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APPENDICES

1860-A Commentary

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 provincial- and municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities and the Ontario Ministry of Transportation.

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 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.

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

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D 4355-07</td>
<td>Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus</td>
</tr>
<tr>
<td>D 6241-04</td>
<td>Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50 mm Probe</td>
</tr>
</tbody>
</table>

Canadian General Standards Board (CGSB)

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2 No. 11.1-94</td>
<td>Textile Test Methods - Bursting Strength - Diaphragm Pressure Test</td>
</tr>
<tr>
<td>4.2 No. 12.2-00</td>
<td>Textile Test Methods - Tearing Strength-Trapezoid Method</td>
</tr>
<tr>
<td>148.1 No. 1-94</td>
<td>Methods of Testing Geosynthetics - Geotextiles - Sampling and Preparation of Test Specimens</td>
</tr>
<tr>
<td>148.1 No. 4-94</td>
<td>Methods of Testing Geosynthetics - Geotextiles - Normal Water Permeability Under No Compressive Load</td>
</tr>
<tr>
<td>148.1 No. 7.3-92</td>
<td>Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles</td>
</tr>
<tr>
<td>148.1 No. 10-94</td>
<td>Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size</td>
</tr>
</tbody>
</table>
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.

**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 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 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 above requirements are 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 Grab tensile strength requirement for the class of geotextile specified in the Contract Documents or purchasing order.

Seams of the 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 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 Silt Fence

Geotextiles for 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 permanently legible identification tag or label on the protective wrap or the inner core or affixed to the 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. This requirement is waived for certified geotextiles bearing the distinctive BNQ labels and identification affixed to geotextile rolls and covering according to BNQ 7009-910.

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 in accordance to the requirements of this specification, the following samples shall be tested according to the methods identified in Tables 1, 2, or 3, as applicable:

a) For Class I or II geotextile, one sample per 10,000 m² 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 geotextile is less than the lot size specified above, a minimum of one QA sample per geotextile type shall be tested to verify the material meets the requirements of this specification.

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 will be responsible for all costs associated with QA testing.

1860.08.02 Sampling

Sampling shall be according to CAN/CGSB 148.1, Method No. 1. QA sampling shall be carried out by the Contractor in the presence of the Contract Administrator.

All QA samples shall be duplicate samples. One of the samples shall be randomly selected for testing by the QA laboratory and the remaining samples shall be retained by the QA laboratory for possible referee testing.
Each portion of the duplicate sample shall be full roll width and a minimum of 3 continuous metres in length in the machine direction. For temporary silt fence geotextile attached to wooden stakes, samples shall consist of continuous sections including the stakes. The stakes shall be cut flush with the edge of the silt fence geotextile material.

All geotextiles samples shall be dry, free of damage, dust, or other contamination.

Each portion of the duplicate sample shall be rolled and placed into separate suitable UV-protective containers (e.g., sealed cardboard box or opaque plastic bag). Wet or moist geotextile samples shall be allowed to dry completely in a protected place away from direct sunlight prior to packaging. If a rolled sample is too large to fit within the UV-protective container, it may be folded with a minimum number of folds. Where security bags and seals are required, each UV-protective container shall fit within a separate security bag.

Each portion of the duplicate sample shall be accompanied by a copy of the roll label or identification tag, as well as the appropriate contract-related information and testing requirements. All such information shall be placed in a moisture-proof envelope directly attached to each UV-protective container. Each container shall then be placed in a separate security bag and sealed by the Contract Administrator.

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 of the test result that failed to meet the requirements. The Contractor shall notify the Contract Administrator in writing invoking this option within 2 Business Days following notification of unacceptable material. The notification shall include the material and specific attribute or attributes for which the referee testing is being requested.

The Owner shall select a referee laboratory within 3 Business Days following the Contractor's notification to invoke referee testing. The Contract Administrator shall deliver referee samples to the referee laboratory. If referee materials are not available, the Contractor shall be responsible for obtaining and submitting new samples to the referee laboratory from a location to be decided by the Contract Administrator. The Contract Administrator shall be present to witness the sampling.

