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

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

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

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

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

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

Ontario Provincial Standard Specifications (OPSSs)					
930	November 2014	April 2025	TBD	Rev: Construction Specification for Structure Rehabilitation - Concrete Patches, Refacing, and Overlays is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed.	Mike Pearsall

Note: The 930 implemented in April 2025 replaces 930, November 2014 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR STRUCTURE REHABILITATION - CONCRETE PATCHES, REFACING, AND OVERLAYS

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930.01 SCOPE

This specification covers the requirements for concrete structure rehabilitation, including; concrete patches, concrete refacing, normal concrete overlays, and silica fume concrete overlays.

~~930.01.01 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.~~

~~930.01.02 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.~~

930.02 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 Specification, Construction

OPSS 904	Concrete Structures
OPSS 905	Steel Reinforcement for Concrete
OPSS 919	Formwork and Falsework
OPSS 928	Structure Rehabilitation - Concrete Removal
OPSS 929	Abrasive Blast Cleaning - Concrete Construction
OPSS 932	Crack Repair - Concrete

Ontario Provincial Standard Specification, Material

OPSS 1302	Water
OPSS 1350	Concrete - Materials and Production

Ontario Ministry of Transportation Publications

Structure Rehabilitation Manual

MTO Laboratory Testing Manual:

LS-430	Method of Test for Bond Strength by Tensile Load
LS-435	Method of Test for Linear Shrinkage of Concrete
LS-601	Materials Finer than 75 µm Sieve in Mineral Aggregates by Washing
LS-607	Determination of Percent Crushed Particles in Processed Coarse Aggregate

MTO Forms:
PH-CC-736 Notification of Placement of Concrete

CSA Standards

A23.2-14C	Obtaining and Testing Drilled Cores for Compressive Strength Testing*
C22.2 No. 211.2-M1984 (1992)	Rigid PVC (Un-plasticized) Conduit
G30.5-M1983 (R1998)	Welded Steel Wire Fabric for Concrete Reinforcement

* [Part of A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete]

ASTM International

~~A 53/A 53M~~A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
~~A 123/A 123M~~A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
~~A 153 -~~ A153-09	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
~~D 4285~~D4285-83-(R2006)	Method for Indicating Oil or Water in Compressed Air

930.03 DEFINITIONS

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

Concrete Patches, Formed Surfaces means concrete patches where at least one face of the patch requires formwork.

Concrete Patches, Unformed Surfaces means concrete patches located in the top surface of decks, sidewalks, and curbs where no formwork is required.

Concrete Refacing means concrete refacing where at least one of the surfaces of a component is entirely overlaid with concrete. ~~-~~Concrete refacing typically applies to pier columns, pier caps, abutments, vertical walls of culverts and tunnels, concrete barrier, and parapet walls.

Form and Pump Placement Method means a method of placing concrete by pumping directly into formwork through injection ports.

Hot Weather means those conditions when the air temperature is at or above 28~~ºC.~~ °C. It is also considered to exist when the air temperature is at or is likely to rise above 28~~ºC~~°C within 24 hours after concrete placement. Temperature refers to shade temperature.

Injection Port means a mechanical device with a manual shut-off that is attached to the formwork and connected to the discharge line of a pump to facilitate delivery of concrete directly into the formwork.

Rehabilitation means any modification, alteration, or improvement to a structure or its components that is designed to correct defects or deficiencies.

Self-Consolidating Concrete (SCC) means a highly flowable yet stable concrete that can spread readily into place, fill the formwork, and encapsulate the reinforcement without any mechanical consolidation or vibration and without undergoing segregation or excessive bleeding. ~~-~~It may be designed for high strength and durability in addition to flow characteristics.

Segregation means visible separation of the mortar and coarse aggregate particles in the plastic concrete resulting in concrete that is not uniform in appearance or proportions.

Silica Fume Concrete means concrete which includes silica fume and may in addition include other supplementary cementing materials having specified rapid chloride permeability at 28 to 32 Days of 1,000 coulombs or less.

Structure means any bridge, culvert, tunnel, retaining wall, wharf, dock, guideway, or any part thereof or other reinforced concrete component designed to carry loads, including high mast pole footings and sign support footings.

930.04 DESIGN AND SUBMISSION REQUIREMENTS

930.04.01 Design Requirements

930.04.01.01 Formwork and Falsework

Design submission shall be according to OPSS 919 with the following additional requirements:

a) Working Drawings for soffit repairs shall be designed and sealed by an Engineer.

b) Formwork and falsework for soffit repairs subjected to live traffic vibrations on the deck shall be designed for an additional dynamic load allowance of 50% the weight of plastic concrete being supported.

Timber formwork and falsework for soffit repairs shall be designed using permanent load duration factors and shall accommodate additional pressure due to pumping of repair concrete.

930.04.02 Submission Requirements

930.04.02.01 Notification of Placement of Concrete

Prior to each placing operation, form PH-CC-736, accompanied by all supporting documentation as indicated on the form shall be submitted to the Contract Administrator.

930.04.02.02 Cold Weather Protection

930.04.02.02.01 General

A description of the methods to be used to control the concrete temperature and temperature difference in cold weather shall be submitted to the Contract Administrator 3 Days prior to the commencement of concrete production. Cold weather is considered to exist when the air temperature is at or below 10 °C. °C. It is also considered to exist when the air temperature is at or is likely to fall below 10 °C °C within 96 hours after concrete placement. Temperature refers to shade temperature. The submission shall be according to the Temperature Control Plans clause of OPSS 904.

930.04.02.02.02 Temperature Records

Datalogger temperature records and a record of any actions taken to maintain control of temperature and temperature difference shall be submitted to the Contract Administrator at the end of each Business Day during the temperature monitoring period. At the end of the temperature monitoring period, a complete temperature record shall be submitted to the Contract Administrator.

930.04.02.03 Concrete Mix Design

Concrete mix design submissions shall be according to OPSS 1350, with the additional requirement that test data for linear shrinkage shall be required and submitted within 40 Days of the mix design submission.

930.04.02.04 Hot Weather Concreting

A description of the methods to be used to control the concrete temperature shall be submitted to the Contract Administrator 3 Days prior to the commencement of concrete production in hot weather.

930.04.02.05 Placement Methods

When the form and pump placement method is specified in the Contract Documents or self-consolidating concrete is used, 4 copies of the details of the placement method shall be submitted to the Contract Administrator at least 3 Days prior to commencement of the work. The details shall include methodology and equipment to be used and shall bear the seal and signature of an Engineer.

930.04.02.06 Formwork and Falsework

Working Drawings for soffit repairs shall be submitted to the Contract Administrator 3 Days prior to the commencement of formwork and falsework installation, for information purposes only.

930.05 MATERIALS

930.05.01 General

The following materials shall be according to OPSS 904:

a) Burlap.

b) Insulation material.

c) Moisture vapour barrier.

If a bonding agent is used, it shall be compatible with the repair material.

930.05.02 Anchors

Anchors for the attachment of the welded steel wire fabric to the concrete surface shall be galvanized according to ASTM ~~A 153~~A153 and be of adequate length and strength to resist a pull-out force of 1.0 kN.

930.05.03 Concrete

The concrete shall be according to OPSS 1350 with the following modifications:

a) The minimum specified 28-Day compressive strength shall be 30 MPa, except for silica fume overlays which shall be 40 MPa.

b) Coarse aggregates for overlays shall consist of a minimum of 60% crushed particles when tested according to MTO LS-607 and shall have 1.00% by mass maximum passing the 75 µm sieve when tested according to MTO LS-601. Coarse aggregate for overlays that form the bridge deck riding surface shall be composed of at least 80% siliceous rocks and minerals.

c) Linear shrinkage test data for each mix design shall be submitted for information purposes. Testing shall be carried out in accordance with LS-435 and specimens may be cast at the ready mixed plant or at the site. Laboratory testing shall be carried out by a laboratory who has participated in an MTO correlation program for linear shrinkage.

d) For concrete patches where the longest dimension, width or length, of individual patches is less than 400 mm, a proposal may be submitted to the Contract Administrator for approval to use a proprietary patching material. The patching material shall be mixed, handled, and cured according to the manufacturer's instructions.

e) SCC will be considered on an individual project basis for patches and refacing subject to the Contract Administrator's approval. If permitted for use, SCC shall be according to the ministry's current specification for SCC. A copy of the specification can be obtained from the Ministry's Material Engineering and Research Office, 1201 Wilson Avenue, Downsview, M3M 1J8.

930.05.04 Drainage Tubes

Rigid polyvinyl chloride (PVC) drainage tubes shall be according to CSA C22.2 No. 211.2. Galvanized steel drainage tubes shall be according to ASTM A53/A53M and galvanizing shall be according to ASTM ~~A 123~~A123.

930.05.05 Forms

Forms shall be according to OPSS 919, with the exception that all forms shall be medium density overlay plywood.

930.05.06 Proprietary Patching Materials

Proprietary patching materials shall be from the ministry's list of concrete patching materials.

930.05.07 Tie Wire

Tie wire shall be according to OPSS 905.

930.05.08 Welded Steel Wire Fabric

Welded steel wire fabric shall be welded galvanized steel and shall be according to CSA G30.5. Galvanizing shall be according to ASTM ~~A 123~~A123.

930.05.09 Water

Water used for curing, fog-misting of concrete, pre-soaking of burlap, and bonding agent shall be according to OPSS 1302.

930.06 EQUIPMENT

930.06.01 General

The following equipment shall be according to OPSS 904:

a) Bridge deck finishing machine, screed rails, screed rail chairs, and work bridges used for overlays.

b) Consolidating equipment.

c) Hand finishing tools.

d) Straight edges.

930.06.02 Buggies

Buggies used for transporting and placing the concrete may be hand operated or motorized. Motorized concrete buggies shall have a capacity no greater than 0.5 m^3.

930.06.03 Compressor - Air Blasting

The compressed air shall be clean, dry, and free from oil residue and other contaminants when tested according to ASTM D 4285.

930.06.04 Fog Misting Equipment

Fog misting equipment shall be provided for the curing of the silica fume concrete overlays. Hand held fogging wands shall be used.

A fogging system mounted on the finishing machine may also be used, provided it does not result in dripping or accumulation of water on the concrete surface.

930.06.05 Form and Pump Placement Method Equipment

When the form and pump placement method is specified in the Contract Documents, the pump shall be a positive displacement type pump and shall be capable of delivering adequate volumes of concrete to maintain a continuous placement.

930.06.06 Sawing Equipment - Overlays

The sawing equipment shall be self-propelled and capable of sawing the concrete overlay full depth in one pass.

930.07 CONSTRUCTION

930.07.01 General

Typical locations and areas of repair are as shown on the Contract Drawings; however, the actual locations and extent of repair shall be as determined during the layout of the repair areas according to OPSS 928 and as directed by the Contract Administrator.

930.07.02 Operational Constraints

The Contract Administrator shall be notified of the intent to place the overlay, concrete patches, or concrete refacing 1 Business Day prior to the commencement of the placing operation. The work shall not proceed until the concrete surface preparation has been completed and form PH-CC-736 has been received and signed by the Contract Administrator.

Construction equipment shall be permitted on the bridge deck or other concrete components, provided that:

a) Contamination by oil or other deleterious substances is prevented.

b) Equipment vehicles and runways are not supported by steel reinforcement.

c) Only the finishing machine and buggies used to place concrete are allowed on the abrasive blast cleaned portions of the deck or other concrete components. No other vehicles or equipment, including concrete ready mix trucks shall be permitted.

d) Heavy vehicles such as concrete ready mix trucks or dump trucks shall not be permitted on any portion of the deck, within a span, once concrete removals within the deck have commenced in that span.

No construction vehicles, equipment, or traffic, with the exception of sawcutting equipment shall be permitted on the finished surface of the overlay, patches, and on deck surface directly over soffit patches or refacing until the curing and cold weather protection period has been completed and a minimum compressive strength of 25 MPa has been attained.

Prior to seasonal shutdown, operations shall be scheduled in such a manner to ensure that overlays, concrete patches, and concrete refacing are completed in all areas where concrete removal has commenced. No steel reinforcement shall be left exposed during seasonal shutdown.

930.07.03 Normal Concrete Overlay
Silica Fume Concrete Overlay

930.07.03.01 Minimum Thickness of Overlay

The thickness of the overlay shall be according to the requirements of the Contract Drawings with no areas less than 45 mm in thickness.

930.07.03.02 Surface Preparation

All concrete surfaces against which new concrete is to be placed shall be clean, sound and free from loose or unsound fragments, coatings and any other foreign substances or debris, and shall be sufficiently rough to ensure that a full bond is developed with the new concrete.

A bonding agent may be used. The Contract Administrator shall be notified in writing whether a bonding agent is to be used and, if so, the bonding agent shall be identified.

The portion of curb face, barrier wall or parapet wall, and all existing concrete surfaces which have not been scarified, against which new concrete is to be placed, shall be uniformly roughened by means of scabbling, chipping, or bush hammering. A surface profile of 5 ± 2 mm shall be achieved by exposing the aggregates across the entire surface.

All concrete surfaces and steel reinforcement to receive the overlay shall be abrasive blast cleaned according to OPSS 929.

Immediately prior to pre-wetting the concrete surface, all dust and loose material shall be removed from the prepared surface by using compressed air, except where anode mesh is to be used.

When anode mesh is required, the concrete surface shall be pressure washed with water using a pressure not less than 10 MPa with the anode mesh in place. The pressure washing shall take place immediately prior to pre-wetting. All debris resulting from drilling of anchor holes and other accumulated dirt adhering to the anode or concrete surfaces shall be removed.

All concrete surfaces to receive an overlay shall be pre-wetted and continuously maintained in a wet condition for a minimum period of 6 hours immediately prior to the application of the concrete overlay or bonding agent when used. Excess water shall be removed from the surface using compressed air immediately prior to the application of the bonding agent or concrete overlay.

930.07.03.03 Placing of Screed Rails

Supports for the screed rails shall be installed outside the area to be overlaid or waterproofed. The screed rails shall be continued beyond the deck, at each end, to a length that will enable the finishing machine to be driven beyond the end of deck.

930.07.03.04 Dry Run

A dry run shall be made to verify that the minimum thickness of the overlay can be achieved, in the presence of the Contract Administrator, prior to each placing operation.

The Contract Administrator shall be notified at least 1 Business Day in advance of a dry run. When the dry run indicates that an unsatisfactory thickness will result, the screed rails shall be adjusted in order to obtain the minimum thickness and the dry run repeated in the area of screed rail adjustment.

For silica fume concrete overlays, the ability to successfully fog mist shall be demonstrated to the Contract Administrator at the time of the dry run. The same equipment and process shall be used to fog mist the overlay.

930.07.03.05 Placing of Concrete

The placing of concrete shall be according to OPSS 904 with the following modifications:

a) Concrete shall not be placed when the ambient air temperature or existing concrete surface temperature is below 10 ~~°C~~°C or likely to fall below 10 ~~°C~~°C, or is above 30 ~~°C~~°C or likely to rise above 30 ~~°C~~°C throughout the duration of the concrete placing operation.

   Prior to placing new concrete, it shall be demonstrated to the Contract Administrator that the substrate temperatures meet the Contract requirements, by measuring and recording the substrate temperatures using a contact thermometer or infrared thermometer.

b) Concrete shall not be placed adjacent to any new concrete less than 48 hours old. If the ambient air temperature falls below 10 ~~°C~~°C within the first 48 hours after placement of concrete, the 48 hour time requirement shall be extended to 96 hours.

   In addition, for staged overlay construction, concrete shall not be placed adjacent to any new concrete having a compressive strength less than 20 MPa.

c) All concrete overlay 3 m or wider shall be placed with bridge deck finishing equipment.

d) Any concrete or bonding agent deposited in areas other than the intended point of discharge shall be removed immediately.

e) Unless otherwise specified in the Contract Documents, concrete for partial depth removal areas shall be placed at the same time as the overlay. Concrete for full depth removal areas shall be placed prior to placing the overlay and left with a rough surface finish.

f) Cold joints shall not be permitted.

930.07.03.06 Construction Joints

Construction joints shall be permitted only where shown in the Contract Drawings or in the case of unexpected interruptions during the placing operation, as directed by the Contract Administrator.

All construction joints shall be formed using bulkheads. The height of the bulkhead shall match the thickness of the overlay.

The edge and face created by the bulkhead shall be a clean vertical face free from any defects such as honeycombing or spalls. If the construction joint formed by the bulkhead is deemed unacceptable by the Contract Administrator, a new construction joint shall be created by sawcutting back to a limit where the quality of concrete is acceptable to the Contract Administrator.

930.07.03.07 Surface Finish

The surface finish shall be according to OPSS 904.

930.07.03.08 Surface Tolerance

The surface tolerance shall be according to OPSS 904.

930.07.03.09 Surface Texture

Where the surface of the overlay forms the driving surface of the bridge deck, the surface shall be given a texture with a wire broom or comb having a single row of tines. The required texture shall be transverse grooves which may vary from 1.5 mm width at 15 mm centres to 4.5 mm width at 20 mm centres with a groove depth varying from 3.0 mm to 4.5 mm. The texture shall extend uniformly to within 300 mm of the curb or barrier wall or parapet wall.

930.07.03.10 Curing

Normal concrete overlay shall be cured according to the requirements for Curing with Burlap and Water clause of OPSS 904 for a minimum curing period of 4 Days, except that for concrete subjected anytime to cold weather during the first 96 hours after concrete placement, the curing period shall be extended to 7 Days.

Silica fume concrete overlay shall be cured according to the requirements for high performance concrete (HPC) of OPSS 904 for a minimum curing period of 7 Days.

Where waterproofing is to be applied to an overlay following curing with burlap and water, the overlay shall be air dried for at least 72 hours prior to the application of waterproofing.

930.07.04 Concrete Patches, Formed Surface
Concrete Patches, Unformed Surface
Concrete Patches, Form and Pump
Concrete Refacing
Concrete Refacing, Form and Pump

930.07.04.01 Surface Preparation

All concrete surfaces against which new concrete is to be placed shall be clean, sound and free from loose or unsound fragments, coatings, and any other foreign substances or debris and shall be sufficiently rough to ensure that a full bond is developed with the new concrete.

A bonding agent may be used. The Contract Administrator shall be notified in writing whether a bonding agent is to be used and, if so, the bonding agent shall be identified.

All existing concrete surfaces against which new concrete is to be placed shall be uniformly roughened by means of scabbling, chipping, or bush hammering. A surface profile of 5 ± 2 mm shall be achieved by exposing the aggregates across the entire surface.

All concrete surfaces and steel reinforcement to receive new concrete shall be abrasive blast cleaned according to OPSS 929.

Immediately prior to pre-wetting the concrete surface, all dust and loose material shall be removed from the prepared surface of the repair area by using compressed air.

The surface of the existing concrete shall be pre-wetted and continuously maintained in a wet condition for a period of 6 hours immediately prior to placing any new concrete. Prior to placing concrete, excess water shall be removed from the surface using compressed air.

930.07.04.02 Placement of Welded Steel Wire Fabric

When welded steel wire fabric is specified in the Contract Documents, it shall not be installed until after the concrete surface and exposed steel reinforcement in the repair area have been abrasive blast cleaned. The welded steel wire fabric shall not be abrasive blast cleaned at any time.

Where there is no exposed steel reinforcement, the wire fabric shall be fastened to the concrete with anchors placed no further than 600 mm apart, in a grid pattern.

Where steel reinforcement is exposed, the wire fabric shall be securely fastened to the steel reinforcement by tie wires placed no further than 600 mm apart, in a grid pattern. When the exposed steel reinforcement is not capable of providing rigid support for the wire fabric, anchors shall be used to support the wire fabric.

The wire fabric shall be installed flat, tight, and at the locations shown in the Contract Drawings using spacers and anchors. The edges of adjoining wire fabric shall overlap by two-wire spacing plus 100 mm. The wire fabric shall be kept clean of any contamination that could reduce the bond of the repair material to the wire surface.

930.07.04.03 Installation of Anchors and Dowels

Holes for anchors and dowels shall be drilled into the concrete at the location and spacing as specified in the Contract Documents. They shall be installed in such a way as to not cause delamination or other damage to the surrounding concrete. Each anchor used to fasten the welded steel wire fabric into the concrete shall be installed to resist a pull out force of at least 1.0 kN at either sides of the concrete interface.

930.07.04.04 Formwork and Falsework

The erection and removal of formwork and falsework shall be according to OPSS 919 and it shall be designed to retain the concrete and withstand the placement pressures. The formwork shall be placed to provide the specified cover to steel reinforcement or welded steel wire fabric, or both, as specified in the Contract Documents. When this results in over-building of the existing concrete surface, a 1H:1V slope shall be provided to meet the existing surface at the edges of the repair area. The perimeter of the formwork shall be sealed to be grout-tight. Vent holes shall be installed at the highest locations.

930.07.04.05 Placing of Concrete

The placing of concrete shall be according to OPSS 904 with the following modifications:

a) Concrete shall not be placed when the ambient air temperature or existing concrete surface temperature is below 10 °C or likely to fall below 10 °C or is above 30 °C or likely to rise above 30 °C throughout the duration of the concrete placing operation.

   Prior to placing new concrete, it shall be demonstrated to the Contract Administrator that the substrate temperatures meet the Contract requirements by measuring and recording the substrate temperatures using a contact thermometer or infrared thermometer.

b) Concrete shall not be placed adjacent to any new concrete less than 48 hours old. If the ambient air temperature falls below 10 °C within the first 48 hours after placement of concrete, the 48 hour time requirement shall be extended to 96 hours.

c) For form and pump method, the port arrangement and pumping procedures shall be designed to ensure that requirements of this specification are met.

d) Cold joints shall not be permitted.

930.07.04.06 Construction Joints

Construction joints in concrete shall be permitted at the locations shown on the Contract Drawings and shall be according to OPSS 904. Any additional construction joints required to suit the construction operation and to meet the specified crack control criteria shall be subject to approval by the Contract Administrator.

930.07.04.07 Surface Finish

The surface finish shall be according to OPSS 904.

930.07.04.08 Surface Tolerance

The surface tolerance shall be according to OPSS 904.

930.07.04.09 Curing

930.07.04.09.01 General

Normal concrete shall be cured for a minimum period of 4 Days, except that for concrete subjected anytime to cold weather during the first 96 hours after concrete placement the curing period shall be extended to 7 Days.

930.07.04.09.02 Unformed Surfaces

Concrete shall be cured for the full duration of the curing period according to the Curing with Burlap and Water clause in OPSS 904. The burlap and the moisture vapour barrier shall then be removed and the concrete permitted to air dry for not less than 72 hours prior to any application of tack coat for waterproofing, where applicable.

930.07.04.09.03 Formed Surfaces

930.07.04.09.03.01 General

All exposed concrete surfaces of formed components shall be cured as specified in the Unformed Surfaces clause.

930.07.04.09.03.02 Concrete Patches, Formed Surface
Concrete Patches, Form and Pump

Curing shall be according to the following:

a) If the formwork is left in place for the duration of the curing period, no additional curing shall be required.

b) Where the formwork is to be removed within the specified curing period, curing shall be applied as specified in the Unformed Surfaces clause, curing shall be applied immediately after removal of the formwork and remain in place until the end of the curing period. Under no circumstance shall the concrete be left uncured for more than 2 hours during the removal of formwork.

930.07.04.09.03.03 Concrete Refacing
Concrete Refacing, Form and Pump

Burlap and water shall be applied immediately to the top of all exposed concrete surfaces, within 2 to 4 m of the finishing operation. The burlap shall be soaked for 24 hours prior to placing and shall be kept continuously wet by means of an operating soaker hose placed along the top of the component being refaced. The soaker hose shall be placed immediately after the concrete has set and its operation shall not cause fines to be washed out.

Forms for all surfaces, except soffit for structural components, shall be removed within 16 to 24 hours of concrete placement, unless the Contractor is unable to remove the forms due to structural concerns. All concrete surfaces shall be immediately covered with wet burlap and moisture vapour barrier for the remainder of the minimum curing period according to the requirements of Curing with Burlap and Water clause in OPSS 904. Under no circumstance shall the concrete be left uncured for more than 2 hours during the removal of the formwork.

