



Ontario Provincial Standards Unit
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REVISION INFORMATION SHEET

ONTARIO PROVINCIAL STANDARDS FOR ROADS AND PUBLIC WORKS

VOLUME 6 PROVINCIAL-ORIENTED MATERIAL SPECIFICATIONS

MANUAL REVISION #9

APRIL 2017

UPDATING ONTARIO PROVINCIAL STANDARDS FOR YOUR USE

Each roads and public works owner (Owner) is responsible for determining implementation dates and directions for use of Ontario Provincial Standards; therefore, manual holders are cautioned about immediately discarding superseded and cancelled standards.

ACCESSING AND OBTAINING ONTARIO PROVINCIAL STANDARDS

The Ontario Provincial Standards for Roads and Public Works (OPS) manuals and the latest published updates for each of the eight OPS manuals are available as follows:

- Available electronically on the OPS/MTO website. Online access to the current, updated, and archived standards; indexes; OPS User Notes; and publication Revision Information Sheets are available free of charge at the site.
(<http://www.rags.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage>)
- The eight OPS manuals of standards are also available for free as well in a single PDF format on the website.

A link to the Ontario Provincial Standards on the MTO Library website is available on the OPS website (www.ops.on.ca). Also on this site under News and Activities are notices for updates and changes in OPS.

Questions should be directed by email to Ontario.Prov.Standards@ontario.ca

WAITING TO HEAR FROM YOU

If you have a suggestion to revise a standard or you have a standard that works in your ministry, municipality, or area, send it to the Head, OPS Administration, for review and possible inclusion into the Ontario Provincial Standards.

THIS MANUAL IS REVISED AS FOLLOWS:

Index Pages Volume 6

Remove the entire index and replace with the attached revised index.

Standard Specifications Volume 6

Superseded/Cancelled (Remove)		Revised/New (Insert)		Remarks
OPSS.PROV	Dated	OPSS.PROV	Dated	
		1005	Apr 2017	“MATERIAL SPECIFICATION FOR AGGREGATES – STREAMBED MATERIAL” See Summary of Revisions.
1006	Apr 2013	1006	Apr 2017	“MATERIAL SPECIFICATION FOR AGGREGATES – SURFACE TREATMENT” See Summary of Revisions.
1102	Nov 2016	1102	Apr 2017	“MATERIAL SPECIFICATION FOR LIQUID ASPHALT USED IN SPRAYING, SEALING AND PRIMING APPLICATIONS” Formatting update with no technical content changes.
1504	Nov 2016	1504	Apr 2017	“MATERIAL SPECIFICATION FOR STEEL BEAM GUIDE RAIL” Formatting update with no technical content changes.
1505	Nov 2016	1505	Apr 2017	“MATERIAL SPECIFICATION FOR CHANNEL COMPONENTS FOR STEEL BEAM GUIDE RAIL” Formatting update with no technical content changes.
		2423	Apr 2017	“MATERIAL SPECIFICATION FOR STEEL POLES, BASE MOUNTED” See Summary of Revisions.
		2461	Apr 2017	“MATERIAL SPECIFICATION FOR SIGNAL HEADS” See Summary of Revisions.

Superseded/Cancelled (Remove)		Revised/New (Insert)		Remarks
OPSS.PROV	Dated	OPSS.PROV	Dated	
		2475	Apr 2017	“MATERIAL SPECIFICATION FOR UNINTERRUPTIBLE POWER SUPPLY SYSTEMS FOR LED TRAFFIC SIGNALS” This is a New Specification.
		2502	Apr 2017	“MATERIAL SPECIFICATION FOR SODIUM CHLORIDE” No technical changes. Specification reformatted and reorganized according to current OPS guidelines.

SUMMARY OF REVISIONS TO OPSS.PROV 1005

MATERIAL SPECIFICATION FOR AGGREGATES – STREAMBED MATERIAL

- Section 1005.02, References, Canadian and Provincial Statutes deleted.
- Subsection 1005.03, Definitions, has been rewritten for consistency with other MTO fishery related documentation.

SUMMARY OF REVISIONS TO OPSS.PROV 1006

MATERIAL SPECIFICATION FOR AGGREGATES – SURFACE TREATMENT

- Subsection 1006.08.03, Sampling, has been rewritten.
- Subsection 1006.08.04, Acceptance, has been rewritten with the addition of clauses 1006.08.04.01, Acceptance of Physical Properties and 1006.08.04.02, Acceptance of Production Properties Based on LS-602 and LS-607.
- Tables 1 & 2, revised.
- Table 3 revised and retitled Production Requirements
- Table 4, Mean Requirements for Gradation (LS-602) and Table 5, Range Requirements For Gradation (LS-602) Purposes, added.

SUMMARY OF REVISIONS TO OPSS.PROV 2423

MATERIAL SPECIFICATION FOR STEEL POLES, BASE MOUNTED

- Section 2423.02, References, updated
- Subsection 2423.07.01, General, has been rewritten.

SUMMARY OF REVISIONS TO OPSS.PROV 2461

MATERIAL SPECIFICATION FOR SIGNAL HEADS

- Section 2461.02, References, has been rewritten.
- Subsection 2461.05.07, Backboards, has been rewritten.

MANUAL REVISION RECORD

Provincial-Oriented

Volume 6 – Material Specifications

This record should remain in the manual at all times. Revisions are numbered sequentially. This sheet should be filled in after each revision has been placed into the manual. It will quickly indicate to users whether the contents of the manual are up-to-date.

REVISION NUMBER	REVISION DATE	ENTERED BY	REVISION NUMBER	DATE	ENTERED BY
1	APR 2010	Included in new manuals	27		
2	NOV 2012	Included in new manuals	28		
3	APRIL 2013	Included in new manuals	29		
4	NOV 2013	Included in new manuals	30		
5	NOV 2014	Included in new manuals	31		
6	APRIL 2015	Included in new manuals	32		
7	NOV 2015	Included in new manuals	33		
8	NOV 2016	Included in new manuals	34		
9	APR 2017	Included in new manuals	35		
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**ONTARIO
PROVINCIAL
STANDARD
SPECIFICATION**

**VOLUME 6 INDEX
PROVINCIAL-ORIENTED
MATERIAL SPECIFICATIONS**

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APR 2013	1003	Aggregates - Hot Mix Asphalt
NOV 2012	1004	Aggregates – Miscellaneous
APR 2017	1005	Aggregates – Streambed Material
APR 2017	1006	Aggregates - Surface Treatment
APR 2013	1010	Aggregates - Base, Subbase, Select Subgrade, and Backfill Material
DIVISION 11 - BITUMENS		
NOV 2014	1101	Performance Graded Asphalt Cement
APR 2017	1102	Liquid Asphalt Used In Spraying, sealing and Priming Applications
NOV 2016	1103	Emulsified Asphalt
NOV 2016	1151	Superpave and Stone Mastic Asphalt Mixtures
NOV 2016	1152	SC-800 Patching Material
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NOV 2016	1203	Bearings – Rotational and Sliding Surface
APR 2015	1205	Clay Seal
NOV 2016	1210	Deck Joint Assemblies
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DIVISION 14 - METAL		
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NOV 2014	1601	Wood, Preservative Treatment, and Shop Fabrication
DIVISION 17 - COATINGS		
NOV 2014	1704	Paint Coating Systems for Structural Steel
DIVISION 18 - PIPES AND ASSOCIATED DRAINAGE ITEMS		
NOV 2014	1820	Circular and Elliptical Concrete Pipe
NOV 2015	1841	Notice to Users of OPSS.PROV 1841 (Non-Pressure Polyvinyl Chloride Pipe Products)
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CURRENTLY NO SPECIFICATIONS		
DIVISION 20 - SIGNS AND SIGN SUPPORT		
CURRENTLY NO SPECIFICATIONS		
DIVISION 21 - CLOTHING, CLOTH, AND THE LIKE		
CURRENTLY NO SPECIFICATIONS		
DIVISION 22 - UNASSIGNED		
CURRENTLY NO SPECIFICATIONS		
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NOV 2014	2301	Impressed Current Cathodic Protection System for Bridge Structures
DIVISION 24 - ELECTRICAL		
NOV 2016	2422	Heavy Class Steel and Sectional Steel Poles, Base Mounted
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NOV 2016	2434	High Pressure Sodium Luminaires For Underpass Lighting
NOV 2016	2453	Sectional Steel Poles
APR 2017	2461	Signal Heads
NOV 2016	2471	Sectional Steel High Mast Lighting Poles
NOV 2016	2474	Anchorage Assembly – High Mast Lighting Pole
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MATERIAL SPECIFICATION FOR AGGREGATES - STREAMBED MATERIAL

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1005.09	OWNER PURCHASE OF MATERIAL - Not Used
APPENDICES	Not Used

1005.01 SCOPE

This specification covers the material requirements for aggregates used as streambed material.

1005.01.01 Specification Significance and Use

This specification is written as a provincial-oriented specification. Provincial-oriented specifications are written 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.

1005.01.02 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.

1005.02 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, Materials

OPSS 1001 Aggregates - General

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:

LS-601	Materials Finer than 75 µm Sieve in Mineral Aggregates by Washing
LS-602	Sieve Analysis of Aggregates
LS-618	Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
LS-619	Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
LS-625	Guidelines for Sampling of Aggregate Materials
LS-630	Determination of the Amount of Contamination of Coarse Aggregate

ASTM International

D 6473-10 Standard Test Method for Specific Gravity and Absorption of Rock for Erosion Control

1005.03 DEFINITIONS

For the purpose of this specification, the definitions in OPSS 182 and the following definitions apply:

Deleterious Material means as defined in OPSS 1001.

1005.05 MATERIALS

1005.05.01 General

The requirements of OPSS 1001 shall apply to this specification.

All streambed materials shall consist of clean, hard, durable, natural particles that are free of earth, humus, clay or other coatings, clay lumps, shale or shaley partings, deleterious materials, or deleterious substances. Crushed rock, reclaimed asphalt pavement, reclaimed hydraulic cement concrete, glass, ceramics, or any other reclaimed or slag materials shall not be used.

