MATERIAL SPECIFICATION FOR GEOTEXTILES

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1860.01 SCOPE

This specification covers the material requirements for geotextiles.

1860.01.01 Specification Significance and Use

This specification has been developed for use in municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities in Ontario.

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

1860.01.02 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.

1860.02 REFERENCES

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

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

ASTM International

D 4354-12	Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing
D 4355/D 4355M-14	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
D 4491/D 4491M-17	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
D 4533/D 4533M-15	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
D 4873-16	Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
D 4632/D 4632M-15a	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
D 6241-14	Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50 mm Probe

Canadian General Standards Board (CGSB)

148.1 No. 10-94	Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size

Bureau de Normalisation du Québec (BNQ)

BNQ 7009-910	Geotextiles - Quality of Geotextiles Used in Road Engineering - Certification Protocol

1860.03 DEFINITIONS

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

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

Filtration Opening Size (FOS) means the opening size of a geotextile in microns corresponding to 95% by mass particle diameter passing through the geotextile in the hydrodynamic sieving test CAN/CGSB 148.1, Method No. 10.

Geosynthetic means a synthetic material used in geotechnical engineering applications. Geosynthetics may include such items as geotextiles, geomembranes, geocells, geogrids, geonets, and geocomposites.

Geotextile means a permeable synthetic textile material that is used in association with foundation, soil, rock, earth, or other geotechnical related material for one or more of the following functions: separation, filtration, drainage, or protection. They may be woven, non-woven, or knitted.

Lat means a length equal to the circumference of a full geotextile roll provided by the manufacturer.

Minimum Average Roll Value (MARV) means the average value minus two standard deviations of a given property established by the manufacturer during production. The average roll value for a given property must meet or exceed this value.

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.

Quality Control (QC) means a system or series of activities carried out by the Contractor, Subcontractor, supplier, and manufacturer to ensure that materials supplied to the Owner meet the specified requirements.

Referee Testing means testing of a material attribute for the purpose of resolving acceptance issues at the request of the Contractor or the Owner.

1860.04 DESIGN AND SUBMISSION REQUIREMENTS

1860.04.01 Submission Requirements

Prior to the use of a geotextile in the Work, a certificate from the manufacturer stating the name of the manufacturer, product name, style number, chemical composition, and other pertinent information required to fully describe the geotextile as evaluated under the manufacturer's QC program, shall be submitted to the Contract Administrator. The certificate shall identify the name of the supplier of the geotextile covered pipe or tubing. A person having legal authority to bind the manufacturer or supplier shall attest to this certificate.

Upon request, documentation describing the manufacturer's QC program shall be made available to the Contract Administrator.

The requirements stated above shall be waived for geotextiles certified according to BNQ 7009-910.

1860.05 MATERIALS

Geotextile fibre or yarn shall be composed of at least 95% by mass of polypropylene, polyethylene, polyester, or other synthetic polymers, excluding polyamides.

Geotextiles shall contain stabilizers or inhibitors, if necessary, to make the filaments resistant to deterioration by excessive ultraviolet (UV) light and heat exposure. Geotextiles shall be resistant to acid and alkali action and shall be unaffected by micro-organisms and insects.

1860.07 PRODUCTION

1860.07.01 Woven Geotextiles

Woven geotextiles shall be produced by interlacing two or more sets of filaments, yarns, fibres, film, tape, or other elements in such a way that the elements pass each other, essentially at right angles and with one set of elements parallel to the fabric axis. The edge of woven geotextiles shall be finished to prevent the outer yarn from pulling away.

1860.07.02 Non-Woven Geotextiles

Non-woven geotextiles shall consist of a manufactured sheet, web, or batt of directionally or randomly-oriented fibres, filaments, or other elements produced by bonding or interlocking the elements by mechanical, thermal, or chemical means.

1860.07.03 Knitted Sock Geotextiles

Knitted sock geotextiles shall be produced by interlooping one or more yarns, fibres, or filaments in a continuous tube. Knitted sock geotextiles are suitable only for wrapping of subdrain pipe.