Forms for soffit of structural components including decks, pier caps, beams, and arch ribs shall not be removed until the full curing time has elapsed.

930.07.05 Cold Weather Protection

930.07.05.01 General

Concrete shall be protected during cold weather. The protection system shall be designed for the worst conditions that can be reasonably anticipated from local weather records, forecasts, site conditions, and past experience for the time period during which the protection is required.

Regardless of ambient air temperature, overlays shall be moist cured with burlap and water at all times. During cold weather, burlap shall be prevented from freezing.

930.07.05.02 Control of Temperature and Temperature Difference

During cold weather, the temperature of the concrete shall be monitored and controlled according to the Control of Temperature and Temperature Difference subsection in OPSS 904, with the following exceptions:

a) Thermocouple wires shall be embedded near the concrete surface in a minimum of 4 locations for each Day of concrete placement, as directed by the Contract Administrator. Thermocouples for monitoring ambient air temperature shall be installed in the shade close to the surface of the concrete at a minimum frequency of 1 thermocouple for each Day of placement.

b) For cold weather conditions, protection of concrete shall, at a minimum, be as shown in Table 1. Protective measures shall be increased based on consideration of the specific type of rehabilitation in order to comply with the specified temperature constraints, as required.

c) The cold weather protection shall be gradually removed or reduced in such a manner that the maximum allowable drop of concrete temperature for each 24 hour period as shown in Table 1 is not exceeded. The protection shall not be totally removed nor shall the concrete be fully exposed to the air until the average concrete temperature is within 10 °C°C of the air temperature.

930.07.06 Material Sampling and Testing

930.07.06.01 Plastic Concrete Testing

The sampling and testing of the plastic concrete for slump, air content, and temperature shall be according to OPSS 1350 with the exception that the minimum frequency of testing shall be one test from each load of concrete. Results shall be recorded and shall be submitted to the Contract Administrator, upon request.

930.07.06.02 Early Strength Determination

Where early loading of concrete is proposed or anticipated, sets of cylinders for testing for early strength determination shall be prepared according to OPSS 904.

930.07.06.03 Samples for Compressive Strength, Air Void System Parameters and Rapid Chloride Permeability - Acceptance Testing

The Contractor shall be responsible for sampling and transportation of samples for acceptance testing of compressive strength, air void system, and rapid chloride permeability by the Owner according to OPSS 1350.

930.07.06.03.01 Samples for Acceptance Testing Where Rehabilitation Involves the Use of Anode Mesh Cathodic Protection

Cylinders for acceptance testing of compressive strength shall be according to OPSS 1350.

Where anode mesh is used, cores shall not be required and cylinders shall be cast for determination of air void system and rapid chloride permeability. One cylinder shall be made for determination of air void system parameters to represent each 300 m^2 of surface area of overlay and for each 100 m^2 of surface area of patches and refacing placed.

For silica fume overlays, two additional cylinders shall be made for determination of rapid chloride permeability to represent each 300 m^2 of surface area of overlay placed. One cylinder shall be used for acceptance testing and the remaining cylinder shall be retained for referee testing.

The cylinders shall be 100 mm diameter x 200 mm long and shall be made, field cured, and transported according to the Test Cylinders clause in OPSS 1350.

930.07.06.04 Tensile Bond Strength

The following shall be marked to facilitate the selection of testing locations and avoid damage to the embedded materials due to coring:

a) For rehabilitation involving use of anode mesh cathodic protection in overlay, the locations of anode distribution bars, wiring, and embedded hardware.

b) For rehabilitation involving use of glass fiber reinforced polymer (GFRP) reinforcing, the reinforcing bar locations.

Application of tack coat, where applicable, shall not be carried out until the testing of tensile bond strength is completed.

930.07.06.05 Filling of Core Holes

Filling of core holes shall be according to OPSS 1350.

930.07.07 Remedial Work

Remedial work shall be carried out as shown in Table 2.

Treatment for deck with waterproofing and paving shall not begin until the specified curing period and the air drying period has elapsed. For all other exposed components, the treatment shall not begin until a minimum period of 28 Days has elapsed after placement of concrete.

Repair of cracks shall be according to OPSS 932. Alternatively, a proposal for repair may be submitted to the Contract Administrator for review to show that the repair method and material shall be able to restore the structural integrity of the concrete across the cracks. The inspection and monitoring of cracks shall continue up to the date of waterproofing or completion of the Work, whichever is later.

The application of tack coat for waterproofing shall not proceed until all defects have been addressed and remedial work accepted by the Contract Administrator.

930.07.08 Modification of Deck Drains

Modification of deck drains shall be made prior to waterproofing the deck.

930.07.09 Drainage Tubes in Deck

Installation of drainage tubes shall be made prior to waterproofing the deck.

930.07.10 Management of Excess Materials

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

930.08 QUALITY ASSURANCE

930.08.01 Testing - Tensile Bond Strength

The Contract Administrator shall use a covermeter to locate steel reinforcement prior to testing in order to avoid coring through the steel and shall perform the sampling and testing of cores from overlays, concrete patches, and concrete refacing to determine tensile bond strength.

A lot shall consist of the total quantity of concrete patches, concrete refacing, or overlay for each item, except for the following where tensile bond shall not be measured:

a) When the total measured area of concrete patches on a structure is less than 20 m^2.

b) When the total area of concrete refacing on a structure is less than 20 m^2.

c) In circular columns with spiral reinforcement.

Each lot shall be divided into sublots as follows:

a) Sublots for overlays shall be approximately equal in size and not greater than 300 m^2. Separate sublots are required for each overlay placement.

b) Sublots for concrete patches shall not be combined with areas of concrete refacing for determining sublots. Sublots shall be approximately equal in size and not greater than 100 m^2. Work on different structures shall not be combined in the same sublot.

c) Soffit repairs shall be a separate sublot and a sublot shall not be greater than 100 m^2.

The tensile bond strength testing shall be carried out on 3 in-situ cores taken within 1 m of each other for each sublot. The core locations shall be randomly selected by the Contract Administrator. Additional testing shall not be permitted.

The cores shall be obtained by the Contract Administrator according to CSA A23.2-14C. Cores shall be 100 mm in diameter and extend into the parent concrete to the depth as specified in LS-430. The testing shall be according to LS-430 and shall be carried out when the concrete is 7 to 10 Days of age. The equipment used to measure the tensile bond strength shall be equipped with a maximum load indicator.

If a core comes loose during coring operation, another core shall be obtained within 300 mm of the original core location.

If failure occurs in the epoxy adhesive and the specified strength of 1.0 MPa has not been reached, the test shall be repeated within 300 mm of the original core location. If a failure occurs fully within the parent concrete, this shall be considered a valid result, unless the Contractor has been directed to leave unsound concrete in place. Retesting is not required when the specified strength of 1.0 MPa has been achieved

Individual test results shall be forwarded to the Contractor, as they become available.

930.08.02 Inspection After Curing

The Contract Administrator shall inspect the Work to determine if the completed work contains any of the following defects:

a) Areas of debonding.

b) Honeycombed areas, spalls, and cold joints.

c) Cracks requiring remedial work as shown in Table 2.

930.08.03 Acceptance

930.08.03.01 Concrete Compressive Strength, Air Void System in Hardened Concrete or Rapid Chloride Permeability for Silica Fume Overlays

Acceptance, referee testing and referee testing cost of concrete compressive strength, air void system in hardened concrete, and rapid chloride permeability for silica fume overlays shall be according to OPSS 1350.

930.08.03.02 Tensile Bond Strength

For a sublot to be acceptable, the average tensile bond strength of the sublot shall be a minimum of 1.0 MPa. Sublots with average tensile bond strength less than 1.0 MPa and more than or equal to 0.8 MPa shall be accepted with payment reduction. The payment reduction factor (Pr_i) for the tensile bond strength testing for each sublot shall be calculated based on the following equation:

$$Pr_i = 1.25 (1 - B)$$

Where:

B = The average tensile bond strength (MPa) for each sublot. For the purpose of calculating the payment reduction factor, a value of 1.0 MPa shall be used for B when the average tensile bond strength is greater than 1.0 MPa.

i = Sublot number

The payment reduction, Pr, for the lot is calculated by one of the following equations:

For the concrete patches, concrete refacing, place concrete overlay, and place silica fume concrete overlay items, the following equation shall be used:

$$Pr = \text{Tender Unit Price} \times [(Pr_1 \times LQ_1) + (Pr_2 \times LQ_2) ..... (Pr_n \times LQ_n)]$$

Where:

Pr_i = The payment reduction for sublot i

LQ_i = Quantity for sublot i (m^3)

n = The total number of sublots

For the finish and cure concrete overlay and finish and cure silica fume concrete overlay items, the following equation shall be used:

$$Pr = \frac{\text{Lump Sum} \times [(Pr_1 \times SA_1) + (Pr_2 \times SA_2) ..... (Pr_n \times SA_n)]}{SA_T}$$

Where:

Pri = The payment reduction for sublot i
SA_i = Surface area for sublot i (m^2)
SA_T = Total surface area of the lot (m^2)
n = The total number of sublots

For the purpose of calculating the payment reduction for concrete overlays, the Pr shall be applied to both place concrete overlay and finish and cure concrete overlay items.

For the purpose of calculating the payment reduction for silica fume concrete overlays, the Pr shall be applied to both place silica fume concrete overlay and finish and cure silica fume concrete overlays items.

930.08.03.03 Acceptance at the Completion of Work

The Contract Administrator shall reject all or a portion of the sublot based on:

a) The presence of debonding, honeycombed areas, spalls and cold joints.

b) Cracks as shown in Table 2.

c) Average tensile bond strength less than 0.8 MPa.

d) Any work that does not meet the requirements of this specification and the acceptance requirements of OPSS 1350.

e) Unsatisfactory completion of remedial work associated with surface tolerance, surface finish, cracks, or any other deficiencies.

930.08.03.04 Performance During General Warranty Period

In addition to the acceptance requirements stated herein, concrete in the structure shall meet the requirements as shown in Table 2 during and up to the end of the general warranty period.

930.09 MEASUREMENT FOR PAYMENT

930.09.01 General

For all types of overlays, there shall be no measurement for the following:

a) Concrete produced in excess of that required for the placing operation.

b) Quantity of bonding agent.

For construction joints in overlay that do not meet the requirements specified in this specification and is deemed unacceptable by the Contract Administrator, the portion of overlay removed shall be deducted from the volume indicated on the delivery ticket.

No measurement shall be made for areas of new overlays, concrete patches, and concrete refacing that were removed according to the requirements of the Remedial Work subsection.

930.09.02 Actual Measurement

930.09.02.01 Place Concrete Overlay
Place Silica Fume Concrete Overlay

Measurement shall be by the volume of concrete placed, including concrete placed in partial depth removals, in cubic metres by delivery ticket. Deductions shall be made for the following:

a) Concrete produced in excess of that required for the placing operation.

b) The portion of the overlay that is sawcut back and removed at the construction joint.

c) The portion of concrete removals not approved by the Contract Administrator.

The total volume shall be calculated to the nearest cubic metre.

930.09.02.02 Concrete Patches, Formed Surface
Concrete Patches, Unformed Surface
Concrete Patches, Form and Pump
Concrete Refacing
Concrete Refacing, Form and Pump

930.09.02.02.01 By Volume

Measurement shall be by the volume of concrete placed in cubic metres.

The volumes shall be calculated by multiplying each area to be patched by the average depth. Depths shall be taken on a grid system to best describe the profile at the particular area. The Contract Administrator, in the presence of the Contractor, shall take a minimum of 3 measurements for each removal area or 10 for every m^2, after concrete removal is completed by placing a straight edge across the removal area and measuring the depth from the straight edge to the concrete.

The depths shall be measured and averaged to the nearest millimetre.

No measurement shall be made for concrete required to fill localized areas behind the second layer of steel reinforcement.

The total volume shall be calculated to the nearest 0.1 m^3.

930.09.02.03 Modification of Deck Drains

For measurement purposes, a count shall be made of the number of deck drains modified.

930.09.02.04 Drainage Tubes in Deck

For measurement purposes, a count shall be made of the number of drainage tubes placed.

930.09.03 Plan Quantity Measurement

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

930.10 BASIS OF PAYMENT

930.10.01 Modification of Deck Drains - Item
Drainage Tubes in Deck - Item
Place Concrete Overlay - Item
Place Silica Fume Concrete Overlay - Item
Finish and Cure Concrete Overlay - Item
Finish and Cure Silica Fume Concrete Overlay - Item
Concrete Patches, Formed Surface - Item
Concrete Patches, Unformed Surface - Item
Concrete Patches, Form and Pump - Item
Concrete Refacing - Item
Concrete Refacing, Form and Pump - Item

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work, subject to payment adjustments as specified in the Contract Documents. Payment at the Contract price for the above tender items shall also include abrasive blast cleaning of the concrete surface for concrete patches and concrete refacing. Payment for abrasive blast cleaning of steel reinforcement and the concrete surface to receive an overlay shall be administered according to OPSS 929.

When the Contract does not contain a separate tender item for providing access to the work, the Contract price for the concrete patching and concrete refacing items shall include full compensation for all labour, Equipment, and Material to do the work, including provision of access.

No payment shall be made for normal concrete, silica fume concrete or self-consolidating concrete or both required to patch, reface, or overlay areas of concrete removal where the removal was not approved by the Contract Administrator.

TABLE 1
Minimum Cold Weather Protective Measures

Anticipated Minimum Air Temperature °C	**Protective Measure**
+10 to +6	PM2
+5 to 0	PM3
-1 to –5	PM4
-6 and lower	PM5
Maximum Allowable Drop in Concrete Temperature / 24 hours	15 °C

PM2 - Protective Measure - Cover concrete with insulation having an R-Value of 0.67 **
PM3 - Protective Measure - Cover concrete with insulation having an R-Value of 1.33 **
PM4 - Protective Measure - Cover concrete with insulation having an R-Value of 2.00 **
PM5 - Protective Measure - House and heat according to the Housing and Heating clause of OPSS 904.

** Note: ~~-~~All R-Values are metric.

The conversion factor from metric to imperial unit is:

Metric R value x 5.678 = Imperial R value

~~Table~~TABLE 2
Performance Requirements at Time of Construction and During Warranty Period

	Test Method	Performance Requirements	Consequence of Non-Conformance
Concrete Surface Scaling	Visual inspection and assessment of severity of-scaling according to Figures 1 to 6.	At the end of the warranty period, there shall be no medium or severe scaling and total area of light scaling shall be no more than 5% of the component.	Areas of medium and severe scaling shall be removed and replaced full depth. For light scaling greater than 5% of the component, the Contractor shall submit a repair proposal for approval by the ministry.
Concrete Delamination or Debonding	As described in the Structure Rehabilitation Manual.	Delaminated or debonded areas shall not be present.	Remove and replace.
Cracks	Visual inspection and measurement by means of crack comparator. Width of crack is measured at the widest point of the crack, not average width of crack. Cracks in overlays and patches to be waterproofed shall be measured after the air drying period.	For overlays and patches to be waterproofed and paved, width of cracks shall be less than 0.50 mm and linear measurement of cracks greater than 0.50 mm within 1 m^2 shall be less than 2 m.	Repair cracks greater than 0.50 mm in width according to OPSS 932, unless the linear measurement of cracks greater than or equal to 0.50 mm per m^2 exceeds 2 m. -If the linear measurement of cracks greater than 0.50 mm in width exceeds 2 m per m^2, remove and replace.
		For exposed overlays, refacing and patches, width of cracks shall be less than 0.30 mm and linear measurement of cracks greater than 0.30 mm within 1 m^2 shall be less than 2 m.	Repair cracks greater than 0.30 mm in width according to OPSS 932, unless the linear measurement of cracks greater than or equal to 0.30 mm per m^2 exceeds 2 m. -If the linear measurement of cracks greater than 0.30 mm in width exceeds 2 m per m^2, remove and replace.
Spalls, Exposed Reinforcement, Honey-Combing, and Other Observed Unanticipated Defects and Deterioration	Visual inspection.	Spalls, exposed reinforcement, honey-combing, or other observed defects and deterioration shall not be present at the end of the warranty period.	Remove and replace.

Note:

A. Where the area failing to meet the performance requirement is a large proportion of the repair area, the entire repair shall be removed and replaced.

FIGURE 1
Example of Light Scaling

FIGURE 2
Example of Light Scaling

FIGURE 3
Example of Medium Scaling

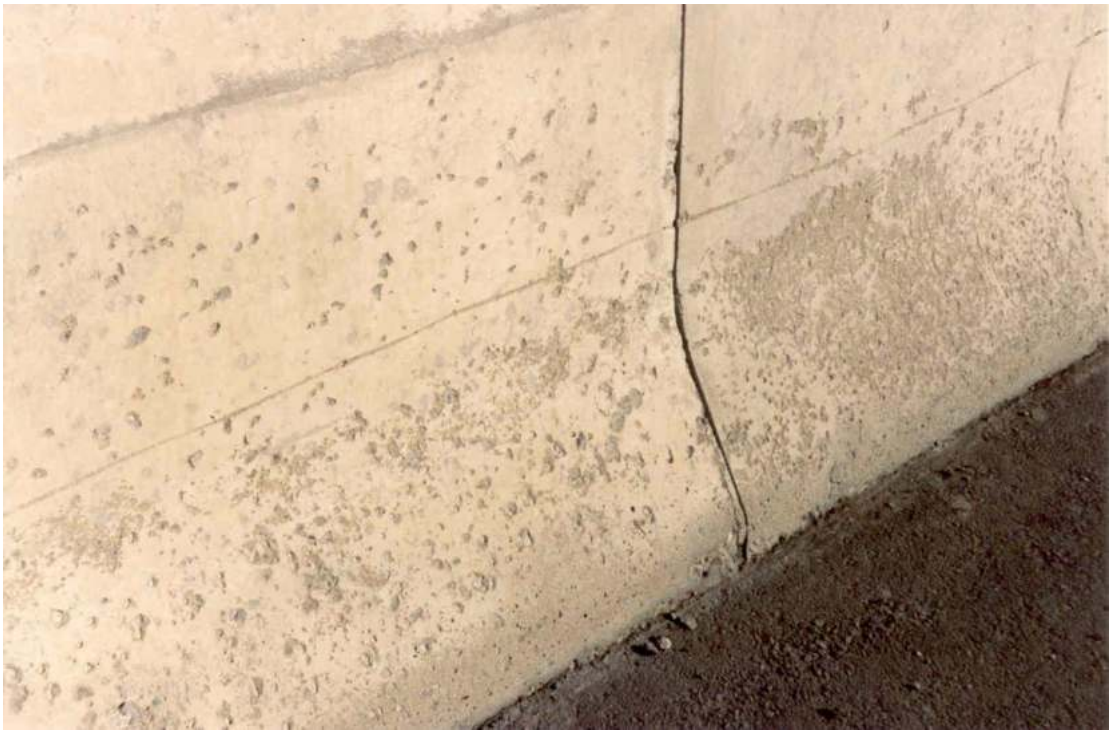


FIGURE 4
Example of Medium Scaling

FIGURE 5
Example of Severe Scaling

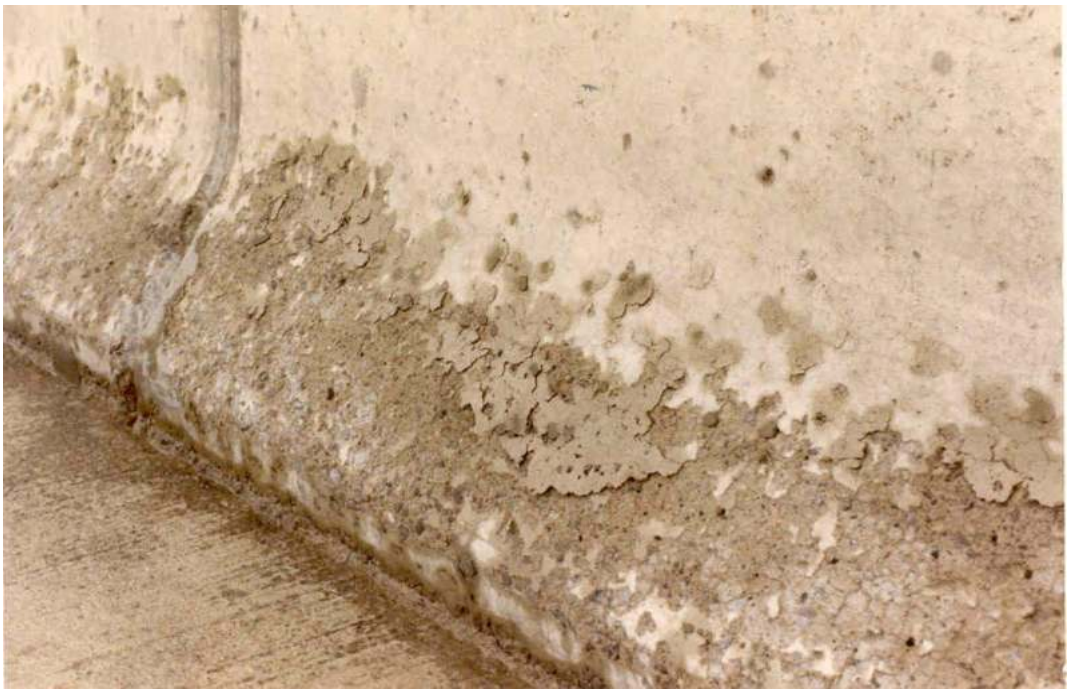
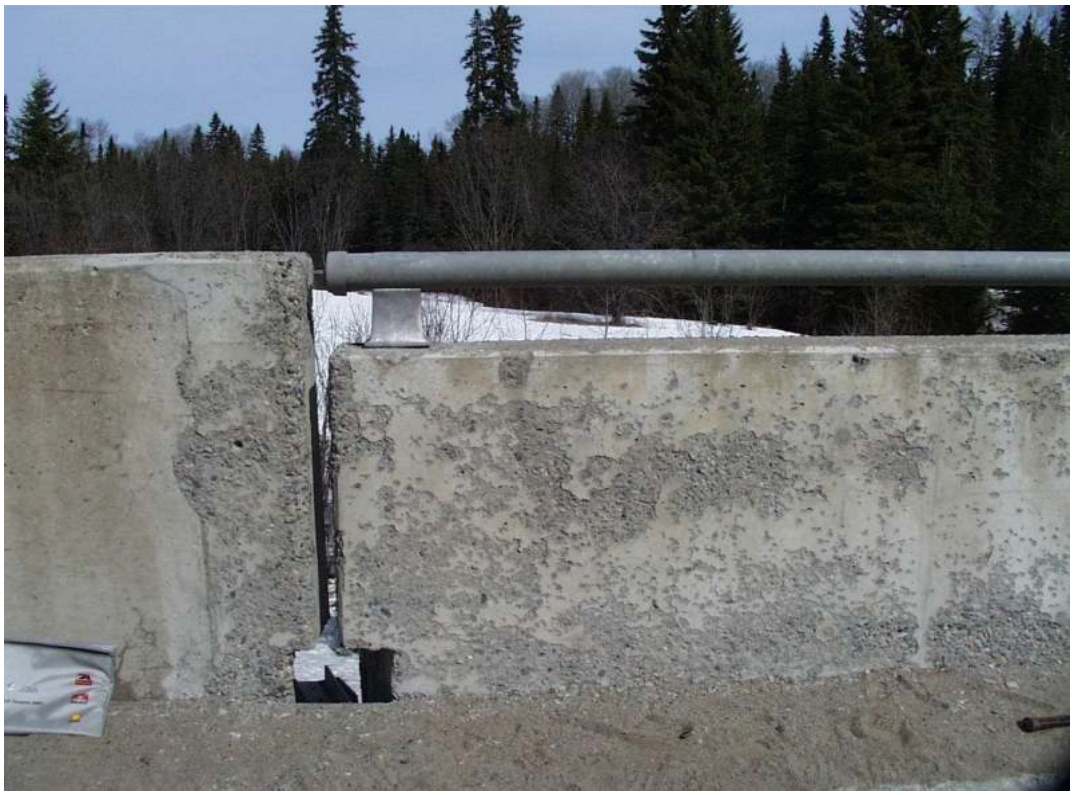


FIGURE 6
Example of Severe Scaling



FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

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

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.

