
NTPEP Committee Work Plan for Geosynthetics for Subgrade Stabilization

NTPEP Designation: SSGEO-20-01



**National Transportation Product Evaluation Program
555 12th Street N.W., Suite 1000
Washington, D.C. 20001**

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INTRODUCTION

The National Transportation Product Evaluation Program (NTPEP) was established to minimize the amount of duplicative testing of transportation materials performed by AASHTO member states by providing a process where manufacturer/suppliers submit their products to NTPEP for laboratory and/or field testing. The results of the testing are then shared with member departments for their use in product quality assurance.

This practice provides NTPEP member departments information about the stabilization geosynthetics testing and facility audit program. In keeping with the NTPEP philosophy of purely testing materials and auditing facilities for compliance with the work plan, no conclusions are provided with the test results. The evaluation and acceptance or rejection of the product test and facility audit results are left up to each member department.

1. SCOPE

1.1 This work plan covers the requirements and testing criteria for the National Transportation Product Evaluation Program (NTPEP) evaluation of geosynthetics for subgrade stabilization. NTPEP serves the member departments of the American Association of State Highway and Transportation Officials (AASHTO).

1.2 The purpose of AASHTO's NTPEP SSGEO work plan for stabilization geosynthetics is to establish a list of manufacturing plants and private label companies, and their associated geosynthetic products that conform to the quality control and product testing requirements of this work plan. It should be noted that there is a companion document to this work plan that governs the auditing of the facilities described in this work plan. That companion document is NTPEP SP-01, Standard Practice for Qualification of Highway Product Manufacturers Through the Use of NTPEP Audits.

1.3 AASHTO member departments can then use this information in their quality assurance program for stabilization geosynthetics. This may include utilizing this information to establish a qualified supplier list and/or a qualified products list.

1.4 By participating in this program, the participant agrees to supply Class 1A Geotextiles that meet or exceed the requirements of AASHTO M 288 and follow the minimum quality control provisions of the program for stabilization geosynthetics. NTPEP validates this agreement through testing the

geosynthetic product(s) to verify compliance with the applicable standards and auditing the participant's quality system.

1.5 The manufacturer or private label company agrees that NTPEP may use the test results along with other relevant information for review and verification of compliance with this NTPEP work plan and the requirements of AASHTO M 288, if applicable. If compliance is demonstrated, the NTPEP will list the product(s) and facilities conforming to this work plan in DataMine, NTPEP's online database.

1.6 This work plan may involve hazardous materials, operations, and equipment. It does not purport to address all safety problems associated with its use. When conducting evaluations for the test methods included in this work plan, please use the required personal protective equipment (PPE). It is the responsibility of the user of this work plan to establish the appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards:

- AASHTO M 288 – Geosynthetic Specification for Highway Applications

2.2 ASTM Standards:

- ASTM D4354 – Standard Practice for Sampling of Geosynthetics for Testing
- ASTM D4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
- ASTM D4439 – Standard Terminology for Geosynthetics
- ASTM D4595 – Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
- ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile
- ASTM D4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
- ASTM D6637/D6637M – Standard Test Method for Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method
- ASTM D7737 – Standard Test Method for Individual Geogrid Junction Strength

Note 1 – All ASTM test methods referenced herein are copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania, USA 19428-2959. All AASHTO specifications referenced herein are copyrighted by American Association of State Highway and Transportation Officials, 444 North Capitol Street N.W., Suite 249, Washington, D.C. 20001.

3. TERMINOLOGY

3.1 **Annual NTPEP Audit** - Audit of a manufacturer's plant and associated internal test facilities by a NTPEP auditor and any AASHTO member department co-auditor that wishes to participate.

3.2 **Audit Supervisor** - The individual responsible for administering and managing the audit program.

3.3 **Deficiency, Major** - A procedure missing from the quality system: nonconformance that results in the probable shipment of nonconforming product.

3.4 **Deficiency, Minor** - A quality issue that does not result in the breakdown of the quality system, failure in part of the documented system.

3.5 **Geogrid** - Geosynthetic formed by a regular network of integrally connected elements with apertures greater than 1/4 inch to allow interlocking with surrounding soil, rock, earth, and other surrounding materials to function primarily as reinforcement.

3.6 **Geosynthetic Lot** - The amount of geosynthetic produced per product style under the same standard operating conditions during a specific period of time not to exceed 12 consecutive months.

3.7 **Geotextile** - Permeable geosynthetic comprised solely of textiles.

3.8 **Independent Laboratory Acceptable to NTPEP** - Laboratory that is accredited by the Geosynthetic Accreditation Institute (GAI) to perform specific tests as outlined in the work plan and has on-site qualified technicians and equipment necessary to perform the tests per ASTM and AASHTO standards.

3.9 **Initial Audit** - The first NTPEP audit conducted at a manufacturing plant.

3.10 **Lot Summary** - A lot specific table showing all sequential sample roll test results and the associated lot statistics for each measured property. Statistics presented include average, standard deviation, minimum and maximum average roll value.

3.11 **Manufacturer** - All producing plants and testing laboratories a manufacturer owns and operates.

3.12 **MARV** - The minimum average roll value (MARV) for the geosynthetic, defined as the average value minus two (2) standard deviations from documented quality control test results for a defined lot of production sampled in accordance with ASTM D4354, Table 1.

3.13 Maximum Test Value - The maximum test value for the geosynthetic, defined as the highest value from documented quality control test results for a defined lot of production sampled in accordance with ASTM D4354, Table 1.

3.14 MD - Machine direction of geosynthetic.

3.15 Minimum Test Value - The minimum test value for the geosynthetic, defined as the lowest value from documented quality control test results for a defined lot of production sampled in accordance with ASTM D4354, Table 1.

3.16 NTPEP Auditor - An individual retained by NTPEP to review submittals, coordinate auditing and testing, and report audit findings and resin and geosynthetic split sample test results.

3.17 NTPEP Geosynthetics Technical Committee Chairman - The individual responsible for all technical aspects of this work plan and together with the NTPEP manager, resolves any conflicts that may arise.

3.18 NTPEP Manager - The individual responsible for overseeing that all areas of the program are conducted in accordance with this work plan.

3.19 NTPEP Split Sample - Specimen selected from the production line or inventory to be tested by both the manufacturer and NTPEP designated independent laboratory.

