Usage Guide for

NTPEP Audit Programs

NTPEP Designation: [NAP-1-20]
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Scope

This document serves as a usage guide for the National Transportation Product Evaluation Program (NTPEP) manufacturer audit programs or NAP (National Audit Program). NTPEP serves the member departments of the American Association of State Highway and Transportation Officials (AASHTO). This usage guide is intended to help Member Agency (DOT) engineers and technicians understand the reasoning behind why certain materials are audited at the source of production, explain how the material is evaluated, and provide various ways of using the results for material acceptance.

Background

The program was developed out of the need for standardization. Industry requested a unified approach to material acceptance while the state DOT’s were experiencing a decrease in knowledge due to a reduction in workforce. This program is an attempt to help both sides.

From its inception, NTPEP primarily coordinated the testing of highway materials and then published the results of that testing for the member State Transportation Agencies to use. As the NTPEP testing program grew, the need for an alternate way to evaluate certain materials (directly at the source of production) led to the development of an audit program. In 2008 the first audit was performed thereby launching the “NAP way” of handling materials. In these audit programs not only are the products sampled and tested by NTPEP designated laboratories to evaluate the products, but an on-site inspection audit is performed to review the manufacturing process, the facilities, and the manufacturer’s quality control procedures.

Purpose of conducting audits

Audited products are generally produced/fabricated to an AASHTO or ASTM specification. There are a couple of reasons why some material processes are more suitable for performing audits on than others. For instance, it may be that the material has a low failure rate and is typically accepted based on a Manufacturer’s Certification with possibly some limited additional testing. The audit allows the DOT to have more than just the Manufacturer’s Certification and provides additional process and testing information. In other cases, the equipment and expertise needed to conduct particular tests may be cost prohibitive for DOTs to own and use. In that case, the DOT typically accepts the product based on the manufacturer’s own test results. The audit process provides those test results through an independent means.
In other instances, the DOT may require an on-site inspection of certain types of material production facilities sometimes necessitating costly travel arrangements.

With NAP, a qualified auditor performs the on-site audit and randomly samples products for testing. All audit findings and test results are published for DOTs to review and consider for their use. Each manufacturer requesting an audit pays a fee to participate in the program. This fee covers the costs associated with: travel, testing, and the administration of the program. Agencies utilizing the program do not incur the costs associated with the audit unless they have additional requirements than those covered under NAP.

**Materials included in the audit program**

Materials that are currently audited through NAP include:

- High Density Polyethylene (HDPE) and Polypropylene Pipe
- Steel Reinforced Polyethylene Pipe (SRPE)
- Reinforcing Steel Bar (REBAR)
- Welded Wire Reinforcement (WWR)
- A1064 Wire (Wire)
- Stainless Steel Bar ( SSTL)
- Seven Wire Strand (SWS)
- Polyvinyl Chloride (PVC) Profile Wall Drainage Pipe
- Corrugated Metal Pipe (CMP)
- Elastomeric Bridge Bearing Pads (EBB)
- Geosynthetics (GTX) and Reinforced Geosynthetices (REGEO)
- Guiderail/Guardrail (GRL)

Each of these materials has specific attributes that make it a viable area for NTPEP involvement. More detailed information about these materials is included in the appendices of this document.

**Overview of the audit process**

NTPEP’s general process for auditing consists of:

- Conducting a pre-audit review of the Manufacturer’s Quality Systems Manual;
- Conducting an on-site audit of documentation control, production, quality control testing, and storage;
- Obtaining companion samples for NTPEP Designated Laboratory testing;
- Publishing the results of the completed audit.

The audit process is described in detail in NTPEP Standard Practice SP01, “Standard Practice for Qualification of Highway Product Manufacturers Through the Use of NTPEP Audits” and is available on the NTPEP website at [www.ntpep.org](http://www.ntpep.org). Additionally, under each product Committee, a Work Plan has been developed that works with SP01 to address the particulars for each audited material.
Manufacturers submit an application to NTPEP for an audit and audits are scheduled on a regional basis. Auditors may handle several materials during their audit run.

State DOT materials representatives are contacted in advance of upcoming audits in their state so that they can accompany the NTPEP auditor during the site visit if they wish to do so. State DOT materials personnel are encouraged to join the auditor whenever possible so that they can be assured that all areas of concern to them are fully covered.

