**Structural Specifications**

Structural Specifications – General

Abbreviations

When the following abbreviations are used in the Structural Specifications, they shall have the following meanings:

ACI American Concrete Institute

AISI American Iron and Steel Institute

ASTM American Society for Testing and Materials

CAN/CSA Canadian Standards Association

DSM Designated Sources for Materials

EVA Ethylene-Vinyl Acetate

FOS Filtration Opening Size

L Low Carbon

LN Low Carbon, Nitrogen Enhanced

MTO Ministry of Transportation Ontario

OPSS Ontario Provincial Standard Specifications

OPSS.MUNI Ontario Provincial Standard Specifications - Municipal

QVE Quality Verification Engineer

UNS Unified Numbering System

Structural Specifications – Items

Item S001 Earth Excavation for Structure

The above item shall be completed in accordance with OPSS.MUNI 902 (Nov 2021) as amended by the following:

**902.04.02.02 Milestone Inspections** is deleted in its entirety and replaced with the following:

**902.04.02.02 Milestone Inspections**

The Contractor shall ensure that the Owner witnesses the following interim inspections of the work:

1. Dewatering of excavation for structure
2. Completion of excavation for foundation
3. Excavation for backfill and frost tapers
4. Backfilling

The next operation shall not proceed until the Owner has examined the excavation and provided approval in writing to perform subsequent work.

**902.07.05.02 Excavation for Foundations** is amended by the addition of the following:

The Contractor shall coordinate with the Owner’s geotechnical Professional Engineer to carry out an inspection of the structure foundation excavation to confirm that the Site conditions revealed are consistent with the design assumptions and to ensure that the geotechnical aspects of the work are being carried out as intended.

If, after excavating to the specified elevations, the material encountered proves to be unacceptable to the Owner, the Contractor shall perform additional excavation as directed by the Owner; the cost of which is included in the unit price for this item.

The Contractor shall dispose of all excavated materials which are unsuitable for, or in excess of, the fill requirements under this Contract, at a location arranged for by the Contractor at its own expense and to the satisfaction of the Owner. Unless specified otherwise in the Contract Documents, all surplus or unsuitable excavated materials shall become the property of the Contractor, and accordingly shall be disposed of outside of the Contract limits at no additional cost to the Owner. The Contractor shall obtain all necessary written approvals from the appropriate landowners and various municipal agencies for the disposal of such materials as set out in OPSS.MUNI 180 (Nov 2021).

Stockpiling materials on Site is not permitted. All materials which are excavated or removed as part of the work of this item shall be immediately transported to an off-Site storage location arranged for by the Contractor, or to a disposal site.

Item S002 Granular Backfill to Structure

The above item shall be completed in accordance with OPSS.MUNI 902 (Nov 2021) as amended by the following:

**902.07.06.01 General** is amended by the addition of the following:

The Contractor shall place granular backfill in the location(s) as shown on the Drawings. Where the Contractor has excavated beyond these limits, or has failed to place earth fill up to the lower limits, it shall supply, place and compact, to the satisfaction of the Owner, either earth or granular material, whichever the Owner shall direct, as required to fill the resulting excess volume. All costs of supplying and placing such additional materials shall be deemed to be included in the Contract Price.

The Contractor shall use hand operated vibratory type compaction equipment only for compaction of backfill within 1.2 metres of the structure. Hand operated vibratory equipment shall have an energy output no greater than 6.7 kilowatts.

The backfill material shall be placed in layers not exceeding 200 mm in thickness before compaction.

Item S003 Dewatering Structure Excavation

The above item shall be completed in accordance with OPSS.MUNI 902 (Nov 2021) as amended by the following:

**902.04.02.02 Milestone Inspections** is deleted in its entirety and replaced with the following:

**902.04.02.02 Milestone Inspections**

The Contractor shall ensure that the Owner witnesses the following interim inspections of the work:

1. Dewatering of excavation for structure
2. Completion of excavation for foundation
3. Excavation for backfill and frost tapers
4. Backfilling

The next operation shall not proceed until the Owner has examined the excavation and provided approval in writing to perform subsequent work.

**902.07.04 Dewatering Structure Excavation** is amended by the addition of the following:

After the dewatering, the excavation shall be inspected and accepted by the Owner prior to construction of the footing. The Contractor shall not proceed with subsequent work until the Owner has given permission in writing.

**902.10.02 Dewatering Structure Excavations - Item** is deleted in its entirety and replaced with the following:

**902.10.02 Dewatering Structure Excavations - Item**

Payment shall be made at the lump sum price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified. Payment shall be made in one (1) lump sum payment upon completion of all work under this item to the satisfaction of the Owner.