3.20 Periodic Testing - Additional testing completed on specimens collected aside from what is tested during the annual on-site audit.

3.21 Plant - An individual geosynthetic manufacturing facility.

3.22 Private Label Products - Private label products are products currently listed in NTPEP by a source manufacturer and offered for sale under the private label company's brand.

3.23 Product Category - A series of private label products distinguished by their manufacturing process and polymer. For this SSGEO work plan, product categories include either woven geotextile or punched and drawn geogrid. See Appendix of *Usage Guide for NTPEP Audit Programs* for description of a woven geotextile. See Section 1.4 of *Designing with Geosynthetics* (Koerner) for description of a punched and drawn geogrid.

3.24 Product Line - A series of products that are manufactured at the same plant using the same polymer, manufacturing process, and stabilization package. The only difference among all the products in the product line is in the product weight/unit area or number of fibers contained in each yarn.

3.25 Product Style - The proprietary name/number used as a designation for a specific product.

3.26 Production Line - A sequential operation established in a manufacturing plant to take raw material and produce a geosynthetic product ready for use. The production line may consist of several steps and equipment components or a singular step and equipment.

3.27 Production Unit - Regarding a geosynthetic lot, a production unit shall be defined as a product roll.

3.28 Quality Management System (QMS) - The system by which a manufacturer or private labeler controls and documents the quality of the products it produces or distributes.

3.29 QMS Desk Top Audit - A complete review of a participant's QMS and the corresponding documentation by NTPEP or its designee.

3.30 Raw Materials - Materials acquired by a geosynthetic manufacturer for use in a production line to create a finished geosynthetic product, such as raw polymer/resin, strips, straps, fibers (including slit film fibers), yarns and polymeric additives (e.g., antioxidants, carbon black, fillers, other polymers to create polymer blends, dyes, and reworked material). Unfinished or partially finished fabrics, felts, etc., are not considered raw materials.

3.31 Raw Material Lot - A lot of raw material for a geosynthetic manufacturing facility is a railcar or truckload, hopper truckload, or truckload of boxes, but no larger than the lot of raw material as defined by the raw material supplier.

3.32 Recycled Plastic - Post consumer (e.g., detergent bottles, etc.) recycled polymer used to produce geosynthetic for non-DOT jobs.

3.33 Reworked (or Regrind) Material - A plastic from a processor's own production that has been reground, pelletized, or solvated after having been previously processed by molding, extrusion, etc. (ASTM D883)

3.34 Single-Stream Resin - A single stream resin is a feed of one virgin resin and may include carbon black pellets and reworked material.

3.35 Source Manufacturer - The manufacturer that functions as the source for a finished product and who is responsible for the quality of the finished product, including the QC testing conducted to assure the quality of the product.

3.36 Stabilization Geosynthetics – Woven geotextiles and geogrids that stabilize soil or aggregate for subgrades and pavements.

3.37 Surveillance Audit - An audit conducted by NTPEP at a plant after major deficiencies are noted during a previous on-site audit. If a local DOT performs a plant audit, which is not the annual inspection by NTPEP, and finds major non-compliance issues, then a follow up NTPEP

audit will be performed at the manufacturer's expense. Surveillance audits may not necessarily be announced and will proceed regardless of the availability of key QC staff.

3.38 **XD** - Cross-machine direction of geosynthetic.

4. SIGNIFICANCE AND USE OF THE NTPEP STABILIZATION GEOSYNTHETICS PROGRAM

4.1 The NTPEP Stabilization Geosynthetics Program assesses the conformance of both manufacturing plants and products, and those who provide products manufactured by others (i.e., private label products). The program includes the following:

4.1.1 Desk Top Audit of the Participant's Quality Management System (at least once every three years, if the participant has not been previously audited for the GTX or REGEO work plans)

4.1.2 Initial and Annual On-Site NTPEP Audits

4.1.3 Split Sample Testing of Stabilization Geosynthetics (obtained during auditing of participants)

4.1.4 Identification of Geosynthetic Products (marking/tagging and labeling)

4.1.5 A NTPEP website with the following information:

4.1.5.1 A listing of geosynthetic products, by manufacturer or private label company and product style, tested and for Class 1A Geotextiles, found to conform to the requirements of AASHTO M 288;

4.1.5.2 A listing of participating manufacturing plants and private label companies with a QMS found to conform to this work plan; and

4.1.5.3 A document library containing this work plan and a secure online database, i.e., DataMine, where AASHTO member departments can view participants' QMS documents and test results. DataMine can be accessed through the AASHTO/NTPEP web site link at <http://data.ntpep.org/>.

5. APPLICATION FOR PROGRAM INCLUSION

5.1 Participants in the NTPEP Product Evaluation Program for stabilization geosynthetics (defined as geosynthetic manufacturers and private label companies) must apply through the NTPEP DataMine website during each submittal cycle. Every year, the submittal cycle opens as per [NTPEP.org](https://www.ntpep.org) > **NTPEP DataMine > Submit A Product**. (Note: The submittal cycle is determined based on administrative needs for scheduling and invoicing) Every 3rd year, participants must submit a completed pre-audit application so that a desktop review can be performed by NTPEP for each participating facility. The desktop review must be completed before the on-site audit can be scheduled.

5.2 Any manufacturer of geosynthetic products, or private label company, that sells stabilization geosynthetics manufactured by others under their own brand may participate in the program. For information regarding costs, and their associated due dates, please refer to the terms and conditions located under DataMine's Legal Information section.

5.3 For companies that distribute geosynthetic products under a private label and that wish to have those products included in the NTPEP program, the manufacturers that produce those products must participate in and conform to this NTPEP work plan and maintain a current listing for the product.

5.4 When changes are made in a NTPEP listed product tested and reported under the SSGEO program, the manufacturer shall notify the NTPEP program manager. Any changes in fundamental manufacturing method, nominal product weight, base polymer(s) architecture, or coatings/stabilizers will be considered a product change, and a reevaluation of the product may be required by NTPEP for continued listing. Changes in the published property MARV's or minimum values for the product (from those that were published at the time of the current NTPEP evaluation) will not be considered as a product change if the change can be shown to be a result of a reduction in manufacturing variability as documented by routine lot summary calculations.