When any change in the character of the aggregate occurs or when the performance of an aggregate meeting the requirements of this specification is found to be unsatisfactory, use of that aggregate shall be discontinued until a reappraisal with the approval of the Contract Administrator proves the source to be satisfactory.

All streambed materials shall meet the requirements shown in Table 1 for physical properties and Tables 2 and 3 for gradation.

1005.07 PRODUCTION

1005.07.01 Aggregate Processing, Handling, and Stockpiling

Aggregates separated during processing shall be placed in individual stockpiles. Processed aggregates secured from different sources and aggregates from the same source, but of different gradations shall be placed in individual stockpiles.

Aggregates that have become mixed with foreign matter of any description or aggregates from different stockpiles that have become mixed with each other shall not be used and shall be removed from the stockpile immediately.

1005.08 QUALITY ASSURANCE

1005.08.01 General

The total quantity of each different streambed material type from each source location shall represent an individual lot.

Each lot shall be randomly sampled as specified in the Contract Documents.

The Contract Administrator shall be allowed access to all sampling locations.

The laboratory designated by the Owner shall carry out QA testing for the purpose of ensuring that aggregates used in the Work are according to the physical property and gradation requirements of this specification. The Owner shall be responsible for all costs associated with testing for QA purposes, unless otherwise indicated in this specification. Individual test results shall be forwarded to the Contractor, as they become available.

Test data for each aggregate type shall be managed independently. When more than one source is used for supplying material, test data from each source and product shall be managed independently.

1005.08.02 Sampling

Sampling shall be according to LS-625 and taken at the time and location determined by the Contract

Administrator. Samples shall be of sufficient mass to conduct the necessary gradation and physical property tests of the material. Minimum sample sizes for each aggregate type shall be as shown in Table 4.

Unless otherwise indicated, all QA samples shall be taken from individual stockpiles constructed at the Working Area or at the source. Each QA sample shall be treated as a discrete sample and not combined or blended with any other sample.

All samples shall be duplicate samples.

The Contractor shall provide new or clean sample bags or containers that are constructed to prevent the loss of any part of the material or contamination or damage to the contents during shipment. Metal or cardboard containers are unacceptable. QA samples shall be identified both inside and outside of the sample container. Data shall be included with QA samples shall be according to the requirements of MTO Form PH-D-10.

At least one set of QA samples shall be obtained for each aggregate type used in the Work. The Contract Administrator shall seal each QA sample container at the time and place of sampling.

The Contractor shall deliver all samples to the appropriate laboratory in a condition that is suitable for testing.

1005.08.03 Testing and Retention of Samples

When the Contract Administrator has elected to carry out QA testing, one of the duplicate samples shall be randomly selected for testing by the QA laboratory. The QA laboratory shall retain the remaining sealed sample for possible referee testing, if required.

1005.08.04 Acceptance

QA test results shall be used for acceptance purposes, except when referee testing has been carried out.

When QA test results for the sample representing an individual lot shows that the material meets the applicable gradation and physical property requirements of this specification, the lot shall be accepted.

When QA test results show that the material does not meet the applicable requirements of this specification, then all the aggregates in that lot shall be considered rejected and shall be removed from the Work at no additional cost to the Owner.

The Contract Administrator shall notify the Contractor that material represented by the test result is not acceptable. This notification shall take place in writing within 3 Business Days of receipt of the non-conforming data.

1005.08.05 Referee Testing

The Contractor may invoke referee testing for one or more attributes by submitting a written request to the Contract Administrator within 5 Business Days following notification that the aggregate does not meet the requirements of this specification.

Referee testing shall be carried out, as specified herein and elsewhere in the Contract Documents.

The retained duplicate QA sample shall be used for referee testing.

All referee test results for a lot shall replace the respective QA tests for acceptance of the applicable lot and shall be binding on both the Owner and the Contractor.

If a lot is not accepted based on the referee test results, then the Contractor shall be responsible for the cost of the referee testing of that lot, including the cost of transporting the samples to the referee laboratory, at the rates specified elsewhere in the Contract Documents. In all other cases, the Owner shall bear the cost of the referee testing and the cost of transporting the samples of that lot.

TABLE 1
Physical Property Requirements for Streambed Materials

Description of Test	Test Number	SB-6.7	SB-13.2	SB-19	SB-37.5	SB-53	SB-100	SB-200	SB-300
Specific Gravity, Minimum	ASTM D 6473 (Note 1)	-	-	-	-	-	2.50	2.50	2.50
Absorption, % Maximum		-	-	-	-	-	2.0	2.0	2.0
Loss by Washing, Pass 75 µm Sieve, Guideline A, % Maximum	LS-601	5.0	2.0	2.0	-	2.0	-	-	-
Micro-Deval Abrasion Coarse Aggregate Loss, Grading A % Maximum	LS-618	-	30	30	30 (Note 2)	30	-	-	-
Micro-Deval Abrasion Fine Aggregate Loss, % Maximum	LS-619	35	-	-	35	-	-	-	-
Amount of Contamination, % Maximum	LS-630	0.5	0.5	0.5	0.5	0.5	(Note 3)	(Note 3)	(Note 3)

Notes:

1. These requirements shall be based on the average test results for at least five pieces of rock where the source is macroscopically uniform or at least eight pieces of rock where the source is macroscopically non-uniform. In addition, no individual piece of tested rock shall have a specific gravity less than 2.30 or an absorption greater than 3.5%.
2. The coarse aggregate Micro-Deval abrasion loss shall be waived if the material has more than 80% passing the 4.75 mm sieve.
3. Stockpiles of SB-100, SB-200, and SB-300 shall not contain any visible contamination.

TABLE 2
Gradation Requirements for Streambed Sand and Gravel
Percent Passing

Sieve Size mm	Gradation (LS-602) of Streambed Materials % Less Than Sieve Size Specified				
	SB-6.7	SB-13.2	SB-19	SB-37.5	SB-53
63.00	-	-	-	-	100
53.00	-	-	-	100	90-100
37.50	-	-	-	90-100	-
26.50	-	-	100	50-100	-
19.00	-	-	90-100	-	0-15
16.00	-	100	-	-	-
13.20	-	96-100	-	-	-
9.50	100	50-73	0-55	30-100	-
6.70	97-100	-	-	-	-
4.75	90-100	0-10	0-10	20-100	-
2.36	50-95	-	-	-	-
1.18	20-90	-	-	10-100	-
0.60	0-70	-	-	-	-
0.30	0-35	-	-	2 - 65	-
0.15	0-15	-	-	-	-
0.07	0-5	0-2	0-2	0-8	0-2

TABLE 3
Gradation Requirements for Streambed Cobbles and Boulders
Percent Passing

Mass kg	Gradation % Less Than Mass Specified (Note 1)		
	SB-100	SB-200	SB-300
55			100
30			40-60
16	-	100	0-10
7	-	40-60	-
2	100	0-10	-
0.5	40-60	-	-
0.3	0-10	-	-
Note: 1. The gradation shall be determined by individually weighing a minimum of 20 randomly chosen stone particles from the stockpile, then comparing the total mass of the stone particles within each fraction with the total mass of all of the stone particles that were measured.			

TABLE 4
Sample Size Requirements

Streambed Material	Minimum Sample Size kg (Note 1)
SB-6.7	10
SB-13.2	20
SB-19	20
SB-37.5	40
SB-53	80
SB-100	25 (consisting of cobbles from 0.4 to 1.5 kg each for ASTM D 6473 only)
SB-200	100 (consisting of cobbles from 5 to 12 kg each for ASTM D 6473 only)
SB-300	700 (consisting of cobbles/boulders from 25 to 45 kg each for ASTM D 6473 only) (Note 2)
Notes: 1. Individual sample bags shall not exceed 25 kg. 2. Large cobbles and small boulders may be broken to manageable sizes of no less than 12 kg and no more than 25 kg.	



MATERIAL SPECIFICATION FOR AGGREGATES - SURFACE TREATMENT

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1006.09	OWNER PURCHASE OF MATERIAL - Not Used
APPENDICES	Not Used

1006.01 SCOPE

This specification covers the requirements for aggregates for use in surface treatment.

1006.01.01 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.

1006.01.02

Appendices Significance and Use

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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.

1006.02

REFERENCES

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

Ontario Provincial Standard Specifications, Materials

OPSS 1001 Aggregates - General

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:

- LS-601 Material Finer than 75 μm Sieve in Mineral Aggregates by Washing
- LS-602 Sieve Analysis of Aggregates
- LS-604 Relative Density and Absorption of Coarse Aggregate
- LS-606 Soundness of Aggregate by Use of Magnesium Sulphate
- LS-607 Percent Crushed Particles in Processed Coarse Aggregate
- LS-608 Percent Flat and Elongated Particles in Coarse Aggregate
- LS-609 Petrographic Analysis of Coarse Aggregate
- LS-613 Determination of Insoluble Residue of Carbonate Aggregates
- LS-614 Freezing and Thawing of Coarse Aggregate
- LS-618 The Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
- LS-619 Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
- LS-625 Guidelines for Sampling of Granular Materials
- LS-631 Qualitative Determination of Presence of Plastic Fines in Aggregates

MTO Forms:

PH-D-10 Aggregate Sample Data Sheet

1006.03

DEFINITIONS

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

Duplicate Samples means two samples taken at the same time and location, one to be used for quality assurance testing and the other for referee testing.

Lot means a specific quantity of material from a single source.

Physical Property means an inherent attribute or feature of an aggregate material. Tests are carried out to determine an aggregate's resistance to weathering or degradation or both. Aggregate production processes generally do not affect physical properties.

Quality Assurance (QA) means a system or series of activities carried out by the Owner to ensure that Materials received from the Contractor meet the requirements specified in the Contract Documents.

Slag means for the purposes of this specification, fused silicate material from the processing of ores and includes air-cooled blast furnace slag, blast furnace slag, copper slag, nickel slag, and steel slag.

1006.05

MATERIALS

1006.05.01

Aggregates

Aggregates shall be according to OPSS 1001, unless otherwise specified in this specification.

