MATERIALS QUALITY ASSURANCE PROCEDURES MANUAL

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In accordance with the 2012
Standard Specifications for Construction

MDOT
Michigan Department of Transportation

CONSTRUCTION FIELD SERVICES DIVISION

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Terminology and Definitions

AASHTO - American Association of State Highway and Transportation Officials

AMRL - AASHTO Materials Reference Laboratory

ASTM - American Society for Testing and Materials

CCRL - Cement and Concrete Reference Laboratory

CML – Central Materials Laboratory

LIMS - Laboratory Information Management System

MSG – Materials Source Guide

MTM – Michigan Test Method

NIST - National Institute of Standards and Technology

NRL - National Reference Laboratory

NTPEP - National Transportation Product Evaluation Program

QPL – Qualified Products List

Acceptance: Criteria used to make a decision on the acceptability of the material placed or intended for use on construction project. Samples are taken by MDOT, consultant, or contractor personnel (when independently verified). For certain local government projects, this function may also be accomplished by employees of the local agency or their consultants.

BASIS OF ACCEPTANCE: Refers to the method by which materials incorporated into MDOT projects are accepted. Below is a list of all the current Basis of Acceptance methods used by MDOT for acceptance of materials.

- **Visual Inspection (VI):** (See MQAP Section 1.07) Materials which may be visually inspected by MDOT personnel for acceptance or rejection. When a maximum VI limit is given for materials with another specified basis of acceptance, materials may be accepted by VI up to maximum VI quantities as indicated for that material, per item, per project. (NOTE: All materials should be visually inspected prior to incorporation into the job without quantity limit, and may be rejected on that basis even though material may be acceptable on another basis.)

- **Tested Stock (Tested Stock):** (See Section 2.01) Tested stock samples represent a defined quantity (batch, heat, lot, tank, etc.) of the manufacturer's or supplier's inventory that is sampled and tested by MDOT and has been set aside for use on state and federally funded projects. Approved material(s) may then be shipped to any MDOT project until the approved quantity is depleted. Distribution of form 1922 “Shipment of Tested Stock Report” as detailed in the MQAP is required upon shipment of approved Tested Stock material(s) to MDOT projects.

- **General Certification (Gen Cert):** (See Section 3.01) When this certification is specified as the basis of acceptance in the contract documents, it must be provided in accordance with Section 3.01 of this manual. A general certification must include Company name, address, and contact information, contract number, date certification was produced, name of contractor, a general description of the material(s) with MDOT specification designation, a list of the applicable specifications (ASTM, AASHTO, MDOT or other designations as appropriate), and a statement that the material(s) conforms to these specifications.

  - Qualified Product List (QPL): (See Section 6.01) Products that have been tested and/or evaluated by MDOT and found to meet performance and/or other specification requirements. A Qualified Products List (QPL) of these products is maintained in the Materials Source Guide. All QPL materials must be documented per Section 6.01 of this manual with a General Certification.

- **Test Data Certification (Test Data Cert):** (See Section 3.01) When this certification is specified as the basis of acceptance in the Materials Acceptance Requirements Table, in addition to the requirements of a General Certification, the certification must also include laboratory test report(s) for samples obtained from the same lot(s), batch, heat, etc. of material represented by the certification and tested according to applicable specifications (ASTM, AASHTO, MDOT).

- **Approved Manufacturer (Appr Mfr):** (See Section 3.02) A manufacturer who has submitted quality control documentation and/or material samples, and has been given approval status to certify specific material(s). General Certification per the requirements of Section 3.01 must accompany all Approved Manufacturer shipments to either an Approved Supplier location or the MDOT project site. These certifications must also include quantity shipped. Strict adherence to the requirements for Certification Documentation and Distribution is required of all Approved Manufacturers.

  - Approved Supplier: (See Section 3.02) When Approved Manufacturer is specified as the basis of acceptance in the contract documents, the material must be supplied by the manufacturer or by an Approved Supplier. An Approved Supplier must recertify Approved Manufacturer material(s). Strict adherence to the requirements for Certification Documentation and Distribution is required of all Approved Suppliers for the recertification of material(s). All original Approved Manufacturer General Certification(s) must accompany the material(s) shipment to the MDOT project site. When Approved Manufacturer is specified, a supplier may not distribute or recertify material(s) unless they have been granted Approved Supplier status.

- **Special Provision:** Revisions and additions to the Standard and Supplemental Specifications applicable to an individual project. Special Provisions have been reviewed and approved for use by the Construction Field Services Support Area. Materials acceptance may be defined by these documents included in the project proposals.

- **Fabrication Inspection (Fabrication Inspection):** Materials subjected to Fabrication Inspection are those that are typically manufactured offsite and shipped to the project. Refer to the proper subsection of the Materials Quality Assurance Procedures Manual (Chapter 4) to find the requirements of the various Fabrication Inspections currently performed by MDOT.

- **Acceptance Testing (Test):** Sampling and testing of a material to determine compliance with specification requirements prior to incorporation into the project. Acceptance testing is the required basis of acceptance for some materials, as indicated in the contract documents, but may be applied to all materials regardless of the basis of acceptance.

Certification Verification (CV): (See Section 3.03) Samples and tests used to validate and monitor manufacturer's certifications of construction materials.

Independent Assurance Test (IAT): (See Section 5.02) Samples and tests performed to provide an independent check on the reliability of personnel conducting acceptance sampling and testing and the equipment used.

For Information Only (FIO): (See Section 1.01) Representative samples and tests and/or other procedures used for the purpose of making independent checks on the quality of the product being furnished. Comparative samples and tests conducted as described in section 1.01.07.D of this manual will be considered FOI samples.

Research and Development (R&D): Sampling and testing performed in an effort to enhance the department's knowledge of material performance. This may be either for evaluation of new materials or as part of a forensic investigation of material performance.

1.01 SCOPE AND OBJECTIVES OF THE QUALITY ASSURANCE PROGRAM

1.01.01. Introduction

A. Materials Quality Assurance (QA) sampling and testing procedures described in this manual have been developed by Michigan Department of Transportation (MDOT) in accordance with Title 23, of The Code of Federal Regulations, Part 637.

B. The Materials QA program includes acceptance sampling and testing, independent assurance testing, project materials certification, retention of sampling and testing records, verification of test procedures, calibration of testing apparatus and participation in the development and implementation of technical training for personnel involved in materials sampling and testing.

C. For ease of use in the field, the details of portions of these QA procedures are distributed under separate cover. The following MDOT publications are considered to be a part of the overall quality assurance program employed by the department to assure that all materials incorporated into MDOT construction projects are in reasonably close conformance with contract documents and the standard specifications for construction.

1. *Construction Manual* - Provides guidance to field construction staff on project administration, project records, construction inspection and materials sampling and testing in the field.

2. *Density Control Handbook* - Compilation of tests used by MDOT for density control testing in the field.

3. *HMA Production Manual* - Covers Procedures for Hot Mix Asphalt (HMA) Mix Design Processing; Certification of Hot Mix Asphalt (HMA) Plants; HMA QC/QA Procedures for Field Testing; HMA Lab and Technician Qualification Program.

4. *Lab and Technician Qualification Programs* – Provides guidelines for region materials testing labs regarding various aspects of quality systems based on the AASHTO R-18 document.

5. *Materials Source Guide* – Provides information and guidance to personnel associated with sampling, testing and inspection of materials used in Michigan Department of Transportation and Federal Aid Secondary projects.

6. *Michigan Test Methods* - Sampling and testing procedures that are either unique to MDOT or that are modifications of established ASTM, AASHTO or other standards organizations.

7. *Quality System Manual* - Internal operating document detailing the organization, staffing, equipment calibration, sample management and test reporting processes in place in MDOT materials testing laboratories to ensure the accuracy and integrity of laboratory information.

1.01.02. Objectives of the Materials QA Program

A. Design and implement sampling and testing procedures to assure that materials are in reasonably close conformity with plans and specifications.

B. Provide sufficient documentation through test results and other pertinent records, to allow project office staff to take remedial action and/or make adjustments in the contract unit prices.

C. Continuously compare MDOT testing procedures with currently accepted testing standards, regularly calibrate sampling and testing apparatus for accuracy and monitor personnel for materials control competency.

D. Maintain a materials testing database to allow MDOT to evaluate new materials, analyze materials performance over time and to assist in materials acceptance decisions.

E. Maintain quality of acceptance testing labs, equipment and technicians by implementing and monitoring quality systems in MDOT materials testing labs.

F. Should questions arise as to the quality of materials or workmanship on federally funded projects, MDOT will promptly furnish information and perform additional sampling and testing when specifically requested to do so by the FHWA Division Administrator. The results of all quality assurance sampling and testing are available to the Federal Highway Administration.

1.01.03. Personnel Qualifications

A. Personnel performing acceptance sampling and testing on projects on the federally funded National Highway System (NHS) must be qualified according to the following:

1. *Aggregate* - A certified aggregate technician must do the sampling. The supervisor in charge of the testing operation must be certified. The person who verifies and signs documentation for test results and certification must be certified.

2. *Hot Mix Asphalt* - A certified hot mix asphalt technician must do all sampling and testing. The person who signs documentation for acceptance must be certified.

3. *Concrete* - A certified technician must perform all tests on fresh and hardened concrete

4. *Soil Density* - A qualified technician must perform all soil density tests.

1.01.04. Acceptance Sampling and Testing

A. Acceptance sampling and testing is conducted on MDOT construction projects according to the contract documents and this manual (and by reference those listed in 1.01.01 of this section). Together, these documents contain all the instructions to fulfill the requirements of this Materials QA program.

1.01.05. Independent Assurance Program

A. *Independent Assurance Test (IAT) Procedures* - All personnel conducting acceptance testing on the federally funded NHS are subject to independent verification according to Section 5.02 of this manual. The IAT serves to check the equipment and procedures being used as well as the personnel conducting the various acceptance tests.

B. *Laboratory and Technician Qualification Programs* - All laboratories and technicians involved in conducting testing on the federally funded NHS are subject to the Laboratory and Technician Qualification Programs according to Section 5.03 of this manual.

1.01.06. Project Record Retention

A. The project files are retained in accordance with the MDOT Record Retention Schedule and are available to the general public under the Freedom of Information Act.

1.01.07. Laboratory and Field Testing Equipment

A. Test procedures and test apparatus will be validated regularly.

B. All equipment used by MDOT, contract agencies or contractors for material inspection, sampling or testing must be calibrated. Calibration of equipment will be conducted at the frequencies recommended by national standards (AASHTO, ASTM, and NIST) and/or as required by the respective Laboratory and Technician Qualification Program. The calibration frequencies will be strictly observed to ensure verifiable test results.

1. All Troxler moisture/density gauges used by MDOT or contract agencies for density testing must be calibrated. Calibration of these nuclear gauges must be done every 12 months using the 3-block calibration process.

C. Laboratory Quality Systems

1. *Central Materials Laboratory Inspection (CML)* - In addition to the required equipment calibration, the CML will participate in AMRL and CCRL inspection and reference sample testing programs. Reports of all inspections and reference sample testing will be reviewed by the Engineer of the Construction Field Services (CFS) Division and participating unit supervisors. Any deficiencies found in laboratory procedures or apparatus and all non-conforming test results will be investigated and corrective action will be taken. Copies of reports, including corrective actions, will be furnished to FHWA.

2. *Region QA Laboratories* - Refer to Section 5.03 for quality system requirements.

D. Field Testing Operations

1. MDOT continuously validates the competency of Region personnel and the accuracy of materials sampling and testing apparatus through independent assurance testing and field reviews. These reviews will be used to identify training needs.

1.02 RESPONSIBILITIES OF PERSONNEL

1.02.01. Scope

A. MDOT staff at the central office and Region level are responsible for administering the Department's Quality Assurance Program.

1.02.02. Region Engineer

A. Observe these procedures and ensure implementation of all applicable portions of this program for all MDOT construction projects and all MDOT administered local government construction projects unless the local governmental agency has its own procedures approved by the FHWA.

B. Support all aspects of the Materials QA Program within the Region's jurisdiction. This includes acceptance sampling and testing, Independent Assurance Testing (IAT), project materials certification, retention of sampling and testing records, verification of acceptability of test procedures and testing apparatus, information samples and tests, certification verification samples and tests, Construction Field Services (CFS) Division Central Materials Laboratory comparative samples and tests, and tested stock.

C. Review and approve all Project Record Certification Reviews.

1.02.03. Region Construction Engineer

A. Coordinate the Materials QA Program within the Region as assigned by the Region Engineer.

B. Supervise the IAT program by selecting a Region IAT Coordinator from the Region staff who will manage the IAT program which may include assistance from TSC staff. IATs are required by Federal Highway Administration policy on all federally funded projects on the National Highway System. These tests cannot be delegated to the Contractor.

C. Supervise project final review by selecting individuals from the Region staff and/or consultant engineering firms who will review materials testing for proper quantities, method of measurement and adequate documentation.

D. Supervise the coordination of Materials QA programs by selecting individuals who will obtain and submit certification verification samples as requested by the CFS staff and assist in the control of Tested Stock suppliers and approved suppliers.

1.02.04. Project or Construction Engineer

A. Assure all Material Source Lists are submitted by Contractors.

B. Assure all material used in the work has been properly inspected and documented. This includes visual inspection of all material incorporated in the work.

C. Request the necessary Independent Assurance Tests.

D. The local agency project engineer is to ensure that project materials and products are sampled and tested as required. Local agencies are to use their own resources and/or

third party consultant resources to ensure project material testing compliance. Local agencies may request MDOT assistance and/or sampling and testing for unique project needs.

E. The local agency project engineer will determine the lack of available local agency and consultant personnel to perform inspection and testing services for local agency projects receiving federal or state funds and request the services of the region/TSC materials staff or Lansing statewide laboratories, as appropriate. The local agency engineer will submit requests to the Region Construction Engineer including the following information:

1. The local agency.

2. The project identification numbers.

3. The specific contract items that need to be tested or inspected by region/TSC staff or the Lansing statewide laboratories.

4. A statement that the local agency cannot reasonably obtain the inspection or testing services from the private sector.

F. The Region Construction Engineer will review requests for local agency testing and determine if region materials staff are available to perform the testing or request assistance for testing from the Lansing statewide laboratories.