5.5 The participation process is summarized as follows:

5.5.1 The participant must make a formal request through the NTPEP website to participate in the program. The request must list the participant's facilities and products to be evaluated and describe the participant's QMS.

5.5.2 Once the QMS is found to conform, the participant facility, including all associated internal testing facilities that the participant desires to qualify, will be audited. This shall constitute the initial audit. Geosynthetic samples will be taken for testing in accordance with the appropriate AASHTO or ASTM specification and this NTPEP work plan. For the initial audit, the required minimum number of products tested during the initial audit will depend on the current status of the product testing cycle for the participant. However, the participant may request up to 100% of their products be tested as part of the initial audit.

5.5.3 An initial on-site audit will be scheduled approximately 4 weeks in advance. The plant will receive an announcement letter from AASHTO.

5.5.4 Each geosynthetic product requested for inclusion into the program will be separately tested once every 3 years. For private label products, since the products that are private labeled must be from a source manufacturer who has been audited by NTPEP and found compliant, only a limited check testing program on representative products within the product category will be conducted.

5.5.5 Audit reports are released to the NTPEP DataMine website and can be viewed by all AASHTO member departments and the personnel from the participant company at which the audit was conducted. A copy of the draft summary is also provided to the plant personnel at the completion of the on-site audit.

5.5.6 Each participating company is also listed on the NTPEP website, showing if they are compliant with the program.

Note 2 – If major deficiencies are noted during an on-site audit, a surveillance audit will be required to be completed. Surveillance audits may not necessarily be announced and will proceed regardless of the availability of key QC staff.

6. ANNUAL MANUFACTURING PLANT AUDITS

6.1 Once initial plant QMS and product conformance is established as described in Section 5 above, annual NTPEP auditing and testing will be required for a manufacturer's plant to remain on the NTPEP list of compliant facilities. The annual audits will be announced to the manufacturer in advance to make sure the manufacturer's key quality and manufacturing personnel are available during the audit. Audits will not occur on weekends or national holidays.

6.2 Annual plant audits will include the following:

6.2.1 Documentation Review - The auditor(s) will check the availability of the most current AASHTO and ASTM standards, review training and competency records, and evaluate the most current quality manual documentation and equipment records to verify implementation of the plant's QMS.

6.2.2 Production Line Inspection - During production line inspection, the auditor(s) will walk through the manufacturing process to observe the conditions of the lines, consistency of the manufacturing process, and methodology for tracking raw materials used for all products in the product line. The auditor(s) will also verify the online and end-of-line marking/tagging and labeling requirements during the production line inspection.

6.2.3 Sampling and Testing – Audits will include the sampling of stabilization geosynthetics from current production or inventory. The products sampled for independent testing will be those that are newly submitted to the program and those re-submitted on the 3-year approval cycle. If no product submittals have been received for the year of the audit, no samples will be taken. Samples will be submitted to the NTPEP designated independent laboratory for evaluation. Additional samples will be taken from the

same rolls and tested by the manufacturer. During sampling, the auditor(s) will verify that marking/tagging and labeling are compliant with the requirements and take representative pictures of the marking/tags and labels. If a sample is taken from production instead of inventory and then later the manufacturer informs NTPEP that the roll the sample was taken from does not meet the QMS requirements, resampling may be necessary. Any resampling will be at the discretion of NTPEP and the associated costs will be borne by the manufacturer.

Note 3 – All geosynthetic samples selected over a 3-year period at each plant during the annual audit shall collectively represent all geosynthetic products requested for inclusion into the NTPEP program. Thus, each geosynthetic product included in the NTPEP program will have been tested at least once during the 3-year period.

6.2.4 Inventory Inspection and Traceability - The auditor(s) will inspect the condition of the stabilization geosynthetics in the plant's inventory storage facility. Additionally, the auditor(s) will select various product styles of stabilization geosynthetics and verify that roll test results, raw material lot test results/certifications, and a lot summary associated with each lot representing the product style selected are available for the samples of geosynthetics selected.

6.2.5 Quality Control Testing Evaluation - Each geosynthetic manufacturer will be asked to demonstrate the quality control tests they perform on a regular basis. While performing each test, the most current AASHTO or ASTM test methods may be referenced if needed. The equipment used for each test will be examined and applicable records will be reviewed.

6.2.6 The NTPEP Audit Team - The NTPEP audit team consists of the NTPEP auditor (AASHTO employee or designated subcontracted auditor) and an AASHTO member department co-auditor(s) from any state that wishes to participate. The auditor will produce a single audit report, which will include findings from both the auditor and AASHTO member department co-auditor(s), if present.

6.2.7 Inspection Visits and Testing - AASHTO member departments using the NTPEP listing have the right to conduct inspection visits and audit any manufacturer's plant and associated laboratory included in the program to determine compliance with the program requirements. Unscheduled inspection visits will be announced to the manufacturing plant by pre-announcing a window of a minimum two weeks of time for the audit to take place. They may also randomly select samples of product in production for confirmation testing to meet their quality assurance requirements.

Note 4 – Inspection visits may result in the need for an additional NTPEP surveillance audit.

6.2.8 Proprietary Information - The manufacturer may reserve the right to require NTPEP audit team and/or AASHTO members to sign confidentiality agreements prior to visiting plants or facilities to protect information the manufacturer considers to be proprietary. The confidentiality agreement shall not restrict the ability of NTPEP to distribute information in the final audit report necessary to understand the audit findings to the NTPEP membership. However, NTPEP members shall not distribute such information to anyone outside of their organizations.

6.3 For manufacturers that have multiple plants, an audit will need to be conducted at each plant with regard to the geosynthetic products produced in each of the respective plants submitted for NTPEP evaluation. For materials defined as raw materials, the producer of the raw materials does not need to be audited; however, traceability and quality assurance procedures and documentation used/obtained by the geosynthetic manufacturer will be evaluated as part of the geosynthetic manufacturer audit.

7. ANNUAL PRIVATE LABEL COMPANY AUDITS

7.1 An annual audit is required of companies that private label products produced by others. The focus of the audit is to establish traceability of these products to an audited geosynthetic manufacturing plant that is in compliance with this work plan. The company audit will include documentation review as applicable to records traceability and retention, and QA procedures used by the company and all its satellite warehouse/distribution facilities to assure the quality of the products they purchase, private label and sell, inventory/warehouse inspection to evaluate the condition of the private labeled rolls and product marking/tagging, and sampling and testing of randomly selected rolls of product. The annual audits will be announced to the company in advance to make sure the company's key quality personnel are available during the audit. Audits will not occur on weekends or national holidays.