Aggregates shall be clean, hard durable particles produced from sands, gravels, or quarried rock and shall be free of earth, humus, clay coatings, and clay lumps or fragments of any size or shape.

Aggregates containing slag or composed of slag shall not be acceptable for use as surface treatment aggregates.

At the discretion of the Owner, aggregate may be accepted or rejected for physical properties on the basis of past field performance, according to Note 1 shown in Table 1.

When any change in the character of the aggregate occurs or when the performance of aggregate meeting the requirements of this specification is found to be unsatisfactory, use of that aggregate shall be discontinued until a reappraisal by the Contractor, with the approval of the Contract Administrator, proves the source to be satisfactory.

1006.07

PRODUCTION

1006.07.01

Aggregate Processing, Handling, and Stockpiling

Aggregates separated during processing, aggregates secured from different sources, and aggregates from the same source but of different gradations shall be stockpiled separately. When screenings from primary and secondary crushers are produced separately, they shall be stockpiled separately.

Aggregates that have become mixed with foreign matter of any description or aggregates from different stockpiles that have become mixed with each other shall not be used and shall be removed from the stockpile immediately.

1006.08 QUALITY ASSURANCE

1006.08.01 General

The laboratory designated by the Owner shall carry out QA testing for purposes of ensuring that the aggregates used in the Work are according to the physical property and grading requirements of this specification. The Owner shall be responsible for all costs associated with testing for QA purposes, unless otherwise specified in the Contract Documents. Individual test results shall be forwarded to the Contractor, as they become available.

When a hydrated lime anti-stripping agent is used, test samples for the physical property requirements shall be taken prior to the addition of the hydrated lime. If this is not practical, samples coated in hydrated lime may be taken and the lime removed by washing prior to testing. In this case, the requirements for LS-601 shall be waived.

QA acceptance of aggregates for surface treatment shall be based on lots that are sampled and tested for both physical properties and gradation.

1006.08.02 Alternative to LS-614

LS-614 shall be used for acceptance, unless written notification to the Contract Administrator to replace it with LS-606 for acceptance is received prior to sampling of the applicable materials for QA purposes. Provided the Contract Administrator has received such a request, LS-606 shall be used. Otherwise, conformance to LS-614 shall be required.

When notification is provided after QA testing using LS-614 has been initiated, the Contractor shall then be charged \$600.00 for each test initiated, which includes the cost of the testing using LS-614, administrative charges, and additional sampling, if required.

1006.08.03 Sampling

Aggregates to be used in the Work shall be made available for sampling a minimum of 3 weeks prior to the time of intended use. The Contract Administrator shall have access to all sampling locations at any time with notice to the Contractor. The stockpiles from which the samples are to be taken shall contain at least 10% of the total quantity of aggregate needed or a minimum quantity of 500 tonnes or 250 m³, whichever is greater, unless otherwise directed by the Contract Administrator.

All samples shall be duplicate samples obtained from stockpiles according to LS-625 and all other requirements stated elsewhere in the Contract Documents.

For physical properties, at least one set of QA samples of each aggregate and from each individual source shall be randomly sampled from lots according to the schedule shown in Table 1.

For production properties, lots according to the schedule shown in Table 1 shall be divided into four sublots of approximately equal tonnage. One duplicate QA sample shall be randomly obtained from each subplot.

Duplicate QA samples with a minimum mass of 25 kg shall be taken from the stockpiles. Each bag or container shall hold no more than 30 kg of material.

The Contractor shall provide new or clean sample bags or containers that are constructed to prevent the loss of any part of the material or contamination or damage to the contents during shipment. Metal or cardboard containers are unacceptable. The Contract Administrator shall seal each QA sample container at the time and place of sampling.

QA samples shall be identified both inside and outside of the sample container. Data to be included with QA samples shall be according to MTO form PH-D-10.

In the event that the Contractor is unavailable to take the samples, no further materials shall be placed in the Work until they have been taken.

One of the duplicate QA samples shall be randomly selected for testing by the QA laboratory. The QA laboratory shall retain the remaining sample for referee testing, if required.

1006.08.04 Acceptance

The acceptability of a lot of aggregates for surface treatment may result in payment at full price, payment at a reduced price, or rejection.

Irrespective of the negotiation of a reduced price payment, the warranty provisions of the Contract Documents shall apply.

1006.08.04.01 Acceptance of Physical Properties

A lot of aggregates shall be deemed to be acceptable for physical properties if all of the test results for the samples representing that lot meet all of the requirements shown in Table 2.

If a tested sample of aggregates representing a lot does not meet all of the requirements of this specification, then a reduced price payment of 20% shall be given for that lot, as long as the applicable test results for that sample do not:

- a) Exceed the requirement for LS-614, or LS-606 if it has been accepted by the Owner as an alternative to LS-614, by more than 25% of the specified value.
- b) Exceed the requirement for LS-618 by more than 10% of the specified value.
- c) Exceed the requirement for LS-619 by more than 15% of the specified value.
- d) Identify plastic fines within the material, when determined according to LS-631 and meet the requirements for LS-602 on the 75 µm sieve.
- e) Exceed 10% of the specified value for any other requirement stated in this specification.

Should the test results for the sample not meet all of the requirements listed above, then all of the aggregates within that lot shall be considered rejectable and any surface treatment that includes those aggregates shall be removed from the Work at no cost to the Owner.

1006.08.04.02 Acceptance of Production Properties Based on LS-602 and LS-607

Test results from each subplot within a lot shall be combined to determine the mean and the range of the lot for each test.

All lot means and ranges for test results carried out according to LS-602 and LS-607 shall be computed to one decimal place and reported on the MTO Form PH-D-ST by the Contract Administrator.

The acceptability of a lot based on LS-602 and LS-607 may result in payment at full price, payment at a reduced price or rejection.

A complete or incomplete lot shall be deemed to meet the applicable requirements for LS-602 and LS-607, if the mean of the test results for that lot is within the limits specified in Table 3 and the range of the test results for that lot is within the limits specified in Table 5.

Lots that are subject to a total payment adjustment factor of more than 25 percent in respect of lot mean and range are deemed to be rejected and shall be removed from the Work at no cost to the Owner.

When the Contractor chooses to use a lot or incomplete lot that does not meet the requirements of LS-602 and LS-607 and is not subject to removal then, at the request of the Contractor, a payment adjustment calculated according to the following formula shall be allowed:

$\text{PAYMENT REDUCTION} = \text{lot quantity in tonnes (or m}^3\text{)} \times \text{item price in \$/tonne (or \$/m}^3\text{)} \times \text{payment adjustment factor (\%)}$,

where:

The lot quantity shall be expressed in tonnes (or m³) and the item price shall be the contract price for the tender quantity in tonnes (or m³).

The payment adjustment factor, in percent for production properties, shall be equal to the sum of the adjustment points determined as follows:

- a) adjustment points shall be applied for each 0.1 percent that the mean gradation falls outside the gradation specification limits for each sieve, according to Table 4,
- b) 0.1 adjustment points shall be applied for each 0.1 percent that the range exceeds the maximum acceptable range for each sieve, according to Table 5; and
- c) 0.2 adjustment points shall be applied for each 0.1 percent that the lot mean falls below the applicable limits for percent crushed.

The reduced price payment for the lot given above shall be in addition to any payment reduction determined according to the Acceptance of Physical Properties clause.

1006.08.05 Referee Testing

The Contractor may invoke referee testing for one or more attributes by submitting a written request to the Contract Administrator within 5 Business Days following notification that the aggregate does not meet the requirements of this specification.

Referee testing shall be carried out as specified herein and elsewhere in the Contract Documents.

The retained QA samples shall be used for referee testing.

All referee test results for a lot shall replace the respective QA tests for acceptance of the applicable lot and shall be binding on both the Owner and the Contractor.

If a lot is not accepted at full payment based on the referee test results, the Contractor shall then be responsible for the cost of referee testing of that lot, including the cost of transporting the samples to the referee laboratory at the rates specified elsewhere in the Contract Documents. In all other cases, the Owner shall bear the cost of the referee testing and the cost of transporting the samples of that lot.

TABLE 1
Lot Schedule for Sampling and Testing

Quantity from Each Source In tonnes (or m³)	Class 1, 2, 3, 4, 5, and 6
< 500 t (or <250 m ³)	Sampling and testing may be waived at the discretion of the Owner.
500 t to 5,000 t (or 250 to 2,500 m ³)	One lot for both physical properties and gradation.
> 5,000 t (or > 2,500 m ³) (Note 1)	Gradation: 5,000 tonne lots up to 20,000 tonnes and 10,000 tonne lots thereafter (or 2,500 m ³ lots up to 10,000 m ³ and 5,000 m ³ lots thereafter) Physical Properties: 20,000 tonne lots (or 10,000 m ³ lots)
Notes: 1. When the quantity of granular material is insufficient for a complete lot and is: a) less than one-half the quantity of a complete lot, that quantity shall then be added to the previous lot; or b) greater than or equal to one-half the quantity of a complete lot, then that quantity shall form its own lot.	

