This directive outlines the approval, project acceptance and quality assurance programs for geosynthetics used on Department projects.

I. GEOSYNTHETIC APPROVAL PROCESS

A. The manufacturer/supplier applying for product approval shall submit samples of material as directed herein.

1. All geotextiles, including those sold under a private label agreement, being submitted for testing and approval must be submitted through the American Association of State Highway and Transportation Officials (AASHTO) National Transportation Product Evaluation Program (NTPEP). The program has four submittal periods per calendar year. Information regarding submittal is available at the address shown below:

   AASHTO-NTPEP Coordinator
   444 N. Capitol St., NW, Suite 249
   Washington, DC 20001

2. Effective January 1, 2000, the acceptance criteria for geotextiles, as shown in this directive, is based on the most current version of the AASHTO M-288 Specification for Geotextiles.

3. For other geosynthetics, i.e., geomembranes and various prefabricated composite drains see the appropriate sections of this directive.

B. Following completion of testing, the submitting firm is notified, in writing, as to the materials approval/rejection for use on NYSDoT projects, and where appropriate, the applications that the material is approved for.

C. Following approval of a geotextile or geomembrane, 3" x 5" swatches of the material tested will be sent to the Regional Geotechnical Engineer for use in the project site material acceptance procedures detailed below.
II. PROJECT SITE MATERIAL ACCEPTANCE PROCEDURES

A. Project Staff Responsibilities:

1. Each roll of material is to be properly identified either by a label on the geosynthetic or the container. The container may be either the cover wrapping or the core around which the geosynthetic is rolled. If the material contains no label, it is to be rejected immediately.

NOTE: Partially used rolls of materials from projects other than the current project are not to be accepted for use on the current project unless the original product labels are attached to the roll, and a letter from the previous project Engineer-In-Charge verifies that the information on the labels is correct.

2. Properly labeled material is next verified as appearing on the Approved List. If the style designation delivered to the site does not appear on the Approved List it is to be rejected immediately.

NOTE: For materials approved between publications of the official Approved List, the letter to the manufacturer/supplier of acceptance serves as proof of approval.

3. Once steps 1 and 2 are met satisfactorily, the project staff shall cut a swatch, and if indicated on the most current approved lists, a ten square yard sample of the material from a representative roll and deliver them to the Regional Geotechnical Engineer.

4. In the case of the prefabricated composite drainage materials, the drain material shall be properly labeled as per Section II.A.1. As the geotextile covering must appear on the Approved List for drainage geotextiles, a letter identifying the geotextile must also accompany the shipment. If indicated on the Approved List, a 1 meter long sample of the drain, with the geotextile, is to be obtained and sent to the Regional Geotechnical Engineer.

B. Region Geotechnical Engineer Responsibilities:

1. The swatch of material cut from the material delivered to the project shall be visually compared to the swatch provided to the Regional Geotechnical Engineer by the Bureau at time of initial approval. If there is a visual discrepancy, the Geotechnical Engineering Bureau shall be contacted immediately for determination of subsequent actions.
2. The ten square yard sample of geotextile or geomembrane, or the three foot length of prefabricated drain, shall be forwarded to the Geotechnical Engineering Bureau for quality assurance testing.

III. QUALITY ASSURANCE PROCEDURES

A. Geotechnical Engineering Bureau Responsibilities:

1. The results of the quality assurance testing will not effect the use of a material on the project for which it is supplied. It is for the purpose of monitoring any changes in manufacturing processes which may affect the original properties that were determined at the time of initial approval. Several scenarios may develop as a result of this phase of testing.

   a. The properties are shown to be the same as originally determined within the statistical validity of the test. No action will be taken.

   b. The properties are shown to be significantly different than originally determined.

      1. If the results are within the acceptable minimum for approval, contact with the manufacturer will be made by the Bureau to determine what has changed.

      2. If the results are below the minimum acceptable for approval, the product’s status on the Approved List will be reevaluated. The manufacturer will be notified of the review.