1860.07.04 Seams

When sections of geotextile are joined by sewing, the seam strength shall be at least 90% of the minimum tensile strength requirement for the class of geotextile specified in the Contract Documents.

Seams joining two sections of geotextile shall be sewn with thread meeting the material requirements for the geotextile or, shall be bonded by thermal or chemical means.

1860.07.05 Physical Requirements

1860.07.05.01 Woven and Non-Woven Geotextiles

Woven and non-woven geotextiles are classified as either Class I or Class II and shall meet the physical property requirements shown in Table 1.

1860.07.05.02 Knitted Sock Geotextiles

Knitted sock geotextiles shall meet the physical property requirements shown in Table 2.

1860.07.05.03 Temporary Silt Fence

Geotextiles for temporary silt fence shall be woven or non-woven and shall meet the physical property requirements shown in Table 3.

1860.07.06 Protection during Shipment and Storage

Geotextiles shall be protected against excessive UV exposure and contamination from dirt, dust, moisture, and any other deleterious materials, until they are installed. All geotextiles shall be wrapped in an opaque protective covering from the time of manufacture to the time of installation. The geotextiles and protective wrapping shall be free of tears and punctures, upon delivery to the work.

Geotextiles intended to be covered by soil, rock, earth, or other materials shall not be exposed to direct sunlight for more than 72 hours following the removal of the protective wrap.

Geotextiles shall be protected from temperatures greater than 60 °C.

1860.07.07 Identification

Each roll of geotextile or geotextile-covered pipe or tubing shall be clearly marked according to ASTM D 4873 with a permanent, legible identification tag or label either on the protective wrap or the inner core as applicable, or affixed to a geotextile-covered pipe or tubing. Product labels shall show the name of the manufacturer or supplier, product number, type, Class, roll number, and date of manufacture.

For Class I and Class II geotextiles, the product label requirements stated in the paragraph above, shall be waived for geotextiles certified by the BNQ according to BNQ 7009-910 for the requirements specified in the Materials and Production sections. BNQ-certified geotextiles shall bear the "BNQ" mark of conformity, the BNQ Product Designation, as specified in Table 1, as well as all other identification marks specified by BNQ.

1860.08 QUALITY ASSURANCE

1860.08.01 General

When the Owner has elected to carry out QA testing to ensure that material used in the Work is according to the requirements of this specification, applicable geotextiles shall be sampled and tested according to the methods identified in Tables 1, 2, or 3, at the following rates:

a) For Class I or II geotextile, one sample per 10,000 m^2 of installed product.

b) For knitted sock geotextile, one sample per 10,000 m of installed subdrain pipe wrapped with knitted sock geotextile.

c) For temporary silt fence geotextile, one sample per 10,000 m of silt fence barrier installed.

When the quantity of a geotextile is less than the lot size specified above, a minimum of one QA sample per each geotextile type shall be tested to verify that the material meets the requirements of this specification.

As specified elsewhere in the Contract Documents, the Contract Administrator shall be allowed access to all sampling locations and reserves the right to request a QA sample at any time without notice to the Contractor.

Testing shall be carried out at a laboratory designated by the Owner. The Owner shall be responsible for all costs associated with QA testing.

1860.08.02 Sampling

1860.08.02.01 General

QA sampling shall be carried out by the Contractor, in the presence of the Contract Administrator.

Sampling shall be according to ASTM D 4354 and as specified in the Contract Documents.

All QA samples shall be duplicate samples with both samples taken side-by-side.

Each sample shall be rolled and placed into separate UV-protective containers (e.g., sealed cardboard box or opaque plastic bag). If a rolled sample is too large to fit within a UV-protective container, it may be folded in a manner that minimizes the number of folds required to fit the sample into the container.

Each sample shall be accompanied with a copy of the roll label or identification tag, as well as the appropriate contract-related information and testing requirements, as specified in the Contract Documents. All such information shall be placed in a moisture-proof envelope directly attached to each UV-protective container.

Where security bags and seals are required, each UV-protective container shall be placed within a separate security bag sealed by the Contract Administrator.