1.02.05. Director of Bureau of Field Services

A. Oversee the development and application of the statewide Materials QA program.

B. Oversee budgeting for the acquisition of testing equipment and supplies and provide for the maintenance of the equipment whenever possible.

C. Provide for the appropriate level of direct staffing and contract services necessary to support the Materials QA program.

1.02.06. Lansing Statewide Laboratory Staff

A. Develop and monitor statewide materials acceptance procedures.

B. Provide materials testing procedure training as required.

C. Administer central laboratory and contractual sampling and testing.

D. Review requests for local agency testing and determine if Lansing statewide laboratory resources are available to perform the testing.

E. Monitor Region materials sampling and testing operations, review Region laboratories, test personnel and randomly review completed projects.

F. Arrange for CCRL and AMRL inspections of the central laboratory and supply FHWA with copies of their findings.

G. Monitor materials certification programs and request certification verification samples when required.

1.03 USING COMMERCIAL TESTING AGENCIES

1.03.01. Scope

A. The use of a commercial testing agency may be permitted when:

1. Out-of-state sources of materials cause it to be uneconomical to use MDOT personnel for the necessary sampling and testing.

2. A review of available personnel indicates that the necessary materials sampling and testing for scheduled projects cannot be fulfilled.

3. The required inspection work is of a specialized nature.

4. The commercial testing agency certifies that no conflict of interest exists.

1.03.02. Utilization

A. Selection of a commercial testing agency is based upon the range of services offered, staff, location, experience and past performance.

B. Instructions are issued to the materials supplier advising them to contact our agent when the material is available for inspection.

C. Our agent is authorized to inspect or sample the material and is furnished with the necessary information to do so.

D. The extent of inspections that are conducted by a testing agency is determined and coordinated by Construction Field Services (CFS).

1.03.03. Contract Administration

A. Upon completion of the work, our agent prepares the necessary documentation and forwards its reports to CFS.

B. Reports are reviewed for accuracy and completeness and are distributed to the field personnel.

C. The material represented by the reports is identified by tags, heat numbers, lot numbers, batch numbers, or in some other manner as indicated in the report.

D. The agency invoices MDOT and this is reviewed, approved, coded, and processed.

E. Processing includes comparing reports with the invoice vouchers covering the work.

F. Additional work beyond the provisions of the contract requires State Administrative Board and FHWA approval prior to performing the work.

G. An agency's performance is evaluated on a continuing basis in relation to the services rendered and a comparison with other agencies when possible.

H. The agency must use the appropriate MDOT Form/s.

1.04 PROCESSING OF MATERIALS SOURCE LIST (FORM 501)

1.04.01. Scope

A. A completed and signed Materials Source List (Form 501) is required project documentation, and required for payment of associated items of work. Electronic signatures as described in Bureau of Highways Instructional Memorandum (BOHIM) 12-02 are acceptable. The Materials Source List is not a substitute for other required material quality control and quality assurance documentation.

1.04.02. Contractor Responsibilities

A. The Contractor must provide a completed and signed Materials Source List to the Construction/Project Engineer in accordance with subsection 105.01 of the Standard Specifications for Construction. The Materials Source List may be submitted at or prior to the pre-construction meeting.

B. The Contractor may submit the signed Materials Source List via regular mail, email, fax, or other electronic method.

C. The Materials Source List will include the following information as applicable:

1. Material name (general)
2. Specific product name (for specialty and/or QPL materials)
3. Specification reference (from Materials Source Guide)
4. Approximate quantity
5. Material type, size, class, etc.
6. Source of material including:

    a. Name of manufacturer and/or supplier
    b. Contact information
    c. Pit number (if applicable)
    d. Location

D. If the source of material changes, the Contractor must provide a revised Materials Source List to the Construction/Project Engineer prior to the material being incorporated into the project.

E. Prime contractors are responsible for submission of the Materials Source Lists for all materials including their subcontractors.

1.04.03. Region Materials Staff/Engineer Responsibilities

A. The materials staff in the region may assist the Project/Construction Engineer in determining the following:

1. Which items originate locally. Acceptance instructions will be referenced in the last column.

2. Which items originated elsewhere that will be sampled or inspected on the project.

3. Which items are to be supplied by sources with certification, QPL, or tested stock privileges, as listed in the current Materials Source Guide.

1.05 RANDOM SAMPLING BY THE CUBE ROOT METHOD

1.05.01. Scope

A. When the lot of material to be sampled is not obviously from a single run or batch of the producer, select a number of the items or containers to be sampled at random. The number of samples must be equivalent to the cube root of the total number of items or containers in the lot and a sample must be taken of each item or from each container selected. For convenience, the following table shows the number of samples to be selected from shipments of various sizes.

Number of Items or Containers in Shipment	Number of Items or Containers to be Sampled
2-8	2
9-27	3
28-64	4
65-125	5
126-216	6
217-343	7
344-512	8
513-729	9
730-1000	10
1001-1331	11
(etc.)	(etc.)

1.06 RANDOM SAMPLING FOR QUALITY CONTROL/QUALITY ASSURANCE PROJECTS

1.06.01. Scope

A. This random sampling guide is to be used in conjunction with MDOT QC/QA special provisions and may be used in other instances when random sampling is required.

B. This procedure ensures the randomness of locations for collecting quality assurance and verification samples. Random numbers used to determine sample units and/or location will not be shown to the Contractor to avoid possibly influencing the operation.

C. Use a random number generator function on a calculator or computer to determine the transport unit from which material samples will be collected (based on tonnage or volume of material) and also the longitudinal and transverse location of samples from the grade. Generate each random number needed individually. Do not use a random number generator to produce a separate table to replace the table included in this section.

D. If no calculator or computer random number generator is available, substitute the random number table included here.

1.06.02. Pavement Random Sampling

A. Pure random sampling of pavements may result in clustered sampling locations and although this is statistically valid, it is not preferred. To better represent the entire lot of material being evaluated,use a stratified random process for sampling linear features such as pavement, shoulders and ramps. With stratified random sampling, the lot is first subdivided into sublots from which the samples are randomly selected. This method results in samples which fall more uniformly throughout the lot.

1.06.03. Structure Random Sampling

A. Pure random sampling may be used for point cases such as structures. However, if the lot will consist of discrete substructure or superstructure units such as footings or abutments the stratified random sampling approach should be applied in order to obtain a more representative sample population. In this case individual substructure or superstructure units or grouping of units may be considered a sublot for the purpose of sampling.

1.06.04. Appurtenant Item Random Sampling

A. Sample appurtenant items such as curb and gutter, barrier walls, sidewalk, or driveways, which are generally combined into lots for evaluation, using a stratified random sampling method to ensure a representative sample population. The lot is first divided into sublots and samples collected randomly from each sublot based on volume or tonnage of material placed.

1.06.05. General Stratified Random Sampling Procedure

A. Follow these procedures to locate random samples within each lot and/or sublot. Refer to the project documents for definitions of lot and sublot and for sampling frequency.

B. Determine the material to be included in a lot prior to placement and divide it into the required number of sublots to meet the sampling frequency specified. Record and/or mark the beginning point of each lot and sublot. This is necessary to allow test results to be correlated with performance and to ensure that core results correlate with lot samples of mixtures when necessary.

C. In the event that material production or placement exceeds the anticipated lot quantity, continue sampling in a random manner and include all test results in the evaluation of the lot.

1.06.06. Using the Random Number Table

A. Select numbers at random without looking at the table.

B. It is best to use a pointer (mechanical pencil with the lead retracted or a letter opener) when selecting numbers.

C. Place the table conveniently so that selections will not be limited to a particular area of the table.

D. If the pointer does not land directly on a number move to the right if between columns or down if between rows to the nearest number. If the pointer lands off the edge of the table repeat the selection process.

E. Always proceed down the column for additional numbers. Do not select each number separately when using the random number table as this may introduce bias into the random process. If all the numbers in the column are used before the end of the project, select a new starting number and proceed in the same manner.

F. If the longitudinal and transverse location of a sample must be determined, then select any pair of numbers from the random number table as the beginning numbers for the project. Use the leftmost number to determine the random longitudinal distance and the rightmost number will be used to determine the random transverse distance. In the event that the two numbers selected are in the same column, repeat the selection process.

1.06.07. Samples from the Transport Unit

A. To determine the random sample transport unit, generate a number using a calculator or computer or select any number in the table. This number will be the beginning number for the project and is used to determine the sample location within the cumulative lot tonnage or volume of material placed.

B. Once the transport unit that contains the random sample is identified, the actual sample location depends on the material being placed. Follow AASHTO, ASTM, MTM or other MDOT specified sampling procedures for collecting the sample from the randomly selected transport unit.

1.06.08. HMA or Concrete Cores

A. Use two separate random numbers to determine the longitudinal and transverse location of core samples.

B. Generate two individual numbers using a calculator or computer. Use the first number to determine the random longitudinal distance and use the second number to determine the random transverse distance.

C. Divide the lot into sublots as required to meet the specified sampling frequency. It is not necessary for the coring sublots to exactly coincide with the mixture sublots.

D. Determine the longitudinal location of the core within the sublot by multiplying the length of pavement in the sublot by the first random number. The longitudinal measurement begins at the starting point for each sublot and continues in the direction of paving.

E. Determine the transverse location by multiplying the width of paving by the second random number.

1. *Concrete* - If the sample location is less than 1 foot (0.30 meters) from either edge of pavement, add or subtract 1 foot (0.30 meters) to obtain an acceptable sampling location. Any sample location restrictions included in the project documents take precedence.

2. *HMA* - If the sample location is less than 2 inches (50 mm) from either edge of pavement, add or subtract 2 inches (50 mm) to obtain an acceptable sampling location. Any sample location restrictions included in the project documents take precedence.

1.06.09. Samples from the Grade

A. Randomly select the transport unit to be sampled using the same procedure as for sampling from the transport unit.

B. Compute and record the approximate total length of material that the randomly selected transport unit will place.

C. Select sets of two random numbers using the procedure described for locating core samples.

D. Multiply the length of material placed from the randomly selected transport unit by the first random number to obtain the longitudinal distance to the sample point. The start of measurement begins at the end of material placement immediately prior to the randomly selected unit containing the random sample.

E. If it is necessary to locate the sample transversely, use the second random number selected in 1.06.09C and follow the procedure described for locating core samples.

1.06.10. HMA Loose Mixture from the Roadway Using Mini-Stockpile for Hand Patching, Scratch Course, and Paving Operations Under Five Feet

A. Select the tonnage to be sampled by a random method.

B. Once the transport unit has been identified, have the Contractor make a mini-stockpile (approximately 3-5 tons). For one composite sample, take at least four approximately equal increments of material from around the stockpile at different heights. At each location around the stockpile, first form a shelf, then take an increment of that sample by digging down into the shelf. Place this material in a bucket with all other increments sampled from

that stockpile. This forms one composite sample.

1.06.11. Selection of Verification Sample

A. Follow this procedure to select which quality assurance sample split will be tested for verification.

B. Determine the number of samples from which a verification sample is to be selected. This will generally be only two or three samples.

C. Number the samples in the order in which they were collected.

D. Generate a number using a computer or calculator random number generator and multiply it by 10.

E. Using only the digit to the left of the decimal point (do not round off), determine if it matches any of the usable numbers. (Example: if there are three samples to choose from, only the integers 1, 2 or 3 are usable.) If it is usable, this is the sample to be tested.

F. If the number is not usable repeat the process until a usable number is selected.

1.07 VISUAL INSPECTION

1.07.01. Scope

A. Visual Inspections (VIs) must be performed on **ALL** materials coming onto the jobsite. .VIs are not limited to small quantities of untested or uncertified materials, but are considered to be a routine procedure for **ALL** materials reaching the site. Approval for use must be given by the Construction/Project Engineer or a delegated inspector. Damaged, suspicious, or non-uniform appearing material that have been tested or certified must not be approved for use until a passing retest can be obtained.

1.07.02. Procedures

A. All materials must to be subjected to a VI, regardless of any previous testing and inspection. Look for damage due to handling and shipping, workmanship, and quality.

B. *Tested Materials* – Tested materials are materials or items that have been tested for use on a specific job before being used. They must be identified by the inspector to assure that they are the ones called for, with proper size, shape, coating, etc. Any material or item that has been tested may be sampled and retested at any point if there are doubts about its quality or authenticity.

C. *Tested Stock Materials* – Tested Stock consists of various materials that are pretested, stored, and maintained by manufacturers, suppliers or contractors at their facilities. When these materials are shipped to the job site, they must be accompanied by a “Shipment of Tested Stock Report” (Form 1922).

D. *Certified Materials* – Certified materials are materials or products that are tested by the manufacturer. Quality control testing is performed according to MDOT procedures and specifications, and the manufacturer certifies by document that the material or product meets MDOT specifications. The certification document must contain specific information regarding what is being certified. The VI checks the material that is actually delivered for such things as quantity, size, class, grade, heat or lot numbers, manufacturer, MDOT Spec#, MDOT material name, etc.

E. *Untested, Uncertified Materials or Products* – This category (including but not limited to Qualified Products, Special Provisions) requires the most vigorous visual inspection. The material or product is checked for conformance to requirements, including the project proposal and MDOT’s Materials Source Guide.

F. *Buy America Certification* – The requirements of Chapter 4.12 of this manual are applicable to all materials that contain “Steel and Iron” as defined.

1.07.03. Summary

A. Visual Inspection is a dynamic and important part of quality assurance. It should not be considered or used simply as a way to approve items without having to sample and test. Inspectors must be conscious of the fact that when they view a material or product they are performing a VI. It is a useful and effective VI only if there is a proper reaction when something is found to be wrong.

1.08 TAGGING OR MARKING MATERIALS SAMPLED FOR PROJECTS

1.08.01. Scope

A. This procedure provides a uniform method of informing recipients of material at a project site regarding the status of sampling and/or testing on that material.

B. "Out of State" tagging and marking is normally performed by outside agencies acting at the direction of MDOT in accordance with Section 1.08.03 of this procedure.

C. For material stored and sampled at a project site, the sampler may or may not use tags. Tagging will be at his/her discretion and dependent upon the situation encountered.