Item S004 Concrete in Structure

Item S005 Concrete in Substructure

Item S006 Concrete in Substructure and Retaining Walls

Item S007 Concrete in Deck

Item S008 Concrete in Barrier Walls

Item S009 Concrete in Parapet Walls

Item S010 Concrete in Approach Slab

Item S011 Concrete in Toe Wall

The above item(s) shall be completed in accordance with OPSS.MUNI 904 (Nov 2023) as amended by the following:

**904.01 Scope** is amended by the addition of the following:

All cold weather concreting and hot weather concreting is deemed to be included in the above item(s) and no additional payment shall be made for this work.

**904.05 Materials** is amended by the addition of the following:

Clear stone for drainage shall be 19 mm clear stone in accordance with OPSS.MUNI 1004 (Nov 2021).

Geotextile filter fabric shall be Class 1, non-woven with a FOS between 75 μm and 150 μm conforming to OPSS.MUNI 1860 (Nov 2018).

EVA foam shall conform to the requirements of ASTM D-1056.

Unshrinkable fill shall be in accordance with OPSS.MUNI 1359 (Nov 2016).

904.09.02 Actual Measurement is amended by deleting subsection 904.09.02.01 in its entirety and replacing it with the following:

904.09.02.01 Concrete in Structure

 Concrete in Substructure

 Concrete in Substructure and Retaining Walls

 Concrete in Deck

 Concrete in Barrier Walls

 Concrete in Parapet Walls

 Concrete in Approach Slab

 Concrete in Toe Wall

Measurement of concrete shall be by volume in cubic metres (m3).

Measurement shall be made within the designated limits of the work.

Item S012 Dowels into Concrete

The above item shall be completed in accordance with OPSS.MUNI 904 (Nov 2023) as amended by the following:

**904.03 Definitions** is amended by the addition of the following:

**Dowel Adhesive** means an adhesive used to secure the dowel in concrete.

**Proof of Process Installation** means the procedure by which the Contractor demonstrates to the Owner that the dowel installation materials and methods will produce a Product that meets the pull test requirements of the Contract Documents.

**Quality Verification Engineer (QVE)** means a Professional Engineer retained by the Contractor, and who is otherwise acceptable to the Owner, to confirm that the specified working drawings and components of the Work as indicated in the Contract are in general conformance with the Contract Documents.

904.04 Design and Submission Requirements is amended by the addition of the following:

904.04.01.06 Certificate of Conformance for Dowel Installation

Upon completion of the installation of metallic dowels, and prior to the placing of concrete, the Contractor shall submit to the Owner a Certificate of Conformance sealed, signed and dated by the QVE. The certificate shall state that the work has been carried out in general conformance with the Contract Documents.

**904.05.13 Dowels** is amended by the addition of the following:

Dowels shall be new, clean and free of deleterious material.

**904.05.14 Dowel Adhesive** is deleted in its entirety and replaced with the following:

904.05.14 Dowel Adhesive

Dowel adhesive shall be a material listed in the MTO’s DSM list. The Contractor shall select a material suitable for the application.

**904.07.05.03 Installation** is deleted in its entirety and replaced with the following:

904.07.05.03 Installation

The Contractor shall drill dowel holes to the required dimensions and depths as specified in the Contract Documents. Core drilling of the dowel holes is not permitted.

Holes that are started but not completed shall be cleaned and filled with a proprietary patching material from the MTO’s DSM list.

The Contractor’s installation and removal operations shall not cause spalling, cracking or other damage to the surrounding concrete. Any damage caused by the Contractor’s operation shall be repaired in a manner acceptable to the Owner at no additional cost to the Owner.

Steel reinforcement and other existing embedments shall not be cut or damaged by the drilling process. Prior to drilling holes, the Contractor shall locate existing steel reinforcement, utility ducts, post tensioning hardware and any unsound concrete in the vicinity of the dowel locations. If any of these are encountered during the drilling operations, the Contractor shall notify the Owner immediately.

The Contractor shall prepare, clean and place dowel adhesive in the drill holes as per the adhesive manufacturer’s recommendations. The Contractor shall properly position dowels as specified in the Contract Documents. The dowel adhesive shall completely fill the drill hole once the dowel is installed. All excess adhesive shall be struck-off flush with the concrete surface and removed from the surrounding concrete surface area.

The Contractor shall maintain dowels in the proper position and protect them from being disturbed during the setting of the dowel adhesive and shall prevent the loss of dowel adhesive from the holes.

The Contractor shall allow five (5) Working Days for the Owner to carry out the testing.

The Contractor shall provide access to the dowels for testing and shall not install formwork or attach anything to the dowels (such as steel reinforcement or utility ducts) until the pull tests have been completed and the dowel lots are accepted into the Work.

**904.08.04.01 Acceptance of Dowels into Concrete** is deleted in its entirety and replaced with the following:

904.08.04.01 Acceptance of Dowels into Concrete

904.08.04.01.01 General

Installed dowels shall be accepted based on conformance to the visual acceptance criteria and pull testing criteria outlined below.