1860.08.02.02 Sample Size, Preparation, and Marking

Samples of Class I and Class II geotextiles shall be the full width of the roll and at least 2.0 meters in length in the machine direction.

Samples of temporary silt fence geotextile and knitted socks shall be a minimum of 3.0 m^2 in area.

When samples are taken from a roll of material for testing, at least a full lat of the material from that roll shall be discarded prior to sampling.

All samples shall be completely dry, free of damage, dust, or other contamination, at all times. Any samples that have been allowed to become moist or wet shall be air-dried in a protected place, away from direct sunlight until they are completely dry, prior to packaging.

All samples shall be permanently marked with the machine direction.

For temporary silt fence geotextile that is attached to wooden stakes, the wooden stakes shall be carefully removed to avoid any tearing of the geotextile and the stakes discarded. The area within 150 mm of each of the stakes that were removed, shall then be permanently marked by crosshatching, to ensure that such areas are not used for testing.

1860.08.03 Acceptance

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

1860.08.04 Referee Testing

When QA test results do not meet the requirements of this specification, the Contractor has the option of invoking referee testing for the test result or results that failed to meet the requirements, as long as a duplicate QA sample is available for testing.

The Contractor shall notify the Contract Administrator, in writing, invoking this option within 5 Business Days following notification of unacceptable material. The notification shall include the type and, where applicable, the class of geotextile, as well as the specific attribute or attributes for which the referee testing is being requested.

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

The Owner shall select a referee laboratory, within 5 Business Days following the Contractor's notification to invoke referee testing.

The Contractor may observe the testing, at no additional cost to the Owner. The Contract Administrator shall notify the Contractor a minimum of 5 Business Days in advance of the date of referee testing. Provided that such notice was given, referee testing shall be carried out regardless of the absence of observers.

Observers shall follow the referee laboratory protocols for access to the premises and testing equipment and shall not unnecessarily impede the progress of the testing. Observers shall be permitted to validate sample identification and view sample condition. Subject to safety requirements, test method, and equipment limitations, Observers shall be permitted to observe test procedures, take notes, view equipment readings, and review completed work sheets while in attendance.

Concerns with sample condition or sample identification shall be made known prior to commencement of the referee testing. Comments on deviations from the applicable test method shall be made at the time of testing. Unresolved concerns shall be specific in nature and submitted, in writing, to the laboratory's designated representative and other observers, at the time of testing.

Referee test results shall be binding on both the Owner and the Contractor.

When a referee test result shows that the materials are in accordance with the physical property requirements of this specification, then the material represented by that test result shall be accepted.

When a referee test result shows that the material does not meet the physical property requirements of this specification, then the material represented by that test result, including any material already in the Work, shall be considered rejectable.

The Owner shall be responsible for the cost of referee testing, provided that the referee test results show that the geotextile meets the applicable requirements of this specification. Otherwise, the Contractor shall be responsible for the cost of referee testing.

1860.09 OWNER PURCHASE OF MATERIAL

1860.09.01 General

Geotextiles supplied to the Owner under this specification shall be of the type, Class, and FOS range as specified in the Contract Documents. Material not meeting the requirements of this specification may be rejected by the Owner.

1860.09.02 Measurement and Payment

Payment at the price specified in the Contract Documents, in square metres, shall be for the supply of geotextiles delivered to the destination on the date and time specified.

Rejected material shall be replaced at no additional cost to the Owner.

TABLE 1
Physical Property Requirements for Woven and Non-Woven Geotextiles

Property	Test Method	Unit	Geotextile Class			
			Class I		Class II*	
			Woven	Non-Woven	Woven	Non-Woven
			BNQ Product Designation			
			OPSS 1860-I-W	OPSS 1860-I-N	OPSS 1860-II-W	OPSS 1860-II-N
Tensile strength, MARV, minimum	ASTM D 4632/D 4632M	N	800	350	1100	700
Tear strength, MARV, minimum	ASTM D 4533/D 4533M	N	300	180	400	250
Puncture strength, MARV, minimum	ASTM D 6241	N	1650	990	2200	1375
Permittivity, minimum	ASTM D 4491/D 4491M, Method A	s^{-1}	0.05			
Filtration opening size (FOS)	CAN/CGSB 148.1, Method No. 10	µ	As specified in the Contract Documents			
Ultraviolet stability, minimum	ASTM D 4355	%	50% retained tensile strength at 500 hours			