During the on-site audit, the auditor typically witnesses testing of selected products and also obtains comparison samples of those products for independent testing and comparison. The results are used as part of the overall audit process. Once the process has been completed, manufacturers who meet the requirements of SP01 and the particular Work Plan are listed as being “compliant”.

Using the results of the audit process

The results of these audits are uploaded to DataMine and are available for DOTs to use as they deem best for their agency. Typically, the results are used in conjunction with having a manufacturer be considered for a Qualified Product Listing. The NAP process is a standardized way to present the data. Final acceptance (approval, certifying, etc.) is performed by the DOT. Member Agencies may wish to use the results to:

- Place a manufacturer and directly related products from that manufacturer on a Qualified Products Listing with no additional testing. This would be a good alternative for DOTs that are currently accepting products based on manufacturer’s certifications alone.
- Consider a manufacturer for a Qualified Products Listing with some additional source testing. Some DOTs may want to request or perform additional testing on a particular product and/or still take field samples for product acceptance.
- Take the DOT product inspection process to a higher level by adding the NTPEP audit as a portion of their own evaluation of the manufacturer.
Appendix A: Geotextile (GTX) Audit Program

The Geosynthetics Technical Committee facilitates the laboratory evaluation and auditing program for Geotextile products (GTX) in accordance with the AASHTO Materials Specification M288. The technical committee coordinates the listing of participating manufacturer, converter and private labeler facilities with product information, audit findings and test results. Geotextiles are used in a wide variety of highway applications including subsurface drainage, separation, stabilization, erosion control, temporary silt fence and paving. High strength geotextiles used for reinforcement applications including retaining walls, steepened slopes and subgrade stabilization are not addressed in this program but are covered under separate NTPEP programs.

A.1. Geotextile Types

Geotextiles are made from synthetic fibers, filaments, yarns, straps and sheets consisting of long-chain synthetic polymers composed of polyolefins or polyesters. These materials are formed into a stable network such that they retain their dimensional stability relative to each other, including selvages, i.e., the edge portion of a geotextile. Geotextiles can be either woven or non-woven.

Woven geotextiles are manufactured by weaving together strips or threads so that they are interlaced perpendicular to each other to form a tight criss-cross or mesh. This process can produce woven geotextiles that are quite strong with high tensile strengths at low strains. These characteristics make wovens useful for highway projects in reinforcement applications like stabilizing soft or loose soils under heavy loads. Woven geotextiles are generally lightweight and typically more plastic-like in feel and appearance. Silt fence is a common use for woven geotextiles because some wovens have a very tight weave which tends to be less porous meaning water will pass through them more slowly.

Non-woven geotextiles are manufactured from staple fibers or continuous filaments by needle-punching, heat bonding or other methods. This process can produce non-woven geotextiles with controlled porosities which make non-wovens useful for filtration and separation functions. Depending on the application, non-woven geotextiles are often referred to by weight (e.g., 3.4 oz. per square yard) and are typically more felt-like in feel and appearance. Subsurface drains are a common use for non-woven geotextiles to separate stone from in-situ soils and prevent fines from clogging drains.

AASHTO M288 lists the minimum required geotextile strength by class for both wovens and non-wovens based on “elongation”, i.e., how much the geotextile “stretches”. In general, woven geotextiles have lower elongations than non-woven geotextiles so typically, wovens are categorized as those with less than 50% elongation and non-wovens are categorized as those with greater than 50% elongation.

A.2. Participant Types

The GTX audit program covers three different types of participants, Manufacturers who produce and sell geotextiles, Converters who purchase geotextiles from source manufacturer(s) and modify them for sale and Private Labelers who purchase geotextiles from source manufacturer(s) and sell geotextiles as their own product style (brand) as packaged and labeled by the manufacturer. Converters may be considered manufacturers if they accept full responsibility for the product quality or they change the properties of source geotextiles in the
conversion process. It is important to note that all geotextiles purchased by converters (not considered manufacturers) and private labelers must come from NTPEP participating manufacturing facilities. Therefore, only product traceability audits and limited product verification testing are required for converters (not considered manufacturers) and private labelers while more extensive facility audits and product traceability and verification testing are required for manufacturers (and converters considered manufacturers).