1.08.02. Definitions

The following types of tags and markings may be used:

A. *Numbered Metallic Sample Tag* - Metallic locking type tags (commonly called "deer tags") which are sequentially numbered to provide a positive method of identifying a sample relative to the material sampled. The presence of these tags would indicate that samples have been taken but does not necessarily mean that the material is approved.

B. *Numbered Plastic Sample Tag* – Yellow plastic sequentially numbered zip tie locking tag that is used to identlfy a sample. The number on this tag is documented on the MDOT Sample ID Form (1923) for traceability purposes.

C. *Sampled Wire Tag* - Yellowish-green colored wire-on paper tags used to mark a population of material that has been sampled. The presence of this tag on a population of material indicates that a sample of the material has been taken, but does not provide information on the status of the test results.

D. *Sampled Adhesive Tag* – Yellowish-green adhesive paper tag that is used to mark a population of material that has been sampled. The presence of this tag on a population of material indicates that a sample of the material has been taken, but does not provide information on the status of the test results.

E. *Approval Wire Tag* - Red wire paper tag that is used to mark a population of material that has been sampled, tested, and approved for use. The tag states the word "Approved" and has space for the inspector's name or initials, date, and project information. The presence of this tag indicates the material has been approved and the material may be incorporated into the work.

F. *Approval Adhesive Tag* - Red adhesive paper tag that is used to mark a population of material that has been sampled, tested, and approved for use. The tag states the word "Approved" and has space for the inspector's name or initials, date, and project information. The presence of this tag indicates the material has been approved and the material may be incorporated into the work.

G. *Structural Fabrication Approval Stamp* - Ink stamp with the words "Approved for Use" applied to structural fabrication elements required to be accepted based on "Fabrication

Inspection". Stamp is required to be on Bill of Lading and is sometimes placed on elements if accessible to the inspector.

H. *"M" Hammer Mark* - A hammer applied letter "M" indented into the material being inspected to indicate acceptance of the item at the time it was applied.

I. *Orange "M"* - A painted letter "M" applied with a spray-can of orange colored paint.

1.08.03. Out-of-State

A. In the case of materials coming from out-of-state, the sampling may be accomplished by private testing consultants or testing agencies of another state's Department of Transportation acting on our behalf. In these cases, they have their own method of identifying sampled and tested material, which is usually explained in their sampling report.

B. Material received with consultant tags attached (or tags from another state DOT) indicates that the material has been sampled and approved, that it may be used in the work, and that a test report is forthcoming.

C. An exception to this would be where the "Sampled" tag is used, in which case the material should not be used until confirmation of approval is received.

1.09 DISPOSITION OF MATERIALS BASED ON LABORATORY TEST RESULTS

1.09.01. Scope

A. Disposition of materials subjected to laboratory testing is based, in part, on the results of laboratory tests. Technical and engineering judgment of Construction Field Services (CFS) and project staff must be applied when reviewing the ramifications of specific test results. While it is beyond the scope of this discussion to consider every material and circumstance which may be encountered, the following illustrates the decision-making process applied when determining the disposition of materials failing to meet all contract specifications.

1.09.02. Disposition of Non-Specification Materials

A. Disposition is based on several factors, including the type of sample, type of material, parameter being measured, magnitude of the failure and performance record of a particular supplier.

B. Type of sample considers the intended use of information gained through laboratory testing.

1. Acceptance samples represent specific shipments of material to be incorporated into a specific project or maintenance and warehouse material covered by a purchase order. The results of laboratory tests on acceptance samples are used to accept, recommend for use or reject material. This determination is required before any material incorporated into the project may be paid for by the Construction/Project Engineer. Acceptance sample IDs must include a contract ID purchase order number to which test results will be reported.

2. Tested stock samples represent a defined quantity (batch, heat, lot, tank, etc) of the manufacturer's or supplier's inventory that is sampled and tested by the Michigan Department of Transportation (MDOT) and has been set aside for use on state- and federally-funded projects (see Section 2.01). Materials allowed in Tested Stock are those for which the manufacturing process is standardized and for which testing of random samples provides results which are representative of the stockpile. The results of laboratory tests on Tested Stock samples are used to either approve or reject materials intended for use on MDOT projects. Approved material may then be shipped to any MDOT project until the approved quantity is depleted. Test reports issued for these samples are referenced by the manufacturer or supplier each time material from the Tested Stock inventory is shipped to a project.

3. Certification verification samples are quality assurance samples for material accepted on the basis of the manufacturer’s certification (see Chapter 3.03). Except in the case of failure to meet a critical parameter, when it is imperative that incorporation of material be prevented, the results of laboratory testing of these samples are not used to accept or reject material. Instead, the results are used to verify material accepted on the basis of the manufacturer’s certification does, in fact, meet all required specifications.

4. Other samples may be tested for information in the course of material research or investigation. Aggregate source, qualified product samples and concrete cores used to verify pavement thickness and depth of steel are included in this category. The results of these laboratory tests may be used to determine the acceptability of new materials for use on future projects or the need to take corrective action on an existing project.

C. Type of material considers the criticality of the material being tested based on the degree to which it affects the safety, performance and durability of the final product. If the result of immediate or accelerated failure of the material will be catastrophic, possibly resulting in severe injury or loss of life, or if this failure of the material may result in excessive cost for repair or replacement, the material will be considered critical for the purposes of determining its disposition. Consider the following examples of critical versus non-critical materials: guardrail beam versus ROW fence posts and reinforcing steel versus silt fence.

NOTE: All structural members are considered critical when determining their disposition based on the results of laboratory testing.

D. Failure mode considers which aspect of the specification the material fails to meet. When deciding the disposition of material the question is asked: Will the fact the material does not meet a specification requirement result in a lessening of the integrity or service life of the material? Consider the following example of critical parameters affecting the integrity or service life versus those which are considered non-critical or contractual parameters: tensile strength (integrity) versus coating thickness (service life) versus bar markings (non-critical or contractual) for epoxy coated rebar.

E. Magnitude of the failure must be considered in conjunction with the type of sample, material tested and the failure mode. Testing history, frequency of sampling and project-specific constraints may all come into play when determining the acceptable magnitude of deviation from specifications. Consider the following example of a 2 percent deviation from specification for different types of materials and failure mode: 2 percent over specification on socket depth on a PVC conduit coupling from a supplier with a history of providing specification materials (acceptable, non-critical material with neither integrity nor service life adversely affected, and a proven performance record) versus 2 percent deviation from specification on tensile strength and under specification on zinc coating for a 3 inch (75 mm) anchor bolt (unacceptable, critical material with both integrity and service life adversely affected).

F. Further investigation may be necessary once the test results are reviewed. The material may be resampled if allowed by applicable specifications. The circumstances affecting and affected by the acceptance or rejection of the material will be investigated. This may involve consultation with Design Division, Maintenance Division, Traffic and Safety Division and the Region Delivery staff, including the Construction/Project Engineer. All findings of this investigation will be reviewed by the Laboratory Supervisor and Supervising Engineer before the final disposition is recommended. There are cases when the judgment and experience of the person responsible for the work into which the material is to be incorporated must be depended upon to decide if the job conditions warrant the use of the material and whether or not any use limitations or pay adjustments will be imposed. If an agreement cannot be reached because of non-engineering ramifications, this person will be called upon to accept or reject the materials in question.

1.09.03. Test Reports

A. Test reports will reflect the results of all specification parameters tested, the results of additional investigation conducted and the recommended disposition of the material. Additional remarks may be included, depending upon the type of sample and the final disposition of the material. Test reports may not have more than one statement regarding the disposition of the materials tested. Results for more than one sample of a material may be issued on the same test report provided the same Material Test Protocol applies and the material is recommended for use.

If the determination is made, based upon the results of the original sample, to resample the material the remarks on the original sample test report will state the materials was resampled. The original sample report will be cross-referenced in the remarks on the resample report. The resample report will indicate the final disposition of the material.

Any report which must be superseded due to an error or omission on the original report will include the statement "The report supersedes Report of Sample ID_____, dated due to _____."

B. Acceptance sample test reports will show the contract identification (and the control section number and project number where applicable). If the material does not meet specifications, the parameters which did not meet specification will be identified. When the decision is made, based on sound technical and engineering judgments, to use non-specification materials the contacts made and circumstances considered in reaching this decision will be noted. The additional remark "Recommended for use" will be included.

C. Tested Stock test reports will have the words "Tested Stock" in the header. Tested Stock samples must meet all critical specifications in order for the material represented by the sample to be accepted for use. If these specifications are met the report will indicate "Material is approved for use as Tested Stock". Supplier information and the quantity of material represented by the sample will be shown on all Tested Stock test reports.

D. Certification verification test reports will have the words "Certification Verification" in the header. Certification verification samples are not used to accept or reject material and therefore will only state whether the material did or did not meet specifications. Manufacturer and supplier information will be shown on all certification verification test reports. If the material was sampled from a project location the control section and project number will be shown.

E. Warehouse items tested will show the purchase order number. If all specifications are met there will be a statement indicating "Sample tested meets specifications". If the material does not meet specifications, those parameters which did not meet specifications will be identified.

NOTE: As directed by the Financial Operations Division, warehouse items tested by CFS must meet all specifications.

F. Other categories of samples must indicate their intended purpose such as "R&D", "Qualified Product", "IAT" or "For Information Only" in the header.

1.09.04. Notification

A. Notification of the appropriate person(s) is the responsibility of the Laboratory Supervisor or Supervising Engineer whenever the results of a test are critical to the integrity or progress of a project.

1.10 RESAMPLING

1.10.01. Scope

A. This procedure describes steps to be taken when a resample may be requested from a lot of material previously sampled for acceptance testing. The usual reason for resampling is that testing on the original sample failed to meet specifications.

1.10.02. Basis for Resampling

A. Material tested in the laboratory will be resampled only when requested by Construction Field Services staff. Material tested in the field will be resampled only when requested by the TSC Manager, Construction/Project Engineer, or his/her representative.

1. Request by the Contractor, producer, or supplier is not a valid reason for resampling except when one of the reasons listed in 1.10.02B applies.

B. Requests for resampling should be made under the following conditions:

1. Material fails specification requirements on initial testing and specifications require that additional samples be tested to verify results of original test. (Example: ASTM specification for welded wire fabric.)

2. Test results are abnormal, and it is suspected at validation that either the sample was not representative of material, or testing procedure introduced an error.

3. Test equipment malfunctioned, improper test procedure was used, or sampling was known to have been performed incorrectly, regardless of results obtained on original sample.

4. The condition of the material has changed from the time of original sampling. (a) Material has degraded due to exposure, handling, etc. (b) Material quality has been improved by additional processing, defective portions have been culled and removed, concrete has had time and curing to gain additional strength, etc.

5. The original material has been removed and replaced by new material. (This is not actually a resample, but is original sampling of a new lot of material.)

1.10.03. Number of Samples Upon Resampling

A. For material resampled under conditions of 1.10.02B1, 1.10.02B2, or 1.10.02B3, when material represented consists of a number of individual pieces, the resample must consist of twice the number of samples as submitted in the original sampling, unless a greater number is required by the specification. When material represented is a bulk material (such as stockpiled aggregates, liquids in tanks or drums, etc.), the resample must be one sample but should be obtained by compositing approximately twice as many increments as for the original sample. An exception is made when the intent is to determine the variation within the bulk material, in which case a number of samples must be taken as directed, each representing a portion of the quantity.

B. For material resampled under conditions of 1.10.02B4 and 1.10.02B5, samples must be taken at the normal sampling frequency (unless instructed otherwise) and should not be labeled or considered as resamples. If material is not represented by a new number (batch, lot, heat, etc.), add remarks to sample identification to indicate how material has been changed (reprocessed, culled, new material, etc.).

1.11 CONSTRUCTION PROJECT DOCUMENTATION REQUIRED FOR MINIMUM JOB CONTROL DEVIATIONS

1.11.01. Scope

A. This procedure covers the deviation from minimum job control requirements on MDOT administered construction projects. Appropriate documentation must be created and retained in the specific construction project's records whenever a decision is made to intentionally deviate from any minimum job control requirements of any of MDOT's procedures, publications or specifications.

1.11.02. Related Documents

A. Current Standard Specifications for Construction

B. Density Control Handbook

C. Construction Manual

1.11.03. Procedure

A. *MDOT Projects*

1. Whenever a Construction/Project Engineer decides to deviate from any minimum job control requirement identified in any of MDOT's procedures, publications, or specifications, appropriate documentation must be created.

2. The Construction/Project Engineer will create and date the documentation immediately upon the decision to deviate from the minimum job control requirement.

B. *Local Government Projects*

1. Whenever a Local Project Engineer decides to deviate from any minimum job control requirement identified in any of MDOT's procedures, publications, or specifications, appropriate documentation must be created.

2. The Local Project Engineer will create and date the documentation immediately upon the decision to deviate from the minimum job control requirement and must obtain concurrence from the appropriate MDOT Engineer prior to filing the document.

1.11.04. Records

A. The document must indicate the specific reasons that the decision is made.

B. Appropriate reasons may include applied statistical analysis, specific engineering principals, or other appropriate logic.

C. The document must indicate the date of the recommendation, the name and date that the appropriate individual concurs with the recommendation, the job reference information, and any other extenuating information.

D. The documentation used for this operation must be retained in the specific construction project's records.

E. Sample documentation attached.

MDOT
Michigan Department of Transportation

OFFICE MEMORANDUM

DATE: January 01, 2012

TO: PROJECT FILE
54321-JN12345

SAMPLE MEMO

FROM: Xxxx Y. Zzzz, P.E.
Construction/Project Engineer

SUBJECT: Job Control Requirement Deviation

The minimum requirements for in place density of aggregate base for this project currently are; 1 test per 500 feet per width of 25 feet or less.

The minimum requirement is revised, for this project only, to: 1 density test per 750 feet per width of 25 feet only if the current method of placement, conditions, and materials all remain the same. If a single failing test is recorded, more frequent tests will be performed and the minimum will be revised back to the normal policy.

REASON: This project involves 2.5 miles of placement of Aggregate Base. The material being supplied is 22 AA (100 percent limestone) from the same certified source and has not materially changed. The method of placement and handling is established and is producing passing tests. All tests recorded in the last one mile section have passed. The material and methods are expected to remain the same and passing tests are also expected.