The Contractor may observe the testing at no cost to the Owner. The Contract Administrator shall notify the Owner and Contractor a minimum of 3 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 samples identification and view sample condition. Subject to safety requirements, test method, and equipment limitations, they shall also 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 material does not meet the physical requirements of this specification, the material represented by the test result, including material in the Work, shall not be accepted.

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

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

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 specified in the purchasing order. Material not meeting the requirements of the specification may be rejected by the Owner.

1860.09.02 Measurement and Payment

Payment at the price specified in the purchasing order 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 extra cost to the Owner.
### TABLE 1
Physical Requirements for Woven and Non-Woven Geotextiles

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Class I Woven</th>
<th>Non-Woven</th>
<th>Class II Woven</th>
<th>Non-Woven</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength, MARV, minimum</td>
<td>CAN/CGSB 148.1, Method No. 7.3</td>
<td>N</td>
<td>800</td>
<td>330</td>
<td>1100</td>
<td>660</td>
</tr>
<tr>
<td>Elongation at break, typical</td>
<td>CAN/CGSB 148.1, Method No. 12.2</td>
<td>%</td>
<td>&lt;25</td>
<td>&gt;50</td>
<td>&lt;25</td>
<td>&gt;50</td>
</tr>
<tr>
<td>Tear strength, MARV, minimum</td>
<td>CAN/CGSB 4.2, Method No. 12.2</td>
<td>N</td>
<td>300</td>
<td>180</td>
<td>400</td>
<td>250</td>
</tr>
<tr>
<td>Puncture strength, MARV, minimum</td>
<td>ASTM D 6241</td>
<td>N</td>
<td>1650</td>
<td>990</td>
<td>2200</td>
<td>13750</td>
</tr>
<tr>
<td>Permittivity, minimum</td>
<td>CAN/CGSB 148.1, Method No. 4</td>
<td>s⁻¹</td>
<td>0.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filtration opening size (FOS), typical</td>
<td>CAN/CGSB 148.1, Method No. 10</td>
<td>μm</td>
<td>As specified in the Contract Documents or purchasing order</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultraviolet stability, minimum</td>
<td>ASTM D 4355</td>
<td>%</td>
<td>50% retained tensile strength at 500 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 2
Physical Requirements for Knitted Sock Geotextiles

<table>
<thead>
<tr>
<th>Laboratory Test</th>
<th>Test Method</th>
<th>Acceptance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mullen Diaphragm Burst Strength, minimum, kPa</td>
<td>CAN/CGSB 4.2, Method No. 11.1</td>
<td>600</td>
</tr>
<tr>
<td>FOS, maximum, μm</td>
<td>CAN/CGSB 148.1, Method No. 10</td>
<td>500</td>
</tr>
<tr>
<td>Permittivity, minimum, s⁻¹</td>
<td>CAN/CGSB 148.1, Method No. 4</td>
<td>2.75</td>
</tr>
<tr>
<td>Property</td>
<td>Test Method</td>
<td>Unit</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum post spacing</td>
<td></td>
<td>m</td>
</tr>
<tr>
<td>Tensile strength, MARV, minimum</td>
<td>CAN/CGSB 148.1, Method No. 7.3</td>
<td>N</td>
</tr>
<tr>
<td>Elongation at break, typical</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Permittivity, minimum</td>
<td>CAN/CGSB 148.1, Method No. 4</td>
<td>s^-1</td>
</tr>
<tr>
<td>Filtration Opening Size (FOS), maximum</td>
<td>CAN/CGSB 148.1, Method No. 10</td>
<td>μm</td>
</tr>
<tr>
<td>Ultraviolet stability, minimum</td>
<td>ASTM D 4355</td>
<td>%</td>
</tr>
</tbody>
</table>
Appendix 1860-A, November 2010
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 purchasing order:

- 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

No information provided here.