A.3. Marking and Labeling Requirements

Product styles from product lines and categories produced at NTPEP audited plants will be marked and labeled per the requirements of the NTPEP GTX program. At a minimum, labeling includes the product name, production information (date and roll no.) and AASHTO classification or “NTPEP Listed” printed on the label. Also, NTPEP listed geotextiles will be marked with the NTPEP manufacturer’s code at least every 5 meters. The manufacturer’s code is a unique ID assigned to each manufacturing plant facility and a listing of IDs with plant information is available to State DOTs upon request.

A.4. Audits and Testing

AASHTO M288 recognizes 8 primary properties that are used to specify geotextiles for most functions. These properties with their corresponding ASTM test methods are as follows:

- Grab and Sewn Seam Strength, Elongation: ASTM D4632
- Tear Strength: ASTM D4533
- Puncture Strength: ASTM D6241
- Permittivity: ASTM D4491
- Apparent Opening Size (AOS): ASTM D4751
- Ultraviolet (UV) Stability: ASTM D4355

Four additional properties are specified for paving fabrics only that include Tensile Strength (ASTM D5035), Mass Per Unit Area (ASTM D5261), Asphalt Retention (ASTM D6140) and Melting Point (ASTM D276). There are other applications of geotextiles referencing additional properties as well as other types of geosynthetics in M288 that do not apply to the NTPEP GTX program.

While all NTPEP participants are audited yearly, geotextiles from manufacturing facilities are sampled every 3 years for verification testing. For converters (not considered manufacturers) and private labelers, geotextiles are randomly sampled each year for testing. It is important to note that the audits and testing are independent of each other but run concurrently as geotextile samples are collected during on-site audits. Participants are required to apply for the program each year in the fall for the following year’s audit cycle. If a participant does not apply for the program, they are considered withdrawn from the program and their audit findings and test results are removed from NTPEP’s online database, DataMine.

A.5. Program Goals, Benefits and Uses

The primary goal of the testing is to confirm that geotextile properties published by participants are accurate and the geotextiles meet the requirements of AASHTO M288, so State DOTs don’t have to do their own independent testing. The primary goal of the audits is to provide regular checks of the Quality Assurance/Quality Control (QA/QC) of the geotextile sourcing and manufacturing, so State DOTs don’t have to use their own resources to verify the quality of the
NTPEP listed geotextiles. These savings are further amplified when one considers that much of the geotextile manufacturing done today is in international locations. The participants have benefited from the NTPEP GTX program as well by minimizing duplication of efforts. As more DOTs use NTPEP, there are fewer DOTs that manufacturers, converters and private labelers will address independently. Most State DOTs maintain Approved or Qualified Products Lists (APL or QPL) for geotextiles. DOTs typically incorporate NTPEP by requiring that geotextiles be NTPEP listed to be on their APL or QPL.
Appendix B: Elastomeric Bridge Bearing Pad (EBB) Audit Program

Introduction:
The Elastomeric Bridge Bearing Pads (EBB) Technical Committee (TC) facilitates the laboratory testing and auditing program for plain and laminated elastomeric bridge bearings in accordance with AASHTO M251 (Standard Specification for Plain and Laminated Elastomeric Bridge Bearings). The TC coordinates a listing of participating manufacturer facilities, as well as audit results.

Bridge bearings are structural devices that transmit loads, most typically from the superstructure to substructure, while facilitating translation and/or rotation. Plain elastomeric bearing pads are made exclusively of elastomer, which provides limited translation and rotation. Laminated elastomeric bearing pads (or steel-reinforced elastomeric bearing pads) are made from alternate laminates of steel and elastomer bonded together during vulcanization. Vertical loads are carried by compression of the elastomer. Movements parallel to the reinforcing layers and rotations are accommodated by deformation of the elastomer.