Note: The 930 implemented in April 2025 replaces 930, November 2014 with no technical content changes.

CONSTRUCTION SPECIFICATION FOR STRUCTURE REHABILITATION - CONCRETE PATCHES, REFACING, AND OVERLAYS

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930.01 SCOPE

This specification covers the requirements for concrete structure rehabilitation, including; concrete patches, concrete refacing, normal concrete overlays, and silica fume concrete overlays.

930.02 REFERENCES

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

Ontario Provincial Standard Specification, Construction

OPSS 904 Concrete Structures
OPSS 905 Steel Reinforcement for Concrete
OPSS 919 Formwork and Falsework
OPSS 928 Structure Rehabilitation - Concrete Removal
OPSS 929 Abrasive Blast Cleaning - Concrete Construction
OPSS 932 Crack Repair - Concrete

Ontario Provincial Standard Specification, Material

OPSS 1302 Water
OPSS 1350 Concrete - Materials and Production

Ontario Ministry of Transportation Publications

Structure Rehabilitation Manual

MTO Laboratory Testing Manual:
LS-430 Method of Test for Bond Strength by Tensile Load
LS-435 Method of Test for Linear Shrinkage of Concrete
LS-601 Materials Finer than 75 µm Sieve in Mineral Aggregates by Washing
LS-607 Determination of Percent Crushed Particles in Processed Coarse Aggregate

MTO Forms:
PH-CC-736 Notification of Placement of Concrete

CSA Standards

A23.2-14C	Obtaining and Testing Drilled Cores for Compressive Strength Testing*
C22.2 No. 211.2-M1984 (1992)	Rigid PVC (Un-plasticized) Conduit
G30.5-M1983 (R1998)	Welded Steel Wire Fabric for Concrete Reinforcement

* [Part of A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete]

ASTM International

A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153-09	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
D4285-83-(R2006)	Method for Indicating Oil or Water in Compressed Air

930.03 DEFINITIONS

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

Concrete Patches, Formed Surfaces means concrete patches where at least one face of the patch requires formwork.

Concrete Patches, Unformed Surfaces means concrete patches located in the top surface of decks, sidewalks, and curbs where no formwork is required.

Concrete Refacing means concrete refacing where at least one of the surfaces of a component is entirely overlaid with concrete. Concrete refacing typically applies to pier columns, pier caps, abutments, vertical walls of culverts and tunnels, concrete barrier, and parapet walls.

Form and Pump Placement Method means a method of placing concrete by pumping directly into formwork through injection ports.

Hot Weather means those conditions when the air temperature is at or above 28°C. It is also considered to exist when the air temperature is at or is likely to rise above 28°C within 24 hours after concrete placement. Temperature refers to shade temperature.

Injection Port means a mechanical device with a manual shut-off that is attached to the formwork and connected to the discharge line of a pump to facilitate delivery of concrete directly into the formwork.

Rehabilitation means any modification, alteration, or improvement to a structure or its components that is designed to correct defects or deficiencies.

Self-Consolidating Concrete (SCC) means a highly flowable yet stable concrete that can spread readily into place, fill the formwork, and encapsulate the reinforcement without any mechanical consolidation or vibration and without undergoing segregation or excessive bleeding. It may be designed for high strength and durability in addition to flow characteristics.

Segregation means visible separation of the mortar and coarse aggregate particles in the plastic concrete resulting in concrete that is not uniform in appearance or proportions.

Silica Fume Concrete means concrete which includes silica fume and may in addition include other supplementary cementing materials having specified rapid chloride permeability at 28 to 32 Days of 1,000 coulombs or less.

Structure means any bridge, culvert, tunnel, retaining wall, wharf, dock, guideway, or any part thereof or other reinforced concrete component designed to carry loads, including high mast pole footings and sign support footings.

930.04 DESIGN AND SUBMISSION REQUIREMENTS

930.04.01 Design Requirements

930.04.01.01 Formwork and Falsework

Design submission shall be according to OPSS 919 with the following additional requirements:

a) Working Drawings for soffit repairs shall be designed and sealed by an Engineer.

b) Formwork and falsework for soffit repairs subjected to live traffic vibrations on the deck shall be designed for an additional dynamic load allowance of 50% the weight of plastic concrete being supported.

Timber formwork and falsework for soffit repairs shall be designed using permanent load duration factors and shall accommodate additional pressure due to pumping of repair concrete.

930.04.02 Submission Requirements

930.04.02.01 Notification of Placement of Concrete

Prior to each placing operation, form PH-CC-736, accompanied by all supporting documentation as indicated on the form shall be submitted to the Contract Administrator.

930.04.02.02 Cold Weather Protection

930.04.02.02.01 General

A description of the methods to be used to control the concrete temperature and temperature difference in cold weather shall be submitted to the Contract Administrator 3 Days prior to the commencement of concrete production. Cold weather is considered to exist when the air temperature is at or below 10°C. It is also considered to exist when the air temperature is at or is likely to fall below 10°C within 96 hours after concrete placement. Temperature refers to shade temperature. The submission shall be according to the Temperature Control Plans clause of OPSS 904.

930.04.02.02.02 Temperature Records

Datalogger temperature records and a record of any actions taken to maintain control of temperature and temperature difference shall be submitted to the Contract Administrator at the end of each Business Day during the temperature monitoring period. At the end of the temperature monitoring period, a complete temperature record shall be submitted to the Contract Administrator.

930.04.02.03 Concrete Mix Design

Concrete mix design submissions shall be according to OPSS 1350, with the additional requirement that test data for linear shrinkage shall be required and submitted within 40 Days of the mix design submission.

930.04.02.04 Hot Weather Concreting

A description of the methods to be used to control the concrete temperature shall be submitted to the Contract Administrator 3 Days prior to the commencement of concrete production in hot weather.

930.04.02.05 Placement Methods

When the form and pump placement method is specified in the Contract Documents or self-consolidating concrete is used, 4 copies of the details of the placement method shall be submitted to the Contract Administrator at least 3 Days prior to commencement of the work. The details shall include methodology and equipment to be used and shall bear the seal and signature of an Engineer.

930.04.02.06 Formwork and Falsework

Working Drawings for soffit repairs shall be submitted to the Contract Administrator 3 Days prior to the commencement of formwork and falsework installation, for information purposes only.

930.05 MATERIALS

930.05.01 General

The following materials shall be according to OPSS 904:

a) Burlap.

b) Insulation material.

c) Moisture vapour barrier.

If a bonding agent is used, it shall be compatible with the repair material.

930.05.02 Anchors

Anchors for the attachment of the welded steel wire fabric to the concrete surface shall be galvanized according to ASTM A153 and be of adequate length and strength to resist a pull-out force of 1.0 kN.

930.05.03 Concrete

The concrete shall be according to OPSS 1350 with the following modifications:

a) The minimum specified 28-Day compressive strength shall be 30 MPa, except for silica fume overlays which shall be 40 MPa.

b) Coarse aggregates for overlays shall consist of a minimum of 60% crushed particles when tested according to MTO LS-607 and shall have 1.00% by mass maximum passing the 75 µm sieve when tested according to MTO LS-601. Coarse aggregate for overlays that form the bridge deck riding surface shall be composed of at least 80% siliceous rocks and minerals.

c) Linear shrinkage test data for each mix design shall be submitted for information purposes. Testing shall be carried out in accordance with LS-435 and specimens may be cast at the ready mixed plant or at the site. Laboratory testing shall be carried out by a laboratory who has participated in an MTO correlation program for linear shrinkage.

d) For concrete patches where the longest dimension, width or length, of individual patches is less than 400 mm, a proposal may be submitted to the Contract Administrator for approval to use a proprietary patching material. The patching material shall be mixed, handled, and cured according to the manufacturer's instructions.

e) SCC will be considered on an individual project basis for patches and refacing subject to the Contract Administrator's approval. If permitted for use, SCC shall be according to the ministry's current specification for SCC. A copy of the specification can be obtained from the Ministry's Material Engineering and Research Office, 1201 Wilson Avenue, Downsview, M3M 1J8.

930.05.04 Drainage Tubes

Rigid polyvinyl chloride (PVC) drainage tubes shall be according to CSA C22.2 No. 211.2. Galvanized steel drainage tubes shall be according to ASTM A53/A53M and galvanizing shall be according to ASTM A123.

930.05.05 Forms

Forms shall be according to OPSS 919, with the exception that all forms shall be medium density overlay plywood.

930.05.06 Proprietary Patching Materials

Proprietary patching materials shall be from the ministry's list of concrete patching materials.

930.05.07 Tie Wire

Tie wire shall be according to OPSS 905.

930.05.08 Welded Steel Wire Fabric

Welded steel wire fabric shall be welded galvanized steel and shall be according to CSA G30.5. Galvanizing shall be according to ASTM A123.

930.05.09 Water

Water used for curing, fog-misting of concrete, pre-soaking of burlap, and bonding agent shall be according to OPSS 1302.

930.06 EQUIPMENT

930.06.01 General

The following equipment shall be according to OPSS 904:

a) Bridge deck finishing machine, screed rails, screed rail chairs, and work bridges used for overlays.

b) Consolidating equipment.

c) Hand finishing tools.

d) Straight edges.

930.06.02 Buggies

Buggies used for transporting and placing the concrete may be hand operated or motorized. Motorized concrete buggies shall have a capacity no greater than 0.5 m^3.

930.06.03 Compressor - Air Blasting

The compressed air shall be clean, dry, and free from oil residue and other contaminants when tested according to ASTM D4285.

930.06.04 Fog Misting Equipment

Fog misting equipment shall be provided for the curing of the silica fume concrete overlays. Hand held fogging wands shall be used.

A fogging system mounted on the finishing machine may also be used, provided it does not result in dripping or accumulation of water on the concrete surface.

930.06.05 Form and Pump Placement Method Equipment

When the form and pump placement method is specified in the Contract Documents, the pump shall be a positive displacement type pump and shall be capable of delivering adequate volumes of concrete to maintain a continuous placement.

930.06.06 Sawing Equipment - Overlays

The sawing equipment shall be self-propelled and capable of sawing the concrete overlay full depth in one pass.

930.07 CONSTRUCTION

930.07.01 General

Typical locations and areas of repair are as shown on the Contract Drawings; however, the actual locations and extent of repair shall be as determined during the layout of the repair areas according to OPSS 928 and as directed by the Contract Administrator.

930.07.02 Operational Constraints

The Contract Administrator shall be notified of the intent to place the overlay, concrete patches, or concrete refacing 1 Business Day prior to the commencement of the placing operation. The work shall not proceed until the concrete surface preparation has been completed and form PH-CC-736 has been received and signed by the Contract Administrator.

Construction equipment shall be permitted on the bridge deck or other concrete components, provided that:

a) Contamination by oil or other deleterious substances is prevented.

b) Equipment vehicles and runways are not supported by steel reinforcement.

c) Only the finishing machine and buggies used to place concrete are allowed on the abrasive blast cleaned portions of the deck or other concrete components. No other vehicles or equipment, including concrete ready mix trucks shall be permitted.

d) Heavy vehicles such as concrete ready mix trucks or dump trucks shall not be permitted on any portion of the deck, within a span, once concrete removals within the deck have commenced in that span.

No construction vehicles, equipment, or traffic, with the exception of sawcutting equipment shall be permitted on the finished surface of the overlay, patches, and on deck surface directly over soffit patches or refacing until the curing and cold weather protection period has been completed and a minimum compressive strength of 25 MPa has been attained.

Prior to seasonal shutdown, operations shall be scheduled in such a manner to ensure that overlays, concrete patches, and concrete refacing are completed in all areas where concrete removal has commenced. No steel reinforcement shall be left exposed during seasonal shutdown.

930.07.03 Normal Concrete Overlay
Silica Fume Concrete Overlay

930.07.03.01 Minimum Thickness of Overlay

The thickness of the overlay shall be according to the requirements of the Contract Drawings with no areas less than 45 mm in thickness.

930.07.03.02 Surface Preparation

All concrete surfaces against which new concrete is to be placed shall be clean, sound and free from loose or unsound fragments, coatings and any other foreign substances or debris, and shall be sufficiently rough to ensure that a full bond is developed with the new concrete.

A bonding agent may be used. The Contract Administrator shall be notified in writing whether a bonding agent is to be used and, if so, the bonding agent shall be identified.

The portion of curb face, barrier wall or parapet wall, and all existing concrete surfaces which have not been scarified, against which new concrete is to be placed, shall be uniformly roughened by means of scabbling, chipping, or bush hammering. A surface profile of 5 ± 2 mm shall be achieved by exposing the aggregates across the entire surface.

All concrete surfaces and steel reinforcement to receive the overlay shall be abrasive blast cleaned according to OPSS 929.

Immediately prior to pre-wetting the concrete surface, all dust and loose material shall be removed from the prepared surface by using compressed air, except where anode mesh is to be used.

When anode mesh is required, the concrete surface shall be pressure washed with water using a pressure not less than 10 MPa with the anode mesh in place. The pressure washing shall take place immediately prior to pre-wetting. All debris resulting from drilling of anchor holes and other accumulated dirt adhering to the anode or concrete surfaces shall be removed.

All concrete surfaces to receive an overlay shall be pre-wetted and continuously maintained in a wet condition for a minimum period of 6 hours immediately prior to the application of the concrete overlay or bonding agent when used. Excess water shall be removed from the surface using compressed air immediately prior to the application of the bonding agent or concrete overlay.

930.07.03.03 Placing of Screed Rails

Supports for the screed rails shall be installed outside the area to be overlaid or waterproofed. The screed rails shall be continued beyond the deck, at each end, to a length that will enable the finishing machine to be driven beyond the end of deck.

930.07.03.04 Dry Run

A dry run shall be made to verify that the minimum thickness of the overlay can be achieved, in the presence of the Contract Administrator, prior to each placing operation.

The Contract Administrator shall be notified at least 1 Business Day in advance of a dry run. When the dry run indicates that an unsatisfactory thickness will result, the screed rails shall be adjusted in order to obtain the minimum thickness and the dry run repeated in the area of screed rail adjustment.

For silica fume concrete overlays, the ability to successfully fog mist shall be demonstrated to the Contract Administrator at the time of the dry run. The same equipment and process shall be used to fog mist the overlay.

930.07.03.05 Placing of Concrete

The placing of concrete shall be according to OPSS 904 with the following modifications:

a) Concrete shall not be placed when the ambient air temperature or existing concrete surface temperature is below 10°C or likely to fall below 10°C, or is above 30°C or likely to rise above 30°C throughout the duration of the concrete placing operation.

   Prior to placing new concrete, it shall be demonstrated to the Contract Administrator that the substrate temperatures meet the Contract requirements, by measuring and recording the substrate temperatures using a contact thermometer or infrared thermometer.

b) Concrete shall not be placed adjacent to any new concrete less than 48 hours old. If the ambient air temperature falls below 10°C within the first 48 hours after placement of concrete, the 48 hour time requirement shall be extended to 96 hours.

   In addition, for staged overlay construction, concrete shall not be placed adjacent to any new concrete having a compressive strength less than 20 MPa.

c) All concrete overlay 3 m or wider shall be placed with bridge deck finishing equipment.

d) Any concrete or bonding agent deposited in areas other than the intended point of discharge shall be removed immediately.

e) Unless otherwise specified in the Contract Documents, concrete for partial depth removal areas shall be placed at the same time as the overlay. Concrete for full depth removal areas shall be placed prior to placing the overlay and left with a rough surface finish.

f) Cold joints shall not be permitted.

930.07.03.06 Construction Joints

Construction joints shall be permitted only where shown in the Contract Drawings or in the case of unexpected interruptions during the placing operation, as directed by the Contract Administrator.

All construction joints shall be formed using bulkheads. The height of the bulkhead shall match the thickness of the overlay.

The edge and face created by the bulkhead shall be a clean vertical face free from any defects such as honeycombing or spalls. If the construction joint formed by the bulkhead is deemed unacceptable by the Contract Administrator, a new construction joint shall be created by sawcutting back to a limit where the quality of concrete is acceptable to the Contract Administrator.

930.07.03.07 Surface Finish

The surface finish shall be according to OPSS 904.

930.07.03.08 Surface Tolerance

The surface tolerance shall be according to OPSS 904.

930.07.03.09 Surface Texture

Where the surface of the overlay forms the driving surface of the bridge deck, the surface shall be given a texture with a wire broom or comb having a single row of tines. The required texture shall be transverse grooves which may vary from 1.5 mm width at 15 mm centres to 4.5 mm width at 20 mm centres with a groove depth varying from 3.0 mm to 4.5 mm. The texture shall extend uniformly to within 300 mm of the curb or barrier wall or parapet wall.

930.07.03.10 Curing

Normal concrete overlay shall be cured according to the requirements for Curing with Burlap and Water clause of OPSS 904 for a minimum curing period of 4 Days, except that for concrete subjected anytime to cold weather during the first 96 hours after concrete placement, the curing period shall be extended to 7 Days.

Silica fume concrete overlay shall be cured according to the requirements for high performance concrete (HPC) of OPSS 904 for a minimum curing period of 7 Days.

Where waterproofing is to be applied to an overlay following curing with burlap and water, the overlay shall be air dried for at least 72 hours prior to the application of waterproofing.

930.07.04 Concrete Patches, Formed Surface
Concrete Patches, Unformed Surface
Concrete Patches, Form and Pump
Concrete Refacing
Concrete Refacing, Form and Pump

930.07.04.01 Surface Preparation

All concrete surfaces against which new concrete is to be placed shall be clean, sound and free from loose or unsound fragments, coatings, and any other foreign substances or debris and shall be sufficiently rough to ensure that a full bond is developed with the new concrete.

A bonding agent may be used. The Contract Administrator shall be notified in writing whether a bonding agent is to be used and, if so, the bonding agent shall be identified.

All existing concrete surfaces against which new concrete is to be placed shall be uniformly roughened by means of scabbling, chipping, or bush hammering. A surface profile of 5 ± 2 mm shall be achieved by exposing the aggregates across the entire surface.

All concrete surfaces and steel reinforcement to receive new concrete shall be abrasive blast cleaned according to OPSS 929.

Immediately prior to pre-wetting the concrete surface, all dust and loose material shall be removed from the prepared surface of the repair area by using compressed air.

The surface of the existing concrete shall be pre-wetted and continuously maintained in a wet condition for a period of 6 hours immediately prior to placing any new concrete. Prior to placing concrete, excess water shall be removed from the surface using compressed air.

930.07.04.02 Placement of Welded Steel Wire Fabric

When welded steel wire fabric is specified in the Contract Documents, it shall not be installed until after the concrete surface and exposed steel reinforcement in the repair area have been abrasive blast cleaned. The welded steel wire fabric shall not be abrasive blast cleaned at any time.

Where there is no exposed steel reinforcement, the wire fabric shall be fastened to the concrete with anchors placed no further than 600 mm apart, in a grid pattern.

Where steel reinforcement is exposed, the wire fabric shall be securely fastened to the steel reinforcement by tie wires placed no further than 600 mm apart, in a grid pattern. When the exposed steel reinforcement is not capable of providing rigid support for the wire fabric, anchors shall be used to support the wire fabric.

The wire fabric shall be installed flat, tight, and at the locations shown in the Contract Drawings using spacers and anchors. The edges of adjoining wire fabric shall overlap by two-wire spacing plus 100 mm. The wire fabric shall be kept clean of any contamination that could reduce the bond of the repair material to the wire surface.

930.07.04.03 Installation of Anchors and Dowels

Holes for anchors and dowels shall be drilled into the concrete at the location and spacing as specified in the Contract Documents. They shall be installed in such a way as to not cause delamination or other damage to the surrounding concrete. Each anchor used to fasten the welded steel wire fabric into the concrete shall be installed to resist a pull out force of at least 1.0 kN at either sides of the concrete interface.

930.07.04.04 Formwork and Falsework

The erection and removal of formwork and falsework shall be according to OPSS 919 and it shall be designed to retain the concrete and withstand the placement pressures. The formwork shall be placed to provide the specified cover to steel reinforcement or welded steel wire fabric, or both, as specified in the Contract Documents. When this results in over-building of the existing concrete surface, a 1H:1V slope shall be provided to meet the existing surface at the edges of the repair area. The perimeter of the formwork shall be sealed to be grout-tight. Vent holes shall be installed at the highest locations.

930.07.04.05 Placing of Concrete

The placing of concrete shall be according to OPSS 904 with the following modifications:

a) Concrete shall not be placed when the ambient air temperature or existing concrete surface temperature is below 10°C or likely to fall below 10°C or is above 30°C or likely to rise above 30°C throughout the duration of the concrete placing operation.

   Prior to placing new concrete, it shall be demonstrated to the Contract Administrator that the substrate temperatures meet the Contract requirements by measuring and recording the substrate temperatures using a contact thermometer or infrared thermometer.

b) Concrete shall not be placed adjacent to any new concrete less than 48 hours old. If the ambient air temperature falls below 10°C within the first 48 hours after placement of concrete, the 48 hour time requirement shall be extended to 96 hours.

c) For form and pump method, the port arrangement and pumping procedures shall be designed to ensure that requirements of this specification are met.

d) Cold joints shall not be permitted.

930.07.04.06 Construction Joints

Construction joints in concrete shall be permitted at the locations shown on the Contract Drawings and shall be according to OPSS 904. Any additional construction joints required to suit the construction operation and to meet the specified crack control criteria shall be subject to approval by the Contract Administrator.

930.07.04.07 Surface Finish

The surface finish shall be according to OPSS 904.

930.07.04.08 Surface Tolerance

The surface tolerance shall be according to OPSS 904.

930.07.04.09 Curing

930.07.04.09.01 General

Normal concrete shall be cured for a minimum period of 4 Days, except that for concrete subjected anytime to cold weather during the first 96 hours after concrete placement the curing period shall be extended to 7 Days.

930.07.04.09.02 Unformed Surfaces

Concrete shall be cured for the full duration of the curing period according to the Curing with Burlap and Water clause in OPSS 904. The burlap and the moisture vapour barrier shall then be removed and the concrete permitted to air dry for not less than 72 hours prior to any application of tack coat for waterproofing, where applicable.

930.07.04.09.03 Formed Surfaces

930.07.04.09.03.01 General

All exposed concrete surfaces of formed components shall be cured as specified in the Unformed Surfaces clause.

930.07.04.09.03.02 Concrete Patches, Formed Surface
Concrete Patches, Form and Pump

Curing shall be according to the following:

a) If the formwork is left in place for the duration of the curing period, no additional curing shall be required.

b) Where the formwork is to be removed within the specified curing period, curing shall be applied as specified in the Unformed Surfaces clause, curing shall be applied immediately after removal of the formwork and remain in place until the end of the curing period. Under no circumstance shall the concrete be left uncured for more than 2 hours during the removal of formwork.

930.07.04.09.03.03 Concrete Refacing
Concrete Refacing, Form and Pump

Burlap and water shall be applied immediately to the top of all exposed concrete surfaces, within 2 to 4 m of the finishing operation. The burlap shall be soaked for 24 hours prior to placing and shall be kept continuously wet by means of an operating soaker hose placed along the top of the component being refaced. The soaker hose shall be placed immediately after the concrete has set and its operation shall not cause fines to be washed out.

Forms for all surfaces, except soffit for structural components, shall be removed within 16 to 24 hours of concrete placement, unless the Contractor is unable to remove the forms due to structural concerns. All concrete surfaces shall be immediately covered with wet burlap and moisture vapour barrier for the remainder of the minimum curing period according to the requirements of Curing with Burlap and Water clause in OPSS 904. Under no circumstance shall the concrete be left uncured for more than 2 hours during the removal of the formwork.