_____, P.E.
Signature - Construction/Project Engineer

cc: Region Materials Supervisor
Construction Engineer (for local agency projects only)

1.12 GENERAL QUALITY ASSURANCE PROCEDURES FORMAT

1.12.01. Description

A. A quality assurance procedure is a definitive, accepted method for performing one or more specific operations or functions. Examples include selection of samples, inspection procedures for fabrications or equipment, use of testing devices in the field and guidelines or certification of materials or processes.

1.12.02. Subject Headings

A. The subject headings may be similar to those used in test methods, but in many cases other types of headings will be required. The following headings should be included (in order). Headings with an asterisk (*) should be used in all procedures; the others are optional as appropriate.

- Title *
- Scope, General, etc. *
- Referenced Documents
- Procedure, Method, etc. *
- Report
- Appendixes

1.12.03. Title

A. The title should be concise, but complete enough to identify the nature of the procedure. It should identify the subject of application and should be distinguishable from similar titles.

1.12.04. Scope

A. Information should be provided here to describe the purpose of application of the procedure, how and when the procedure should be used, and by whom. Significant attributes of the procedure may be discussed.

B. Any appropriate comments as to the limitations of the procedure should be made in the scope.

1.12.05. Referenced Documents

A. List the designation (test method number, form number, etc.) and title of referenced material included in the procedure. This is to eliminate the need for continually repeating titles throughout the text.

1.12.06. Procedure

A. Include in this section the detailed directions for performing the task described in the document. Change the subject heading as necessary to better describe the operation, and a number of paragraphs may be required to describe all aspects of the procedure. Give each such paragraph a distinctive heading.

B. In some cases, use of a diagram or schematic may be of value to the user of the procedure, including typical filled-out worksheets.

1.12.07. Report

A. Include detailed information regarding calculating, interpreting or reporting results of the operations described in the procedure, when appropriate. When desirable, separate these items of information into separate sections.

1.12.08. Appendices

A. Use appendices to provide supplementary information to aid in understanding and utilizing the procedure.

1.12.09. General Guidelines

A. Describe the actions of the inspector, operator, etc. as necessary. The procedure should tell how, not necessarily why.

B. Give instructions in the active voice ("Measure the length..." not "The inspector should measure the length...").

C. Refer to other manuals, specifications, etc. by name and number, when necessary. Do not include, word-for-word, the information in the reference material. List the specification designation, manual, form name, etc. in the "Referenced Documents" section.

D. Include forms in the procedure only when it is necessary to show an example of a completed form. If it is not necessary to show a completed form, a reference to the form name and number will suffice.

E. Present instructions in general context, not specific to MDOT. These procedures may be used by consultants and others.

F. Do not make reference to MDOT organization, inspectors official work station, specific supervisors, etc. unless necessary to the procedure.

G. Avoid reference to specific paragraph numbers of referenced documents as much as possible. Omit year for standard specifications, ASTM and AASHTO specifications if not specifically needed.

2.01 GENERAL TESTED STOCK PROCEDURES

2.01.01. Scope

A. Tested stock samples represent a defined quantity (batch, heat, lot, tank, etc.) of the manufacturer's or supplier's inventory that is sampled and tested by the Michigan Department of Transportation (MDOT) and has been set aside for use on state and federally funded projects. Materials allowed in Tested Stock are those for which the manufacturing process is standardized and for which testing of random samples provides results which are representative of the stockpile. The results of laboratory tests on Tested Stock samples are used to either approve or reject materials intended for use on MDOT projects. Approved material may then be shipped to any MDOT project until the approved quantity is depleted. Test reports issued for these samples are referenced by the manufacturer or supplier each time material from the Tested Stock inventory is shipped to a project.

B. This procedure describes the steps involved in requesting Tested Stock privileges, establishing tested stockpiles and shipping Tested Stock to projects.

C. Materials approved for Tested Stock are designated under “Basis of Acceptance” in the Materials Acceptance Requirements Table of Chapter 7. The MDOT designation for materials can be found in the Materials Acceptance Requirements Table of Chapter 7 and the Standard Specifications for Construction. The manufacturers and suppliers who have been granted Tested Stock privileges for specific materials, are listed in the Materials Source Guide (MSG).

D. The requirements for Tested Stockpiles of Aggregate can be found in Section 2.02 of this manual.

E. The Buy America compliance list of Approved Tested Stock Suppliers is published on the internet at the following link; http://www.michigan.gov/mdot/0,1607,7-151-9622_11044_11367---,00.html

2.01.02. General

A. The Construction Field Services Division (CFS), Materials Control, is responsible for overseeing the Tested Stock Program, including granting and withdrawing Tested Stock privileges based on Division and Region recommendations.

B. It is the Contractor’s responsibility to ensure that all documentation for Tested Stock material to be incorporated into the project is accurate and is delivered as required by 2.01.06.

C. Tested Stock requests are classified as either manufacturer or supplier requests and are processed accordingly.

D. When used in these procedures, *manufacturer* refers to a producer or fabricator of highway materials with control over the quality, workmanship, and handling of material shipped to an MDOT project.

E. When used in these procedures, *supplier* refers to an individual or company who has no control, other than through careful handling, over the quality and workmanship of material shipped to an MDOT project.

F. Manufacturers and suppliers granted Tested Stock privileges must agree, in writing, to comply with all requirements of these procedures. Failure to comply may result in withdrawal of Tested Stock privileges by MDOT.

G. Approved Tested Stock manufacturer and suppliers must maintain quality control records and tested stock shipment records for a period of two years after the last date of shipment. These records must be made available to MDOT representatives upon request.

2.01.03. Request for Tested Stock Privileges

A. Manufacturers or suppliers requesting to maintain Tested Stock of materials for use on state and federally funded projects must submit a written request, including the information listed below, to:

Michigan Department of Transportation
Construction Field Services Division
Materials Control
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909
Fax written request to CFS at (517) 322-5664.
Email written request to MDOT-MaterialsControl@michigan.gov please specify "Request for Tested Stock Privileges" in the subject line of the email.

B. Manufacturer Request

1. Company name, address, and contact information.

2. Specific name of material(s) (MDOT designation) to be handled as Tested Stock including size, grade, type, etc.

3. Reference to AASHTO, ASTM, or MDOT Standard Specification covering the material(s).

4. Manufacturer's quality control procedure for each material. This can be a narrative description or a formal procedures manual.

5. Quality control test reports for the material(s) covering a minimum of ten production runs. Acceptance test reports for material used on MDOT projects or independent laboratory test results are acceptable.

6. Names of other state DOTs using the material(s).

7. Sample of material(s) if requested.

8. Buy America Certification – To be included on the Buy America Compliance Listing. See Chapter 4.12 of this Manual for details.

C. Supplier Request

1. Company name, address, and contact information.

2. Company name, address, and contact information of the manufacturer supplying material(s).

3. Specific name of material(s) (MDOT designation) to be handled as Tested Stock including size, grade, type, etc.

4. MDOT Tested Stock test results for items, lot or batch of material to be placed in Tested Stock.

5. If material(s) does not come from an Approved Tested Stock manufacturer, all information included in 2.01.03B must be submitted.

D. The evaluation may include the following steps:

1. A review of MDOT's experience with the material and the manufacturer to determine if it is appropriate to allow tested stock of the material.

2. A review of the quality control program and test reports to verify that the manufacturer is capable of producing uniform material which consistently meets established specifications.

3. Contact with other agencies to determine their experience with the material and the manufacturer.

4. If the source and material are considered appropriate for Tested Stock, a site visit may be arranged to determine if there is adequate storage space to properly separate Tested Stock from "commercial material" and to discuss the program requirements.

E. The manufacturer or supplier will be notified, in writing, of approval or denial of Tested Stock privileges.

2.01.04. Sampling and Acceptance of Tested Stock

A. The manufacturer or supplier must determine the quantity of material which will be sampled and maintained in Tested Stock, based on experience and anticipated orders. MDOT will not be responsible for a manufacturer's or supplier's remaining Tested Stock in the event a change in specifications renders the material unusable on MDOT projects.

B. The manufacturer or supplier must notify CFS Materials Control or Region Materials personnel when a stockpile of material is available at the site to be sampled for inclusion as Tested Stock. No material is to be shipped from this stockpile until approval has been received from MDOT.

C. The MDOT representative assigned to sample the stockpiled material must be given access to all material in order to allow for the collection of a representative sample. This may require palletized and bundled materials to be opened, or may require having equipment available to move large items.

D. It is the manufacturer's or supplier's responsibility to arrange for shipping of required samples to CFS for testing.

E. If the representative sample taken from the stockpiled material fails to meet all critical specifications, the entire stockpile of material will be rejected. Sampling will only be re-authorized when it is documented that a new lot, batch, heat, etc. has been stockpiled.

F. All material approved for use as Tested Stock must be stored separately and must be clearly identified with a lot, batch, or heat number. This identification must be printed on

each bundle, container or individual item and must remain in place until the material is incorporated into the project.

G. Tested Stock material may be accepted by the Construction/Project Engineer, if it is properly documented and a visual inspection at the site shows the workmanship and condition of the material to be satisfactory.

2.01.05. Withdrawal and Reinstatement of Tested Stock Privilege

A. Failure to comply with these procedures may result in withdrawal of Tested Stock privileges. A warning letter may be written indicating the improper procedure and requesting action to rectify the problem.

B. Tested Stock privileges may be withdrawn if material intended for Tested Stock repeatedly fails to conform to specification requirements.

C. Withdrawn privileges can be reinstated only if the supplier has corrected the identified deficiencies and has documented, to the satisfaction of MDOT, the actions taken to prevent these deficiencies in the future.

2.01.06. Shipment of Tested Stock

A. When a shipment is made to an MDOT project from Tested Stock, a signed *Shipment of Tested Stock Report* (Form 1922) must be completed and distributed as follows. The manufacturer or supplier is responsible for obtaining, from the Contractor, all information required on the *Shipment of Tested Stock Report***,** including project numbers and physical dimensions.

1. When a manufacturer or supplier is shipping to the jobsite:

   a. A copy must accompany shipment to the jobsite or be faxed to the Construction/Project Engineer and the Contractor.

   b. A copy must be faxed (517-322-5664) or emailed to CFS on the same day the material is shipped to the jobsite. Email forms to MDOT-MaterialsControl@michigan.gov please specify "Shipment of Tested Stock" in the subject line of the email.

   c. A copy is to be retained by the manufacturer or supplier.

2. When a manufacturer is shipping to a supplier:

   a. A copy must accompany shipment or be faxed to distributor.

   b. A copy must be faxed (517-322-5664) or emailed to CFS on the same day the material is shipped to the distributor. Email forms to MDOT-MaterialsControl@michigan.gov please specify "Shipment of Tested Stock" in the subject line of the email.

   c. A copy is to be retained by the manufacturer.

B. CFS Materials Control will maintain a file of all Tested Stock acceptance test reports and *Shipment of Tested Stock Report* forms as well as an inventory of material in stock at each of the suppliers' locations.

C. Each Tested Stock source must, at the stockpile location, maintain a current inventory of all Tested Stock at that location, perform an annual review of inventory records and an actual inventory count, for the purpose of monitoring program compliance and adjustment to records maintained by CFS.

2.01.07. Limited Shelf Life Tested Stock Material

A. The items listed here have a limited shelf life and will be deleted from Tested Stock at the end of the shelf life period. These materials must be clearly labeled with the date of manufacture.

ITEM	SHELF LIFE
AASHTO M 294 Pipe	1 year from MDOT Tested Stock Approval Date
Epoxies	1 year from date of manufacture

2.02 TESTED STOCKPILES OF AGGREGATE

2.02.01. Scope

A. This procedure describes the requirements for maintaining pretested stockpiles of aggregates for use on MDOT projects.

B. Written authorization must be received by the producer, from MDOT, to maintain pretested stockpiles of aggregates.

2.02.02. Application For Tested Stock

A. The producer must request the Tested Stock privilege for each production site, in writing, to the affected Region materials staff.

B. The Region materials staff must inspect the producer's facilities and procedures for handling of aggregates, establish a reporting system and ascertain whether the producer can comply with all MDOT standards.

1. The Region must make a recommendation to the Construction Field Services (CFS) Division, Aggregate Quality Control Group, for confirmation or denial of the privilege.

2. The Aggregate Quality Control Group reserves the option of visiting the production site to aid in its determination for granting permission for Tested Stock.

2.02.03. Testing

A. See 902 of the Materials Acceptance Requirements Table for testing frequencies of Tested Stock Aggregates to be supplied by Non-Prequalified Aggregate Sources.

B. Aggregates produced for Tested Stock will be tested and approved by MDOT personnel or as otherwise authorized and are reserved for use on MDOT approved projects only.

C. All approved stockpiles will be identified by a sign indicating the Michigan Series Number and Class Letter including the notation "State Use Only". Letters and numbers on the sign must be a minimum of 3 inches (75 mm) in height and clearly legible. The sign must be of wood or metal, rectangular in shape, and fastened to a wood or metal post and located adjacent to the stockpile the sign represents.

2.02.04. Record Keeping and Inventory Control

A. An up-to-date inventory of all tested stockpile aggregates must be kept by the producer and made available to MDOT representatives upon request.

B. The inventory must include the Michigan Series and Class, weights or volumes in each stockpile and weights or volumes and dates shipped to each projects numbered hot mix asphalt (HMA) or concrete plant.

C. If questionable, the quantities remaining in stockpiles must be determined by the producer to the satisfaction of MDOT.

1. MDOT may delete tested stockpile material or recommend that testing charges be assessed for material which has been tested under these procedures but not used in approved MDOT work in any one calendar year.

2.02.05. Shipment and Certification

A. Each authorized shipment must be accompanied by a legible certification. The certification can be a part of the trip ticket or stamped on the back of it.

B. The certification must include the following:

1. A statement that the aggregate came from an approved tested stockpile.

2. Source (pit number)

3. Date of shipment

4. Project number, HMA plant number or concrete plant number

5. Michigan Series Number and Class Letter

6. Weight or volume in shipment

C. The producer will forward one copy of the Weekly Shipment Summary, by the close of business each Monday, to CFS, Aggregate Quality Control Group, and the Region. In the case where another Region is involved, MDOT will furnish a duplicate to that Region.

2.02.06. Withdrawal and Reinstatement of Certification Privileges

A. In instances of violation of these procedures, the privilege of certification may be rescinded after review and action by CFS and further shipments to MDOT projects will be tested on a project-by-project basis.