IV. TESTING AND EVALUATION PROCESSES

A. Geotextiles

1. The Department's evaluation of geotextiles submitted will be based on the following tests:

   a. Soil Retention - The test to evaluate this characteristic will be performed in accordance with Apparent Opening Size Test, ASTM D4751.

   b. Flow Capacity - The test to evaluate this characteristic will be performed in accordance with the Permittivity Test, ASTM Method D4491.

   c. Tensile Strength - The tests to evaluate this characteristic will be performed in accordance with the following.
1. Grab Test Method, ASTM D4632
2. Trapezoid Tear Test Method, ASTM D4533
3. Puncture Strength Test Method, ASTM D4833

2. Requirements

Following is a table of the requirements for acceptance to the Approved List for the pay items established in the standard and special specifications. The pay items are identified by applications as shown below:

**Table 1 - Geotextile Strength Property Requirements**

<table>
<thead>
<tr>
<th>Property</th>
<th>Geotextile Strength Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class 1</td>
</tr>
<tr>
<td></td>
<td>Elongation</td>
</tr>
<tr>
<td>Grab Strength</td>
<td>&lt; 50%</td>
</tr>
<tr>
<td></td>
<td>1400 N (315 lbf)</td>
</tr>
<tr>
<td>Tear Strength</td>
<td>500 N (112 lbf)</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>500 N *(112 lbf)</td>
</tr>
</tbody>
</table>

1 Values are minimum average value for specimens tested.
2 Class of geotextile required for specific applications is designated in the application tables which follow (Tables 2-8).
3 Soft Conversion: 1 lb = 4.45 N
4 For woven monofilament geotextiles the minimum average value is 250 N (56 lbs).

**Table 2 - Drainage Geotextile Requirements**

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements - % In-situ Soil Passing No. 200 US Std. Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength Class</td>
<td>Class 2 from Table 1&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Geotextile Structure</td>
<td>Non - Woven</td>
</tr>
<tr>
<td>Permittivity&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.5 sec&lt;sup&gt;-1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Apparent Opening Size&lt;sup&gt;3&lt;/sup&gt;</td>
<td>0.43 mm</td>
</tr>
</tbody>
</table>

<sup>1</sup> Default selection. The Engineer may specify a Class 3 geotextile for drainage geotextile applications based on one or more of the following:
   a. The Engineer has found Class 3 geotextiles to have sufficient survivability based on field experience.
b. The Engineer has found Class 3 geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.

c. Subsurface drain depth is less than 2 m, drain aggregate diameter is less than 30mm and the compaction requirement is less than 95% of AASHTO T99.

2 Minimum Average Value for tested specimens

3 Maximum Average Value for tested specimens

For cohesive soils with a PI > 7, the AOS maximum average value is 0.33 mm.

**Table 3 - Separation Geotextile Requirements**

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength Class</td>
<td>Class 2 from Table 1(^1)</td>
</tr>
<tr>
<td>Geotextile Structure</td>
<td>Woven and Non-Woven</td>
</tr>
<tr>
<td>Permittivity(^2)</td>
<td>0.02 sec(^{-1})</td>
</tr>
<tr>
<td>Apparent Opening Size(^3)</td>
<td>0.60 mm</td>
</tr>
</tbody>
</table>

\(^1\) Default geotextile selection. The Engineer may specify a Class 3 geotextile from Table 1 based on one or more of the following:

a. The Engineer has found Class 3 geotextiles to have sufficient survivability based on field experience.
b. The Engineer has found Class 3 geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.
c. Aggregate cover thickness of the first lift over the geotextile exceeds 300 mm and the aggregate diameter is less than 50 mm.
d. Aggregate cover thickness of the first lift over the geotextile exceed 150 mm, aggregate diameter is less than 30 mm, and construction equipment contact pressure is less than 550 kPa.

\(^2\) Minimum Average Value for tested specimens. Default value. The permittivity of the geotextile should be greater than that of the soil. The permeability of the geotextile may also be required to be greater than that of the soil.

\(^3\) Maximum Average Value for tested specimens

**Table 4 - Stabilization Geotextile Requirements**

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength Class</td>
<td>Class 1 from Table 1(^1)</td>
</tr>
<tr>
<td>Geotextile Structure</td>
<td>Woven and Non-Woven</td>
</tr>
<tr>
<td>Permittivity(^2)</td>
<td>0.05 sec(^{-1})</td>
</tr>
<tr>
<td>Apparent Opening Size(^3)</td>
<td>0.43 mm</td>
</tr>
</tbody>
</table>

\(^1\) Default geotextile selection. The Engineer may specify a Class 2 or 3 geotextile from Table 1 based on one or more of the following:

a. The Engineer has found the class of geotextile to have sufficient survivability based on field experience.
b. The Engineer has found the class of geotextile to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.

c. The Engineer has found the class of geotextile to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.

