Reference Type/Code	Existing Version	New Version	Implemented In CPS	New, Revised (Rev), Cancelled (Can), Reissued/Reinstated (Rei)	Initiator
Ontario Provincial Standard Specifications (OPSSs)					
610	November 2016	April 2025	TBD	Rev: Construction Specification for Removal of Electrical Equipment and Materials is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed.	Mike Pearsall
615	April 2017	April 2025	TBD	Rev: Construction Specification for Installation of Poles is implemented. The specification has been updated to new PROV format with no technical content changes. Applicable content from SSP 615S06 has been incorporated into OPSS 615.	Mike Pearsall
620	April 2017	April 2025	TBD	Rev: Construction Specification for Traffic Signal Equipment is implemented. The specification has been updated to new PROV format with no technical content changes. Applicable content from SSP 106S18 has been incorporated into OPSS 620.	Mike Pearsall
622	April 2017	April 2025	TBD	Rev: Construction Specification for Installation of Traffic Signal Controllers is implemented. The specification has been updated to new PROV format with no technical content changes. Applicable content from SSP 106S19 and 622F03 has been incorporated into OPSS 622.	Mike Pearsall
630	November 2016	April 2025	TBD	Rev: Construction Specification for Installation of Sectional Steel High Mast Lighting Poles is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Gender neutral language updated. Applicable content from SSP 630F02 has been incorporated into OPSS 630.	Mike Pearsall
706	November 2016	April 2025	TBD	Rev: Construction Specification for Temporary Traffic Control Devices is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 107S05 has been incorporated into OPSS 706.	Mike Pearsall

Reference Type/Code	Existing Version	New Version	Implemented In CPS	New, Revised (Rev), Cancelled (Can), Reissued/Reinstated (Rei)	Initiator
708	November 2016	April 2025	TBD	Rev: Construction Specification for Portable Temporary Traffic Signals is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed.	Mike Pearsall
723	November 2016	April 2025	TBD	Rev: Construction Specification for Energy Attenuators is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 107S06 and 723S03 has been incorporated into OPSS 723.	Mike Pearsall
903	April 2016	April 2025	TBD	Rev: Construction Specification for Deep Foundations is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 109F57 has been incorporated into OPSS 903.	Mike Pearsall
909	November 2016	April 2025	TBD	Rev: Construction Specification for Prestressed Concrete - Precast Girders is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Gender neutral language updated. Applicable content from SSP 109S24 has been incorporated into OPSS 909.	Mike Pearsall
918	November 2016	April 2025	TBD	Rev: Construction Specification for Modular Bridge Structures for Temporary Installations is implemented. The specification has been updated to new PROV format with no technical content changes. Applicable content from SSP 109S27 has been incorporated into OPSS 918.	Mike Pearsall
928	April 2012	April 2025	TBD	Rev: Construction Specification for Structure Rehabilitation - Concrete Removal is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 109S32 has been incorporated into OPSS 928.	Mike Pearsall

Reference Type/Code	Existing Version	New Version	Implemented In CPS	New, Revised (Rev), Cancelled (Can), Reissued/Reinstated (Rei)	Initiator
930	November 2014	April 2025	TBD	Rev: Construction Specification for Structure Rehabilitation - Concrete Patches, Refacing, and Overlays is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed.	Mike Pearsall
1004	November 2012	April 2025	TBD	Rev: Material Specification for Aggregates – Miscellaneous is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 110S16 has been incorporated into OPSS 1004.	Mike Pearsall
1006	April 2017	April 2025	TBD	Rev: Material Specification for Aggregates - Surface Treatment is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 110S05 has been incorporated into OPSS 1006.	Mike Pearsall
1010	April 2013	April 2025	TBD	Rev: Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed.	Mike Pearsall

Reference Type/Code	Existing Version	New Version	Implemented In CPS	New, Revised (Rev), Cancelled (Can), Reissued/Reinstated (Rei)	Initiator
Standard Special Provisions (SSPs)					
106S18	April 2017	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Traffic Signal Equipment is revised to reflect the new publication version of OPSS 620.	Mike Pearsall
106S19	April 2017	N/A	TBD	Can: SSP Amendment to Construction Specification for Installation of Traffic Signal Controllers is cancelled. Applicable content has been incorporated into OPSS 622.	Mike Pearsall
107S05	April 2017	N/A	TBD	Can: SSP Amendment to Construction Specification for Temporary Traffic Control Devices is cancelled. Applicable content has been incorporated into OPSS 706.	Mike Pearsall
107S06	January 2025	N/A	TBD	Can: SSP Amendment to Construction Specification for Energy Attenuators is cancelled. Applicable content has been incorporated into OPSS 723.	Mike Pearsall
109S24	January 2025	N/A	TBD	Can: SSP Amendment to Construction Specification for Prestressed Concrete - Precast Girders is cancelled. Applicable content has been incorporated into OPSS 909.	Mike Pearsall
109S27	March 2018	N/A	TBD	Can: SSP Amendment to Construction Specification for Modular Bridge Structures for Temporary Installations is cancelled. Applicable content has been incorporated into OPSS 918.	Mike Pearsall
109S32	March 2018	N/A	TBD	Can: SSP Amendment to Construction Specification for Structure Rehabilitation - Concrete Removal is cancelled. Applicable content has been incorporated into OPSS 928.	Mike Pearsall
109F57	June 2020	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Deep Foundations is revised to reflect the new publication version of OPSS 903. Applicable content has been incorporated into OPSS 903.	Mike Pearsall
110S05	February 2019	N/A	TBD	Can: SSP Amendment to Material Specification for Aggregates - Surface Treatment is cancelled. Applicable content has been incorporated into OPSS 1006.	Mike Pearsall

Reference Type/Code	Existing Version	New Version	Implemented In CPS	New, Revised (Rev), Cancelled (Can), Reissued/Reinstated (Rei)	Initiator
110S06	February 2019	April 2025	TBD	Rev: SSP Amendment to Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material is revised to reflect the new publication version of OPSS 1010.	Mike Pearsall
110S16	May 2023	N/A	TBD	Can: SSP Amendment to Material Specification for Aggregates - Miscellaneous is cancelled. Applicable content has been incorporated into OPSS 1004.	Mike Pearsall
610F01	November 2016	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Removal of Electrical Equipment and Materials is revised to reflect the new publication version of OPSS 610.	Mike Pearsall
615S05	August 2019	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Installation of Poles is revised to reflect the new publication version of OPSS 615.	Mike Pearsall
615S06	August 2019	N/A	TBD	Can: SSP Amendment to Construction Specification for Installation of Poles is cancelled. Applicable content has been incorporated into OPSS 615.	Mike Pearsall
630F02	June 2020	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Installation of Sectional Steel High Mast Lighting Poles is revised to reflect the new publication version of OPSS 630. Applicable content has been incorporated into OPSS 630.	Mike Pearsall
682F03	June 2020	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Installation of Traffic Signal Controllers is revised to reflect the new publication version of OPSS 622. Applicable content has been incorporated into OPSS 622.	Mike Pearsall
682S13	November 2016	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Installation of Poles is revised to reflect the new publication version of OPSS 615.	Mike Pearsall
682S16	June 2017	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Installation of Traffic Signal Controllers is revised to reflect the new publication version of OPSS 622.	Mike Pearsall

Reference Type/Code	Existing Version	New Version	Implemented In CPS	New, Revised (Rev), Cancelled (Can), Reissued/Reinstated (Rei)	Initiator
682F22	November 2016	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Removal of Electrical Equipment and Materials is revised to reflect the new publication version of OPSS 610.	Mike Pearsall
682S30	November 2016	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Installation of Poles is revised to reflect the new publication version of OPSS 615.	Mike Pearsall
706F04	August 2018	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Temporary Traffic Control Devices is revised to reflect the new publication version of OPSS 706.	Mike Pearsall
708F01	November 2016	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Portable Temporary Traffic Signals is revised to reflect the new publication version of OPSS 708.	Mike Pearsall
723S03	May 2019	N/A	TBD	Can: SSP Amendment to Construction Specification for Energy Attenuators is cancelled. Applicable content has been incorporated into OPSS 723.	Mike Pearsall

Ontario Provincial Standard Specifications (OPSSs)					
630	November 2016	April 2025	TBD	Rev: Construction Specification for Installation of Sectional Steel High Mast Lighting Poles is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Gender neutral language updated. Applicable content from SSP 630F02 has been incorporated into OPSS 630.	Mike Pearsall
Standard Special Provisions (SSPs)					
630F02	June 2020	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Installation of Sectional Steel High Mast Lighting Poles is revised to reflect the new publication version of OPSS 630. Applicable content has been incorporated into OPSS 630.	Mike Pearsall

Note: The 630 implemented in April 2025 replaces 630, November 2016 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR INSTALLATION OF SECTIONAL STEEL HIGH MAST LIGHTING POLES

TABLE OF CONTENTS

630.01 SCOPE

This specification covers the requirements for the installation of sectional steel high mast lighting poles complete with raising and lowering equipment, including mechanical and electrical components.

~~630.01.01 Specification Significance and Use~~

~~This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.~~

~~Use of this specification or any other specification shall be according to the Contract Documents.~~

~~**630.01.02 Appendices Significance and Use**~~

~~Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.~~

~~Appendices are developed for the Owner's use only.~~

~~Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.~~

~~Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.~~

~~The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.~~

630.02 REFERENCES

~~When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.~~

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Material

OPSS 2471 Sectional Steel High Mast Lighting Poles
OPSS 2476 Raising and Lowering Equipment for High Mast Lighting Poles

CSA Standards

S6-14 Canadian Highway Bridge Design Code

~~**630.03 DEFINITIONS**~~

~~For the purpose of this specification, the following definitions apply:~~

~~**Certificate of Conformance** means a document issued by the Quality Verification Engineer confirming that the specified components of the Work are in general conformance with the requirements of the Contract Documents.~~

~~**Quality Verification Engineer (QVE)** means an Engineer retained by the Contractor qualified to provide the services specified in the Contract Documents.~~

630.04 DESIGN AND SUBMISSION REQUIREMENTS

630.04.01 Submission Requirements

630.04.01.01 Assembly of Sectional Steel High Mast Lighting Poles

Installation drawings, calculations, and procedures shall be submitted to the Contract Administrator at least 14 Days prior to the commencement of scheduled start of pole assembly for approval. An Engineer shall affix ~~his or her~~their seal and signature on the installation drawings, calculations, and procedures verifying that they are consistent with the Contract Documents and sound engineering practices.

These installation drawings, calculations, and procedures shall include all details of equipment to be used in jacking the sections together and lifting the assembled pole, including placing and securing it on the anchorage assembly.

630.04.01.02 Training Certificate

A certificate of training from the manufacturer of the high mast lighting raising and lowering equipment for each person who will be doing the installation work shall be submitted to the Contract Administrator. The certificates shall be submitted 14 Days prior to the commencement of the installation work, and the work shall not proceed until the certificates are accepted by the Contract Administrator. Training certificates that are 5 years old or more shall not be accepted.

The training certificate shall state that the manufacturer certifies that the individual has successfully completed training in the following areas:

a) Assembly of the pole sections.

b) Assembly of the raising and lowering equipment.

c) Operation of the raising and lowering equipment.

d) Installation of high mast poles and lighting equipment.

e) Levelling of the luminaire ring assembly.

f) Inspection of high mast poles and lighting equipment.

g) Maintenance and repair techniques for sectional steel high mast lighting equipment.

h) Safety procedures.

The training certificate shall be dated and signed by officers of the manufacturer and shall indicate the dates that the training was provided.

630.04.01.03 Inspection after Fabrication of Sectional Steel High Mast Lighting Pole Equipment

A Manufacturer's Certificate of Conformance shall be submitted to the Contract Administrator upon completion of the fabrication of the sectional steel high mast lighting pole equipment.

630.05 MATERIALS

630.05.01 Sectional Steel High Mast Lighting Poles

Sectional steel high mast lighting poles shall be according to OPSS 2471 and as specified in the Contract Documents.

630.05.02 Raising and Lowering Equipment

Raising and lowering equipment shall be according to OPSS 2476.

630.07 CONSTRUCTION

630.07.01 General

General requirements for electrical work shall be as specified in the Contract Documents.

630.07.01.01 Ordering Sectional Steel High Mast Lighting Poles and Raising and Lowering Equipment

Immediately following the award of the Contract, the high mast lighting poles and the raising and lowering equipment shall be ordered, as required for this Contract. All necessary measures shall be taken to ensure sectional steel high mast lighting poles and the raising and lowering equipment are 100% compatible and fully functional.

Verification of the delivery dates of the high mast lighting poles and the raising and lowering equipment shall be obtained from the suppliers and submitted to the Contract Administrator within 72 hours after the award of the Contract.

Timely and accurate communication shall be maintained with both the Owner and the suppliers regarding the delivery, schedules, and requirements for the high mast lighting poles and the raising and lowering equipment.

Delivery and off-loading of the sectional steel high mast lighting poles and the raising and lowering equipment shall be completed in a timely and efficient manner.

630.07.02 Sectional Steel High Mast Lighting Poles and Equipment

630.07.02.01 Assembly of Sectional Steel High Mast Lighting Poles

The lifting equipment used in contact with the pole sections shall be non-abrasive in nature.

Sectional steel high mast lighting poles shall be assembled so that all sections for individual poles are matched as fabricated. The completed sectional steel high mast lighting pole shall be according to the overall tolerances specified in the Contract Documents.

630.07.02.02 Raising and Lowering Equipment

The raising and lowering equipment and the mechanical and electrical components shall be installed according to the manufacturer's specifications and recommendations.

The raising and lowering equipment manufacturer shall be present during the equipment installation to ensure proper assembly procedures and commissioning.

630.07.02.03 Pole Installation

At least 14 Days prior to the start of pole installation, the Contract Administrator shall be informed, in writing, of the pending operation.

The anchorage setting templates shall be removed prior to installation of lighting poles.

The pole shall be installed plumb, with the base plate positioned and the door orientated as specified in the Contract Documents. ~~–~~The pole shall have adequate support during installation.~~–~~ The pole shall not be considered self-supporting until all fasteners in the base are tightened by the turn-of-nut method according to CSA S6.

A 12 mm square, welded, 19 AWG galvanized steel metal mesh shall be placed around the outside circumference of the anchor bolt circle, between the pole base plate and the footing after pole installation is completed.

The orientation of the high mast lighting pole shall be as specified in the Contract Documents.

630.07.02.04 High Mast Lighting Equipment

High mast lighting equipment shall be installed as specified in the Contract Documents.

630.07.03 Quality Control

630.07.03.01 Pre-Installation Testing and Inspection

The pre-installation testing and inspection of the high mast lighting pole complete with raising and lowering equipment, including mechanical and electrical components, shall be according to manufacturer's specification and the Contract Documents.

~~A letter of compliance from the manufacturer of the sectional steel high mast lighting pole equipment, certifying that the sectional steel high mast lighting pole equipment is according to the Contract Documents shall be submitted to the Contract Administrator by the Contractor.~~

Testing on the torque limiter shall be conducted on the internal drive raising and lowering equipment and on the portable power drill for the external drive raising and lowering equipment unit. ~~-~~The Contractor shall ensure that the torque limiter is set and functions according to the manufacturer's recommendations. ~~–~~The cord connecting the control to each raising and lowering motor or portable power drill shall be a minimum length of 13 m.

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.

630.07.03.02 Proof of Performance Testing and Inspection

The ring assembly, including luminaires, and the raising and lowering equipment shall be fully raised, latched, unlatched, and fully lowered a minimum of five times for each installed sectional steel high mast lighting pole. After each raising and lowering sequence, every piece of the raising and lowering equipment shall be inspected to ensure that all components are functioning properly and are not damaged. ~~-~~The cables inside the pole shall be inspected.~~-~~ Twisted cables shall be untwisted prior to each subsequent raising and lowering sequence.

The following shall be inspected:

a) Winch gear and housing.

b) Winch cable.

c) Supporting cables.

d) Power cable.

e) Ring assembly.

f) Latching system.

If problems or deficiencies occur during the testing, the test shall be stopped and the problem or deficiency corrected. Once the problem or deficiency has been corrected, the testing process of the pole and associated material shall be repeated in full.

Each ring assembly and supporting cable shall be inspected and adjusted to ensure that the ring is level.

630.07.03.02.01 Certificate of Conformance

A Certificate of ConformanceRequest to Proceed shall be submitted to the Contract Administrator uponadministrator after completion of the work. The Quality Verification Engineer shall affix his or her sealproof of performance testing and signature toinspection.

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

630.07.03.02.01 Test and Inspection Report

The testing and inspection results shall be documented in a report and submitted to the Contract Administrator. The report shall include sufficient detail to demonstrate and confirm the following:

a) All of the high mast equipment at each high mast pole was tested and inspected.

b) The high mast lighting raising and lowering equipment is in general conformance with the requirements ofaccording to the Contract Documents.

c) Each sectional steel high mast lighting pole has been installed plumb with the base plate positioned as specified in the Contract Documents.

d) Each sectional steel high mast lighting pole and raising and lowering equipment passed the proof of performance testing and inspection.

e) The torque limiter has been fully tested and verified to be fully functional according to the manufacturer's recommendations and the Contract Documents.

f) The sectional steel high mast lighting pole jacking and installation procedures have been carried out according to the installation drawings, calculations, and procedures.

g) At the end of the testing at each sectional steel high mast lighting pole, the ring assembly has been levelled, raised to the top of the pole, and fully and properly docked and latched to the head frame assembly at the top of the pole.

A Request to Proceed shall be submitted to the Contract Administrator after completion of the test and inspection report.

The next operation after the test and inspection report shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

630.07.04 Document Submission

The service manual for the high mast lighting equipment shall document in detail the installation and operation of the high mast lighting equipment and components. It shall include clear and detailed illustrations indicating layouts of controls, displays, schematic and wiring diagrams, and other information required to correctly operate a fully assembled and operational high mast lighting unit, as well as the maintenance and service aspects of individual components.

The service manual for the high mast lighting equipment shall include part numbers and settings and options of installation and operation. The manual shall provide sections that completely describe the theory of operation using block diagrams, wiring and schematic diagrams, diagnostic and repair procedures, assembly instructions and drawings, component layout drawings, and acceptable manufacturers and suppliers of miscellaneous component parts.

Each manual for the high mast lighting equipment shall detail all major assembling, adjusting, and aligning procedures and identify all acceptable tolerances or variances. Manuals shall also include:

a) Detailed specifications of major components.

b) Copies of the Working Drawings specified in OPSS 2471 and OPSS 2476 reduced to 8½ x 11" paper format.

c) Component warranty certificates.

d) Operating instructions.

e) All other relevant documents or drawings.

630.07.05 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

630.08 QUALITY ASSURANCE

The Owner may make random inspections of individual high mast lighting poles, visually check for proper assembly with related equipment, and witness the raising and lowering of the ring assembly.

630.09 MEASUREMENT FOR PAYMENT

630.09.01 Actual Measurement

630.09.01.01 25 m Sectional Steel High Mast Lighting Poles and Equipment
30 m Sectional Steel High Mast Lighting Poles and Equipment
35 m Sectional Steel High Mast Lighting Poles and Equipment
40 m Sectional Steel High Mast Lighting Poles and Equipment
45 m Sectional Steel High Mast Lighting Poles and Equipment

For measurement purposes, a count shall be made of the number of each size of sectional steel high mast lighting poles and equipment installed.

630.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

630.10 BASIS OF PAYMENT

630.10.01 25 m Sectional Steel High Mast Lighting Poles and Equipment - Item
30 m Sectional Steel High Mast Lighting Poles and Equipment - Item
35 m Sectional Steel High Mast Lighting Poles and Equipment - Item
40 m Sectional Steel High Mast Lighting Poles and Equipment - Item
45 m Sectional Steel High Mast Lighting Poles and Equipment - Item

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

Progress payments shall be based on the following percentages of the Contract price for milestones accepted by the Contract Administrator:

a) 35% for delivery of all high mast lighting poles and equipment

b) 5% for certificate of training

c) 20% for installation of all high mast lighting poles and equipment

d) 40% for the completed and ~~signed Certificate of Conformance for all High Mast Lighting Poles~~accepted Test and ~~Equipment~~

~~**Appendix 630-A, November 2016**~~
~~**FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**~~

~~**Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.**~~

~~**Designer Action/Considerations**~~

~~No information provided here.~~

~~**Related Ontario Provincial Standard Drawings**~~

~~No information provided here.~~
Inspection Report.

Note: The 630 implemented in April 2025 replaces 630, November 2016 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR INSTALLATION OF SECTIONAL STEEL HIGH MAST LIGHTING POLES

TABLE OF CONTENTS

630.01 SCOPE

This specification covers the requirements for the installation of sectional steel high mast lighting poles complete with raising and lowering equipment, including mechanical and electrical components.

630.02 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Material

OPSS 2471 Sectional Steel High Mast Lighting Poles
OPSS 2476 Raising and Lowering Equipment for High Mast Lighting Poles

CSA Standards

S6-14 Canadian Highway Bridge Design Code

630.04 DESIGN AND SUBMISSION REQUIREMENTS

630.04.01 Submission Requirements

630.04.01.01 Assembly of Sectional Steel High Mast Lighting Poles

Installation drawings, calculations, and procedures shall be submitted to the Contract Administrator at least 14 Days prior to the commencement of scheduled start of pole assembly for approval. An Engineer shall affix their seal and signature on the installation drawings, calculations, and procedures verifying that they are consistent with the Contract Documents and sound engineering practices.

These installation drawings, calculations, and procedures shall include all details of equipment to be used in jacking the sections together and lifting the assembled pole, including placing and securing it on the anchorage assembly.

630.04.01.02 Training Certificate

A certificate of training from the manufacturer of the high mast lighting raising and lowering equipment for each person who will be doing the installation work shall be submitted to the Contract Administrator. The certificates shall be submitted 14 Days prior to the commencement of the installation work, and the work shall not proceed until the certificates are accepted by the Contract Administrator. Training certificates that are 5 years old or more shall not be accepted.

The training certificate shall state that the manufacturer certifies that the individual has successfully completed training in the following areas:

a) Assembly of the pole sections.

b) Assembly of the raising and lowering equipment.

c) Operation of the raising and lowering equipment.

d) Installation of high mast poles and lighting equipment.

e) Levelling of the luminaire ring assembly.

f) Inspection of high mast poles and lighting equipment.

g) Maintenance and repair techniques for sectional steel high mast lighting equipment.

h) Safety procedures.

The training certificate shall be dated and signed by officers of the manufacturer and shall indicate the dates that the training was provided.

630.04.01.03 Inspection after Fabrication of Sectional Steel High Mast Lighting Pole Equipment

A Manufacturer’s Certificate of Conformance shall be submitted to the Contract Administrator upon completion of the fabrication of the sectional steel high mast lighting pole equipment.

630.05 MATERIALS

630.05.01 Sectional Steel High Mast Lighting Poles

Sectional steel high mast lighting poles shall be according to OPSS 2471 and as specified in the Contract Documents.

630.05.02 Raising and Lowering Equipment

Raising and lowering equipment shall be according to OPSS 2476.

630.07 CONSTRUCTION

630.07.01 General

General requirements for electrical work shall be as specified in the Contract Documents.

630.07.01.01 Ordering Sectional Steel High Mast Lighting Poles and Raising and Lowering Equipment

Immediately following the award of the Contract, the high mast lighting poles and the raising and lowering equipment shall be ordered, as required for this Contract. All necessary measures shall be taken to ensure sectional steel high mast lighting poles and the raising and lowering equipment are 100% compatible and fully functional.

Verification of the delivery dates of the high mast lighting poles and the raising and lowering equipment shall be obtained from the suppliers and submitted to the Contract Administrator within 72 hours after the award of the Contract.

Timely and accurate communication shall be maintained with both the Owner and the suppliers regarding the delivery, schedules, and requirements for the high mast lighting poles and the raising and lowering equipment.

Delivery and off-loading of the sectional steel high mast lighting poles and the raising and lowering equipment shall be completed in a timely and efficient manner.

630.07.02 Sectional Steel High Mast Lighting Poles and Equipment

630.07.02.01 Assembly of Sectional Steel High Mast Lighting Poles

The lifting equipment used in contact with the pole sections shall be non-abrasive in nature.

Sectional steel high mast lighting poles shall be assembled so that all sections for individual poles are matched as fabricated. The completed sectional steel high mast lighting pole shall be according to the overall tolerances specified in the Contract Documents.

630.07.02.02 Raising and Lowering Equipment

The raising and lowering equipment and the mechanical and electrical components shall be installed according to the manufacturer’s specifications and recommendations.

The raising and lowering equipment manufacturer shall be present during the equipment installation to ensure proper assembly procedures and commissioning.

630.07.02.03 Pole Installation

At least 14 Days prior to the start of pole installation, the Contract Administrator shall be informed, in writing, of the pending operation.

The anchorage setting templates shall be removed prior to installation of lighting poles.

The pole shall be installed plumb, with the base plate positioned and the door orientated as specified in the Contract Documents. The pole shall have adequate support during installation. The pole shall not be considered self-supporting until all fasteners in the base are tightened by the turn-of-nut method according to CSA S6.

A 12 mm square, welded, 19 AWG galvanized steel metal mesh shall be placed around the outside circumference of the anchor bolt circle, between the pole base plate and the footing after pole installation is completed.

The orientation of the high mast lighting pole shall be as specified in the Contract Documents.

630.07.02.04 High Mast Lighting Equipment

High mast lighting equipment shall be installed as specified in the Contract Documents.

630.07.03 Quality Control

630.07.03.01 Pre-Installation Testing and Inspection

The pre-installation testing and inspection of the high mast lighting pole complete with raising and lowering equipment, including mechanical and electrical components, shall be according to manufacturer's specification and the Contract Documents.

Testing on the torque limiter shall be conducted on the internal drive raising and lowering equipment and on the portable power drill for the external drive raising and lowering equipment unit. The Contractor shall ensure that the torque limiter is set and functions according to the manufacturer's recommendations. The cord connecting the control to each raising and lowering motor or portable power drill shall be a minimum length of 13 m.

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.

630.07.03.02 Proof of Performance Testing and Inspection

The ring assembly, including luminaires, and the raising and lowering equipment shall be fully raised, latched, unlatched, and fully lowered a minimum of five times for each installed sectional steel high mast lighting pole. After each raising and lowering sequence, every piece of the raising and lowering equipment shall be inspected to ensure that all components are functioning properly and are not damaged. The cables inside the pole shall be inspected. Twisted cables shall be untwisted prior to each subsequent raising and lowering sequence.

The following shall be inspected:

a) Winch gear and housing.

b) Winch cable.

c) Supporting cables.

d) Power cable.

e) Ring assembly.

f) Latching system.

If problems or deficiencies occur during the testing, the test shall be stopped and the problem or deficiency corrected. Once the problem or deficiency has been corrected, the testing process of the pole and associated material shall be repeated in full.

Each ring assembly and supporting cable shall be inspected and adjusted to ensure that the ring is level.

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

630.07.03.02.01 Test and Inspection Report

The testing and inspection results shall be documented in a report and submitted to the Contract Administrator. The report shall include sufficient detail to demonstrate and confirm the following:

a) All of the high mast equipment at each high mast pole was tested and inspected.

b) The high mast lighting raising and lowering equipment is according to the Contract Documents.

c) Each sectional steel high mast lighting pole has been installed plumb with the base plate positioned as specified in the Contract Documents.

d) Each sectional steel high mast lighting pole and raising and lowering equipment passed the proof of performance testing and inspection.

e) The torque limiter has been fully tested and verified to be fully functional according to the manufacturer's recommendations and the Contract Documents.

f) The sectional steel high mast lighting pole jacking and installation procedures have been carried out according to the installation drawings, calculations, and procedures.

g) At the end of the testing at each sectional steel high mast lighting pole, the ring assembly has been levelled, raised to the top of the pole, and fully and properly docked and latched to the head frame assembly at the top of the pole.