**Note: A Class II Woven geotextile may be used to replace a Class I Woven geotextile or a Class II Non-Woven geotextile may be used to replace a Class I Non-Woven geotextile, as long as the geotextile being proposed for use meets the requirements for Filtration Opening Size (FOS), according to CAN/CGSB 148.1, Method No. 10, as specified in the Contract Documents.*

TABLE 2
Physical Property Requirements for Knitted Sock Geotextiles

Property	Test Method	Acceptance Requirements
Puncture resistance, N	ASTM D 6241	800
FOS, maximum, µm	CAN/CGSB 148.1, Method No. 10	As specified in the Contract Documents
Permittivity, minimum, s^{-1}	ASTM D 4491/D 4491M, Method A	2.75

TABLE 3
Physical Property Requirements for Temporary Silt Fence Geotextiles

Property	Test Method	Unit	Supported Silt Fence	Unsupported Silt Fence	
				Woven	Non-Woven
Maximum post spacing	-	m	1.2	2.0	1.2
Tensile strength, MARV, minimum	ASTM D 4632/D 4632M	N	400	550	
Permittivity, minimum	ASTM D 4491/D 4491M	s^{-1}	0.05		
Filtration Opening Size (FOS), maximum	CAN/CGSB 148.1, Method No. 10	µm	As specified in the Contract Documents		
Ultraviolet stability, minimum	ASTM D 4355/D 4355M	%	70% retained tensile strength at 500 hours		

Appendix 1860-A, November 2018
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

The Owner should specify the following in the Contract Documents:

- Class, type (e.g., woven or non-woven), and FOS range of the geotextile. (1860.09.01)

The designer may consider reducing the sampling frequency for larger quantities of geotextile. (1860.08.01)

The designer should be aware that higher strength materials than those specified in Table 1 are available for specific applications.

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

OPSD 206.050	Subdrain Pipe Connection and Outlet
OPSD 207.030	Concrete and Composite Pavement on Open Graded Drainage Layer
OPSD 207.041	Subdrain Pipe Open Graded Drainage Layer
OPSD 207.044	Subdrain Pipe Connection and Outlet Open Graded Drainage Layer
OPSD 216.021	Subdrain Pipe Connection and Outlet
OPSD 219.110	Light-Duty Silt Fence Barrier
OPSD 219.130	Heavy-Duty Silt Fence Barrier
OPSD 219.131	Heavy-Duty Wire-Backed Silt Fence Barrier
OPSD 219.210	Temporary Rock Flow Check Dam
OPSD 219.211	Temporary Rock Flow Check Dam Flat Bottom Ditch
OPSD 219.231	Temporary Berm Barrier for Slope Drain
OPSD 219.240	Sediment Trap for Dewatering
OPSD 219.260	Turbidity Curtain
OPSD 219.261	Turbidity Curtain Seam Detail
OPSD 802.013	Flexible Pipe Embedment and Backfill Rock Excavation
OPSD 802.014	Flexible Pipe Embedment in Embankment Original Ground: Earth or Rock
OPSD 802.023	Flexible Pipe Arch Embedment and Backfill Rock Excavation
OPSD 802.024	Flexible Pipe Arch Embedment in Embankment Original Ground: Earth or Rock
OPSD 802.033	Rigid Pipe Bedding, Cover, and Backfill rock Excavation
OPSD 802.034	Rigid Pipe Bedding and Cover in Embankment Original Ground: Earth or Rock
OPSD 802.053	Horizontal Elliptical Rigid Pipe Bedding, Cover, and Backfill Rock Excavation
OPSD 802.054	Horizontal Elliptical Rigid Pipe Bedding and cover in Embankment Original Ground: Earth or Rock
OPSD 810.010	General Rip-Rap Layout for Sewer and Culvert Outlets
OPSD 810.020	General Rip-Rap Layout for Ditch Inlets