\(^2\) Minimum Average Value for tested specimens. Default value. The permittivity of the geotextile should be greater than that of the soil.
The permeability of the geotextile may also be required to be greater than that of the soil.

\(^3\) Maximum Average Value for tested specimens
Table 5 - Slope Protection Geotextile Requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements - % In-Situ Soil Passing No. 200 US Std. Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 15 % (Class A)</td>
</tr>
<tr>
<td>Strength Class</td>
<td>Class 1 from Table 1</td>
</tr>
<tr>
<td>Geotextile Class</td>
<td>Needle Punched Non-Woven</td>
</tr>
<tr>
<td>Permittivity</td>
<td>0.7 sec$^{-1}$</td>
</tr>
<tr>
<td>Apparent Opening Size</td>
<td>0.43 mm</td>
</tr>
</tbody>
</table>

1 In general, the default geotextile selection is appropriate for conditions of equal or less severity than either of the following:
   a. The stone slope protection weights do not exceed 100 kg, the stone drop height is less than 1 m, and no aggregate bedding layer is required.
   b. The stone slope protection weighs less than 100 kg, the stone drop height is less than 1 m, and the geotextile is protected by a 150 mm thick aggregate bedding layer designed to be compatible with the stone slope protection layer. More severe applications require assessment of geotextile survivability based on a field trial section, and may require a geotextile with higher strength values.

The Engineer may specify a Class 2 geotextile from Table 1 based on one or more of the following:
   a. The Engineer has found Class 2 geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.
   b. The stone slope protection weighs less than 100 kg, the stone drop height is less than 1 m, and the geotextile is protected by a 150 mm thick aggregate bedding layer designed to be compatible with the stone slope protection layer.
   c. The stone slope protection weights do not exceed 100 kg, and the stone is placed from a zero drop height.
   d. The Engineer has found Class 2 geotextiles to have sufficient survivability based on field experience.

Minimum Average Value for specimens tested. The Engineer may require geotextile permeability testing and/or performance testing based on engineering design for drainage systems in problematic soil environments.

Site specific geotextile design should be performed. Also, for cohesive soils with a PI greater than 7, a geotextile maximum average value for apparent opening size is 0.30 mm.

Table 6 - Turbidity Curtain Geotextile Requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength Class</td>
<td>Class 2 from Table 1</td>
</tr>
<tr>
<td>Geotextile Structure</td>
<td>Woven and Non-Woven</td>
</tr>
<tr>
<td>Permittivity</td>
<td>0.40 sec$^{-1}$</td>
</tr>
<tr>
<td>Apparent Opening Size</td>
<td>0.30 mm</td>
</tr>
</tbody>
</table>

1 Minimum Average Value for specimens tested.

2 Maximum Average Value for specimens tested.
**Table 7 - Silt Fence Geotextile Requirements**

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements</th>
<th>Supported Silt Fence</th>
<th>Unsupported Silt Fence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fence Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supported Silt Fence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsupported Silt Fence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geotextile Structure</td>
<td>Woven or Non-Woven</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Post Spacing</td>
<td>1.2 m</td>
<td>1.2 m</td>
<td>2 m</td>
</tr>
<tr>
<td>Grab Strength - MD</td>
<td>400 N (90 lbf)</td>
<td>550 N (123 lbf)</td>
<td>550 N (123 lbf)</td>
</tr>
<tr>
<td>Grab Strength - XD</td>
<td>400 N (90 lbf)</td>
<td>450 N (101 lbf)</td>
<td>450 N (101 lbf)</td>
</tr>
<tr>
<td>Permittivity</td>
<td>0.05 sec⁻¹</td>
<td>0.05 sec⁻¹</td>
<td>0.05 sec⁻¹</td>
</tr>
<tr>
<td>Apparent Opening Size</td>
<td>0.60 mm</td>
<td>0.60 mm</td>
<td>0.60 mm</td>
</tr>
</tbody>
</table>

1. Silt fence support shall consist of 14 gage steel wire with a mesh spacing of 150 mm x 150 mm or prefabricated polymeric mesh of equivalent strength.
2. As measured in accordance with ASTM D4632
3. As measured in accordance with ASTM D4632
4. Minimum Average Values for specimens tested. These default values are based on empirical evidence with a variety of sediments. For environmentally sensitive areas, a review of previous experience and/or site or regionally specific geotextile tests should be performed to confirm these requirements.
5. Maximum Average Values for specimens tested.