Key Aspects of the Program:
This program audits both the quality control processes of the bearing manufacturers, as well as the elastomer materials and finished product. In terms of the quality control processes, each manufacturer’s quality manual is provided for review by the states as a part of the EBB audit program. Regarding the material and bearing reviews, the following table lists the Test Property and Test Designation (i.e., test specification) that is required by the program:

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Test Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear Modulus</td>
<td>ASTM D4014 (See notes in AASHTO M251, Section 8.8.4)</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D412</td>
</tr>
<tr>
<td>Ultimate Elongation</td>
<td>ASTM D412</td>
</tr>
<tr>
<td>Low Temperature Britteness</td>
<td>ASTM D746, Procedure B (Temperatures as per AASHTO M251, Table 1)</td>
</tr>
<tr>
<td>Bond Strength</td>
<td>AASHTO M251, Appendix X2</td>
</tr>
</tbody>
</table>

Optional Tests*

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Test Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compression Stiffness</td>
<td>AASHTO M251, Annex C</td>
</tr>
</tbody>
</table>

*When requested by the state to be performed

The following is intended to provide a high-level overview of the significance of each of the tests performed as a part of this program:

- Material (Elastomer) Quality Control Tests
  - Shear Modulus
  - Tensile Strength
  - Ultimate Elongation
  - Low Temperature Brittleness
    - The significance of these tests comes in the form of bearing function. The material values for the elastomer are specified by the engineer in the design of elastomeric bridge bearings – both laminated and plain. If the elastomer material properties do not meet the design requirements, the bearing will not function as intended and may even fail. Premature deterioration and/or incorrect function may, in turn, cause additional damage or deterioration to the other elements of the bridge.

- Finished Bearing Pad Quality Control Tests
Compression Strain
Compression Load
Creep and Shear Bond Strength
Shear Modulus Testing

- The significance of these tests comes in the form of bearing function. These tests measure the ability of the finished bearing to function as intended in the design of the elastomeric bridge bearing – both laminated and plain. These tests provide indicators of the quality of the workmanship in assembling the different materials in laminated pads, and their ability to sustain different loadings. If these test requirements aren’t met, premature deterioration and/or incorrect function may occur, which in turn, may cause additional damage or deterioration to the other elements of the bridge.

**Terminology:**
See EBB-18-01, Section 3 for applicable terminology for this audit program.

**Review of Evaluations and Significance of Data Generated:**
The results of the EBB audits are uploaded to DataMine and are available for DOT’s to use as they deem best for their agency. Final acceptance (approval, certifying, etc.) is performed by the DOT.
Appendix C: Corrugated Metal Pipe Audit Program

Introduction:
Corrugated Metal Pipe (CMP) are hollow steel tubes manufactured into a variety of lengths and diameter sizes. They are produced by four distinct methods which include; riveted, helical lock, spot welded, and helical continuous welded seams. In all methods, raw steel is first cast into a more workable starting form. It is then made into a pipe by stretching the steel out into a seamless tube or forcing the edges together and sealing them with a weld. CMP is used in a variety of applications, such as culverts, storm water detention/retention systems, storm sewers, small bridge replacements, caissons and foundation structures, aeration pipe, pedestrian and animal passages, and material conduits.

The Corrugated Metal Pipe (CMP) Technical Committee (TC) facilitates the laboratory testing and auditing program for the following material types:

- **Galvanized**: Hot rolled steel that is coated in zinc to form a 2oz/sq. ft. protective coating.
- **Aluminum**: Constructed from two metallurgically bonded aluminum alloys.
- **Aluminized Type 2**: Hot rolled steel that is coated in aluminum to form a 1oz/sq. ft. protective coating.
- **Polymer**: Galvanized steel that has a 10mil polymeric film laminated to both sides of the steel. This is the premier protective coating for CMP that offers multiple layers of protection, supreme abrasion resistance, and the ability to withstand the widest range of soil and water environments.

Audited products conform to AASHTO M36 (Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains). The TC coordinates a listing of participating manufacturer facilities, as well as audit results.

Audit Program:
The purpose of the program is to provide audit information from manufacturing plants that comply with the quality control and product testing requirements of this program. AASHTO member departments can then use this information in their quality assurance program for Manufacturer/product acceptance. This may include utilizing this information to establish a qualified Manufacturer list, and/or a qualified products list. By participating in this program, the Manufacturer agrees to the audit process and procedure. The CMP audit program currently assesses two facets established in the review. These components consist of “On-Site Audit” and “Annual Product Testing”. Details of the on-site audit and annual testing are clarified in the SP01 and approved CMP work plan.