7.2 AASHTO member departments using the NTPEP listing have the right to conduct inspection visits and audit any private label company included in the program to determine compliance with the program requirements. Unscheduled inspection visits will be announced to the private label company by pre-announcing a window of a minimum two weeks of time for the audit to take place. They may also randomly select samples of product for testing to meet their quality assurance requirements.

8. QUALITY MANAGEMENT SYSTEM (QMS) REQUIREMENTS FOR MANUFACTURERS

8.1 NTPEP audits will be based on a manufacturer following a quality control program at the plant that provides assurance that the geosynthetic products produced conform to this NTPEP work plan. The manufacturer will implement a documented QMS. Each geotextile manufacturer shall include elements that it considers necessary to assure that Class 1A Geotextiles meet AASHTO M 288, but as a minimum, for all geosynthetic manufacturers, the QMS shall include or address the following:

8.1.1 Organization and Organizational Policies

8.1.2 Product Marking, Tagging, and Labeling

8.1.3 Manufacturing Process and Documentation Control

8.1.4 Quality Control of Raw Materials

8.1.5 Quality Control Inspection, Measurement, and Testing for Stabilization Geosynthetics Products

8.1.6 Quality Control Personnel - Training and Competency Evaluation

- 8.1.7 Statistical Analysis of Test Results
- 8.1.8 Resolution of Non-Conforming Product or Test Results
- 8.1.9 Retention of Records and Test Results, and Product Traceability
- 8.1.10 Quality Control Testing Facilities
- 8.1.11 Marking, Tagging, Storing, Shipping, and Handling of Finished Stabilization Geosynthetics Products
- 8.1.12 Internal Quality Audits of Each Plant Producing Product
- 8.1.13 Lists of Plants, Quality Control Testing Facilities, and Technicians

8.2 The following sections provide more information about each of the 13 elements identified above.

8.2.1 (Detailed information for 8.1.1) Organization and Organizational Policies – The QMS shall indicate the line of authority from the QC testing technicians to the QA manager, ensure that QC testing technicians have the authority to require corrective action, and ensure that the QA manager is independent of production management and of equal status to production managers.

8.2.2 (Detailed information for 8.1.2) Product Marking, Tagging, and Labeling – Each geosynthetic product manufactured for AASHTO M288 qualification, if applicable and NTPEP program participation shall be clearly labeled as described in Section 8.2.2.3. In addition, physical marking of products is required for geotextiles and optional for geogrids as described in Section 8.2.2.1. For geogrids that are not marked, tagging is required at each end of the roll as described in Section 8.2.2.2. Once the unique manufacturer marking or tag has been established, NTPEP notification is required before making any changes to the marking/tagging.

8.2.2.1 Marking shall be printed on the product at a frequency of at least once per 16.4 ft (5 meters). As a minimum, the physical marking shall include the unique NTPEP ID assigned to the manufacturing plant facility. In addition, manufacturers are encouraged to mark products with any or all of the information from the product labeling. The mark will be established and recorded by NTPEP, in collaboration with the manufacturer, during the application process for the initial audit or at a later on-site audit if marking or tagging was not required by this work plan at the time of the initial audit.

8.2.2.2 Tagging shall be securely attached to geogrid products at the beginning and end of each roll. Tags shall be durable, tamper proof, and non-removable (without cutting) and shall be unique for each manufacturer and manufacturing plant facility. As a minimum, the tagging shall include the unique NTPEP ID assigned to the manufacturing plant facility. In addition, manufacturers are encouraged to include any or all of the information from the product labeling on the tagging. The tag will be established and recorded by NTPEP, in collaboration with the manufacturer, during the application process for the initial audit or at a later on-site audit if marking or tagging was not required by this work plan at the time of the initial audit.

8.2.2.3 Labels shall be affixed by the product manufacturer to one end of the outside of the geosynthetic roll outer wrapping and both ends of the inside of the geosynthetic roll core (for products that have a core) where they are easily visible for inspection. For geosynthetic rolls wider than 6.6 ft (2 meters) without a core, labels shall be affixed to both ends of the outer wrapping. Labeling shall be attached in a

manner that would make the label difficult to remove or replace. As a minimum, the labeling shall contain the following information about the product and its production: the roll and lot number, the product name (if the manufacturer is supplying the product to a private label company, the product name is the one that will be used by the private label company), the production date, NTPEP ID number (shall match the marking or tags on the product) and Class 1A for geotextile products that meet AASHTO M 288 or “NTPEP listed” for all other products. If the permanent mark or secure tag described above contains all the information required for the labels, only one label on one end of the outside of the geosynthetic roll outer wrapping is required and affixing labels to the geosynthetic roll core may be eliminated.

8.2.3 (Detailed information for 8.1.3) Manufacturing Process and Documentation Control –

Each geosynthetic manufacturer shall establish, document, and maintain a QMS available for review by the NTPEP audit team, similar to the QMS documentation required for a certificate of registration from the International Organization for Standardization (ISO) 9001:2015 quality management system. If a manufacturer owns multiple geosynthetic manufacturing plants, each plant shall have its own QMS.

8.2.4 (Detailed information for 8.1.4) Quality Control of Raw Materials – The QMS shall include requirements for evaluating the quality of incoming resins, yarns, and other raw materials. The manufacturer shall do, as a minimum, the following:

- Establish specifications to be used for procuring raw materials used in the manufacture of stabilization geosynthetic products and confirm that Certificates of Analysis (COA) demonstrate compliance with those specifications.
- COAs are provided with each raw material shipment (if shipment contains more than one lot as defined by the raw materials supplier lot definition, COAs shall be provided for each raw material lot).
- If more than one raw material supplier lot is used in a single lot of geosynthetic product, the geosynthetic manufacturer shall have specified maximum variances of COA properties allowed in a single geosynthetic product lot.
- If geosynthetic manufacturer conducts raw materials QA testing to verify the COA provided by a supplier, those QA test results are traceable to the COA's and raw materials lot numbers.
- Geosynthetic manufacturer maintains records of raw materials such that COAs, showing raw material suppliers' lot numbers, are traceable to final geosynthetic product on a roll/geosynthetic lot specific basis.