**Table 8 - Bedding Geotextile Requirements**

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements - % In-Situ Soil Passing No. 200 US Std. Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure/Strength Class</td>
<td>Monofilament / Class 2 from Table 1</td>
</tr>
<tr>
<td>Permittivity</td>
<td>0.7 sec⁻¹, 0.2 sec⁻¹, 0.1 sec⁻¹</td>
</tr>
<tr>
<td>Apparent Opening Size</td>
<td>0.43 mm, 0.25 mm, 0.22 mm</td>
</tr>
</tbody>
</table>

1. In general, the default geotextile selection is appropriate for conditions of equal or less severity than either of the following:
   a. The stone slope protection weights do not exceed 100 kg, the stone drop height is less than 1 m, and no aggregate bedding layer is required.
   b. The stone slope protection weighs more than 100 kg, the stone drop height is less than 1 m, and the geotextile is protected by a 150 mm thick aggregate bedding layer designed to be compatible with the stone slope protection layer. More severe applications require assessment of geotextile survivability based on a field trial section, and may require a geotextile with higher strength values.
   The Engineer may specify a Class 2 geotextile from Table 1 based on one or more of the following:

2. Soft Conversion: 1 lbf = 4.45 N
a. The Engineer has found Class 2 geotextiles to have sufficient survivability based on field experience.
b. The Engineer has found Class 2 geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.
c. Armor layer stone weighs less than 100 kg, drop height is less than 1 m, and the geotextile is protected by a 150 mm thick aggregate bedding layer designed to be compatible with the armor layer.
d. Armor layer stone weights do not exceed 100 kg and stone is placed with zero drop height.

Minimum Average Value for specimens tested. The Engineer may require geotextile permeability testing and/or performance testing based on engineering design for drainage systems in problematic soil environments.

Site specific geotextile design should be performed. Also, for cohesive soils with a PI greater than 7, a geotextile maximum average value for apparent opening size is 0.30 mm.

B. Geomembranes

1. Producers of geomembranes shall demonstrate the quality of their products before being placed on the Department's Approved List. The producer shall provide:
   a. A completed New York State Department of Transportation Product Evaluation Form, Form Number SM 465.
   b. A test data sheet identifying the geomembrane properties.
   c. A demonstration of previous successful field performance.
   d. A 16 sq m sample of geomembrane to allow for testing by the Department.

2. The Department's evaluation of geomembranes submitted will be based on the following tests:
   a. Tensile Strength - Test in accordance with ASTM D4632, Grab Test Method.
   b. Elongation - Test in accordance with ASTM D4632.
   c. Trapezoidal Tear Resistance - Test in accordance with ASTM D4535, Trapezoid Tear Test Method.
   d. Puncture - Test in accordance with ASTM D4833, Index Puncture Resistance.

3. Requirements
   a. Ultimate Tensile Strength - 800 N (180 lbf) (5)
   b. Ultimate Elongation - 65% (5)
   c. Trapezoid Tear Resistance - 265 N (60 lbf) (5)
   d. Puncture - 400 N (90 lbf) (6)
Minimum value in weaker principal direction. The average of the test results in the weaker principal direction shall be equal to or greater than the stated values.
The average of the test results for puncture shall meet or exceed the stated value.

C. Prefabricated Vertical Drains
1. Producers of prefabricated vertical drains shall demonstrate the quality of their products before being placed on the Department's Approved List. The producer shall provide:
   a. A completed New York State Department of Transportation Product Evaluation Form, Form Number SM 465.
   b. A test data sheet identifying the cover geotextile and core and their properties.
   c. A demonstration of previous successful field performance.
   d. A 10 m long sample of the prefabricated vertical drain to allow for testing by the Department.
   e. Proof of the geotextile having been submitted to the NTPEP if not already on the NYSDOT Approved List.