On-Site Audit:
A required formal application process is submitted, reviewed, and accepted prior to any on-site audit. Once the application is approved, a facility is selected, and an audit date is established. The NTPEP audit team will then notify the manufacturer and facility with plans to conduct the audit. The review will include the following:

- Quality Control Testing Evaluation
- Production Record Review of Products
- Inspection of Products
- Testing of Products
- Buy America

Annual Product Testing:
Samples are obtained during the audit process and tested for verification against the applicable standard. Material is obtained for sampling during the audit and sent to a 3rd party testing laboratory, or on-site tests are verified. Specimens are fabricated and the following properties are evaluated.
<table>
<thead>
<tr>
<th>Metal Test Property</th>
<th>Product Specification</th>
<th>Material Specification</th>
<th>Test Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile/ Yield /Elongation</td>
<td>AASHTO M 36, M 190, M 196, M 245</td>
<td>AASHTO M 197, M 218, M 246, M 274, M 289, ASTM A929</td>
<td>ASTM A370</td>
</tr>
<tr>
<td>Metal Thickness</td>
<td>AASHTO M 36, M 196</td>
<td>AASHTO M 197, M 218, M 246, M 274, M 289, ASTM A929</td>
<td>ASTM A1073</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finished Pipe Test Property</th>
<th>Product Specification</th>
<th>Material Specification</th>
<th>Test Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (Helical Lock Seam)</td>
<td>AASHTO M 36, M 196</td>
<td>M 197, M 218, M 246, M 274, M 289,</td>
<td>AASHTO T 249</td>
</tr>
<tr>
<td>Cup Test (Helical Continuous Welded Seam)</td>
<td>AASHTO M 36</td>
<td>ASTM A796</td>
<td>AASHTO T 241</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coating Test Property</th>
<th>Product Specification</th>
<th>Material Specification</th>
<th>Test Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc-Coated</td>
<td>AASHTO M 36</td>
<td>AASHTO M 218</td>
<td>ASTM A90</td>
</tr>
<tr>
<td>Aluminum-Coated</td>
<td>AASHTO M 36</td>
<td>AASHTO M 274</td>
<td>ASTM E376</td>
</tr>
<tr>
<td>55 Percent Aluminum-Zinc Alloy-Coated</td>
<td>AASHTO M 36</td>
<td>AASHTO M 289</td>
<td>ASTM A792 ASTM E376</td>
</tr>
<tr>
<td>Zinc-5 Percent Aluminum-Mischmetal Alloy-Coated</td>
<td>AASHTO M36</td>
<td>AASHTO M 289</td>
<td>ASTM A924</td>
</tr>
<tr>
<td>Polymer</td>
<td>AASHTO M 245</td>
<td>AASHTO M 245</td>
<td>ASTM A849</td>
</tr>
</tbody>
</table>

Review of Evaluations and Significance of Data Generated:
Audit results (in the form of an Audit Report, a Conformance Report for the tested samples, and any Corrective Action Reports) will be located in the web-based database – DataMine. The DataMine database can be accessed through the AASHTO/NTPEP website link at http://data.ntpep.org/. Once the test data is reported to the Auditor by the NTPEP Designated Laboratory, the Auditor will review the data to ensure completeness. The Conformance Report will be posted to DataMine and will be available to the product manufacturer and the end state user participants for review.

Audit results will be made available to all participating states through the AASHTO/NTPEP DataMine website. No judgement as to a product’s acceptability to any state DOT requirement is made in DataMine. End state user participants are responsible for establishing their criteria for product acceptability.
Appendix D: Reinforcing Steel and Wire  
(REBAR/WWR/WIRE/SSTL/SWS)  
Audit Program Specifics

The Reinforcing Steel and Wire Technical Committee facilitates the auditing program for reinforcing steel and wire products. The technical committee coordinates a listing of participating producing mills/manufacturing facilities along with audit results.

Reinforcing steel is used primarily for the reinforcement of concrete products (precast concrete items, concrete pavements, cast-in-place structural concrete, etc.). It generally is furnished as one of the following finished products: bars or welded wire sheets/rolls. All of these products start out in the same way.

Products covered in this program are:

- Reinforcing bars
- Reinforcing wires
- Welded wire
- Seven-wire strand
- Stainless-steel bars

B.1 Steel-Making Process

Reinforcing steel starts out as scrap metal (cars, appliances, machining waste, etc.) which is shredded and separated into piles based upon chemistry. Pre-determined weights are combined and melted in a large ceramic-lined steel bucket by means of an electric arc furnace. Huge positively charged electrodes are lowered into the negatively charged bucket of scrap and create an arc. This electric arc melts the scrap steel consuming everything attached (paint, insulation, etc.). All non-ferrous products, consumed during the melt, float to the surface and are poured off as slag.