A Request to Proceed shall be submitted to the Contract Administrator after completion of the test and inspection report.

The next operation after the test and inspection report shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

630.07.04 Document Submission

The service manual for the high mast lighting equipment shall document in detail the installation and operation of the high mast lighting equipment and components. It shall include clear and detailed illustrations indicating layouts of controls, displays, schematic and wiring diagrams, and other information required to correctly operate a fully assembled and operational high mast lighting unit, as well as the maintenance and service aspects of individual components.

The service manual for the high mast lighting equipment shall include part numbers and settings and options of installation and operation. The manual shall provide sections that completely describe the theory of operation using block diagrams, wiring and schematic diagrams, diagnostic and repair procedures, assembly instructions and drawings, component layout drawings, and acceptable manufacturers and suppliers of miscellaneous component parts.

Each manual for the high mast lighting equipment shall detail all major assembling, adjusting, and aligning procedures and identify all acceptable tolerances or variances. Manuals shall also include:

a) Detailed specifications of major components.

b) Copies of the Working Drawings specified in OPSS 2471 and OPSS 2476 reduced to 8½ x 11" paper format.

c) Component warranty certificates.

d) Operating instructions.

e) All other relevant documents or drawings.

630.07.05 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

630.08 QUALITY ASSURANCE

The Owner may make random inspections of individual high mast lighting poles, visually check for proper assembly with related equipment, and witness the raising and lowering of the ring assembly.

630.09 MEASUREMENT FOR PAYMENT

630.09.01 Actual Measurement

630.09.01.01 25 m Sectional Steel High Mast Lighting Poles and Equipment
30 m Sectional Steel High Mast Lighting Poles and Equipment
35 m Sectional Steel High Mast Lighting Poles and Equipment
40 m Sectional Steel High Mast Lighting Poles and Equipment
45 m Sectional Steel High Mast Lighting Poles and Equipment

For measurement purposes, a count shall be made of the number of each size of sectional steel high mast lighting poles and equipment installed.

630.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

630.10 BASIS OF PAYMENT

630.10.01 25 m Sectional Steel High Mast Lighting Poles and Equipment - Item
30 m Sectional Steel High Mast Lighting Poles and Equipment - Item
35 m Sectional Steel High Mast Lighting Poles and Equipment - Item
40 m Sectional Steel High Mast Lighting Poles and Equipment - Item
45 m Sectional Steel High Mast Lighting Poles and Equipment - Item

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

Progress payments shall be based on the following percentages of the Contract price for milestones accepted by the Contract Administrator:

a) 35% for delivery of all high mast lighting poles and equipment

b) 5% for certificate of training

c) 20% for installation of all high mast lighting poles and equipment

d) 40% for the completed and accepted Test and Inspection Report.

25m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.
30m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.
35m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.
40m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.
45m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.

Special Provision No. 630F02 ~~March 2018~~April 2025

Amendment to OPSS 630, ~~November 2016~~April 2025

~~**630.03 DEFINITIONS**~~

~~Section 630.03 of OPSS 630 is deleted in its entirety.~~

~~**630.04 DESIGN AND SUBMISSION REQUIREMENTS**~~

~~**630.04.01 Submission Requirements**~~

~~Subsection 630.04.01 of OPSS 630 is amended by the addition of the following clause:~~

~~**630.04.01.03 Inspection after Fabrication of Sectional Steel High Mast Lighting Pole Equipment**~~

~~A Manufacturer's Certificate of Conformance shall be submitted to the Contract Administrator upon completion of the fabrication of the sectional steel high mast lighting pole equipment.~~

630.05 MATERIALS

630.05.01 Sectional Steel High Mast Lighting Poles

Subsection 630.05.01 of OPSS 630 is deleted in its entirety and replaced with the following:

Sectional steel high mast lighting poles shall be according to OPSS 2471 and Table 1.

TABLE 1
Item/Accessory Description

___* m Sectional Steel high mast lighting pole, complete with ___* tenon arms, internal drive, top latching raising/lowering device and shroud, for use with ___* m pole, ___* volt ___* phase operation.
___* m Sectional Steel high mast lighting pole, complete with ___* tenon arms, internal drive, top latching raising/lowering device, for use with ___* m pole, ___* volt ___* phase operation.
___* m Sectional Steel high mast lighting pole, complete with ___* tenon arms, external drive, top latching raising/lowering device, shroud and ___* portable power drill(s) for use with ___* m pole, ___* volt ___* phase operation.
___* m Sectional Steel high mast lighting pole, complete with ___* tenon arms, external drive, top latching, raising/lowering device, for use with ___* m pole___, * volt ___* phase operation.

[* Designer Fill-In for Table 1, See Notes to Designer]

630.07 CONSTRUCTION

630.07.03.01 Pre-Installation Testing and Inspection

Clause 630.07.03.01 of OPSS 630 is deleted in its entirety and replaced with the following:

The pre-installation testing and inspection of the high mast lighting pole complete with raising and lowering equipment, including mechanical and electrical components, shall be according to manufacturer's specification and the Contract Documents.

Testing on the torque limiter shall be conducted on the internal drive raising and lowering equipment and on the portable power drill for the external drive raising and lowering equipment unit. The Contractor shall ensure that the torque limiter is set and functions according to the manufacturer's recommendations. The cord connecting the control to each raising and lowering motor or portable power drill shall be a minimum length of 13 m.

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.

630.07.03.02 Proof of Performance Testing and Inspection

Clause 630.07.03.02 of OPSS 630 is amended by the addition of the following

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

630.07.03.02.01 Certificate of Conformance

Clause 630.07.03.02.01 of OPSS 630 is deleted in its entirety and replaced with the following:

630.07.03.02.01 Test and Inspection Report

The testing and inspection results shall be documented in a report and submitted to the Contract Administrator. The report shall include sufficient detail to demonstrate and confirm the following:

a) All of the high mast equipment at each high mast pole was tested and inspected.

b) The high mast lighting raising and lowering equipment is according to the Contract Documents.

c) Each sectional steel high mast lighting pole has been installed plumb with the base plate positioned as specified in the Contract Documents.

d) Each sectional steel high mast lighting pole and raising and lowering equipment passed the proof of performance testing and inspection.

~~e) The torque limiter has been fully tested and verified to be fully functional according to the manufacturer's recommendations and the Contract Documents.~~

~~f) The sectional steel high mast lighting pole jacking and installation procedures have been carried out according to the installation drawings, calculations, and procedures.~~

~~g) At the end of the testing at each sectional steel high mast lighting pole, the ring assembly has been levelled, raised to the top of the pole, and fully and properly docked and latched to the head frame assembly at the top of the pole.~~

~~A Request to Proceed shall be submitted to the Contract Administrator after completion of the test and inspection report.~~

~~The next operation after the test and inspection report shall not proceed until a Notice to Proceed has been received from the Contract Administrator.~~

~~630.10 BASIS OF PAYMENT~~

~~**630.10.01 25 m Sectional Steel High Mast Lighting Poles and Equipment - Item**~~
~~**30 m Sectional Steel High Mast Lighting Poles and Equipment - Item**~~
~~**35 m Sectional Steel High Mast Lighting Poles and Equipment - Item**~~
~~**40 m Sectional Steel High Mast Lighting Poles and Equipment - Item**~~
~~**45 m Sectional Steel High Mast Lighting Poles and Equipment - Item**~~

~~Subsection 630.10.01 of OPSS 630 is amended by deleting point d) in its entirety and replacing it with the following:~~

~~d) 40% for the completed and accepted Test and Inspection Report.~~

NOTES TO DESIGNER:

* For each high mast lighting pole the designer shall determine the required number of tenon arms, based on one tenon arm per luminaire, and the voltage and phase operation. These requirements shall be inserted into Table 1.

  For each high mast lighting pole the designer shall determine, in consultation with the MTO Regional electrical design and maintenance staff, the type of raising and lowering drive system (internal or external), to use, and whether a shroud is required. These requirements shall be inserted into Table 1.

WARRANT: Always with these tender items.

25m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.
30m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.
35m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.
40m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.
45m SECTIONAL STEEL HIGH MAST LIGHTING POLES AND EQUIPMENT - Item No.

Special Provision No. 630F02 April 2025

Amendment to OPSS 630, April 2025

630.05 MATERIALS

630.05.01 Sectional Steel High Mast Lighting Poles

Subsection 630.05.01 of OPSS 630 is deleted in its entirety and replaced with the following:

Sectional steel high mast lighting poles shall be according to OPSS 2471 and Table 1.

TABLE 1
Item/Accessory Description

_*_ m Sectional Steel high mast lighting pole, complete with _*_ tenon arms, internal drive, top latching raising/lowering device and shroud, for use with _*_ m pole, _*_ volt _*_ phase operation.
_*_ m Sectional Steel high mast lighting pole, complete with _*_ tenon arms, internal drive, top latching raising/lowering device, for use with _*_ m pole, _*_ volt _*_ phase operation.
_*_ m Sectional Steel high mast lighting pole, complete with _*_ tenon arms, external drive, top latching raising/lowering device, shroud and _*_ portable power drill(s) for use with _*_ m pole, _*_ volt _*_ phase operation.
_*_ m Sectional Steel high mast lighting pole, complete with _*_ tenon arms, external drive, top latching raising/lowering device, for use with _*_ m pole, _*_ volt _*_ phase operation.

[* Designer Fill-In for Table 1, See Notes to Designer]

NOTES TO DESIGNER:

* For each high mast lighting pole the designer shall determine the required number of tenon arms, based on one tenon arm per luminaire, and the voltage and phase operation. These requirements shall be inserted into Table 1.

For each high mast lighting pole the designer shall determine, in consultation with the MTO Regional electrical design and maintenance staff, the type of raising and lowering drive system (internal or external), to use, and whether a shroud is required. These requirements shall be inserted into Table 1.

WARRANT: Always with these tender items.

Ontario Provincial Standard Specifications (OPSSs)					
706	November 2016	April 2025	TBD	Rev: Construction Specification for Temporary Traffic Control Devices is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 107S05 has been incorporated into OPSS 706.	Mike Pearsall
Standard Special Provisions (SSPs)					
107S05	April 2017	N/A	TBD	Can: SSP Amendment to Construction Specification for Temporary Traffic Control Devices is cancelled. Applicable content has been incorporated into OPSS 706.	Mike Pearsall
706F04	August 2018	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Temporary Traffic Control Devices is revised to reflect the new publication version of OPSS 706.	Mike Pearsall

Note: The 706 implemented in April 2025 replaces 706, November 2016 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR TEMPORARY TRAFFIC CONTROL DEVICES

TABLE OF CONTENTS

706.01 SCOPE

This specification covers the requirements for the use of temporary traffic control devices during construction.

~~706.01.01 Specification Significance and Use~~

~~This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.~~

~~Use of this specification or any other specification shall be according to the Contract Documents.~~

~~**706.01.02 Appendices Significance and Use**~~

~~Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.~~

~~Appendices are developed for the Owner's use only.~~

~~Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.~~

~~Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.~~

~~The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.~~

706.02 REFERENCES

~~When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.~~

This specification refers to the following standards, specifications or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 703 Permanent Small Signs and Support Systems

Ontario Provincial Standard Specifications, Material

OPSS 2001 Signs

Ontario Ministry of Transportation Publications

Ontario Traffic Manual (OTM):
Book 7 ~~–~~- Temporary Conditions (Office and Field Editions)

Designated Sources for Materials (DSM)

706.03 DEFINITIONS

Temporary Traffic Control Signs means all traffic control signs and associated devices identified in OTM Book 7, including vehicles and sign trailers required to support signs and equipment to supply sign lighting; but excludes highway number markers.

Small Sign means small sign as defined in OPSS 703.

706.04 DESIGN AND SUBMISSION REQUIREMENTS

A copy of the traffic control plan shall be submitted to the Contract Administrator at the pre-work meeting.

706.05 MATERIALS

706.05.01 Retroreflective Sheeting

Retroreflective sheeting shall be according to OPSS 2001.

706.05.02 Automated Flagger Assistance Devices

Automated flagger assistance devices (AFAD) shall be according to OTM Book 7.

706.05.03 Temporary Traffic Control Signs

Temporary traffic control signs shall be according to OTM Book 7.

706.05.04 Portable Variable Message Signs

Portable variable message signs (PVMS) shall be supplied from a source named on the ministry's DSM.

706.05.04.01 Modem

Modem requirements for PVMS shall be as specified in the Contract Documents.

706.07 CONSTRUCTION

706.07.01 Temporary Traffic Control Signs

706.07.01.01 General

The work of temporary traffic control signs shall include:

a) Installation and relocation according to OTM Book 7 unless otherwise specified in the Contract Documents.

b) Temporarily relocating, modifying as required, and reinstalling existing small signs.

c) Installing and removing contract information signs.

d) Installing and removing Speed Fines Doubled (TC-90) signs.

Messaging for all temporary traffic control signs shall be according to OTM Book 7 unless otherwise specified in the Contract Documents.

When a Contract is in a designated bilingual area, bilingual temporary traffic control signs shall be installed. ~~-~~If a bilingual temporary traffic control sign is not available, then the French temporary traffic control sign shall be installed. ~~-~~A French Construction Zone Begins sign (Rb-90AF) and a French Construction Zone Ends sign (Rb-90BF) shall be installed next to the corresponding English Rb-90A and Rb-90B signs. ~~–~~All other French temporary traffic control signs shall be installed 150 m downstream from the English sign.

Temporary traffic control signs shall be installed before work affecting traffic begins, remain operational throughout the duration of the operation requiring signs and be removed upon completion of the operation.

Prior to seasonal shutdown, temporary traffic control signs shall be reviewed and signs that are not required during the seasonal shutdown period shall be removed. At the end of the seasonal shutdown period, the removed signs shall be reinstalled as required.

The condition of the temporary traffic control signs shall meet the quality replacement guidelines specified in OTM Book 7 for the duration of the Work. Signs that do not meet the guidelines shall be removed and replaced.

706.07.01.02 Existing Small Signs

Any existing small signs, excluding Tourism-Oriented Directional Signing and Logo Sign Program signs, removed to accommodate construction shall be kept operational by placement on a temporary support. Temporarily relocated existing small signs shall be kept at the same height, offset and approximate location from traffic as before relocation. All existing small signs shall be reinstalled, at or as close as possible to the original location, according to OPSS 703 upon completion of the Work.

Temporary modifications to existing small signs shall be according to OTM Book 7 unless otherwise specified in the Contract Documents.

706.07.01.03 Contract Information Signs

Contract information signs shall be installed according to OTM Book 7 and removed upon completion of the Work. Contract information signs shall be either a TC-81 sign or an Owner supplied contract information sign.

Owner supplied contract information signs shall be picked up at the location specified in the Contract Documents. The Contractor shall arrange for the pickup of the signs. At Contract Completion, Owner supplied contract information signs shall be returned to the Owner at a location specified by the Contract Administrator.

706.07.02 Road Closing/Restriction Notice Sign (TC-64)

Road closing/restriction notice (TC-64) signs shall be installed and relocated at locations specified in the Contract Documents. Timing requirements for TC-64 signs shall be as specified in OTM Book 7.

The Contract Administrator shall be notified when the Contractor's operations results in changes to the TC-64 sign message details (i.e. dates, times, etc.).

706.07.03 Automated Flagger Assistance Devices

AFAD shall be installed, relocated and removed at locations as specified in the Contract Documents.

If the closure extends across an entrance or side road, a traffic control person shall also be present to direct traffic with a stop/slow paddle according to OTM Book 7.

706.07.04 Portable Variable Message Sign

Installation, including the construction of a temporary base, relocation, and messaging on the PVMS shall be as specified in the Contract Documents. The exact location of the PVMS shall be proposed by the Contractor and shall meet the following criteria:

a) Maximizes visibility for motorists without impacting safety in accordance with the ministry's clear zone requirements.

b) Installed on a level surface with adequate bearing capacity to support the weight of the PVMS and

temporary base materials.

The Contract Administrator shall approve the location of the PVMS prior to it being deployed. The Contractor Administrator shall be notified at least 2 Business days in advance regarding the delivery, relocation, and removal of PVMS within the construction work zone.

Modem installation, testing, and decommissioning for the PVMS shall be as specified in the Contract Documents.

The PVMS control box shall be secured from entry by unauthorized personnel. There shall be security measures or devices in place to prevent message tampering of the sign.

All PVMS and any temporary base shall be removed upon completion of the Work.

706.07.04.01 Maintenance of Portable Variable Message Sign

Maintenance shall be performed for the continuous operation of the PVMS, as required, throughout the duration of the Contract. Daily inspection of the PVMS shall be conducted to ensure that the PVMS meets the following maintenance requirements:

a) PVMS sign face is aimed with the sign sight tube to the center of the approach roadway approximately 200m upstream of the sign to ensure maximum visibility.

b) Solar panels are tilted and rotated to face south.

c) All pixels and LEDs in the sign face remain operational.

d) Sign is elevated to its maximum height with the locking pin in place; sign face is to be regularly cleaned from dirt, road salt or debris that may obstruct the visibility of the sign.

e) Batteries are replaced as needed to ensure that battery levels are maintained per the supplier's operational requirements.

f) Modems and other remote communications equipment remain operational.

Immediate repairs shall be required whenever there is a failure or cessation of the operation of any component or components of the PVMS. The Contract Administrator shall be notified immediately each time repair work is performed on a PVMS.

~~**706.07.05 Management of Excess Materials**~~

~~Management of excess materials shall be according to the Contract Documents.~~

~~706.07.06~~ **Freeway Paving Operations**

When paving on a freeway within 3 m of a travelled lane open to traffic with no barrier designed to restrain errant vehicles between the paving operation and traffic, the following protection measures shall be applied:

a) A temporary regulatory speed reduction of 20 km/hr less than the normal posted regulatory speed (NPRS) shall be implemented during the paving operation. All signing shall be according to OTM Book 7. All existing NPRS signs within the reduced speed zone shall be covered while the temporary regulatory speed reduction signs are in use. The existing NPRS signs shall be restored when the reduced speed zone is not required and the temporary regulatory speed reduction signs shall be covered.

b) When a temporary regulatory speed reduction is in effect, a portable variable message sign (PVMS) shall be placed in advance of the first Maximum Speed Ahead signs at a location to be provided by the CA. If the Contract is in a bilingual area, an additional PVMS sign shall be deployed for the approved equivalent French message at least 150 m after the English PVMS. PVMS locations shall be verified to be legible to approaching motorists for at least 300 m and not be obstructed by existing signing or other obstructions. PVMS message details shall be as directed by the Contract Administrator.

When there is only a single lane open to traffic that is adjacent to the paving operation, the use of pace vehicles is permitted to limit the speed of traffic to that of the temporary regulatory speed reduction. The use of pace vehicles shall be according to OTM Book 7.

706.07.06 Management of Excess Materials

Management of excess materials shall be according to the Contract Documents.

706.09 MEASUREMENT FOR PAYMENT

706.09.01 Actual Measurement

706.09.01.01 Automated Flagger Assistance Devices

For measurement purposes, a count shall be made of the number of AFAD installed.

706.09.01.02 Portable Variable Message Sign (Temporary)

For measurement purposes, a count shall be made of the number of PVMS installed.

706.09.01.03 Portable Variable Message Sign, Relocation

For measurement purposes, a count shall be made of the number of PVMS relocated.

PVMS that are temporarily surplus for intermediate stages but will be required later shall be paid as one relocation for the combined moves into and out of the site storage, including any off-site storage required due to space restrictions.

706.09.01.04 Road Closing/Restriction Notice Signs (TC-64)

For measurement purposes, a count shall be made of the number of TC-64 signs installed.

706.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

706.10 BASIS OF PAYMENT

706.10.01 Automated Flagger Assistance Devices – Item
Portable Variable Message Sign (Temporary) – Item
Portable Variable Message Sign, Relocation - Item

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

706.10.02 Temporary Traffic Control Signs - Item

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

For progress payment, fifty percent of the Contract price shall be paid upon the supply and installation of the complete initial traffic control plan. The balance will be prorated over the balance of the Contract Time.

Reinstallation of temporary traffic control signs after seasonal shutdown shall be at no additional cost to the Owner.

706.10.03 Road Closing/Restriction Notice Signs (TC-64) - Item

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

Changes to the TC-64 sign message details (i.e. dates, times, etc.) required as a result of the Contractor's operations shall be completed at no additional cost to the Owner.

Progress payments shall be made as follows:	60% of the unit price per sign upon installation; 20% of the unit price per sign upon relocation; 20% of the unit price per sign upon removal.
If no relocation is required:	60% of the unit price per sign upon installation; 40% of the unit price per sign upon removal.

On each occasion when the Contractor fails to install the TC-64 signs according to the requirements of this specification, or fails to remove the TC-64 signs within two hours of re-opening of the affected roadway, a payment reduction of $2,000.00 shall be assessed. A further payment reduction of $2,000.00 per Day, or part thereof, with no maximum payment reduction, shall be assessed until such time as the TC-64 signs are removed.

706.10.04 Removals and Replacements

The removal and replacement of defective workmanship or materials shall be at no additional cost to the Owner.

706.10.05 Freeway Paving Operations

The protection measures specified for freeway paving operations shall be at no additional cost to the Owner.

Appendix 706-A, November 2016
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.

Note: The 706 implemented in April 2025 replaces 706, November 2016 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR TEMPORARY TRAFFIC CONTROL DEVICES

TABLE OF CONTENTS

706.01 SCOPE

This specification covers the requirements for the use of temporary traffic control devices during construction.

706.02 REFERENCES

This specification refers to the following standards, specifications or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 703 Permanent Small Signs and Support Systems

Ontario Provincial Standard Specifications, Material

OPSS 2001 Signs

Ontario Ministry of Transportation Publications

Ontario Traffic Manual (OTM):
Book 7 - Temporary Conditions (Office and Field Editions)

Designated Sources for Materials (DSM)

706.03 DEFINITIONS

Temporary Traffic Control Signs means all traffic control signs and associated devices identified in OTM Book 7, including vehicles and sign trailers required to support signs and equipment to supply sign lighting; but excludes highway number markers.

Small Sign means small sign as defined in OPSS 703.

706.04 DESIGN AND SUBMISSION REQUIREMENTS

A copy of the traffic control plan shall be submitted to the Contract Administrator at the pre-work meeting.

706.05 MATERIALS

706.05.01 Retroreflective Sheeting

Retroreflective sheeting shall be according to OPSS 2001.

706.05.02 Automated Flagger Assistance Devices

Automated flagger assistance devices (AFAD) shall be according to OTM Book 7.

706.05.03 Temporary Traffic Control Signs

Temporary traffic control signs shall be according to OTM Book 7.

706.05.04 Portable Variable Message Signs

Portable variable message signs (PVMS) shall be supplied from a source named on the ministry's DSM.

706.05.04.01 Modem

Modem requirements for PVMS shall be as specified in the Contract Documents.

706.07 CONSTRUCTION

706.07.01 Temporary Traffic Control Signs

706.07.01.01 General

The work of temporary traffic control signs shall include:

a) Installation and relocation according to OTM Book 7 unless otherwise specified in the Contract Documents.

b) Temporarily relocating, modifying as required, and reinstalling existing small signs.

c) Installing and removing contract information signs.

d) Installing and removing Speed Fines Doubled (TC-90) signs.

Messaging for all temporary traffic control signs shall be according to OTM Book 7 unless otherwise specified in the Contract Documents.

When a Contract is in a designated bilingual area, bilingual temporary traffic control signs shall be installed. If a bilingual temporary traffic control sign is not available, then the French temporary traffic control sign shall be installed. A French Construction Zone Begins sign (Rb-90AF) and a French Construction Zone Ends sign (Rb-90BF) shall be installed next to the corresponding English Rb-90A and Rb-90B signs. All other French temporary traffic control signs shall be installed 150 m downstream from the English sign.

Temporary traffic control signs shall be installed before work affecting traffic begins, remain operational throughout the duration of the operation requiring signs and be removed upon completion of the operation.

Prior to seasonal shutdown, temporary traffic control signs shall be reviewed and signs that are not required during the seasonal shutdown period shall be removed. At the end of the seasonal shutdown period, the removed signs shall be reinstalled as required.

The condition of the temporary traffic control signs shall meet the quality replacement guidelines specified in OTM Book 7 for the duration of the Work. Signs that do not meet the guidelines shall be removed and replaced.

706.07.01.02 Existing Small Signs

Any existing small signs, excluding Tourism-Oriented Directional Signing and Logo Sign Program signs, removed to accommodate construction shall be kept operational by placement on a temporary support. Temporarily relocated existing small signs shall be kept at the same height, offset and approximate location from traffic as before relocation. All existing small signs shall be reinstalled, at or as close as possible to the original location, according to OPSS 703 upon completion of the Work.

Temporary modifications to existing small signs shall be according to OTM Book 7 unless otherwise specified in the Contract Documents.

706.07.01.03 Contract Information Signs

Contract information signs shall be installed according to OTM Book 7 and removed upon completion of the Work. Contract information signs shall be either a TC-81 sign or an Owner supplied contract information sign.

Owner supplied contract information signs shall be picked up at the location specified in the Contract Documents. The Contractor shall arrange for the pickup of the signs. At Contract Completion, Owner supplied contract information signs shall be returned to the Owner at a location specified by the Contract Administrator.

706.07.02 Road Closing/Restriction Notice Sign (TC-64)

Road closing/restriction notice (TC-64) signs shall be installed and relocated at locations specified in the Contract Documents. Timing requirements for TC-64 signs shall be as specified in OTM Book 7.

The Contract Administrator shall be notified when the Contractor's operations results in changes to the TC-64 sign message details (i.e. dates, times, etc.).

706.07.03 Automated Flagger Assistance Devices

AFAD shall be installed, relocated and removed at locations as specified in the Contract Documents.

If the closure extends across an entrance or side road, a traffic control person shall also be present to direct traffic with a stop/slow paddle according to OTM Book 7.

706.07.04 Portable Variable Message Sign

Installation, including the construction of a temporary base, relocation, and messaging on the PVMS shall be as specified in the Contract Documents. The exact location of the PVMS shall be proposed by the Contractor and shall meet the following criteria:

a) Maximizes visibility for motorists without impacting safety in accordance with the ministry's clear zone requirements.

b) Installed on a level surface with adequate bearing capacity to support the weight of the PVMS and temporary base materials.

The Contract Administrator shall approve the location of the PVMS prior to it being deployed. The Contractor Administrator shall be notified at least 2 Business days in advance regarding the delivery, relocation, and removal of PVMS within the construction work zone.

Modem installation, testing, and decommissioning for the PVMS shall be as specified in the Contract Documents.

The PVMS control box shall be secured from entry by unauthorized personnel. There shall be security measures or devices in place to prevent message tampering of the sign.

All PVMS and any temporary base shall be removed upon completion of the Work.

706.07.04.01 Maintenance of Portable Variable Message Sign

Maintenance shall be performed for the continuous operation of the PVMS, as required, throughout the duration of the Contract. Daily inspection of the PVMS shall be conducted to ensure that the PVMS meets the following maintenance requirements:

a) PVMS sign face is aimed with the sign sight tube to the center of the approach roadway approximately 200m upstream of the sign to ensure maximum visibility.

b) Solar panels are tilted and rotated to face south.

c) All pixels and LEDs in the sign face remain operational.

d) Sign is elevated to its maximum height with the locking pin in place; sign face is to be regularly cleaned from dirt, road salt or debris that may obstruct the visibility of the sign.

e) Batteries are replaced as needed to ensure that battery levels are maintained per the supplier's operational requirements.

f) Modems and other remote communications equipment remain operational.