8.2.5 (Detailed information for 8.1.5) Quality Control Inspection, Measurement, and Testing for Stabilization Geosynthetics Products

8.2.5.1 The QMS shall describe the geosynthetic manufacturer's visual inspection and production monitoring procedures. As a minimum the procedure shall require the manufacturer to conduct visual inspections continuously during production of the final product for the following:

- Holes,
- Damage,
- Thin spots,

- Other workmanship items as described in AASHTO M 288, and
- Proper product marking/tagging and labeling.

8.2.5.2 The QMS shall also describe production equipment operational indicators to assure consistency in the operation of the production line. Examples include temperature sensors, pressure sensors, and any other indicators that can be used to quickly assess malfunctions. These operational indicators shall alert the production staff of the problem in a timely manner so that production can be immediately stopped to address the issue.

8.2.5.3 The QMS shall define the quality control tests, the method for random sampling, the size of the sample, and the lot size not to exceed 12 consecutive months for production facility quality control sampling and testing. The QMS shall also include an example of a quality control test report form. The QMS shall reference applicable AASHTO and ASTM standards. The QMS shall also describe any company procedures used.

8.2.5.4 The QMS shall require that the manufacturer perform and record the results of QC tests at the frequencies summarized in Table 1.

Table 1: Stabilization Geosynthetics Manufacturer QC Test Requirements

Test Designation	ASTM Standard	Notes	Reported Value	Units	Test Frequency
Wide-Width Tensile Strength and Elongation	D4595 (geotextiles) or D6637/D6637M Method B (geogrids)	Woven Geotextile and Biaxial Geogrid products only, Tested @ ultimate and 2% strain	MARV	MD lbs/ft/% XD lbs/ft/%	ASTM D4354 <i>Table 1</i>
Permittivity	D4491	Geotextile products only	Minimum test value	sec ⁻¹	ASTM D4354 <i>Table 1</i>
Apparent Opening Size (AOS)	D4751	Geotextile products only	Maximum test value	mm	ASTM D4354 <i>Table 1</i>
Single Rib Tensile Strength	D6637/D6637M Method A	Geogrid products only, Tested in all rib directions	MARV	lbs	ASTM D4354 <i>Table 1</i>
Junction Strength	D7737 Method A	Geogrid products only	MARV	lbs	ASTM D4354 <i>Table 1</i>
Percent Open Area	Direct Measure	Geogrid products only	Typical	%	ASTM D4354 <i>Table 1</i>
Rib and Junction Thickness	Direct Measure	Geogrid products only	Typical	mm	ASTM D4354 <i>Table 1</i>
UV Resistance	D4355	All Geosynthetic products,	Typical Value*	MD % retained XD % retained	Annually

	(500 hr exposure)	At least one of lightest weight product within the product line tested			
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*Typical value is the test result of independent testing performed within the previous 12 months

8.2.5.5 The QMS shall ensure that:

- Each sample selected for quality control inspection and testing is designated with a product ID and sample control number for record keeping and traceability;
- The test report for each sample identifies the product, plant, date, shift of manufacture, and production line, and lot designation for the raw materials; and
- That quality control test reports (not samples) are maintained and available for review for 3 years, and may be in electronic form (i.e., paper copies not required).

8.2.6 (Detailed information for 8.1.6) Quality Control Personnel - Training and Competency Evaluation

8.2.6.1 The QMS shall ensure that:

- The manufacturer's QA manager meets the requirements established by the manufacturer;
- The QA manager qualifies technicians performing QC testing;
- QC personnel are familiar with the tests they perform; and
- QC personnel have sufficient authority to assure that corrective actions are carried out when necessary.

8.2.6.2 The QMS shall describe the manufacturer's QC technician qualification program. As a minimum the program shall include:

- Training in the AASHTO, ASTM, or company test procedures, operation of equipment, the procedures to be used, calculations required, and reporting;
- Demonstration of competency for each required test;
- Demonstration of ability to properly document test results;
- Annual auditing of each technician's ability to satisfactorily perform the required tests; and
- Retraining when a test method is revised.

8.2.6.3 Training and competency reviews shall be documented in such a way that compliance with the requirements for the initial and updated training and the initial and annual competency reviews can be demonstrated for each technician and for each test the technician performs. The documentation shall include the date of the training or competency review and contain the hand written signature or initials of the trainer/reviewer and the technician. This documentation shall be retained, for a minimum period of 5 years, at each facility where quality control testing occurs, and shall be made available to NTPEP for review upon request.

8.2.7 (Detailed information for 8.1.7) Statistical Analysis of Test Results – The QMS shall include a description of the manufacturer's approach using quality control data to monitor production and initiate changes or improvements in production as needed to maintain consistent quality and to establish

certifiable property values. The manufacturer shall maintain lot-specific summary tables for each product style (lot summaries). Table 2 is an example of a lot summary table.

Table 2 – Woven Geotextile

[illegible]

¹ Note that along with std. deviation, the statistic Coefficient of Variation (COV) is often useful, but is for specimen to specimen variation comparisons, and so COV is not used in calculating MARVs.

Table 2 – Geogrid

[illegible]

¹ Note that along with std. deviation, the statistic Coefficient of Variation (COV) is often useful, but is for specimen to specimen variation comparisons, and so COV is not used in calculating MARVs.

8.2.8 (Detailed information for 8.1.8) Resolution of Non-Conforming Product or Test Results – The QMS shall include a procedure for resolving non-conforming product or test results. The procedure shall specify that:

8.2.8.1 Test reports clearly identify the deficiencies relative to targeted minimum property values;

8.2.8.2 All product produced subsequent to the previous testing be identified and quarantined pending investigation of the failure;

8.2.8.3 Investigations include obtaining and testing check samples, unless the manufacturer decides to only investigate manufacturing contributing factors based on observations and production monitoring records and dispose of the quarantined material without further testing;

8.2.8.4 If the first check sample meets requirements, the manufacturer shall document the reasons for the original failure and may release the quarantined material, with the exception of the roll of material from which the failing sample was obtained, and resume normal production and testing;

8.2.8.5 If the first check sample fails, the manufacturer shall take corrective action to bring the product into conformance, shall note the corrective action on the test report, and shall continue QC testing to verify the deficiency has been corrected;

8.2.8.6 If additional QC testing also fails, the manufacturer shall repeat the process until the deficiency is corrected;

8.2.8.7 All non-conforming material shall be segregated in the inventory. This segregated inventory shall be handled using one of the following options:

- Re-worked to manufacture new product or
- Scrapped.

