signs.

7.1.2 All installation work shall be carried during permitted times for lane closures as specified elsewhere in the Contract.

7.1.3 The Contractor shall coordinate communication and central software configurations with the Owner. At least one month notice shall be provided by the Contractor to allow for any configuration work required by the Owner.

7.2 Sign Installation

7.2.1 The requirements of OPSS 915 shall apply to this work.

7.2.2 All mechanical hardware for initial attachment shall be attached and secured prior to the reopening of lanes to traffic. Attachment of all hardware shall be completed prior to the release of crane cables.

7.3 Installation of Sign to Controller Cabinet Cables

7.3.1 The Contractor shall complete all wiring between the VMS sign case and controller cabinet. The interconnect power and communications cables shall be installed in liquid tight conduit between the nipples on the sign case and the ducting system. The interconnecting cables shall use the ducting system attached to sign support beams or structures, and shall be installed in continuous, unspliced lengths between the sign case and the controller cabinet. Cables and connectors shall not be stressed during or after installation.

7.3.2 All Ethernet control cables shall be properly terminated on industry standard termination panels within the sign case and field cabinet.

7.3.3 All electrical installations shall meet the requirements of Ontario Electrical Safety Code.

8. QUALITY ASSURANCE

The Owner or Contract Administrator shall be provided the opportunity to perform quality assurance testing including, but not be limited to, the following:

- a) Quality inspection of all fabricated items
- b) Testing on site with a field test computer (locally).

9. MEASUREMENT FOR PAYMENT

Measurement for payment of the number of variable message signs is by Plan Quantity.

The unit of measurement is each.

10. BASIS OF PAYMENT

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment and Materials required to do the work including manufacturing, delivery, installation, testing and the production of all drawings, text and test results.

INTERMEDIATE SIGNS, GROUND MOUNTED, NEW - Item No.
INTERMEDIATE SIGNS, RELOCATION - Item No.
INTERMEDIATE SIGNS, REMOVAL - Item No.

Special Provision No. 709S01M

Jan 2024

Amendment to OPSS 709, November 2018 - Permanent Intermediate Signs and Support System

709.01 SCOPE

Section 709.01 of OPSS 709 is deleted in its entirety and replaced by the following:

This specification covers the requirements for the installation, relocation and removal of permanent intermediate signs and support systems

709.02 REFERENCES

Section 709.02 of OPSS 709 is amended by the addition of the following:

Ontario Provincial Standard Specifications, Material:

OPSS 904 Concrete Structures
OPSS 1350 Concrete - Materials and Production

ASTM International

B 209M-07 Aluminum and Aluminum Alloy Sheet and Plate, Metric
B 221M-07 Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

709.03 DEFINITIONS

The definitions of the following terms in Section 709.03 of OPSS 709 are deleted in their entirety and replaced by the following:

Intermediate Sign Assembly means one or more plywood and aluminum extruded sign boards with a width up to 4.2 m and height up to 3.0 m whereas total sign area shall not be greater than 7.2 m² mounted on a two metal posts breakaway sign support system with specified sign hardware, or mounted to a concrete structure, or to an overhead sign truss.

Sign Support System means a steel post of specified dimensions, hardware, and material embedded vertically into the ground for mounting sign boards at a specified height above the roadway and ground. The system shall consist of a double post configuration.

709.05 MATERIALS

The first paragraph in Subsection 709.05.02 of OPSS 709 is deleted in its entirety and replaced by the following:

All supplied metal posts, bolts, washers, nuts, keeper plates, hinge sockets, stainless steel tubes, pipe sleeves, slip base including plates, anchor stub and sign clamps shall be according to the manufacturer's specifications and as specified in the Contract Documents.

Subsection 709.05 of OPSS 709 is further amended by the addition of the following clauses:

709.05.04 Aluminum

Extruded aluminum tubing shall be 6061-T6 alloy according to ASTM B 221M.

Aluminum sheet and plate shall be 6061-T6 alloy according to ASTM B 209M.

709.05.05 Concrete

Concrete shall have a nominal minimum 28-Day compressive strength as specified in the Contract Documents and shall be according to OPSS 1350.

A superplasticizer shall be used to attain a slump of 150 mm ± 30 mm.

709.07 CONSTRUCTION

709.07.01 General

Subsection 709.07.01 is amended by the addition of the following:

When an intermediate sign support is specified in the Contract Documents, the Contractor has the option of using one of the following systems:

- a) Slip Safe Supreme
- b) Highway Gator

Section 709.05 of OPSS 709 is amended by the addition of the following subsection:

Removed signs shall not be obliterated and shall be handed over to the Owner at their nominated on-site storage location. The Owner shall be responsible to either store them or obliterate them.

Section 709.07 of OPSS 709 is amended by the addition of the following subsection:

709.07.07 Concrete

Concrete shall be used according to OPSS 904.