Immediate repairs shall be required whenever there is a failure or cessation of the operation of any component or components of the PVMS. The Contract Administrator shall be notified immediately each time repair work is performed on a PVMS.

706.07.05 Freeway Paving Operations

When paving on a freeway within 3 m of a travelled lane open to traffic with no barrier designed to restrain errant vehicles between the paving operation and traffic, the following protection measures shall be applied:

a) A temporary regulatory speed reduction of 20 km/hr less than the normal posted regulatory speed (NPRS) shall be implemented during the paving operation. All signing shall be according to OTM Book 7. All existing NPRS signs within the reduced speed zone shall be covered while the temporary regulatory speed reduction signs are in use. The existing NPRS signs shall be restored when the reduced speed zone is not required and the temporary regulatory speed reduction signs shall be covered.

b) When a temporary regulatory speed reduction is in effect, a portable variable message sign (PVMS) shall be placed in advance of the first Maximum Speed Ahead signs at a location to be provided by the CA. If the Contract is in a bilingual area, an additional PVMS sign shall be deployed for the approved equivalent French message at least 150 m after the English PVMS. PVMS locations shall be verified to be legible to approaching motorists for at least 300 m and not be obstructed by existing signing or other obstructions. PVMS message details shall be as directed by the Contract Administrator.

When there is only a single lane open to traffic that is adjacent to the paving operation, the use of pace vehicles is permitted to limit the speed of traffic to that of the temporary regulatory speed reduction. The use of pace vehicles shall be according to OTM Book 7.

706.07.06 Management of Excess Materials

Management of excess materials shall be according to the Contract Documents.

706.09 MEASUREMENT FOR PAYMENT

706.09.01 Actual Measurement

706.09.01.01 Automated Flagger Assistance Devices

For measurement purposes, a count shall be made of the number of AFAD installed.

706.09.01.02 Portable Variable Message Sign (Temporary)

For measurement purposes, a count shall be made of the number of PVMS installed.

706.09.01.03 Portable Variable Message Sign, Relocation

For measurement purposes, a count shall be made of the number of PVMS relocated.

PVMS that are temporarily surplus for intermediate stages but will be required later shall be paid as one relocation for the combined moves into and out of the site storage, including any off-site storage required due to space restrictions.

706.09.01.04 Road Closing/Restriction Notice Signs (TC-64)

For measurement purposes, a count shall be made of the number of TC-64 signs installed.

706.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

706.10 BASIS OF PAYMENT

706.10.01 Automated Flagger Assistance Devices - Item
Portable Variable Message Sign (Temporary) - Item
Portable Variable Message Sign, Relocation - Item

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

706.10.02 Temporary Traffic Control Signs - Item

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

For progress payment, fifty percent of the Contract price shall be paid upon the supply and installation of the complete initial traffic control plan. The balance will be prorated over the balance of the Contract Time.

Reinstallation of temporary traffic control signs after seasonal shutdown shall be at no additional cost to the Owner.

706.10.03 Road Closing/Restriction Notice Signs (TC-64) - Item

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

Changes to the TC-64 sign message details (i.e. dates, times, etc.) required as a result of the Contractor's operations shall be completed at no additional cost to the Owner.

Progress payments shall be made as follows:	60% of the unit price per sign upon installation; 20% of the unit price per sign upon relocation; 20% of the unit price per sign upon removal.
If no relocation is required:	60% of the unit price per sign upon installation; 40% of the unit price per sign upon removal.

On each occasion when the Contractor fails to install the TC-64 signs according to the requirements of this specification, or fails to remove the TC-64 signs within two hours of re-opening of the affected roadway, a payment reduction of $2,000.00 shall be assessed. A further payment reduction of $2,000.00 per Day, or part thereof, with no maximum payment reduction, shall be assessed until such time as the TC-64 signs are removed.

706.10.04 Removals and Replacements

The removal and replacement of defective workmanship or materials shall be at no additional cost to the Owner.

706.10.05 Freeway Paving Operations

The protection measures specified for freeway paving operations shall be at no additional cost to the Owner.

PORTABLE VARIABLE MESSAGE SIGN, RELOCATION - Item No.
PORTABLE VARIABLE MESSAGE SIGN (TEMPORARY) - Item No.

Special Provision No. 706F04 ~~August 2018~~April 2025

Amendment to OPSS 706, ~~November 2016~~April 2025

Designation of Modem and Message Details for PVMS

[* Designer Option, See Notes to Designer]

NOTES TO DESIGNER:

*** Designer Option**

Insert **one** of the following two options as appropriate:

Option 1 - Shall be selected when a modem is required.

Option 2 - Shall be selected when a modem is not required and the PVMS is to be controlled locally by the contractor.

Option 1

706.05 MATERIALS

Clause 706.05.04.01 of OPSS 706 is deleted in its entirety and replaced with the following:

706.05.04 Portable Variable Message Signs

706.05.04.01 Modem

Each PVMS shall have a modem. The Modem shall be procured and activated at least 2 weeks prior to requiring the PVMS. The Modem SIM card shall be ordered from Wireless Personal Communications Inc. (WPCI) at **www.wpci.com**; Bell Mobility.

The following details shall be provided to WPCI when ordering:

a) Contract number and MTO Region.
b) The sign make and model.
c) Proposed deployment location for the sign.
d) Billing contact information and address.
e) The date when the modem is required and the proposed duration for use.
f) Two emergency contact numbers with respect to the account.

706.07 CONSTRUCTION

706.07.04 Portable Variable Message Signs

Subsection 706.07.04 of OPSS 706 is amended by the addition of the following:

All messages displayed on the PVMS shall be via centralized control by the Regional Traffic Operations Centre unless otherwise specifically directed.

The modem shall be installed in the PVMS and connected to the power and CAT5 communications cables. The modem shall be tested with WPCI to ensure full functionality prior to sign deployment. WPCI shall provide written communication confirming that the modem is operational and properly configured per the associated sign type. For any issues regarding the activation of the modem, please contact WPCI via e-mail: **corpserv@wpci.com**.

At least 2 business days prior to the deployment of the PVMS, the following information shall be provided to the Contract Administrator and the Regional Traffic Operations Centre:

a) Static IP address(es).
b) Phone number(s).
c) ESN #(s), sign manufacturer and model.
d) Proposed deployment location for the sign(s).

Modems shall not be transferred from other ministry contracts. The modem(s) shall be activated and deactivated specifically for the purposes of this contract.

At Contract Completion, a request shall be made to WPCI in writing via e-mail: **corpserv@wpci.com** to deactivate the modem(s). A written confirmation from WPCI that the modem(s) has been deactivated as of the specified date shall be provided to the Contract Administrator.

706.10 BASIS OF PAYMENT

706.10.01 Portable Variable Message Sign (Temporary) - Item

Subsection 706.10.01 of OPSS 706 is amended by the addition of the following:

Progress payments for the above tender item shall be based on the following percentages of the Contract price:

a) 90% for supply and installation, and

b) 10% upon receipt of written notification from Bell-Mobility - WPCI that the modem(s) has been deactivated.

Section 706.10 of OPSS 706 is amended by the addition of the following subsection:

706.10.05 Modem

The Contractor shall be responsible for the payment of the modem and all fees associated with it, such as the activation and monthly data communication fees, throughout the duration of the Contract.

Option 2

706.07 CONSTRUCTION

706.07.04 Portable Variable Message Signs

Subsection 706.07.04 of OPSS 706 is amended by the addition of the following:

All messages displayed on the PVMS shall be controlled locally. The messaging on the signs shall be:

PVMS #	Message Details
**	***

Designer Fill-Ins for Option 2:

** Fill-in the PVMS number (PVMS-1) or PVMS relocation number (PVMS-1-R1)

*** Fill-in the sign messaging. If the contract is in a designated bilingual area, the corresponding French sign messages must also be included. The sign messages are to be obtained from the Regional Traffic Section.

WARRANT: Always with these tender items.

PORTABLE VARIABLE MESSAGE SIGN, RELOCATION - Item No.
PORTABLE VARIABLE MESSAGE SIGN (TEMPORARY) - Item No.

Special Provision No. 706F04 April 2025

Amendment to OPSS 706, April 2025

Designation of Modem and Message Details for PVMS

[* Designer Option, See Notes to Designer]

NOTES TO DESIGNER:

*** Designer Option**

Insert **one** of the following two options as appropriate:

Option 1 - Shall be selected when a modem is required.

Option 2 - Shall be selected when a modem is not required and the PVMS is to be controlled locally by the contractor.

Option 1

706.05 MATERIALS

Clause 706.05.04.01 of OPSS 706 is deleted in its entirety and replaced with the following:

706.05.04 Portable Variable Message Signs

706.05.04.01 Modem

Each PVMS shall have a modem. The Modem shall be procured and activated at least 2 weeks prior to requiring the PVMS. The Modem SIM card shall be ordered from Wireless Personal Communications Inc. (WPCI) at **www.wpci.com**; Bell Mobility.

The following details shall be provided to WPCI when ordering:

a) Contract number and MTO Region.
b) The sign make and model.
c) Proposed deployment location for the sign.
d) Billing contact information and address.
e) The date when the modem is required and the proposed duration for use.
f) Two emergency contact numbers with respect to the account.

706.07 CONSTRUCTION

706.07.04 Portable Variable Message Signs

Subsection 706.07.04 of OPSS 706 is amended by the addition of the following:

All messages displayed on the PVMS shall be via centralized control by the Regional Traffic Operations Centre unless otherwise specifically directed.

The modem shall be installed in the PVMS and connected to the power and CAT5 communications cables. The modem shall be tested with WPCI to ensure full functionality prior to sign deployment. WPCI shall provide written communication confirming that the modem is operational and properly configured per the associated sign type. For any issues regarding the activation of the modem, please contact WPCI via e-mail: **corpserv@wpci.com**.

At least 2 business days prior to the deployment of the PVMS, the following information shall be provided to the Contract Administrator and the Regional Traffic Operations Centre:

a) Static IP address(es).
b) Phone number(s).
c) ESN #(s), sign manufacturer and model.
d) Proposed deployment location for the sign(s).

Modems shall not be transferred from other ministry contracts. The modem(s) shall be activated and deactivated specifically for the purposes of this contract.

At Contract Completion, a request shall be made to WPCI in writing via e-mail: **corpserv@wpci.com** to deactivate the modem(s). A written confirmation from WPCI that the modem(s) has been deactivated as of the specified date shall be provided to the Contract Administrator.

706.10 BASIS OF PAYMENT

706.10.01 Portable Variable Message Sign (Temporary) - Item

Subsection 706.10.01 of OPSS 706 is amended by the addition of the following:

Progress payments for the above tender item shall be based on the following percentages of the Contract price:

a) 90% for supply and installation, and

b) 10% upon receipt of written notification from Bell-Mobility - WPCI that the modem(s) has been deactivated.

Section 706.10 of OPSS 706 is amended by the addition of the following subsection:

706.10.05 Modem

The Contractor shall be responsible for the payment of the modem and all fees associated with it, such as the activation and monthly data communication fees, throughout the duration of the Contract.

Option 2

706.07 CONSTRUCTION

706.07.04 Portable Variable Message Signs

Subsection 706.07.04 of OPSS 706 is amended by the addition of the following:

All messages displayed on the PVMS shall be controlled locally. The messaging on the signs shall be:

PVMS #	Message Details
**	***

Designer Fill-Ins for Option 2:

** Fill-in the PVMS number (PVMS-1) or PVMS relocation number (PVMS-1-R1)

*** Fill-in the sign messaging. If the contract is in a designated bilingual area, the corresponding French sign messages must also be included. The sign messages are to be obtained from the Regional Traffic Section.

WARRANT: Always with these tender items.

Ontario Provincial Standard Specifications (OPSSs)					
708	November 2016	April 2025	TBD	Rev: Construction Specification for Portable Temporary Traffic Signals is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed.	Mike Pearsall
Standard Special Provisions (SSPs)					
708F01	November 2016	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Portable Temporary Traffic Signals is revised to reflect the new publication version of OPSS 708.	Mike Pearsall

Note: The 708 implemented in April 2025 replaces 708, November 2016 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR PORTABLE TEMPORARY TRAFFIC SIGNALS

TABLE OF CONTENTS

708.01 SCOPE

This specification covers the requirements for the installation, operation and maintenance of portable temporary traffic signals.

~~**708.01.01 Specification Significance and Use**~~

~~This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.~~

~~Use of this specification or any other specification shall be according to the Contract Documents.~~

~~**708.01.02 Appendices Significance and Use**~~

~~Appendices are not for use in provincial Contracts as they are developed for municipal use, and then, only when invoked by the Owner.~~

~~Appendices are developed for the Owner's use only.~~

~~Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner.~~

~~Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.~~

~~Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.~~

~~The decision to use any appendix is determined by an Owner after considering their Contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.~~

708.02 REFERENCES

~~When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.~~

This specification refers to the following standards, specifications, or publications:

Ontario Ministry of Transportation Publications

Designated Sources for Materials (DSM)

Ontario Traffic Manual (OTM):
Book 7, Temporary Conditions
Book 12, Traffic Signals

708.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Portable Temporary Traffic Signals (PTTS) means two traffic control signal heads mounted onto a movable trailer.

708.05 MATERIALS

708.05.01 Portable Temporary Traffic Signals

Portable temporary traffic signals shall be supplied from a source named on the ministry's DSM.
The traffic control signal heads shall have a minimum vertical mounting height of 5 metres for both the primary and secondary signal heads.

The primary and secondary signal heads shall be separated by a minimum of 3.0 metres measured laterally.

The signal heads shall be reversible on the trailer's boom.

Highway yellow backboards shall be used on each signal head.

All signal lenses shall comply with the Institute of Transportation Engineers interim/final specifications for incandescent or light emitting diode lamps for chromaticity and luminous intensity.

708.05.02 Temporary Illumination

Temporary illumination shall be provided for all PTTS installations being used at night. Temporary illumination shall meet the following requirements:

a) A minimum of one luminaire shall be mounted over each PTTS trailer.

b) Each luminaire shall have a minimum light output of 22,000 lumens.

c) Each luminaire shall be mounted a minimum of 9 metres vertically above the roadway surface.

d) The temporary illumination shall be powered by generator or line power.

e) Temporary illumination shall be on from dusk until dawn. If the temporary illumination has a photo controller, then the temporary illumination shall be switched on when ambient light levels are at 16 Lux and lower and switched off when ambient light levels are at 50 Lux and higher.

708.07 CONSTRUCTION

708.07.01 General

PTTS and its temporary illumination shall be installed and relocated at the locations specified in the Contract Documents, or on the signed legal drawing (PHM-125). PTTS shall be installed on a level and stable surface that allows for on-site maintenance and service of the units.

The PTTS shall be positioned to prevent displacement or damage by weather, maintenance activities, vehicle impact or vandalism.

The Contract Administrator shall be given a minimum of 24-hour notice prior to the activation of the PTTS. The PTTS shall be activated in the presence of the Contract Administrator.

708.07.02 Operational Constraints

Operation of PTTS shall be permitted between April 1st and November 30th of each calendar year. The operation of PTTS outside of this period shall not be permitted unless otherwise specified in the Contract

Documents. If PTTS are permitted outside of this period, the PTTS shall be configured with environmental controls to permit operation at any temperature.

When not in use, the PTTS shall be removed or the traffic control signal heads covered or turned up and/or away from the roadway.

708.07.03 Operational Capabilities

708.07.03.01 Portable Traffic Control Signals

The installation and operation of portable temporary traffic signals shall be according to the OTM Book 7 and the traffic control signal head display criteria specified in OTM Book 12.

PTTS shall have the following operational capabilities:

a) Pre-timed signal operations where the green time, the amber clearance, and the all red times can be manually input to the controller.

b) Fully actuated operation using a variety of detection devices including loops, microwave, video or non-loop in-pavement detection equipment that will:

   i). Place a call for a green indication when red or amber is being displayed.
   ii). Extend the green indication from a minimum to a maximum green time by a user selectable amount each time a vehicle is detected during the green display (extension time).

c) Rest in red or the last phase served. The user must be able to select this mode through software input on a construction site.

d) The user must be able to manually enter a minimum green time, a maximum green time, and an extension time for actuated operations.

e) All timing intervals are capable of being set in increments of one second.

f) Default mode – flashing red shall display in both directions (at both master and local trailers) at the same time.

g) Manual mode – shall allow an operator to interrupt the other modes and return to the previous mode when finished.

h) Default mode warning system – the PTTS shall have the email, text messaging or cell/satellite paging warning system activated and monitored, to advise the Owner/operator and/or Contractor when the signals have gone into the “default mode”.

i) Be able to communicate between the master and local units through either radio or hardwire with conflict monitoring enabled to ensure malfunctions are identified. The units shall be set up so that if communications are lost, both units will revert to “default mode” operation.

j) All conflicts must be recorded in an error log with the exact date and time of the occurrence. The error log must be retrievable by the Owner.

708.07.03.02 Trailer Unit

Each PTTS trailer unit shall have the following operational capabilities:

a) Be able to operate as either a master or local.

b) Be interconnected by either hardwire or radio.

708.07.03.03 Controller

Each controller shall have the following operational capabilities:

a) Be capable of providing variable all red clearance intervals between 0 – 600 seconds.

b) Have circuitry that detects low voltage and prevents the occurrence of an unsafe (conflicting) signal indication. In the event of low voltage the signal must default to a flashing all red.

c) Must be password protected or have other security devices in place to prevent program tampering.

d) Provide a red flash cycle that is flashed continuously at a rate of 50 – 60 times per minute with a 50% duty cycle.

e) If a radio interconnection is used then the system must have a mobile license from Industry Canada.

708.07.03.04 Power Supply

The PTTS shall be powered by one or more of the following methods:

a) Generator

b) Solar power

c) Electrical line power

If a generator is being used to power the PTTS and temporary illumination, suitable housing and sound reduction measures shall be installed to enclose the generator and reduce external noise levels to less than 45 dBA measured at a distance of 7 metres from the generator. The housing shall provide sufficient ventilation to prevent overheating and permit exhausting of any hazardous fumes.

The PTTS shall have a battery backup with a battery capacity sufficient to operate the system for a minimum of 14 ~~days~~Days without recharging.

The power supply and other electronic controls shall be completely inaccessible to unauthorized personnel and protected by a sturdy, lockable metal enclosure.

708.07.04 Traffic Signal Control Programming and Timing

A technical expert knowledgeable in the operation of the PTTS shall be at the site to provide assistance during the initial set-up of the unit and shall remain on site until the unit is operating to the satisfaction of the Contract Administrator.

The traffic signal timing as specified in the Contract Documents shall be programmed into the traffic signal controller.

The controller shall be set up by performing all programming, setting all timing controls, switch settings and conflict monitoring.

708.07.05 Temporary Traffic Signals Supplied by Owner

Where the Owner supplies the PTTS, the PTTS shall be picked up and transported from the Owner's premises as specified in the Contract Documents. Once the PTTS is placed into operation, the operation, and maintenance of the PTTS shall be completed at no additional cost to the Owner.

PTTS shall be returned to the Owner's premises or to an alternate site specified by the Contract Administrator within 7 Days of being taken out of operation.

708.07.06 Maintenance of Portable Temporary Traffic Signals

Routine, non-routine and emergency maintenance work required for continuous and proper operation of the PTTS shall be performed as specified in the Contract Documents.

A technical expert shall be available on-call 24 hours a day, 7 ~~days~~Days a week, to troubleshoot any PTTS problems on site and perform all work required to restore the PTTS to full operation.

When directed by the Contract Administrator, the traffic signal operation shall be manually overridden to reduce or eliminate queuing traffic.

A logbook shall be maintained and kept with the PTTS or at a location agreed upon with the Owner. The logbook shall record any fieldwork performed on the PTTS system, including the replacement of any hardware, changes to the software, or changes to the configuration, phasing, or timing parameters. The time and date of each entry in the logbook shall be signed by the individual making the entry.

708.09 MEASUREMENT FOR PAYMENT

708.09.01 Portable Temporary Traffic Signals

For measurement purposes, a count shall be made of the number of PTTS installed. Each PTTS shall be counted only once, regardless of the number of times it is relocated.

708.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

708.10 BASIS OF PAYMENT

708.10.01 Portable Temporary Traffic Signals - Item

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

Site visits by the technical expert required to restore the PTTS to full operation shall be at no additional cost to the Owner.

Appendix 708-A, November 2016
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.

Note: The 708 implemented in April 2025 replaces 708, November 2016 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR PORTABLE TEMPORARY TRAFFIC SIGNALS

TABLE OF CONTENTS

708.01 SCOPE

This specification covers the requirements for the installation, operation and maintenance of portable temporary traffic signals.

708.02 REFERENCES

This specification refers to the following standards, specifications, or publications:

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Designated Sources for Materials (DSM)

Ontario Traffic Manual (OTM):
Book 7, Temporary Conditions
Book 12, Traffic Signals

708.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Portable Temporary Traffic Signals (PTTS) means two traffic control signal heads mounted onto a movable trailer.

708.05 MATERIALS

708.05.01 Portable Temporary Traffic Signals

Portable temporary traffic signals shall be supplied from a source named on the ministry's DSM.
The traffic control signal heads shall have a minimum vertical mounting height of 5 metres for both the primary and secondary signal heads.

The primary and secondary signal heads shall be separated by a minimum of 3.0 metres measured laterally.

The signal heads shall be reversible on the trailer's boom.

Highway yellow backboards shall be used on each signal head.

All signal lenses shall comply with the Institute of Transportation Engineers interim/final specifications for incandescent or light emitting diode lamps for chromaticity and luminous intensity.

708.05.02 Temporary Illumination

Temporary illumination shall be provided for all PTTS installations being used at night. Temporary illumination shall meet the following requirements:

a) A minimum of one luminaire shall be mounted over each PTTS trailer.

b) Each luminaire shall have a minimum light output of 22,000 lumens.

c) Each luminaire shall be mounted a minimum of 9 metres vertically above the roadway surface.

d) The temporary illumination shall be powered by generator or line power.

e) Temporary illumination shall be on from dusk until dawn. If the temporary illumination has a photo controller, then the temporary illumination shall be switched on when ambient light levels are at 16 Lux and lower and switched off when ambient light levels are at 50 Lux and higher.

708.07 CONSTRUCTION

708.07.01 General

PTTS and its temporary illumination shall be installed and relocated at the locations specified in the Contract Documents, or on the signed legal drawing (PHM-125). PTTS shall be installed on a level and stable surface that allows for on-site maintenance and service of the units.

The PTTS shall be positioned to prevent displacement or damage by weather, maintenance activities, vehicle impact or vandalism.

The Contract Administrator shall be given a minimum of 24-hour notice prior to the activation of the PTTS. The PTTS shall be activated in the presence of the Contract Administrator.

708.07.02 Operational Constraints

Operation of PTTS shall be permitted between April 1st and November 30th of each calendar year. The operation of PTTS outside of this period shall not be permitted unless otherwise specified in the Contract Documents. If PTTS are permitted outside of this period, the PTTS shall be configured with environmental controls to permit operation at any temperature.

When not in use, the PTTS shall be removed or the traffic control signal heads covered or turned up and/or away from the roadway.

708.07.03 Operational Capabilities

708.07.03.01 Portable Traffic Control Signals

The installation and operation of portable temporary traffic signals shall be according to the OTM Book 7 and the traffic control signal head display criteria specified in OTM Book 12.

PTTS shall have the following operational capabilities:

a) Pre-timed signal operations where the green time, the amber clearance, and the all red times can be manually input to the controller.

b) Fully actuated operation using a variety of detection devices including loops, microwave, video or non-loop in-pavement detection equipment that will:

   i. Place a call for a green indication when red or amber is being displayed.
   ii. Extend the green indication from a minimum to a maximum green time by a user selectable amount each time a vehicle is detected during the green display (extension time).

c) Rest in red or the last phase served. The user must be able to select this mode through software input on a construction site.

d) The user must be able to manually enter a minimum green time, a maximum green time, and an extension time for actuated operations.

e) All timing intervals are capable of being set in increments of one second.

f) Default mode – flashing red shall display in both directions (at both master and local trailers) at the same time.

g) Manual mode – shall allow an operator to interrupt the other modes and return to the previous mode when finished.

h) Default mode warning system – the PTTS shall have the email, text messaging or cell/satellite paging warning system activated and monitored, to advise the Owner/operator and/or Contractor when the signals have gone into the “default mode”.

i) Be able to communicate between the master and local units through either radio or hardwire with conflict monitoring enabled to ensure malfunctions are identified. The units shall be set up so that if communications are lost, both units will revert to “default mode” operation.

j) All conflicts must be recorded in an error log with the exact date and time of the occurrence. The error log must be retrievable by the Owner.

708.07.03.02 Trailer Unit

Each PTTS trailer unit shall have the following operational capabilities:

a) Be able to operate as either a master or local.

b) Be interconnected by either hardwire or radio.

708.07.03.03 Controller

Each controller shall have the following operational capabilities:

a) Be capable of providing variable all red clearance intervals between 0 – 600 seconds.

b) Have circuitry that detects low voltage and prevents the occurrence of an unsafe (conflicting) signal indication. In the event of low voltage the signal must default to a flashing all red.

c) Must be password protected or have other security devices in place to prevent program tampering.

d) Provide a red flash cycle that is flashed continuously at a rate of 50 – 60 times per minute with a 50% duty cycle.

e) If a radio interconnection is used then the system must have a mobile license from Industry Canada.

708.07.03.04 Power Supply

The PTTS shall be powered by one or more of the following methods:

a) Generator

b) Solar power

c) Electrical line power

If a generator is being used to power the PTTS and temporary illumination, suitable housing and sound reduction measures shall be installed to enclose the generator and reduce external noise levels to less than 45 dBA measured at a distance of 7 metres from the generator. The housing shall provide sufficient ventilation to prevent overheating and permit exhausting of any hazardous fumes.

The PTTS shall have a battery backup with a battery capacity sufficient to operate the system for a minimum of 14 Days without recharging.

The power supply and other electronic controls shall be completely inaccessible to unauthorized personnel and protected by a sturdy, lockable metal enclosure.

708.07.04 Traffic Signal Control Programming and Timing

A technical expert knowledgeable in the operation of the PTTS shall be at the site to provide assistance during the initial set-up of the unit and shall remain on site until the unit is operating to the satisfaction of the Contract Administrator.

The traffic signal timing as specified in the Contract Documents shall be programmed into the traffic signal controller.

The controller shall be set up by performing all programming, setting all timing controls, switch settings and conflict monitoring.

708.07.05 Temporary Traffic Signals Supplied by Owner

Where the Owner supplies the PTTS, the PTTS shall be picked up and transported from the Owner's premises as specified in the Contract Documents. Once the PTTS is placed into operation, the operation, and maintenance of the PTTS shall be completed at no additional cost to the Owner.

PTTS shall be returned to the Owner's premises or to an alternate site specified by the Contract Administrator within 7 Days of being taken out of operation.

708.07.06 Maintenance of Portable Temporary Traffic Signals

Routine, non-routine and emergency maintenance work required for continuous and proper operation of the PTTS shall be performed as specified in the Contract Documents.

A technical expert shall be available on-call 24 hours a day, 7 Days a week, to troubleshoot any PTTS problems on site and perform all work required to restore the PTTS to full operation.

When directed by the Contract Administrator, the traffic signal operation shall be manually overridden to reduce or eliminate queuing traffic.

A logbook shall be maintained and kept with the PTTS or at a location agreed upon with the Owner. The logbook shall record any fieldwork performed on the PTTS system, including the replacement of any hardware, changes to the software, or changes to the configuration, phasing, or timing parameters. The time and date of each entry in the logbook shall be signed by the individual making the entry.