TABLE 2
Physical Property Requirements

MTO Laboratory Test	MTO Test No.	Class 1 (Note 1)	Class 2 (Note 1)	Class 3 (Note 1)	Class 4	Class 5 (Note 1)	Class 6 (Note 1)
Wash Pass 75 µm sieve, Guideline B, % maximum	LS-601	1.3 (Note 2)	--	1.3 (Note 2)	--	1.3 (Note 2)	1.3 (Note 2)
Absorption, % maximum	LS-604	1.75	--	2.0	--	1.75	1.75
Flat and Elongated Particles, % maximum	LS-608	20	20	20	--	20	20
Petrographic Examination, % non-carbonate of retained 4.75 mm, minimum	LS-609	60 (Note 3)	60 (Note 3)	60 (Note 3)	--	60 (Note 3)	60 (Note 3)
Unconfined Freeze-Thaw, % maximum loss (Note 4)	LS-614	6	15	6	--	6	6
Micro-Deval Abrasion (Coarse Aggregate), % maximum loss	LS-618	17	25	17	--	17	17
Micro-Deval Abrasion (Fine Aggregate), % maximum loss	LS-619	--	30	--	25	--	--
Plastic Fines	LS-631	--	NP	--	NP	--	--
Alternative Requirement to Unconfined Freeze-Thaw Loss, LS-614							
Magnesium Sulphate Soundness (coarse aggregate), % max loss	LS-606	12	15	12	--	12	12
Notes: 1. With the exception of LS-619 and LS-631, the physical property requirements for Class 1, 2, 3, 5, and 6 aggregates noted above shall be conducted on the material retained on the 4.75 mm sieve. 2. When quarried rock is used as a source of coarse aggregate, a maximum of 2.0% passing the 75 µm sieve shall be permitted. 3. The requirements listed below are only applicable to the area to the north and west of a boundary defined by the north shore of Lake Superior, the north shore of the St. Mary's River, the south shore of St. Joseph's Island, the north shore of Lake Huron easterly to the north and east shore of Georgian Bay, excluding Manitoulin Island, along the Severn River to Washago and a line easterly passing through Norland, Burnt River, Burleigh Falls, Madoc, and hence easterly along Highway 7 to Perth and northerly to Calabogie and easterly to Arnprior and the Ottawa River: a) When the coarse aggregate for use in surface treatment is obtained from a gravel pit or quarry containing more than 40% carbonate rock type (e.g., limestone and dolostone) then blending with aggregate from non-carbonate rock types shall be required to increase the minimum non-carbonate rock type content of the coarse aggregate to 60%, as determined by petrographic examination, LS-609. In cases of dispute, LS-613 shall be used with a minimum acid insoluble residue of 60%. b) When the coarse aggregate for use in surface treatment is obtained from a non-carbonate source, blending with aggregate from carbonate rock types is not permitted. 4. The Owner shall waive the requirements for LS-614, unconfined freeze-thaw, provided the Contractor has submitted a written request that the coarse aggregates meet the alternative requirements for LS-606, magnesium sulphate soundness.							

TABLE 3
Production Requirements

Lab Test Description	MTO Test Number	Class 1 (Note 1)	Class 2	Class 3	Class 4	Class 5 (Note 1)	Class 6
Sieve Analysis	LS-602	% Passing By Mass					
	Sieve Size						
	19.0 mm	--	100	100	--	--	--
	16.0 mm	--	98-100	96-100	--	--	100
	13.2 mm	100	75-95	67-86	--	--	96-100
	9.5 mm	75-100	50-80	29-52	100	100	50-73
	6.7 mm	0-40	--	--	--	40-85	--
	4.75 mm	0-10	25-50	0-10	70-100	5-25	0-10
	2.36 mm	--	--	--	10-100	0-10	--
	1.18 mm	--	10-40	--	5-90	0-5	--
	600 µm	--	--	--	3-70	--	--
	300 µm	--	2-20	--	2-40	--	--
	150 µm	--	2-13	--	0-15	--	--
	75 µm	(Note 2)	2-7	(Note 2)	0-7	(Note 2)	(Note 2)
	Percent Crushed Particles	LS-607	% Minimum				
60			60	60	-	60	60
Notes: 1. Class 1 and Class 5 aggregates shall be washed according to OPSS 1001. 2. The requirements for percent passing the 75 µm for Class 1, 3, 5, and 6 aggregates are shown in Table 2.							

TABLE 4
Mean Requirements For Gradation (LS-602)

MTO Sieve Designation	Adjustment Points Per 0.1% Deviation from Specified Limit					
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
19.0 mm	--	0.1	0.1	--	--	--
16.0 mm	--	0.1	0.1	--	--	0.1
13.2 mm	0.1	0.1	0.1	--	--	0.1
9.5 mm	0.1	0.1	0.1	0.1	0.1	0.1
6.7 mm	0.1	--	--	--	0.1	--
4.75 mm	Excess Passing 0.5 / Insufficient Passing 0.2					
2.36 mm	--	--	--	--	0.1	--
1.18 mm	--	0.1	--	--	0.1	--
600 µm		--	--	0.1	--	--
300 µm	--	0.1	--	0.1	--	--
150 µm	--	0.1	--	0.1	--	--
75 µm	--	1.0	--	1.0	--	--

TABLE 5
Range Requirements For Gradation (LS-602)

MTO Sieve Designation	Maximum Acceptable Range					
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
19.0 mm	--	1	1	--	--	--
16.0 mm	--	2	4	--	--	1
13.2 mm	1	12	14	--	--	4
9.5 mm	20	14	16	1	1	14
6.7 mm	24	--	--	--	24	--
4.75 mm	8	14	5	18	14	6
2.36 mm	--	--	--	34	8	--
1.18 mm	--	14	--	34	4	--
600 µm	--	--	--	--	--	--
300 µm	--	12	--	22	--	--
150 µm	--	8	--	12	--	--
75 µm	--	4	--	6	--	--



**ONTARIO
PROVINCIAL
STANDARD
SPECIFICATION**

**METRIC
OPSS.PROV 1102
APRIL 2017
(FORMERLY OPSS 1102, NOVEMBER 2007)**

Note: The PROV implemented in April 2017 replaces OPSS 1102 COMMON, November 2007 with no technical content changes.

**MATERIAL SPECIFICATION FOR
LIQUID ASPHALT USED IN SPRAYING,
SEALING, AND PRIMING APPLICATIONS**

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1102.01 SCOPE

This specification covers the requirements for different types and grades of liquid asphalt for use in highway construction and maintenance.

1102.01.01 Specification Significance and Use

This specification has been developed for use in provincial oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by the Ontario Ministry of Transportation.

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

1102.01.02 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.

1102.02 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:

Ministry of Transportation Publications

MTO Laboratory Testing Manual:

LS-200	Penetration of Bituminous Materials
LS-201	Flash Point by Cleveland Open Cup
LS-202	Kinematic Viscosity of Asphalt
LS-204	Solubility of Bituminous Materials
LS-205	Ductility of Bituminous Materials

ASTM International

D 36-95 (2000) e1	Softening Point of Bitumen (Ring-and-Ball Apparatus)
D 140-01(2007)	Sampling Bituminous Materials
D 243-02	Residue of Specified Penetration
D 402-02	Distillation of Cut-back Asphaltic (Bituminous) Products
D 3143-98	Flash Point of Cut-back Asphalt with Tag Open-Cup Apparatus

1102.03 DEFINITIONS

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

Liquid Asphalt means an asphalt cement mixed with volatile materials to increase the flow qualities of the asphalt cement.

1102.05 MATERIALS

1102.05.01 General

Liquid asphalt shall be of the type and grade specified in the Contract Documents and shall be supplied from a source approved by the Owner.

Under no circumstances shall the source of supply or the product be changed or partial or total supply allocated to another supplier without the prior approval of the Owner.

1102.05.02 Physical Requirements

Liquid asphalt shall be according to Tables 1, 2, 3, and 4.

1102.05.03 Shipment

The material shall be shipped in clean containers. Containers which are being reused shall be inspected, and cleaned, if required, prior to loading to ensure there is no contamination.

When shipment is by tank truck or railway tank car, the material shall arrive at the destination at a temperature at least 5 °C higher than the minimum spraying/mixing temperature specified in Table 5 and not more than the maximum temperature specified in Table 5.

1102.08 QUALITY ASSURANCE

1102.08.01 Compliance

Liquid asphalt shall be according to Tables 1, 2, 3, and 4 for the particular grade and type when tested according to the test methods designated in the tables.

1102.08.02 Inspection

The Owner may inspect shipping containers for cleanliness at any time.

1102.08.03 Sampling

Representative samples of material being supplied shall be taken, if specified in the Contract Documents, according to ASTM D 140 from either the supplier's plant or any shipment in the presence of the Contract Administrator. Samples taken prior to delivery shall be at no extra cost to the Owner.

1102.08.04 Testing

Samples may be tested by the Owner according to the tests listed in material requirements tables.

1102.08.05 Rejection

Failure of any sample to conform to any of the material requirements shall be cause for rejection of the material. Rejected materials shall be replaced at no extra cost to the Owner.

1102.09 OWNER PURCHASE OF MATERIAL

Liquid asphalt shall be measured by mass in tonnes as specified in the purchasing order. The tare of the hauling vehicle shall be determined for each load.

Payment at the price specified in the purchasing order shall be for the supply of the liquid asphalt delivered to the destination on the date and time specified.

The cost of all testing, except that performed in the Owner's laboratory, shall be included in the price.

TABLE 1
Rapid Curing Liquid Asphalts

Grade	RC-30		RC-70		RC-250		RC-800		RC-3000		Test Method
Requirements	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Tests on Liquid Asphalt											
Flash Point (Tag Open Cup), °C	--	--	--	--	27	--	27	--	27	--	ASTM D 3143
Kinematic Viscosity (at 60 °C), mm ² /s	30	60	70	140	250	500	800	1600	3000	6000	LS-202
Distillation Test Distillate (% of total distillate to 360 °C)											ASTM D 402
to 190 °C	15	--	10	--	--	--	--	--	--	--	
to 225 °C	55	--	50	--	35	--	15	--	--	--	
to 260 °C	75	--	70	--	60	--	45	--	25	--	
to 316 °C	90	--	85	--	80	--	75	--	70	--	
Residue from Distillation to 360 °C, Volume, % by Difference	50	--	55	--	65	--	75	--	80	--	
Tests on Residue from Distillation											
Penetration (at 25 °C, 100 g, 5 s), 0.1 mm	80	120	80	120	80	120	80	120	80	120	LS-200
Ductility (at 25 °C, 5 cm/min), cm (Note 1)	100	--	100	--	100	--	100	--	100	--	LS-205
Solubility, % by mass (Note 2)	99.5	--	99.5	--	99.5	--	99.5	--	99.5	--	LS-204
Notes:											
1. If the ductility at 25 °C is less than 100, the material is acceptable if the ductility at 15 °C is more than 100.											
2. Using trichloroethylene as solvent.											