Dowels tested in-situ will be accepted on a lot basis.

All dowels, with the exception of dowels installed in the following applications, shall be subjected to in-situ pull testing for acceptance purposes:

* Concrete box culvert extensions
* Refacing of all structural elements (e.g. abutments, columns, wing walls, etc.) less than 2 m in height
* Widening of footings
* Concrete patches
* Concrete pavement repairs
* Slip-formed barrier walls

Proof of process installation shall be used in lieu of in-situ testing when the Owner determines that in-situ testing is not possible (e.g. confined spaces, restricted clearance for the test device, dowels too short to fit the testing device grips, etc.).

904.08.04.01.02 Visual Acceptance Criteria

Completed dowel installations shall be properly positioned as specified in the Contract Documents and shall be free of damage to the dowel and dowel coating. Excess dowel adhesive shall be struck off flush with the concrete surface and removed from the surrounding area.

904.08.04.01.03 Pull Testing Criteria

904.08.04.01.03.01 General

Pull testing will be carried out by the Owner according to the Pull Test Guide for Testing of Metallic Dowels, of Uncoated, Coated or Stainless Steel available from the MTO’s Materials Engineering and Research Office, Concrete Section. The Contractor may be present during the testing procedure.

An individual dowel shall not be subjected to more than one (1) pull test.

All spalling, cracking and other damage to the surrounding concrete caused by the Contractor’s installation or removal of dowels shall be repaired at the Contractor’s expense and in a manner acceptable to the Owner.

904.08.04.01.03.02 Dowel Load Duration Time

904.08.04.01.03.02.01 Dowels Embedded Less than, or Equal to, 200 mm

Dowels with an embedment depth less than, or equal to, 200 mm shall be considered acceptable when they can hold the load specified in Table 1 without any change in the load for 15 seconds.

904.08.04.01.03.02.02 Dowels Embedded Greater Than 200 mm

Dowels with an embedment depth greater than 200 mm shall be considered acceptable when they can hold the load specified in Table 1 without any change in the load for 60 seconds.

904.08.04.01.03.03 Lot Size - In-Situ Testing Only

A lot shall consist of no more than 200 dowels of the same type in a single stage. Where a single stage is less than 200, dowels of the same type the lot shall be the single lot.

904.08.04.01.03.04 In-Situ Pull Test Requirements

The Owner will randomly select 10 dowels in each lot for testing.

Any damage to the dowel coating shall be repaired by the Contractor in a manner acceptable to the Owner.

If two (2) or more dowels fail, the Owner will conduct additional pull testing on twenty (20) dowels in the lot. If two (2) or more dowels fail, the lot shall be deemed unacceptable and the lot shall be removed and replaced at the Contractor’s expense.

Replacement dowels shall be accepted by pull testing, or proof of process installation, as directed by the Owner.

Additional pull testing shall be at the Contractor’s expense as detailed in Section 10 – BASIS OF PAYMENT.

All testing shall be completed before concrete is placed.

904.08.04.01.03.04.01 Replacement of Failed Dowels

Any installed dowels that fail the pull test shall be removed and replaced by the Contractor at no additional cost to the Owner. In lieu of removal, dowels can be cut off flush with the concrete surface.

The Contractor shall install a new dowel in a location approved by the Owner.

904.08.04.01.03.05 Proof of Process Installation

The Owner will select the location(s) for proof of process installations in area(s) where the concrete and element are the same.

Dowels shall not be installed into the Work until the Owner has accepted the proof of process installation procedure.

An approved proof of process installation procedure for dowel types shall be valid for the Contract for 120 Days from the date of acceptance. After 120 Days, proof of process installation shall be repeated using the same method, materials, dowel type and process to re-qualify the proof of process installation procedure.

The Owner may, at any time, require re-qualification of the proof of process installation procedure. When a re-qualification process is required, and it has been deemed acceptable by the Owner, it shall be valid for 120 Days from the date of re-qualification.

The number of dowels required for each proof of process installation shall be five (5) dowels for each dowel type to be installed in the Work.

Straight bars may be installed for proof of process installation.

If any dowel fails, the proof of process installation shall be considered unacceptable. The Contractor shall not be permitted to install any of the dowel types in the Work until a successful proof of process installation procedure for the dowel type has been completed and accepted by the Owner.

Any installed dowels used for proof of process installation that fail the pull test shall be removed by the Contractor at no additional cost to the Owner. If directed by the Owner, the remaining dowels shall be removed by the Contractor at no additional cost to the Owner. Cutting off dowels flush with the concrete surface is permitted.

Upon the successful completion of a proof of process installation procedure, the Contractor will be permitted to install dowel types in the location(s) specified in the Contract Documents using the accepted installation procedure.