708.09 MEASUREMENT FOR PAYMENT

708.09.01 Portable Temporary Traffic Signals

For measurement purposes, a count shall be made of the number of PTTS installed. Each PTTS shall be counted only once, regardless of the number of times it is relocated.

708.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

708.10 BASIS OF PAYMENT

708.10.01 Portable Temporary Traffic Signals - Item

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

Site visits by the technical expert required to restore the PTTS to full operation shall be at no additional cost to the Owner.

Special Provision No. 708F01 ~~November 2016~~April 2025

Amendment to OPSS 708, ~~November 2016~~April 2025

Traffic Signal Timing

708.07.04 Traffic Signal Control Programming and Timing

Subsection 708.07.04 of OPSS 708 is amended by deleting the second paragraph in its entirety and replacing it with the following:

The traffic signal timing shall be programmed into the traffic signal controller as specified in the Generic Signal Timing Sheet. ~~-~~The generic timing shall be transcribed onto the standard timing sheet for the PTTS controller being used, and a copy of the standard timing sheet shall be kept in the controller. ~~-~~A copy of the standard timing sheet, with a copy of the Generic Signal Timing Sheet attached, shall be submitted to the Contract Administrator prior to PTTS activation.

GENERIC SIGNAL TIMING SHEET

MAINSTREET (HWY): _____ TIMING DEVELOPED BY: _____

DATE TIMING DEVELOPED: _____

OPERATIONAL NOTES:

FUNCTION/OPERATION	**MOVEMENT**	
	Direction 1	Direction 2
PERMITTED MOVEMENTS	-	-
RED LOCK	-	-
AMBER LOCK	-	-
VEHICLE RECALL	-	-
VEHICLE MAX RECALL	-	-
RED REST	-	-
DISPLAY RED ON STARTUP	-	-
PLACE VEHICLE CALLS ON STARTUP	-	-

INTERVAL TIMES	**MOVEMENT**	
	Direction 1	Direction 2
MINIMUM GREEN	-	-
VEHICLE EXTENSION (PASSAGE TIME)	-	-
MAX GREEN (INCLUDES MIN GREEN)	-	-
MAX GREEN 2 (ALTERNATE MAX GREEN)	-	-
AMBER CLEARANCE	-	-
ALL RED CLEARANCE	-	-

DETECTOR SETUP	**MOVEMENT**	
	Direction 1	Direction 2
DELAY TIME ON PRESENCE DETECTION	-	-

TIME OF DAY	**TIME OF DAY**		**DAY OF WEEK**							**MOVEMENT**	
OPERATIONS	[START]	[END]	S	M	T	W	T	F	S	Direction 1	Direction 2
MAX RECALL			-	-	-	-	-	-	-	-	-
MIN RECALL			-	-	-	-	-	-	-	-	-
MAX GREEN 2			-	-	-	-	-	-	-	-	-

na --- not applicable

NOTES TO DESIGNER:

Designer to fill in the generic signal timing sheet for review by Regional Traffic Section. Include additional timing sheets as required.

WARRANT: Always with this tender item.

Special Provision No. 708F01 April 2025

Amendment to OPSS 708, April 2025

Traffic Signal Timing

708.07.04 Traffic Signal Control Programming and Timing

Subsection 708.07.04 of OPSS 708 is amended by deleting the second paragraph in its entirety and replacing it with the following:

The traffic signal timing shall be programmed into the traffic signal controller as specified in the Generic Signal Timing Sheet. The generic timing shall be transcribed onto the standard timing sheet for the PTTS controller being used, and a copy of the standard timing sheet shall be kept in the controller. A copy of the standard timing sheet, with a copy of the Generic Signal Timing Sheet attached, shall be submitted to the Contract Administrator prior to PTTS activation.

GENERIC SIGNAL TIMING SHEET

MAINSTREET (HWY): _____ TIMING DEVELOPED BY: _____

DATE TIMING DEVELOPED: _____

OPERATIONAL NOTES:

FUNCTION/OPERATION	**MOVEMENT**	
	Direction 1	Direction 2
PERMITTED MOVEMENTS	-	-
RED LOCK	-	-
AMBER LOCK	-	-
VEHICLE RECALL	-	-
VEHICLE MAX RECALL	-	-
RED REST	-	-
DISPLAY RED ON STARTUP	-	-
PLACE VEHICLE CALLS ON STARTUP	-	-

INTERVAL TIMES	**MOVEMENT**	
	Direction 1	Direction 2
MINIMUM GREEN	-	-
VEHICLE EXTENSION (PASSAGE TIME)	-	-
MAX GREEN (INCLUDES MIN GREEN)	-	-
MAX GREEN 2 (ALTERNATE MAX GREEN)	-	-
AMBER CLEARANCE	-	-
ALL RED CLEARANCE	-	-

DETECTOR SETUP	**MOVEMENT**	
	Direction 1	Direction 2
DELAY TIME ON PRESENCE DETECTION	-	-

TIME OF DAY	**TIME OF DAY**		**DAY OF WEEK**							**MOVEMENT**	
OPERATIONS	[START]	[END]	S	M	T	W	T	F	S	Direction 1	Direction 2
MAX RECALL			-	-	-	-	-	-	-	-	-
MIN RECALL			-	-	-	-	-	-	-	-	-
MAX GREEN 2			-	-	-	-	-	-	-	-	-

na --- not applicable

NOTES TO DESIGNER:

Designer to fill in the generic signal timing sheet for review by Regional Traffic Section. Include additional timing sheets as required.

WARRANT: Always with this tender item.

Ontario Provincial Standard Specifications (OPSSs)					
723	November 2016	April 2025	TBD	Rev: Construction Specification for Energy Attenuators is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 107S06 and 723S03 has been incorporated into OPSS 723.	Mike Pearsall
Standard Special Provisions (SSPs)					
107S06	January 2025	N/A	TBD	Can: SSP Amendment to Construction Specification for Energy Attenuators is cancelled. Applicable content has been incorporated into OPSS 723.	Mike Pearsall
723S03	May 2019	N/A	TBD	Can: SSP Amendment to Construction Specification for Energy Attenuators is cancelled. Applicable content has been incorporated into OPSS 723.	Mike Pearsall

Note: The 723 implemented in April 2025 replaces 723, November 2015 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR ENERGY ATTENUATORS

TABLE OF CONTENTS

723.01 SCOPE

This specification covers the requirements for the installation of permanent and temporary energy attenuators and relocation of temporary energy attenuators.

~~723.01.01 Specification Significance and Use~~

~~This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.~~

Use of this specification or any other specification shall be according to the Contract Documents.

723.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

723.02 REFERENCES

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 314	Untreated Granular Subbase, Base, Surface Shoulder, and Stockpiling
OPSS 510	Removal
OPSS 705	Flexible Delineator Posts
OPSS 740	Concrete Barriers
OPSS 904	Concrete Structures

Ontario Provincial Standard Specifications, Material

OPSS 1350	Concrete - Materials and Production
OPSS 1440	Steel Reinforcement for Concrete

Ontario Ministry of Transportation Publications

Ontario Traffic Manual (OTM):
Book 6 - Warning Signs

ASTM International

~~A 123/A 123M~~A123/A123M-13 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
~~A 325~~A325-14 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
~~A 780/A 780M~~A780/A780M-09 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
~~D 4956~~D4956-13 Retroreflective Sheeting for Traffic Control

723.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Dual Duty means a new high exposure energy attenuator that is supplied and installed in a temporary configuration during construction, temporarily relocated as required, and then relocated to its permanent location prior to the end of the Work.

High Exposure means an energy attenuator that is installed in a location where the risk of impact is expected to be high such as in gore areas at exit ramps and express - collector transfers.

Reduced Exposure means a temporary energy attenuator that is installed in a location where the risk of impact is expected to be low. ~~-~~These energy attenuators should be specified in a location where they will be required for short duration of less than four months, are frequently relocated, and where they are not required during seasonal shutdown.

723.04 DESIGN AND SUBMISSION REQUIREMENTS

723.04.01 Design Requirements

The energy attenuator manufacturer shall complete the design of any non-standard details (e.g., a connection or transition to a rigid object other than a concrete barrier or temporary concrete barrier) at locations specified in the Contract Documents.

723.04.02 Submission Requirements

One copy of the manufacturer's installation instructions and Working Drawings shall be submitted to the Contract Administrator.

Installation of the energy attenuator shall not commence until the Contract Administrator has received the copy of the instructions and Working Drawings.

723.04.02.01 Submission Requirements for Non-Standard Details

Three copies of Working Drawings, prepared by the manufacturer, for any non-standard details shall be submitted to the Contract Administrator prior to the commencement of construction. The Working Drawings shall show full details of the materials and installation procedures.~~-~~ An Engineer's seal and signature shall be affixed on the Working Drawings verifying that the drawings are consistent with the Contract Documents.~~-~~ The submission of Working Drawings shall be accompanied by 3 copies of a letter that has been signed by the manufacturer, on company letterhead, summarizing the details of the proposed design.

Installation of the energy attenuator shall not commence until the Contract Administrator has received and accepted the copy of the letters and Working Drawings.

723.05 MATERIALS

723.05.01 General

All supplied system components shall be according to the manufacturer's specifications.

723.05.02 Energy Attenuator Systems

The names of systems acceptable for the Energy Attenuator - Permanent items are shown in Table 1.

The names of systems acceptable for the Energy Attenuator - Temporary items are shown in Table 2.

The Contractor shall have the option of supplying and installing any of these approved systems shown for the appropriate tender item.

723.05.03 Concrete

Concrete for pads and anchor blocks shall be according to OPSS 1350 with a nominal minimum 28-Day compressive strength of 30 MPa.

723.05.04 Steel Reinforcement

Steel reinforcement shall be according to OPSS 1440.

723.05.05 Anchor Bolts

Anchor bolts shall be supplied and installed according to energy attenuator manufacturer recommendations.

723.05.06 Bolts for Connection of BB-BEAT System to Concrete Barrier

Bolts used to connect the BB-BEAT system to the concrete barrier shall be according to ASTM ~~A 325~~A325 and shall be hot dip galvanized according to ASTM ~~A 123~~A123.

723.05.07 U Channel Posts

Posts shall be 2.44 m long perforated steel U channel with 11 mm diameter holes spaced on 50 mm centres, minimum weight of 4.46 kg/m, and hot dip galvanized according to ASTM ~~A 123~~A123.

723.05.08 Flexible Delineator Posts

Flexible delineator posts shall be according to OPSS 705. ~~-~~The post colour shall be orange.

723.05.09 Reflective Sheeting

Flexible delineator posts shall be outfitted with high intensity retroreflective sheeting according to ASTM ~~D 4956~~D4956, Type IV; white colour; and to the dimensions specified in the Contract Documents.

723.05.10 Reuse of Materials

Notwithstanding subsection GC 5.02, Quality of Material, paragraph 01 of the General Conditions of Contract, the reuse of materials is permitted for temporary energy attenuator installations and relocations, provided the components have not been damaged to affect the safety performance of the system.

723.07 CONSTRUCTION

723.07.01 General

Permanent and temporary energy attenuators shall be installed according to manufacturer's instructions at locations specified in the Contract Documents. A reference for energy attenuator Contract Drawing Notation is shown in Table 3.

Energy attenuators shall not be placed on surfaces with a crossfall greater than 6%.

723.07.01.01 Foundation for TAU-M Systems

Existing or new 150 mm minimum thick asphalt over 150 mm minimum thick compacted granular base may be used to support the TAU-M energy attenuator for permanent and temporary installations. The asphalt shall extend a minimum of 500 mm beyond the anchor bolts. Braces and anchoring for asphalt shall be used when the TAU-M system is installed on asphalt over granular according to manufacturer's specifications.

723.07.02 Permanent Installation

723.07.02.01 New Concrete Pads

Levelling and site preparation required for the existing granular base shall be performed prior to placing the concrete pad. The concrete pad shall be constructed as specified in the Contract Documents. Concrete shall be placed, cured, and finished according to OPSS 904.

The granular base below new concrete pads shall be a minimum depth of 150 mm of existing or new Granular A and shall be according to OPSS 314.

723.07.02.02 Existing Concrete Surfaces and Pads

When specified in the Contract Documents, existing 200 mm thick concrete surfaces, pads, or precast pads may be used to support the energy attenuator.

723.07.02.03 Connection of BB-BEAT and QuadTrend Systems to Concrete Barrier

When the BB-BEAT or QuadTrend system is connected to new concrete barrier, the adjacent 4.0 m of concrete barrier shall be according to OPSS 740 and the Contract Documents.

When the BB-BEAT or QuadTrend system is connected to existing concrete barrier, the adjacent 4.0 m of existing concrete barrier shall be removed according to OPSS 510 and a new 4.0 m section of concrete barrier shall be installed according to OPSS 740 and the Contract Documents.

723.07.02.04 Rear Cable Anchor Blocks for QuadTrend Systems

Rear cable anchor blocks shall be as specified in the Contract Documents. In both earth and rock fills, rear cable anchor blocks shall be placed on slopes 3H:1V or flatter. The cable supplied with the unit shall be used to determine the proper location of the rear cable anchor block.

In porous or crumbly soils, forms for cast-in-place anchor blocks shall be used to prevent contamination of the concrete. Forms may be left in place or removed.

The top of the concrete block shall be flush with the embankment slope and the rear cable anchor assembly shall not protrude more than 100 mm above ground.

723.07.02.05 Damage to Galvanizing

Precautions shall be taken to protect galvanizing against damage. Minor abrasions shall be repaired according to ASTM ~~A 780.~~ A780. Components with major abrasions shall be replaced.

The method of repair for any damage shall be approved by the Contract Administrator prior to the commencement of such work.

723.07.02.06 Posts for BB-BEAT Systems

All posts shall be set to the alignment specified in the Contract Documents, regardless of the material encountered. Permissible tolerance for plumb shall be 20 mm maximum over the post length above the ground. The driving of posts shall be accomplished with methods and equipment that leave the posts free of distortion, burring, and any other damage.

All lower end posts shall be installed so that not more than 100 mm is exposed above finished grade.

723.07.03 Temporary Installation

723.07.03.01 Existing Concrete Surface

Existing 200 mm minimum thick concrete surfaces, pads, or precast pads may be used to support the energy attenuator.

723.07.03.02 Asphalt Over Concrete

Existing or new 75 mm minimum thick asphalt over 75 mm minimum thick concrete pavement may be used to support the energy attenuator.

723.07.03.03 Asphalt Over Compacted Granular

Existing or new 150 mm minimum thick asphalt over 150 mm minimum thick compacted granular base may be used to support the energy attenuator. The asphalt shall extend a minimum of 500 mm beyond the anchor bolts.

723.07.03.04 Reduced Exposure

When water filled energy attenuator systems are in use, the temperature shall be monitored on a daily basis. When the temperature is predicted to fall below freezing, antifreeze agents according to manufacturer recommendations shall be added to the water. The use of a water filled energy attenuator system when frozen is not permissible.

Water filled energy attenuator systems shall not be left in place during a seasonal shutdown period without approval from the Contract Administrator. When approval from the Contract Administrator is not granted, water filled energy attenuator systems shall be replaced with another approved energy attenuator listed for the reduced exposure tender item for the duration of the seasonal shutdown period.

Disposal of liquid materials shall be managed according to the Contract Documents.

723.07.03.05 Dual Duty

A new high exposure energy attenuator shall be supplied and installed in a temporary configuration during construction at the locations specified in the Contract Documents.

723.07.03.06 Relocation

Temporary energy attenuators, object markers, oversize snowplow markers, object marker posts, and flexible delineator posts shall be relocated as specified in the Contract Documents, including the removal of existing and installation of new anchor bolts and mounting hardware.

Prior to completion of the Contract, dual duty energy attenuators and associated object markers, oversize snowplow markers, and object marker posts including the replacement of anchor bolts and mounting hardware, shall be relocated to their permanent locations as specified in the Contract Documents and in accordance with the General and Permanent Installation subsections.

723.07.03.07 Permanent and Temporary Concrete Barriers

Temporary concrete barriers shall be modified and installed as specified in the Contract Documents and the modified surfaces shall be smooth. Temporary concrete barriers shall be anchored as specified in the Contract Documents.

Permanent existing concrete barriers shall be modified as specified in the Contract Documents and the modified surfaces shall be smooth.

723.07.04 Delineation

723.07.04.01 Object Markers and Oversize Snowplow Markers

A Wa-33 object marker according to OTM Book 6, a Wz-2 oversize snowplow marker, and galvanized mounting hardware shall be installed at each energy attenuator.

When installed on a paved surface, the object marker and oversize snowplow marker shall be integrally attached to a surface mounted flexible post. The signs and post shall be supplied by the manufacturer as a complete unit. The post shall have the ability to bend 90° from vertical and self-restore after impacts. The minimum outside diameter of the post shall be 60 mm. The post shall be anchored to the pavement according to manufacturer's recommendations.

When installed on a granular surface, the Wa-33 object marker and Wz-2 oversize snowplow marker shall be securely fastened to a U channel post and the post shall be direct buried to a minimum embedment depth of 900 mm.

Posts shall be installed at locations specified in the Contract Documents.

723.07.04.02 Flexible Delineator Posts

Flexible delineator posts shall be installed according to OPSS 705 at locations specified in the Contract Documents.

723.07.05 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

723.09 MEASUREMENT FOR PAYMENT

723.09.01 Actual Measurement

723.09.01.01 Energy Attenuator - Permanent, Narrow
Energy Attenuator - Permanent, Wide
Energy Attenuator - Permanent, Extra Wide
Energy Attenuator - Permanent, Super Wide
Energy Attenuator - Permanent, High Exposure

Energy Attenuator - Permanent, Single-Sided

For measurement purposes, a count shall be made of the number of complete energy attenuator systems installed.

723.09.01.02 **Energy Attenuator - Temporary, Narrow**
Energy Attenuator - Temporary, Wide
Energy Attenuator - Temporary, Extra Wide
Energy Attenuator - Temporary, Super Wide
Energy Attenuator - Temporary, Reduced Exposure
Energy Attenuator - Temporary, Dual Duty

For measurement purposes, a count shall be made of the number of complete energy attenuator systems installed and removed, up to the maximum number of systems required to be in place at any one time during the Contract.

723.09.01.03 **Energy Attenuator - Relocation, Narrow**
Energy Attenuator - Relocation, Wide
Energy Attenuator - Relocation, Extra Wide
Energy Attenuator - Relocation, Super Wide
Energy Attenuator - Relocation, Reduced Exposure
Energy Attenuator - Relocation, Dual Duty

For measurement purposes, a count shall be made of the number of complete energy attenuator systems relocated. Systems that are temporarily surplus and are required for future stages shall be paid for as one relocation for the combined moves into and out of storage, including any off-site storage required due to on-site restrictions.

723.09.02 **Plan Quantity Measurement**

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

723.10 **BASIS OF PAYMENT**

723.10.01 **Energy Attenuator - Permanent, Narrow - Item**
Energy Attenuator - Permanent, Wide - Item
Energy Attenuator - Permanent, Extra Wide - Item
Energy Attenuator - Permanent, Super Wide - Item
Energy Attenuator - Permanent, High Exposure - Item
Energy Attenuator - Permanent, Single-Sided - Item
Energy Attenuator - Temporary, Narrow - Item
Energy Attenuator - Temporary, Wide - Item
Energy Attenuator - Temporary, Extra Wide - Item
Energy Attenuator - Temporary, Super Wide - Item
Energy Attenuator - Temporary, Reduced Exposure - Item
Energy Attenuator - Temporary, Dual Duty - Item
Energy Attenuator - Relocation, Narrow - Item
Energy Attenuator - Relocation, Wide - Item
Energy Attenuator - Relocation, Extra Wide - Item
Energy Attenuator - Relocation, Super Wide - Item
Energy Attenuator - Relocation, Reduced Exposure - Item
Energy Attenuator - Relocation, Dual Duty - Item

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

When the Contract contains separate items for the work required by this specification, payment shall be at the Contract price and according to the specification for such work.

Costs associated with any required removals and replacement or repairs of defective work and materials shall be the Contractor's responsibility at no additional cost to the Owner.

TABLE 1
Energy Attenuator, Permanent (EAP)

Energy Attenuator	NCHRP Report 350 or AASHTO MASH Crash Test Level		Permanent Installation					
	TL-2	TL-3	Narrow (NA)	Wide (WI)	Extra Wide (EW)	Super Wide (SW)	High Exposure (HE)	Single Sided (SS)
TAU-M System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
TAU-XR System (Note 1)	Yes	Yes	Yes	No	No	No	Yes	No
TAU-II Wide System (Note 2)	Yes	Yes	No	Yes	No	No	No	No
TAU-II Extra Wide System	Yes	Yes	No	No	Yes	No	No	No
Quadguard M10 System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
Quadguard M10 Wide System (Notes 1 and 2)	N/A	Yes	No	Yes	No	No	No	No
Quadguard Wide System (Note 2)	Yes	Yes	No	Yes	No	No	No	No
Quadguard Extra Wide System	Yes	Yes	No	No	Yes	No	No	No
Quadguard Super Wide System	No	Yes	No	No	No	Yes	No	No
Delta System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
QuadTrend	No	Yes	No	No	No	No	No	Yes
BB-Beat	No	Yes	No	No	No	No	No	Yes
Smart System (Note 1)	Yes	Yes	Yes	No	No	No	Yes	No
Hercules System (Note 1)	N/A	Yes	Yes	No	No	No	No	No
Hercules 12 System (Note 1)	N/A	Yes	Yes	No	No	No	No	No

Note:

1. AASHTO MASH crash test compliant system.
2. The Quadguard M10 Wide (meeting AASHTO MASH TL-3) shall be used for Permanent Unidirectional configurations requiring a TL-3 crash test compliant system. For Permanent Unidirectional configurations requiring a TL-2 crash test compliant system and for all Bidirectional configurations of Energy Attenuator, Wide, systems listed on Table 1 and meeting NCHRP Report 350 shall be used.

TABLE 2
Energy Attenuator, Temporary (EAT)

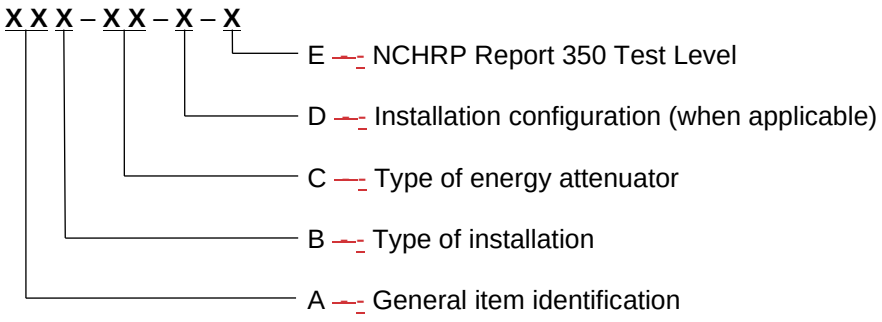
Energy Attenuator	NCHRP Report 350 or AASHTO MASH Crash Test Level		Temporary Installation					
	TL-2	TL-3	Reduced Exposure (RE) (Note 2)	Narrow (NA)	Wide (WI)	Extra Wide (EW)	Super Wide (SW)	Dual Duty (DD)
TAU-M System (Note 1)	Yes	Yes	No	Yes	No	No	No	No
TAU-XR System (Note 1)	Yes	Yes	No	Yes	No	No	No	Yes
TAU-II Wide System	Yes	Yes	No	No	Yes	No	No	No
TAU-II Extra Wide System	Yes	Yes	No	No	No	Yes	No	No
ABSORB 350 System	Yes	Yes	Yes	No	No	No	No	No
ABSORB-M System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
Quadguard M10 System (Note 1)	Yes	Yes	No	Yes	No	No	No	No
Quadguard Wide System	Yes	Yes	No	No	Yes	No	No	No
Quadguard Extra Wide System	Yes	Yes	No	No	No	Yes	No	No
Quadguard Super Wide System	No	Yes	No	No	No	No	Yes	No
Delta System (Note 1)	Yes	Yes	No	Yes	No	No	No	No
Smart System (Note 1)	Yes	Yes	No	Yes	No	No	No	Yes
SLED System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
Quash System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
Hercules System (Note 1)	N/A	Yes	No	Yes	No	No	No	No
Hercules 12 System (Note 1)	N/A	Yes	No	Yes	No	No	No	No

Notes:

1. AASHTO MASH crash test compliant system.
2. ABSORB 350 energy attenuator system shall be used when Movable Temporary Concrete Barrier is specified.

TABLE 3
Contract Drawing Notation

A	**EA** - Energy Attenuator
B	**P** - Permanent **T** - Temporary **R** - Relocation
C	**NA** - Narrow **WI** - Wide **EW** - Extra Wide **SW** - Super Wide **HE** - High Exposure **SS** - Single-Sided **RE** - Reduced Exposure **DD** - Dual Duty
D	**U** - Unidirectional **B** - Bidirectional **N** - Not applicable
E	**2** - NCHRP Report 350 TL-2 **3** - NCHRP Report 350 TL-3



Appendix 723-A, November 2015
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.

Note: The 723 implemented in April 2025 replaces 723, November 2015 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR ENERGY ATTENUATORS

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723.01 SCOPE

This specification covers the requirements for the installation of permanent and temporary energy attenuators and relocation of temporary energy attenuators.

723.02 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 314 Untreated Granular Subbase, Base, Surface Shoulder, and Stockpiling
OPSS 510 Removal
OPSS 705 Flexible Delineator Posts
OPSS 740 Concrete Barriers
OPSS 904 Concrete Structures

Ontario Provincial Standard Specifications, Material

OPSS 1350 Concrete - Materials and Production
OPSS 1440 Steel Reinforcement for Concrete

Ontario Ministry of Transportation Publications

Ontario Traffic Manual (OTM):
Book 6 - Warning Signs

ASTM International

A123/A123M-13	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A325-14	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A780/A780M-09	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
D4956-13	Retroreflective Sheeting for Traffic Control

723.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Dual Duty means a new high exposure energy attenuator that is supplied and installed in a temporary configuration during construction, temporarily relocated as required, and then relocated to its permanent location prior to the end of the Work.

High Exposure means an energy attenuator that is installed in a location where the risk of impact is expected to be high such as in gore areas at exit ramps and express - collector transfers.

Reduced Exposure means a temporary energy attenuator that is installed in a location where the risk of impact is expected to be low. These energy attenuators should be specified in a location where they will be required for short duration of less than four months, are frequently relocated, and where they are not required during seasonal shutdown.

723.04 DESIGN AND SUBMISSION REQUIREMENTS

723.04.01 Design Requirements

The energy attenuator manufacturer shall complete the design of any non-standard details (e.g., a connection or transition to a rigid object other than a concrete barrier or temporary concrete barrier) at locations specified in the Contract Documents.

723.04.02 Submission Requirements

One copy of the manufacturer’s installation instructions and Working Drawings shall be submitted to the Contract Administrator.

Installation of the energy attenuator shall not commence until the Contract Administrator has received the copy of the instructions and Working Drawings.

723.04.02.01 Submission Requirements for Non-Standard Details

Three copies of Working Drawings, prepared by the manufacturer, for any non-standard details shall be submitted to the Contract Administrator prior to the commencement of construction. The Working Drawings shall show full details of the materials and installation procedures. An Engineer's seal and signature shall be affixed on the Working Drawings verifying that the drawings are consistent with the Contract Documents. The submission of Working Drawings shall be accompanied by 3 copies of a letter that has been signed by the manufacturer, on company letterhead, summarizing the details of the proposed design.

Installation of the energy attenuator shall not commence until the Contract Administrator has received and accepted the copy of the letters and Working Drawings.