8.2.8.8 If no assignable cause is determined for the failing production then the test values associated with the failing rolls will be maintained in the database or files and kept in the MARV calculation within the lot summary or

8.2.8.9 If an assignable cause is identified for the failing production it shall be documented along with a corrective action, then the failing test values may be removed from the lot summary but must be maintained in the database or files. The failing test values must be replaced by new values reflecting material sampled and tested to validate the corrective action.

8.2.9 (Detailed information for 8.1.9) Retention of Records and Test Results, and Product Traceability – The QMS shall describe in detail the process for storing and the location of stored quality control test reports, and how traceability of retained information from raw materials to final products is maintained. The maintained records may be stored in electronic form (i.e., long-term storage of paper copies is not required). The QMS shall ensure that:

8.2.9.1 Test reports are retained for at least 3 years and are available to the NTPEP upon request;

8.2.9.2 Product and product test reports are identified in such a way that the test results for any geosynthetic and raw material used to manufacture the geosynthetic can be located;

8.2.9.3 Documentation that indicates the action taken to resolve raw material or product failures;

8.2.9.4 The manufacturer retains a copy of the NTPEP audit documentation for a facility and actions taken to resolve any noted deficiencies on file at the facility for a period of 5 years;

8.2.9.5 Raw material test reports and the raw material manufacturer's certificate of analysis, and any raw material testing conducted by the geosynthetic manufacturer are traceable to the final product and can be retrieved upon request;

8.2.9.6 The manufacturer maintains a record of QC technician training and competency review documentation;

8.2.9.7 The manufacturer maintains a record of equipment maintenance activities; and

8.2.9.8 The manufacturer maintains a record of all calibration activities, including the person doing the work and the date the calibration activities were performed.

8.2.10 (Detailed information for 8.1.10) Quality Control Testing Facilities

Note 5 – QC testing may be performed at a location separate from the geosynthetic manufacturing facility and/or by independent laboratories. If an independent laboratory is not acceptable to NTPEP (see Section 3.9), the laboratory shall be subjected to review and evaluation in accordance with this work plan.

8.2.10.1 The QC testing facility shall:

- Maintain current versions of all AASHTO, ASTM, and company test procedures for all tests performed and a current version of the company's QMS documentation;
- Adequately house and allow proper operation of all required testing equipment; and
- Maintain records of all NTPEP reviews and actions taken to resolve any noted deficiencies.

8.2.10.2 The QMS shall describe in detail the requirements for the QC test facility(ies) and include, as a minimum, a description of how the following requirements are met:

- The plant shall cover QC responsibilities at all times, including when the QA manager is away from the plant for any reason.
- The manufacturer's QA manager shall be responsible for QC testing at all facilities and assure that all sampling and testing is done by technicians meeting the requirements of the manufacturer's technician qualification program.
- QC testing equipment shall be calibrated/verified in accordance with the equipment manufacturer's recommendations at least once every 12 months by personnel qualified for such work.
- QC testing equipment shall be properly maintained.

8.2.11 (Detailed information for 8.1.11) Marking, Tagging, Storing, Shipping, and Handling of Finished Stabilization Geosynthetics Products

8.2.11.1 The QMS shall:

- Describe the manufacturer's method for permanently marking/tagging the geosynthetic in accordance with the minimum requirements of this program;
- Detail and explain any coding used to mark/tag the geosynthetic; and
- Describe the procedures used to ensure that product handling, storage, and shipping processes will not adversely affect the material composition, characteristics, or product quality.

8.2.12 (Detailed information for 8.1.12) Internal Quality Audits of Each Plant Producing Product

8.2.12.1 The QMS shall include a description of the procedures used to conduct internal audits. The manufacturer, or an independent auditor hired by the manufacturer, shall perform these audits at least annually unless problems in the quality control program or with the quality of the product indicate more frequent audits are necessary. The internal audits shall include the following as a minimum:

- Evaluation of plant inspection,
- Inspection of testing equipment and calibrations,
- Observation of raw material sampling and lot control procedures,
- Observation of final product sampling and testing procedures,
- Review of product certification procedures,
- Review of inspection and testing report documentation, and
- Review of nonconforming product documentation and actions taken.

8.2.12.2 The QMS shall ensure that:

- Audit findings are discussed with plant management and testing technicians and documented in a report;
- Corrective actions are taken as necessary and documented in the report, and
- The most recent report is included in QMS documentation submissions.

8.2.13 (Detailed information for 8.1.13) Lists of Plants, Quality Control Testing Facilities, and Technicians – The QMS shall include the address and telephone numbers of all plants and QC testing facilities for

which the manufacturer desires NTPEP qualification. The QMS shall also identify the QA contact for each facility with contact information and lines of responsibility.

9. QUALITY MANAGEMENT SYSTEM (QMS) REQUIREMENTS FOR PRIVATE LABEL COMPANIES

9.1 Companies that distribute products manufactured by others under a private label shall establish a QMS documenting the procedures used to maintain traceability of the products to the source manufacturer, how they maintain quality control of their private label products, requirements for warehousing and storage of the stabilization geosynthetic products, how they maintain records or quick access to records of the product they purchase and re-sell (including current manufacturer QC data for those products), and that the records retention requirements in this work plan are met. These companies will be required to participate in and conform to an annual audit of their QMS. Private label products will be subject to sampling/testing at the warehousing location during the annual QMS audit or at DOT customer project sites to verify compliance with these quality requirements. Conformance testing shall be completed in accordance with Section 10.3 of this document.