Forms for soffit of structural components including decks, pier caps, beams, and arch ribs shall not be removed until the full curing time has elapsed.

930.07.05 Cold Weather Protection

930.07.05.01 General

Concrete shall be protected during cold weather. The protection system shall be designed for the worst conditions that can be reasonably anticipated from local weather records, forecasts, site conditions, and past experience for the time period during which the protection is required.

Regardless of ambient air temperature, overlays shall be moist cured with burlap and water at all times. During cold weather, burlap shall be prevented from freezing.

930.07.05.02 Control of Temperature and Temperature Difference

During cold weather, the temperature of the concrete shall be monitored and controlled according to the Control of Temperature and Temperature Difference subsection in OPSS 904, with the following exceptions:

a) Thermocouple wires shall be embedded near the concrete surface in a minimum of 4 locations for each Day of concrete placement, as directed by the Contract Administrator. Thermocouples for monitoring ambient air temperature shall be installed in the shade close to the surface of the concrete at a minimum frequency of 1 thermocouple for each Day of placement.

b) For cold weather conditions, protection of concrete shall, at a minimum, be as shown in Table 1. Protective measures shall be increased based on consideration of the specific type of rehabilitation in order to comply with the specified temperature constraints, as required.

c) The cold weather protection shall be gradually removed or reduced in such a manner that the maximum allowable drop of concrete temperature for each 24 hour period as shown in Table 1 is not exceeded. The protection shall not be totally removed nor shall the concrete be fully exposed to the air until the average concrete temperature is within 10°C of the air temperature.

930.07.06 Material Sampling and Testing

930.07.06.01 Plastic Concrete Testing

The sampling and testing of the plastic concrete for slump, air content, and temperature shall be according to OPSS 1350 with the exception that the minimum frequency of testing shall be one test from each load of concrete. Results shall be recorded and shall be submitted to the Contract Administrator, upon request.

930.07.06.02 Early Strength Determination

Where early loading of concrete is proposed or anticipated, sets of cylinders for testing for early strength determination shall be prepared according to OPSS 904.

930.07.06.03 Samples for Compressive Strength, Air Void System Parameters and Rapid Chloride Permeability - Acceptance Testing

The Contractor shall be responsible for sampling and transportation of samples for acceptance testing of compressive strength, air void system, and rapid chloride permeability by the Owner according to OPSS 1350.

930.07.06.03.01 Samples for Acceptance Testing Where Rehabilitation Involves the Use of Anode Mesh Cathodic Protection

Cylinders for acceptance testing of compressive strength shall be according to OPSS 1350.

Where anode mesh is used, cores shall not be required and cylinders shall be cast for determination of air void system and rapid chloride permeability. One cylinder shall be made for determination of air void system parameters to represent each 300 m^2 of surface area of overlay and for each 100 m^2 of surface area of patches and refacing placed.

For silica fume overlays, two additional cylinders shall be made for determination of rapid chloride permeability to represent each 300 m^2 of surface area of overlay placed. One cylinder shall be used for acceptance testing and the remaining cylinder shall be retained for referee testing.

The cylinders shall be 100 mm diameter x 200 mm long and shall be made, field cured, and transported according to the Test Cylinders clause in OPSS 1350.

930.07.06.04 Tensile Bond Strength

The following shall be marked to facilitate the selection of testing locations and avoid damage to the embedded materials due to coring:

a) For rehabilitation involving use of anode mesh cathodic protection in overlay, the locations of anode distribution bars, wiring, and embedded hardware.

b) For rehabilitation involving use of glass fiber reinforced polymer (GFRP) reinforcing, the reinforcing bar locations.

Application of tack coat, where applicable, shall not be carried out until the testing of tensile bond strength is completed.

930.07.06.05 Filling of Core Holes

Filling of core holes shall be according to OPSS 1350.

930.07.07 Remedial Work

Remedial work shall be carried out as shown in Table 2.

Treatment for deck with waterproofing and paving shall not begin until the specified curing period and the air drying period has elapsed. For all other exposed components, the treatment shall not begin until a minimum period of 28 Days has elapsed after placement of concrete.

Repair of cracks shall be according to OPSS 932. Alternatively, a proposal for repair may be submitted to the Contract Administrator for review to show that the repair method and material shall be able to restore the structural integrity of the concrete across the cracks. The inspection and monitoring of cracks shall continue up to the date of waterproofing or completion of the Work, whichever is later.

The application of tack coat for waterproofing shall not proceed until all defects have been addressed and remedial work accepted by the Contract Administrator.

930.07.08 Modification of Deck Drains

Modification of deck drains shall be made prior to waterproofing the deck.

930.07.09 Drainage Tubes in Deck

Installation of drainage tubes shall be made prior to waterproofing the deck.

930.07.10 Management of Excess Materials

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

930.08 QUALITY ASSURANCE

930.08.01 Testing - Tensile Bond Strength

The Contract Administrator shall use a covermeter to locate steel reinforcement prior to testing in order to avoid coring through the steel and shall perform the sampling and testing of cores from overlays, concrete patches, and concrete refacing to determine tensile bond strength.

A lot shall consist of the total quantity of concrete patches, concrete refacing, or overlay for each item, except for the following where tensile bond shall not be measured:

a) When the total measured area of concrete patches on a structure is less than 20 m^2.

b) When the total area of concrete refacing on a structure is less than 20 m^2.

c) In circular columns with spiral reinforcement.

Each lot shall be divided into sublots as follows:

a) Sublots for overlays shall be approximately equal in size and not greater than 300 m^2. Separate sublots are required for each overlay placement.

b) Sublots for concrete patches shall not be combined with areas of concrete refacing for determining sublots. Sublots shall be approximately equal in size and not greater than 100 m^2. Work on different structures shall not be combined in the same sublot.

c) Soffit repairs shall be a separate sublot and a sublot shall not be greater than 100 m^2.

The tensile bond strength testing shall be carried out on 3 in-situ cores taken within 1 m of each other for each sublot. The core locations shall be randomly selected by the Contract Administrator. Additional testing shall not be permitted.

The cores shall be obtained by the Contract Administrator according to CSA A23.2-14C. Cores shall be 100 mm in diameter and extend into the parent concrete to the depth as specified in LS-430. The testing shall be according to LS-430 and shall be carried out when the concrete is 7 to 10 Days of age. The equipment used to measure the tensile bond strength shall be equipped with a maximum load indicator.

If a core comes loose during coring operation, another core shall be obtained within 300 mm of the original core location.

If failure occurs in the epoxy adhesive and the specified strength of 1.0 MPa has not been reached, the test shall be repeated within 300 mm of the original core location. If a failure occurs fully within the parent concrete, this shall be considered a valid result, unless the Contractor has been directed to leave unsound concrete in place. Retesting is not required when the specified strength of 1.0 MPa has been achieved

Individual test results shall be forwarded to the Contractor, as they become available.

930.08.02 Inspection After Curing

The Contract Administrator shall inspect the Work to determine if the completed work contains any of the following defects:

a) Areas of debonding.

b) Honeycombed areas, spalls, and cold joints.

c) Cracks requiring remedial work as shown in Table 2.

930.08.03 Acceptance

930.08.03.01 Concrete Compressive Strength, Air Void System in Hardened Concrete or Rapid Chloride Permeability for Silica Fume Overlays

Acceptance, referee testing and referee testing cost of concrete compressive strength, air void system in hardened concrete, and rapid chloride permeability for silica fume overlays shall be according to OPSS 1350.

930.08.03.02 Tensile Bond Strength

For a sublot to be acceptable, the average tensile bond strength of the sublot shall be a minimum of 1.0 MPa. Sublots with average tensile bond strength less than 1.0 MPa and more than or equal to 0.8 MPa shall be accepted with payment reduction. The payment reduction factor (Pr_i) for the tensile bond strength testing for each sublot shall be calculated based on the following equation:

$$Pr_i = 1.25 (1 - B)$$

Where:

B = The average tensile bond strength (MPa) for each sublot. For the purpose of calculating the payment reduction factor, a value of 1.0 MPa shall be used for B when the average tensile bond strength is greater than 1.0 MPa.

i = Sublot number

The payment reduction, Pr, for the lot is calculated by one of the following equations:

For the concrete patches, concrete refacing, place concrete overlay, and place silica fume concrete overlay items, the following equation shall be used:

$$Pr = \text{Tender Unit Price} \times [(Pr_1 \times LQ_1) + (Pr_2 \times LQ_2) ..... (Pr_n \times LQ_n)]$$

Where:

Pri = The payment reduction for sublot i

LQ_i = Quantity for sublot i (m^3)

n = The total number of sublots

For the finish and cure concrete overlay and finish and cure silica fume concrete overlay items**,** the following equation shall be used:

$$Pr = \frac{\text{Lump Sum} \times [(Pr_1 \times SA_1) + (Pr_2 \times SA_2) ..... (Pr_n \times SA_n)]}{SA_T}$$

Where:

Pri = The payment reduction for sublot i

SA_i = Surface area for sublot i (m^2)

SA_T = Total surface area of the lot (m^2)

n = The total number of sublots

For the purpose of calculating the payment reduction for concrete overlays, the Pr shall be applied to both place concrete overlay and finish and cure concrete overlay items.

For the purpose of calculating the payment reduction for silica fume concrete overlays, the Pr shall be applied to both place silica fume concrete overlay and finish and cure silica fume concrete overlays items.

930.08.03.03 Acceptance at the Completion of Work

The Contract Administrator shall reject all or a portion of the sublot based on:

a) The presence of debonding, honeycombed areas, spalls and cold joints.

b) Cracks as shown in Table 2.

c) Average tensile bond strength less than 0.8 MPa.

d) Any work that does not meet the requirements of this specification and the acceptance requirements of OPSS 1350.

e) Unsatisfactory completion of remedial work associated with surface tolerance, surface finish, cracks, or any other deficiencies.

930.08.03.04 Performance During General Warranty Period

In addition to the acceptance requirements stated herein, concrete in the structure shall meet the requirements as shown in Table 2 during and up to the end of the general warranty period.

930.09 MEASUREMENT FOR PAYMENT

930.09.01 General

For all types of overlays, there shall be no measurement for the following:

a) Concrete produced in excess of that required for the placing operation.

b) Quantity of bonding agent.

For construction joints in overlay that do not meet the requirements specified in this specification and is deemed unacceptable by the Contract Administrator, the portion of overlay removed shall be deducted from the volume indicated on the delivery ticket.

No measurement shall be made for areas of new overlays, concrete patches, and concrete refacing that were removed according to the requirements of the Remedial Work subsection.

930.09.02 Actual Measurement

930.09.02.01 Place Concrete Overlay
Place Silica Fume Concrete Overlay

Measurement shall be by the volume of concrete placed, including concrete placed in partial depth removals, in cubic metres by delivery ticket. Deductions shall be made for the following:

a) Concrete produced in excess of that required for the placing operation.

b) The portion of the overlay that is sawcut back and removed at the construction joint.

c) The portion of concrete removals not approved by the Contract Administrator.

The total volume shall be calculated to the nearest cubic metre.

930.09.02.02 Concrete Patches, Formed Surface
Concrete Patches, Unformed Surface
Concrete Patches, Form and Pump
Concrete Refacing
Concrete Refacing, Form and Pump

930.09.02.02.01 By Volume

Measurement shall be by the volume of concrete placed in cubic metres.

The volumes shall be calculated by multiplying each area to be patched by the average depth. Depths shall be taken on a grid system to best describe the profile at the particular area. The Contract Administrator, in the presence of the Contractor, shall take a minimum of 3 measurements for each removal area or 10 for every m^2, after concrete removal is completed by placing a straight edge across the removal area and measuring the depth from the straight edge to the concrete.

The depths shall be measured and averaged to the nearest millimetre.

No measurement shall be made for concrete required to fill localized areas behind the second layer of steel reinforcement.

The total volume shall be calculated to the nearest 0.1 m^3.

930.09.02.03 Modification of Deck Drains

For measurement purposes, a count shall be made of the number of deck drains modified.

930.09.02.04 Drainage Tubes in Deck

For measurement purposes, a count shall be made of the number of drainage tubes placed.

930.09.03 Plan Quantity Measurement

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

930.10 BASIS OF PAYMENT

930.10.01

Modification of Deck Drains - Item
Drainage Tubes in Deck - Item
Place Concrete Overlay - Item
Place Silica Fume Concrete Overlay - Item
Finish and Cure Concrete Overlay - Item
Finish and Cure Silica Fume Concrete Overlay - Item
Concrete Patches, Formed Surface - Item
Concrete Patches, Unformed Surface - Item
Concrete Patches, Form and Pump - Item
Concrete Refacing - Item
Concrete Refacing, Form and Pump - Item

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work, subject to payment adjustments as specified in the Contract Documents. Payment at the Contract price for the above tender items shall also include abrasive blast cleaning of the concrete surface for concrete patches and concrete refacing. Payment for abrasive blast cleaning of steel reinforcement and the concrete surface to receive an overlay shall be administered according to OPSS 929.

When the Contract does not contain a separate tender item for providing access to the work, the Contract price for the concrete patching and concrete refacing items shall include full compensation for all labour, Equipment, and Material to do the work, including provision of access.

No payment shall be made for normal concrete, silica fume concrete or self-consolidating concrete or both required to patch, reface, or overlay areas of concrete removal where the removal was not approved by the Contract Administrator.

TABLE 1
Minimum Cold Weather Protective Measures

Anticipated Minimum Air Temperature °C	**Protective Measure**
+10 to +6	PM2
+5 to 0	PM3
-1 to –5	PM4
-6 and lower	PM5
Maximum Allowable Drop in Concrete Temperature / 24 hours	15 °C

PM2 - Protective Measure - Cover concrete with insulation having an R-Value of 0.67 **
PM3 - Protective Measure - Cover concrete with insulation having an R-Value of 1.33 **
PM4 - Protective Measure - Cover concrete with insulation having an R-Value of 2.00 **
PM5 - Protective Measure - House and heat according to the Housing and Heating clause of OPSS 904.

** Note: All R-Values are metric.

The conversion factor from metric to imperial unit is:

Metric R value x 5.678 = Imperial R value

TABLE 2
Performance Requirements at Time of Construction and During Warranty Period

	Test Method	Performance Requirements	Consequence of Non-Conformance
Concrete Surface Scaling	Visual inspection and assessment of severity of-scaling according to Figures 1 to 6.	At the end of the warranty period, there shall be no medium or severe scaling and total area of light scaling shall be no more than 5% of the component.	Areas of medium and severe scaling shall be removed and replaced full depth. For light scaling greater than 5% of the component, the Contractor shall submit a repair proposal for approval by the ministry.
Concrete Delamination or Debonding	As described in the Structure Rehabilitation Manual.	Delaminated or debonded areas shall not be present.	Remove and replace.
Cracks	Visual inspection and measurement by means of crack comparator. Width of crack is measured at the widest point of the crack, not average width of crack. Cracks in overlays and patches to be waterproofed shall be measured after the air drying period.	For overlays and patches to be waterproofed and paved, width of cracks shall be less than 0.50 mm and linear measurement of cracks greater than 0.50 mm within 1 m^2 shall be less than 2 m.	Repair cracks greater than 0.50 mm in width according to OPSS 932, unless the linear measurement of cracks greater than or equal to 0.50 mm per m^2 exceeds 2 m. If the linear measurement of cracks greater than 0.50 mm in width exceeds 2 m per m^2, remove and replace.
		For exposed overlays, refacing and patches, width of cracks shall be less than 0.30 mm and linear measurement of cracks greater than 0.30 mm within 1 m^2 shall be less than 2 m.	Repair cracks greater than 0.30 mm in width according to OPSS 932, unless the linear measurement of cracks greater than or equal to 0.30 mm per m^2 exceeds 2 m. If the linear measurement of cracks greater than 0.30 mm in width exceeds 2 m per m^2, remove and replace.
Spalls, Exposed Reinforcement, Honey-Combing, and Other Observed Unanticipated Defects and Deterioration	Visual inspection.	Spalls, exposed reinforcement, honey-combing, or other observed defects and deterioration shall not be present at the end of the warranty period.	Remove and replace.

Note:

A. Where the area failing to meet the performance requirement is a large proportion of the repair area, the entire repair shall be removed and replaced.

FIGURE 1
Example of Light Scaling

FIGURE 2
Example of Light Scaling

FIGURE 3
Example of Medium Scaling

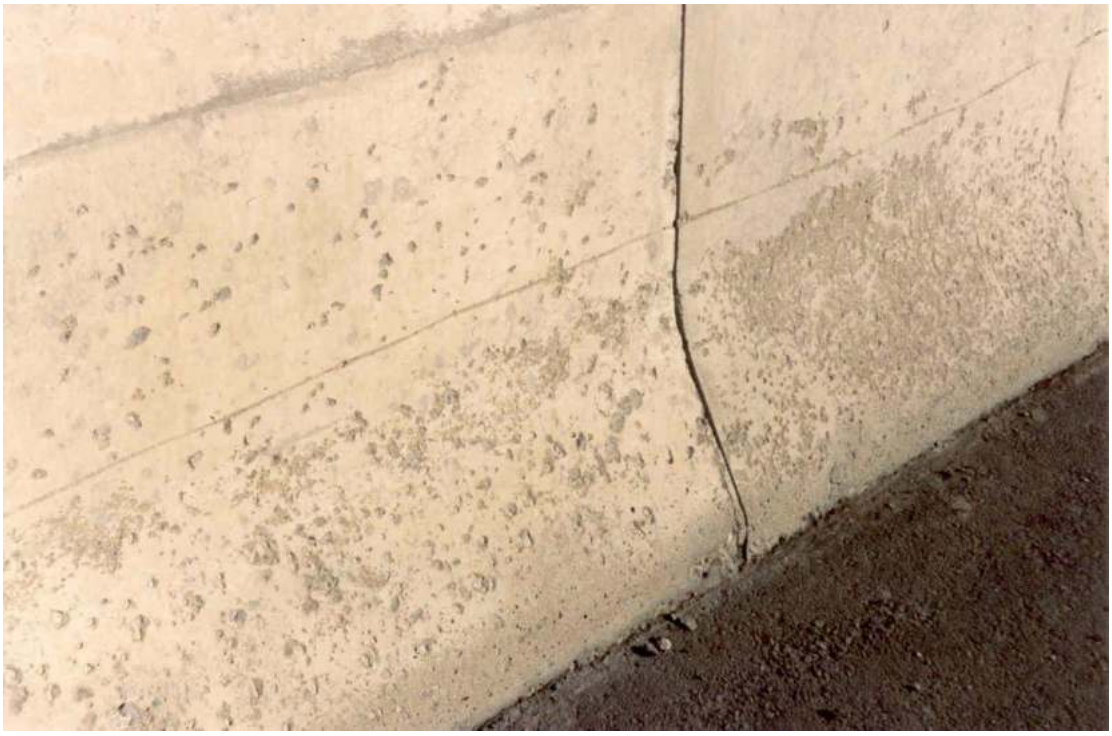


FIGURE 4
Example of Medium Scaling

FIGURE 5
Example of Severe Scaling

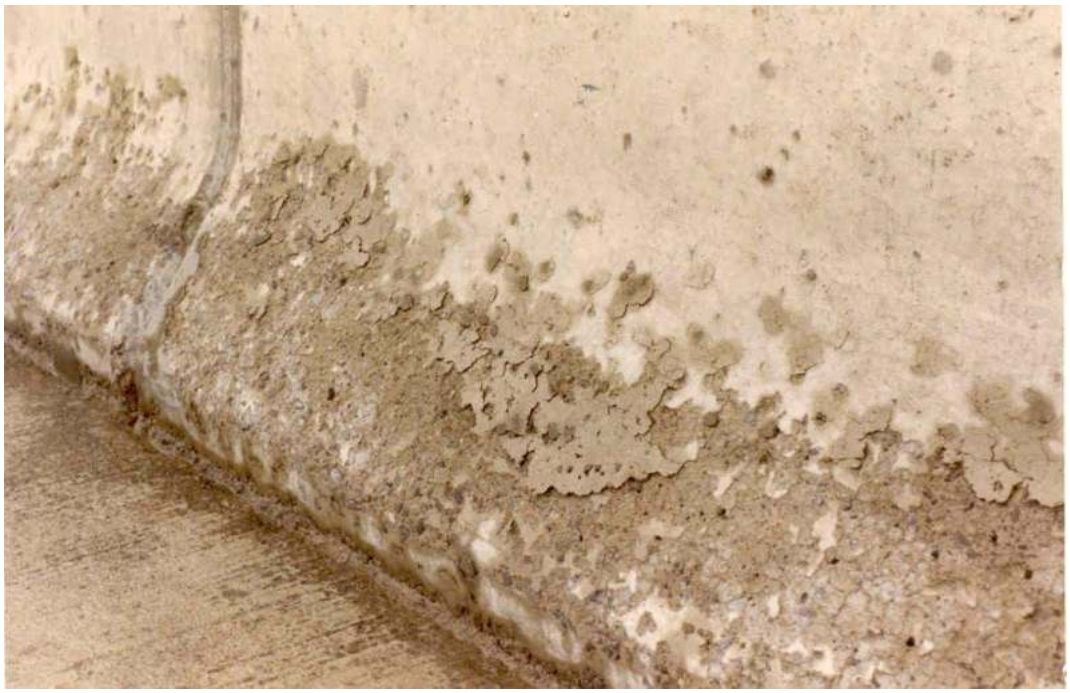
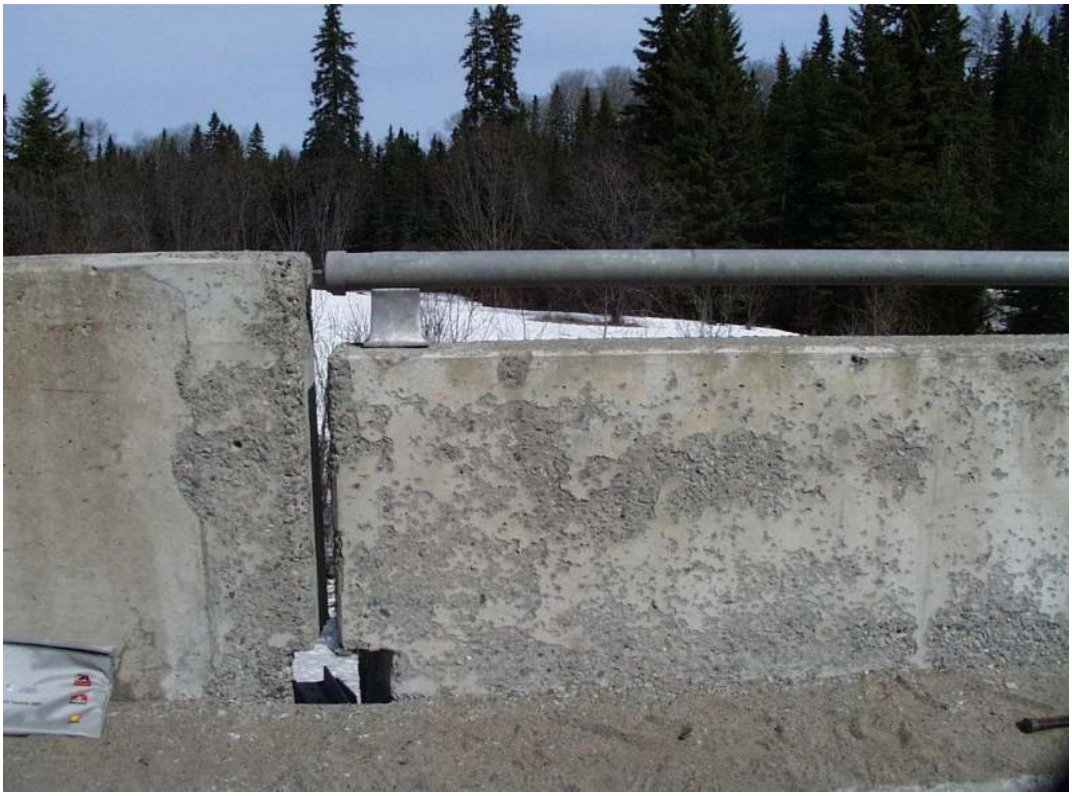


FIGURE 6
Example of Severe Scaling



Ontario Provincial Standard Specifications (OPSSs)					
1004	November 2012	April 2025	TBD	Rev: Material Specification for Aggregates – Miscellaneous is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 110S16 has been incorporated into OPSS 1004.	Mike Pearsall
Standard Special Provisions (SSPs)					
110S16	May 2023	N/A	TBD	Can: SSP Amendment to Material Specification for Aggregates - Miscellaneous is cancelled. Applicable content has been incorporated into OPSS 1004.	Mike Pearsall

Note: The 1004 implemented in April 2025 replaces 1004, November 2012 with no technical content changes.