If the Contractor changes the accepted procedure for any dowel type from that used for the proof of process installation, the Contractor shall repeat the proof of process installation according to the changed procedures, prior to incorporating any dowel types into the Work.

Item S013 Reinforcing Steel Bar

Item S014 Stainless Steel Reinforcing Steel Bar

The above item(s) shall be completed in accordance with OPSS.MUNI 905 (Nov 2017) as amended by the following:

**905.04.01.02.01 Steel Reinforcement Working Drawings** is amended by the addition of the following:

As part of the work of the above item(s), at least fifteen (15) Working Days prior to placing reinforcement for any part of the Work, the Contractor shall prepare reinforcing bar schedules and detail drawings and submit them to the Owner for review. The Contractor shall supply mill test certificates for all reinforcing steel to be used on this Contract.

The locations, sizes and spacing of reinforcing steel and couplers are shown on the Drawings. Shop Drawings prepared by the Contractor shall indicate the bend radii, ACI or MTO bar configuration types, detail dimensions, quantities and weights. The Contractor shall submit four (4) copies of the schedules and drawings to the Owner for review a minimum of ten (10) Working Days prior to fabrication. Shop Drawings shall show the intended locations and details of splices.

**905.05.01 Steel Reinforcement** is amended by the addition of the following:

Stainless steel reinforcing bars shall be of a stainless steel type as specified in Table 1 below.

TABLE 1: Grade of Stainless Steel

|  |  |  |
| --- | --- | --- |
| **COMMON OR TRADE NAME** | **AISI TYPE** | **UNS DESIGNATION** |
| Type 316 LN | 316 LN | S31653 |
| Type 2205 Duplex | 2205 | S31803 |
| NOTES:1. Condition/Finish: stainless steel reinforcing bars and shapes shall be hot rolled and pickled, or hot rolled and descaled, to the required mechanical properties and dimensions. |

Stainless steel reinforcing bars shall be manufactured by a manufacturer listed under "Mills" in the MTO’s DSM list #9.65.76 "Reinforcing Steel, Stainless, Mills and Fabricators".

Stainless steel reinforcing bars shall be fabricated by a fabricator listed under "Fabricators" in the MTO’s DSM list #9.65.76 "Reinforcing Steel, Stainless, Mills and Fabricators".

**905.07.02 Reinforcing Steel Bars, Stainless Steel Reinforcing Bars, and Splice Bars** is amended by the addition of the following:

When requested by the Owner, the Contractor shall provide randomly selected samples of the steel reinforcement to the Owner for quality control purposes, at no additional cost to the Owner. The samples shall be tested to verify the chemical and mechanical properties in accordance with OPSS.MUNI 905. The Contractor shall replace all materials that fail to meet the specified requirements at no additional cost to the Owner.

Existing reinforcing bars may be bent up in order to facilitate the process of placing new reinforcing steel; however, bending of existing rebars shall only be done using equipment such as a “hickey”. Any loosening or cracking up of the concrete as a result of bending the rebar shall be removed and repaired by the Contractor at its own expense to the satisfaction of the Owner and in accordance with the concrete specification shown in the Drawings.

Tie wire used to tie stainless steel reinforcing bars shall be Type 316 LN or Type 316 L, stainless steel wire, 1.2 mm or 1.6 mm in diameter.

Bar chairs for supporting stainless steel reinforcing bars shall be non-metallic. Concrete chairs shall not be used to support stainless steel reinforcing bars.

Stainless steel reinforcing delivered and stored on Site shall be protected from damage and contamination. The bars shall be stored clear of the ground on timbers or other suitable protective cribbing spaced to prevent sags in the bundles.

Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles.

Stainless steel reinforcing bars shall be stored separately from reinforcing steel bars, with the bar tags maintained and clearly visible until ready for placing.

At the time that the concrete is placed, stainless steel reinforcing bars shall be free of mud, oil, other contaminants that could adversely affect bonding strength, and deposits of iron and non-stainless steels.

Stainless steel reinforcing, which is damaged or contaminated through the Contractor’s negligence, shall be replaced and/or cleaned at the Contractor’s expense.

**905.09.01 Actual Measurement** is amended by the addition of the following:

905.09.01.02 Reinforcing Steel Bars

 Stainless Steel Reinforcing Steel Bars

Measurement shall be by mass in tonnes (t).

Item S015 Mechanical Connectors

Item S016 Stainless Steel Mechanical Connectors

The above item(s) shall be completed in accordance with OPSS.MUNI 905 (Nov 2017) as amended by the following:

**905.01 Scope** is amended by the addition of the following:

The Contractor shall supply, fabricate, deliver and install reinforcing bars and stainless reinforcing bars with mechanical connectors and stainless mechanical steel connectors for all reinforcing steel and stainless steel reinforcing steel at construction joints in the portions of structures, as indicated on the Drawings. The splicer bars with couplers shall match each varying size of reinforcing steel bar as required.