The molten steel, after initial melt, is transferred to a ladle (another lined steel bucket) where certain alloying agents are added to refine the steel mixture. During this stage the chemistry is periodically tested for compliance with the particular steel recipe (specification and grade) being produced.

After mixing to the proper recipe, the molten steel is cast into rectangular “billets”. The molten steel mixture is poured into water-cooled copper molds which cast continuous rectangular sections which are cut to length, identified, and stored. The billets are identified by “heat” (cast from the same melt or ladle of steel) and are marked with the heat number and billet number. At this stage, the billet has identification and only the chemistry test results. Any physical test results will come later when the steel is a finished product.

B.2 Bar Production (Plain and Deformed)

In the production of reinforcing bars, the billets are heated to approximately 1950 °F in a furnace and sent through a series of rollers which gradually reduce the billet into the round bar.
This “hot-rolling” process can produce:

- straight or coiled deformed bar with the last set of rollers producing upset ribs/deformations
- plain bar (often called smooth round) or rod (small diameter coiled plain bar) by removing the last set of rollers (with deformations).

When tested by the producing mill’s Quality Control Laboratory, physical properties (tensile, yield, elongation, bend, etc.) are determined for the heat of finished bars. Rod only has chemical properties until it is drawn (where the physical properties can be determined).

**B.3 Wire/Welded Wire Reinforcement (Plain and Deformed) Production**

Wire (produced from rod) can be used alone or welded to produce welded wire reinforcement. The rod is descaled (cleaned) and “drawn” or “rolled” through a series of dies to produce the required wire size (diameter). Cold-drawing/rolling reduces the diameter and provides cold-working of the steel to produce the necessary physical properties. Deformation can be produced in the wire by crimping the wire to produce indentions or by sending the wire through dies (similar to deformed bars) that produce deformations.

Welded wire reinforcement is produced by welding wire (as produced above) in the desired configurations to produce flat sheets or rolls. Welding is performed by electric resistance units capable of joining all wire intersections in a row simultaneously. Additional quality control testing is necessary to determine weld quality.

**B.4 Seven Wire Steel Strand for Prestressed Concrete Low Relaxation Production**

The wire rod used to produce seven wire strand is descaled (cleaned) to remove the mill scale from the surface of the wire. Once the mill scale has been removed, the wire rod is coated with a textured coating that allows a lubricant to adhere to the wire during the drawing process.

The wire, through a cold working process, is drawn through a series of dies which gives the wire the desired mechanical properties. Strands consists of seven wires which are configured as six outer wires and one center wire which is loaded into the stranding machine. The center wire is the largest of the seven wires. The wires are pulled off of the strander at a specified rate which controls the lay of the strand. Once the wires have been wound into strand, the strand is run through a continuous heat which gives the stand its physical characteristics. The strand is then quenched in a water bath which freezes the physical characteristics and rinses any remaining residuals from the surface of the strand.

**B.5 Audit Program**

The audits are a review of typical daily production of highway products. Reviews of manufacturing and testing are representative of normal production. The on-site testing of samples should be what you would expect to find any time a visit is made.

When the audit is completed, the report is forwarded to the AASHTO Supervisor for review. Once the report has been reviewed and any revisions finalized, the audit results, preaudit documentation, and current Quality Manual are all uploaded onto the NTPEP Audit Program (NAP) website.
B.6 Testing

It is important to know what test results are available from testing in accordance with the product specifications and how to use them. There are few chemical requirements for reinforcing steel and mainly minimum requirements for the physical tests.

Direct comparison between the product results and the documented test results shown on the Mill Test Report (MTR) will not match exactly. For example, the chemistry of a sample taken from the steel product versus the values listed on the MTR will not match exactly because the chemistry reported on the MTR is not a direct product test. While the results are representative of the product, they may be from several tests performed during the melting and mixing of the heat of steel.