9.2 The company QMS shall include or address the following:

9.2.1 Organization and organizational policies, including locations of all warehousing facilities;

9.2.2 The company's source manufacturer qualification and quality review requirements;

9.2.3 Requirements for visual inspection of each geosynthetic product, verifying the as-manufactured product marking/tagging and labeling, and manufacturer supplied certifications, and lot specific source manufacturer QA data;

9.2.4 How the company verifies incoming and outgoing shipments of geosynthetic materials at all warehouses/distribution facilities are compliant with the requirements established in the company's quality policies document, including private label product specifications;

9.2.5 How the company maintains traceability of specific geosynthetic rolls to specific orders;

9.2.6 Resolution of non-conforming product or test results, including how geosynthetic products that are determined to not meet requirements are identified, traced, and quarantined;

9.2.7 How source manufacturer certifications and QC test results are retained or quickly accessed, and private label product traceability to the source manufacturer product data are maintained; and

9.2.8 Marking/tagging, storing, shipping, and handling of finished stabilization geosynthetic products.

10. PRODUCT CONFORMANCE TESTING (NTPEP SPLIT SAMPLE TESTING)

10.1 The NTPEP Stabilization Geosynthetic Program requires that Class 1A Geotextiles be sampled and tested to determine conformance with AASHTO M 288.

10.2 Sampling and Testing for Manufacturing Plants

10.2.1 Once initial product evaluation has been established, an AASHTO/DOT auditor will sample geosynthetics during each plant audit. At a minimum, all manufacturer product styles must be sampled and tested within a 3-year period.

10.2.2 The AASHTO/DOT auditor will randomly select the product roll from which the samples will be taken and oversee the specific product samples taken. Each sample will be split, with the manufacturer retaining one set of samples for in-house testing and the auditor retaining the other set of samples split from the overall sample taken for AASHTO NTPEP testing. If the geosynthetic manufacturer does not have capability to perform a particular test as specified in the work plan, the split samples may be tested by an independent laboratory acceptable to NTPEP (see Section 3.9). Each set of samples shall consist of a minimum of three laboratory samples measuring 3 feet in length by the width of the roll and shall be obtained from the single roll selected by the auditor. The samples shall not include the outer wrap of the roll. For rolls less than 12 feet wide, the length of the sample shall yield a minimum area of 36 square feet for each sample. The AASHTO/DOT auditor will label all samples to be tested. Two samples are to be sent to the NTPEP designated lab – one for primary testing and one for re-testing, if needed. The third sample is to be retained by the manufacturer for split-sample testing.

10.2.3 The AASHTO/DOT auditor shall complete an identification label and attach it to each sample (an example of the label is shown in Figure 1). The completed label shall identify the NTPEP designation number, manufacturer, style, roll number, lot number, the AASHTO/DOT auditor's name, date sampled, and date shipped. Alternatively, this information may be written directly on the geosynthetic sample. The sample shall be clearly marked to indicate the MD along the outer edge of the sample.

AASHTO-NTPEP TEST SAMPLE	
NTPEP DESIGNATION SSGEO	
MANUFACTURER	_____
PRODUCT STYLE	_____
ROLL NO.	_____ LOT/BATCH NO. _____
WHERE SAMPLED	_____
SAMPLED BY	_____
NTPEP REPRESENTATIVE	_____
DATE SAMPLED	_____

Figure 1. Example geosynthetic product sample identification label.

10.2.4 The sample shall be rolled for shipment to the AASHTO NTPEP designated testing facility. It shall be placed inside, or around, a rigid core during shipment. The package shall be wrapped with a protective cover. If sample rolling is not possible, at the discretion of the manufacturer, the samples may be loosely boxed for shipment to preserve sample integrity. It is imperative that the product obtained for cyclic qualification/re-qualification testing represents actual current production of the product. Thus, to this end, the inventory made available to the auditor from which to pick a sample roll must be from a production, or production(s), of at least 10 rolls manufactured within the 12 months immediately previous to the date of the audit. Further, at least 6 rolls from this production, or productions, representing various times during the production(s), shall be retained and made available for sampling. The auditor will select one roll at random. A full roll list and a lot summary for the production lot from which the auditor selects a sample shall be furnished to the auditor.

10.2.5 In addition, an “In-Plant Sampling Report” must be completed by the sampler. One copy of this report must accompany the samples.

10.2.6 All tests identified in Section 8.2.5 in this work plan shall be conducted. Within 15 days after the sample is taken, the manufacturer shall submit their split sample test results to the NTPEP audit program supervisor. Once the NTPEP laboratory results are available and submitted to the NTPEP audit program supervisor, the NTPEP audit program supervisor will compare the test results and determine if both sets of test results are in compliance with the NTPEP work plan. If any of the test results are not in compliance, the NTPEP audit program supervisor will request from the manufacturer an explanation of any noncompliant test results, including any corrective actions found necessary in the manufacturing process or testing procedures. The NTPEP audit program supervisor will post the comparison of the split sample results and the corrective action taken in the secure area of the NTPEP website, available only to AASHTO member departments and the manufacturer for whom the testing was conducted, and annually evaluate the split sample results and report on testing proficiency.

10.2.7 The test results for a product will be in compliance with this NTPEP work plan if:

10.2.7.1 The test results meet or exceed all AASHTO M 288 requirements, if applicable, for the product and

10.2.7.2 The test results meet or exceed the manufacturer’s MARV’s, minimums, or maximums for the product established based on the values submitted in the participant’s annual application.

10.3 Sampling and Testing for Products Distributed/Sold under a Private Label

10.3.1 A reduced sampling and testing program will be conducted for NTPEP quality assurance (QA) purposes for companies that market and distribute products manufactured by others to confirm consistency between the product testing conducted by the source manufacturer and NTPEP on the manufacturer’s products as described in the previous section, and the products distributed and sold under a private label.

10.3.2 “Consistency” is defined as meeting or exceeding the same AASHTO M 288 requirements, if applicable, as the source manufacturer’s audit results demonstrated and that they also meet or exceed the source manufacturer’s MARV, minimum, or maximum for the source product which is based on the source manufacturer’s QC test results conducted in conformance with the source manufacturer audit.

10.3.3 Sampling shall be conducted in a manner that is consistent with the sampling protocol and documentation process as defined in the previous section for testing to evaluate conformance of the manufacturer to this work plan.

10.3.4 Testing conducted on private label products shall include all tests identified in Section 8.2.5. Except for UV resistance, testing will be conducted annually on one product from each product category selected at the discretion of the auditor. For UV resistance, testing will be conducted on a 3-year cycle on the lightest weight product from each product category.