MATERIAL **SPECIFICATION FOR AGGREGATES - MISCELLANEOUS**

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~~**APPENDICES**~~

~~**1004-A Commentary**~~

1004.01 SCOPE

This specification covers material requirements for aggregates for use as clear stone, granular sheeting, gabion stone, mortar sand, rip-rap, rock protection, truck arrester bed aggregate and winter sand.

~~1004.01.01 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.~~

~~1004.01.02 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.~~

1004.02 REFERENCES

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

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

Ontario Provincial Standard Specifications, Material

OPSS 1001 Aggregates - General
OPSS 1010 Aggregates - Base, Subbase, Select Subgrade and Backfill Material

Ontario Ministry of Transportation Publications

Designated Sources for Materials (DSM):
DSM #3.05.25 Aggregates: Surface Friction Courses

MTO Laboratory Testing Manual:
LS-601 Materials 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-607 Determination of Percent Crushed Particles in Processed Coarse Aggregate
LS-608 Determination of Percent Flat and Elongated Particles in Coarse Aggregate
LS-610 Organic Impurities in Sands for Concrete
LS-614 Freezing and Thawing of Coarse Aggregate
LS-616 Petrographic Analysis of Fine Aggregate
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-631 Determination of Presence of Plastic Fines in Aggregates

MTO Forms:
PH-D-10 Aggregate Sample Data Sheet

ASTM International

~~C 87~~C87/87M-10	Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
~~D 6473~~D6473-10	Standard Test Method for Specific Gravity and Absorption of Rock for Erosion Control

1004.03 DEFINITIONS

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

Clear Stone means a graded aggregate intended for use in drainage, backfill, bedding, and other applications.

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.

Gabion Stone means a graded fractured rock aggregate intended for use in gabion baskets and gabion mats.

Granular Sheeting means a graded granular aggregate material intended for use as a protective surface layer on erodible soil slopes.

Mortar Sand means a fine aggregate intended for application in Portland cement based mortars.

Nominal Maximum Size means the largest sieve in the applicable specification upon which material is permitted to be retained.

Physical Property means an inherent attribute or feature of an aggregate material. ~~-~~Tests are carried out to determine a material's resistance to weathering or degradation or both.

Pit-Run Material means material excavated directly from an existing bank in a pit and delivered to the job site without further processing, i.e., crushing, screening, washing, and classifying.

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 specified requirements.

Referee Testing means testing of a material property or attribute for the purpose of resolving acceptance.

Rip-Rap means a well graded, fractured rock or crushed reclaimed concrete intended for use as slope protection in hydraulic channels.

Rock Protection means a well graded, fractured rock or crushed reclaimed concrete intended for use as general slope protection.

Spheroidal Particle means when the ratio of the greatest dimension in the longitudinal axis compared to the least dimension in a plane perpendicular to the longitudinal axis is less than 2:1.

Truck Arrester Bed Aggregate means a single-sized aggregate used in runaway truck lanes to slow and stop the progress of vehicles.

Winter Sand means a fine aggregate intended for application to roadways during winter conditions to improve frictional properties of the pavement surface.

1004.05 MATERIALS

1004.05.01 General

The requirements of OPSS 1001 shall apply to this specification.

All aggregate source materials shall be clean, hard, durable particles free of earth, humus, clay or other coatings, clay lumps, shale or shaley partings and other deleterious materials. Aggregates may be sands, gravels, cobbles, boulders, or quarried rock. Reclaimed asphalt pavement, reclaimed hydraulic cement concrete, glass, other reclaimed materials, and slag materials shall not be used. When reclaimed materials are permitted by this specification or specified in the Contract Documents, they shall be homogeneously blended. When reclaimed hydraulic cement concrete is permitted, it shall not contain loose reinforcing material and shall be free of protruding metal.

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 the aggregate shall be discontinued until a reappraisal by the Contractor, with the approval of the Contract Administrator, proves the source to be satisfactory.

Irrespective of compliance or non-compliance with the gradation and physical property requirements of this specification, aggregates may be accepted or rejected on the basis of field performance, as determined by the Owner.

1004.05.02 Clear Stone

Clear stone may be 53.0 mm, 19.0 mm Type I, 19.0 mm Type II, 16.0 mm, 13.2 mm, or 9.5 mm and shall meet the physical property requirements shown in Table 1 and the gradation requirements shown in Table 2.

1004.05.03 Granular Sheeting

Granular sheeting shall meet the physical property requirements shown in Table 3 and the gradation requirements shown in Table 4.

1004.05.04 Mortar Sand

Mortar sand shall consist of natural sand, or with the approval of the Contract Administrator, other inert materials with similar characteristics, or combinations thereof, having hard, strong, durable particles.

Mortar sand shall meet the physical property requirements shown in Table 5 and the gradation requirements shown in Table 6.

1004.05.05 Gabion Stone, Rip-Rap and Rock Protection

Gabion stone, rip-rap and rock protection shall meet the physical property requirements shown in Table 7 unless one of the following apply:

a) The gabion stone, rip-rap or rock protection is from a source on the ministry's DSM list; or

b) Acceptance by the Owner based on a written request for consideration containing the following:

   i. Prior test results demonstrating that the physical requirements are according to Table 7.
   ii. The testing has been done within 12 months of the material being used in the Work.
   iii. Field performance has continually been satisfactory.

Gabion stone, rip-rap and rock protection shall meet the gradation requirements shown in Table 8.

1004.05.06 Truck Arrester Bed Aggregate

Truck arrester bed aggregate shall be pit-run material meeting the physical property requirements shown in Table 9 and the gradation requirements shown in Table 10. In addition, truck arrester bed aggregate shall meet the following shape requirements:

a) Rounded particles shall be a minimum of 30% by mass. Rounded particles shall be determined by the procedure given in LS-607, reporting the percentage of rounded particles instead of crushed particles. The test specimen size shall be a minimum of 3,000 g passing the 26.5 mm sieve and retained on the 19 mm sieve.

b) Spheroidal particles shall be a minimum of 50% by mass. Spheroidal particles shall be determined by the procedure given in LS-608, using a figure-eight calliper in which the ratio of the opening at one end to that at the other end is 2:1 instead of 4:1. The test specimen size shall be a minimum of 3,000 g passing the 26.5 mm sieve and retained on the 19 mm sieve.

1004.05.07 Winter Sand

Winter sand shall meet the physical property requirements shown in Table 11 and the gradation requirements shown in Table 12.

1004.07 PRODUCTION

1004.07.01 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.

1004.08 QUALITY ASSURANCE

1004.08.01 General

Each aggregate, with the exception of mortar sand, shall be randomly sampled in lots according to Table 13.

When the quantity of aggregate material is insufficient for a complete lot and the quantity is:

a) Less than one-half the quantity of a complete lot, then that quantity shall be added to the previous lot.

b) Greater than or equal to one-half the quantity of a complete lot, then that quantity shall form its own lot.

Mortar sand shall be sampled and tested at the discretion of the Contract Administrator.

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

The laboratory designated by the Owner shall carry out testing for purposes of ensuring that 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 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.

1004.08.02 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 size requirements for aggregate types listed in Table 14 shall be according to Table 14.

Unless specified in the Contract Documents, all samples shall be taken from materials delivered to the Working Area. Each sample shall be treated as a discrete sample and not combined or blended with any other sample. When material contains blended or reclaimed aggregates or both, sampling shall be performed on the final blended product.

Duplicate samples shall be obtained for each aggregate used in the Work.

New or clean sample containers shall be provided for sampling by the Contractor. Containers shall be 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.

Samples shall be identified both inside and outside of the sample container. The Contract Administrator shall seal each sample container at the time and place of sampling. Data to be included with samples shall be according to the requirements of MTO Form PH-D-10, Aggregate Sample Data Sheet.

1004.08.03 Testing and Retention of Samples

1004.08.03.01 General

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 referee testing, if required.

1004.08.03.02 Winter Sand

Following delivery, winter sand shall be subject to a visual inspection of the stockpile to determine the presence of oversize material. Oversize particles may be confirmed with a 9.5 mm sieve.

1004.08.03.03 Gabion Stone, Rip-Rap and Rock Protection,

Unless specified in the Contract Documents, the laboratory designated by the Owner shall carry out QA testing of physical properties according to Table 7.

The Contract Administrator shall carry out the QA testing at the Working Area for gradation requirements according to Table 8.

1004.08.03.01 Winter Sand

Following delivery, winter sand shall be subject to a visual inspection of the stockpile to determine the presence of oversize material. Oversize particles may be confirmed with a 9.5 mm sieve.

1004.08.04 Acceptance

QA test results shall be used for acceptance purposes, except when referee testing of any aggregate or a visual examination of winter sand has been carried out.

When QA test results show that the material meets the applicable gradation and physical property requirements of this specification, the material 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 rejectable and removed from the Work at no cost to the Owner.

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

1004.08.05 Referee Testing

1004.08.05.01 General

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 is not as specified in the Contract Documents.

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

The retained duplicate sample(s) shall be used for each attribute referee testing that is invoked.

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, 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.

1004.08.05.02 Gabion Stone, Rip-Rap and Rock Protection

Upon receiving the Contractor's written request, the Contract Administrator may elect to carry out the referee testing directly after the QA testing.

The Contract Administrator shall carry out the referee testing for gradation requirements according to Table 8 on 20 stone particles they randomly choose at the Working Area.

TABLE 1
Physical Property Requirements for Clear Stone

MTO Laboratory Test	MTO Test Number	Nominal Maximum Size			
		53 mm	19 mm		16 mm, 13.2 mm, and 9.5 mm
			Type I	Type II	
Wash Pass 75 µm Sieve, Guideline B, % maximum	LS-601	2.0	2.0	2.0	2.0
Percent Crushed Particles, % minimum	LS-607	-	50	60	60
Micro-Deval Abrasion, Coarse Aggregate, % maximum loss	LS-618	25	25	25	25

TABLE 2
Gradation Requirements for Clear Stone

Sieve Size	Gradation (LS-602), Percent Passing					
	Nominal Maximum Size					
	53 mm	19 mm		16 mm	13.2 mm	9.5 mm
		Type I	Type II			
63 mm	100	-	-	-	-	-
53 mm	90 - 100	-	-	-	-	-
26.5 mm	-	100	100	-	-	-
19.0 mm	0 - 15	85 - 100	90 - 100	100	-	-
16.0 mm	-	-	65 - 90	96 - 100	100	-
13.2 mm	-	-	-	67 - 86	96 - 100	100
9.5 mm	-	0 - 55	20 - 55	29 - 52	50 - 73	95 - 100
6.7 mm	-	-	-	-	-	20 - 45
4.75 mm	-	0 - 10	0 - 10	0 - 10	0 - 10	0 - 10
75 µm	0 - 2.0	0 - 2.0	0 - 2.0	0 - 2.0	0 - 2.0	0 - 2.0

TABLE 3
Physical Property Requirements for Granular Sheeting

MTO Laboratory Test	MTO Test Number	Requirement
Percent Crushed Particles, % minimum	LS-607	60
Petrographic Requirement, Fine Aggregate, Part A	LS-616	(Note 1)
Micro-Deval Abrasion, Coarse Aggregate, % maximum loss (Note 2)	LS-618	30
Micro-Deval Abrasion, Fine Aggregate, % maximum loss	LS-619	35
Plastic Fines	LS-631	NP

Notes:

1. Requirements for only materials north of the French/Mattawa Rivers: For materials with > 4.0% passing the 75 µm sieve, the amount of mica passing the 150 µm sieve and retained on the 75 µm sieve shall not exceed 10% of the material on that sieve. Prior data demonstrating compliance with this requirement shall be acceptable provided that such testing has been done within the past 5 years and the Contractor can show to the satisfaction of the Owner that field performance has continued to be acceptable.
2. The requirement for the coarse aggregate Micro-Deval abrasion loss test shall be waived if the material has more than 80% passing the 4.75 mm sieve.

TABLE 4
Gradation Requirements for Granular Sheeting

Sieve Size	Gradation (LS-602), Percent Passing
150 mm	100
63 mm	-
37.5 mm	57 - 100
26.5 mm	50 - 90
13.2 mm	35 - 65
4.75 mm	20 - 40
1.18 mm	10 - 23
300 µm	5 - 13
150 µm	0 - 10
75 µm	0 - 8

TABLE 5
Physical Property Requirements for Mortar Sand

MTO Laboratory Test	Test Number	Requirement
Organic Impurities, Organic Plate Number	LS-610	3 (Note 1)
Mortar Strength Test	ASTM C 87/C87M	(Note 2)

Notes:

1. When the fine aggregate for use as mortar sand is subjected to this test, it shall not produce a darker colour than the standard solution or Organic Plate Number 3. However, a fine aggregate failing this test may be approved by the Owner, if it meets the requirements of the Mortar Strength Test according to ASTM C 87.

2. Mortar specimens comprised of fine aggregate for use as Mortar Sand and hydraulic cement shall develop a compressive strength at the age of 7 Days, of not less than 90% of the strength developed by a mortar prepared in the same manner, with the same cement and with graded Ottawa sand having a fineness modulus of 2.40 $\pm$ 0.10.

TABLE 6
Gradation Requirements for Mortar Sand

Sieve Size	Gradation (LS-602), Percent Passing
4.75 mm	100.0
2.36 mm	95 - 100
1.18 mm	60 - 100
600 μm	35 - 80
300 μm	15 - 50
150 μm	2 - 15
75 μm	0 - 5.0

TABLE 7
Physical Property Requirements for Gabion Stone, Rip-Rap and Rock Protection

MTO Laboratory Test	Test Number	Gabion Stone and Rip-Rap	Rock Protection
Specific Gravity, minimum	ASTM D 6473 (Note 1)	2.50	2.50
Absorption, % maximum		2.0	2.0
Flat and Elongated Particles, % maximum	LS-608 (Note 2)	15	15
Micro-Deval Abrasion Coarse Aggregate, Grading A % maximum loss	LS-618 (Note 3)	25	25

Notes:

1. These requirements shall be based on the average test results for at least 5 pieces of rock when the source is macroscopically uniform or at least 8 pieces of rock when the source is macroscopically non-uniform. In addition, no individual piece of tested rock shall have a specific gravity less than 2.30 or anabsorption greater than 3.5%.

2. These requirements shall be based on measurements taken of at least 20 randomly-chosen pieces of rock either in stockpile at the source or after being delivered to the site.

3. Testing using LS-618 may be carried out on another aggregate product that is being simultaneously produced from the same crushing stage as Rip-Rap, Gabion Stone or Rock Protection, as long as the other aggregate product being produced is sufficient for sampling and testing, according to the requirements of the procedure. As an example, if the Contractor can show that both Rip-Rap and Granular A which meets the requirements of OPSS 1010, are being simultaneously produced from a primary crusher, a sample of the Granular A may be used for acceptance testing, in-lieu of testing a sample of Rip-Rap.

TABLE 8
Gradation Requirements for Gabion Stone, Rip-Rap and Rock Protection

Mass kg	**Approximate Dimension of an Equivalent Cube in cm** (Note 1)	**Gradation, percent less than mass specified** (Note 2)				
		Gabion Stone		**Rip-Rap**		**Rock Protection**
		G-3	**G-10**	**R-10**	**R-50**	
330	50.0	-	-	-	-	100
75	30.5	-	-	-	100	↑ Well-Graded ↓
50	26.5	-	-	-	70 - 90	
25	21.0	-	-	-	40 - 55	
15	18.0	-	100	100	-	
10	15.5	-	90 - 100	70 - 90	-	
5	12.5	100	-	40 - 55	-	
3	10.5	90 - 100	-	-	-	0 - 10
2.5	10.0	-	0 - 5	-	0 - 15	-
0.5	6.0	0 - 5	-	0 - 15	-	-

Notes:

1. These dimensions are for estimating purposes only and are based on material having a specific gravity of 2.65.

2. The gradation shall be determined by individually weighing a minimum of 20 randomly-chosen stone particles from a sample taken from the stockpile representing a lot then comparing the total mass of the stone particles within each fraction with the total mass of all of the stone particles measured in the sample. For pieces of rock with masses that are larger than 25 kg, the approximate dimension of the equivalent cube determined using an average of the three rectilinear measurements of the piece shall be allowed, in lieu of weighing.

TABLE 9
Physical Property Requirements for Truck Arrester Bed Aggregate

MTO Laboratory Test	MTO Test Number	Requirement
Wash Pass 75 µm Sieve, Guideline B, % maximum	LS-601	1.0
Absorption, % maximum	LS-604	2.0
Unconfined Freeze-Thaw, % maximum loss	LS-614	6
Micro-Deval Abrasion, Coarse Aggregate, % maximum loss	LS-618	21

TABLE 10
Gradation Requirements for Truck Arrester Bed Aggregate

Sieve Size Mm	Gradation (LS-602), Percent Passing
37.5	100
26.5	90 - 100
19.0	0 - 10

TABLE 11
Physical Property Requirements for Winter Sand

Laboratory Test	MTO Test Number	Requirement
Micro-Deval Abrasion, fine aggregate, % maximum loss	LS-619	25 (Note 1)

Notes:

1. When obtained from sources on St. Joseph Island, Manitoulin Island, or areas of Ontario south and west of a boundary delineated by the Severn River, Provincial Highway 12, and Provincial Highway 7 east of Highway 12.

TABLE 12
Gradation Requirements for Winter Sand

Sieve Size	Gradation (LS-602), Percent Passing
9.5 mm	100.0 (Note 1)
6.7 mm	97 - 100
4.75 mm	90 - 100
2.36 mm	50 - 95
1.18 mm	20 - 90
600 μm	0 - 70
300 μm	0 - 35
150 μm	0 - 15
75 μm	0 - 5.0

Notes:

1. In addition to LS-602, this shall be confirmed by visual inspection of the stockpile.

2. The minimum size of the test sample shall be 5 kg. Following oven drying, the sample shall be sieved on the 9.5 mm, 6.7 mm, and 4.75 mm sieves. Material passing the 4.75 mm sieve shall be split to an appropriate size according to LS-602 for subsequent washing and fine sieving. The final grading shall be calculated according to LS-602 as the percentage of material passing each sieve based on the total mass of the oven dried sample.

TABLE 13
Lot Sizes

Aggregate Type	Units of Measurement	Physical Properties and Gradation (Based on Tender Quantities)		
Clear Stone	tonnes (t)	< 200 t: at CA's discretion	200 – 5000 t: One lot	> 5000 t: 5000 t lots
Gabion Stone	m^3 of gabion baskets	< 100 m^3: at CA's discretion	100 – 1000 m^3: One lot	> 1000 m^3: 1000 m^3 lots
Granular Sheeting	m^2	< 200 m^2: at CA's discretion	200 – 5000 m^2: One lot	> 5000 m^2: 5000 m^2 lots
Rip-Rap	m^2	< 200 m^2: at CA's discretion	200 – 5000 m^2: One lot	> 5000 m^2: 5000 m^2 lots
Rock Protection	m^3	< 200 m^3: at CA's discretion	200 – 5000 m^3: One lot	> 5000 m^3: 5000 m^3 lots
Truck Arrester Bed	tonnes (t)	< 5000 t: One lot	> 5000 t: 5000 t lots	
Winter Sand	tonnes (t)	< 500 t: at CA's discretion	500-10000 t: One Lot	> 10000 t: 10000 t lots

TABLE 14
Sample Size Requirements

Aggregate	Nominal Maximum Size mm	Minimum Sample Size kg
Clear Stone	53	80
	19.0	20
	16.0	15
	13.2	15
	9.5	10
Granular Sheeting		25
Mortar Sand		10
RipRap / Gabion Stone / Rock Protection (for physical properties only)		25 (consisting of stone particles from 2 to 5 kg each)
Truck Arrestor Bed Aggregate		75
Winter Sand		10

Appendix 1004-A, November 2012
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

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

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.

Note: The 1004 implemented in April 2025 replaces 1004, November 2012 with no technical content changes.

MATERIAL SPECIFICATION FOR AGGREGATES - MISCELLANEOUS

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1004.01 SCOPE

This specification covers material requirements for aggregates for use as clear stone, granular sheeting, gabion stone, mortar sand, rip-rap, rock protection, truck arrester bed aggregate and winter sand.

1004.02 REFERENCES

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

Ontario Provincial Standard Specifications, Material

OPSS 1001 Aggregates - General
OPSS 1010 Aggregates - Base, Subbase, Select Subgrade and Backfill Material

Ontario Ministry of Transportation Publications

Designated Sources for Materials (DSM):
DSM #3.05.25 Aggregates: Surface Friction Courses

MTO Laboratory Testing Manual:
LS-601 Materials 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-607 Determination of Percent Crushed Particles in Processed Coarse Aggregate
LS-608 Determination of Percent Flat and Elongated Particles in Coarse Aggregate
LS-610 Organic Impurities in Sands for Concrete
LS-614 Freezing and Thawing of Coarse Aggregate
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LS-619 Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
LS-625 Guidelines for Sampling of Aggregate Materials
LS-631 Determination of Presence of Plastic Fines in Aggregates

MTO Forms:
PH-D-10 Aggregate Sample Data Sheet

ASTM International

C87/87M-10 Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
D6473-10 Standard Test Method for Specific Gravity and Absorption of Rock for Erosion Control

1004.03 DEFINITIONS

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

Clear Stone means a graded aggregate intended for use in drainage, backfill, bedding, and other applications.

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.

Gabion Stone means a graded fractured rock aggregate intended for use in gabion baskets and gabion mats.

Granular Sheeting means a graded granular aggregate material intended for use as a protective surface layer on erodible soil slopes.

Mortar Sand means a fine aggregate intended for application in Portland cement based mortars.

Nominal Maximum Size means the largest sieve in the applicable specification upon which material is permitted to be retained.

Physical Property means an inherent attribute or feature of an aggregate material. Tests are carried out to determine a material's resistance to weathering or degradation or both.

Pit-Run Material means material excavated directly from an existing bank in a pit and delivered to the job site without further processing, i.e., crushing, screening, washing, and classifying.

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 specified requirements.

Referee Testing means testing of a material property or attribute for the purpose of resolving acceptance.

Rip-Rap means a well graded, fractured rock or crushed reclaimed concrete intended for use as slope protection in hydraulic channels.

Rock Protection means a well graded, fractured rock or crushed reclaimed concrete intended for use as general slope protection.

Spheroidal Particle means when the ratio of the greatest dimension in the longitudinal axis compared to the least dimension in a plane perpendicular to the longitudinal axis is less than 2:1.

Truck Arrester Bed Aggregate means a single-sized aggregate used in runaway truck lanes to slow and stop the progress of vehicles.

Winter Sand means a fine aggregate intended for application to roadways during winter conditions to improve frictional properties of the pavement surface.

1004.05 MATERIALS

1004.05.01 General

The requirements of OPSS 1001 shall apply to this specification.

All aggregate source materials shall be clean, hard, durable particles free of earth, humus, clay or other coatings, clay lumps, shale or shaley partings and other deleterious materials. Aggregates may be sands, gravels, cobbles, boulders, or quarried rock. Reclaimed asphalt pavement, reclaimed hydraulic cement concrete, glass, other reclaimed materials, and slag materials shall not be used. When reclaimed materials are permitted by this specification or specified in the Contract Documents, they shall be homogeneously blended. When reclaimed hydraulic cement concrete is permitted, it shall not contain loose reinforcing material and shall be free of protruding metal.