723.05 MATERIALS

723.05.01 General

All supplied system components shall be according to the manufacturer's specifications.

723.05.02 Energy Attenuator Systems

The names of systems acceptable for the Energy Attenuator - Permanent items are shown in Table 1.

The names of systems acceptable for the Energy Attenuator - Temporary items are shown in Table 2.

The Contractor shall have the option of supplying and installing any of these approved systems shown for the appropriate tender item.

723.05.03 Concrete

Concrete for pads and anchor blocks shall be according to OPSS 1350 with a nominal minimum 28-Day compressive strength of 30 MPa.

723.05.04 Steel Reinforcement

Steel reinforcement shall be according to OPSS 1440.

723.05.05 Anchor Bolts

Anchor bolts shall be supplied and installed according to energy attenuator manufacturer recommendations.

723.05.06 Bolts for Connection of BB-BEAT System to Concrete Barrier

Bolts used to connect the BB-BEAT system to the concrete barrier shall be according to ASTM A325 and shall be hot dip galvanized according to ASTM A123.

723.05.07 U Channel Posts

Posts shall be 2.44 m long perforated steel U channel with 11 mm diameter holes spaced on 50 mm centres, minimum weight of 4.46 kg/m, and hot dip galvanized according to ASTM A123.

723.05.08 Flexible Delineator Posts

Flexible delineator posts shall be according to OPSS 705. The post colour shall be orange.

723.05.09 Reflective Sheeting

Flexible delineator posts shall be outfitted with high intensity retroreflective sheeting according to ASTM D4956, Type IV; white colour; and to the dimensions specified in the Contract Documents.

723.05.10 Reuse of Materials

Notwithstanding subsection GC 5.02, Quality of Material, paragraph 01 of the General Conditions of Contract, the reuse of materials is permitted for temporary energy attenuator installations and relocations, provided the components have not been damaged to affect the safety performance of the system.

723.07 CONSTRUCTION

723.07.01 General

Permanent and temporary energy attenuators shall be installed according to manufacturer's instructions at locations specified in the Contract Documents. A reference for energy attenuator Contract Drawing Notation is shown in Table 3.

Energy attenuators shall not be placed on surfaces with a crossfall greater than 6%.

723.07.01.01 Foundation for TAU-M Systems

Existing or new 150 mm minimum thick asphalt over 150 mm minimum thick compacted granular base may be used to support the TAU-M energy attenuator for permanent and temporary installations. The asphalt shall extend a minimum of 500 mm beyond the anchor bolts. Braces and anchoring for asphalt shall be used when the TAU-M system is installed on asphalt over granular according to manufacturer's specifications.

723.07.02 Permanent Installation

723.07.02.01 New Concrete Pads

Levelling and site preparation required for the existing granular base shall be performed prior to placing the concrete pad. The concrete pad shall be constructed as specified in the Contract Documents. Concrete shall be placed, cured, and finished according to OPSS 904.

The granular base below new concrete pads shall be a minimum depth of 150 mm of existing or new Granular A and shall be according to OPSS 314.

723.07.02.02 Existing Concrete Surfaces and Pads

When specified in the Contract Documents, existing 200 mm thick concrete surfaces, pads, or precast pads may be used to support the energy attenuator.

723.07.02.03 Connection of BB-BEAT and QuadTrend Systems to Concrete Barrier

When the BB-BEAT or QuadTrend system is connected to new concrete barrier, the adjacent 4.0 m of concrete barrier shall be according to OPSS 740 and the Contract Documents.

When the BB-BEAT or QuadTrend system is connected to existing concrete barrier, the adjacent 4.0 m of existing concrete barrier shall be removed according to OPSS 510 and a new 4.0 m section of concrete barrier shall be installed according to OPSS 740 and the Contract Documents.

723.07.02.04 Rear Cable Anchor Blocks for QuadTrend Systems

Rear cable anchor blocks shall be as specified in the Contract Documents. In both earth and rock fills, rear cable anchor blocks shall be placed on slopes 3H:1V or flatter. The cable supplied with the unit shall be used to determine the proper location of the rear cable anchor block.

In porous or crumbly soils, forms for cast-in-place anchor blocks shall be used to prevent contamination of the concrete. Forms may be left in place or removed.

The top of the concrete block shall be flush with the embankment slope and the rear cable anchor assembly shall not protrude more than 100 mm above ground.

723.07.02.05 Damage to Galvanizing

Precautions shall be taken to protect galvanizing against damage. Minor abrasions shall be repaired according to ASTM A780. Components with major abrasions shall be replaced.

The method of repair for any damage shall be approved by the Contract Administrator prior to the commencement of such work.

723.07.02.06 Posts for BB-BEAT Systems

All posts shall be set to the alignment specified in the Contract Documents, regardless of the material encountered. Permissible tolerance for plumb shall be 20 mm maximum over the post length above the ground. The driving of posts shall be accomplished with methods and equipment that leave the posts free of distortion, burring, and any other damage.

All lower end posts shall be installed so that not more than 100 mm is exposed above finished grade.

723.07.03 Temporary Installation

723.07.03.01 Existing Concrete Surface

Existing 200 mm minimum thick concrete surfaces, pads, or precast pads may be used to support the energy attenuator.

723.07.03.02 Asphalt Over Concrete

Existing or new 75 mm minimum thick asphalt over 75 mm minimum thick concrete pavement may be used to support the energy attenuator.

723.07.03.03 Asphalt Over Compacted Granular

Existing or new 150 mm minimum thick asphalt over 150 mm minimum thick compacted granular base may be used to support the energy attenuator. The asphalt shall extend a minimum of 500 mm beyond the anchor bolts.

723.07.03.04 Reduced Exposure

When water filled energy attenuator systems are in use, the temperature shall be monitored on a daily basis. When the temperature is predicted to fall below freezing, antifreeze agents according to manufacturer recommendations shall be added to the water. The use of a water filled energy attenuator system when frozen is not permissible.

Water filled energy attenuator systems shall not be left in place during a seasonal shutdown period without approval from the Contract Administrator. When approval from the Contract Administrator is not granted, water filled energy attenuator systems shall be replaced with another approved energy attenuator listed for the reduced exposure tender item for the duration of the seasonal shutdown period.

Disposal of liquid materials shall be managed according to the Contract Documents.

723.07.03.05 Dual Duty

A new high exposure energy attenuator shall be supplied and installed in a temporary configuration during construction at the locations specified in the Contract Documents.

723.07.03.06 Relocation

Temporary energy attenuators, object markers, oversize snowplow markers, object marker posts, and flexible delineator posts shall be relocated as specified in the Contract Documents, including the removal of existing and installation of new anchor bolts and mounting hardware.

Prior to completion of the Contract, dual duty energy attenuators and associated object markers, oversize snowplow markers, and object marker posts including the replacement of anchor bolts and mounting hardware, shall be relocated to their permanent locations as specified in the Contract Documents and in accordance with the General and Permanent Installation subsections.

723.07.03.07 Permanent and Temporary Concrete Barriers

Temporary concrete barriers shall be modified and installed as specified in the Contract Documents and the modified surfaces shall be smooth. Temporary concrete barriers shall be anchored as specified in the Contract Documents.

Permanent existing concrete barriers shall be modified as specified in the Contract Documents and the modified surfaces shall be smooth.

723.07.04 Delineation

723.07.04.01 Object Markers and Oversize Snowplow Markers

A Wa-33 object marker according to OTM Book 6, a Wz-2 oversize snowplow marker, and galvanized mounting hardware shall be installed at each energy attenuator.

When installed on a paved surface, the object marker and oversize snowplow marker shall be integrally attached to a surface mounted flexible post. The signs and post shall be supplied by the manufacturer as a complete unit. The post shall have the ability to bend 90° from vertical and self-restore after impacts. The minimum outside diameter of the post shall be 60 mm. The post shall be anchored to the pavement according to manufacturer’s recommendations.

When installed on a granular surface, the Wa-33 object marker and Wz-2 oversize snowplow marker shall be securely fastened to a U channel post and the post shall be direct buried to a minimum embedment depth of 900 mm.

Posts shall be installed at locations specified in the Contract Documents.

723.07.04.02 Flexible Delineator Posts

Flexible delineator posts shall be installed according to OPSS 705 at locations specified in the Contract Documents.

723.07.05 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

723.09 MEASUREMENT FOR PAYMENT

723.09.01 Actual Measurement

723.09.01.01 Energy Attenuator - Permanent, Narrow
Energy Attenuator - Permanent, Wide
Energy Attenuator - Permanent, Extra Wide
Energy Attenuator - Permanent, Super Wide
Energy Attenuator - Permanent, High Exposure
Energy Attenuator - Permanent, Single-Sided

For measurement purposes, a count shall be made of the number of complete energy attenuator systems installed.

723.09.01.02 Energy Attenuator - Temporary, Narrow
Energy Attenuator - Temporary, Wide
Energy Attenuator - Temporary, Extra Wide
Energy Attenuator - Temporary, Super Wide
Energy Attenuator - Temporary, Reduced Exposure
Energy Attenuator - Temporary, Dual Duty

For measurement purposes, a count shall be made of the number of complete energy attenuator systems installed and removed, up to the maximum number of systems required to be in place at any one time during the Contract.

723.09.01.03 Energy Attenuator - Relocation, Narrow
Energy Attenuator - Relocation, Wide
Energy Attenuator - Relocation, Extra Wide
Energy Attenuator - Relocation, Super Wide
Energy Attenuator - Relocation, Reduced Exposure
Energy Attenuator - Relocation, Dual Duty

For measurement purposes, a count shall be made of the number of complete energy attenuator systems relocated. Systems that are temporarily surplus and are required for future stages shall be paid for as one relocation for the combined moves into and out of storage, including any off-site storage required due to on-site restrictions.

723.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

723.10 BASIS OF PAYMENT

723.10.01 Energy Attenuator - Permanent, Narrow - Item
Energy Attenuator - Permanent, Wide - Item
Energy Attenuator - Permanent, Extra Wide - Item
Energy Attenuator - Permanent, Super Wide - Item
Energy Attenuator - Permanent, High Exposure - Item
Energy Attenuator - Permanent, Single-Sided - Item

Energy Attenuator - Temporary, Narrow - Item
Energy Attenuator - Temporary, Wide - Item
Energy Attenuator - Temporary, Extra Wide - Item
Energy Attenuator - Temporary, Super Wide - Item
Energy Attenuator - Temporary, Reduced Exposure - Item
Energy Attenuator - Temporary, Dual Duty - Item
Energy Attenuator - Relocation, Narrow - Item
Energy Attenuator - Relocation, Wide - Item
Energy Attenuator - Relocation, Extra Wide - Item
Energy Attenuator - Relocation, Super Wide - Item
Energy Attenuator - Relocation, Reduced Exposure - Item
Energy Attenuator - Relocation, Dual Duty - Item

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

When the Contract contains separate items for the work required by this specification, payment shall be at the Contract price and according to the specification for such work.

Costs associated with any required removals and replacement or repairs of defective work and materials shall be the Contractor’s responsibility at no additional cost to the Owner.

TABLE 1
Energy Attenuator, Permanent (EAP)

Energy Attenuator	NCHRP Report 350 or AASHTO MASH Crash Test Level		Permanent Installation					
	TL-2	TL-3	Narrow (NA)	Wide (WI)	Extra Wide (EW)	Super Wide (SW)	High Exposure (HE)	Single Sided (SS)
TAU-M System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
TAU-XR System (Note 1)	Yes	Yes	Yes	No	No	No	Yes	No
TAU-II Wide System (Note 2)	Yes	Yes	No	Yes	No	No	No	No
TAU-II Extra Wide System	Yes	Yes	No	No	Yes	No	No	No
Quadguard M10 System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
Quadguard M10 Wide System (Notes 1 and 2)	N/A	Yes	No	Yes	No	No	No	No
Quadguard Wide System (Note 2)	Yes	Yes	No	Yes	No	No	No	No
Quadguard Extra Wide System	Yes	Yes	No	No	Yes	No	No	No
Quadguard Super Wide System	No	Yes	No	No	No	Yes	No	No
Delta System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
QuadTrend	No	Yes	No	No	No	No	No	Yes
BB-Beat	No	Yes	No	No	No	No	No	Yes
Smart System (Note 1)	Yes	Yes	Yes	No	No	No	Yes	No
Hercules System (Note 1)	N/A	Yes	Yes	No	No	No	No	No
Hercules 12 System (Note 1)	N/A	Yes	Yes	No	No	No	No	No

Note:

1. AASHTO MASH crash test compliant system.
2. The Quadguard M10 Wide (meeting AASHTO MASH TL-3) shall be used for Permanent Unidirectional configurations requiring a TL-3 crash test compliant system. For Permanent Unidirectional configurations requiring a TL-2 crash test compliant system and for all Bidirectional configurations of Energy Attenuator, Wide, systems listed on Table 1 and meeting NCHRP Report 350 shall be used.

TABLE 2
Energy Attenuator, Temporary (EAT)

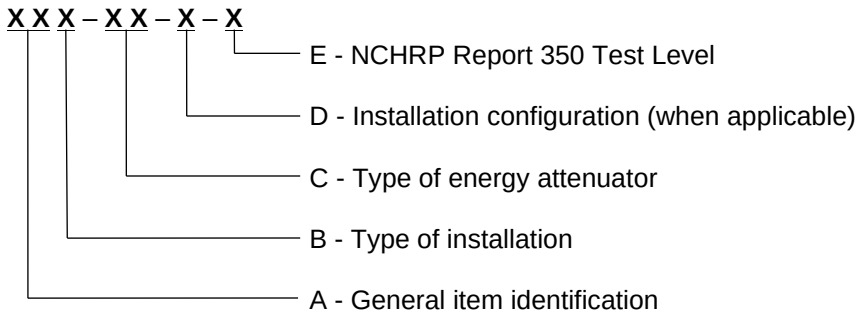
Energy Attenuator	NCHRP Report 350 or AASHTO MASH Crash Test Level		Temporary Installation					
	TL-2	TL-3	Reduced Exposure (RE) (Note 2)	Narrow (NA)	Wide (WI)	Extra Wide (EW)	Super Wide (SW)	Dual Duty (DD)
TAU-M System (Note 1)	Yes	Yes	No	Yes	No	No	No	No
TAU-XR System (Note 1)	Yes	Yes	No	Yes	No	No	No	Yes
TAU-II Wide System	Yes	Yes	No	No	Yes	No	No	No
TAU-II Extra Wide System	Yes	Yes	No	No	No	Yes	No	No
ABSORB 350 System	Yes	Yes	Yes	No	No	No	No	No
ABSORB-M System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
Quadguard M10 System (Note 1)	Yes	Yes	No	Yes	No	No	No	No
Quadguard Wide System	Yes	Yes	No	No	Yes	No	No	No
Quadguard Extra Wide System	Yes	Yes	No	No	No	Yes	No	No
Quadguard Super Wide System	No	Yes	No	No	No	No	Yes	No
Delta System (Note 1)	Yes	Yes	No	Yes	No	No	No	No
Smart System (Note 1)	Yes	Yes	No	Yes	No	No	No	Yes
SLED System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
Quash System (Note 1)	Yes	Yes	Yes	No	No	No	No	No
Hercules System (Note 1)	N/A	Yes	No	Yes	No	No	No	No
Hercules 12 System (Note 1)	N/A	Yes	No	Yes	No	No	No	No

Notes:

1. AASHTO MASH crash test compliant system.
2. ABSORB 350 energy attenuator system shall be used when Movable Temporary Concrete Barrier is specified.

TABLE 3
Contract Drawing Notation

A	**EA** - Energy Attenuator
B	**P** - Permanent **T** - Temporary **R** - Relocation
C	**NA** - Narrow **WI** - Wide **EW** - Extra Wide **SW** - Super Wide **HE** - High Exposure **SS** - Single-Sided **RE** - Reduced Exposure **DD** - Dual Duty
D	**U** - Unidirectional **B** - Bidirectional **N** - Not applicable
E	**2** - NCHRP Report 350 TL-2 **3** - NCHRP Report 350 TL-3



Ontario Provincial Standard Specifications (OPSSs)					
903	April 2016	April 2025	TBD	Rev: Construction Specification for Deep Foundations is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 109F57 has been incorporated into OPSS 903.	Mike Pearsall
Standard Special Provisions (SSPs)					
109F57	June 2020	April 2025	TBD	Rev: SSP Amendment to Construction Specification for Deep Foundations is revised to reflect the new publication version of OPSS 903. Applicable content has been incorporated into OPSS 903.	Mike Pearsall

Note: The 903 implemented in April 2025 replaces 903, April 2016 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR
DEEP FOUNDATIONS

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903.01 SCOPE

This specification covers the requirements for the supply and installation of deep foundation units.

~~903.01.01 Specification Significance and Use~~

~~This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.~~

~~Use of this specification or any other specification shall be according to the Contract Documents.~~

~~**903.01.02 Appendices Significance and Use**~~

~~Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.~~

~~Appendices are developed for the Owner's use only.~~

~~Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.~~

~~Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.~~

~~The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.~~

903.02 REFERENCES

~~When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.~~

This specification refers to the following specifications, standards, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 904	Concrete Structures
OPSS 905	Steel Reinforcement for Concrete
OPSS 909	Prestressed Concrete - Precast members
OPSS 911	Coating Structural Steel Systems

Ontario Provincial Standard Specifications, Material

OPSS 1302	Water
OPSS 1350	Concrete - Materials and Production
OPSS 1440	Steel Reinforcement for Concrete

Ontario Ministry of Transportation Publications

MTO Forms:
PH-CC-701 Request to Proceed
PH-CC-702 Notice to Proceed

CSA Standards

G40.20-04/G40.21-04 (R2009)	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
CAN3-056-1962(R2006)	Round Timber Piles
O80 Series-08	Wood Preservation
W47.1-03 (R2008)	Certification of Companies for Fusion Welding of Steel
W48-06	Filler Materials and Allied Materials for Shielded Metal Arc Welding

W59-03(R2008) Welded Steel Construction (Metal Arc Welding)
W178.1-08 Certification of Welding Inspection Organizations
W178.2-08 Certification of Welding Inspectors

Canadian General Standards Board (CGSB)

48.9712-2006 Non-destructive Testing, Qualification and Certification of Personnel

ASTM International

~~A 252~~A252-98(2007) Welded and Seamless Steel Pipe Piles
~~A 328/A 328M~~A328/A328M-07 Steel Sheet Piling
A500~~-/-~~/A500M~~-/-~~-21 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A572~~-/-~~/A572M~~-/-~~-18 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
A913~~-/-~~/A913M~~-/-~~-19 Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST)
~~D 1143/ D 1143M~~D1143/D1143M-07 Standard Test Methods for Deep Foundations Under Static Axial Compressive Load
~~D 3689~~D3689-07 Standard Test Methods for Deep Foundations Under Static Axial Tensile Load
~~D 3966~~D3966-07 Standard Test Method for Deep Foundations Under Lateral Loads

American Petroleum Institute (API)

API 13A Drilling Fluid Materials, 17th Edition, 10.00.08
RP 13B-1 Standard Procedure for Field Testing Water Based Drilling Fluids, 4th Edition,

Steel Structures Painting Council (SSPC)

SP10/NACE No.2-Jan. 1, 2001 Near-White Blast Cleaning

International Organization for Standardization/International Electrotechnical Commission (ISO/IEC)

17025 General Requirements for the Competence of the Testing and Calibration Laboratories

903.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Anvil means the component of a diesel hammer that acts as an impact block for the ram.

Bedrock means a natural solid bed of the hard, stable, cemented part of the earth's crust, igneous, metamorphic, or sedimentary in origin that may or may not be weathered.

Caisson Pile means a cast in place deep foundation unit with or without an enclosing liner formed by placing concrete in a bored or excavated hole.

Cap Block means a material placed on top of the helmet to cushion the blow of the hammer and to attenuate the peak impact energy without causing excessive loss of the impact energy.

Casing means open ended enclosing cylindrical steel tubing or pipe permanently installed in the ground. Casings are structurally required and can be used to stabilize and excavated hole.

Deep Foundation Unit means a structural member, driven or otherwise, installed in the ground to transfer the

loads from a structure to soil or rock and derives supporting resistance from the surrounding soil or rock or from the soil or rock strata below its tip or a combination of both.

Displacement Caisson Pile means a pile formed in the ground by driving a casing or liner with a concrete plug or an expendable metal plate attached to it and replacing the displaced soil with unreinforced or reinforced concrete.

Driven Pile means one of the following pile types: ~~–~~steel H, tube, or sheet piles; wooden pile; or precast reinforced concrete pile that has been installed by means of a pile driver.

Driving Shoe means reinforcement attached to the bottom of the pile and designed to protect the pile during driving or to penetrate into a hard stratum.

Driving to a Set means driving the pile to the requirement that satisfies pile driving criteria correlated to a required pile resistance.

~~**Engineer** means a professional engineer licensed by the Professional Engineers Ontario to practice in the Province of Ontario.~~

Follower means a removable extension that transmits the hammer blows to the head of the pile.

Helmet means a formed steel cap that fits over the top of a pile head to retain in position a resilient cap block.

Jetting means the use of a jet of water at high pressure directed into the ground below the pile tip to assist its penetration.

Liner means open ended enclosing steel tubing or pipe temporarily installed in the ground to facilitate the construction of caisson piles.

Pile means a relatively slender structural element that is installed, wholly or partly in the ground by driving, drilling, auguring, jetting, or other means.

Pile Cap means a footing or some other structural component used to transfer the load to the piles as well as maintaining them in position.

Pile Cushion means a pad of resilient material placed between the helmet and the top of a precast reinforced concrete or wooden pile to minimize damage to the head during driving.

Pile Group means the piles supporting a pile cap.

Pumped Concrete means a method of transporting concrete through hose or pipe by means of positive and continuous pressure.

Ram means the moving or driving part of an air, steam, diesel, or drop pile hammer that delivers an impact blow to an anvil and to the pile.

Retapping means verifying that the specified resistance previously attained has been sustained by imparting appropriate hammer energy to the pile and monitoring pile penetration.

Rock Points means a specially designed steel tip fitted to piles to enable them to be driven into hard, sound sloped bedrock.

Sheet Pile means a pile that is designed to interlock with adjacent piles and form a continuous wall for the purpose of resisting mainly lateral forces and to reduce seepage.

Slurry means a drilling fluid, consisting of water mixed with one or more of various solids or polymers, used to

maintain the stability of the side walls and bottom of an excavation.

Tremie means a hopper with a vertical pipe used for placing concrete under water. The foot of the pipe is always submerged in concrete except during commencement of concreting and the upper level of the concrete in the pipe is always above water level.

903.04 DESIGN AND SUBMISSION REQUIREMENTS

903.04.01 Design Requirements

903.04.01.01 Concrete

The Contractor is responsible for providing plastic concrete with suitable characteristics for installation. The concrete shall be flow able, non-segregating concrete that does not exhibit rapid slump loss.

903.04.02 Submission Requirements

903.04.02.01 General

All submissions shall bear the seal and signature of an Engineer experienced in the field of deep foundations.

When welded field splices are used, welding procedures according to the Canadian Welding Bureau shall be submitted to the Contract Administrator.

903.04.02.02 Preconstruction Survey

A condition survey of property and structures that may be affected by the work shall be submitted to the Contract Administrator prior to commencing the work. The survey shall include the locations and conditions of adjacent properties; buildings; underground structures; Utility services; and structures, such as walls abutting the site.

903.04.02.03 Materials

903.04.02.03.01 Mill Certificates

One copy of the mill certificates, indicating that the steel meets the requirements for the appropriate standards for H-piles, tube piles, casings, and sheet piles shall be submitted to the Contract Administrator at the time of delivery.

Where mill test certificates originate from a mill outside Canada or the United States of America, the information on the mill certificates shall be verified by testing by a Canadian laboratory. The laboratory shall be certified by an organization accredited by the Standards Council of Canada to comply to comply with the requirements of ISO/IEC 17025 for the specific tests or type of tests required by the material standard specified on the mill test certificate. The mill test certificates shall be stamped with the name of the Canadian testing laboratory and appropriate wording stating that the material conforms to the specified material requirements. The stamp shall include the appropriate material specification number, the date (i.e., yyyy-mm-dd), and the signature of an authorized officer of the Canadian testing laboratory.

903.04.02.03.02 Concrete

A suitable, site-specific concrete mix design that meets the requirements of the hardened concrete shall be submitted to the Contract Administrator 14 Days prior to construction, for information purposes only.

903.04.02.03.03 Slurry

The following shall be submitted to the Contract Administrator 14 Days prior to construction, for information purposes only:

a) The type, source, and physical and chemical properties of the bentonite or polymer.

b) The source of water.

c) Method of mixing slurry.

d) The water solids ratio and the mass and volumes of the constituent parts, including any chemical admixtures or physical treatment employed to produce slurry with the required physical properties.

e) Details of procedure to be used for monitoring the quality of the slurry.

f) A test report showing the properties of the slurry and certifying that the slurry meets the requirements of API- RP 13B-1.

g) Method of disposal of the slurry.

903.04.02.04 Installation

903.04.02.04.01 Driven Piles

The following shall be submitted to the Contract Administrator as least 14 Days prior to construction, for information purposes only:

a) A schedule of work identifying time and sequence of activities.

b) Type of equipment, anvil, helmet, and hammer details, including the hammer energy assumed by the Contractor, stated potential energy (rated energy) of the hammer, operating efficiency, and weight of ram.

c) Working Drawings of precast concrete piles showing the pile dimensions, concrete strength, tendon arrangement, working stresses and arrangement of steel reinforcement, schedules, elongation calculations, method and sequence of casting, complete specifications and details of the prestressing steel, and lift anchors and lifting point locations.

d) The method of maintaining the steel reinforcement cages in position, when steel reinforcement cages are used in tube piles.

e) Procedure for monitoring pile installation.

f) Details of the method of attaching proprietary driving shoes.

g) When load testing is specified in the Contract Documents, details of the full-scale test, including site preparation and the details of the load application, components, equipment, testing apparatus, and method of monitoring.

h) Information pertinent to establishing the resistance of a pile when the wave equation analysis method is used.

903.04.02.04.02 Caisson Piles

The following shall be submitted to the Contract Administrator at least 14 Days prior to construction, for information purposes only:

a) A schedule of work identifying time and sequence of activities.

b) Detailed procedures for caisson excavation in overburden and rock.

c) Detailed procedures for casing and liner installation and for the withdrawal of the liner.

d) Detailed procedures for slurry displacement method of excavation, including disposal of slurry upon completion.

e) Detailed procedures for tremie concrete, including the size of tremie delivery pipe.

f) Detailed procedure for placing concrete in the dry.

g) Method of maintaining the steel reinforcement cages in position in the caisson.

h) Details of filling the annular void around a casing.

i) Details of procedure to be used for monitoring installation.

j) When load testing is specified in the Contract Documents, details of the full-scale test, including site preparation, details of the load application, components, equipment, testing apparatus, and method of monitoring.

903.04.02.04.03 Displacement Caisson Piles

The following shall be submitted to the Contract Administrator as least 14 Days prior to construction, for information purposes only:

a) A schedule of work identifying time and sequence of activities.

b) Type of equipment, anvil, helmet, and hammer details, including the hammer energy assumed by the Contractor, stated potential energy (rated energy) of the hammer, operating efficiency, maximum stroke or drop, and weight of the ram.

c) Details of procedures used for installation of displacement caisson piles, including detailed procedures for liner installation and withdrawal.

d) Method of maintaining the steel reinforcement cages in position in the pile.

e) Details of procedure to be used for monitoring pile installation.

f) When load testing is specified in the Contract Documents, details of the full-scale test, including site preparation, and the details of the load application, components, equipment, testing apparatus, and method of monitoring.