2. The Department's evaluation of prefabricated vertical drains submitted will be based on the following tests:
   a. Prefabricated Vertical Drain
      1. Equivalent Sand Drain Diameter - Test in accordance with NYSDOT - GEB Large Diameter Consolidation Test.
      2. Lateral Pressure - Test in accordance with NYSDOT - GEB Lateral Pressure Test Method.
   b. Cover Geotextile
      1. See Section IV-A - Drainage geotextiles

3. Requirements
   a. Prefabricated Vertical Drain
1. Equivalent Sand Drain Diameters - 40 mm minimum.\(^7\)

2. Lateral Pressure Test - Net core flow capacity at 145 kPa shall be a minimum of 10 cc/sec.\(^7\)

b. Cover Geotextile Wrapping

1. See Section IV-A - Drainage geotextiles

\(^7\) The average of the test results shall meet or exceed the stated values.

D. Prefabricated Composite Structural Drains\(^8\) (PCSD)

1. Producers of PCSD’s shall demonstrate the quality of their products before being placed on the Department's Approved List. The producer shall provide:

   a. A completed New York State Department of Transportation Product Evaluation Form, Form Number SM 465.

   b. A test data sheet identifying the properties of the protective geotextile and the core.

   c. A demonstration of previous successful field performance.

   d. A 1.5 sq m sample of the PCSD drain to allow for testing by the Department.

   e. Proof of the geotextile having been submitted to the NTPEP if not already on the NYSDOT Approved List.

2. The Department's evaluation of PCSDs submitted will be based on the following tests:

   a. PCSD

      1. Flow Capacity Under Load - Test in accordance with ASTM D4716 Hydraulic Transmissivity Test Method.

   b. Geotextile

      1. See Section IV-A - Drainage geotextiles

3. Requirements

   a. PCSD
1. Hydraulic Transmissivity

   a. For impermeable cores, where flow is allowed on both sides, the hydraulic transmissivity shall be 0.8 L/s/m of width under 72 kPa and a hydraulic gradient of 0.1\(^{(9)}\).

   b. For permeable cores, or one sided flow impermeable cores, the hydraulic transmissivity shall be 0.4 L/s/m of width under 72 kPa and a hydraulic gradient of 0.1\(^{(9)}\).

(8) This includes prefabricated composite structural drains used as integral abutment drains.

(9) The average of the test results shall meet or exceed the stated values.

b. Geotextile

   1. See Section IV-A - Drainage geotextiles - The geotextile shall be a strength class 2 or higher, and an Apparent Opening Size Class A drainage geotextile.

   c. In installations where concrete is to be poured against the prefabricated composite structural drain, only drains with impermeable cores will be allowed.

E. Prefabricated Composite Integral Abutment Drains (PCIAD)

   1. Producers of PCIAD’s shall demonstrate the quality of their products before being placed on the Department's Approved List. The approval procedure for PCIAD’s follows the PCSD procedure.

      a. The criteria for acceptance of PCIAD’s shall be same as for PCSD except that the minimum thickness of the PCIAD shall be 10 mm (0.4 in) as measured by ASTM D5199.

F. Prefabricated Composite Edge Drains (PCED)

   1. Producers of PCED’s shall demonstrate the quality of their products before being placed on the Department's Approved List. The producer shall provide:

      a. A completed New York State Department of Transportation Evaluation Form, Form Number SM 465.

      b. A test data sheet identifying the cover geotextile and core and their properties.

      c. A demonstration of previous successful field performance.
d. A 1.5 sq m sample of the PCED.

e. Proof of the geotextile having been submitted to the NTPEP if not already on the NYSDOT Approved List.

The average of the test results shall meet or exceed the stated values.

2. The Department's evaluation of PCEDs submitted will be based on the following tests:

a. PCED


3. Geotextile Intrusion - Test in accordance with NYSDOT - GEB Intrusion Test.

b. Cover Geotextile

1. See Section IV-A. - Drainage geotextiles

3. Requirements

a. PCED

1. Flow Capacity - 3 L/s/m of width when tested at a 69 kPa load after 100 hours, at a hydraulic gradient of 0.1. If the flow channel is separated into two or more parts, only the flow rate of the section facing the pavement will be considered.

2. Core Compressive Strength - At a 300 kPa comprehensive load applied perpendicular to the face of the PCED, the deflection of the core material shall not exceed 20% of the original thickness.

3. Geotextile Intrusion - For tightly wrapped geotextile covers, intrusion of the geotextile into the core openings of the PCED shall not exceed 10% of the PCED thickness under a 310 kPa compressive load applied perpendicular to the face of the PCED.

b. Cover Geotextile

1. See Section IV-A- Drainage geotextiles.