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 the aggregate shall be discontinued until a reappraisal by the Contractor, with the approval of the Contract Administrator, proves the source to be satisfactory.

Irrespective of compliance or non-compliance with the gradation and physical property requirements of this specification, aggregates may be accepted or rejected on the basis of field performance, as determined by the Owner.

1004.05.02 Clear Stone

Clear stone may be 53.0 mm, 19.0 mm Type I, 19.0 mm Type II, 16.0 mm, 13.2 mm, or 9.5 mm and shall meet the physical property requirements shown in Table 1 and the gradation requirements shown in Table 2.

1004.05.03 Granular Sheeting

Granular sheeting shall meet the physical property requirements shown in Table 3 and the gradation requirements shown in Table 4.

1004.05.04 Mortar Sand

Mortar sand shall consist of natural sand, or with the approval of the Contract Administrator, other inert materials with similar characteristics, or combinations thereof, having hard, strong, durable particles.

Mortar sand shall meet the physical property requirements shown in Table 5 and the gradation requirements shown in Table 6.

1004.05.05 Gabion Stone, Rip-Rap and Rock Protection

Gabion stone, rip-rap and rock protection shall meet the physical property requirements shown in Table 7 unless one of the following apply:

a) The gabion stone, rip-rap or rock protection is from a source on the ministry's DSM list; or

b) Acceptance by the Owner based on a written request for consideration containing the following:

   i. Prior test results demonstrating that the physical requirements are according to Table 7.
   ii. The testing has been done within 12 months of the material being used in the Work.
   iii. Field performance has continually been satisfactory.

Gabion stone, rip-rap and rock protection shall meet the gradation requirements shown in Table 8.

1004.05.06 Truck Arrester Bed Aggregate

Truck arrester bed aggregate shall be pit-run material meeting the physical property requirements shown in Table 9 and the gradation requirements shown in Table 10. In addition, truck arrester bed aggregate shall meet the following shape requirements:

a) Rounded particles shall be a minimum of 30% by mass. Rounded particles shall be determined by the procedure given in LS-607, reporting the percentage of rounded particles instead of crushed particles. The test specimen size shall be a minimum of 3,000 g passing the 26.5 mm sieve and retained on the 19 mm sieve.

b) Spheroidal particles shall be a minimum of 50% by mass. Spheroidal particles shall be determined by the procedure given in LS-608, using a figure-eight calliper in which the ratio of the opening at one end to that at the other end is 2:1 instead of 4:1. The test specimen size shall be a minimum of 3,000 g passing the 26.5 mm sieve and retained on the 19 mm sieve.

1004.05.07 Winter Sand

Winter sand shall meet the physical property requirements shown in Table 11 and the gradation requirements shown in Table 12.

1004.07 PRODUCTION

1004.07.01 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.

1004.08 QUALITY ASSURANCE

1004.08.01 General

Each aggregate, with the exception of mortar sand, shall be randomly sampled in lots according to Table 13.

When the quantity of aggregate material is insufficient for a complete lot and the quantity is:

a) Less than one-half the quantity of a complete lot, then that quantity shall be added to the previous lot.

b) Greater than or equal to one-half the quantity of a complete lot, then that quantity shall form its own lot.

Mortar sand shall be sampled and tested at the discretion of the Contract Administrator.

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

The laboratory designated by the Owner shall carry out testing for purposes of ensuring that 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 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.

1004.08.02 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 size requirements for aggregate types listed in Table 14 shall be according to Table 14.

Unless specified in the Contract Documents, all samples shall be taken from materials delivered to the Working Area. Each sample shall be treated as a discrete sample and not combined or blended with any other sample. When material contains blended or reclaimed aggregates or both, sampling shall be performed on the final blended product.

Duplicate samples shall be obtained for each aggregate used in the Work.

New or clean sample containers shall be provided for sampling by the Contractor. Containers shall be 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.

Samples shall be identified both inside and outside of the sample container. The Contract Administrator shall seal each sample container at the time and place of sampling. Data to be included with samples shall be according to the requirements of MTO Form PH-D-10, Aggregate Sample Data Sheet.

1004.08.03 Testing and Retention of Samples

1004.08.03.01 General

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 referee testing, if required.

1004.08.03.02 Winter Sand

Following delivery, winter sand shall be subject to a visual inspection of the stockpile to determine the presence of oversize material. Oversize particles may be confirmed with a 9.5 mm sieve.

1004.08.03.03 Gabion Stone, Rip-Rap and Rock Protection,

Unless specified in the Contract Documents, the laboratory designated by the Owner shall carry out QA testing of physical properties according to Table 7.

The Contract Administrator shall carry out the QA testing at the Working Area for gradation requirements according to Table 8.

1004.08.03.01 Winter Sand

Following delivery, winter sand shall be subject to a visual inspection of the stockpile to determine the presence of oversize material. Oversize particles may be confirmed with a 9.5 mm sieve.

1004.08.04 Acceptance

QA test results shall be used for acceptance purposes, except when referee testing of any aggregate or a visual examination of winter sand has been carried out.

When QA test results show that the material meets the applicable gradation and physical property requirements of this specification, the material 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 rejectable and removed from the Work at no cost to the Owner.

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

1004.08.05 Referee Testing

1004.08.05.01 General

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 is not as specified in the Contract Documents.

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

The retained duplicate sample(s) shall be used for each attribute referee testing that is invoked.

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, 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.

1004.08.05.02 Gabion Stone, Rip-Rap and Rock Protection

Upon receiving the Contractor’s written request, the Contract Administrator may elect to carry out the referee testing directly after the QA testing.

The Contract Administrator shall carry out the referee testing for gradation requirements according to Table 8 on 20 stone particles they randomly choose at the Working Area.

TABLE 1
Physical Property Requirements for Clear Stone

MTO Laboratory Test	MTO Test Number	Nominal Maximum Size			
		53 mm	19 mm		16 mm, 13.2 mm, and 9.5 mm
			Type I	Type II	
Wash Pass 75 µm Sieve, Guideline B, % maximum	LS-601	2.0	2.0	2.0	2.0
Percent Crushed Particles, % minimum	LS-607	-	50	60	60
Micro-Deval Abrasion, Coarse Aggregate, % maximum loss	LS-618	25	25	25	25

TABLE 2
Gradation Requirements for Clear Stone

Sieve Size	Gradation (LS-602), Percent Passing					
	Nominal Maximum Size					
	53 mm	19 mm		16 mm	13.2 mm	9.5 mm
		Type I	Type II			
63 mm	100	-	-	-	-	-
53 mm	90 - 100	-	-	-	-	-
26.5 mm	-	100	100	-	-	-
19.0 mm	0 - 15	85 - 100	90 - 100	100	-	-
16.0 mm	-	-	65 - 90	96 - 100	100	-
13.2 mm	-	-	-	67 - 86	96 - 100	100
9.5 mm	-	0 - 55	20 - 55	29 - 52	50 - 73	95 - 100
6.7 mm	-	-	-	-	-	20 - 45
4.75 mm	-	0 - 10	0 - 10	0 - 10	0 - 10	0 - 10
75 µm	0 - 2.0	0 - 2.0	0 - 2.0	0 - 2.0	0 - 2.0	0 - 2.0

TABLE 3
Physical Property Requirements for Granular Sheeting

MTO Laboratory Test	MTO Test Number	Requirement
Percent Crushed Particles, % minimum	LS-607	60
Petrographic Requirement, Fine Aggregate, Part A	LS-616	(Note 1)
Micro-Deval Abrasion, Coarse Aggregate, % maximum loss (Note 2)	LS-618	30
Micro-Deval Abrasion, Fine Aggregate, % maximum loss	LS-619	35
Plastic Fines	LS-631	NP

Notes:

1. Requirements for only materials north of the French/Mattawa Rivers: For materials with > 4.0% passing the 75 µm sieve, the amount of mica passing the 150 µm sieve and retained on the 75 µm sieve shall not exceed 10% of the material on that sieve. Prior data demonstrating compliance with this requirement shall be acceptable provided that such testing has been done within the past 5 years and the Contractor can show to the satisfaction of the Owner that field performance has continued to be acceptable.
2. The requirement for the coarse aggregate Micro-Deval abrasion loss test shall be waived if the material has more than 80% passing the 4.75 mm sieve.

TABLE 4
Gradation Requirements for Granular Sheeting

Sieve Size	Gradation (LS-602), Percent Passing
150 mm	100
63 mm	-
37.5 mm	57 - 100
26.5 mm	50 - 90
13.2 mm	35 - 65
4.75 mm	20 - 40
1.18 mm	10 - 23
300 µm	5 - 13
150 µm	0 - 10
75 µm	0 - 8

TABLE 5
Physical Property Requirements for Mortar Sand

MTO Laboratory Test	Test Number	Requirement
Organic Impurities, Organic Plate Number	LS-610	3 (Note 1)
Mortar Strength Test	ASTM C 87/C87M	(Note 2)

Notes:

1. When the fine aggregate for use as mortar sand is subjected to this test, it shall not produce a darker colour than the standard solution or Organic Plate Number 3. However, a fine aggregate failing this test may be approved by the Owner, if it meets the requirements of the Mortar Strength Test according to ASTM C 87.

2. Mortar specimens comprised of fine aggregate for use as Mortar Sand and hydraulic cement shall develop a compressive strength at the age of 7 Days, of not less than 90% of the strength developed by a mortar prepared in the same manner, with the same cement and with graded Ottawa sand having a fineness modulus of 2.40 $\pm$ 0.10.

TABLE 6
Gradation Requirements for Mortar Sand

Sieve Size	Gradation (LS-602), Percent Passing
4.75 mm	100.0
2.36 mm	95 - 100
1.18 mm	60 - 100
600 μm	35 - 80
300 μm	15 - 50
150 μm	2 - 15
75 μm	0 - 5.0

TABLE 7
Physical Property Requirements for Gabion Stone, Rip-Rap and Rock Protection

MTO Laboratory Test	Test Number	Gabion Stone and Rip-Rap	Rock Protection
Specific Gravity, minimum	ASTM D 6473 (Note 1)	2.50	2.50
Absorption, % maximum		2.0	2.0
Flat and Elongated Particles, % maximum	LS-608 (Note 2)	15	15
Micro-Deval Abrasion Coarse Aggregate, Grading A % maximum loss	LS-618 (Note 3)	25	25

Notes:

1. These requirements shall be based on the average test results for at least 5 pieces of rock when the source is macroscopically uniform or at least 8 pieces of rock when the source is macroscopically non-uniform. In addition, no individual piece of tested rock shall have a specific gravity less than 2.30 or anabsorption greater than 3.5%.

2. These requirements shall be based on measurements taken of at least 20 randomly-chosen pieces of rock either in stockpile at the source or after being delivered to the site.

3. Testing using LS-618 may be carried out on another aggregate product that is being simultaneously produced from the same crushing stage as Rip-Rap, Gabion Stone or Rock Protection, as long as the other aggregate product being produced is sufficient for sampling and testing, according to the requirements of the procedure. As an example, if the Contractor can show that both Rip-Rap and Granular A which meets the requirements of OPSS 1010, are being simultaneously produced from a primary crusher, a sample of the Granular A may be used for acceptance testing, in-lieu of testing a sample of Rip-Rap.

TABLE 8
Gradation Requirements for Gabion Stone, Rip-Rap and Rock Protection

Mass kg	**Approximate Dimension of an Equivalent Cube in cm** (Note 1)	**Gradation, percent less than mass specified** (Note 2)				
		Gabion Stone		**Rip-Rap**		**Rock Protection**
		G-3	**G-10**	**R-10**	**R-50**	
330	50.0	-	-	-	-	100
75	30.5	-	-	-	100	↑ Well-Graded ↓
50	26.5	-	-	-	70 - 90	
25	21.0	-	-	-	40 - 55	
15	18.0	-	100	100	-	
10	15.5	-	90 - 100	70 - 90	-	
5	12.5	100	-	40 - 55	-	
3	10.5	90 - 100	-	-	-	0 - 10
2.5	10.0	-	0 - 5	-	0 - 15	-
0.5	6.0	0 - 5	-	0 - 15	-	-

Notes:

1. These dimensions are for estimating purposes only and are based on material having a specific gravity of 2.65.

2. The gradation shall be determined by individually weighing a minimum of 20 randomly-chosen stone particles from a sample taken from the stockpile representing a lot then comparing the total mass of the stone particles within each fraction with the total mass of all of the stone particles measured in the sample. For pieces of rock with masses that are larger than 25 kg, the approximate dimension of the equivalent cube determined using an average of the three rectilinear measurements of the piece shall be allowed, in lieu of weighing.

TABLE 9
Physical Property Requirements for Truck Arrester Bed Aggregate

MTO Laboratory Test	MTO Test Number	Requirement
Wash Pass 75 µm Sieve, Guideline B, % maximum	LS-601	1.0
Absorption, % maximum	LS-604	2.0
Unconfined Freeze-Thaw, % maximum loss	LS-614	6
Micro-Deval Abrasion, Coarse Aggregate, % maximum loss	LS-618	21

TABLE 10
Gradation Requirements for Truck Arrester Bed Aggregate

Sieve Size Mm	Gradation (LS-602), Percent Passing
37.5	100
26.5	90 - 100
19.0	0 - 10

TABLE 11
Physical Property Requirements for Winter Sand

Laboratory Test	MTO Test Number	Requirement
Micro-Deval Abrasion, fine aggregate, % maximum loss	LS-619	25 (Note 1)

Notes:

1. When obtained from sources on St. Joseph Island, Manitoulin Island, or areas of Ontario south and west of a boundary delineated by the Severn River, Provincial Highway 12, and Provincial Highway 7 east of Highway 12.

TABLE 12
Gradation Requirements for Winter Sand

Sieve Size	Gradation (LS-602), Percent Passing
9.5 mm	100.0 (Note 1)
6.7 mm	97 - 100
4.75 mm	90 - 100
2.36 mm	50 - 95
1.18 mm	20 - 90
600 μm	0 - 70
300 μm	0 - 35
150 μm	0 - 15
75 μm	0 - 5.0

Notes:

1. In addition to LS-602, this shall be confirmed by visual inspection of the stockpile.

2. The minimum size of the test sample shall be 5 kg. Following oven drying, the sample shall be sieved on the 9.5 mm, 6.7 mm, and 4.75 mm sieves. Material passing the 4.75 mm sieve shall be split to an appropriate size according to LS-602 for subsequent washing and fine sieving. The final grading shall be calculated according to LS-602 as the percentage of material passing each sieve based on the total mass of the oven dried sample.

TABLE 13
Lot Sizes

Aggregate Type	Units of Measurement	Physical Properties and Gradation (Based on Tender Quantities)		
Clear Stone	tonnes (t)	< 200 t: at CA's discretion	200 – 5000 t: One lot	> 5000 t: 5000 t lots
Gabion Stone	m^3 of gabion baskets	< 100 m^3: at CA's discretion	100 – 1000 m^3: One lot	> 1000 m^3: 1000 m^3 lots
Granular Sheeting	m^2	< 200 m^2: at CA's discretion	200 – 5000 m^2: One lot	> 5000 m^2: 5000 m^2 lots
Rip-Rap	m^2	< 200 m^2: at CA's discretion	200 – 5000 m^2: One lot	> 5000 m^2: 5000 m^2 lots
Rock Protection	m^3	< 200 m^3: at CA's discretion	200 – 5000 m^3: One lot	> 5000 m^3: 5000 m^3 lots
Truck Arrester Bed	tonnes (t)	< 5000 t: One lot	> 5000 t: 5000 t lots	
Winter Sand	tonnes (t)	< 500 t: at CA's discretion	500-10000 t: One Lot	> 10000 t: 10000 t lots

TABLE 14
Sample Size Requirements

Aggregate	Nominal Maximum Size mm	Minimum Sample Size kg
Clear Stone	53	80
	19.0	20
	16.0	15
	13.2	15
	9.5	10
Granular Sheeting		25
Mortar Sand		10
RipRap / Gabion Stone / Rock Protection (for physical properties only)		25 (consisting of stone particles from 2 to 5 kg each)
Truck Arrestor Bed Aggregate		75
Winter Sand		10

Ontario Provincial Standard Specifications (OPSSs)					
1006	April 2017	April 2025	TBD	Rev: Material Specification for Aggregates - Surface Treatment is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed. Applicable content from SSP 110S05 has been incorporated into OPSS 1006.	Mike Pearsall
Standard Special Provisions (SSPs)					
110S05	February 2019	N/A	TBD	Can: SSP Amendment to Material Specification for Aggregates - Surface Treatment is cancelled. Applicable content has been incorporated into OPSS 1006.	Mike Pearsall

Note: The 1006 implemented in April 2025 replaces 1006, April 2017 with no technical content changes.

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**~~

~~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.~~

1006.02 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 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
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MTO Forms:

PH-CC-110 Surface Treatment Aggregates - Gradation, Computation, Acceptance & Payment Adjustment Sheets
PH-D-10 Aggregate Sample Data Sheet

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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 m^3, 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 sublot.

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 sublot 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~~CC-110 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:

PAYMENT REDUCTION = lot quantity in tonnes (or m^3) x item price in $/tonne (or $/m^3$) x payment adjustment factor (%),

where:

The lot quantity shall be expressed in tonnes (or m^3) and the item price shall be the contract price for the tender quantity in tonnes (or m^3).

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 m^3)	**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 insoluable 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	--	--

Note: The 1006 implemented in April 2025 replaces 1006, April 2017 with no technical content changes.

MATERIAL SPECIFICATION FOR AGGREGATES - SURFACE TREATMENT

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1006.01 SCOPE

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

1006.02 REFERENCES

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
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LS-613 Determination of Insoluble Residue of Carbonate Aggregates
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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.

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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.

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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 m^3, 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 sublot.

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 sublot 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-CC-110 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:

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

where:

The lot quantity shall be expressed in tonnes (or m^3) and the item price shall be the contract price for the tender quantity in tonnes (or m^3).

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 m^3)	**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 insoluable 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 Specifications (OPSSs)					
1010	April 2013	April 2025	TBD	Rev: Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material is implemented. The specification has been updated to new PROV format with no technical content changes. Legacy Appendix A removed.	Mike Pearsall
Standard Special Provisions (SSPs)					
110S06	February 2019	April 2025	TBD	Rev: SSP Amendment to Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material is revised to reflect the new publication version of OPSS 1010.	Mike Pearsall

Note: The 1010 implemented in April 2025 replaces 1010, April 2013 with no technical content changes.

MATERIAL SPECIFICATION FOR AGGREGATES - BASE, SUBBASE, SELECT SUBGRADE, AND BACKFILL MATERIAL

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~~1010-A Commentary~~

1010.01 SCOPE

This specification covers the requirements for granular aggregate materials for use in subgrade, subbase, base, gravel surface course, shouldering and bedding and backfill to sewers, culverts, and other structures.

~~1010.01.01 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.~~

~~**1010.01.02 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.~~

1010.02 REFERENCES

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

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

Ontario Provincial Standard Specifications Material

OPSS 1001 Aggregates - General

Ontario Ministry of Transportation Publications

Laboratory Testing Manual:

LS-601	Material Finer than 75 μm Sieve in Mineral Aggregates by Washing
LS-602	Sieve Analysis of Aggregates
LS-607	Percent Crushed Particles in Processed Coarse Aggregate
LS-614	Freezing and Thawing of Coarse Aggregate
LS-617	Percent Particles with Two or More Crushed Faces and Uncrushed Particles in Processed Coarse Aggregate
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-621	Determination of Amount of Asphalt Coated Particles in Coarse Aggregate
LS-625	Guidelines for Sampling of Granular Materials
LS-630	Determination of Amount of Contamination of Coarse Aggregates
LS-631	Qualitative Determination of Presence of Plastic Fines in Aggregates
LS-709	Determination of Permeability of Granular Soils

MTO Forms:

PH-D-1A	Granular A Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1B	Granular B Types I, II & III Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1M	Granular M Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1O	Granular O Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1SSM	SSM Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-10	Aggregate Sample Data Sheet

1010.03 DEFINITIONS

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

Bench means a ledge parallel to the stratigraphic bedding that, in quarries, forms a single level of operation above which rock is excavated from a contiguous face.

Delivery Sample means a random sample taken at the point of loading or discharge from delivery vehicles.

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.

Fines means material passing the 75 μm sieve when tested according to LS-601 or LS-602.

Gradation Test means a test used to determine the particle size distribution of an aggregate or soil material by sieving.

Lot means a specific quantity of material from a single source or a specified amount of construction assumed to be produced by the same process.

Mean means the arithmetic average of a set of data.

Physical Property means an inherent attribute or feature of an aggregate or soil material. Tests are carried out to determine a materials resistance to weathering or degradation or both. Physical properties are generally not affected by production.

Production Property means an attribute or feature of an aggregate or soil material, including gradation, that is introduced through the manufacturing process (i.e., crushing, screening, blending etc.). Tests are carried out to measure the affects of the process on the material.

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.

Random Numbers means numbers generated by chance, and recorded in random number tables.

Random Sample means a sample based on random numbers so that any portion of a lot or sublot has an equal opportunity of being selected.

Range means the difference between the largest and the smallest measurements in a set of data.

Road Sample means a random sample taken from road construction after placement and spreading of the material in the work, but prior to compaction.

Steel Slag means the non-metallic product resulting from the production of steel in a basic oxygen furnace or an electric arc furnace.

1010.05 MATERIALS

1010.05.01 General

Aggregates for Granular A, O, B, M and SSM shall be according to OPSS 1001, unless otherwise specified in this specification, and shall conform to the requirements of Table 2 and Table 3 when tested according to the test methods identified herein.

Aggregates shall be clean, hard, durable particles and shall be produced from material free of earth, humus, clay coatings, and clay lumps or fragments of any size or shape. When tested according to LS-630, the total amount of wood shall not exceed 0.1% by mass, and the total amount of clay brick, gypsum, gypsum plaster wallboard and other contaminants shall not exceed a combined total of 1.0% by mass.

When reclaimed asphalt pavement (RAP), post-consumer glass or ceramic material is used, it shall be homogeneously blended in a manner acceptable to the Contract Administrator.

Steel slag shall not be used.

1010.05.02 Granular O

Aggregates for Granular O shall be produced from a quarry or from boulders, cobbles or gravel retained on the 50 mm sieve. Recycled or reclaimed materials, including hydraulic cement concrete, RAP, slag, glass, and ceramic are not permitted.

1010.05.03 Granular A and M

Aggregates for Granular A and M shall be produced from one or a blend of the following:

a) Boulders, cobbles, gravel, sand, and fines from naturally formed deposits.

b) A quarry or talus.

c) Reclaimed hydraulic cement concrete.

d) Iron blast furnace slag or nickel slag.

Granular A and M aggregates may include up to 30% by mass of asphalt coated particles derived from RAP, and not more than a combined total of 15% by mass of glass or ceramic material or both, unless specified elsewhere in the Contract Documents.

Granular A or M produced with RAP containing steel slag aggregates is acceptable for unpaved shouldering purposes only. Such materials shall be stockpiled separately.

1010.05.04 Granular B

Granular B may be of Type I, Type II, or Type III.

Aggregates for Granular B shall be aggregates produced from one or a blend of the following, subject to the following restrictions:

a) Boulders, cobbles, gravel, sand, and fines from naturally formed deposits.

b) A quarry or talus.

c) Reclaimed hydraulic cement concrete.

d) Iron blast furnace slag or nickel slag.

Aggregates for Granular B Type I and Type III may include up to 30% by mass of asphalt coated particles derived from RAP, and not more than a combined total of 15% by mass of glass or ceramic material or both. RAP containing steel slag aggregates shall not be permitted.

Aggregates for Granular B Type II shall only be produced from a quarry or from talus, iron blast furnace slag, or nickel slag. Recycled materials shall not be permitted.