903.04.02.04.04 Steel Reinforcement Cages

Working Drawings showing the fabrication details of the steel reinforcement cages, including the lifting points and lifting lugs, shall be submitted to the Contract Administrator at least 14 days prior to fabrication, for information purposes only.

903.05 MATERIALS

903.05.01 Wooden Piles

Wooden piles shall be according to CAN3-056 and shall be clean and peeled. Treated piles shall be pressure

treated with creosote according to CAN/CSA-080.

Wooden piles shall be provided with collars sufficiently strong to prevent splitting of the head of the wooden pile during driving.

903.05.02 Steel Piles

903.05.02.01 H-Piles

Steel H-Piles shall be of the grade specified in the Contract Documents and shall be according to CSA G40.20/G40.21.

When CSA G40.20/G40.21, Grade 350W has been specified, the following steel grades may be substituted:

a) ASTM A572, Grade 345; or

b) ASTM A913, Grade 345.

When CSA G40.20/G40.21, Grade 450W has been specified, the following steel grades may be substituted:

a) ASTM A572, Grade 450; or

b) ASTM A913, Grade 450.

903.05.02.02 Tube Piles

Steel tube piles shall be as specified in the Contract Documents. When ASTM A252, Grade 3 has been specified, the following steel grades may be substituted:

a) ASTM A500, Grade C; or

b) CSA G40.20/G40.21, Grade 350W.

903.05.02.03 Sheet Piles

Steel sheet piles shall be according to ASTM ~~A 328M~~A328M.

903.05.02.04 Straightness Tolerance for Steel Piles, Casings, and Liners

Steel piles, casings, and liners shall conform to a straightness tolerance of 1.5 mm maximum per metre of length.

Steel sheet piles shall be sufficiently straight to prevent binding in the interlock during driving.

903.05.03 Driving Shoes and Rock Points

Rock points and driving shoes shall be as specified in the Contract Documents.

Driving shoes shall transfer the driving stresses to the pile over the full cross-sectional area of the pile.

Where precast concrete piles are driven into dense or hard material, a steel driving shoe cast into the concrete shall be provided.

Where wooden piles are driven into dense material, a steel plate driving shoe shall be provided to prevent damage to the bottom of the pile.

903.05.04 Casing for Caissons

Casings shall be according to ASTM ~~A 252~~A252, Grade 2.~~-~~ If welded, they shall be welded by the electric arc method according to CSA W59.

The casing wall thickness specified is the minimum that shall be supplied. ~~-~~The wall thickness shall be increased as required to ensure the casing is not damaged during handling and installation.

903.05.05 Steel Reinforcement

Steel reinforcement shall be according to OPSS 1440.

903.05.06 Concrete

903.05.06.01 General

Concrete shall be according to OPSS 1350.

903.05.06.02 Tube Piles

Concrete shall have a slump of 150 to 180 mm.

903.05.06.03 Caisson Piles

Concrete shall have a slump of 150 to 180 mm. ~~–~~When approved by the Contract Administrator in writing, admixtures may be used.~~–~~ Where the liner is to be withdrawn, sufficient retarder shall be added to prevent arching of concrete during liner withdrawal and to prevent setting of concrete until after the liner is withdrawn.

903.05.07 Precast Concrete Piles

The production of precast reinforced concrete piles shall be according to OPSS 904, OPSS 905, and OPSS 909.

Steel reinforcement shall be placed such that direct loading during the ram stroke shall not occur.

Lifting anchors shall be at least 25 mm clear from reinforcement or prestressing steel in the pile.

Concrete in precast reinforced concrete piles shall be according to OPSS 1350 and have a nominal minimum 28~~-~~-Day compressive strength of 45 MPa.

Concrete for precast reinforced concrete piles shall be cured according to OPSS 904.

Concrete for precast reinforced concrete piles shall be placed in smooth mortar-tight forms that are supported to prevent excessive deformation or settlement during placing or curing.

Unformed surfaces shall be finished smooth.

When removed from the form, the pile shall present true, smooth, even surfaces free from honeycombs and voids. ~~–~~The pile shall be straight so that a line stretched from butt to tip on any face shall not be more than 25 mm from the face of the pile at any point.

Each precast reinforced concrete pile shall have the date of manufacture (i.e., yyyy-mm-dd) inscribed on it.

903.05.08 Slurry

903.05.08.01 Solids

Bentonite and polymers shall be according to API Spec 13A.

903.05.08.02 Water

Water shall be according to OPSS 1302.

903.05.08.03 Slurry Composition

The slurry shall consist of a stable colloidal suspension of pulverized solids or polymers thoroughly mixed with water. The density, viscosity, sand content, and pH of the slurry being used during excavation shall be according to API RP 13B-1.

903.06 EQUIPMENT

903.06.01 Hammers

Hammers shall be capable of installing the piles, casings, and liners to the depth or resistance specified in the Contract Documents, without damage to the portions that are not cut off.

The hammer used to chisel the rock point into the rock shall be capable of delivering a controlled blow in 10% increments ranging in energy from zero to the maximum hammer energy.

For precast reinforced concrete piles, the heaviest hammer practicable shall be employed and the stroke limited so as not to damage the piles. When choosing the size of the hammer, consideration shall be given to whether the pile is to be driven to a resistance or to a given depth.

903.06.02 Helmets and Striker Plates

The head of steel piles shall be protected by a striker plate or a helmet. Helmets shall have adequate and suitable cushioning material. Helmets and striker plates shall distribute the blow of the hammer evenly throughout the cross-section of the pile head.

903.06.03 Leads

Pile driver leads shall be built to afford freedom of movement for the hammer and shall be held in position at the top and bottom by guys, stiff braces, or other approved means to ensure support of the pile, casing, or liner while it is being driven. Swinging leads shall not be permitted.

Batter piles, casings, or liners shall be driven with leads aligned parallel to the axis of the pile, casing, or liner. The leads shall be equipped with a fixed, rigid, adjustable kicker.

903.06.04 Followers

When use of followers are specified in the Contract Documents, followers shall be of type, size, shape, length, and weight as to permit driving the pile, casing, or liner at the location and to the required depth or ultimate resistance specified in the Contract Documents. The follower shall be provided with a socket or hood carefully fitted to the top of the pile, casing, or liner to minimize loss of energy and to prevent damage to the pile, casing, or liner, and shall have sufficient rigidity to prevent "whip" during driving.

When followers are permitted, an identical follower shall be used when the set is being determined.

903.07 CONSTRUCTION

903.07.01 Transporting, Storing, and Handling Piles, Casings, Liners, and Reinforcing Steel Reinforcement Cages

903.07.01.01 General

Piles, casings, liners, and steel reinforcement shall be transported, stored, and handled in such a manner that damage is prevented and the strength of the components is not affected by deterioration or deformation.

Components shall be lifted and placed using appropriate lifting equipment, temporary bracing, guys, or stiffening devices so that the components are at no time overloaded, unstable, or unsafe.

Material shall be supported to prevent unequal settlement when stacked.

903.07.01.02 Wooden Piles

Canthooks, dogs, pile pulls, or use of other lifting methods that might damage the integrity of the pressure treated surface shall not be used. Cuts or breaks in the surface of treated piling shall be given three brush coats of hot creosote oil. Bolt holes shall be treated with three applications of hot creosote oil applied with a bolt hole treater.

903.07.01.03 Handling Holes in Steel Piles

Unless otherwise approved by the Contract Administrator, holes shall only be made in the portion of the pile to be cut off or in the portion of the pile to be encased in concrete.

When other holes are approved to be cut in a pile they shall be covered by splice plates placed on both sides of the section. The thickness and the mechanical properties of the plate material shall be at least equivalent to the pile material.

903.07.01.04 Precast Reinforced Concrete Piles

Precast concrete piles shall be handled only from the designated lifting points.

When lifting or transporting precast reinforced concrete piles lift anchors, slings, or other approved means shall be used. Care shall be taken when lifting and transporting to avoid any overstressing of the pile or cracking of the concrete.

Precast reinforced concrete piles shall be so handled to avoid breaking or chipping their edges.

Lift anchors shall be removed and the holes filled with a non-shrink grout or epoxy installed according to the manufacturer's recommendations.

903.07.01.05 Caisson Casings and Liners

Casings and liners shall be handled and stored in such a manner to avoid damage or distortion to them. The casings and liners shall be maintained circular within ± 2% of the casing or liner diameter.

903.07.02 Driven Piles

903.07.02.01 Pile Driving Requirements and Restrictions

Piles shall not be driven until embankment work or excavation work has been completed to the underside of the footing. When driving of the piles is completed, all material between the piles shall be removed to the correct elevation and any holes or voids created shall be filled to the correct elevation with compacted material approved by the Contract Administrator.

Piles shall be installed at the locations specified in the Contract Documents and to the set or depth specified without being damaged. Damage to the pile, casing, or liner during driving shall be prevented by limiting the drop or energy and number of blows of the hammer. The hammer, helmet, cap block, striker plate, and pile shall be coaxial and shall sit squarely upon each other.

A shorter stroke shall be used and proper precaution shall be taken when there is a danger of damaging or over driving the piles, casing, or liners under conditions such as:

a) In the early stages of driving a long pile where a hard layer near the ground surface has to be penetrated.

b) Where there is very soft material of a considerable depth and a large penetration is achieved at each hammer blow.

c) Where it is anticipated the pile shall meet refusal on rock or other impenetrable soil.

d) When piles are driven onto sloping bedrock.

Damage to adjacent structures, Utilities, and fresh concrete shall be prevented during pile installation. Piles shall not be driven within a radius of 8 m of concrete that has been in place for less than 72 hours. Piles shall not be driven within a radius of 15 m of concrete that has been in place for less than 72 hours without the approval of the Contract Administrator.

The tops of all piles shall be either square to the longitudinal axis of the pile or horizontal as indicated in the Contract Documents.

Piles shall not be forced into their proper position by the use of excessive manipulation. Pile damage due to excessive driving shall be avoided.

903.07.02.02 Driving Shoes and Rock Points

Driving shoes and rock points shall be installed in locations specified in the Contract Documents.

Driving shoes shall be welded in accordance with the Contract Documents.

When driving shoes are specified in the Contract Documents, the Titus H bearing pile point or APF Hard Bite, standard model, may be substituted for the driving shoes.

When Oslo points are specified in the Contract Documents, the Titus H bearing pile point or APF, rock injector model, may be substituted for the pile points.

Where proprietary driving shoes are used, they shall be welded or otherwise attached to the driven piles according to the manufacturer's specifications.

903.07.02.03 Splicing

903.07.02.03.01 General

Any damaged material shall be cut-off prior to splicing.

903.07.02.03.02 Wooden Piles

Wooden piles shall not be spliced.

903.07.02.03.03 H-Piles, Tube Piles, and Sheet Piles

Welding shall be according to CSA W59 and shall be done by a qualified welder employed by a firm certified according to CSA W47.1, Division 1 or Division 2.

Steel H-piles and steel tube piles may be spliced providing the pieces being spliced are not less than 3 m long, except for integral abutments' piles, where the pieces being spliced shall not be less than 7.0 m long. Where piles are located in a waterbody, splices shall be located below the low water level, unless otherwise encased in concrete.

Sheet piles shall not be spliced without approval by the Contract Administrator.

903.07.02.03.04 Precast Reinforced Concrete Piles

Precast reinforced concrete piles shall only be spliced when specified in the Contract Documents and the splices shall only be made with approved mechanical splicing devices.

903.07.02.04 Concrete in Steel Tube Piles

Concrete in steel tube piles shall be placed according to OPSS 904.

903.07.02.05 Cutting Off Piles

903.07.02.05.01 General

Driven piles shall be cut to the elevation as specified in the Contract Documents.

The length of pile supplied shall be sufficient to ensure there is no damaged material below the cut off. Damaged material at the pile head shall be cut off.

Piles shall not be cut off until retapping, redriving, and specified load testing are complete.

903.07.02.05.02 Wooden Piles

Where wooden piles are broomed, splintered, or otherwise damaged below the cut-off elevation, the pile shall be considered defective and shall be replaced.

903.07.02.06 Protective Coating for Steel H and Steel Tube Piles

Exposed steel H and steel tube piles shall have a coal tar epoxy protective coating applied from an elevation 600 mm below the low water level or finished ground surface up to the top of the exposed steel.

The steel surfaces shall be cleaned according to SSPC-SP10 prior to application of a coal tar epoxy system that shall be according to OPSS 911.

903.07.02.07 Monitoring Driven Piles

903.07.02.07.01 General

The driving of piles shall be carefully monitored and controlled. Pile driving records shall be produced for each pile and shall be submitted to the Contract Administrator.

Piles shall not be overdriven. When driving to a specified ultimate resistance, driving to a set or driving to bedrock, the piles shall be driven to the anticipated tip elevation. The Contract Administrator shall be notified if the piles do not reach set at the anticipated tip elevation~~,~~.

In soils where there is a possibility of piles moving upward due to ground heave, elevations of completed pile tops shall be measured at intervals while nearby piles are being installed. The readings shall be recorded and submitted to the Contract Administrator as the work proceeds.

903.07.02.07.02 Driving to a Specified Elevation

Piles shall be driven to an elevation specified in the Contract Documents. Driving piles to other elevations shall only be done when approved in writing by the Contract Administrator.

903.07.02.07.03 Driving to a Specified Ultimate Resistance

903.07.02.07.03.01 General

The Quality Verification Engineer shall establish the reference set used to determine ultimate resistance and measure and record the set for individual pile acceptance.

The set and rebound measurements shall be obtained by the Quality Verification Engineer. The Quality Verification Engineer shall determine the measured ultimate resistance and verify that the design ultimate resistance has been achieved.

903.07.02.07.03.02 Driving to a Set

The founding elevation shall be established by driving to a set determined in accordance with the dynamic formula specified in the Contract Documents or by the application of the wave equation analysis procedure that verifies the pile resistance. This set shall be established on the first pile of every ten piles driven in a pile group.

The other piles shall be controlled by the pile penetration rate in blows per millimetre that correlates to the set.

When new conditions, such as change in hammer size, change in pile size, or change in soil material occur, new sets shall be determined.

903.07.02.07.03.03 Driving to Bedrock

When driving piles to bedrock, the pile shall be adequately seated on bedrock without damaging the pile.

Where rock points are used, the rock points shall penetrate into the rock. Piles driven using rock points shall be driven to ensure adequate seating on the bedrock without damaging the pile.

Driving of piles on sloping bedrock shall be stopped when initial contact is made with the bedrock. The bedrock elevation shall be recorded. Driving shall then continue, commencing with energy of 10% of the maximum energy of the hammer. The pile shall be driven in sets of 20 blows at this energy until no penetration is observed. Twenty additional blows shall be applied, and, if no penetration is observed, the energy shall be increased by an additional 10% and the above procedure repeated.

Driving shall continue with these stepped increases in energy and with the same series of blows as described above, until the pile has been seated on the bedrock.

If unrealistic excessive penetration per blow is observed, driving shall be stopped and this excessive penetration immediately reported to the Contract Administrator.

The Quality Verification Engineer shall determine when the hammer energy can be increased and when the driving is complete for each pile.

903.07.02.07.04 Wave Equation Analysis

When requested by the Contract Administrator, all equipment, material, and personnel shall be supplied to conduct the wave equation analysis procedure.

903.07.02.07.05 Hammer Performance

When requested by the Contract Administrator, the hammer performance using the pile driving analyzer or other approved equivalent shall be verified in the presence of the Contract Administrator. Hammer performance shall be verified to ensure that the actual potential energy (rated energy) is not less than 90% of the stated potential energy. All instrumentation, access, and assistance for the testing and monitoring as directed by the Contract Administrator shall be provided.

903.07.02.07.06 Retapping Tests on Piles

In each pile group, 10% of the piles rounded up to the next whole number, but no fewer than two piles, shall be retapped no sooner than 24 hours after installation of the individual pile to confirm that the ultimate axial resistance has been sustained.

Retapping of piles driven to bedrock is not required.

903.07.02.07.07 Retapping and Redriving Piles

When the retapping tests indicate that the ultimate axial resistance has not been achieved on any one pile, all piles in the group shall be retapped.

Where the retapping reveals that the ultimate axial resistance of the piles has not been achieved, the piles that have not achieved the ultimate axial resistance shall be redriven to the specified resistance.

Where piles have risen, the piles shall be redriven to the original depth.

903.07.02.08 Jetting

Jetting shall be carried out in such a manner that the resistance of the piles already in place and the safety of adjacent structures shall not be impaired. Jetting shall be stopped at least 1 m above the final expected pile-tip elevation and at least 1 m above the tip elevation of any piles previously driven within 2 m of the jet. Where piles are to be end bearing on rock, jetting may be carried to the rock surface.

The driving and jetting of precast reinforced concrete piles shall not be carried out simultaneously.

903.07.03 Caisson Piles

903.07.03.01 General

Caissons shall be constructed as specified in the Contract Documents.

The final bearing elevation shall be as specified in the Contract Documents or as determined by the Contract Administrator. When permanent casings are not specified, the caisson shall be constructed in a drilled hole with or without the use of a temporary liner or slurry as determined by the Contractor.

903.07.03.02 Excavation

903.07.03.02.01 General

Sidewall stability shall be maintained throughout the excavation and concrete placement operation. Soil cave-in into the excavation hole shall be prevented.

The bottom of the excavation shall be cleaned before the start of concrete placement.

Excavation methods shall be such that the sides and bottom of the hole are straight and free of loose material that might prevent intimate contact of the concrete with undisturbed soil or bedrock.

Except when founded on sloping rock, the caisson bottom shall be level. On sloping rock, the caisson bottom may be stepped, with each step not greater than ¼ the diameter of the bearing area.

903.07.03.02.02 Casings

When an auger is used to excavate for a casing, the diameter of the auger shall be no greater than the outside diameter of the casing.

903.07.03.02.03 Liners

The diameter of the excavation for the installation of liners shall not exceed the diameter of the liner by more than 150 mm.

903.07.03.02.04 Slurry Method

The level of slurry in the excavation shall be sufficient to prevent the intrusion of water and to maintain a stable wall with no cave-in, sloughing, or basal heave.

Slurry shall be tested as specified in API RP 13B-1All test equipment required for the tests shall be provided. A slurry sampler capable of obtaining samples at any depth within the caisson hole shall be available at all times.

At least 1 set of tests shall be completed every 4 hours during the slurry operation. Samples shall be taken from the mud tank and from within the caisson at a depth within 300 mm of the bottom.

903.07.03.03 Inspection of the Excavation

The bottom of excavations shall be visually inspected.

903.07.03.04 Dewatering

Where dewatering is required, a dewatering scheme shall be employed in such a manner as to prevent any disturbance to the base founding material. The dewatering shall not create subsidence or cause ground loss that may adversely affect the work or adjacent structures.

903.07.03.05 Backfilling Liners Left in Place

The annular space between a liner permanently left in place and shaft excavation shall be filled with concrete or fluid grout.

903.07.03.06 Steel Reinforcement

Steel reinforcement steel shall be installed according to OPSS 905. Steel reinforcement cages shall be checked to ensure conformance to the Working Drawings prior to installation and during placement of concrete.

The steel reinforcement cage shall be fabricated in one piece.

Welding of steel reinforcement and use of splices shall not be done unless specified in the Contract Documents.

The steel reinforcement shall not be displaced or distorted during the construction of the caisson.

903.07.03.07 Concrete

903.07.03.07.01 General

A Request to Proceed shall be submitted to the Contract Administrator before the concrete placement.

The reinforcement shall not be displaced or distorted during the construction of the caisson.

The placement of concrete shall not proceed until the Contract Administrator has inspected the caisson hole and issued a Notice to Proceed.

Concrete shall be placed immediately after the Notice to Proceed has been received and shall be placed in the caisson according to OPSS 904 and as specified herein.

Arching of concrete during casing withdrawal shall be prevented.

903.07.03.07.02 Concrete Placed in the Dry

The concrete may be placed free fall provided the fall is vertically down the centre of the opening and transverse ties, spacers or other objects do not impede the free fall. In the event of interference with the concrete free fall, an elephant trunk or other means shall be used to prevent concrete segregation.

Concrete shall be placed in a continuous operation from the bottom to the top of the caisson or, where columns are cast integral with the caisson, to the elevation of the bottom of the column steel reinforcement cage. The concrete shall be vibrated for the last 1.5 m of the pour.

903.07.03.07.03 Concrete Placed Under Water or Under Slurry

Tremie or pumped concrete shall be carried out in one continuous operation. The tremie or pumping operation shall be a continuous flow of concrete that prevents the inflow of water or slurry.

Where tremie concrete is to be placed in a caisson under water, the Contractor shall maintain an adequate head of water within the excavations to prevent the inflow of water through the base or walls of the caisson as the concrete is being placed.

Where tremie is placed under slurry, the caisson shall be filled with concrete entirely by tremie and the method of deposition shall not be changed part way up the caisson.

When concrete placement is not started within 6 hours of acceptance of the excavation, the excavation shall be redrilled, cleaned, and the slurry tested before concrete placement commences.

903.07.03.07.04 Withdrawal of Liners

Arching of concrete during withdrawal of the liner shall be prevented.

During withdrawal, the bottom of the liner shall have a minimum embedment into the concrete being placed and a sufficient head of concrete shall be maintained above the bottom of the liner at all times to prevent intrusion of soil and water into the hole.

During withdrawal, upward or downward movement of the steel reinforcement shall be monitored. Upward or downward movement shall be restricted to 150 mm.

A theoretical concrete level shall be calculated based on the quantity of concrete placed and the caisson dimensions, and this theoretical level shall be compared to the actual level of concrete in the caisson to provide a check for possible separation of shaft concrete during liner withdrawal.

903.07.03.07.05 Founding Elevation

The final founding elevation shall be as specified in the Contract Documents or an elevation approved in writing by the Contract Administrator. When casings are not specified in the Contract Documents, the caisson shall be constructed in a drilled hole with or without the use of a liner or slurry as determined by the Contractor.

Except when founded on sloping unweathered bedrock, the caisson bottom shall be level. On sloping unweathered bedrock, the caisson bottom may be stepped, with each step not greater than one quarter the diameter of bearing area.

Complete access to inspect the bearing area of the caisson pile prior to the placement of concrete shall be given to the Contract Administrator.

903.07.04 Displacement Caisson Piles

Work shall be carried out in accordance with the displacement caisson pile suppliers' installation procedures. A permanent liner shall be used when specified in the Contract Documents.

The sequence of installation shall be such as to prevent damage to any recently completed piles.

The pile shall not be founded above or below the specified pile tip elevation without approval in writing from the Contract Administrator.

A Request to Proceed shall be submitted to the Contract Administrator before the installation of displacement caisson piles.

The next operation shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

903.07.05 Tolerances

903.07.05.01 Driven Piles

a) Cut-off elevation ± 25 mm.

b) Deviation from vertical not more than 1H:50V, except in the case of a pile cap or footing supporting only a single row of piles the deviation shall not be more than 1H:75V in the direction of the span.

c) The deviation from the specified inclination for battered piles shall not exceed 1H:25V.

d) The centre of the pile at the junction with the pile cap shall be within 150 mm measured horizontally of that specified except in the case of a pile cap or footing supported on a single row of piles the deviation shall not be more than 75 mm measured horizontally in the direction of the span.

903.07.05.02 Caissons and Displacement Caisson Piles

a) Cut-off elevation ± 25 mm.

b) Horizontal location at cut-off not more than 5% of shaft diameter or 75 mm, whichever is less.

c) Vertical alignment not more than 2% of the caisson length from vertical for vertical caissons, or 2% of the caisson length from the specified inclination for battered caissons.

903.07.06 Load Test

When a load test is specified in the Contract Documents, the testing shall be according to ASTM D1143 for piles under vertical static load, ASTM D3689 for piles under tensile load, and ASTM D3966 for piles under lateral loads. The Contract Administrator shall witness the pile load test. All records and results of the pile load test shall be submitted to the Contract Administrator.

All necessary personnel, equipment, and material to make adjustments during the tests shall be provided and at least one skilled worker shall be present for the complete duration of each test. This worker shall have demonstrated experience in load testing of piles.

The following shall be provided for the duration of all testing:

a) A level dry working area at the test location

b) An adequate enclosure sufficient to provide complete protection from adverse weather conditions

c) All temporary work required to obtain access to the site for the personnel, equipment, and materials.

Upon completion of the tests, the site shall be cleared and restored to the satisfaction of the Contract Administrator. Piles that are not part of the finished work shall be cut off 1.2 m below ground level or 0.6 m below stream bed level. Any resulting void shall be backfilled with suitable fill material.

903.07.07 Repair of Welds

Any section of weld that does not meet the requirements of the Contract Documents shall be removed and rewelded.

903.07.08 Quality Control

903.07.08.01 Inspection and Testing of Welds

903.07.08.01.02 Visual Inspection of Welds

Complete access to visually inspect the welds shall be given to the Contract Administrator.

All welds shall conform with the requirements of CSA W59 and the Contract Documents. A representative sample of splice welds, not less than 30%, shall be selected by the Contract Administrator for visual inspection. The sample of splice welds shall be taken from different piles.

If the sample of splice welds do not pass the visual inspection and need to be repaired, the visual inspection by the Contract Administrator may be increased up to 100% of the welds.

903.07.08.01.03 Non-Destructive Testing of Welds

The Contract Administrator shall be notified in writing, 48 hours in advance of installing piles, which will require weld splicing. The Contract Administrator shall be immediately notified in writing if there are any schedule changes for each pile requiring weld splicing.

A Request to Proceed shall be submitted to the Contract Administrator after the completion of splice welds for each construction stage of work.

The next operation shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

Radiographic or ultrasonic testing shall be carried out by the Contract Administrator using procedures according to CSA W59.

Ultrasonic or radiographic testing shall be carried out on the entire length of selected splice welds chosen at random by the Contract Administrator.

The welds selected for the random ultrasonic or radiographic testing shall be taken from different piles and shall include 10% of the splice welds, rounded to the next highest number, but no fewer than two.

If any welds do not pass the ultrasonic or radiographic-testing and need to be repaired, these non-destructive testing requirements may be increased up to 100% of the welds.

903.07.08.01.04 Repaired Welds

All welds that have been repaired shall be visually inspected and shall undergo non-destructive testing performed by the Contract Administrator.

903.07.08.02 Non-Destructive Test Reports and Visual Inspection Reports

Results from completed Visual Inspection Reports and Non-Destructive Test Reports will be provided upon request.

903.09 MEASUREMENT FOR PAYMENT

903.09.01 Actual Measurement

903.09.01.01 H-Piles, Tube Piles, Wooden Piles, and Precast Reinforced Concrete Piles

Measurement of piles shall be by length in metres of the piling left in place after cut-off.

903.09.01.02 Sheet Piles

Measurement of sheet piles shall be by area in square metres based on the driving lines specified and the length of piling left in place after cut-off.

903.09.01.03 Driving Shoes

For measurement purposes, a count shall be made of the number of drive shoes used.

903.09.01.04 Rock Points

For measurement purposes, a count shall be made of the number of rock points used.

903.09.01.05 Caissons and Displacement Caisson Piles

Measurement of caissons and displacement caisson piles shall be by length in metres of the depth along the centreline between the approved bearing surface at the bottom and the specified elevation at the top.

903.09.01.06 Retapping Piles

For measurement purposes, a count shall made of the number of piles retapped above and beyond the minimum number described in the Retapping Tests on Piles clause.

Piles retapped as part of the minimum number required for the retapping tests described in the Retapping Tests on Piles clause shall not be measured for payment.