**905.05.04.02 Reinforcing Steel Bars, Stainless Steel Reinforcing Bars** is amended by the addition of the following:

All mechanical couplers shall be supplied by an approved supplier listed in the MTO’s Designated Sources for Materials list #9.65.58 or #9.65.76.

Coupler assemblies shall consist of two (2), 410 MPa reinforcing steel threadbars and couplers as detailed on the Drawings.

Stainless steel mechanical connectors and splice bars shall be of a stainless steel type specified in Table 1 below.

TABLE 1: Grade of Stainless Steel

|  |  |  |
| --- | --- | --- |
| **COMMON OR TRADE NAME** | **AISI TYPE** | **UNS DESIGNATION** |
| Type 316 LN | 316 LN | S31653 |
| Type 2205 Duplex | 2205 | S31803 |
| NOTES:1. Condition/Finish: reinforcing stainless steel bars and shapes shall be hot rolled and pickled, or hot rolled and descaled, to the required mechanical properties and dimensions. |

**905.07.02.08 Mechanical Connections** is amended by the addition of the following:

The installation of the mechanical connectors and stainless mechanical steel connectors at the face of the formwork shall have clear access to allow for concrete to adequately fill all voids.

Item S017 Barrier Wall Railing

Item S018 Parapet Wall Railing

Item S019 Pedestrian Railing

Item S020 Bicycle Railing

The above item(s) shall be completed in accordance with OPSS.MUNI 908 (Nov 2022).

Item S021 Embedded Work in Structures

The above item shall be completed in accordance with OPSS.MUNI 913 (Nov 2017) as amended by the following:

**913.07 Construction** is amended by the addition of the following:

913.07.03 Acceptance of Embedded Works

The Contractor shall leave the embedded works exposed until written acceptance has been received from the Owner.

**913.10.01 Embedded Work in Structure – Item** is deleted in its entirety and replaced with the following:

913.10.01 Embedded Work in Structure – Item

Payment shall be made at the lump sum price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified. Payment shall be made in one (1) lump sum payment upon completion of all work under this item to the satisfaction of the Owner.

Item S022 Bridge Deck Waterproofing

Item S023 Membrane Reinforcement

Item S024 Form and Fill Grooves

Item S025 Deck Surface Preparation

Item S026 Modification of Deck Drains

The above item(s) shall be completed in accordance with OPSS.MUNI 914 (Nov 2014) as amended by the following:

**914.07.07 Form and Fill Grooves** is amended by the addition of the following to the first paragraph:

Forming and filling of grooves shall be performed within fourteen (14) Days of surface course asphalt placement at the location of each groove.

**914.07.08.01 Delivery of Samples** is deleted in its entirety and replaced with the following:

914.07.08.01 Delivery of Samples

Samples of the waterproofing membrane, waterproofing membrane reinforcement, joint sealing compound, tack coat and the protection board shall be delivered, when requested, to the Owner.

Item S027 Bearings

Item S028 Jacking of Superstructure

The above item(s) shall be completed in accordance with OPSS.MUNI 922 (Apr 2017) as amended by the following:

**922.03 Definitions** is amended by the addition of the following:

**Design Engineer** means a Professional Engineer with a minimum of five (5) years of relative bridge structural design experience or equivalent, retained by the Contractor, who produces the original design and working drawings.

**Design Checking Engineer** means a Professional Engineer with a minimum of seven (7) years of relative bridge structural design experience or equivalent, retained by the Contractor, who checks the original design and working drawings.

**922.04.01.01.01 General** is deleted in its entirety and replaced with the following:

922.04.01.01.01 General

The Contractor shall submit five (5) sets of bearing layout and installation drawings to the Owner at least fifteen (15) Working Days prior to commencement of bearing installation, for information purposes only. A Professional Engineer shall affix its seal and signature on the layout and installation drawings verifying that the drawings are consistent with the Contract Documents and sound engineering practices.

The Contractor shall have a copy of these drawings at the Site prior to and during Site installation of the bearings.

**922.04.01.02 Jacking** is deleted in its entirety and replaced with the following:

922.04.01.02 Jacking

The Contractor shall be responsible for the design of the jacking system.

When jacking of the superstructure is specified in the Contract Documents or is required due to the Contractor’s method of construction, the Contractor shall submit five (5) sets of the jacking (or jacking proposal) drawings to the Owner at least fifteen (15) Working Days prior to the commencement of jacking, for review.