1010.05.05 Select Subgrade Material (SSM)

Aggregates for select subgrade material shall be produced only from natural deposits of non-plastic silt, sand, and gravel material. Recycled or reclaimed materials of any type shall not be permitted.

1010.08 QUALITY ASSURANCE

1010.08.01 General

The laboratory designated by the Owner shall carry out QA testing for purposes of ensuring that aggregates used in the Work conform to the physical and production requirements of this specification. Individual test results shall be forwarded to the Contractor, as they become available.

The Owner shall be responsible for all costs associated with testing for QA purposes, unless otherwise specified in this specification.

QA testing for physical properties may be waived by the Contract Administrator when the delivered quantity of Granular A, O, B, M, or SSM is less than 5,000 tonnes.

1010.08.01.01 Sampling

QA samples shall be taken according to the Contract Documents and LS-625 and shall be road samples or delivery samples obtained from the Work at a location determined by the Contract Administrator. When required, the Contractor shall provide a front-end loader to obtain material for QA samples.

When it is not possible to take road or delivery samples, samples of compacted material taken with the permission of the Owner shall be used for QA acceptance purposes.

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

QA sampling and testing shall be based on lots that are established for each aggregate type; Granular A, O, B, M, and SSM. When more than one aggregate source is used, separate lots shall also be established for each source. When aggregates are produced from materials that are extracted from within the right-of way, each area within a 1,000 m segment of the right-of-way or within a radius of 500 m of the extraction operation located within the right-of-way shall be considered equivalent to a single aggregate source for QA acceptance purposes. When aggregates are produced with blended or reclaimed materials or both, QA testing shall be performed on the final product.

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 to be included with QA samples shall be according to MTO form PH-D-10.

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

All QA samples shall be duplicate samples. One of the samples shall be randomly selected for testing by the QA laboratory and the remaining sample shall be retained by the QA laboratory for possible referee testing.

1010.08.01.02 Sample Size

The mass of the each QA sample shall meet the requirements shown in Table 4. When more than 30 kg of material is required, the total sample shall be recombined prior to testing.

1010.08.02 Physical Properties

At least one set of duplicate QA samples of each aggregate to be used in the Work shall be randomly sampled from lots of 25,000 tonnes or part thereof for physical properties. All materials delivered to the Work shall be included within a lot.

1010.08.02.01 Testing of Physical Properties

The QA laboratory shall carry out testing for each physical property requirement shown in Table 2, as applicable for each QA sample.

1010.08.02.02 Acceptance of Physical Properties

The acceptability of a lot for physical properties may result in payment at full price, payment at a reduced price, or rejection.

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

If a tested sample of aggregates representing a lot does not meet all of the requirements shown in Table 2, then a reduced price payment of 20% of the tender price shall be given for that lot for physical properties, as long as the lot is not rejectable and the applicable test results for that sample:

a) do not exceed the requirement for LS-614 by more than 25% of the specified value.

b) do not exceed the requirement for LS-618 by more than 10% of the specified value.

c) do not identify plastic fines within the material, when determined according to LS-631 and acceptance test results for LS-602 are not subject to a payment adjustment on the 75µm sieve.

d) meet all other physical property requirements of this specification.

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

The reduced price payment for the lot given above shall be in addition to any payment reduction determined according to the Acceptance Based on LS-602 and LS-607 clause for production properties.

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

shall apply.

1010.08.03 Production Properties

All lots for production properties shall be divided into four sublots of approximately equal tonnage and one duplicate QA sample shall be randomly obtained from each sublot.

For each tender item, the Contract Administrator shall estimate the quantities of granular materials obtained from each different source or process. Then, for each of those individual sources or processes, the Contract Administrator shall identify the number and size of each lot to be sampled and tested using the lot schedule shown in Table 1.

In addition, if circumstances such as the closure of the construction season or changes in production or delivery result in a lot not being completed, then the Contractor shall notify the Contract Administrator prior to the first sample is taken within that lot, in order for the Contract Administrator to adjust the sublot sizes equally to accommodate the reduced tonnage. If such notification is not given in time, then acceptance shall be based on the number of sampled sublots that are available for the incomplete lot. All lots shall be deemed to be complete at the end of each calendar year.

1010.08.03.01 Testing of Production Properties

The QA laboratory shall conduct sieve analysis according to LS-602 and determine test results for each sieve designation shown in Table 3. The QA laboratory shall also carry out testing for percent crushed particles according to LS-607, particles with two or more crushed faces according to LS-617, and amount of asphalt coated particles according to LS-621, as applicable.

1010.08.03.02 Acceptance of Production Properties

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

1010.08.03.02.01 Acceptance Based on LS-602 and LS-607

All lot means and ranges for test results carried out according to LS-602 and LS-607, as applicable, shall be computed to one decimal place and reported on the appropriate MTO form by the Contract Administrator, as indicated below:

Granular A	PH-D-1A
Granular O	PH-D-1O
Granular B, Types I, II or III	PH-D-1B
Granular M	PH-D-1M
SSM	PH-D-1SSM

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 shown in Table 3 and the range of the test results for that lot is within the limits shown in Table 5.

Lots that are subject to a total payment adjustment factor of more than 25% 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 a complete or incomplete lot does not meet the requirements of LS-602 and LS-607, is not subject to removal, but the Contractor chooses to use the lot or for some reason it cannot be totally excluded from the

Work, then at the request of the Contractor, an adjusted payment calculated according to the following formula shall be allowed in lieu of removal:

PAYMENT REDUCTION = lot quantity (tonnes) x item price ($/tonne) x payment adjustment factor (%)

Where:

The lot quantity shall be expressed in tonnes as determined according to Table 6, and the item price shall be according to one of the following:

a) The contract price for the items having the tender quantity in tonnes.

b) $21.50 per tonne for Granular A, O, and M; $15.50 per tonne for Granular B Type II; $15.00 per tonne for Granular B Type I and Type III; and $8.50 per tonne for SSM where bidding is not by tender quantity such as lump sum Contracts.

In addition, the payment adjustment factor, in percent, shall be equal to the sum of the adjustment points determined as follows:

a) Adjustment points shall be applied for each 0.1% that the mean gradation falls outside the gradation specification limits for each sieve, according to Table 7.

b) 0.1 adjustment points shall be applied for each 0.1% that the range exceeds the maximum acceptable range for each sieve.

c) 0.2 adjustment points shall be applied for Granular A or M for each 0.1% 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.

1010.08.03.02.02 Acceptance Based on LS-617 or LS-621

A lot shall be deemed to meet the applicable requirements of this specification for LS-617 or LS-621, if the mean value of the test results for that lot is within the limits shown in Table 3. When the mean value of the test results for that lot does not meet these requirements, the material shall be considered deficient and managed according to the requirements specified elsewhere in the Contract Documents.

1010.08.04 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 lot 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 samples for all sublots shall be used for referee testing of the lot.

All referee test results 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, 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 of that lot.

~~Table~~TABLE 1
Lot Schedule for Sampling and Testing

Quantity for Each Source or Process (tonnes)	Gran A, O, and M	Granular B Type I, B Type II, B Type III, and SSM
< 1,000	Sampling and testing may be waived at the discretion of the Contract Administrator	
1,000 - 5,000	One lot	One lot
> 5,000 (Note 1)	5,000 tonne lots up to 20,000 tonnes, and 10,000 tonne lots thereafter	10,000 tonne lots up to 20,000 tonnes, and 20,000 tonne lots thereafter

Note:

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~~TABLE 2
Physical Property Requirements

Laboratory Test	MTO Test Number	Granular					Select Subgrade Material
		A	B		M	O	
			Type I / Type III	Type II			
Unconfined Freeze-Thaw, % maximum loss	LS-614	-	-	-	-	15	-
Micro-Deval Abrasion (Coarse Aggregate), % maximum loss	LS-618	25	30 (Note 1)	30	25	21	30 (Note 1)
Micro-Deval Abrasion (Fine Aggregate), % maximum loss	LS-619	30	35	35	30	25	-
Amount of Contamination	LS-630	(Note 2)					
Plastic Fines	LS-631	NP (Non-Plastic)					
Determination of Permeability, k	LS-709	(Note 3)					

Notes:

1. The coarse aggregate micro-Deval abrasion loss test requirement shall be waived if the material has more than 80% passing the 4.75 mm sieve.
2. Granular A, B Type I, B Type III, or M may contain up to 15% by mass crushed glass or ceramic material or both. Granular A, O, B Type I, B Type III, and M shall not contain more than 1.0% by mass of any combination of wood, clay brick, gypsum, gypsum wall board, or plaster. Granular B Type II and SSM shall not contain more than 0.1% by mass of wood.
3. For materials north of the French/Mattawa Rivers only, the coefficient of permeability, *k* shall be greater than 1.0 x 10^{-4} cm/s or alternatively, when past field experience has demonstrated satisfactory performance. Prior data demonstrating compliance with this requirement for *k* shall be acceptable provided that such testing has been done within 5 years of the material being used and field performance has continually been shown to be satisfactory.

~~Table~~TABLE 3
Production Requirements

Lab Test	MTO Test Number	Granular						SSM
		A	B			M	O	
	LS-602 (sieve)		Type I (Note 2)	Type II	Type III (Note 2)			
	150 mm	-	100	-	100	-	-	100
	106 mm	-	-	100	-	-	-	-
	37.5 mm	-	-	-	-	-	100	-
	26.5 mm	100	50.0-100	50.0-100	50.0-100	-	95.0-100	50.0-100
	19.0 mm	85.0-100 (87.0-100) Note 3	-	-	-	100	80.0-95.0	-
	13.2 mm	65.0-90.0 (75.0-95.0) Note 3	-	-	-	75.0-95.0	60.0-80.0	-
Sieve Analysis, % passing	9.5 mm	50.0-73.0 (60.0-83.0) Note 3	-	-	32.0-100	55.0-80.0	50.0-70.0	-
	4.75 mm	35.0-55.0 (40.0-60.0) Note 3	20.0-100	20.0-55.0	20.0-90.0	35.0-55.0	20.0-45.0	20.0-100
	1.18 mm	15.0-40.0	10.0-100	10.0-40.0	10.0-60.0	15.0-40.0	0-15.0	10.0-100
	300 μm	5.0-22.0	2.0-65.0	5.0-22.0	2.0-35.0	5.0-22.0	-	5.0-95.0
	150 μm	-	-	-	-	-	-	2.0-65.0
	75 μm	2.0-8.0 (2.0-10.0) Note 4	0-8.0 (0-10.0) Note 4	0-10.0	0-8.0 (0-10.0) Note 4	2.0-8.0 (2.0-10.0) Note 4	0-5.0	0-25.0
Percent Crushed Particles, % minimum	LS-607	60	-	100	-	60	100	-
2 or more Crushed Faces, % minimum	LS-617	-	-	-	-	-	85 Note 5	-
Asphalt Coated Particles, Coarse Aggregates,% maximum	LS-621	30	30	0	30	30	0	0

Notes:

1. When Granular B is used for granular backfill for pipe subdrains, 100% of the material shall pass the 37.5 mm sieve.
2. When RAP is blended with Granular B Type I or Type III, 100% of the RAP shall pass the 75 mm sieve. Conditions in Note 1 supersede this requirement.
3. When the aggregate is obtained from an iron blast furnace slag source.
4. When the aggregate is obtained from a quarry or blast furnace slag or nickel slag source.
5. When Granular O is produced from boulders, cobbles, or gravel retained on the 50 mm sieve.

~~Table~~TABLE 4
Sample Size

Material	Minimum Mass of Field Samples, kg (Note 1)
Granular O, A, M; Granular B, SSM (100% passing 26.5 mm sieve)	25
Granular B, SSM	50

Notes:

1. Individual sample containers shall hold no more than 30 kg of aggregate. When more than 30 kg is required, additional sample containers shall be used.

~~Table~~TABLE 5
Range Requirements For Gradation (LS-602)

MTO Sieve	Maximum Acceptable Range						
	Granular						SSM
	A	B Type I	B Type II	B Type III	M	O	
150 mm	-	1	-	1	-	-	1
106 mm	-	-	1	-	-	-	-
37.5 mm	-	-	-	-	-	1	-
26.5 mm	1	-	30.0	-	-	5.0	-
19.0 mm	8.0	-	-	-	1	8.0	-
13.2 mm	20.0	-	-	-	16.0	17.0	-
9.5 mm	20.0	-	-	-	18.0	17.0	-
4.75 mm	18.0	-	22.0	-	18.0	18.0	-
1.18 mm	18.0	-	18.0	-	18.0	12.0	-
300 μm	12.0	50.0	12.0	25.0	12.0	-	-
75 μm	5.0	7.0	5.0	7.0	5.0	4.0	15.0

~~Table~~TABLE 6
Lot Quantity Determinations for Adjusted Payments

Item	Road or Delivery Samples
Items having the tender quantity in tonnes.	The quantity measured for payment by weighing.
All other items.	The weighed quantity when available; otherwise the theoretical quantity calculated by the Contract Administrator using a conversion factor of 2.0 tonnes per cubic metre.

~~Table~~TABLE 7
Adjustment Points

MTO Sieve Designation	Adjustment Points Per 0.1% Deviation from Specified Limit				
	Granular A	**Granular B**	**Granular M**	**Granular O**	**Select Subgrade Material**
150 mm	-	0.1 (Note 1)	-	-	0.1
106.5 mm	-	0.1 (Note 2)	-	-	
37.5 mm	-	-	-	0.1	-
26.5 mm	0.1	0.1	-	0.1	0.1
19.0 mm	0.1	-	0.1	0.1	-
13.2 mm	0.1	-	0.1	0.1	-
9.5 mm	0.1	-	0.1	0.1	-
4.75 mm	Excess Passing 0.5 / Insufficient Passing 0.2				0.1
1.18 mm	0.1	0.1	0.1	0.1	0.1
300 μm	0.1	0.1	0.1	-	0.1
150 μm	-	-	-	-	0.1
75 μm	1.0	1.0	1.0	1.0	0.5

Notes:

1. Granular B Type I and Type III only.
2. Granular B Type II only.

Appendix 1010-A, April 2013
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

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

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.

Note: The 1010 implemented in April 2025 replaces 1010, April 2013 with no technical content changes.

MATERIAL SPECIFICATION FOR AGGREGATES - BASE, SUBBASE, SELECT SUBGRADE, AND BACKFILL MATERIAL

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1010.01 SCOPE

This specification covers the requirements for granular aggregate materials for use in subgrade, subbase, base, gravel surface course, shouldering and bedding and backfill to sewers, culverts, and other structures.

1010.02 REFERENCES

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

Ontario Provincial Standard Specifications Material

OPSS 1001 Aggregates - General

Ontario Ministry of Transportation Publications

Laboratory Testing Manual:
LS-601 Material Finer than 75 μm Sieve in Mineral Aggregates by Washing
LS-602 Sieve Analysis of Aggregates

LS-607 Percent Crushed Particles in Processed Coarse Aggregate
LS-614 Freezing and Thawing of Coarse Aggregate
LS-617 Percent Particles with Two or More Crushed Faces and Uncrushed Particles in Processed Coarse Aggregate
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-621 Determination of Amount of Asphalt Coated Particles in Coarse Aggregate
LS-625 Guidelines for Sampling of Granular Materials
LS-630 Determination of Amount of Contamination of Coarse Aggregates
LS-631 Qualitative Determination of Presence of Plastic Fines in Aggregates
LS-709 Determination of Permeability of Granular Soils

MTO Forms:
PH-D-1A Granular A Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1B Granular B Types I, II & III Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1M Granular M Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1O Granular O Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1SSM SSM Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-10 Aggregate Sample Data Sheet

1010.03 DEFINITIONS

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

Bench means a ledge parallel to the stratigraphic bedding that, in quarries, forms a single level of operation above which rock is excavated from a contiguous face.

Delivery Sample means a random sample taken at the point of loading or discharge from delivery vehicles.

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.

Fines means material passing the 75 μm sieve when tested according to LS-601 or LS-602.

Gradation Test means a test used to determine the particle size distribution of an aggregate or soil material by sieving.

Lot means a specific quantity of material from a single source or a specified amount of construction assumed to be produced by the same process.

Mean means the arithmetic average of a set of data.

Physical Property means an inherent attribute or feature of an aggregate or soil material. Tests are carried out to determine a materials resistance to weathering or degradation or both. Physical properties are generally not affected by production.

Production Property means an attribute or feature of an aggregate or soil material, including gradation, that is introduced through the manufacturing process (i.e., crushing, screening, blending etc.). Tests are carried out to measure the affects of the process on the material.

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.

Random Numbers means numbers generated by chance, and recorded in random number tables.

Random Sample means a sample based on random numbers so that any portion of a lot or sublot has an equal opportunity of being selected.

Range means the difference between the largest and the smallest measurements in a set of data.

Road Sample means a random sample taken from road construction after placement and spreading of the material in the work, but prior to compaction.

Steel Slag means the non-metallic product resulting from the production of steel in a basic oxygen furnace or an electric arc furnace.

1010.05 MATERIALS

1010.05.01 General

Aggregates for Granular A, O, B, M and SSM shall be according to OPSS 1001, unless otherwise specified in this specification, and shall conform to the requirements of Table 2 and Table 3 when tested according to the test methods identified herein.

Aggregates shall be clean, hard, durable particles and shall be produced from material free of earth, humus, clay coatings, and clay lumps or fragments of any size or shape. When tested according to LS-630, the total amount of wood shall not exceed 0.1% by mass, and the total amount of clay brick, gypsum, gypsum plaster wallboard and other contaminants shall not exceed a combined total of 1.0% by mass.

When reclaimed asphalt pavement (RAP), post-consumer glass or ceramic material is used, it shall be homogeneously blended in a manner acceptable to the Contract Administrator.

Steel slag shall not be used.

1010.05.02 Granular O

Aggregates for Granular O shall be produced from a quarry or from boulders, cobbles or gravel retained on the 50 mm sieve. Recycled or reclaimed materials, including hydraulic cement concrete, RAP, slag, glass, and ceramic are not permitted.

1010.05.03 Granular A and M

Aggregates for Granular A and M shall be produced from one or a blend of the following:

a) Boulders, cobbles, gravel, sand, and fines from naturally formed deposits.

b) A quarry or talus.

c) Reclaimed hydraulic cement concrete.

d) Iron blast furnace slag or nickel slag.

Granular A and M aggregates may include up to 30% by mass of asphalt coated particles derived from RAP, and not more than a combined total of 15% by mass of glass or ceramic material or both, unless specified elsewhere in the Contract Documents.

Granular A or M produced with RAP containing steel slag aggregates is acceptable for unpaved shouldering purposes only. Such materials shall be stockpiled separately.

1010.05.04 Granular B

Granular B may be of Type I, Type II, or Type III.

Aggregates for Granular B shall be aggregates produced from one or a blend of the following, subject to the following restrictions:

a) Boulders, cobbles, gravel, sand, and fines from naturally formed deposits.

b) A quarry or talus.

c) Reclaimed hydraulic cement concrete.

d) Iron blast furnace slag or nickel slag.

Aggregates for Granular B Type I and Type III may include up to 30% by mass of asphalt coated particles derived from RAP, and not more than a combined total of 15% by mass of glass or ceramic material or both. RAP containing steel slag aggregates shall not be permitted.

Aggregates for Granular B Type II shall only be produced from a quarry or from talus, iron blast furnace slag, or nickel slag. Recycled materials shall not be permitted.

1010.05.05 Select Subgrade Material (SSM)

Aggregates for select subgrade material shall be produced only from natural deposits of non-plastic silt, sand, and gravel material. Recycled or reclaimed materials of any type shall not be permitted.

1010.08 QUALITY ASSURANCE

1010.08.01 General

The laboratory designated by the Owner shall carry out QA testing for purposes of ensuring that aggregates used in the Work conform to the physical and production requirements of this specification. Individual test results shall be forwarded to the Contractor, as they become available.

The Owner shall be responsible for all costs associated with testing for QA purposes, unless otherwise specified in this specification.

QA testing for physical properties may be waived by the Contract Administrator when the delivered quantity of Granular A, O, B, M, or SSM is less than 5,000 tonnes.

1010.08.01.01 Sampling

QA samples shall be taken according to the Contract Documents and LS-625 and shall be road samples or delivery samples obtained from the Work at a location determined by the Contract Administrator. When required, the Contractor shall provide a front-end loader to obtain material for QA samples.

When it is not possible to take road or delivery samples, samples of compacted material taken with the permission of the Owner shall be used for QA acceptance purposes.

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

QA sampling and testing shall be based on lots that are established for each aggregate type; Granular A, O, B, M, and SSM. When more than one aggregate source is used, separate lots shall also be established for each source. When aggregates are produced from materials that are extracted from within the right-of way, each area within a 1,000 m segment of the right-of-way or within a radius of 500 m of the extraction operation located within the right-of-way shall be considered equivalent to a single aggregate source for QA acceptance purposes. When aggregates are produced with blended or reclaimed materials or both, QA testing shall be performed on the final product.

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 to be included with QA samples shall be according to MTO form PH-D-10.

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

All QA samples shall be duplicate samples. One of the samples shall be randomly selected for testing by the QA laboratory and the remaining sample shall be retained by the QA laboratory for possible referee testing.

1010.08.01.02 Sample Size

The mass of the each QA sample shall meet the requirements shown in Table 4. When more than 30 kg of material is required, the total sample shall be recombined prior to testing.

1010.08.02 Physical Properties

At least one set of duplicate QA samples of each aggregate to be used in the Work shall be randomly sampled from lots of 25,000 tonnes or part thereof for physical properties. All materials delivered to the Work shall be included within a lot.

1010.08.02.01 Testing of Physical Properties

The QA laboratory shall carry out testing for each physical property requirement shown in Table 2, as applicable for each QA sample.

1010.08.02.02 Acceptance of Physical Properties

The acceptability of a lot for physical properties may result in payment at full price, payment at a reduced price, or rejection.

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

If a tested sample of aggregates representing a lot does not meet all of the requirements shown in Table 2, then a reduced price payment of 20% of the tender price shall be given for that lot for physical properties, as long as the lot is not rejectable and the applicable test results for that sample:

a) do not exceed the requirement for LS-614 by more than 25% of the specified value.

b) do not exceed the requirement for LS-618 by more than 10% of the specified value.

c) do not identify plastic fines within the material, when determined according to LS-631 and acceptance test results for LS-602 are not subject to a payment adjustment on the 75µm sieve.

d) meet all other physical property requirements of this specification.

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

The reduced price payment for the lot given above shall be in addition to any payment reduction determined according to the Acceptance Based on LS-602 and LS-607 clause for production properties.

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

1010.08.03 Production Properties

All lots for production properties shall be divided into four sublots of approximately equal tonnage and one duplicate QA sample shall be randomly obtained from each sublot.

For each tender item, the Contract Administrator shall estimate the quantities of granular materials obtained from each different source or process. Then, for each of those individual sources or processes, the Contract Administrator shall identify the number and size of each lot to be sampled and tested using the lot schedule shown in Table 1.

In addition, if circumstances such as the closure of the construction season or changes in production or delivery result in a lot not being completed, then the Contractor shall notify the Contract Administrator prior to the first sample is taken within that lot, in order for the Contract Administrator to adjust the sublot sizes equally to accommodate the reduced tonnage. If such notification is not given in time, then acceptance shall be based on the number of sampled sublots that are available for the incomplete lot. All lots shall be deemed to be complete at the end of each calendar year.

1010.08.03.01 Testing of Production Properties

The QA laboratory shall conduct sieve analysis according to LS-602 and determine test results for each sieve designation shown in Table 3. The QA laboratory shall also carry out testing for percent crushed particles according to LS-607, particles with two or more crushed faces according to LS-617, and amount of asphalt coated particles according to LS-621, as applicable.