903.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

903.10 BASIS FOR PAYMENT

903.10.01 Supply Equipment for Installing Driven Piles - Item
Supply Equipment for Installing Caisson Piles - Item
Supply Equipment for Installing Displacement Caisson Piles - Item

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

For payment purposes, 50% of the work under this item shall be paid when the satisfactory performance of the equipment has been demonstrated to the Contract Administrator by the installation of 1% of piles.

Another 40% shall be paid by progress payments proportional to the work completed. The remaining 10% shall be paid on the satisfactory completion of the installation of piles.

When the hammer performance is requested to be verified, such verification shall be completed at no extra cost to the owner when the energy delivered is less than 90% of the stated potential energy (rated energy) specified in the submission.

When the energy is equal to or greater than 90% of the stated potential energy stated in the required submission, the cost verifying the hammer performance shall be administered as a Change in the Work.

903.10.02 H-Piles - Item
Tube Piles - Item
Precast Concrete Piles - Item
Wood Piles - Item
Displacement Caisson Piles - Item
Caisson Piles - Item
Driving Shoes - Item
Rock Points - Item
Sheet Piles - Item
Load Test - Item

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

Payment for redriving piles shall be at the Contract price for the applicable tender item above.

When the Contractor substitutes driving shoes or Oslo points with Titus H bearing pile points, the cost of such substitutions shall be at no extra cost to the Owner.

903.10.03 Retapping Piles - Item

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

Retapping the minimum specified number of piles for retapping tests shall include all labour, Equipment, and Material to do the work and shall be included in the Contract price for the appropriate pile tender item.

Where additional retapping is required, payment shall be made based on the ratio of the number of piles retapped in a pile group above the minimum requirement, up to the total number of piles in that pile group, times the tender price for retapping all piles for that pile group.

903.10.04 Failed Visual Inspection or Non-Destructive Testing of Welds

Costs associated with any required removals and replacement or repairs of defective welds, following the visual inspection or non-destructive testing, shall be the Contractor's responsibility at no additional cost to the Owner. No additional payment will be made for labour and equipment provided by the Contractor, and the Contractor will pay the Owner $500 for each weld requiring additional re-testing.

Appendix 903-A, April 2016
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.

Note: The 903 implemented in April 2025 replaces 903, April 2016 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR DEEP FOUNDATIONS

TABLE OF CONTENTS

903.01 SCOPE

This specification covers the requirements for the supply and installation of deep foundation units.

903.02 REFERENCES

This specification refers to the following specifications, standards, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 904 Concrete Structures
OPSS 905 Steel Reinforcement for Concrete
OPSS 909 Prestressed Concrete - Precast members
OPSS 911 Coating Structural Steel Systems

Ontario Provincial Standard Specifications, Material

OPSS 1302 Water
OPSS 1350 Concrete - Materials and Production
OPSS 1440 Steel Reinforcement for Concrete

Ontario Ministry of Transportation Publications

MTO Forms:
PH-CC-701 Request to Proceed
PH-CC-702 Notice to Proceed

CSA Standards

G40.20-04/G40.21-04 (R2009)	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
CAN3-056-1962(R2006)	Round Timber Piles
O80 Series-08	Wood Preservation
W47.1-03 (R2008)	Certification of Companies for Fusion Welding of Steel
W48-06	Filler Materials and Allied Materials for Shielded Metal Arc Welding
W59-03(R2008)	Welded Steel Construction (Metal Arc Welding)
W178.1-08	Certification of Welding Inspection Organizations
W178.2-08	Certification of Welding Inspectors

Canadian General Standards Board (CGSB)

48.9712-2006	Non-destructive Testing, Qualification and Certification of Personnel

ASTM International

A252-98(2007)	Welded and Seamless Steel Pipe Piles
A328/A328M-07	Steel Sheet Piling
A500/A500M-21	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A572/A572M-18	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
A913/A913M-19	Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST)
D1143/D1143M-07	Standard Test Methods for Deep Foundations Under Static Axial Compressive Load
D3689-07	Standard Test Methods for Deep Foundations Under Static Axial Tensile Load
D3966-07	Standard Test Method for Deep Foundations Under Lateral Loads

American Petroleum Institute (API)

API 13A	Drilling Fluid Materials, 17th Edition, 10.00.08
RP 13B-1	Standard Procedure for Field Testing Water Based Drilling Fluids, 4th Edition,

Steel Structures Painting Council (SSPC)

SP10/NACE No.2-Jan. 1, 2001 Near-White Blast Cleaning

International Organization for Standardization/International Electrotechnical Commission (ISO/IEC)

17025 General Requirements for the Competence of the Testing and Calibration Laboratories

903.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Anvil means the component of a diesel hammer that acts as an impact block for the ram.

Bedrock means a natural solid bed of the hard, stable, cemented part of the earth's crust, igneous, metamorphic, or sedimentary in origin that may or may not be weathered.

Caisson Pile means a cast in place deep foundation unit with or without an enclosing liner formed by placing concrete in a bored or excavated hole.

Cap Block means a material placed on top of the helmet to cushion the blow of the hammer and to attenuate the peak impact energy without causing excessive loss of the impact energy.

Casing means open ended enclosing cylindrical steel tubing or pipe permanently installed in the ground. Casings are structurally required and can be used to stabilize and excavated hole.

Deep Foundation Unit means a structural member, driven or otherwise, installed in the ground to transfer the loads from a structure to soil or rock and derives supporting resistance from the surrounding soil or rock or from the soil or rock strata below its tip or a combination of both.

Displacement Caisson Pile means a pile formed in the ground by driving a casing or liner with a concrete plug or an expendable metal plate attached to it and replacing the displaced soil with unreinforced or reinforced concrete.

Driven Pile means one of the following pile types: steel H, tube, or sheet piles; wooden pile; or precast reinforced concrete pile that has been installed by means of a pile driver.

Driving Shoe means reinforcement attached to the bottom of the pile and designed to protect the pile during driving or to penetrate into a hard stratum.

Driving to a Set means driving the pile to the requirement that satisfies pile driving criteria correlated to a required pile resistance.

Follower means a removable extension that transmits the hammer blows to the head of the pile.

Helmet means a formed steel cap that fits over the top of a pile head to retain in position a resilient cap block.

Jetting means the use of a jet of water at high pressure directed into the ground below the pile tip to assist its penetration.

Liner means open ended enclosing steel tubing or pipe temporarily installed in the ground to facilitate the construction of caisson piles.

Pile means a relatively slender structural element that is installed, wholly or partly in the ground by driving, drilling, auguring, jetting, or other means.

Pile Cap means a footing or some other structural component used to transfer the load to the piles as well as maintaining them in position.

Pile Cushion means a pad of resilient material placed between the helmet and the top of a precast reinforced concrete or wooden pile to minimize damage to the head during driving.

Pile Group means the piles supporting a pile cap.

Pumped Concrete means a method of transporting concrete through hose or pipe by means of positive and continuous pressure.

Ram means the moving or driving part of an air, steam, diesel, or drop pile hammer that delivers an impact blow to an anvil and to the pile.

Retapping means verifying that the specified resistance previously attained has been sustained by imparting appropriate hammer energy to the pile and monitoring pile penetration.

Rock Points means a specially designed steel tip fitted to piles to enable them to be driven into hard, sound sloped bedrock.

Sheet Pile means a pile that is designed to interlock with adjacent piles and form a continuous wall for the purpose of resisting mainly lateral forces and to reduce seepage.

Slurry means a drilling fluid, consisting of water mixed with one or more of various solids or polymers, used to maintain the stability of the side walls and bottom of an excavation.

Tremie means a hopper with a vertical pipe used for placing concrete under water. The foot of the pipe is always submerged in concrete except during commencement of concreting and the upper level of the concrete in the pipe is always above water level.

903.04 DESIGN AND SUBMISSION REQUIREMENTS

903.04.01 Design Requirements

903.04.01.01 Concrete

The Contractor is responsible for providing plastic concrete with suitable characteristics for installation. The concrete shall be flow able, non-segregating concrete that does not exhibit rapid slump loss.

903.04.02 Submission Requirements

903.04.02.01 General

All submissions shall bear the seal and signature of an Engineer experienced in the field of deep foundations.

When welded field splices are used, welding procedures according to the Canadian Welding Bureau shall be submitted to the Contract Administrator.

903.04.02.02 Preconstruction Survey

A condition survey of property and structures that may be affected by the work shall be submitted to the Contract Administrator prior to commencing the work. The survey shall include the locations and conditions of adjacent properties; buildings; underground structures; Utility services; and structures, such as walls abutting the site.

903.04.02.03 Materials

903.04.02.03.01 Mill Certificates

One copy of the mill certificates, indicating that the steel meets the requirements for the appropriate standards for H-piles, tube piles, casings, and sheet piles shall be submitted to the Contract Administrator at the time of delivery.

Where mill test certificates originate from a mill outside Canada or the United States of America, the information on the mill certificates shall be verified by testing by a Canadian laboratory. The laboratory shall be certified by an organization accredited by the Standards Council of Canada to comply to comply with the requirements of ISO/IEC 17025 for the specific tests or type of tests required by the material standard specified on the mill test certificate. The mill test certificates shall be stamped with the name of the Canadian testing laboratory and appropriate wording stating that the material conforms to the specified material requirements. The stamp shall include the appropriate material specification number, the date (i.e., yyyy-mm-dd), and the signature of an authorized officer of the Canadian testing laboratory.

903.04.02.03.02 Concrete

A suitable, site-specific concrete mix design that meets the requirements of the hardened concrete shall be submitted to the Contract Administrator 14 Days prior to construction, for information purposes only.

903.04.02.03.03 Slurry

The following shall be submitted to the Contract Administrator 14 Days prior to construction, for information purposes only:

a) The type, source, and physical and chemical properties of the bentonite or polymer.

b) The source of water.

c) Method of mixing slurry.

d) The water solids ratio and the mass and volumes of the constituent parts, including any chemical admixtures or physical treatment employed to produce slurry with the required physical properties.

e) Details of procedure to be used for monitoring the quality of the slurry.

f) A test report showing the properties of the slurry and certifying that the slurry meets the requirements of API RP 13B-1.

g) Method of disposal of the slurry.

903.04.02.04 Installation

903.04.02.04.01 Driven Piles

The following shall be submitted to the Contract Administrator as least 14 Days prior to construction, for information purposes only:

a) A schedule of work identifying time and sequence of activities.

b) Type of equipment, anvil, helmet, and hammer details, including the hammer energy assumed by the Contractor, stated potential energy (rated energy) of the hammer, operating efficiency, and weight of ram.

c) Working Drawings of precast concrete piles showing the pile dimensions, concrete strength, tendon arrangement, working stresses and arrangement of steel reinforcement, schedules, elongation calculations, method and sequence of casting, complete specifications and details of the prestressing steel, and lift anchors and lifting point locations.

d) The method of maintaining the steel reinforcement cages in position, when steel reinforcement cages are used in tube piles.

e) Procedure for monitoring pile installation.

f) Details of the method of attaching proprietary driving shoes.

g) When load testing is specified in the Contract Documents, details of the full-scale test, including site preparation and the details of the load application, components, equipment, testing apparatus, and method of monitoring.

h) Information pertinent to establishing the resistance of a pile when the wave equation analysis method is used.

903.04.02.04.02 Caisson Piles

The following shall be submitted to the Contract Administrator at least 14 Days prior to construction, for information purposes only:

a) A schedule of work identifying time and sequence of activities.

b) Detailed procedures for caisson excavation in overburden and rock.

c) Detailed procedures for casing and liner installation and for the withdrawal of the liner.

d) Detailed procedures for slurry displacement method of excavation, including disposal of slurry upon completion.

e) Detailed procedures for tremie concrete, including the size of tremie delivery pipe.

f) Detailed procedure for placing concrete in the dry.

g) Method of maintaining the steel reinforcement cages in position in the caisson.

h) Details of filling the annular void around a casing.

i) Details of procedure to be used for monitoring installation.

j) When load testing is specified in the Contract Documents, details of the full-scale test, including site preparation, details of the load application, components, equipment, testing apparatus, and method of monitoring.

903.04.02.04.03 Displacement Caisson Piles

The following shall be submitted to the Contract Administrator as least 14 Days prior to construction, for information purposes only:

a) A schedule of work identifying time and sequence of activities.

b) Type of equipment, anvil, helmet, and hammer details, including the hammer energy assumed by the Contractor, stated potential energy (rated energy) of the hammer, operating efficiency, maximum stroke or drop, and weight of the ram.

c) Details of procedures used for installation of displacement caisson piles, including detailed procedures for liner installation and withdrawal.

d) Method of maintaining the steel reinforcement cages in position in the pile.

e) Details of procedure to be used for monitoring pile installation.

f) When load testing is specified in the Contract Documents, details of the full-scale test, including site preparation, and the details of the load application, components, equipment, testing apparatus, and method of monitoring.

903.04.02.04.04 Steel Reinforcement Cages

Working Drawings showing the fabrication details of the steel reinforcement cages, including the lifting points and lifting lugs, shall be submitted to the Contract Administrator at least 14 days prior to fabrication, for information purposes only.

903.05 MATERIALS

903.05.01 Wooden Piles

Wooden piles shall be according to CAN3-056 and shall be clean and peeled. Treated piles shall be pressure treated with creosote according to CAN/CSA-080.

Wooden piles shall be provided with collars sufficiently strong to prevent splitting of the head of the wooden pile during driving.

903.05.02 Steel Piles

903.05.02.01 H-Piles

Steel H-Piles shall be of the grade specified in the Contract Documents and shall be according to CSA G40.20/G40.21.

When CSA G40.20/G40.21, Grade 350W has been specified, the following steel grades may be substituted:

a) ASTM A572, Grade 345; or

b) ASTM A913, Grade 345.

When CSA G40.20/G40.21, Grade 450W has been specified, the following steel grades may be substituted:

a) ASTM A572, Grade 450; or

b) ASTM A913, Grade 450.

903.05.02.02 Tube Piles

Steel tube piles shall be as specified in the Contract Documents. When ASTM A252, Grade 3 has been specified, the following steel grades may be substituted:

a) ASTM A500, Grade C; or

b) CSA G40.20/G40.21, Grade 350W.

903.05.02.03 Sheet Piles

Steel sheet piles shall be according to ASTM A328M.

903.05.02.04 Straightness Tolerance for Steel Piles, Casings, and Liners

Steel piles, casings, and liners shall conform to a straightness tolerance of 1.5 mm maximum per metre of length.

Steel sheet piles shall be sufficiently straight to prevent binding in the interlock during driving.

903.05.03 Driving Shoes and Rock Points

Rock points and driving shoes shall be as specified in the Contract Documents.

Driving shoes shall transfer the driving stresses to the pile over the full cross-sectional area of the pile.

Where precast concrete piles are driven into dense or hard material, a steel driving shoe cast into the concrete shall be provided.

Where wooden piles are driven into dense material, a steel plate driving shoe shall be provided to prevent damage to the bottom of the pile.

903.05.04 Casing for Caissons

Casings shall be according to ASTM A252, Grade 2. If welded, they shall be welded by the electric arc method according to CSA W59.

The casing wall thickness specified is the minimum that shall be supplied. The wall thickness shall be increased as required to ensure the casing is not damaged during handling and installation.

903.05.05 Steel Reinforcement

Steel reinforcement shall be according to OPSS 1440.

903.05.06 Concrete

903.05.06.01 General

Concrete shall be according to OPSS 1350.

903.05.06.02 Tube Piles

Concrete shall have a slump of 150 to 180 mm.

903.05.06.03 Caisson Piles

Concrete shall have a slump of 150 to 180 mm. When approved by the Contract Administrator in writing, admixtures may be used. Where the liner is to be withdrawn, sufficient retarder shall be added to prevent arching of concrete during liner withdrawal and to prevent setting of concrete until after the liner is withdrawn.

903.05.07 Precast Concrete Piles

The production of precast reinforced concrete piles shall be according to OPSS 904, OPSS 905, and OPSS 909.

Steel reinforcement shall be placed such that direct loading during the ram stroke shall not occur.

Lifting anchors shall be at least 25 mm clear from reinforcement or prestressing steel in the pile.

Concrete in precast reinforced concrete piles shall be according to OPSS 1350 and have a nominal minimum 28-Day compressive strength of 45 MPa.

Concrete for precast reinforced concrete piles shall be cured according to OPSS 904.

Concrete for precast reinforced concrete piles shall be placed in smooth mortar-tight forms that are supported to prevent excessive deformation or settlement during placing or curing.

Unformed surfaces shall be finished smooth.

When removed from the form, the pile shall present true, smooth, even surfaces free from honeycombs and voids. The pile shall be straight so that a line stretched from butt to tip on any face shall not be more than 25 mm from the face of the pile at any point.

Each precast reinforced concrete pile shall have the date of manufacture (i.e., yyyy-mm-dd) inscribed on it.

903.05.08 Slurry

903.05.08.01 Solids

Bentonite and polymers shall be according to API Spec 13A.

903.05.08.02 Water

Water shall be according to OPSS 1302.

903.05.08.03 Slurry Composition

The slurry shall consist of a stable colloidal suspension of pulverized solids or polymers thoroughly mixed with water. The density, viscosity, sand content, and pH of the slurry being used during excavation shall be according to API RP 13B-1.

903.06 EQUIPMENT

903.06.01 Hammers

Hammers shall be capable of installing the piles, casings, and liners to the depth or resistance specified in the Contract Documents, without damage to the portions that are not cut off.

The hammer used to chisel the rock point into the rock shall be capable of delivering a controlled blow in 10% increments ranging in energy from zero to the maximum hammer energy.

For precast reinforced concrete piles, the heaviest hammer practicable shall be employed and the stroke limited so as not to damage the piles. When choosing the size of the hammer, consideration shall be given to whether the pile is to be driven to a resistance or to a given depth.

903.06.02 Helmets and Striker Plates

The head of steel piles shall be protected by a striker plate or a helmet. Helmets shall have adequate and suitable cushioning material. Helmets and striker plates shall distribute the blow of the hammer evenly throughout the cross-section of the pile head.

903.06.03 Leads

Pile driver leads shall be built to afford freedom of movement for the hammer and shall be held in position at the top and bottom by guys, stiff braces, or other approved means to ensure support of the pile, casing, or liner while it is being driven. Swinging leads shall not be permitted.

Batter piles, casings, or liners shall be driven with leads aligned parallel to the axis of the pile, casing, or liner. The leads shall be equipped with a fixed, rigid, adjustable kicker.

903.06.04 Followers

When use of followers are specified in the Contract Documents, followers shall be of type, size, shape, length, and weight as to permit driving the pile, casing, or liner at the location and to the required depth or ultimate resistance specified in the Contract Documents. The follower shall be provided with a socket or hood carefully fitted to the top of the pile, casing, or liner to minimize loss of energy and to prevent damage to the pile, casing, or liner, and shall have sufficient rigidity to prevent "whip" during driving.

When followers are permitted, an identical follower shall be used when the set is being determined.

903.07 CONSTRUCTION

903.07.01 Transporting, Storing, and Handling Piles, Casings, Liners, and Reinforcing Steel Reinforcement Cages

903.07.01.01 General

Piles, casings, liners, and steel reinforcement shall be transported, stored, and handled in such a manner that damage is prevented and the strength of the components is not affected by deterioration or deformation.

Components shall be lifted and placed using appropriate lifting equipment, temporary bracing, guys, or stiffening devices so that the components are at no time overloaded, unstable, or unsafe.

Material shall be supported to prevent unequal settlement when stacked.

903.07.01.02 Wooden Piles

Canthooks, dogs, pile pulls, or use of other lifting methods that might damage the integrity of the pressure treated surface shall not be used. Cuts or breaks in the surface of treated piling shall be given three brush coats of hot creosote oil. Bolt holes shall be treated with three applications of hot creosote oil applied with a bolt hole treater.

903.07.01.03 Handling Holes in Steel Piles

Unless otherwise approved by the Contract Administrator, holes shall only be made in the portion of the pile to be cut off or in the portion of the pile to be encased in concrete.

When other holes are approved to be cut in a pile they shall be covered by splice plates placed on both sides of the section. The thickness and the mechanical properties of the plate material shall be at least equivalent to the pile material.

903.07.01.04 Precast Reinforced Concrete Piles

Precast concrete piles shall be handled only from the designated lifting points.

When lifting or transporting precast reinforced concrete piles lift anchors, slings, or other approved means shall be used. Care shall be taken when lifting and transporting to avoid any overstressing of the pile or cracking of the concrete.

Precast reinforced concrete piles shall be so handled to avoid breaking or chipping their edges.

Lift anchors shall be removed and the holes filled with a non-shrink grout or epoxy installed according to the manufacturer’s recommendations.

903.07.01.05 Caisson Casings and Liners

Casings and liners shall be handled and stored in such a manner to avoid damage or distortion to them. The casings and liners shall be maintained circular within ± 2% of the casing or liner diameter.

903.07.02 Driven Piles

903.07.02.01 Pile Driving Requirements and Restrictions

Piles shall not be driven until embankment work or excavation work has been completed to the underside of the footing. When driving of the piles is completed, all material between the piles shall be removed to the correct elevation and any holes or voids created shall be filled to the correct elevation with compacted material approved by the Contract Administrator.

Piles shall be installed at the locations specified in the Contract Documents and to the set or depth specified without being damaged. Damage to the pile, casing, or liner during driving shall be prevented by limiting the drop or energy and number of blows of the hammer. The hammer, helmet, cap block, striker plate, and pile shall be coaxial and shall sit squarely upon each other.

A shorter stroke shall be used and proper precaution shall be taken when there is a danger of damaging or over driving the piles, casing, or liners under conditions such as:

a) In the early stages of driving a long pile where a hard layer near the ground surface has to be penetrated.

b) Where there is very soft material of a considerable depth and a large penetration is achieved at each hammer blow.

c) Where it is anticipated the pile shall meet refusal on rock or other impenetrable soil.

d) When piles are driven onto sloping bedrock.

Damage to adjacent structures, Utilities, and fresh concrete shall be prevented during pile installation. Piles shall not be driven within a radius of 8 m of concrete that has been in place for less than 72 hours. Piles shall not be driven within a radius of 15 m of concrete that has been in place for less than 72 hours without the approval of the Contract Administrator.

The tops of all piles shall be either square to the longitudinal axis of the pile or horizontal as indicated in the Contract Documents.

Piles shall not be forced into their proper position by the use of excessive manipulation. Pile damage due to excessive driving shall be avoided.

903.07.02.02 Driving Shoes and Rock Points

Driving shoes and rock points shall be installed in locations specified in the Contract Documents.

Driving shoes shall be welded in accordance with the Contract Documents.

When driving shoes are specified in the Contract Documents, the Titus H bearing pile point or APF Hard Bite, standard model, may be substituted for the driving shoes.

When Oslo points are specified in the Contract Documents, the Titus H bearing pile point or APF, rock injector model, may be substituted for the pile points.

Where proprietary driving shoes are used, they shall be welded or otherwise attached to the driven piles according to the manufacturer's specifications.

903.07.02.03 Splicing

903.07.02.03.01 General

Any damaged material shall be cut-off prior to splicing.

903.07.02.03.02 Wooden Piles

Wooden piles shall not be spliced.

903.07.02.03.03 H-Piles, Tube Piles, and Sheet Piles

Welding shall be according to CSA W59 and shall be done by a qualified welder employed by a firm certified according to CSA W47.1, Division 1 or Division 2.

Steel H-piles and steel tube piles may be spliced providing the pieces being spliced are not less than 3 m long, except for integral abutments' piles, where the pieces being spliced shall not be less than 7.0 m long. Where piles are located in a waterbody, splices shall be located below the low water level, unless otherwise encased in concrete.

Sheet piles shall not be spliced without approval by the Contract Administrator.

903.07.02.03.04 Precast Reinforced Concrete Piles

Precast reinforced concrete piles shall only be spliced when specified in the Contract Documents and the splices shall only be made with approved mechanical splicing devices.

903.07.02.04 Concrete in Steel Tube Piles

Concrete in steel tube piles shall be placed according to OPSS 904.

903.07.02.05 Cutting Off Piles

903.07.02.05.01 General

Driven piles shall be cut to the elevation as specified in the Contract Documents.

The length of pile supplied shall be sufficient to ensure there is no damaged material below the cut off. Damaged material at the pile head shall be cut off.

Piles shall not be cut off until retapping, redriving, and specified load testing are complete.

903.07.02.05.02 Wooden Piles

Where wooden piles are broomed, splintered, or otherwise damaged below the cut-off elevation, the pile shall be considered defective and shall be replaced.

903.07.02.06 Protective Coating for Steel H and Steel Tube Piles

Exposed steel H and steel tube piles shall have a coal tar epoxy protective coating applied from an elevation 600 mm below the low water level or finished ground surface up to the top of the exposed steel.

The steel surfaces shall be cleaned according to SSPC-SP10 prior to application of a coal tar epoxy system that shall be according to OPSS 911.

903.07.02.07 Monitoring Driven Piles

903.07.02.07.01 General

The driving of piles shall be carefully monitored and controlled. Pile driving records shall be produced for each pile and shall be submitted to the Contract Administrator.

Piles shall not be overdriven. When driving to a specified ultimate resistance, driving to a set or driving to bedrock, the piles shall be driven to the anticipated tip elevation. The Contract Administrator shall be notified if the piles do not reach set at the anticipated tip elevation.

In soils where there is a possibility of piles moving upward due to ground heave, elevations of completed pile tops shall be measured at intervals while nearby piles are being installed. The readings shall be recorded and submitted to the Contract Administrator as the work proceeds.

903.07.02.07.02 Driving to a Specified Elevation

Piles shall be driven to an elevation specified in the Contract Documents. Driving piles to other elevations shall only be done when approved in writing by the Contract Administrator.

903.07.02.07.03 Driving to a Specified Ultimate Resistance

903.07.02.07.03.01 General

The Quality Verification Engineer shall establish the reference set used to determine ultimate resistance and measure and record the set for individual pile acceptance.

The set and rebound measurements shall be obtained by the Quality Verification Engineer. The Quality Verification Engineer shall determine the measured ultimate resistance and verify that the design ultimate resistance has been achieved.

903.07.02.07.03.02 Driving to a Set

The founding elevation shall be established by driving to a set determined in accordance with the dynamic formula specified in the Contract Documents or by the application of the wave equation analysis procedure that verifies the pile resistance. This set shall be established on the first pile of every ten piles driven in a pile group.

The other piles shall be controlled by the pile penetration rate in blows per millimetre that correlates to the set.

When new conditions, such as change in hammer size, change in pile size, or change in soil material occur, new sets shall be determined.

903.07.02.07.03.03 Driving to Bedrock

When driving piles to bedrock, the pile shall be adequately seated on bedrock without damaging the pile.

Where rock points are used, the rock points shall penetrate into the rock. Piles driven using rock points shall be driven to ensure adequate seating on the bedrock without damaging the pile.

Driving of piles on sloping bedrock shall be stopped when initial contact is made with the bedrock. The bedrock elevation shall be recorded. Driving shall then continue, commencing with energy of 10% of the maximum energy of the hammer. The pile shall be driven in sets of 20 blows at this energy until no penetration is observed. Twenty additional blows shall be applied, and, if no penetration is observed, the energy shall be increased by an additional 10% and the above procedure repeated.

Driving shall continue with these stepped increases in energy and with the same series of blows as described above, until the pile has been seated on the bedrock.

If unrealistic excessive penetration per blow is observed, driving shall be stopped and this excessive penetration immediately reported to the Contract Administrator.

The Quality Verification Engineer shall determine when the hammer energy can be increased and when the driving is complete for each pile.

903.07.02.07.04 Wave Equation Analysis

When requested by the Contract Administrator, all equipment, material, and personnel shall be supplied to conduct the wave equation analysis procedure.