B. Withdrawn privileges may be reinstated by CFS if the certifier has corrected the problems to the satisfaction of MDOT.

3.01 MATERIALS CERTIFICATION PROCEDURES

3.01.01. Scope

A. This procedure covers the requirements for General Certifications and Test Data Certifications.

B. Certifiable materials are designated under "Basis of Acceptance" in the Materials Acceptance Requirements Table of Chapter 7. This table can also be found in the “Materials Source Guide” (MSG).

C. Additional detailed procedures have been written to cover certification of materials from Approved Manufacturers and Approved Suppliers. See Section 3.02 for the requirements for Approved Manufacturers and Approved Suppliers.

D. See Chapter 4.12 of this manual for the requirements for Buy America Certification of Steel and Iron products.

3.01.02. General

A. It is the Contractor's responsibility to ensure that ALL certifications for material to be incorporated into the project are accurate and are delivered as required by Section 3.01.03C of this document.

3.01.03. Certification Documentation

A. Where more than one piece of paper is included in the certification document, all pages must be numbered (__ of __) and include Contract I.D. in order to reunite them should they become separated.

B. Stencil, stamp, or otherwise mark all certified material prior to delivery to a supplier or project. This mark must identify the AASHTO, ASTM, or MDOT specification that the material meets, to allow the material to be recognized and checked against the manufacturer’s or supplier’s certification document. For Qualified Product List (QPL) materials, this mark is not required. QPL materials must have a label that clearly identifies the manufacturer and product name.

C. General Certification - This documentation must consist of ALL of the following:

1. Company name, address, and contact information.

2. Date the certification was produced.

3. Contract number (Control Section/Job Number).

4. Name of Contractor.

5. If material is certified by a supplier or Contractor, the manufacturer's name must be included on the certification.

6. For non-QPL materials, a list of all applicable specifications (ASTM, AASHTO, MDOT or other designations as appropriate) which the material is certified to meet. For QPL materials, indicate QPL specification section number as shown in the Materials Source Guide, and the product name.

7. Any applicable specification modifier such as class, grade, type, etc.

8. Name of material (MDOT designation). The proper name of materials can be found in the Materials Acceptance Requirements Table of Chapter 7, and the Standard Specifications for Construction.

9. Identification markings on shipment as required by Section 3.01.03B.

10. A statement, signed by a responsible representative of the manufacturer, supplier, or Contractor that the material represented by the certification meets all MDOT listed specification requirements. For QPL materials, this certification statement indicates that the product(s) incorporated were selected from the MDOT QPL.

D. Test Data Certification – This documentation must consist of all the requirements of a General Certification. In addition to the requirements of Section 3.01.03C, the following information must also be included:

1. Laboratory test report(s) for samples obtained from the same lot(s), batch, heat, etc. of material represented by the certification and tested in accordance with the applicable specifications.

3.01.04. Certifications Distribution

A. Certification documents must be distributed as follows:

1. Submit to the Construction/Project Engineer.

NOTE: See Section 3.02.07 of this manual for Certification Distribution requirements of Approved Manufacturers/Suppliers.

3.01.05. Acceptance/Rejection of Certified Materials

A. Certified material may be accepted by the Construction/Project Engineer if the sources of all applicable materials are listed on the project's *Materials Source List* (Form 501). If visual inspection at the project site shows the condition of the material to be unsatisfactory, or a material source is different from what was identified on the Materials Source List, the Engineer may perform inspections of the materials, including sampling and testing, in accordance with the methods required by the contract to determine if the material meets the contract requirements. MDOT reserves the right to reject materials that are determined to not meet the contract requirements.

B. If any laboratory reports submitted as part of a Test Data certification indicate that a critical parameter falls outside of specification limits the material may be rejected. Prior to rejection of the material, an investigation of circumstances may be made. This may include consultation with CFS, Design, Traffic and Safety, or Maintenance Divisions and the Construction/Project Engineer.

3.02 PROCEDURES FOR APPROVED MANUFACTURERS/SUPPLIERS

3.02.01. Scope

A. MDOT will accept some highway materials provided from a Manufacturer/Supplier on the Approved Manufacturer/Supplier lists, provided the manufacturer or supplier complies with all program requirements. Approved Manufacturer/Suppliers are required to provide MDOT with written documentation that all applicable material specifications are met (a certification statement).

B. Materials that must be provided from an Approved Manufacturer/Supplier are designated “Appr Mfr” under "Basis of Acceptance" in the Materials Acceptance Requirements Table of Chapter 7. This table can also be found in the “Materials Source Guide” (MSG).

C. These procedures apply only to manufacturers and suppliers who have been given the privilege of certifying *specific* materials which would otherwise be tested on a job-by-job basis.

D. Where necessary, additional detailed procedures have been written to cover certification of individual materials. These detailed procedures follow and include these Procedures for Manufacturers/Suppliers.

3.02.02. General

A. The Construction Field Services Division (CFS), Materials Control, is responsible for overseeing the Manufacturers/Suppliers Certification Program, including granting and withdrawing certification privileges based on Division and Region recommendations.

B. It is the Contractor's responsibility to ensure that ALL certifications for material to be incorporated into the project are accurate and are delivered as required by 3.02.03C of this document.

C. When used in these procedures, a *Manufacturer* refers to a producer or fabricator of highway materials with control over the quality, workmanship, and handling of material shipped to an MDOT project.

D. When used in these procedures, a *Supplier* refers to an individual or company who has no control, other than through careful handling, over the quality and workmanship of material shipped to an MDOT project.

E. When used in these procedures, *Approved Manufacturer* refers to a manufacturer who has submitted quality control documentation and/or material samples for evaluation and who has been given approved status in accordance with Section 3.02.03 to *certify specific* materials.

F. When used in these procedures, *Approved Supplier* refers to a supplier who has been given approved status in accordance with 3.02.05 to supply materials which are manufactured by Approved Manufacturers.

3.02.03. Request for Approved Manufacturer Status

A. The manufacturer of the material to be certified must contact CFS, Materials Control, in writing or by email, to request consideration for approval status. See Section 3.02.07.A2 of this manual for submittal address, please specify "Approved Manufacturer Status Request". Requests must include the following information:

1. Specific name of the material (MDOT designation) to be certified.

2. Reference to AASHTO, ASTM, MDOT Standard Specification or other specification covering the material.

3. Manufacturer's quality control procedure for the material. This can be a narrative description or a formal procedures manual.

4. Quality control test reports, independent laboratory test reports, and/or acceptance test reports from other agencies, covering a minimum of five consecutive production runs/lots/heats. Any combination of these reports is acceptable, provided that each report is for a different production run/lot/heat. Test reports must be for material produced no more than two years prior to submittal for MDOT approval.

5. Names of other state DOTs using the material.

6. Sample of the material if requested.

7. Sample certification form to be used when supplying material.

8. Shop drawing if required.

9. A written statement agreeing to comply with all the general certification requirements in addition to applicable procedures covering individual materials.

10. Buy America Certification if applicable. To be included on the Buy America Compliance listing, see Chapter 4.12 of this Manual for details.

B. The evaluation may include the following steps:

1. A review of MDOT's experience with the material and the manufacturer to determine if it is appropriate to allow certification of the material.

2. A review of the quality control program and test reports to verify that the manufacturer is capable of producing uniform material which consistently meets established specifications.

3. Contact with other agencies to determine their experience with the material and the manufacturer.

4. An onsite review of the manufacturing process and facility.

C. If the review indicates an adequate quality level, MDOT will permit certification on a provisional basis. During the time of provisional certification, the frequency of certification verification sampling by MDOT will be increased. Assuming that these samples continue to meet MDOT specifications, certification will be allowed on a continuing basis.

3.02.04. Approved Manufacturer Certification Documentation

A. Approved Manufacturers must provide General Certification documentation in accordance with section 3.01 of this manual. In addition to the requirements of section 3.01, quantity shipped must be listed on this certification.

3.02.05. Request for Approved Supplier Status

A. Once a manufacturer has been granted Approved Manufacturer status for a material, a supplier may request Approved Supplier status to supply that material. The supplier of the material to be certified must contact CFS, Materials Control, in writing or by email, to request consideration for approval status. See Section 3.02.07.A2 of this manual for submittal address, please specify “Approved Supplier Status Request”. Requests must include the following information:

1. Company name, address, and contact information.

2. Specific name of the material (MDOT designation) to be certified.

3. Sample Recertification form to be used when supplying material.

4. A written statement agreeing to comply with all General Certification requirements in addition to applicable procedures covering individual materials.

B. If the Approved Supplier performs additional processing on the material subsequent to receiving it from the Approved Manufacturer, the material is no longer covered by the Approved Manufacturer's certification. The processed material must be independently approved for certification according to Section 3.02.04 of this manual.

3.02.06. Approved Supplier Recertification Documentation

A. Approved Supplier Recertification documentation must meet the requirements of Section 3.01 with the following modifications:

1. The certification from the Approved Manufacturer to the Approved Supplier is not required to show a project number.

2. When any portion of this material is shipped to a project, the Approved Supplier must issue a Supplier's Recertification which states that the material represented is the same material covered by the Approved Manufacturer's certification. Approved Suppliers may not modify any material.

3. A copy of the original Approved Manufacturer’s certification must accompany the Approved Supplier’s Recertification.

4. Quantity of material shipped.

3.02.07. Certification Distribution

A. Certification documents must be distributed as follows:

1. One copy must accompany the shipment for the Contractor’s files and one copy must be mailed, emailed or faxed to the Construction/Project Engineer’s office on the date of shipment.

2. One copy must be mailed, emailed, or faxed on date of shipment to:

Michigan Department of Transportation
Construction Field Services Division
Materials Control
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909
Fax: 517-322-5664
Email: MDOT-MaterialsControl@michigan.gov please specify "Approved Manufacturer/Approved Supplier Certification" in the subject line of the email.

3.02.08. Approved Manufacturer/Supplier Status

A. Approved Manufacturers/Suppliers must maintain quality control records and material certificates for a period of three years after the date of shipment for all material supplied on the basis of certification to MDOT projects. These records must be made available to MDOT representatives upon request.

B. Lists of Approved Manufacturers and Approved Suppliers are included in the Materials Source Guide.

C. Buy America compliance lists of Approved Manufacturers and Approved Suppliers are published on the internet at the following link; http://www.michigan.gov/mdot/0,1607,7-151-9622_11044_11367---,00.html

D. Approved Manufacturers/Suppliers must notify CFS Materials Control of any changes in company name, location, ownership, etc.

3.02.09. Acceptance/Rejection of Certified Materials

A. Certified material may be accepted by the Construction/Project Engineer if the sources of all applicable materials are listed on the project's *Materials Source List* (Form 501). If visual inspection at the project site shows the condition of the material to be unsatisfactory or a material source is different from what was identified on the Materials Source List, MDOT reserves the right to reject the material, conduct further inspection, or test the material.

3.02.10. Withdrawal and Reinstatement of Approved Manufacturer/Supplier Status

A. Failure to comply with these procedures may result in withdrawal of Approved Manufacturer/Supplier status. A warning letter may be written indicating the improper procedure and requesting action to rectify the problem.

B. Approved Manufacturer/Supplier status may be withdrawn if the certified material deviates from specification requirements in a critical parameter or if the material repeatedly fails to conform to specification requirements by any amount in any aspect.

C. Withdrawn Approved Manufacturer/Supplier status can be reinstated only if the certifier has corrected the identified deficiencies and has documented, to the satisfaction of MDOT, the actions taken to prevent these deficiencies in the future. In the case of an Approved Manufacturer, testing of samples or review of other data may be required.

D. Additional requirements covering the withdrawal and reinstatement of certification privileges may be included in the detailed procedures for individual materials.

3.03 CERTIFICATION VERIFICATION SAMPLING AND TESTING

3.03.01. Scope

A. Certification Verification consists of periodic sampling and testing or field inspection of materials accepted on the basis of certification, for the purpose of validating the quality of the manufacturer's product.

B. When the certification verification sample fails critical parameters of the specification, the information can be used as the basis for either rejecting the material or delaying its use until additional samples can be tested.

C. Materials listed in the Materials Source Guide as certifiable, but not listed in these procedures, may be sampled and tested as circumstances warrant.

D. The frequency for Certification Verification may be adjusted at any time by the Michigan Department of Transportation, as deemed necessary.

3.03.02. General Responsibilities

A. The Construction Field Services Division (CFS) will notify the appropriate Region Staff of the need to perform Certification Verification sampling and/or field inspection for the items listed in Schedule No. 1.

1. If the sampling and/or inspection cannot be performed within five days of the receipt of these requests, the Region Staff must notify CFS, Materials Control, by telephone or email.

B. Materials not listed in Schedule No. 1, but which also require regular Certification Verification sampling and/or inspection are listed in Schedule No. 2.

1. It is the responsibility of the Region materials staff, unless otherwise noted, to see that the Certification Verification required in Schedule No. 2 is performed.

3.03.03. Submitting Samples

A. When submitting samples to the laboratory for testing, check the box "Certification Verification" on the "*Sample ID*", (Form 1923), in the area reserved for the "Type of Sample".

B. If available, attach a copy of the certification representing the material sampled to the Sample Identification.

3.03.04. Field Inspection Reports

A. All field inspection reports submitted to CFS must note "Certification Verification" in the area normally reserved for project number.

B. Project numbers may be shown under "Remarks".

C. A statement indicating whether the material does or does not meet specification requirements will be entered under "Remarks".

D. If available, a copy of the certification representing the material inspected must accompany these field inspection reports.

E. Construction/Project Engineers will not receive copies of Certification Verification Field Inspection Reports except when failures occur in critical parameters, per paragraph 3.03.01B.

3.03.05. Laboratory Reports

A. Test reports issued by the Testing Laboratory will be reported as "Certification Verification" rather than for specific projects.

B. Project numbers, if shown on the Sample Identification, will be entered under "Remarks".

3.03.06. Sampling Schedules

A. CFS, Materials Control will issue the appropriate instructions to the Region Staff for sampling and/or inspection for those items in Schedule No. 1.

B. The Region materials staff is responsible, unless otherwise noted, for the control of the Certification Verification sampling and/or testing on the items in Schedule No. 2 in accordance with the references noted.