TABLE 2
Medium Curing Liquid Asphalts

Grade	MC-30		MC-70		MC-250		MC-800		MC-3000		Test Method
Requirements	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Tests on Liquid Asphalt											
Flash Point (Tag Open Cup), °C	38	--	38	--	65	--	65	--	65	--	ASTM D 3143
Kinematic Viscosity (at 60 °C), mm ² /s	30	60	70	140	250	500	800	1600	3000	6000	LS-202
Distillation Test Distillate (% of total distillate to 360 °C)											ASTM D 402
to 225 °C	--	25	--	20	--	10	--	--	--	--	
to 260 °C	40	70	20	60	15	55	--	35	--	15	
to 316 °C	75	93	65	90	60	87	45	80	15	75	
Residue from Distillation to 360 °C, Volume, % by Difference	50	--	55	--	67	--	75	--	80	--	
Tests on Residue from Distillation											
Penetration (at 25 °C, 100 g, 5 s), 0.1 mm	120	250	120	250	120	250	120	250	120	250	LS-200
Ductility (at 25 °C, 5 m/min), cm (Note 1)	100	--	100	--	100	--	100	--	100	--	LS-205
Solubility, % by mass (Note 2)	99.5	--	99.5	--	99.5	--	99.5	--	99.5	--	LS-204
Notes:											
1. If the ductility at 25 °C is less than 100, the material is acceptable if the ductility at 15 °C is more than 100.											
2. Using trichloroethylene as solvent.											

TABLE 3
Slow Curing Liquid Asphalts

Grade	SC-70		SC-250		SC-800		SC-3000		Test Method
Requirements	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Tests on Liquid Asphalt									
Flash Point (Cleveland Open Cup), °C.	65	--	80	--	90	--	105	--	LS-201
Kinematic Viscosity (at 60 °C), mm ² /s	70	140	250	500	800	1600	3000	6000	LS-202
Distillation Test Distillate (% of total Distillate to 360 °C)	10	30	4	20	2	12	--	5	ASTM D 402
Tests on Residue from Distillation									
Kinematic Viscosity (at 60 °C), mm ² /s	4	70	8	100	20	160	40	350	LS-202
Solubility, % by mass (Note 1)	99.5	--	99.5	--	99.5	--	99.5	--	LS-204
Asphalt Residue of Specified Penetration and Test									
Residue of 100 Penetration, %	50	--	60	--	70	--	80	--	ASTM D 243
Ductility of 100 Penetration Residue (at 25 °C, 5 cm/min), cm (Note 2)	100	--	100	--	100	--	100	--	LS-205
Notes:									
1. Using trichloroethylene as solvent.									
2. If the ductility at 25 °C is less than 100, the material is acceptable if the ductility at 15 °C is more than 100.									

TABLE 4
MTO Primer and Mixed In Place (M.I.P.)

Grade	MTO Primer		M.I.P.		Test Method
Requirements	Min.	Max.	Min.	Max.	
Tests on Liquid Asphalt					
Flash Point (Tag Open Cup), °C.	--	--	27	--	ASTM D 3143
Kinematic Viscosity (at 60 °C), mm ² /s	20	35	120	180	LS-202
Distillation Test Distillate (% of total distillate to 360 °C), to 190 °C to 225 °C to 260 °C to 316 °C	20 40 70 85	80 -- -- --	10 20 40 --	-- -- -- --	ASTM D 402
Residue from Distillation to 360 °C Volume, % by Difference	50	--	80	--	
Tests on Residue					
Penetration (at 25 °C, 100 g, 5 s), 0.1 mm	80	200	--	--	LS-200
Ductility (at 25 °C, 5 cm/min), cm (Note 1)	100	--	--	--	LS-205
Softening point, °C	--	--	21	32	ASTM D 36
Solubility, % by mass (Note 2)	99.5	--	99.5	--	LS-204
Notes:					
1. If the ductility at 25 °C is less than 100, the material is acceptable if the ductility at 15 °C is more than 100.					
2. Using trichloroethylene as solvent.					

TABLE 5
Temperature Range of Liquid Asphalts for Spraying and Mixing

Grade	Temperature, °C			
	Spraying		Mixing	
	Min.	Max.	Min.	Max.
RC-30, MC-30	30	45	25	45
RC-70, MC-70, SC-70	60	70	55	70
RC-250, MC-250, SC-250	75	90	70	90
RC-800, MC-800, SC-800	90	105	80	105
RC-3000, MC-3000, SC-3000	115	130	110	130
MTO Primer	30	45	--	--
Mixed in Place	--	--	80	105



**ONTARIO
PROVINCIAL
STANDARD
SPECIFICATION**

**METRIC
OPSS.PROV 1504
APRIL 2017**

(Formerly OPSS 1504, November 2010)

Note: The PROV implemented in April 2017 replaces OPSS 1504 COMMON, November 2010 with no technical content changes.

**MATERIAL SPECIFICATION FOR
STEEL BEAM GUIDE RAIL**

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APPENDICES	Not Used

1504.01 SCOPE

This specification covers the requirements for steel beam guide rail, terminal sections, fabricated bases, and installation hardware.

1504.01.01 Specification Significance and Use

This specification has been developed for use in provincial oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by the Ontario Ministry of Transportation.

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

1504.01.02 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.

1504.02 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:

CSA Standards

G40.20/G40.21-04 (R2009)	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels
G164-M92 (R2003)	Hot Dip Galvanizing of Irregularly Shaped Articles
W59-03 (R2008)	Welded Steel Construction (Metal Arc Welding) (Metric Version)

ASTM International

A 307-07 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

1504.05 MATERIALS

1504.05.01 Rail and Terminal Sections

Rail elements shall have a minimum yield strength of 345 MPa.

After fabrication, all rail elements and terminal sections shall be hot dip galvanized according to CAN/CSA G164.

1504.05.02 Fabricated Steel Bases

Steel bases shall be fabricated according to CSA G40.20/G40.21. After fabrication, steel bases shall be hot dip galvanized according to CAN/CSA G164.

1504.05.03 Installation Hardware

All bolts, nuts, and washers shall be according to ASTM A 307 and hot dip galvanized according to CAN/CSA G164.

1504.07 PRODUCTION

1504.07.01 Steel Beam Guide Rail and Terminal Sections

Steel beam guide rail shall consist of rail elements fabricated to develop continuous beam strength with a cross-section as specified in the Contract Documents.

Bolt holes in rail elements, terminal sections, and fabricated bases shall be perpendicular to the surface and shall not deviate more than 1.0 mm in any direction from the true location. Rail element and terminal section ends shall be cut square.

After fabrication, prefabricated curved steel rail elements shall be galvanized according to CAN/CSA G164.

Steel beam guide rail components furnished under this specification shall be interchangeable with similar components regardless of the source or manufacturer.

1504.07.02 Marking

As a minimum, each rail element shall be marked with the following information:

- a) Name, trademark, or brand of the manufacturer.
- b) Standard designation 1504. M180A2 will be accepted as an equivalent standard designation.
- c) Identification symbols or code for heat.
- d) Week number and year of production.

Markings shall be clearly and permanently stamped in the valley of the centre corrugation, placed at a location clear of the splice overlap, and shall not be obscured after installation. The height of the letters and numerals shall be within the range of 19 to 32 mm.

1504.07.03 Welding

All welds shall be according to CSA W59 and shall be continuous.

1504.09 OWNER PURCHASE OF MATERIAL

1504.09.01 Measurement and Payment

For measurement purposes, a count shall be made of the number of steel beam guide rail elements delivered and accepted.

For measurement purposes, a count shall be made of the number of terminal sections delivered and accepted.

For measurement purposes, a count shall be made of the number of fabricated steel bases for guide rail posts delivered and accepted.

Installation hardware shall be measured in the units specified in the purchasing order, delivered and accepted.

Payment at the price specified in the purchasing order shall be for the supply of steel beam guide rail elements, terminal sections, fabricated steel bases, and installation hardware delivered to the destination or destinations at the dates and times specified.

The cost of all testing, except that performed in the Owner's laboratory, shall be included in the price.



**ONTARIO
PROVINCIAL
STANDARD
SPECIFICATION**

**METRIC
OPSS.PROV 1505
APRIL 2017**

(Formerly OPSS 1505, November 2010)

Note: The PROV implemented in April 2017 replaces OPSS 1505 COMMON, November 2010 with no technical content changes.

**MATERIAL SPECIFICATION FOR
CHANNEL COMPONENTS FOR STEEL BEAM GUIDE RAIL**

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1505.09	OWNER PURCHASE OF MATERIAL
APPENDICES	Not Used

1505.01 SCOPE

This specification covers the requirements for steel channel and installation hardware.

1505.01.01 Specification Significance and Use

This specification has been developed for use in provincial oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by the Ontario Ministry of Transportation.

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

1505.01.02 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.

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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.

1505.02 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:

CSA Standards

G164-M92 (R2003) Hot Dip Galvanizing of Irregularly Shaped Articles
S136-07 Cold Formed Steel Structural Members

ASTM International

A 307-07 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

1505.05 MATERIALS

1505.05.01 Cold Rolled Channel

Channels shall be cold rolled steel sections according to CSA S136 and have a minimum yield strength of 345 MPa. After fabrication, sections shall be hot dip galvanized according to CAN/CSA G164.

1505.05.02 Installation Hardware

All bolts, nuts, and washers shall be according to ASTM A 307 and be hot dip galvanized according to CAN/CSA G164.

1505.07 PRODUCTION

1505.07.01 Fabrication Tolerances and Workmanship

Bolt holes in steel channels shall be perpendicular to the surface and shall not deviate more than 1.0 mm in any direction from the true location. Steel channel ends shall be cut square.

After fabrication, curved steel channels shall be hot dip galvanized according to CAN/CSA G164.

1505.07.02 Marking

As a minimum, each steel channel section shall be marked with the following information:

- a) Name, trademark, or brand of the manufacturer.
- b) Standard designation 1505.
- c) Identification symbols or code for heat.
- d) Week number and year of production.

Markings shall be clearly and permanently stamped in the valley of the steel channel, placed at a location clear of the splice overlap, and shall not be obscured after installation. The height of the letters and numerals shall be within the range of 19 to 32 mm.