The comparison sample testing performed during the audit is meant to determine the quality of the testing being done by the manufacturer. Due to the amount of product typically produced by any given manufacturer, the testing of one sample is not particularly representative of the product. AASHTO Designated Laboratory testing is utilized to instill states’ confidence in the manufacturer’s internal testing procedures and quality control program and in the consistency of the quality of the product being produced.

B.6.1 Acceptable Limits of Variation Testing

The following acceptable limits of variation between the manufacturer’s lab and the AASHTO Designated Laboratory testing are used by the NTPEP Committee in comparison of the split sample results. These limits are used to trigger further investigation into the testing practices of the plant laboratory or the NTPEP Designated Laboratory. State agencies may wish to use these values for their own product evaluations or they can adjust them as desired. The comparison worksheets, where applicable, are designed to allow each individual State DOT’s to change the variation limits if they the committee values do not meet their requirements.

B.6.1.1 Reinforcing Bar (AASHTO M31, ASTM A615, ASTM A706)

Test results for sample of three (3) specimens cut from the same heat and tested at each laboratory are expected to vary between laboratories by no more than the following:

- Unit Weight .... 1.0 percent
- Yield ............ 10.0 percent
- Tensile .......... 10.0 percent
- Elongation ...... 4.0 percent

The differences in average test results for the same sample from the same heat tested at each laboratory are expected to vary between laboratories by no more than the following:

- Unit Weight .... 1.0 percent
- Yield ............ 4.0 percent
- Tensile .......... 4.0 percent
- Elongation ...... 3.0 percent

B.6.1.2 Wire and Welded Wire Reinforcement (AASHTO M336, ASTM A1064)
The test results for comparable sample specimens tested at each laboratory are expected to vary between laboratories no more than the following:

Tensile. .............................................. 10 percent
Unit Weight (deformed wire only) ........ 5 percent

The differences in average test results for the same sample from the same heat tested at each laboratory are expected to vary between laboratories by no more than the following:

Tensile. ............................................... 5 percent
Unit Weight (deformed wire only) ....... 2 percent

B.6.1.3 Seven Wire Strand (AASHTO M203, ASTM A416)

There are currently no laboratory comparison requirements for seven wire strand.

B.7 Retests and Re-Audits

Inevitably there will be times when samples fail to meet the requirements of the specifications or proper accepted procedures are not followed during production or testing of material.

If one or more of these conditions occur the manufacturer can request a retest or re-audit. The cost for any retesting or auditing will be borne by the manufacturer. The manufacturer must identify the cause and document changes to correct shortfalls. The NTPEP Reinforcing Steel and Wire Technical Committee leadership will review all audit deficiencies and corrective actions and determine whether or not the corrective actions are acceptable.
Appendix A: Geotextile (GTX) Audit Program

The Geosynthetics Technical Committee facilitates the laboratory evaluation and auditing program for Geotextile products (GTX) in accordance with the AASHTO Materials Specification M288. The technical committee coordinates the listing of participating manufacturer, converter and private labeler facilities with product information, audit findings and test results. Geotextiles are used in a wide variety of highway applications including subsurface drainage, separation, stabilization, erosion control, temporary silt fence and paving. High strength geotextiles used for reinforcement applications including retaining walls, steepened slopes and subgrade stabilization are not addressed in this program but are covered under separate NTPEP programs.

A.1. Geotextile Types

Geotextiles are made from synthetic fibers, filaments, yarns, straps and sheets consisting of long-chain synthetic polymers composed of polyolefins or polyesters. These materials are formed into a stable network such that they retain their dimensional stability relative to each other, including selvages, i.e., the edge portion of a geotextile. Geotextiles can be either woven or non-woven.

Woven geotextiles are manufactured by weaving together strips or threads so that they are interlaced perpendicular to each other to form a tight criss-cross or mesh. This process can produce woven geotextiles that are quite strong with high tensile strengths at low strains. These characteristics make wovens useful for highway projects in reinforcement applications like stabilizing soft or loose soils under heavy loads. Woven geotextiles are generally lightweight and typically more plastic-like in feel and appearance. Silt fence is a common use for woven geotextiles because some wovens have a very tight weave which tends to be less porous meaning water will pass through them more slowly.