11. RESOLUTION OF AUDIT OR TESTING FAILURES AND DISPUTES

11.1 When a nonconformance is found during an audit, the burden will be on the participant to identify the cause; develop, implement and document the resolution; and revise his QA plan to assure future conformance. When the participant is found to not conform to one or more aspects of the governing QMS, the following steps shall be taken:

11.1.1 The NTPEP auditor notifies the participant of the issue(s).

11.1.2 The participant furnishes a Corrective Action Report (CAR) to AASHTO within 15 business days of the final NTPEP audit report to the NTPEP auditor. The CAR is to contain: the issue being addressed, the course(s) of action to be taken and a timeline showing when these actions will be taken. There should be sufficient detail to adequately explain the processes to be followed.

11.1.3 If the CAR is not received within 15 business days, NTPEP notifies the participant that their facility is classified as “non-compliant” with AASHTO’s NTPEP audit program. The audit is considered completed and all fees paid will not be refunded.

11.1.4 If the participant still requests to participate in the program, they will need to reapply (See Section 5).

11.2 When the participant has a dispute with NTPEP regarding procedural issues, it shall be handled as follows:

11.2.1 The participant notifies NTPEP in writing of the dispute, providing appropriate documentation for the committee to fully understand the controversy, and requests a resolution.

11.2.2 Copies of the dispute and documentation are forwarded by NTPEP to the technical committee chairman and vice-chairman and to the NTPEP technical committee liaison. The technical committee, less industry representatives, will convene to discuss the dispute and render a decision on the appropriate resolution. Quorum for the purposes of this decision will be either the chairman or vice-chairman, the NTPEP liaison or his/her designee, and one other technical committee member. The chairman or vice-chairman will communicate the resolution to the participant in writing through NTPEP.

11.2.3 The participant may appeal within 30 days of the date of the resolution. If the dispute is not resolved to the participant's satisfaction, the dispute can be raised to the NTPEP executive committee chairman for resolution by the NTPEP appeals board. The decision by the appeals board is final.

11.3 Inevitably, there are times when the sampled geosynthetic fails to meet specification requirements, or the manufacturer's MARV, minimum, or maximum for the product established based on the QMS evaluated as part of this audit program, when tested by NTPEP, or when the manufacturer is found, during an audit, to have neglected one or more aspects of the governing QMS during manufacturing. While the manufacturer may request a retest, if enough sample is available, the burden will be on the manufacturer to identify the cause, document the resolution, and revise his QA plan to assure future conformance. All results will be reported. Any retesting or re-auditing will be at the discretion of NTPEP and the associated costs will be borne by the manufacturer.

11.4 Disagreements with NTPEP regarding test results will be handled as follows:

11.4.1 The manufacturer should verify that their manufacturing process is operating correctly, that test equipment is calibrated, and that test procedures are correct. If these conditions are met, a set of three samples shall be obtained by an AASHTO representative in accordance with Section 10.2, as appropriate, from the same lot as the failing test. The samples shall be taken from one of the originally sampled geosynthetic rolls or from another geosynthetic roll of the same lot made during the same shift.

11.4.2 The manufacturer will test one of the samples, and if the results meet the specification requirements and the MARV, minimum, or maximum for the product as determined based on the manufacturer's QC test results, the AASHTO representative will send one sample of the same product to an independent laboratory acceptable to NTPEP (see Section 3.8) and a second sample to NTPEP and request that the product be tested. NTPEP will consider the dispute resolved if the manufacturer's test results are in conformance with this work plan and conform with at least one of the other testing facility results (i.e., the manufacturer's test results and either the independent or NTPEP laboratory test results are determined to be in compliance with this work plan as specified in Section 10). If this is not the case, the manufacturer should repeat the process of checking the manufacturing process, the equipment calibration and the test procedures until satisfactory agreement with inter-laboratory testing is accomplished.

11.5 To withdraw from the program, a written request must be received by the NTPEP manager at least five business days before the auditing/sampling is to begin. For information regarding costs, and their associated due dates, please refer to the terms and conditions located under DataMine's Legal Information section.

12. DELIVERABLES – EVALUATION RESULTS AND DATA

12.1 Test result data will be compiled in populated test tables and made available to all participating states and testing companies through the NTPEP DataMine website. No judgment as to a product's acceptability to any state will be made in DataMine. As end-users of the data, AASHTO member departments may establish individual criteria for product acceptability. Product preparation/installation and post-evaluation images and video will also be uploaded to DataMine.

12.2 The populated test tables shall contain the test data generated by the contracted NTPEP laboratory(ies). The images/video uploaded will also be captured by the laboratory(ies) representative.

12.3 Test results will be transmitted electronically in DataMine as follows. Once populated test tables and images are reported to the technical committee's chair and liaison, they will release data and associated images to the manufacturer for review. When the manufacturer reviews and accepts the data, the data will be released to the public through DataMine.

13. PUBLIC NOTICE

13.1 One of the primary reasons for a quality assurance program is to instill confidence in the end- user and the general public that the materials being used for infrastructure construction are of sufficient quality and to facilitate use of products that have proven to be of sufficient quality.

13.2 To this end the program will provide for public notice of companies, plants, and geosynthetic products found to conform with the provisions of this work plan via website postings, with official electronic reports issued to AASHTO member departments.

14. MODIFICATION OF QUALIFIED PRODUCTS (RETEST REQUIREMENTS)

14.1 Product design may change over time as manufacturers improve their products and optimize their manufacturing processes. When a design change is made in a NTPEP listed product, the manufacturer shall notify the NTPEP of the change and submit samples for re-consideration of conformance with this work plan.

14.2 Any changes in manufacturing method, product weight, polymer components (including coatings and stabilizers), and/or polymer component(s) source, will be considered a product change, and a reevaluation of the product may be required by NTPEP for continued listing. Changes in the published

property MARV's or minimum values for the product (from those that were published at the time of the current NTPEP evaluation) will not be considered as a product change if the change can be shown to be a result of a reduction in manufacturing variability as documented by routine lot summary calculations.

15. KEYWORDS

NTPEP; DataMine; stabilization geosynthetics; subgrade stabilization; biaxial geogrids; woven geotextiles