SCHEDULE NO. 1

Spec. Number	Material Name	First Sample	Subsequent Samples	Unit
905.03	Uncoated Steel Reinforcement	20,000	100,000	lbs.
905.03C*	Epoxy Coated Steel Reinforcement	20,000	100,000	lbs.
909.05A*	Corrugated Metal Pipe (Metal Sheets)	500	5,000	ft.
909.07B	Corrugated Plastic Tubing for Underdrains	5,000	50,000	ft.
910.05A	Prefabricated Drainage System	10,000	100,000	ft.
914.07	Dowel Bars	3,000	30,000	ea.
916.02	Silt Fence	3,500	10,000	ft.
919.05	Sawed Wood Posts for Highway Signs	250	2,500	ea.

*See Special Instructions on next page for these items.

SCHEDULE NO. 1 SPECIAL INSTRUCTIONS

905.03C *Epoxy Coated Steel Reinforcement* - Wrap samples to protect the coating from possible damage during shipment. Both the bar manufacturer and the coater's name must be shown on the Sample Identification, (Form 1923).

908.12 *Steel Post for Guardrail* - Field inspection to determine average weight per meter, dimensions and weight of Spelter coating. Submit one post to laboratory. Report test results on Report of Field Inspection, (Form 566).

909.05A *Corrugated Metal Pipe (Metal Sheets)* - Samples will be obtained from fabricated pipe or from stock at the fabricator's yard per instructions of CFS. The Sample Identification, (Form 1923), must include the sheet manufacturer’s name and the pipe fabricator's name.

SCHEDULE NO. 2 SPECIAL INSTRUCTIONS

904.03A *Asphalt Binder* - See Section 3.05.06 of this manual.

*905.07 *Strand for Prestressed Concrete* - One per fabricator, per strand manufacturer, per year.

909.04 *Concrete Pipe Products; RCP & NRCP and Related Items* - See Section 3.10.12 of this manual.

* *May be sampled by the Operations Field Services Division.*

3.04 CERTIFICATION PROCEDURES FOR ASPHALT BINDER

3.04.01. Scope

A. This document describes how the Construction Field Services Division (CFS) will allow suppliers to certify asphalt binder for use on MDOT projects if the criteria specified below are met.

B. Definitions:

1. Approved Asphalt Binder Certifier - A refinery, terminal, or hot mix asphalt (HMA) producer that provides asphalt binder that meets MDOT specifications. If any modifications or blending of asphalt binder from different sources are made at the HMA producer's plant, the HMA producer must be the Approved Asphalt Binder Certifier. Exceptions to these modifications at the HMA plant include using a water-injection foaming device, water foaming additives, and products listed on the Colorado Department of Transportation approved list of unrestricted warm mix asphalt (WMA) technologies. An Asphalt Binder Certifier must be approved at each location that supplies asphalt binder to MDOT projects.

2. Laboratory - The laboratory shall be AASHTO accredited for all asphalt binder tests required by MDOT specifications.

C. Letters and samples referred to in these procedures should be sent to:

Michigan Department of Transportation
Construction Field Services Division
HMA Operations Unit
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909
Fax Number: (517)322-5226

3.04.02. Request for Initial Certification Privileges

A. The request for initial certification privileges must be submitted in writing to the CFS, HMA Operations Unit. Requests must include the following information:

1. Requesting asphalt binder certifier's name.

2. Location (Legal Address).

3. Primary contact information. This must include contact name, phone number, email, and fax number. It is the responsibility of the asphalt binder certifier to ensure the CFS HMA Operations Unit has the most current information.

4. List of asphalt binder grades which will be certified.

5. A Quality Control Plan for review and approval by HMA Operations Unit.

6. Test results for five production runs of asphalt binder. This must be performed for each grade of asphalt binder that will be certified.

7. Submit two 1.0 quart samples of each binder grade to be certified with the request letter.

8. All specification tests must be performed for each grade of asphalt binder to be certified. The specification requirements for asphalt binder can be found in the current Standard Specifications for Construction. These test results must be submitted in a report.

9. An example copy of the Certification Document (meeting the requirements of 3.04.05).

10. The AASHTO Materials Reference Laboratory Reports for Asphalt Binder Proficiency Samples from the past two years. These must be submitted by the laboratory that performs the quality control testing for the certifier.

11. Proof of current AASHTO accreditation.

12. A written and signed statement that the certifier will abide by the certification requirements.

B. CFS will evaluate the request for certification privileges and may grant provisional approval to certify asphalt binder for an MDOT project. The provisional approval for certification will be on a project-by-project basis for one construction season and based on continued satisfactory field and laboratory performance of asphalt binder from this location.

C. If certification privileges are granted, the applying supplier will be notified in writing by the CFS HMA Operations Unit. The list containing the MDOT Approved Asphalt Binder Certifiers, and the grades of asphalt binder which they are approved to certify, is found on the MDOT website under the Construction Field Services section.

D. Requests for initial certification are accepted in the months of November through April. During this period, MDOT will perform any required testing without cost to the asphalt binder certifier. Any requests for initial certification received during the months of May through October will be sent to a third party, AASHTO accredited asphalt binder laboratory, chosen by MDOT. The cost of the sample testing must be paid by the asphalt binder certifier.

3.04.03. <u>Request for Certification Privileges of Additional Grades of Asphalt Binder by an Established Approved Asphalt Binder Certifier</u>

A. The request for certification privileges of additional grades of asphalt binder must be submitted in writing to CFS, HMA Operations Unit. Requests must include the following information:

1. List of asphalt binder grades which will be certified.

2. Submit two 1.0 quart samples of each asphalt binder grade with the request letter.

3. All specification tests pertaining to the asphalt binder grade must be performed for each grade of asphalt binder to be certified.

B. Requests for the addition of asphalt binder grades are accepted in the months of November through April. During this period, MDOT will perform any testing required without cost to the asphalt binder supplier. Any requests for the addition of asphalt binder grades received during the months of May through October will be sent to a third party, AASHTO accredited asphalt binder laboratory, chosen by MDOT. The cost of the sample testing must be paid by the asphalt binder supplier.

3.04.04. Monthly Requirements

A. On a monthly basis, from May through October, submit quality control test reports that comply with the quality control plan referred to in Subsection 3.04.02A5 to CFS, HMA Operations Unit. This must be done for each grade of asphalt binder supplied for MDOT projects during the previous month.

3.04.05. Certification Document

A. Accompany each shipment with a certification document. Transmit the certification document to the Contractor. The certification document must contain the following:

A. Approved Asphalt Binder Certifier's name and location (city, state).
B. Grade of asphalt binder.
C. Tank or lot number.
D. Quantity of asphalt binder shipped to MDOT projects (gallons at 60°F {liters at 12°C}).
E. Date and time of shipment.
F. Purchaser (and/or consignee) and point of delivery.
G. MDOT project and control section numbers.
H. Bill of lading number.
I. Carrier and truck or car number.
J. The certification statement:

"(*Name of Approved Asphalt Binder Certifier*) certifies that the asphalt binder, as transported to the Contractors plant, conforms to the MDOT specifications."

This certification document will be signed by a representative of the approved asphalt binder certifier.

3.04.06. MDOT Monitoring

A. Asphalt binder samples will be taken at the HMA plant before incorporation into the HMA mixture. The asphalt binder samples will be randomly tested for compliance to the specification requirements described in the current Standard Specifications for Construction. These samples are taken to insure that the asphalt binder meets the required specifications for the project.

MDOT will also randomly test asphalt binder samples, taken at the HMA plant before incorporation into the HMA mixture, for the presence of reclaimed engine oil based products. Asphalt binder prepared with reclaimed engine oil based products is not allowed.

3.04.07. Certification Verification

A. When any test result is out of specification from the testing of the asphalt binder samples described in section 3.04.06, CFS HMA Operations Unit will notify the approved asphalt

binder certifier in writing. The CFS HMA Operations Unit will determine the extent of the deficiencies through the following concurrent actions.

1. The Construction/Project Engineer will be notified.

2. An increase in asphalt binder sample testing (described in 3.04.06) for the consecutive days surrounding the original failing tests from the project.

3. The Approved Asphalt Binder Certifier will be required to investigate all aspects of material loading, handling, and delivery.

4. MDOT will witness certification verification sampling from a transport truck when deliveries are made to a HMA plant. Samples will be taken by the Contractor according to AASHTO T 40 (2007) Section 10, Sampling From Tank Cars, Vehicle Tanks, Distributor Trucks or Recirculating Storage Tanks. There must be four one gallon samples taken: for testing by MDOT, an independent AASHTO accredited asphalt binder laboratory, a retained sample, and a sample for the Approved Asphalt Binder Certifier. MDOT's test results will be used to determine specification compliance. If MDOT finds the certification verification sample not meeting specification, MDOT will send a one-gallon sample to an independent AASHTO accredited asphalt binder laboratory for dispute resolution. The test results reported by this lab will be final.

3.04.08. Withdrawal and Reinstatement of Certification Privileges

A. If two consecutive samples from separate transport trucks are found to be out of specification by more than the tolerance limits, the CFS HMA Operations Unit will notify the approved asphalt binder certifier by fax and certified letter that their certification privileges have been withdrawn, for the subject asphalt binder only. CFS HMA Operations Unit will also notify all MDOT regions. Contractors with projects affected by this change will then be required to have the asphalt binder, from this source and grade, tested and accepted for use on specific projects.

B. Withdrawn certification privileges can be reinstated only if the asphalt binder certifier has corrected the identified deficiencies and has documented, to the satisfaction of MDOT, the actions taken to prevent these deficiencies in the future.

3.05 CERTIFICATION PROCEDURES FOR EMULSIFIED ASPHALT

3.05.01. Scope

A. This document describes how the Construction Field Services (CFS) Division will allow suppliers to certify emulsified asphalt for use on MDOT projects if the criteria specified below are met.

B. Definitions:

1. Approved Emulsified Asphalt Certifier - A supplier that provides emulsified asphalt to meet MDOT specifications. A certifier may be an emulsified asphalt manufacturer or a tank storage facility. A supplier must be approved at each location.

2. Laboratory - Must be either the approved certifier's laboratory or a commercial laboratory.

C. Letters and samples referred to in these procedures should be sent to:

Michigan Department of Transportation
Construction Field Services Division
HMA Operations Unit
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909

3.05.02. Request for Initial Certification Privileges

A. The request for initial certification privileges must be submitted in writing to CFS, HMA Operations Unit. Requests must include the following information:

1. Requesting supplier’s name.

2. Location.

3. List of the types of emulsified asphalt which will be certified.

4. A Quality Control Plan for review and approval by HMA Operations Unit.

5. Test results for five production runs of emulsified asphalt. This must be performed for each type of emulsified asphalt that will be certified.

6. Submit two 1 gallon samples of each type of emulsified asphalt with the request letter.

7. All specification tests must be performed for each type of emulsified asphalt to be certified. The specification requirements for emulsified asphalt can be found in the current Standard Specifications for Construction. These test results must be submitted in a report.

8. An example copy of the Certification Document (meeting the requirements of 3.05.05).

9. The AASHTO Materials Reference Laboratory Reports for Emulsified Asphalt Proficiency Samples from the past two years, and proof of AASHTO accreditation for emulsified asphalt testing. These must be submitted by the laboratory that performs the quality control testing for the certifier.

10. A written and signed statement that the certifier will abide by certification requirements.

B. If certification privileges are granted, the applying supplier will be notified in writing by HMA Operations Unit. The list containing the MDOT Approved Certifiers of Emulsified Asphalt, and the types of emulsified asphalt which they are approved to certify, is found on the MDOT website under the Construction Field Services Division section.

C. Requests for initial certification are accepted in the months of November through April. During this period, MDOT will perform any required testing without cost to the emulsified asphalt supplier. Any requests for initial certification received during the months of May through October will be sent to a third party, AASHTO accredited laboratory, chosen by MDOT. The cost of the sample testing must be paid by the emulsified asphalt supplier.

3.05.03. Request for Certification Privileges of Additional Types of Emulsified Asphalt

A. The request for additional certification privileges must be submitted in writing to CFS, HMA Operations Unit. Requests must include the following information:

1. List of types of emulsified asphalt which will be certified.

2. Two 1.0 gallon samples of each type of emulsified asphalt shall be submitted with the application letter.

3. All specification tests must be performed and submitted on split samples for each type of emulsified asphalt to be certified.

B. Requests for additional certification are accepted in the months of November through April. During this period, MDOT will perform any required testing without cost to the emulsified asphalt supplier. Any requests for additional certification received during the months of May through October will be sent to a third party, AASHTO accredited laboratory, chosen by MDOT. The cost of the sample testing must be paid by the emulsified asphalt supplier.

3.05.04. Monthly Requirements

A. On a monthly basis, from May through October, submit quality control test reports that comply with the quality control plan referred to in Subsection 3.05.02.A.4 to HMA Operations Unit. This must be done for each type of emulsified asphalt supplied to MDOT projects during the previous month.

3.05.05. Certification Document

A. Accompany each shipment with a certification document. Transmit the certification document to the Contractor. The certification document must contain the following:

1. Approved certifier's name.
2. Type of emulsified asphalt.
3. Tank or lot number.
4. Quantity of emulsified asphalt shipped to the MDOT projects (gallons at 60ºF).
5. Name and location of the certifier.
6. Purchaser (and/or consignee) and point of delivery.
7. MDOT project and control section numbers.
8. Bill of lading number.
9. Carrier and truck or car number.
10. A certification statement:

"The _____(name of approved certifier)___ certifies that the emulsified asphalt as transported to the Contractor's plant conforms to the MDOT specifications."

This certification will be signed by a representative of the approved certifier.

3.05.06. MDOT Monitoring

A. Submit Certification Verification (CV) samples to the HMA Operations Unit whenever a tank of emulsified asphalt is prepared for MDOT projects. This includes whenever emulsified asphalt is added to a tank which is supplying MDOT projects. These samples must be received by the HMA Operations Unit within seven days of shipment of the emulsified asphalt to MDOT projects. The CV samples will be randomly tested in accordance with the specification requirements described in the contract documents. These samples are taken to verify that the certified emulsified asphalt meets the required specifications.

B. CV samples must consist of two ½ gallon containers of emulsified asphalt accompanied by a completed MDOT Sample Identification form (Form 1923 found on the MDOT website).