Non-woven geotextiles are manufactured from staple fibers or continuous filaments by needle-punching, heat bonding or other methods. This process can produce non-woven geotextiles with controlled porosities which make non-wovens useful for filtration and separation functions. Depending on the application, non-woven geotextiles are often referred to by weight (e.g., 3.4 oz. per square yard) and are typically more felt-like in feel and appearance. Subsurface drains are a common use for non-woven geotextiles to separate stone from in-situ soils and prevent fines from clogging drains.

AASHTO M288 lists the minimum required geotextile strength by class for both wovens and non-wovens based on “elongation”, i.e., how much the geotextile “stretches”. In general, woven geotextiles have lower elongations than non-woven geotextiles so typically, wovens are categorized as those with less than 50% elongation and non-wovens are categorized as those with greater than 50% elongation.

A.2. Participant Types

The GTX audit program covers three different types of participants, Manufacturers who produce and sell geotextiles, Converters who purchase geotextiles from source manufacturer(s)
and modify them for sale and *Private Labelers* who purchase geotextiles from source manufacturer(s) and sell geotextiles as their own product style (brand) as packaged and labeled by the manufacturer. Converters may be considered manufacturers if they accept full responsibility for the product quality or they change the properties of source geotextiles in the conversion process. It is important to note that all geotextiles purchased by converters (not considered manufacturers) and private labelers must come from NTPEP participating manufacturing facilities. Therefore, only product traceability audits and limited product verification testing are required for converters (not considered manufacturers) and private labelers while more extensive facility audits and product traceability and verification testing are required for manufacturers (and converters considered manufacturers).

### A.3. Marking and Labeling Requirements

Product styles from product lines and categories produced at NTPEP audited plants will be marked and labeled per the requirements of the NTPEP GTX program. At a minimum, labeling includes the product name, production information (date and roll no.) and AASHTO classification or “NTPEP Listed” printed on the label. Also, NTPEP listed geotextiles will be marked with the NTPEP manufacturer’s code at least every 5 meters. The manufacturer’s code is a unique ID assigned to each manufacturing plant facility and a listing of IDs with plant information is available to State DOTs upon request.

### A.4. Audits and Testing

AASHTO M288 recognizes 8 primary properties that are used to specify geotextiles for most functions. These properties with their corresponding ASTM test methods are as follows:

- **Grab and Sewn Seam Strength, Elongation**
  - ASTM D4632
- **Tear Strength**
  - ASTM D4533
- **Puncture Strength**
  - ASTM D6241
- **Permittivity**
  - ASTM D4491
- **Apparent Opening Size (AOS)**
  - ASTM D4751
- **Ultraviolet (UV) Stability**
  - ASTM D4355

Four additional properties are specified for paving fabrics only that include Tensile Strength (ASTM D5035), Mass Per Unit Area (ASTM D5261), Asphalt Retention (ASTM D6140) and Melting Point (ASTM D276). There are other applications of geotextiles referencing additional properties as well as other types of geosynthetics in M288 that do not apply to the NTPEP GTX program.

While all NTPEP participants are audited yearly, geotextiles from manufacturing facilities are sampled every 3 years for verification testing. For converters (not considered manufacturers) and private labelers, geotextiles are randomly sampled each year for testing. It is important to note that the audits and testing are independent of each other but run concurrently as geotextile samples are collected during on-site audits. Participants are required to apply for the program each year in the fall for the following year’s audit cycle. If a participant does not apply for the program, they are considered withdrawn from the program and their audit findings and test results
A.5. Program Goals, Benefits and Uses

The primary goal of the testing is to confirm that geotextile properties published by participants are accurate and the geotextiles meet the requirements of AASHTO M288, so State DOTs don’t have to do their own independent testing. The primary goal of the audits is to provide regular checks of the Quality Assurance/Quality Control (QA/QC) of the geotextile sourcing and manufacturing, so State DOTs don’t have to use their own resources to verify the quality of the NTPEP listed geotextiles. These savings are further amplified when one considers that much of the geotextile manufacturing done today is in international locations. The participants have benefited from the NTPEP GTX program as well by minimizing duplication of efforts. As more DOTs use NTPEP, there are fewer DOTs that manufacturers, converters and private labelers will address independently. Most State DOTs maintain Approved or Qualified Products Lists (APL or QPL) for geotextiles. DOTs typically incorporate NTPEP by requiring that geotextiles be NTPEP listed to be on their APL or QPL.