The submission shall include the following, at a minimum:

1. Jacking methodology and sequence
2. Location, number, type and capacity of the jacks to be used
3. Description of the control system, complete with all design, schematics and equipment to be used
4. Location and material to be used for temporary blocking and shimming
5. Schematic showing the configuration of all jacks, stop valves, gauges, manifolds and hydraulic pumps
6. Current calibration certificates for all jacks and gauges
7. Full details of the temporary support system, including forces to be transmitted and the method of transferring the loads to the substructure or founding strata
8. Strengthening of the existing structure where necessary
9. Restrictions on traffic and construction traffic

All jacking drawings shall bear the seal and signature of a Professional Engineer verifying that the drawings are consistent with the Contract Documents and sound engineering practices. The Contractor shall maintain a copy of the signed and sealed jacking drawings at the Site during the jacking setup and operations.

Proposals shall bear the seals and signatures of the Design Engineer and the Design Checking Engineer.

Where the replacement of bearings is called for in the Contract Documents, the design shall take into account the possible difference in bearings size between the new and the original and ensure that the placement of the temporary supports does not interfere with the proper placing of bearings.

Where necessary, the design of temporary supports shall account for articulation of the superstructure.

The design shall account for the condition of the structure at the time of jacking. It shall take into account any deterioration and/or removals prior to, and during, the duration of the jacking and remedial work.

The Contractor shall engage the services of a specialist jacking Subcontractor to assist the Contractor in the jacking of the bridge. The specialist jacking Subcontractor shall have previous experience in the jacking of at least two (2) other bridges. The specialist jacking Subcontractor shall be licensed by the Association of Professional Engineers of Ontario.

The name of the specialist jacking Subcontractor should be identified in the Schedule of Subcontractors included in the Bid Form. A submission confirming the qualifications and experience of the Contractor’s proposed specialist jacking Subcontractor shall be provided to the Owner at the pre-construction meeting. The submission shall include the names and locations of the projects and the extent of involvement by the specialist jacking Subcontractor in each project.

Jacking shall be arranged in such a manner that the total lift and lifting force at each jack location can be individually monitored and controlled.

**922.04.01 Submission Requirements** is amended by the addition of the following:

922.04.01.03 Return of Submissions

Two (2) copies of each submission shall be returned as one of the following:

1. Stamped with the wording that allows for permission to construct. In this case, work can commence on receipt of the drawings by the Contractor.
2. Stamped with the wording that allows for permission to construct as noted. In this case, work can start on receipt of the drawings by the Contractor. The drawings shall be updated as noted and shall be sealed and signed by a Professional Engineer stating the drawings have been revised according to the noted comments.
3. Showing only required changes. In this case, the drawings shall be updated as required and the submission process repeated.

When another authority is involved with the Contract, all submissions shall be made at least twenty-five (25) Working Days prior to the commencement of work.

The Contractor shall have a copy of the stamped updated or accepted drawings at the Site during any jacking operation.

**922.05 Materials** is amended by the addition of the following:

922.05.03 Structural Steel

All structural steel shall be in accordance with CAN/CSA G40.20/G40.21.

922.05.04 High Strength Bolts, Nuts and Washers

High strength bolts shall be in accordance with ASTM A 325M.

High strength nuts and hardened washers shall be suitable for use with the types of bolts specified and shall be in accordance with ASTM A 563M and ASTM F 436M.

The nuts, bolts and washers shall be shipped together as an assembly from the manufacturer.

922.05.05 Mechanical and/or Adhesive Anchors

Mechanical and/or adhesive anchors shall be suitable for dynamic loads and shall be installed according to the manufacturer’s recommendations.

**922.07.02 Bearing Seats** is amended by the addition of the following:

When elastomeric bearings are replaced on an existing structure, the top and bottom of the bearings shall be in full contact with the structure. If any of the bearings are not properly seated, remedial work shall be undertaken until such time that the bearings have full and uniform contact. The expense of such remedial work shall be borne by the Contractor.

**922.07.08 Jacking** is amended by the addition of the following:

922.07.08.01 Pre-Construction Survey

Prior to the start of any work related to the jacking operation, the Contractor shall carry out field measurements of all components of the existing structure that might impact the installation of the temporary supports and ensure that the jacking drawings and calculations are adjusted accordingly. The Design Engineer and the Design Checking Engineer shall determine whether any adjustments based on field measurements will have an impact on the bridge structure. If it is determined that the adjustments will have an impact on the bridge structure, the jacking drawings and calculations shall be submitted to the Owner along with a request for approval.

The Contractor shall also carry out a survey to establish the elevations of the existing bridge deck along the existing bridge deck joints and the elevations of the underside of deck or girders at bearing locations prior to jacking the structure. The survey results shall be submitted to the Owner, prior to jacking, for information purposes only.

The Contractor shall ensure that the existing elevations of the bridge deck, measured before the jacking operation, or the required elevations specified in the Contract Documents are matched after the bearings are replaced and the jacking operation is completed. If the elevations of the bridge deck after the completion of the jacking operation differ from the elevations obtained in the pre-construction survey or those specified on the Contract Documents, the Contractor shall reinstate the bridge deck and girders to the original elevations, or to the new elevations specified in the Contract Documents, as required.