3.05.07. Withdrawal and Reinstatement of Certification Privileges

A. When any test result, on a certification verification sample, is out of specification, CFS will notify the approved certifier by phone and in writing. The CFS HMA Operations Unit will increase the amount of CV sample testing on the type of emulsified asphalt in question.

B. If another CV sample, taken after the approved certifier was initially notified of a deficiency, is found to be out of specification, CFS will notify the approved certifier by fax and certified letter that their certification privileges have been withdrawn for the subject type of emulsified asphalt only. CFS will also notify all MDOT regions. Contractors with projects affected by this change will then be required to have the emulsified asphalt, from this source, tested and accepted for use on specific projects.

C. Withdrawn certification privileges can be reinstated only if the certifier has corrected the identified deficiencies and has documented, to the satisfaction of CFS HMA Operations Unit, the actions taken to prevent these deficiencies in the future.

3.06 PORTLAND CEMENT AND SLAG CEMENT

3.06.01. General

A. The Construction Field Services Division (CFS) will authorize facilities having a satisfactory record of production of acceptable cement to ship Portland/slag cement to Michigan Department of Transportation (MDOT) projects for immediate incorporation in the work. Each shipment must be accompanied by a producer certification that the cement meets MDOT specification requirements for the specified type or grade of cement.

3.06.02. Qualification of New Facilities

A. Facilities for which MDOT does not have a record of past production, which desire to furnish cement for use on MDOT projects, will be required to furnish the following information:

- A written official request for facility approval to certify cement for MDOT projects.
- A written and signed statement that the cement company will comply with all MDOT cement specifications and conditions to maintain certification privileges.
- A written statement that the cement facility will inform MDOT in a timely manner of any changes to their product, production processes, ownership, etc.
- Facility information including address and contact personnel.
- Quality control procedures manual for the facility.
- CCRL report of laboratory inspection, if available.
- 6 months of mill test reports for each type or grade of cement the company intends to certify.
- Example of the company's certification statement on a bill of lading meeting the requirements of 3.06.03.A
- 2 samples (10 lbs/ea.) of each cement type or grade the company intends to certify. The samples must be taken from different production days.
- Any other information that the MDOT Concrete Lab may determine to be necessary to establish adequate assurance that cement furnished under certification will in fact comply with the specification requirements.

3.06.03. Certification of Cement

A. *By Producer* - Each shipment must be accompanied by a certification on a copy of the bill of lading, or other form, which will be transmitted by the Contractor to the Construction/Project Engineer or his/her representative. The form must contain the following information:

- Producer's name.
- Place of production.
- Source of shipment, if other than place of production.
- Purchaser and/or consignee and point of delivery.
- Bill of lading number.
- Carrier and truck or car number.
- Quantity of cement in pounds.

- This certification:

"The ___(*producing company*)___ certifies that the cement in this shipment, produced at (*producing facility*)), conforms to the requirements of MDOT cement Type or Grade ___."

This certification will be signed by a designated representative of the company.

1. In addition, the Producer must provide to CFS, twice yearly (April and November), test results for a complete chemical and physical analysis of each type of cement produced for use on MDOT projects. These requirements are based on ASTM C 150 and C 595 for Portland cement or C989 for slag cement.

B. *By Operators of Ready-Mix Plants* - For shipments to ready-mix plants, which are supplying to commercial work at the same time they are supplying to MDOT projects, all cement placed in the storage bin or silo that is used for MDOT work must be certified by the cement company. The ready-mix plant must also certify the cement according to one of the following requirements:

1. Certify all cement used in concrete delivered to MDOT projects on Form 1155. Form 1155 will be collected by the Region Materials staff.

2. Certify all cement used in MDOT projects on each delivery ticket. Imprint or stamp the following on the tickets:

"This is to certify that the cement used in this concrete was from a certified shipment meeting MDOT specifications.

Cement Producer _____ Cement Type or Grade _____"

3.06.04. Distribution

A. Submit all documentation to the following address as required:

Michigan Department of Transportation
Construction Field Services Division
Concrete Testing Laboratory
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48917
Fax: 517-322-1045

3.06.05. Withdrawal and Reinstatement of Cement Approved Manufacturer Privileges

A. Approved Manufacturer privileges for Portland cement may be withdrawn if the certified material deviates from specification requirements in a critical parameter or if the cement repeatedly fails to conform to specification requirements by any amount in any aspect. A warning letter may be written indicating the improper procedure and requesting action to rectify the problem.

B. Cement from a facility from which MDOT has withdrawn Approved Manufacturer privileges may not be used on projects until each individual shipment has been tested and approved by MDOT.

C. Withdrawn Approved Manufacturer privileges can be reinstated only if the facility has corrected the identified deficiencies and has documented, to the satisfaction of MDOT, the actions taken to prevent these deficiencies in the future.

3.07 FLY ASH FOR USE IN PORTLAND CEMENT CONCRETE

3.07.01. General

A. The Construction Field Services Division (CFS) of Michigan Department of Transportation (MDOT) will authorize facilities having a satisfactory record of furnishing acceptable fly ash from approved sources to ship to MDOT projects for immediate incorporation into the work. Each shipment must be accompanied by a supplier certification that the fly ash meets MDOT specification requirements for the specified class.

B. The supplier must regularly test the fly ash furnished for the proper requirements specified in the MDOT specifications. These are based on ASTM C 618, with modifications as indicated in MDOT's Standard Specifications, or in supplemental specifications included with each project. Records of the test results must be furnished to MDOT upon request. Determination of Loss on Ignition and Fineness must be made in order that certification will include test results from samples taken the day of the shipment or the previous working day.

3.07.02. Referenced Documents

A. ASTM C 618 Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for Use in Portland Cement Concrete

ASTM C 311 Test Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete

3.07.03. Qualification of New Facilities

A. Facilities for which MDOT does not have a record of past production, which desire to furnish fly ash for use on MDOT projects, will be required to furnish the following information:

- A written official request for facility approval to certify fly ash for MDOT projects.
- A written and signed statement that the fly ash company will comply with all MDOT fly ash specifications and conditions to maintain certification privileges.
- A written statement that the fly ash facility will inform MDOT in a timely manner of any changes to their product, production processes, ownership, etc.
- Facility information including address and contact personnel.
- Quality control procedures manual for the facility.
- CCRL report of laboratory inspection, if available.
- 6 months of ASTM C618 reports for each class of fly ash the company intends to certify.
- Example of the company's certification statement on a bill of lading meeting the requirements of 3.07.04.A
- 2 samples (10 lbs/ea.) of each fly ash class the company intends to certify. The samples must be taken from different production days.
- Any other information that the Concrete Lab may determine to be necessary to establish adequate assurance that fly ash furnished under certification will in fact comply with the specification requirements.

3.07.04. Certification of Quality of Fly Ash for Use in Concrete

A. *By Supplier* - Each shipment must be accompanied by a certification on a copy of the bill of lading, or other form, which will be transmitted by the Contractor to the Construction/Project Engineer or his/her representative. The form shall contain the following information:

- Supplier's name.
- Place of production.
- Source of shipment, if other than place of production.
- Purchaser and/or consignee and point of delivery.
- Bill of lading number.
- Carrier and truck or car number.
- Quantity of fly ash in pounds.

1. Include the following certification for fly ash:

"The ___(*Name of supplier*)____ certifies that the fly ash in this shipment conforms to the requirements of ASTM C 618 and Michigan DOT modifications for Class ____ fly ash. Results of test on samples taken within one work day of shipment were: Loss on Ignition, ____ percent; Fineness, retained No. 325 sieve, ____ percent."

This certification must be signed by a designated representative of the supplier.

2. The supplier must provide CFS a copy of the ASTM C618 test results for each source on a monthly basis. In addition, the following information will be furnished, based on tests as described in ASTM C 311.

- Results based on daily shipment samples:
  - Fineness (No. 325 sieve)
  - Moisture Content
  - Loss on Ignition
  - Sulfur Trioxide
- Result based on composite sample (at least weekly):
  - Specific Gravity
- Results based on composite sample (at least monthly):
  - Autoclave Soundness
  - Sum of $SiO_2 + Al_2O_3 + Fe_2O_3$
  - Strength Activity Index (With Portland Cement)
  - Water Requirement

B. *By Operators of Ready-Mix Plants* - For shipments to ready-mix plants which are supplying to commercial work at the same time they are supplying to MDOT projects, all fly ash placed in the storage bin or silo that is used for MDOT work must be certified by the supplier. The ready-mix plant must also certify the fly ash according to one of the following requirements:

1. Certify all fly ash used in concrete delivered to MDOT projects on Form 1155. Form 1155 will be collected by the Region Materials staff.

2. Certify all fly ash used in MDOT projects on each delivery ticket. Imprint or stamp the following on the tickets:

a. "This is to certify the fly ash used in this concrete was from a certified shipment meeting MDOT specifications. Fly Ash ____(supplier and facility)___Fly Ash ___(class)____"

3.07.05. Withdrawal and Reinstatement of Approved Manufacturer Privileges

A. Approved Manufacturer privileges for fly ash may be withdrawn if the certified material deviates from specification requirements in a critical parameter or if the fly ash repeatedly fails to conform to specification requirements by any amount in any aspect. A warning letter may be written indicating the improper procedure and requesting action to rectify the problem.

B. Fly ash from a facility from which MDOT has withdrawn Approved Manufacturer privileges may not be used on projects until each individual shipment has been tested and approved by MDOT.

C. Withdrawn Approved Manufacturer privileges can be reinstated only if the facility has corrected the identified deficiencies and has documented, to the satisfaction of MDOT, the actions taken to prevent these deficiencies in the future.

3.08 CONCRETE PIPE, CULVERT, AND RELATED ITEMS

3.08.01. Scope

A. These procedures provide a means by which the Michigan Department of Transportation (MDOT) may acquire - from specific qualified sources - concrete pipe, precast units for drainage structures, and culvert sections, of the required quality while eliminating the necessity of testing on a project by project basis.

B. These procedures include the certification of all concrete pipe, precast units for drainage structures, and culvert sections, manufactured and tested in accordance with current ASTM or AASHTO specifications. Concrete brick, block, and manhole bases are accepted from Approved Manufacturers, with a General Certification, and are not covered by this procedure.

3.08.02. Referenced Documents

A. The items certified by these procedures must be manufactured and tested according to the following requirements:

ASTM C 14	AASHTO M 86	Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 76	AASHTO M 170	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 412	AASHTO M 178	Concrete Drain Tile
ASTM C 444	AASHTO M 175	Perforated Concrete Pipe
ASTM C 478	AASHTO M 199	Precast Reinforced Concrete Manhole Sections
ASTM C 497	AASHTO T 280	Testing Concrete Pipe, Sections, or Tile
ASTM C 506	AASHTO M 206	Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C 507	AASHTO M 207	Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
ASTM C 655	AASHTO M 242	Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
ASTM C 1504		Manufacture of Precast Reinforced Concrete Three-Sided Structures for Culverts and Storm Drains
ASTM C 1577		Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers

3.08.03. Qualification of New Plants

A. Plants for which MDOT does not have a record of past production, which desire to furnish products for use on MDOT projects must apply for Approved Manufacturer status according to the requirements of section 3.02.

3.08.04. Testing Procedures

A. Concrete Pipe and Precast Drainage Structure Units

1. Test each production run of pipe or precast drainage structure units intended for use on MDOT projects, in accordance with current ASTM specifications. The frequency of testing must be that which the manufacturer determines necessary to assure compliance with specification requirements.

B. Precast Concrete Culvert Sections

1. Testing frequency must be as specified in ASTM C 1504, ASTM C 1577, and/or contract documents.

2. Compressive strength must be determined in accordance with the applicable ASTM or AASHTO specification.

3. Section dimensions and geometry, and reinforcement type and location must be verified and reported for each section.

4. The producer must certify the aggregates, cement, and steel reinforcement used meet the requirements of ASTM C 1504, ASTM C 1577, and the contract documents.

5. MDOT will perform quality assurance testing and inspection for culvert sections with span lengths 20 feet and greater (measured parallel to the roadway centerline) and may perform quality assurance testing and inspection for culverts with a span length (measured parallel to the roadway centerline) less than 20 feet. See Chapter 4 (Miscellaneous Procedures) of this manual for quality assurance testing and inspection of non-prestressed concrete fabrication.

3.08.05. Conducting Tests

A. The required quality control testing may be conducted by an independent testing laboratory, a Professional Engineer licensed in the State of Michigan, or any responsible representative designated by the manufacturer, except as provided in Sections 3.08.04.B.5 and 3.08.04.B.6 above.

3.08.06. Load Testing Equipment

A. In accordance with the requirements of Section 909.02 of the Standard Specifications for Construction, each pipe manufacturer must provide a suitable standard testing machine maintained in good working order.

B. Manufacturers producing only Precast Units for Drainage Structures will not be required to provide a standard testing machine, if an independent testing laboratory is engaged to perform the testing. Independent testing laboratories must provide a suitable standard testing machine maintained in good working order.

C. All testing machines will be calibrated by the Standard Methods of Verification of Testing Machines, ASTM E 4.

D. Pipe testing machines must be verified yearly in accordance with the following schedule:

1. On-site verification is required one year from granting Approved Manufacturer status, with succeeding on-site verification each third year thereafter. Testing performed must subject the pipe to full failure.

2. Off-site verification will be permitted for each of the two intervening years. Testing may include VI or coring of pipe.

NOTE: "On-site" verification is defined as verification at the pipe manufacturing plant of the complete testing machine apparatus. "Off-site" verification is defined as verification of a portion of the testing conducted at a place other than the pipe manufacturing plant.

E. Report and Certification – Submit a report to CFS including the information listed in ASTM E 4, Section 20 and 21, and the following:

- A calibration table showing the actual loads applied as indicated by the calibrating device and the corresponding loads indicated by the testing machine; the error, and the percentage of error.
- The smallest change of load, which can be estimated on the load-indicating apparatus of the testing machine. Refer to ASTM E 4, 16.3.
- A notation indicating either on-site or off-site verification.

1. The calibration table must be prominently posted near the testing equipment.

3.08.07. Test Reports

A. Test reports must be assigned a lot number with a sub-designation of a test number. Short runs must be covered by one lot number and one test number while continuous runs must be covered by one lot number and several test numbers determined by the quantity produced in the run.