1505.09 OWNER PURCHASE OF MATERIAL

1505.09.01 Measurement and Payment

For measurement purposes, a count shall be made of the number of steel channel sections delivered and accepted.

Installation hardware shall be measured in the units specified in the purchasing order, delivered and accepted.

Payment at the price specified in the purchasing order shall be for the supply of steel channels and installation hardware delivered to the destination or destinations at the dates and times specified.

The cost of all testing, except that performed in the Owner's laboratory, shall be included in the price.



MATERIAL SPECIFICATION FOR STEEL POLES, BASE MOUNTED

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2423.07	PRODUCTION
2423.08	QUALITY ASSURANCE
2423.09	OWNER PURCHASE OF MATERIAL – Not Used
APPENDICES	Not Used

2423.01 SCOPE

This specification covers the requirements for base mounted galvanized steel poles maximum 15.1 m in length.

2423.01.01 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.

2423.01.02 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.

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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.

2423.02 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:

CSA Standards

G40.20-13/G40.21-13	General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel
W59-13	Welded Steel Construction (Metal Arc Welding)

ASTM International

A123 / A123M-15	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
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2423.04 DESIGN AND SUBMISSION REQUIREMENTS

2423.04.01 Submission Requirements

2423.04.01.01 Working Drawings

Working Drawings shall be prepared for the fabrication of steel poles.

Three (3) sets of Working Drawings shall be submitted to the Contract Administrator at least 14 Days prior to commencement of fabrication of the steel poles, for information purposes only. Prior to making a submission, the seals and signatures of a design Engineer and a design-checking Engineer shall be affixed on the Working Drawings verifying that the drawings are consistent with the Contract Documents.

Where multi-discipline engineering work is depicted on the same Working Drawing and the design or design-checking Engineer or both are unable to seal and sign the Working Drawing for all aspects of the

work, the drawing shall be sealed and signed by as many additional design and design-checking Engineers as necessary.

As a minimum, the Working Drawings shall include the following information:

- a) Detailed dimensions.
- b) Plans, elevations, sections, and details to show pole structural details.
- c) Equipment layout.
- d) Anchor bolt locations.
- e) Exact pole weight.
- f) Detailed bill of materials.
- g) Details of equipment nameplates.

2423.05 MATERIALS

2423.05.01 General

All steel used in the production of poles shall be according to CSA G40.21, grade 300W, for pole shafts, and grade 300WT, for base plates and gussets.

All steel shall be galvanized according to ASTM A 123.

2423.07 PRODUCTION

2423.07.01 General

The length of the poles shall be as specified in the Contract Documents.

Shafts shall be round or octagonal in cross-section as specified in the Contract Documents and taper uniformly inwards from the base for the length of the pole.

Shafts shall have one or two longitudinal automatically electrically welded joints from top to bottom.

All welding shall be according to CSA W59.

All welds, except for fillet welds, shall be ground smooth.

The maximum permitted number of circumferential welded joints shall be as shown in Table 1.

The pole sections shall be joined by an electrical weld.

After fabrication, the poles shall be galvanized.

Sweep shall not exceed 3.2 mm per 4.57 m, and the overall sweep shall not be greater than:

$(\text{Pole length (m)} / 4.57 \text{ m}) \times 3.2 \text{ mm}$

The pole shall be supplied with a one-piece fabricated rolled steel base plate. The pole may be supplied as specified in the Contract Documents with a one-piece fabricated rolled steel plate without gussets.

The base shall telescope the butt end of the shaft and be secured with one continuous weld on the inside of the base at the end of the shaft and another continuous weld on the outside at the top of the base. All welding at the base shall be made in such a manner that the welded connection develops the same strength of the adjacent shaft section to resist any bending action.

After fabrication, the underside of the base plate shall be true, distortion free, and perpendicular to the centreline of the pole shaft.

A removable galvanized steel or aluminum top cap shall be supplied with the shaft. The cap shall blend with the general pole design to present an overall neat appearance. The cap shall be secured rigidly to the shaft by a hexagonal head stainless steel set screw.

Wiring apertures at the bracket mounting level and at the handhole shall be accurately positioned on the pole. Wiring apertures, complete with neoprene grommets, shall provide a smooth cable entrance.

Handholes shall be complete with covers and shall be reinforced with a steel handhole frame of such strength and cross section that the strength of the shaft is not reduced.

2423.07.02 Mounting Plate for Grounding

The mounting plate for the grounding post shall be welded to the shaft in such a manner as to present a smooth surface on the exterior of the shaft.

A mounting plate with a bronze split-bolt type ground connector suitable for No. 6 AWG wire shall be welded to the inside of each pole. The bronze ground connector shall be attached to the mounting plate prior to shipment.

2423.07.03 Marking

Each pole shall have the following identification markings located approximately 100 mm above the top of the handhole:

- a) Manufacturer's name or trade mark.
- b) Length.
- c) Gauge of steel.
- d) Bolt circle diameter.
- e) Designation OPSS 2423.
- f) Date of manufacture (i.e., yyyy-mm-dd).

These markings shall be on a corrosion-resistant metal plate securely attached to the surface of the pole.

2423.07.04 Packaging and Shipping

Each pole shall be shipped complete with hardware suitably packaged to ensure that all parts are delivered as an entity.

The grounding connector shall be assembled inside the pole prior to shipment.

The Owner shall be notified of the shipping date 3 Business Days prior to delivery.

2423.08 QUALITY ASSURANCE

2423.08.01 Inspection

All work is subject to an inspection by the Owner's representative prior to shipment.

The Owner shall be notified a minimum of 1 Business Day in advance of the date that the fabrication of the poles is to commence.

The Owner's representative shall have free access to the place of fabrication for the purpose of inspecting and examining plant records; certificates; materials used; fabrication process, including welding and galvanizing; and to make any tests as may be considered necessary, while the poles are being fabricated.

TABLE 1
Circumferential Welded Joints

Pole Length m	Maximum Number of Welds
6.0	1
7.5	1
9.0	1
10.5	2
12.0	2
13.6	2
15.1	3



MATERIAL SPECIFICATION FOR SIGNAL HEADS

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2461.06	EQUIPMENT - Not Used
2461.07	PRODUCTION
2461.08	QUALITY ASSURANCE
2461.09	OWNER PURCHASE OF MATERIAL – Not Used
APPENDICES	Not Used

2461.01 SCOPE

This specification covers the requirements for traffic signal heads and associated components and accessories.

2461.01.01 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.

2461.01.02 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.

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2461.02 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

Ontario Traffic Manual (OTM):
Book 12 - Traffic Signals

CSA Standards

C22.2 No. 0.4-04 (R2013)	Bonding of Electrical Equipment
C22.2 No. 43-08 (R2013)	Lampholders (Bi-national standard, with UL 496)
C22.2 No. 84-05 (R2015)	Incandescent Lamps
C22.2 No. 127-15	Equipment and Lead Wires
S157-05 (R2015)	Strength Design in Aluminum

Institute of Transportation Engineers

ST-017B	Equipment and Material Standards of the Institute of Transportation Engineers, April 3, 2006
ST-052	Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED) Circular Signal Supplement, June 27, 2005
ST-054	Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement, July 1, 2007
ST-055	Pedestrian Traffic Control Signal Indicators: Light Emitting Diode (LED) Signal Modules, August 4, 2010

Others

Federal Specification Colour Yellow 595B-33538
Federal Specification Colour Gray MVCL-14187
Ontario Highway Traffic Act, R.S.O. 1990, Chapter H.8

2461.03 DEFINITIONS

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

Backboard means a panel surrounding a signal head used for the purpose of increasing the attention value of the signal.

Chromaticity means the colour quality of light that is defined by the wavelength (hue) and saturation.

Lamp means a light emitting diode (LED) circular signal module, LED arrow signal module, LED pedestrian signal module, or incandescent bulb.

LED Arrow Signal Module means a signal unit comprised of an array of LEDs, lens, and related power supply that provides an arrow traffic signal indication.

LED Pedestrian Signal Module means a signal unit comprised of an array of LEDs, lens, and related power supply that provides a pedestrian signal indication consisting of a walking pedestrian or hand icon.

LED Signal Module means a signal unit comprised of any array of LEDs and related power supply and any required lenses that provides a circular traffic signal indication when connected to appropriate power.

Programmable Visibility Head means the traffic signal head that can be programmed to limit the visible area of the indication.

2461.04 DESIGN AND SUBMISSION REQUIREMENTS

2461.04.01 Design Requirements

2461.04.01.01 Signal Head Requirements

Signal heads shall be designed to be attached to the traffic signal hanger assemblies using cushion hangers, adjustable mid-section hangers, or dual-end hangers with standard 38 mm internal pipe size gusseted pipe and fittings. Structural design of aluminum shall be according to CSA S157.

2461.05 MATERIALS

2461.05.01 General

Signal heads, components, and accessories shall be according to ITE ST-017B and the Contract Documents.

2461.05.02 Signal Head Housings

Signal head housings shall be a die-cast aluminum or a moulded polycarbonate body with hinged door assembly to provide a water and dust tight enclosure. The openings of the signal head housing shall be provided with a removable sealing device. Aluminum alloy shall be according to CSA S157. The

polycarbonate signal head shall be moulded, ultraviolet and heat stabilized, flame retardant resin, and shall be yellow according to Federal Specification Colour Yellow 595B-33538.

When specified in the Contract Documents, the colour of the signal head housing with grey body and the back of the aluminum or polycarbonate backboard shall be according to Federal Specification Colour Gray MVCL-14187.

Stainless steel reinforcing plates shall be provided according to the manufacturer's recommendation for the mounting arrangement specified in the Contract Documents for the signal head.

2461.05.03 Visors

Each lens shall be provided with a removable visor of the cowl (cap) type. When specified in the Contract Documents, lenses shall be provided with removable visors of the tunnel, full-circle, or louvre type.

2461.05.04 Lampholders

Lampholders shall be according to CAN/CSA C22.2 No. 43, complete with lamp grips and provisions for 360° rotation and lateral locking at the focal point of the reflectors.