922.07.08.02 Jacking Points and Loads

Jacks shall only be placed at the jacking points indicated in the Contract Documents. The Contractor shall use jacks with a rated capacity of no less than 200% of the reaction loads specified on the Drawings. Shims and blocking used to support the jacks shall also be designed for 200% of the reaction load specified on the Drawings.

922.07.08.03 Jacking Operations

Prior to jacking, the Contractor shall ensure that all existing expansion joints are free to move vertically. Bolts securing the handrail posts to the parapet walls, if present, shall be loosened to permit jacking without damaging the handrails.

The Contractor shall inform the Owner in writing a minimum of three (3) Working Days prior to the commencement of the jacking operations.

Jacking operations shall be carried out under the direct supervision of a Professional Engineer. Prior to the commencement of jacking operations, the Contractor shall demonstrate the accuracy of all transducer read-outs, relative to manual measurements.

The lifting or lowering of the entire width of the structure shall be carried out in one (1) uniform and synchronized operation. Jacks shall be interconnected through a manifold system to provide a uniform lift at all jacking locations.

At no time during the lifting or lowering of the structure shall the difference between any two (2) jacking points be greater than 3 mm as measured at the center line of the bearings.

The lift at each jacking point shall be monitored continuously during the jacking operation. The maximum lift for all jacking points shall be 3 mm above the final jacking elevation, unless otherwise specified in the Contract Documents.

922.07.08.04 Temporary Supports

Unless specified elsewhere in the Contract Documents, traffic shall not be permitted on, or below, a bridge undergoing jacking. The bridge superstructure shall not be supported on hydraulic jacks for a period longer than that permitted on the jacking drawings, and in no case longer than twelve (12) hours.

When the required lift for all jacking points has been achieved and the bearings have been released, temporary supports such as blocking and shimming shall be placed to support the bridge. The jacks shall then be lowered in one (1) synchronized operation while maintaining the maximum allowable difference between any two (2) jacking points of 3 mm.

The jacks loads shall be transferred to structural blocks and then the jacks released prior to the commencement of bearing seat reconstruction or bearing replacement work.

The superstructure shall not be left on the blocks and shims for more than fifteen (15) Days or as specified otherwise in the Contract Documents.

922.07.08.05 Post-Jacking Survey

Immediately after the structure has been jacked, and prior to the bearing seats being reconstructed, the underside of the superstructure that will be in contact with the new bearings shall be surveyed. The survey shall include the four (4) corners in contact with the bearings and at least one (1) point in the middle. Data from the survey shall be forwarded to the Owner to determine if adjustments to the design are required.

922.07.08.06 Lowering of the Superstructure

Where jacking of the superstructure is accompanied by rehabilitation of bearing seats, the superstructure may be jacked again for the removal of the structural blocks, but only after the concrete in the bearing seats has reached 75% of its design strength. The jacks shall then be lowered in one (1) synchronized operation, while maintaining the maximum allowable difference between any two (2) jacking points of 3 mm, and the superstructure shall be released onto the bearings.

922.07.08.07 Bearing Contact

The bearings shall have uniform and full contact at the top and bottom. If any of the bearings are not properly seated, the bridge shall be jacked up again and remedial work performed, as directed by a Professional Engineer who is otherwise acceptable to the Owner, until all of the bearings have full contact and the superstructure is uniformly supported. Details of proposed methodology, equipment and materials for the remedial work shall be submitted to the Owner for approval prior to carrying out the remedial work.

922.07.08.08 Reinstatement of Structure and Components

Anchor holes shall be filled with non-shrink grout finished flush with, and matching the colour of, the surrounding concrete. No metal components of the jacking system shall be embedded permanently in concrete with less than 40 mm of cover.

All expansion joint and handrail components removed or loosened to facilitate jacking shall be reinstated.

922.07.08.09 Certificate of Conformance upon Completion of the Work

A completed Certificate of Conformance shall be submitted to the Owner upon completion of the Work.

**922.10 Basis of Payment** is amended by the addition of the following:

922.10.02 Jacking of Superstructure - Item

Payment shall be made at the lump sum price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified. Payment will be made as follows:

* 25% of the lump sum price upon satisfactory installation of the jacking system
* 75% of the lump sum price upon satisfactory completion of all jacking work

The total amount paid under this item shall not exceed 100% of the lump sum price for this item.