1010.08.03.02 Acceptance of Production Properties

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

1010.08.03.02.01 Acceptance Based on LS-602 and LS-607

All lot means and ranges for test results carried out according to LS-602 and LS-607, as applicable, shall be computed to one decimal place and reported on the appropriate MTO form by the Contract Administrator, as indicated below:

Granular A	PH-D-1A
Granular O	PH-D-1O
Granular B, Types I, II or III	PH-D-1B
Granular M	PH-D-1M
SSM	PH-D-1SSM

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 shown in Table 3 and the range of the test results for that lot is within the limits shown in Table 5.

Lots that are subject to a total payment adjustment factor of more than 25% 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 a complete or incomplete lot does not meet the requirements of LS-602 and LS-607, is not subject to removal, but the Contractor chooses to use the lot or for some reason it cannot be totally excluded from the Work, then at the request of the Contractor, an adjusted payment calculated according to the following formula shall be allowed in lieu of removal:

PAYMENT REDUCTION = lot quantity (tonnes) x item price ($/tonne) x payment adjustment factor (%)

Where:

The lot quantity shall be expressed in tonnes as determined according to Table 6, and the item price shall be according to one of the following:

a) The contract price for the items having the tender quantity in tonnes.

b) $21.50 per tonne for Granular A, O, and M; $15.50 per tonne for Granular B Type II; $15.00 per tonne for Granular B Type I and Type III; and $8.50 per tonne for SSM where bidding is not by tender quantity such as lump sum Contracts.

In addition, the payment adjustment factor, in percent, shall be equal to the sum of the adjustment points determined as follows:

a) Adjustment points shall be applied for each 0.1% that the mean gradation falls outside the gradation specification limits for each sieve, according to Table 7.

b) 0.1 adjustment points shall be applied for each 0.1% that the range exceeds the maximum acceptable range for each sieve.

c) 0.2 adjustment points shall be applied for Granular A or M for each 0.1% 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.

1010.08.03.02.02 Acceptance Based on LS-617 or LS-621

A lot shall be deemed to meet the applicable requirements of this specification for LS-617 or LS-621, if the mean value of the test results for that lot is within the limits shown in Table 3. When the mean value of the test results for that lot does not meet these requirements, the material shall be considered deficient and managed according to the requirements specified elsewhere in the Contract Documents.

1010.08.04 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 lot 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 samples for all sublots shall be used for referee testing of the lot.

All referee test results 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, 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 of that lot.

TABLE 1
Lot Schedule for Sampling and Testing

Quantity for Each Source or Process (tonnes)	Gran A, O, and M	Granular B Type I, B Type II, B Type III, and SSM
< 1,000	Sampling and testing may be waived at the discretion of the Contract Administrator	
1,000 - 5,000	One lot	One lot
> 5,000 (Note 1)	5,000 tonne lots up to 20,000 tonnes, and 10,000 tonne lots thereafter	10,000 tonne lots up to 20,000 tonnes, and 20,000 tonne lots thereafter

Note:

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

Laboratory Test	MTO Test Number	Granular					Select Subgrade Material
		A	B		M	O	
			Type I / Type III	Type II			
Unconfined Freeze-Thaw, % maximum loss	LS-614	-	-	-	-	15	-
Micro-Deval Abrasion (Coarse Aggregate), % maximum loss	LS-618	25	30 (Note 1)	30	25	21	30 (Note 1)
Micro-Deval Abrasion (Fine Aggregate), % maximum loss	LS-619	30	35	35	30	25	-
Amount of Contamination	LS-630	(Note 2)					
Plastic Fines	LS-631	NP (Non-Plastic)					
Determination of Permeability, k	LS-709	(Note 3)					

Notes:

1. The coarse aggregate micro-Deval abrasion loss test requirement shall be waived if the material has more than 80% passing the 4.75 mm sieve.
2. Granular A, B Type I, B Type III, or M may contain up to 15% by mass crushed glass or ceramic material or both. Granular A, O, B Type I, B Type III, and M shall not contain more than 1.0% by mass of any combination of wood, clay brick, gypsum, gypsum wall board, or plaster. Granular B Type II and SSM shall not contain more than 0.1% by mass of wood.
3. For materials north of the French/Mattawa Rivers only, the coefficient of permeability, *k* shall be greater than 1.0 x 10^{-4} cm/s or alternatively, when past field experience has demonstrated satisfactory performance. Prior data demonstrating compliance with this requirement for *k* shall be acceptable provided that such testing has been done within 5 years of the material being used and field performance has continually been shown to be satisfactory.

TABLE 3
Production Requirements

Lab Test	MTO Test Number	Granular						SSM
		A	B			M	O	
	LS-602 (sieve)		Type I (Note 2)	Type II	Type III (Note 2)			
	150 mm	-	100	-	100	-	-	100
	106 mm	-	-	100	-	-	-	-
	37.5 mm	-	-	-	-	-	100	-
	26.5 mm	100	50.0-100	50.0-100	50.0-100	-	95.0-100	50.0-100
	19.0 mm	85.0-100 (87.0-100) Note 3	-	-	-	100	80.0-95.0	-
	13.2 mm	65.0-90.0 (75.0-95.0) Note 3	-	-	-	75.0-95.0	60.0-80.0	-
Sieve Analysis, % passing	9.5 mm	50.0-73.0 (60.0-83.0) Note 3	-	-	32.0-100	55.0-80.0	50.0-70.0	-
	4.75 mm	35.0-55.0 (40.0-60.0) Note 3	20.0-100	20.0-55.0	20.0-90.0	35.0-55.0	20.0-45.0	20.0-100
	1.18 mm	15.0-40.0	10.0-100	10.0-40.0	10.0-60.0	15.0-40.0	0-15.0	10.0-100
	300 μm	5.0-22.0	2.0-65.0	5.0-22.0	2.0-35.0	5.0-22.0	-	5.0-95.0
	150 μm	-	-	-	-	-	-	2.0-65.0
	75 μm	2.0-8.0 (2.0-10.0) Note 4	0-8.0 (0-10.0) Note 4	0-10.0	0-8.0 (0-10.0) Note 4	2.0-8.0 (2.0-10.0) Note 4	0-5.0	0-25.0
Percent Crushed Particles, % minimum	LS-607	60	-	100	-	60	100	-
2 or more Crushed Faces, % minimum	LS-617	-	-	-	-	-	85 Note 5	-
Asphalt Coated Particles, Coarse Aggregates,% maximum	LS-621	30	30	0	30	30	0	0

Notes:

1. When Granular B is used for granular backfill for pipe subdrains, 100% of the material shall pass the 37.5 mm sieve.
2. When RAP is blended with Granular B Type I or Type III, 100% of the RAP shall pass the 75 mm sieve. Conditions in Note 1 supersede this requirement.
3. When the aggregate is obtained from an iron blast furnace slag source.
4. When the aggregate is obtained from a quarry or blast furnace slag or nickel slag source.
5. When Granular O is produced from boulders, cobbles, or gravel retained on the 50 mm sieve.

TABLE 4
Sample Size

Material	Minimum Mass of Field Samples, kg (Note 1)
Granular O, A, M; Granular B, SSM (100% passing 26.5 mm sieve)	25
Granular B, SSM	50

Notes:

1. Individual sample containers shall hold no more than 30 kg of aggregate. When more than 30 kg is required, additional sample containers shall be used.

TABLE 5
Range Requirements For Gradation (LS-602)

MTO Sieve	Maximum Acceptable Range						
	Granular						SSM
	A	B Type I	B Type II	B Type III	M	O	
150 mm	-	1	-	1	-	-	1
106 mm	-	-	1	-	-	-	-
37.5 mm	-	-	-	-	-	1	-
26.5 mm	1	-	30.0	-	-	5.0	-
19.0 mm	8.0	-	-	-	1	8.0	-
13.2 mm	20.0	-	-	-	16.0	17.0	-
9.5 mm	20.0	-	-	-	18.0	17.0	-
4.75 mm	18.0	-	22.0	-	18.0	18.0	-
1.18 mm	18.0	-	18.0	-	18.0	12.0	-
300 μm	12.0	50.0	12.0	25.0	12.0	-	-
75 μm	5.0	7.0	5.0	7.0	5.0	4.0	15.0

TABLE 6
Lot Quantity Determinations for Adjusted Payments

Item	Road or Delivery Samples
Items having the tender quantity in tonnes.	The quantity measured for payment by weighing.
All other items.	The weighed quantity when available; otherwise the theoretical quantity calculated by the Contract Administrator using a conversion factor of 2.0 tonnes per cubic metre.

TABLE 7
Adjustment Points

MTO Sieve Designation	Adjustment Points Per 0.1% Deviation from Specified Limit				
	Granular A	**Granular B**	**Granular M**	**Granular O**	**Select Subgrade Material**
150 mm	-	0.1 (Note 1)	-	-	0.1
106.5 mm	-	0.1 (Note 2)	-	-	
37.5 mm	-	-	-	0.1	-
26.5 mm	0.1	0.1	-	0.1	0.1
19.0 mm	0.1	-	0.1	0.1	-
13.2 mm	0.1	-	0.1	0.1	-
9.5 mm	0.1	-	0.1	0.1	-
4.75 mm	Excess Passing 0.5 / Insufficient Passing 0.2				0.1
1.18 mm	0.1	0.1	0.1	0.1	0.1
300 μm	0.1	0.1	0.1	-	0.1
150 μm	-	-	-	-	0.1
75 μm	1.0	1.0	1.0	1.0	0.5

Notes:

1. Granular B Type I and Type III only.
2. Granular B Type II only.

1010.05 MATERIALS

1010.05.03 Granular A and M

Subsection 1010.05.03 of OPSS 1010 is amended by deleting the second paragraph in its entirety and replacing it with the following:

Unless specified elsewhere in the Contract Documents, Granular A and M aggregates may include up to a combined total of 15%, by mass, of glass or ceramic material or both and;

a) Up to 50%, by mass, of asphalt-coated particles derived from RAP, when the granular material is being used for shouldering purposes; or

b) Up to 30%, by mass, of asphalt-coated particles derived from RAP, when the granular material is being used for all other purposes.

Tables 3, 5 and 7 of OPSS 1010 are deleted in their entirety and replaced with the following:

1010.05.04 Granular B

Subsection 1010.05.04 of OPSS 1010 is amended by deleting the last paragraph in its entirety and replacing it with the following:

Aggregates for Granular B Type II shall only be produced from a quarry or from talus, crushed concrete with up to 5% asphalt-coated particles, iron blast furnace slag, or nickel slag. No other recycled or reclaimed materials shall be permitted.

1010.05.05 Select Subgrade Material (SSM)

Subsection 1010.05.05 of OPSS 1010 is deleted in its entirety and replaced with the following:

Aggregates for select subgrade material shall be produced only from crushed rock or natural deposits of non-~~-~~plastic silt, sand, and gravel material. Recycled or reclaimed materials of any type shall not be permitted.

~~Table~~TABLE 3
Production Requirements

Lab Test	MTO Test Number	Sieve	Granular						SSM
			A	B Type I (Note 1)	B Type II	B Type III (Note 1)	M	O	
Sieve Analysis, % passing	LS-602	150 mm	-	100	-	100	-	-	100
		106 mm	-	-	100	-	-	-	-
		37.5 mm	-	100 (Note 2)	100 (Note 3)	100 (Note 2)	-	100	-
		26.5 mm	100	50.0 - 100 100 (Note 4)	50.0 - 100 100 (Note 4)	50.0 - 100 100 (Note 4)	-	95.0 - 100	50.0 - 100
		19.0 mm	85.0 - 100 87.0 - 100 (Note 5)	-	-	-	100	80.0 - 95.0	-
		13.2 mm	65.0 - 90.0 75.0 - 95.0 (Note 5)	-	-	-	75.0 - 95.0	60.0 - 80.0	-
		9.5 mm	50.0 - 73.0 60.0 - 83.0 (Note 5)	-	-	32.0 - 100	55.0 - 80.0	50.0 - 70.0	-
		4.75 mm	35.0 - 55.0 40.0 - 60.0 (Note 5)	20.0 - 100	20.0 - 55.0	20.0 - 90.0	35.0 - 55.0	20.0 - 45.0	20.0 - 100
		1.18 mm	15.0 - 40.0	10.0 - 100	10.0 - 40.0	10.0 - 60.0	15.0 - 40.0	0 - 15.0	10.0 - 100
		300 μm	5.0 - 22.0	2.0 - 65.0	5.0 - 22.0	2.0 - 35.0	5.0 - 22.0	-	5.0 - 95.0
		150 μm	-	-	-	-	-	-	2.0 - 65.0
		75 μm	2.0 - 8.0 2.0 - 10.0 (Note 6)	0 - 8.0 0 - 10.0 (Note 6)	0 - 10.0	0 - 8.0 0 - 10.0 (Note 6)	2.0 - 8.0 2.0 - 10.0 (Note 6)	0 - 5.0	0 - 25.0
Percent Crushed Particles, % minimum	LS-607	-	60	-	100	-	60	100	-
2 or more Crushed Faces, % minimum	LS-617	-	-	-	-	-	-	85 (Note 7)	-
Asphalt-Coated Particles, Coarse Aggregates, % maximum	LS-621	-	30 50 (Note 8)	30	0 5 (Note 9)	30	30 50 (Note 8)	0	0

Table 3 Notes:

1. When RAP is blended with other aggregates in Granular B Type I or Type III, 100% of the RAP being used shall pass the 75 mm sieve. However, the conditions given in Notes 2., 3.and 4 supersede this requirement.
2. When Granular B Types I and III are used as granular backfill for pipe subdrains or as a granular blanket for wick drains, 100% of the material shall pass the 37.5 mm sieve.
3. When Granular B, Type II is used as granular backfill for pipe subdrains, as granular backfill for structures or as a granular blanket for wick drains, 100% of the material shall pass the 37.5 mm sieve.
4. When Granular B is used for embedment, bedding or cover material, 100% of the material shall pass the 26.5 mm sieve.
5. When the aggregate is obtained from an iron blast furnace slag source.
6. When the aggregate is obtained from a quarry or blast furnace slag or nickel slag source.
7. When Granular O is produced from boulders, cobbles, or gravel retained on the 50 mm sieve.
8. Aggregates used for shouldering purposes, may include up to 50%, by mass, of asphalt-coated particles.
9. Aggregates produced from crushed concrete, may include up to 5%, by mass, of asphalt-coated particles.

~~Table~~

TABLE 5
Range Requirements for Gradation (LS-602)

MTO Sieve	Maximum Acceptable Range						
	Granular						SSM
	A	B Type I	B Type II	B Type III	M	O	
150 mm	-	1	-	1	-	-	1
106 mm	-	-	1	-	-	-	-
37.5 mm	-	1 (Note 1)	1 (Note 1)	1 (Note 1)	-	1	-
26.5 mm	1	1 (Note 2)	30.0 1 (Note 2)	1 (Note 2)	-	5.0	-
19.0 mm	8.0	-	-	-	1	8.0	-
13.2 mm	20.0	-	-	-	16.0	17.0	-
9.5 mm	20.0	-	-	-	18.0	17.0	-
4.75 mm	18.0	-	22.0	-	18.0	18.0	-
1.18 mm	18.0	-	18.0	-	18.0	12.0	-
300 μm	12.0	50.0	12.0	25.0	12.0	-	-
75 μm	5.0	7.0	5.0	7.0	5.0	4.0	15.0

~~Table 5~~ Notes:

1. When Granular B is used as granular backfill for pipe subdrains, as granular backfill for structures or as a granular blanket for wick drains.
2. When Granular B is used for embedment, bedding or cover material.

~~Table~~TABLE 7
Adjustment Points

MTO Sieve	Adjustment Points Per 0.1% Deviation from Specified Limit				
	Granular				SSM
	A	B	M	O	
150 mm	-	0.1 (Note 1)	-	-	0.1
106.5 mm	-	0.1 (Note 2)	-	-	-
37.5 mm	-	0.1 (Note 3)	-	0.1	-
26.5 mm	0.1	0.1	-	0.1	0.1
19.0 mm	0.1	-	0.1	0.1	-
13.2 mm	0.1	-	0.1	0.1	-
9.5 mm	0.1	-	0.1	0.1	-
4.75 mm	Excess Passing 0.5 / Insufficient Passing 0.2				0.1
1.18 mm	0.1	0.1	0.1	0.1	0.1
300 μm	0.1	0.1	0.1	-	0.1
150 μm	-	-	-	-	0.1
75 μm	1.0	1.0	1.0	1.0	0.5

Table 7 Notes:
1. Granular B Type I and Type III only.
2. Granular B Type II only.
3. When Granular B is used as granular backfill for pipe subdrains, as granular backfill for structures or as a granular blanket for wick drains.

WARRANT: Always with OPSS 1010, Material Specification for Aggregates - Base, Subbase, Select Subgrade and Backfill Material, **except when NSSP SOAG0001 is included.**

AMENDMENT TO OPSS 1010, APRIL 2025

Special Provision No. 110S06 April 2025

1010.05 MATERIALS

1010.05.03 Granular A and M

Subsection 1010.05.03 of OPSS 1010 is amended by deleting the second paragraph in its entirety and replacing it with the following:

Unless specified elsewhere in the Contract Documents, Granular A and M aggregates may include up to a combined total of 15%, by mass, of glass or ceramic material or both and;

a) Up to 50%, by mass, of asphalt-coated particles derived from RAP, when the granular material is being used for shouldering purposes; or

b) Up to 30%, by mass, of asphalt-coated particles derived from RAP, when the granular material is being used for all other purposes.

Tables 3, 5 and 7 of OPSS 1010 are deleted in their entirety and replaced with the following:

1010.05.04 Granular B

Subsection 1010.05.04 of OPSS 1010 is amended by deleting the last paragraph in its entirety and replacing it with the following:

Aggregates for Granular B Type II shall only be produced from a quarry or from talus, crushed concrete with up to 5% asphalt-coated particles, iron blast furnace slag, or nickel slag. No other recycled or reclaimed materials shall be permitted.

1010.05.05 Select Subgrade Material (SSM)

Subsection 1010.05.05 of OPSS 1010 is deleted in its entirety and replaced with the following:

Aggregates for select subgrade material shall be produced only from crushed rock or natural deposits of non-plastic silt, sand, and gravel material. Recycled or reclaimed materials of any type shall not be permitted.

TABLE 3
Production Requirements

Lab Test	MTO Test Number	Sieve	Granular						SSM
			A	B Type I (Note 1)	B Type II	B Type III (Note 1)	M	O	
Sieve Analysis, % passing	LS-602	150 mm	-	100	-	100	-	-	100
		106 mm	-	-	100	-	-	-	-
		37.5 mm	-	100 (Note 2)	100 (Note 3)	100 (Note 2)	-	100	-
		26.5 mm	100	50.0 - 100 100 (Note 4)	50.0 - 100 100 (Note 4)	50.0 - 100 100 (Note 4)	-	95.0 - 100	50.0 - 100
		19.0 mm	85.0 - 100 87.0 - 100 (Note 5)	-	-	-	100	80.0 - 95.0	-
		13.2 mm	65.0 - 90.0 75.0 - 95.0 (Note 5)	-	-	-	75.0 - 95.0	60.0 - 80.0	-
		9.5 mm	50.0 - 73.0 60.0 - 83.0 (Note 5)	-	-	32.0 - 100	55.0 - 80.0	50.0 - 70.0	-
		4.75 mm	35.0 - 55.0 40.0 - 60.0 (Note 5)	20.0 - 100	20.0 - 55.0	20.0 - 90.0	35.0 - 55.0	20.0 - 45.0	20.0 - 100
		1.18 mm	15.0 - 40.0	10.0 - 100	10.0 - 40.0	10.0 - 60.0	15.0 - 40.0	0 - 15.0	10.0 - 100
		300 μm	5.0 - 22.0	2.0 - 65.0	5.0 - 22.0	2.0 - 35.0	5.0 - 22.0	-	5.0 - 95.0
		150 μm	-	-	-	-	-	-	2.0 - 65.0
		75 μm	2.0 - 8.0 2.0 - 10.0 (Note 6)	0 - 8.0 0 - 10.0 (Note 6)	0 - 10.0	0 - 8.0 0 - 10.0 (Note 6)	2.0 - 8.0 2.0 - 10.0 (Note 6)	0 - 5.0	0 - 25.0
Percent Crushed Particles, % minimum	LS-607	-	60	-	100	-	60	100	-
2 or more Crushed Faces, % minimum	LS-617	-	-	-	-	-	-	85 (Note 7)	-
Asphalt-Coated Particles, Coarse Aggregates, % maximum	LS-621	-	30 50 (Note 8)	30	0 5 (Note 9)	30	30 50 (Note 8)	0	0

Table 3 Notes:

1. When RAP is blended with other aggregates in Granular B Type I or Type III, 100% of the RAP being used shall pass the 75 mm sieve. However, the conditions given in Notes 2., 3.and 4 supersede this requirement.
2. When Granular B Types I and III are used as granular backfill for pipe subdrains or as a granular blanket for wick drains, 100% of the material shall pass the 37.5 mm sieve.
3. When Granular B, Type II is used as granular backfill for pipe subdrains, as granular backfill for structures or as a granular blanket for wick drains, 100% of the material shall pass the 37.5 mm sieve.
4. When Granular B is used for embedment, bedding or cover material, 100% of the material shall pass the 26.5 mm sieve.
5. When the aggregate is obtained from an iron blast furnace slag source.
6. When the aggregate is obtained from a quarry or blast furnace slag or nickel slag source.
7. When Granular O is produced from boulders, cobbles, or gravel retained on the 50 mm sieve.
8. Aggregates used for shouldering purposes, may include up to 50%, by mass, of asphalt-coated particles.
9. Aggregates produced from crushed concrete, may include up to 5%, by mass, of asphalt-coated particles.

TABLE 5
Range Requirements for Gradation (LS-602)

MTO Sieve	Maximum Acceptable Range						
	Granular						SSM
	A	B Type I	B Type II	B Type III	M	O	
150 mm	-	1	-	1	-	-	1
106 mm	-	-	1	-	-	-	-
37.5 mm	-	1 (Note 1)	1 (Note 1)	1 (Note 1)	-	1	-
26.5 mm	1	1 (Note 2)	30.0 1 (Note 2)	1 (Note 2)	-	5.0	-
19.0 mm	8.0	-	-	-	1	8.0	-
13.2 mm	20.0	-	-	-	16.0	17.0	-
9.5 mm	20.0	-	-	-	18.0	17.0	-
4.75 mm	18.0	-	22.0	-	18.0	18.0	-
1.18 mm	18.0	-	18.0	-	18.0	12.0	-
300 μm	12.0	50.0	12.0	25.0	12.0	-	-
75 μm	5.0	7.0	5.0	7.0	5.0	4.0	15.0

Notes:

1. When Granular B is used as granular backfill for pipe subdrains, as granular backfill for structures or as a granular blanket for wick drains.
2. When Granular B is used for embedment, bedding or cover material.

TABLE 7
Adjustment Points

MTO Sieve	Adjustment Points Per 0.1% Deviation from Specified Limit				
	Granular				SSM
	A	B	M	O	
150 mm	-	0.1 (Note 1)	-	-	0.1
106.5 mm	-	0.1 (Note 2)	-	-	-
37.5 mm	-	0.1 (Note 3)	-	0.1	-
26.5 mm	0.1	0.1	-	0.1	0.1
19.0 mm	0.1	-	0.1	0.1	-
13.2 mm	0.1	-	0.1	0.1	-
9.5 mm	0.1	-	0.1	0.1	-
4.75 mm	Excess Passing 0.5 / Insufficient Passing 0.2				0.1
1.18 mm	0.1	0.1	0.1	0.1	0.1
300 μm	0.1	0.1	0.1	-	0.1
150 μm	-	-	-	-	0.1
75 μm	1.0	1.0	1.0	1.0	0.5

Table 7 Notes:
1. Granular B Type I and Type III only.
2. Granular B Type II only.
3. When Granular B is used as granular backfill for pipe subdrains, as granular backfill for structures or as a granular blanket for wick drains.

WARRANT: Always with OPSS 1010, Material Specification for Aggregates - Base, Subbase, Select Subgrade and Backfill Material, **except when NSSP SOAG0001 is included.**