2461.05.05 Wiring

Wiring shall be #18 AWG stranded copper type TEW and according to CSA C22.2 No. 127.

2461.05.06 Ground Terminals

Ground lugs shall be provided in signal heads to accommodate a #14 AWG bonding wire.

2461.05.07 Backboards

As a minimum, backboards shall be fabricated from 1.00 mm thick aluminum sheets or 3.00 mm thick high-density polyethylene sheets and shall project a minimum of 125 mm all around beyond the signal head housing. The signal head backboard shall be standard colour yellow according to Federal Specification Colour Yellow 595B-33538.

All backboards shall be opaque.

2461.05.08 Reflectors

Reflectors shall be Alzak aluminum and the reflective surface shall be according to ITE ST-017B.

2461.05.09 Lenses

Lenses shall be convex prismatic of the polycarbonate or glass type according to chromaticity characteristics specified in ITE ST-017B and with the size, type, colour, and orientation specified in the Contract Documents.

2461.05.10 Paint

Paint shall be synthetic resin enamel and according to Federal Standard Colour Yellow 595B-33538.

2461.05.11 Lamps

2461.05.11.01 Incandescent

Incandescent lamps shall be according to the requirements of CSA C22.2 No. 84, ITE ST-017B, and Table 1.

2461.05.11.02 LED

2461.05.11.02.01 LED Modules

LED circular modules at minimum shall be according to ITE ST-052 and the Contract Documents.

LED arrow signal modules at minimum shall be according to ITE ST-054 and the Contract Documents.

Each LED module shall have a single lens with a smooth outer surface. All circular red lenses shall be tinted red and all circular amber lenses shall be tinted amber. The use of tinting or other materials to enhance ON/OFF contrasts shall not affect chromaticity and shall be uniform across the face of the lens. The LED module lens shall be UV stabilized and shall be capable of withstanding direct ultraviolet sunlight exposure for a minimum period of 60 months without exhibiting evidence of deterioration or colour change.

All circular red, amber, and green LED modules shall have an incandescent look that provides a softened and uniform appearance.

LED modules shall be capable of retrofitting and replacing incandescent lamps without modifications to a standard ITE traffic signal housing. Installation shall only require the removal of the existing lens, lamp reflector assembly, and gasket. Each LED module shall have secured jacketed and colour coded cables for connecting to power and for bonding to system ground. The connecting cable shall be rated 600 volts. All wire leads shall be one metre in length, pre-stripped, and tinned.

Each LED module shall be a sealed unit that includes all parts necessary for operation (e.g., printed circuit board, power supply, lens, and gasket) and shall be weatherproof after installation and connection. A one-piece 12.5 mm wide neoprene gasket shall be provided and installed on the LED module prior to delivery.

All LED modules shall be according to the size, colour, and design specified in the Ontario Highway Traffic Act and the OTM Book 12.

LED pedestrian displays shall be the single unit with the walking pedestrian and hand superimposed in the same unit according to the Ontario Highway Traffic Act and the OTM Book 12.

All LED modules shall be approved by the Electrical Safety Authority or by an organization accredited by the Standards Council of Canada.

LED modules for use in programmable visibility head shall comply with the general requirements for LED circular modules. The modules shall be designed and constructed to be installed in a programmable visibility head without modification to the housing.

2461.05.11.02.02 Electrical Requirements

Electrical requirements for LED circular modules shall be according to ITE ST-052; the LED arrow modules shall be according to ITE ST-054; and the LED pedestrian modules shall be according to ITE ST-055.

Maximum power consumption for LED modules shall be according to Table 2 and 3.

Power factor shall be a minimum of 0.95.

2461.05.11.02.03 Photometric Requirements

Photometric requirements of the LED circular modules shall be according to ITE ST-052. Photometric requirements of the LED arrow modules shall be according to ITE ST-054.

All circular LED modules shall be the expanded view type.

2461.05.11.02.04 Physical and Mechanical Requirements

Physical and mechanical requirements for the LED circular modules shall be according to ITE ST-052; the LED arrow modules shall be according to ITE ST-054; and the LED pedestrian modules shall be according to ITE ST-055.

2461.05.11.02.05 LED Module Identification

Each module shall have the manufacturer's name, trademark, model number, serial number, and date of manufacture (i.e., month-year) marked on the back of the module.

The following operating characteristics shall be permanently marked on the back of the module: nominal operating voltage; power consumption, in watts; and volt-amperes.

Each module shall have a symbol of the type of module (e.g., circle or arrow) in the colour of the module marked on the back of the module. The colour of the module shall be written out next to the symbol.

When specific mounting orientation is required, each module shall have prominent and permanent marking consisting of an up arrow or the word UP or TOP.

2461.05.11.02.06 LED Module Warranty

A warranty shall be provided on all LED modules. This warranty shall be in addition to any other warranty specified in the Contract Documents. The warranty on all LED modules shall be according to ITE ST-052.

The warranty period for each LED module shall be 60 months, commencing from the date of Switch On for operation of the traffic signals in which the LED module is used. Any LED module deemed to have a visual or operational deficiency shall be replaced within 30 days. The warranty shall cover all delivery, parts, and material costs.

2461.07 PRODUCTION

2461.07.01 General

Sectional signal heads consisting of one to six sections shall be supplied as specified in the Contract Documents. Where multiple sections are specified, lenses shall be arranged in the following order commencing from the top of the signal head to the bottom:

- a) Red
- b) Amber
- c) Green
- d) Straight Through Green Arrow

e) Left Turn Green / (Amber) Arrow

f) Right Turn Green Arrow

When any of the foregoing indications are not required, the order of arrangement shall be maintained by omitting those sections, which are not required.

Each section shall consist of a signal head housing, wiring, and visor as specified in the Contract Documents. Each section shall consist of LED modules or incandescent lampholders, reflectors, and lens as specified in the Contract Documents. Each complete assembly shall consist of a ground terminal and, when specified in the Contract Documents, a backboard.

Pedestrian signal heads shall consist of one or two housing sections suitable for rectangular signals. One display shall be a translucent lunar orange hand and the other display shall be a translucent lunar white walking pedestrian. Standard square visors shall be provided.

2461.07.02 Wiring

Loops of 150 mm length of wire shall be left in each section.

2461.07.03 Bonding

Metallic components shall be bonded together and grounded to the ground terminal according to CAN/CSA C22.2 No. 0.4.

2461.07.04 Assembly

All components shall be factory assembled using mechanical devices according to the strength requirements of ITE ST-017B.

2461.07.05 Painting

All externally visible portions or components of the metal signal heads, with the exception of lenses and the underside of visors, shall be painted yellow. The underside of the visors of the metal signal heads and the visors of the polycarbonate signal heads shall be painted matte black.

2461.07.06 Signal Head Identification

Each signal head shall have identification markings in a visible location indicating the manufacturer's name or trademark, date of manufacture, and standard designation OPSS 2461.

Identification markings shall be embossed on the signal head or on a corrosion-resistant metal plate securely attached to the signal head.

2461.07.07 Packaging

Each signal head shall be packaged securely in cardboard cartons. Backboards and separately ordered components may be packaged separately.

2461.08**QUALITY ASSURANCE****2461.08.01****Inspection**

The Contract Administrator shall be notified a minimum of 3 Business Days prior to the start of fabrication for the signal heads.

While work is being performed, the Contract Administrator shall have access to the place of manufacture of the signal heads for the purpose of inspecting and examining plant records and certificates, materials used, process of manufacturing, and to make any tests as may be considered necessary.

All signal heads may be subject to an inspection by the Contract Administrator prior to shipment.

TABLE 1
Lamp Requirements

Lens Size and Application	Lamp Wattage Maximum		Lamp Voltage	Lamp Type	Lamp Life Hours	
	Argon	Krypton			Argon	Krypton
300 mm Diameter Traffic Signal Head	150	135	125	clear, traffic	6000	8000
200 mm Diameter Traffic Signal Head	100	90	125	clear, traffic	8000	8000
300 mm Square Pedestrian Signal Head	100	90	125	clear, traffic	8000	8000
300 mm Arrow Signal Head	150	90	125	clear, traffic	6000	8000
200 mm Diameter Flasher Beacon	116		125	clear, traffic	8000	
300 mm Diameter Flasher Beacon	150		125	clear, traffic	6000	
Sign Light Assembly	75		125	clear, PAR 38 (spot)	4000	
Down Light	150		125	clear	6000	

TABLE 2
LED Modules Maximum Power Consumption
Watts

LED Signal Modules						
	Red		Amber		Green	
Temperature, °C	25	74	25	74	25	74
Circular 300 mm	11	17	22	25	15	15
Circular 200 mm	8	13	13	16	12	12
300 mm Arrow	9	12	10	12	11	11
Programmable Visibility Indication	11	17	22	25	15	15

TABLE 3
LED Modules Maximum Power Consumption
Watts

LED Pedestrian Signal Modules		
Temperature, °C	25	74
Hand	10	12
Walking Pedestrian	9	12



**MATERIAL SPECIFICATION FOR UNINTERRUPTIBLE
POWER SUPPLY SYSTEMS FOR LED TRAFFIC SIGNALS**

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2475.07	PRODUCTION
2475.08	QUALITY ASSURANCE – Not Used
2475.09	OWNER PURCHASE OF MATERIAL – Not Used
APPENDICES	Not Used

2475.01 SCOPE

This specification covers the requirements for uninterruptible power supply (UPS) systems for traffic signals utilizing light emitting diode (LED) modules.

2475.01.01 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.

2475.01.02 Appendices Significance and Use

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2475.02 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:

CSA Standards

C22.1-15 Canadian Electrical Code
C22.2 No. 94-M91 (R2001) Special Purpose Enclosures

Electrical Safety Authority

Ontario Electrical Safety Code

National Electrical Manufacturer's Association

TS 2-2016 Traffic Controller Assemblies with NTCIP Requirements Version 03.07

2475.03 DEFINITIONS

AGM VRLA Battery means a sealed battery using absorbed glass mat and valve regulated lead acid technology.