Item S029 Scarifying

Item S030 Access to Work Area, Work Platform and Scaffolding

Item S031 Concrete Removal – Complete Deck

Item S032 Concrete Removal – Deck Joint Assemblies

Item S033 Concrete Removal – Full Depth

Item S034 Concrete Removal – Partial Depth Type A

Item S035 Concrete Removal – Partial Depth Type B

Item S036 Concrete Removal – Partial Depth Type C

Item S037 Concrete Removal – Structural Component

The above item(s) shall be completed in accordance with OPSS.MUNI 928 (Apr 2019) as amended by the following:

**928.07.07.01 General** is amended by the addition of the following:

Extreme care must be taken to prevent overbreaking the concrete beyond the limits of removal. Any overbreak shall be made good by the Contractor at its own expense to the satisfaction of the Owner.

The Contractor shall ensure that no debris from the removal operation drops below the level of the removal area or in a hazardous manner. The containment system installed shall have a heavy grade polyethylene sheet to retain all cutting water and fine debris. No water resulting from the removal operations shall be permitted to enter the watercourse, drainage ditches and sewers.

**928.10.02** is amended by deleting the following:

Access to Work Area, Work Platform and Scaffolding – Item

**928.10 Basis of Payment** is amended by the addition of the following:

928.10.03 Access to Work Area, Work Platform and Scaffolding - Item

Payment shall be made at the lump sum price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified. Payment will be made as follows:

* 50% upon satisfactory installation of the access, work platform and scaffolding
* 50% upon satisfactory removal of access, work platform and scaffolding

The total amount paid under this item shall not exceed 100% of the lump sum price for this item.

Item S038 Abrasive Blast Cleaning for Overlays

Item S039 Abrasive Blast Cleaning of Reinforcing Steel

Item S040 Abrasive Blast Cleaning of Structural Streel in Contact with Concrete

The above item(s) shall be completed in accordance with OPSS.MUNI 929 (Nov 2018).

Item S041 Place Concrete Overlay

Item S042 Place Latex Modified Concrete Overlay

Item S043 Finish and Cure Concrete Overlay

Item S044 Finish and Cure Latex Modified Concrete Overlay

Item S045 Concrete Patches, Formed Surface

Item S046 Concrete Patches, Unformed Surfaces

Item S047 Latex Modified Mortar Patches

Item S048 Concrete Refacing

The above item(s) shall be completed in accordance with OPSS.MUNI 930 (Nov 2014) as amended by the following:

**930.05 Materials** is amended by the addition of the following:

930.05.14 Proprietary Products

Proprietary products may be used for patch repair less than 300 mm x 300 mm. If the proprietary products are used for patch repair, the Contractor shall provide the Owner with four (4) copies of the manufacturer's specifications for placement of the patch material(s) at least five (5) Working Days prior to the placement of the material, for Owner’s review and approval.

The proprietary product used for the concrete repairs shall be from the MTO’s Designated Sources for Materials list for Concrete Patching Materials. Mixing, placing and curing of the proprietary product shall be according to the manufacturer’s instructions, including the temperature restriction for placement.

Repair mortar must be proportioned in accordance to the manufacturer’s recommendations. Mix full batches only; partial batches are not permitted. The repair material shall attain a minimum compressive strength of 50 MPa on 28 Days strength.

**930.09.02.05.02 By Volume** is amended by the addition of the following:

The volume shall be calculated by multiplying each area to be repaired by the average depth. Depths shall be taken on a grid system to best describe the profile at the particular area. If the level of the finished patch is above the original concrete surface, as may be required to achieve 50 mm cover over reinforcing steel, the depth shall be adjusted by adding the difference between the original concrete and the completed patch surfaces.

**930.10.01 Finish and Cure Concrete Overlay** and **Finish and Cure Latex Modified Concrete Overlay – Items** are deleted in its entirety and replaced with the following:

930.10.01 Finish and Cure Concrete Overlay – Item

 Finish and Cure Latex Modified Concrete Overlay – Item

Payment shall be made at the lump sum price and shall be full compensation for all labour, equipment and material required to complete the work as specified. Payment shall be made in one (1) lump sum payment once the overlay has been cured to the satisfaction of the Owner.

Item S049 Crack Injection

The above item shall be completed in accordance with OPSS.MUNI 932 (Nov 2020).

Item S050 Glass Fibre Reinforced Polymer Reinforcing Bar

The above item shall be completed in accordance with OPSS.MUNI 950 (Nov 2017) as amended by the following:

**950.10.01 Glass Fibre Reinforced Polymer Reinforcing Bar – Item** is deleted in its entirety and replaced with the following:

950.10.01 Glass Fibre Reinforced Polymer Reinforcing Bar – Item

Payment shall be made at the lump sum price and shall be full compensation for all labour, equipment and material required to complete the work as specified. Payment shall be made based on the Owner’s estimate of the amount of glass fibre reinforced polymer reinforcing bar installed. The total amount paid under this item shall not exceed 100% of the lump sum price for this item.

Rejected glass fibre reinforced polymer lots or bars shall be replaced at no additional cost to the Owner.