903.07.02.07.05 Hammer Performance

When requested by the Contract Administrator, the hammer performance using the pile driving analyzer or other approved equivalent shall be verified in the presence of the Contract Administrator. Hammer performance shall be verified to ensure that the actual potential energy (rated energy) is not less than 90% of the stated potential energy. All instrumentation, access, and assistance for the testing and monitoring as directed by the Contract Administrator shall be provided.

903.07.02.07.06 Retapping Tests on Piles

In each pile group, 10% of the piles rounded up to the next whole number, but no fewer than two piles, shall be retapped no sooner than 24 hours after installation of the individual pile to confirm that the ultimate axial resistance has been sustained.

Retapping of piles driven to bedrock is not required.

903.07.02.07.07 Retapping and Redriving Piles

When the retapping tests indicate that the ultimate axial resistance has not been achieved on any one pile, all piles in the group shall be retapped.

Where the retapping reveals that the ultimate axial resistance of the piles has not been achieved, the piles that have not achieved the ultimate axial resistance shall be redriven to the specified resistance.

Where piles have risen, the piles shall be redriven to the original depth.

903.07.02.08 Jetting

Jetting shall be carried out in such a manner that the resistance of the piles already in place and the safety of adjacent structures shall not be impaired. Jetting shall be stopped at least 1 m above the final expected pile-tip elevation and at least 1 m above the tip elevation of any piles previously driven within 2 m of the jet. Where piles are to be end bearing on rock, jetting may be carried to the rock surface.

The driving and jetting of precast reinforced concrete piles shall not be carried out simultaneously.

903.07.03 Caisson Piles

903.07.03.01 General

Caissons shall be constructed as specified in the Contract Documents.

The final bearing elevation shall be as specified in the Contract Documents or as determined by the Contract Administrator. When permanent casings are not specified, the caisson shall be constructed in a drilled hole with or without the use of a temporary liner or slurry as determined by the Contractor.

903.07.03.02 Excavation

903.07.03.02.01 General

Sidewall stability shall be maintained throughout the excavation and concrete placement operation. Soil cave-in into the excavation hole shall be prevented.

The bottom of the excavation shall be cleaned before the start of concrete placement.

Excavation methods shall be such that the sides and bottom of the hole are straight and free of loose material that might prevent intimate contact of the concrete with undisturbed soil or bedrock.

Except when founded on sloping rock, the caisson bottom shall be level. On sloping rock, the caisson bottom may be stepped, with each step not greater than ¼ the diameter of the bearing area.

903.07.03.02.02 Casings

When an auger is used to excavate for a casing, the diameter of the auger shall be no greater than the outside diameter of the casing.

903.07.03.02.03 Liners

The diameter of the excavation for the installation of liners shall not exceed the diameter of the liner by more than 150 mm.

903.07.03.02.04 Slurry Method

The level of slurry in the excavation shall be sufficient to prevent the intrusion of water and to maintain a stable wall with no cave-in, sloughing, or basal heave.

Slurry shall be tested as specified in API RP 13B-1All test equipment required for the tests shall be provided. A slurry sampler capable of obtaining samples at any depth within the caisson hole shall be available at all times.

At least 1 set of tests shall be completed every 4 hours during the slurry operation. Samples shall be taken from the mud tank and from within the caisson at a depth within 300 mm of the bottom.

903.07.03.03 Inspection of the Excavation

The bottom of excavations shall be visually inspected.

903.07.03.04 Dewatering

Where dewatering is required, a dewatering scheme shall be employed in such a manner as to prevent any disturbance to the base founding material. The dewatering shall not create subsidence or cause ground loss that may adversely affect the work or adjacent structures.

903.07.03.05 Backfilling Liners Left in Place

The annular space between a liner permanently left in place and shaft excavation shall be filled with concrete or fluid grout.

903.07.03.06 Steel Reinforcement

Steel reinforcement steel shall be installed according to OPSS 905. Steel reinforcement cages shall be checked to ensure conformance to the Working Drawings prior to installation and during placement of concrete.

The steel reinforcement cage shall be fabricated in one piece.

Welding of steel reinforcement and use of splices shall not be done unless specified in the Contract Documents.

The steel reinforcement shall not be displaced or distorted during the construction of the caisson.

903.07.03.07 Concrete

903.07.03.07.01 General

A Request to Proceed shall be submitted to the Contract Administrator before the concrete placement.

The reinforcement shall not be displaced or distorted during the construction of the caisson.

The placement of concrete shall not proceed until the Contract Administrator has inspected the caisson hole and issued a Notice to Proceed.

Concrete shall be placed immediately after the Notice to Proceed has been received and shall be placed in the caisson according to OPSS 904 and as specified herein.

Arching of concrete during casing withdrawal shall be prevented.

903.07.03.07.02 Concrete Placed in the Dry

The concrete may be placed free fall provided the fall is vertically down the centre of the opening and transverse ties, spacers or other objects do not impede the free fall. In the event of interference with the concrete free fall, an elephant trunk or other means shall be used to prevent concrete segregation.

Concrete shall be placed in a continuous operation from the bottom to the top of the caisson or, where columns are cast integral with the caisson, to the elevation of the bottom of the column steel reinforcement cage. The concrete shall be vibrated for the last 1.5 m of the pour.

903.07.03.07.03 Concrete Placed Under Water or Under Slurry

Tremie or pumped concrete shall be carried out in one continuous operation. The tremie or pumping operation shall be a continuous flow of concrete that prevents the inflow of water or slurry.

Where tremie concrete is to be placed in a caisson under water, the Contractor shall maintain an adequate head of water within the excavations to prevent the inflow of water through the base or walls of the caisson as the concrete is being placed.

Where tremie is placed under slurry, the caisson shall be filled with concrete entirely by tremie and the method of deposition shall not be changed part way up the caisson.

When concrete placement is not started within 6 hours of acceptance of the excavation, the excavation shall be redrilled, cleaned, and the slurry tested before concrete placement commences.

903.07.03.07.04 Withdrawal of Liners

Arching of concrete during withdrawal of the liner shall be prevented.

During withdrawal, the bottom of the liner shall have a minimum embedment into the concrete being placed and a sufficient head of concrete shall be maintained above the bottom of the liner at all times to prevent intrusion of soil and water into the hole.

During withdrawal, upward or downward movement of the steel reinforcement shall be monitored. Upward or downward movement shall be restricted to 150 mm.

A theoretical concrete level shall be calculated based on the quantity of concrete placed and the caisson dimensions, and this theoretical level shall be compared to the actual level of concrete in the caisson to provide a check for possible separation of shaft concrete during liner withdrawal.

903.07.03.07.05 Founding Elevation

The final founding elevation shall be as specified in the Contract Documents or an elevation approved in writing by the Contract Administrator. When casings are not specified in the Contract Documents, the caisson shall be constructed in a drilled hole with or without the use of a liner or slurry as determined by the Contractor.

Except when founded on sloping unweathered bedrock, the caisson bottom shall be level. On sloping unweathered bedrock, the caisson bottom may be stepped, with each step not greater than one quarter the diameter of bearing area.

Complete access to inspect the bearing area of the caisson pile prior to the placement of concrete shall be given to the Contract Administrator.

903.07.04 Displacement Caisson Piles

Work shall be carried out in accordance with the displacement caisson pile suppliers' installation procedures. A permanent liner shall be used when specified in the Contract Documents.

The sequence of installation shall be such as to prevent damage to any recently completed piles.

The pile shall not be founded above or below the specified pile tip elevation without approval in writing from the Contract Administrator.

A Request to Proceed shall be submitted to the Contract Administrator before the installation of displacement caisson piles.

The next operation shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

903.07.05 Tolerances

903.07.05.01 Driven Piles

a) Cut-off elevation $\pm$ 25 mm.

b) Deviation from vertical not more than 1H:50V, except in the case of a pile cap or footing supporting only a single row of piles the deviation shall not be more than 1H:75V in the direction of the span.

c) The deviation from the specified inclination for battered piles shall not exceed 1H:25V.

d) The centre of the pile at the junction with the pile cap shall be within 150 mm measured horizontally of that specified except in the case of a pile cap or footing supported on a single row of piles the deviation shall not be more than 75 mm measured horizontally in the direction of the span.

903.07.05.02 Caissons and Displacement Caisson Piles

a) Cut-off elevation ± 25 mm.

b) Horizontal location at cut-off not more than 5% of shaft diameter or 75 mm, whichever is less.

c) Vertical alignment not more than 2% of the caisson length from vertical for vertical caissons, or 2% of the caisson length from the specified inclination for battered caissons.

903.07.06 Load Test

When a load test is specified in the Contract Documents, the testing shall be according to ASTM D1143 for piles under vertical static load, ASTM D3689 for piles under tensile load, and ASTM D3966 for piles under lateral loads. The Contract Administrator shall witness the pile load test. All records and results of the pile load test shall be submitted to the Contract Administrator.

All necessary personnel, equipment, and material to make adjustments during the tests shall be provided and at least one skilled worker shall be present for the complete duration of each test. This worker shall have demonstrated experience in load testing of piles.

The following shall be provided for the duration of all testing:

a) A level dry working area at the test location

b) An adequate enclosure sufficient to provide complete protection from adverse weather conditions

c) All temporary work required to obtain access to the site for the personnel, equipment, and materials.

Upon completion of the tests, the site shall be cleared and restored to the satisfaction of the Contract Administrator. Piles that are not part of the finished work shall be cut off 1.2 m below ground level or 0.6 m below stream bed level. Any resulting void shall be backfilled with suitable fill material.

903.07.07 Repair of Welds

Any section of weld that does not meet the requirements of the Contract Documents shall be removed and rewelded.

903.07.08 Quality Control

903.07.08.01 Inspection and Testing of Welds

903.07.08.01.02 Visual Inspection of Welds

Complete access to visually inspect the welds shall be given to the Contract Administrator.

All welds shall conform with the requirements of CSA W59 and the Contract Documents. A representative sample of splice welds, not less than 30%, shall be selected by the Contract Administrator for visual inspection. The sample of splice welds shall be taken from different piles.

If the sample of splice welds do not pass the visual inspection and need to be repaired, the visual inspection by the Contract Administrator may be increased up to 100% of the welds.

903.07.08.01.03 Non-Destructive Testing of Welds

The Contract Administrator shall be notified in writing, 48 hours in advance of installing piles, which will require weld splicing. The Contract Administrator shall be immediately notified in writing if there are any schedule changes for each pile requiring weld splicing.

A Request to Proceed shall be submitted to the Contract Administrator after the completion of splice welds for each construction stage of work.

The next operation shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

Radiographic or ultrasonic testing shall be carried out by the Contract Administrator using procedures according to CSA W59.

Ultrasonic or radiographic testing shall be carried out on the entire length of selected splice welds chosen at random by the Contract Administrator.

The welds selected for the random ultrasonic or radiographic testing shall be taken from different piles and shall include 10% of the splice welds, rounded to the next highest number, but no fewer than two.

If any welds do not pass the ultrasonic or radiographic-testing and need to be repaired, these non-destructive testing requirements may be increased up to 100% of the welds.

903.07.08.01.04 Repaired Welds

All welds that have been repaired shall be visually inspected and shall undergo non-destructive testing performed by the Contract Administrator.

903.07.08.02 Non-Destructive Test Reports and Visual Inspection Reports

Results from completed Visual Inspection Reports and Non-Destructive Test Reports will be provided upon request.

903.09 MEASUREMENT FOR PAYMENT

903.09.01 Actual Measurement

903.09.01.01 H-Piles, Tube Piles, Wooden Piles, and Precast Reinforced Concrete Piles

Measurement of piles shall be by length in metres of the piling left in place after cut-off.

903.09.01.02 Sheet Piles

Measurement of sheet piles shall be by area in square metres based on the driving lines specified and the length of piling left in place after cut-off.

903.09.01.03 Driving Shoes

For measurement purposes, a count shall be made of the number of drive shoes used.

903.09.01.04 Rock Points

For measurement purposes, a count shall be made of the number of rock points used.

903.09.01.05 Caissons and Displacement Caisson Piles

Measurement of caissons and displacement caisson piles shall be by length in metres of the depth along the centreline between the approved bearing surface at the bottom and the specified elevation at the top.

903.09.01.06 Retapping Piles

For measurement purposes, a count shall made of the number of piles retapped above and beyond the minimum number described in the Retapping Tests on Piles clause.

Piles retapped as part of the minimum number required for the retapping tests described in the Retapping Tests on Piles clause shall not be measured for payment.

903.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

903.10 BASIS FOR PAYMENT

903.10.01 Supply Equipment for Installing Driven Piles - Item
Supply Equipment for Installing Caisson Piles - Item
Supply Equipment for Installing Displacement Caisson Piles - Item

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

For payment purposes, 50% of the work under this item shall be paid when the satisfactory performance of the equipment has been demonstrated to the Contract Administrator by the installation of 1% of piles.

Another 40% shall be paid by progress payments proportional to the work completed. The remaining 10% shall be paid on the satisfactory completion of the installation of piles.

When the hammer performance is requested to be verified, such verification shall be completed at no extra cost to the owner when the energy delivered is less than 90% of the stated potential energy (rated energy) specified in the submission.

When the energy is equal to or greater than 90% of the stated potential energy stated in the required submission, the cost verifying the hammer performance shall be administered as a Change in the Work.

903.10.02 H-Piles - Item
Tube Piles - Item
Precast Concrete Piles - Item
Wood Piles - Item
Displacement Caisson Piles - Item
Caisson Piles - Item
Driving Shoes - Item
Rock Points - Item
Sheet Piles - Item
Load Test - Item

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

Payment for redriving piles shall be at the Contract price for the applicable tender item above.

When the Contractor substitutes driving shoes or Oslo points with Titus H bearing pile points, the cost of such substitutions shall be at no extra cost to the Owner.

903.10.03 Retapping Piles - Item

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

Retapping the minimum specified number of piles for retapping tests shall include all labour, Equipment, and Material to do the work and shall be included in the Contract price for the appropriate pile tender item.

Where additional retapping is required, payment shall be made based on the ratio of the number of piles retapped in a pile group above the minimum requirement, up to the total number of piles in that pile group, times the tender price for retapping all piles for that pile group.

903.10.04 Failed Visual Inspection or Non-Destructive Testing of Welds

Costs associated with any required removals and replacement or repairs of defective welds, following the visual inspection or non-destructive testing, shall be the Contractor's responsibility at no additional cost to the Owner. No additional payment will be made for labour and equipment provided by the Contractor, and the Contractor will pay the Owner $500 for each weld requiring additional re-testing.

~~903.02 REFERENCES~~

~~Section 903.02 of OPSS 903 is amended by the addition of the following:~~

~~ASTM International~~

~~A500 / A500M - 21 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes~~

~~A572 / A572M - 18 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel~~

~~A913 / A913M - 19 Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST)~~

~~903.03 DEFINITIONS~~

~~Section 903.03 of OPSS 903 is amended by the deletion of the definitions for Certificate of Conformance and Quality Verification Engineer.~~

~~903.04 DESIGN AND SUBMISSION REQUIREMENTS~~

~~903.04.02.04.02.01 Milestone Inspections~~

~~Clause 903.04.02.04.02.01 of OPSS 903 is deleted in its entirety.~~

~~903.04.02.05 Qualifications~~

~~Clause 903.04.02.05 of OPSS 903 is deleted in its entirety.~~

~~903.04.02.06 Review of Splice Test Results and Permission to Proceed~~

~~Clause 903.04.02.06 of OPSS 903 is deleted in its entirety.~~

~~903.05 MATERIALS~~

~~903.05.02.01 H Piles~~

~~Clause 903.05.02.01 of OPSS 903 is deleted in its entirety and replaced with the following:~~

~~Steel H-Piles shall be of the grade specified in the Contract Documents and shall be according to CSA G40.20/G40.21.~~

~~When CSA G40.20/G40.21, Grade 350W has been specified, the following steel grades may be substituted:~~

~~a) ASTM A572, Grade 345; or~~

~~b) ASTM A913, Grade 345.~~

~~When CSA G40.20/G40.21, Grade 450W has been specified, the following steel grades may be substituted:~~

~~a) ASTM A572, Grade 450; or~~

~~b) ASTM A913, Grade 450.~~

~~**903.05.02.02 Tube Piles**~~

~~Clause 903.05.02.02 of OPSS 903 is deleted in its entirety and replaced with the following:~~

~~Steel tube piles shall be as specified in the Contract Documents. When ASTM A252, Grade 3 has been specified, the following steel grades may be substituted:~~

~~a) ASTM A500, Grade C; or~~

~~b) CSA G40.20/G40.21, Grade 350W.~~

Dynamic formula or High-Strain Dynamic Testing

903.07 CONSTRUCTION

903.07.02~~.03.03 H-Piles, Tube Piles, and Sheet~~ Driven Piles

~~Clause 903.07.02.03.03 of OPSS 903 is deleted in its entirety and replacing it with the following:~~

~~Welding shall be according to CSA W59 and shall be done by a qualified welder employed by a firm certified according to CSA W47.1, Division 1 or Division 2.~~

~~Steel H-piles and steel tube piles may be spliced providing the pieces being spliced are not less than 3 m long, except for integral abutments' piles, where the pieces being spliced shall not be less than 7.0 m long. Where piles are located in a waterbody, splices shall be located below the low water level, unless otherwise encased in concrete.~~

~~Sheet piles shall not be spliced without approval by the Contract Administrator.~~

~~**903.07.02.07.01 General**~~

~~Clause 903.07.02.07.01 of OPSS 903 is amended by deleting the first paragraph in its entirety and replacing it with the following:~~

~~The driving of piles shall be carefully monitored and controlled. Pile driving records shall be produced for each pile and shall be submitted to the Contract Administrator.~~

903.07.02.07 Monitoring Driven Piles

903.07.02.07.03 Driving to a Specified Ultimate Resistance

Clause 903.07.02.07.03 of OPSS 903 is deleted in its entirety and replaced with the following:

[* Designer Fill-In, See Notes to Designer]

903.07.02.07.04 Wave Equation Analysis

Clause 903.07.02.07.04 of OPSS 903 is deleted in its entirety and replaced with the following:

When requested by the Contract Administrator, all equipment, material, and personnel shall be supplied to conduct the wave equation analysis procedure.

903.07.03.07 Concrete

903.07.03.07.01 General

Clause 903.07.03.07.01 of OPSS 903 is deleted in its entirety and replaced with the following:

A Request to Proceed shall be submitted to the Contract Administrator before the concrete placement.

The reinforcement shall not be displaced or distorted during the construction of the caisson.

The placement of concrete shall not proceed until the Contract Administrator has inspected the caisson hole and issued a Notice to Proceed.

Concrete shall be placed immediately after the Notice to Proceed has been received and shall be placed in the caisson according to OPSS 904 and as specified herein.

Arching of concrete during casing withdrawal shall be prevented.

903.07.03.07.05 Founding Elevation

Clause 903.07.03.07.05 of OPSS 903 is amended by deleting the last paragraph in its entirety and replacing it with the following:

Complete access to inspect the bearing area of the caisson pile prior to the placement of concrete shall be given to the Contract Administrator.

903.07.04 Displacement Caisson Piles

Subsection 903.07.04 of OPSS 903 is amended by deleting the fourth paragraph in its entirety and replacing it with the following:

A Request to Proceed shall be submitted to the Contract Administrator before the installation of displacement caisson piles.

The next operation shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

903.07.06 Load Test

Subsection 903.07.06 of OPSS 903 is amended by deleting the first paragraph in its entirety and replacing it with the following:

When a load test is specified in the Contract Documents, the testing shall be according to ASTM D1143 for piles under vertical static load, ASTM D3689 for piles under tensile load, and ASTM D3966 for piles under

lateral loads. The Contract Administrator shall witness the pile load test. All records and results of the pile load test shall be submitted to the Contract Administrator.

903.07.08 Quality Control

903.07.08.01.01 Qualifications of Companies and Individuals

Clause 903.07.08.01.01 of OPSS 903 is deleted in its entirety.

903.07.08.01.02 Visual Inspection of Welds

Clause 903.07.08.01.02 of OPSS 903 is deleted in its entirety and replaced with the following:

Complete access to visually inspect the welds shall be given to the Contract Administrator.

All welds shall conform with the requirements of CSA W59 and the Contract Documents. A representative sample of splice welds, not less than 30%, shall be selected by the Contract Administrator for visual inspection. The sample of splice welds shall be taken from different piles.

If the sample of splice welds do not pass the visual inspection and need to be repaired, the visual inspection by the Contract Administrator may be increased up to 100% of the welds.

903.07.08.01.03 Non-Destructive Testing of Welds

Clause 903.07.08.01.03 of OPSS 903 is deleted in its entirety and replaced with the following:

The Contract Administrator shall be notified in writing, 48 hours in advance of installing piles, which will require weld splicing. The Contract Administrator shall be immediately notified in writing if there are any schedule changes for each pile requiring weld splicing.

A Request to Proceed shall be submitted to the Contract Administrator after the completion of splice welds for each construction stage of work.

The next operation shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

Radiographic or ultrasonic testing shall be carried out by the Contract Administrator using procedures according to CSA W59.

Ultrasonic or radiographic testing shall be carried out on the entire length of selected splice welds chosen at random by the Contract Administrator.

The welds selected for the random ultrasonic or radiographic testing shall be taken from different piles and shall include 10% of the splice welds, rounded to the next highest number, but no fewer than two.
If any welds do not pass the ultrasonic or radiographic testing and need to be repaired, these non-destructive testing requirements may be increased up to 100% of the welds.

903.07.08.01.04 Repaired Welds

Clause 903.07.08.01.04 of OPSS 903 is deleted in its entirety and replaced with the following:

All welds that have been repaired shall be visually inspected and shall undergo non-destructive testing performed by the Contract Administrator

903.07.08.02 Non-Destructive Test Reports and Visual Inspection Reports

Clause 903.07.08.02 of OPSS 903 is deleted in its entirety and replaced with the following:

Results from completed Visual Inspection Reports and Non-Destructive Test Reports will be provided upon request.

903.07.08.03 Certificate of Conformance

Clause 903.07.08.03 of OPSS 903 is deleted in its entirety.

903.10 BASIS FOR PAYMENT

903.10.01 Supply Equipment for Installing Driven Piles - Item
Supply Equipment for Installing Caisson Piles - Item
Supply Equipment for Installing Displacement Caisson Piles - Item

Subsection 903.10.01 of OPSS 903 is amended by deleting the second paragraph in its entirety and replacing it with the following:

For payment purposes, 50% of the work under this item shall be paid when the satisfactory performance of the equipment has been demonstrated to the Contract Administrator by the installation of 1% of piles.

Another 40% shall be paid by progress payments proportional to the work completed. The remaining 10% shall be paid on the satisfactory completion of the installation of piles.

903.10.04 Failed Visual Inspection or Non-Destructive Testing of Welds

Section 903.10 of OPSS 903 is amended by the addition of the following:

Costs associated with any required removals and replacement or repairs of defective welds, following the visual inspection or non-destructive testing, shall be the Contractor's responsibility at no additional cost to the Owner. No additional payment will be made for labour and equipment provided by the Contractor, and the Contractor will pay the Owner $500 for each weld requiring additional re-testing.

NOTES TO DESIGNER:

* Insert the following clauses and fill-in a Dynamic formula or High-Strain Dynamic Testing when a specified ultimate resistance is recommended by the Foundations Engineer.

903.07.02.07.03.01 General

Piles are to be driven to a specified ultimate resistance that shall be determined using the [Fill in Dynamic Formula, or High-Strain Dynamic Testing] at end of initial driving. If the specified ultimate resistance is not achieved, retap/restrike shall be conducted after initial driving as specified in the Contract Documents.

A Request to Proceed shall be submitted to the Contract Administrator after the design ultimate resistance is achieved.

The next operation shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

903.07.02.07.03.02 Driving to a Set

The founding elevation shall be established by driving to a set determined in accordance with the dynamic formula specified in the Contract Documents or by the application of the wave equation analysis procedure that verifies the pile resistance. This set shall be established on the first pile of every ten piles driven in a pile group.

The other piles shall be controlled by the pile penetration rate in blows per millimetre that correlates to the set.

When new conditions, such as change in hammer size, change in pile size, or change in soil material occur, new sets shall be determined.

903.07.02.07.03.03 Driving to Bedrock

When driving piles to bedrock, the pile shall be adequately seated on bedrock without damaging the pile.

Where rock points are used, the rock points shall penetrate into the rock. Piles driven using rock points shall be driven to ensure adequate seating on the bedrock without damaging the pile.

Driving of piles on sloping bedrock shall be stopped when initial contact is made with the bedrock. The bedrock elevation shall be recorded. Driving shall then continue, commencing with energy of 10% of the maximum energy of the hammer. The pile shall be driven in sets of 20 blows at this energy until no penetration is observed. Twenty additional blows shall be applied, and, if no penetration is observed, the energy shall be increased by an additional 10% and the above procedure repeated.

Driving shall continue with these stepped increases in energy and with the same series of blows as described above, until the pile has been seated on the bedrock.

If unrealistic excessive penetration per blow is observed, driving shall be stopped, and this excessive penetration immediately reported to the Contract Administrator.

WARRANT: Always with OPSS 903, Construction Specification for Deep Foundations.

AMENDMENT TO OPSS 903, APRIL 2025

Special Provision No. 109F57 April 2025

Dynamic formula or High-Strain Dynamic Testing

903.07 CONSTRUCTION

903.07.02 Driven Piles

903.07.02.07 Monitoring Driven Piles

903.07.02.07.03 Driving to a Specified Ultimate Resistance

Clause 903.07.02.07.03 of OPSS 903 is deleted in its entirety and replaced with the following:

[* Designer Fill-In, See Notes to Designer]

NOTES TO DESIGNER:

* Insert the following clauses and fill-in a Dynamic formula or High-Strain Dynamic Testing when a specified ultimate resistance is recommended by the Foundations Engineer.

903.07.02.07.03.01 General

Piles are to be driven to a specified ultimate resistance that shall be determined using the [Fill in Dynamic Formula, or High-Strain Dynamic Testing] at end of initial driving. If the specified ultimate resistance is not achieved, retap/restrike shall be conducted after initial driving as specified in the Contract Documents.

A Request to Proceed shall be submitted to the Contract Administrator after the design ultimate resistance is achieved.

The next operation shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

903.07.02.07.03.02 Driving to a Set

The founding elevation shall be established by driving to a set determined in accordance with the dynamic formula specified in the Contract Documents or by the application of the wave equation analysis procedure that verifies the pile resistance. This set shall be established on the first pile of every ten piles driven in a pile group.

The other piles shall be controlled by the pile penetration rate in blows per millimetre that correlates to the set.

When new conditions, such as change in hammer size, change in pile size, or change in soil material occur, new sets shall be determined.

903.07.02.07.03.03 Driving to Bedrock

When driving piles to bedrock, the pile shall be adequately seated on bedrock without damaging the pile.

Where rock points are used, the rock points shall penetrate into the rock. Piles driven using rock points shall be driven to ensure adequate seating on the bedrock without damaging the pile.

Driving of piles on sloping bedrock shall be stopped when initial contact is made with the bedrock. The bedrock elevation shall be recorded. Driving shall then continue, commencing with energy of 10% of the maximum energy of the hammer. The pile shall be driven in sets of 20 blows at this energy until no penetration is observed. Twenty additional blows shall be applied, and, if no penetration is observed, the energy shall be increased by an additional 10% and the above procedure repeated.

Driving shall continue with these stepped increases in energy and with the same series of blows as described above, until the pile has been seated on the bedrock.

If unrealistic excessive penetration per blow is observed, driving shall be stopped, and this excessive penetration immediately reported to the Contract Administrator.

WARRANT: Always with OPSS 903, Construction Specification for Deep Foundations.