CSA Enclosure Type 3 means an enclosure for either indoor or outdoor use, constructed so as to provide a degree of protection against rain, snow, and windblown dust, undamaged by the external formation of ice on the enclosure.

Gel Cell Battery means a sealed battery containing acid in a gel form.

2475.04 DESIGN AND SUBMISSION REQUIREMENTS

2475.04.01 Design Requirements

Each UPS system shall be designed for the traffic signal controller cabinet and equipment to which the UPS system will be connected. A comprehensive and detailed wiring diagram for each UPS system shall be designed and documented. The wiring diagram shall clearly indicate all UPS system wiring and connections, and shall clearly indicate all wiring and connections between the UPS system and the traffic signal controller cabinet and equipment.

2475.04.02 Submission Requirements

Prior to the installation of the UPS system, three copies of a comprehensive and detailed wiring diagram for each UPS system at each traffic control signal shall be submitted to the Contract Administrator.

2475.05 MATERIALS

2475.05.01 General

The UPS system shall provide uninterruptible power and conditioning of the utility power required for the operation of all electronic equipment used to operate the traffic control signals in the event of main utility power supply failure or voltage or frequency fluctuations.

The UPS system shall be supplied complete with UPS automatic switch.

The UPS control unit shall be a line interactive or double conversion type with automatic voltage regulation for 120V, 60Hz, single phase.

The UPS system shall include all wiring necessary to interconnect the UPS control unit to the power source and to the traffic signal control components.

The UPS control unit must latch from line to battery and from battery to line (transfer time) in less than 60 milliseconds.

When installed at a traffic signal using LED signal lamps, the UPS system shall be capable of maintaining full signal display operation for a minimum of 4 hours after which it shall be capable of maintaining a flashing signal display for a further 6 hours minimum.

Switching from full operation to a flashing operation may be determined by a timer circuit or based on battery capacity.

If the UPS control unit or the batteries fail, the system shall automatically switch back to utility line power.

If line power is restored during flashing operation, the traffic control signals shall commence the start-up sequence specified in the traffic control signals' timing sheet.

The UPS cabinet shall be supplied complete with pedestal or pole mounting hardware as indicated in the Contract Documents.

The battery installation and wiring to the batteries shall be according to Ontario Electrical Safety Code.

The UPS system components shall operate properly for the time periods specified above under the following conditions:

- a) Ambient temperature -37 °C to +74 °C
- b) Humidity: 5 percent to 95 percent
- c) The UPS system components shall withstand shock and vibration according to NEMA TS 2.

2475.05.02 UPS Cabinet

The cabinet shall be approved according to the Ontario Electrical Safety Code.

The UPS cabinet shall be a CSA Enclosure Type 3 cabinet constructed of aluminum and shall be painted grey. The cabinet shall be fabricated using sheet aluminum 3.17 mm thick and adequately reinforced by welded aluminum members.

The dimensions and details of the UPS cabinet shall be according to the Contract Documents.

The cabinet shall have one door hinged on one side with a continuous stainless steel piano hinge.

The door shall use a latch and lock mechanism. The door handle shall be zinc coated and painted the same colour as the cabinet.

The opening in the UPS cabinet shall allow full access to UPS components housed in the cabinet.

The cabinet shall be vented according to the Ontario Electrical Safety Code.

The circuit providing power to the battery heating mats shall be thermostat controlled and the thermostat shall be located in the UPS cabinet.

2475.05.03 Batteries

Batteries shall be AGM VRLA or gel cell technology.

Battery leads to UPS control unit shall be of suitable length and not less than 2.5 metres.

Each battery shall be placed on its own heater mat with all heater mats being supplied with AC power by the UPS control unit.

Battery mats shall become inoperable with loss of line voltage.

The batteries shall be protected by a circuit breaker or a fuse.

Each battery shall be labelled with the date of manufacture. The label shall be at a visible location on the top of the battery.

In addition to any other warranty, the Contractor shall provide a 3 year warranty on the batteries. The warranty period for each battery shall be 3 years, commencing from the date of "switch on" for operation of the UPS system in which the batteries are used. Any defective battery shall be replaced within 30 days. The warranty shall include all labour, Equipment, and Materials required to replace the batteries, including traffic control and all removal and disposal work. The Contractor shall be responsible for the removal and disposal of any defective batteries replaced under warranty. The Owner shall be the sole judge in determining if a battery is defective.

2475.05.04 UPS Control Unit

The UPS control unit shall be rack mountable with the following maximum dimensions: width of 483 mm (19-inch), depth of 254 mm (10 inches), and height of 153 mm (6 inches).

The front face of the control unit shall have indicators capable of displaying the following:

- a) Number of times the system was on battery supply
- b) Total time on battery supply
- c) Battery charge status to indicate the battery capacity

Each of the battery supply indicators listed above shall have a manual reset switch.

The UPS control unit shall have a minimum of one standard 120V grounded socket located on either the back or the front panel.

The UPS control unit shall contain over-current protection located on the front panel to switch power on/off from the batteries and to switch AC input and output power on/off.

The UPS control unit shall have a self-test feature to test the UPS automatic switch and the control circuitry.

The UPS control unit shall have an open collector output or an AC or DC contact closure to indicate when the traffic signal is operating on battery supply.

The UPS control unit shall have an open collector output or an AC or DC contact closure to indicate low battery alarm.

The UPS control unit shall have a minimum of 1 switched AC output that will switch on when the traffic signal has been on battery supply continuously for 4 hours.

A 9 pin male serial port and/or Ethernet port shall be located on the front panel to allow for communication to a laptop computer for changing software settings. The Ethernet port shall support dynamic host configuration protocol (DHCP).

A set of battery voltage test points, or a readout indicating battery voltage condition shall be located on the front panel.

2475.05.05 UPS Automatic Switch

The UPS automatic switch shall allow the UPS control unit to be removed for replacement or maintenance without turning off the traffic signal system.

The utility line power shall be connected to the input of the automatic switch. Under normal operating conditions the automatic switch shall connect the utility line power to the UPS control unit. In the event that the UPS control unit is not present or does not function, the automatic switch shall automatically connect the utility line power directly to the traffic signal system, bypassing the UPS control unit.

2475.05.06 Power Conditioning and the Use of Batteries by the UPS

Under normal operating conditions the utility line power shall flow through the UPS control unit to the traffic signal system and any other connected loads.

When the utility line power is within the operating parameters specified by the UPS manufacturer and the Contract Documents the UPS control unit shall condition and deliver the power to the loads without drawing power from the batteries.

When the utility line power is not within the operating parameters specified by the UPS manufacturer and the Contract Documents the UPS control unit shall condition and deliver the power to the loads by drawing power from the batteries as required.

2475.05.07 Electrical

The UPS system shall accept an AC voltage input range of 85 to 135 VAC, single phase, 2 wire plus ground without drawing on battery power.

The UPS system shall provide voltage regulation at 120 VAC $\pm$ 3 percent under any line, load or battery conditions other than "low battery", and a frequency regulation of 60 Hz $\pm$ 3 Hz synchronized to the utility line power.

Power rating shall be a minimum of 1000 VA (700W). The UPS system shall provide pure sine wave output, computer grade power compatible with all equipment loads, with power factor correction.

The UPS system shall include full time protection from sudden voltage increase with inrush protection and AC line filtering.

The UPS system shall provide complete isolation from the line operating as a separately derived power source according to Section 10, Grounding and Bonding, CSA C22.1.

The direct current (DC) system of the UPS system shall have a nominal DC system voltage of 60 VDC or less. The UPS DC system short circuit current shall not exceed 5000 A.

2475.07 PRODUCTION

All wires and leads shall be tied and secured within the UPS cabinet prior to delivery.



MATERIAL SPECIFICATION FOR SODIUM CHLORIDE

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2502.01 SCOPE

This specification covers the requirements for the supply and delivery of sodium chloride.

2502.01.01 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.

2502.01.02 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.

2502.05 MATERIALS

2502.05.01 General Requirements

Sodium chloride shall be according to the requirements listed in Tables 1 and 2 and shall always be in a free flowing state until used.

2502.07 PRODUCTION

When delivery in bags is specified, sodium chloride shall be delivered in four-ply, asphalt-lined or polyethylene-lined bags in sound condition and containing 40 kg. The closures shall be sewn.

Each bag shall be marked with the following:

- a) Name of supplier/manufacturer.
- b) Net mass.
- c) Salt grade, (i.e., coarse crushed rock salt or fine crushed rock salt).

When delivery in bulk is specified, the sodium chloride shall be shipped by rail or truck, whichever is specified.

2502.08 QUALITY ASSURANCE

2502.08.01 Inspection, Sampling, and Testing

Sodium chloride supplied under this specification shall be subject to inspection and testing. All materials that fail to meet the specified requirements shall be rejected. The supplier shall remove all rejected material as directed at no additional cost to the Owner.

The supplier shall provide to the Owner, a 2 kg sample that is representative of the material to be supplied during the term of the purchase order.

2502.09**OWNER PURCHASE OF MATERIAL****2502.09.01****Measurement and Payment**

Sodium chloride shall be measured by mass in tonnes as specified in the purchase order.

When shipped in bulk, sodium chloride shall be weighed at the source of supply and the mass shall be substantiated by bills of lading in as many copies as the Owner may require.

Payment at the price specified in the purchase order shall be for the supply of the sodium chloride delivered to the destination on the date and time specified.

TABLE 1
Sodium Chloride Chemical Composition, by Mass

Characteristic	Per Cent
Moisture content	not more than 1.5
Sodium chloride content, dry mass basis,	not less than 96.0
Insoluble matter, dry mass basis,	not more than 4.0

TABLE 2
Sodium Chloride Gradation Requirements

MTO Sieve Designation	Per Cent Passing by Weight	
	Coarse Crushed Rock Salt	Fine Crushed Rock Salt
9.5 mm	100	-
4.75 mm	30 - 100	100
2.36 mm	5 - 65	-
1.18 mm	0 - 30	35 min.
600 µm	0 – 10	-