B. Copies of all test results used for certification must be on file at the office of the manufacturer and available for review by MDOT representatives.

3.08.08. Product Identification

A. Concrete Pipe and Precast Drainage Structure Units

1. Make clearly legible markings with a permanent type marking medium. Mark each unit so the information will appear in the following order:

- Producer's name or initials
- Plant designation
- Date of manufacture
- ASTM designation, including class (if applicable)
- Testing lot number

B. Precast Concrete Culvert Sections

1. Mark sections according to the requirements of ASTM C 1504, ASTM C 1577, unless the contract documents specify a unique process.

3.08.09. Manufacturer’s Certification

A. The manufacturer must complete a certification containing the following:

- Applicable ASTM or AASHTO Specification
- Manufacturer
- Project number
- Contractor
- Type and class of material
- Lot number
- Diameter, in inches
- Lineal feet
- Number of pieces

- Signature of manufacturer's authorized representative

B. Two copies of the certification must accompany the shipment.

3.08.10. Stockpiling

A. In those instances where a manufacturer does not propose to consign total production to certified stock, the material to be certified must be readily identified and stored in areas separate from the commercial stock.

3.08.11. Records

A. The manufacturer must maintain an accurate running inventory of certified stock, and the material must be stockpiled in such a manner the inventory can be checked by an MDOT representative as necessary.

3.08.12. Certification Verification

A. MDOT will verify the manufacturer's certification and procedures by Certification Verification a minimum of once per year.

B. The Certification Verification will consist of one or more of the following:

- Random sampling and testing
- Review of inventory records
- Inspection of stockpiling practices
- Observation of manufacturing process
- Witnessing of D-loading of a random stockpiled yard sample, intended for MDOT use, to the required loading and ultimate failure to confirm compliance with strength specifications.

3.08.13. Withdrawal and Reinstatement of Certification Privileges

A. MDOT will review the results of testing of Certification Verification samples for conformance to specification requirements. Certification privileges may be withdrawn if the certified material deviates from specification requirements in a critical parameter or if the plant produces products that repeatedly fail to conform to specification requirements by any amount in any aspect. A warning letter may be written indicating the improper procedure and requesting action to rectify the problem.

B. Products from a plant from which MDOT has withdrawn certification privileges may not be used on projects until each individual shipment has been tested and approved by MDOT.

C. Withdrawn certification privileges can be reinstated only if the plant has corrected the identified deficiencies and has documented, to the satisfaction of MDOT, the actions taken to prevent these deficiencies in the future.

4.01 CONCRETE PIPE INSPECTION

4.01.01. Scope

A. This procedure is to supplement the normal sampling, testing and inspection of concrete pipe by listing various exceptions to the applicable documents. These exceptions are found in Sections 4.01.03, 4.01.04 and 4.01.05 of this document.

4.01.02. Reference Documents

A. Standard Specifications for Construction.

B. AASHTO and ASTM Standards:

ASTM C 14	AASHTO M 86	Concrete Sewer, Storm Drain, and Culvert Pipe (Unreinforced)
ASTM C 76	AASHTO M 170	Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
ASTM C 412	AASHTO M 178	Concrete Drain Tile
ASTM C 507	AASHTO M 207	Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe
ASTM C 655	AASHTO M 242	Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe
ASTM C 39	AASHTO T 22	Compressive Strength of Cylindrical Concrete Specimens
ASTM C 31	AASHTO T 23	Making and Curing Concrete Test Specimens in the Field
ASTM E 4	AASHTO T 67	Standard Practices for Load Verification of Testing Machines
ASTM C 497	AASHTO T 280	Standard Methods of Testing Concrete Pipe, Sections, or Tile

C. MDOT Materials Source Guide

4.01.03. Basis of Acceptance

A. Pipe less than 3 feet in diameter will be tested by the three edge bearing method, using full sized units of pipe, unless otherwise specifically authorized by MDOT.

B. Pipe 3 feet in diameter and larger may be tested for concrete strength by testing cores obtained from the pipe or by the three edge bearing method, at the option of the manufacturer.

C. In special cases, and with prior MDOT approval, concrete strength may be determined by making and testing at least two 6 x 12 inch cylinders from the concrete used in casting the pipe.

1. Cylinders are to be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

4.01.04. Calibration of Testing Devices

A. The calibration table for each device used (showing the gauge reading and the load, in newtons) must be prominently posted near the testing equipment.

B. Post the "Certification of Calibration" near the testing equipment.

4.01.05. Reports

A. The results of inspection will be reported on "Field Report for Concrete Pipe", Form 1920.

4.02 CORRUGATED METAL PIPE AND METAL END SECTIONS FABRICATION

4.02.01. Scope

A. This procedure is to be followed for acceptance inspection where certification has not been made, visual inspection of small quantities, or where certification verification inspection is required.

4.02.02. Reference Documents

A. AASHTO Standards

M 36 Corrugated Steel Pipe, Metallic Coated, for Sewers and Drains
M 196 Corrugated Aluminum Pipe for Sewers and Drains
M 245 Corrugated Steel Pipe, Polymer Precoated, for Sewers and Drains

B. Materials Quality Assurance Procedures Manual

3.03 Certification Verification Sampling and Testing
4.09 Thickness of Zinc and Epoxy Coatings Applied to a Ferrous Base

C. Standard Specifications for Construction

4.02.03. Procedure

A. *Corrugated Metal Pipe*

1. This inspection is primarily a visual inspection of an order of fabricated pipe and consists essentially of dimensional measurements and inspection of workmanship. It includes, but is not limited to, the inspection and/or reporting of the following:

- Shape (circular, pipe arch, etc.).
- Annular or helical corrugations.
- Dimensions, spacing, and placement of rivets.
- Lock seam or welded seam.
- Widths of laps, and depth and spacing of corrugations.
- Weight of metallic coating (on steel pipe), heat number and thickness of sheet.
- Thickness of polymer coating, each side, on polymer coated pipe.
- End finish.
- Size, location, condition, and number of perforations (when required).
- Quantity of each size of pipe in the order.
- Workmanship.

2. The fabricator or contractor must provide assistance needed for proper inspection, depending on where the inspection is being conducted.

3. Uncertified sheets used in the fabricated order must be sampled and tested when their quantity exceeds the visual inspection limits found in the Materials Acceptance Requirements Table of this manual.

4. Determination of the metallic coating thickness by the use of a magnetic thickness gage, or positector, will be permitted on "Visual Inspection" quantities only.

5. Poor workmanship is sufficient cause for rejection of uncertified materials. Poor workmanship includes but is not limited to the presence of one or more of the following in any individual pipe:

- Uneven laps in riveted or spot welded pipe.
- Elliptical shape in pipe intended to be round.
- Variation from a straight centerline.
- Ragged or diagonal sheared edges.
- Loose, unevenly lined, or unevenly spaced rivets.
- Poorly formed rivet heads.
- Loose or poorly formed lockseams.
- Cracks in welded seams.
- Unfinished ends (if order requires finished ends).
- Illegible markings on the metal sheet.
- Lack of rigidity.
- Bruised, scaled, broken, or otherwise damaged metallic coating.
- Damaged or unbonded polymer coating.
- Dents or bends in the metal.

NOTE: Certified material should normally be rejected only for significant deficiencies.

6. The metallic coating (zinc or aluminum) on steel coupling bands must be the same as the coating as the pipe to be coupled. Aluminum coupling bands are to be used with aluminum pipe.

B. *Metal End Sections*

1. This inspection is primarily a visual inspection of an order of fabricated metal end sections, and consists essentially of dimensional measurements, determination of coating thickness, and workmanship.

2. The metallic coating on steel end sections must be the same as the coating on the pipe except zinc-coated steel end sections may be used with aluminum-coated steel pipe.

3. Aluminum end sections must be used with aluminum pipe.

4. Determination of the metallic coating thickness may be made by the use of a magnetic thickness gage or positector.

5. The end sections must be furnished with the appropriate coupling band and connector section.

4.02.04. <u>Identification of Material</u>

A. Tag a sufficient number of pieces of pipe, coupling bands and end sections so the order can be identified at the project site.

B. Each tag must show the date of fabrication, Control Section ID, and Job Number.

4.02.05. Certification Verification

A. A sufficient number of pieces in the shipment will be checked and reported to validate the quality of the manufacturer's product.

B. Information may be reported for each piece of material checked, or if appropriate, averages of several measurements, weights, etc. may be reported.

C. The remarks section of all certification verification inspection reports must include a statement as to whether the material does or does not meet specification requirements.

4.02.06. Reports

A. Inspection of corrugated metal pipe and end sections will be reported on the Inspectors Daily Report.

4.03 LANE TIE AND CONCRETE ANCHOR TESTING

4.03.01. Scope

A. The purpose of performing lane tie or concrete anchor pull-out tests is to determine if these devices have been properly installed. When properly installed, lane ties or anchors should develop pull-out loads that exceed requirements of MDOT Specifications. Lane ties refer to deformed reinforcing bars (with or without epoxy coating), that are cast into the concrete. Concrete anchors refer to mechanical or adhesive anchors that are drilled and set into hardened concrete. Adhesive concrete anchors may also be used as lane ties.

4.03.02. Reference Documents

A. Lane tie load sustaining requirements are covered by the current edition of MDOT's Standard Specifications for Construction 602.03F and 914.10, Standard Plan R-41 series, and the contract documents.

4.03.03. Equipment and Supplies

A. Testing Equipment

- Testing frame; including hydraulic cylinder.
- Hydraulic pump unit; including hose and hydraulic pressure gage.
- 50 pound weight with attached ¾ inch diameter rod.
- Dial indicator kit.
- Drawbar and wedge fixture.

B. Additional Equipment

- Wood blocking for frame legs
- Crescent wrench
- Screw driver
- Vice-grips
- Hammer
- Measuring tape
- Shovel

4.03.04. Selection of Sample

A. Do not perform lane tie pull-out tests until the concrete has attained a flexural strength of 550 psi [653 psi for certain torque anchors].

B. Select a minimum of 15 samples for testing. Samples should be selected from various portions of the project, and scattered throughout the available area. Any areas where there have been changes in method of installation, changes in personnel, changes in equipment, or equipment malfunction should be tested. The number of times that a job must be checked will be determined by the Construction/Project Engineer based on the amount of bulkhead joints with anchoring devices.

4.03.05. Test Procedure for Anchoring Devices Used as Lane Ties

A. Attach drawbar or wedge fixture to the anchoring device which is to be tested.

CAUTION: Any misalignment must be compensated for by wood blocking placed between the appropriate frame leg and the concrete.

B. Slightly preload the anchoring device 100 lbf to 200 lbf, by applying pressure with the hydraulic cylinder.

C. Position and preload the dial indicator to measure extrusion of the anchoring device. Zero the dial indicator before applying any additional load.

CAUTION: When applying load to anchors, do not stand behind the frame. Sudden releases can occur, causing the frame to fly back.

D. Apply load to the anchoring device using slow uniform strokes on the hydraulic pump handle.

E. Monitor both the pressure gage and the dial indicator until one of the following occurs:

1. The anchoring device extrudes 1/16 inch out of the concrete. When this happens, record the load at this point.

   NOTE: Misalignment can sometimes cause the dial indicator to move opposite of the direction it should. When this happens, watch the anchoring device and re-zero the indicator when actual extrusion is first observed.

2. If there is not sufficient movement of the anchor to reach 1/16 inch extrusion, load to 12,000 lbf and stop. Record the capacity as 12,000 lbf.

F. When recording data of anchor pull-out tests, set up data sheet as follows:

Sample Number	Load at Initial Slippage	Load at 1/16 inch Extrusion	Ultimate Load	Ultimate Extrusion

G. If the 12,000 lbf load is not reached, the ultimate load is considered to have occurred when the lane tie loading (as indicated by the pressure gage) remains stationary or decreases as pumping is continued, and anchor extrusion is taking place. Ensure that the gripping devices are not slipping.

H. The lane ties are acceptable if the average load per foot of joint equals or exceeds the requirements of Section 602.03F of the Standard Specifications.

4.03.06. Test Procedure for Anchoring Devices used for Applications Other Than Lane Ties

A. Use the same procedure as used for lane ties. The requirements for load sustaining capabilities and extrusion will be stated in the Contract Documents.

4.04 PRESTRESSED STRUCTURAL PRECAST CONCRETE FABRICATION

4.04.01. Scope

A. This prestressed structural precast concrete fabrication inspection procedure should be used to aid the quality assurance inspector (QAI) in interpreting and enforcing the contract documents for prestressed concrete elements. Fabrication inspection includes the time from verifying materials used for fabrication through loading for shipping to the construction site.

4.04.02. Reference Documents

A. QAI must have a thorough knowledge of the following references:

1. The following sections of the MDOT Standard Specifications for Construction (MDOT SSC) as modified by supplemental specification 12SS-001A – Errata, as applicable:

Section 104	Control of the Work
Section 105	Control of the Materials
Section 708	Prestressed Concrete

2. The following special provisions, as applicable:

12SP-105A	Source of Steel and Iron (Buy America)
12SP-604C	QC and Acceptance of PCC for Structural Precast Concrete
12SP-708A	Special Provision for Strand Debonding
12SP-708B	Prestressed Concrete Bulb-Tee Beam

3. Contract plans and specifications

4. Construction Field Services Division (CFS) Materials Source Guide (MSG)

5. MDOT Structural Fabrication Quality Assurance Guidance Document

6. MDOT Structural Fabrication Unit E-Construction Process

7. Prefabrication meeting minutes (if available)

B. QAI must be familiar with the following references:

1. MDOT Structural Fabrication Request for Information Process

2. MDOT Shop Drawing Review Process

3. MDOT Structural Fabrication Nonconformance Process

4. Michigan Test Methods

MTM 102	Michigan Test Method for Abrasion Resistance of Aggregate by the Los Angeles Machine
MTM 108	Michigan Test Method for Materials Finer than No. 75 Sieve in Mineral Aggregates by Washing
MTM 109	Michigan Test Method for Sieve Analysis of Fine, Dense Graded, Open

	Graded, and Coarse Aggregates in the Field
MTM 114	Michigan Test Method for Making Concrete Specimens for Freeze-Thaw Testing of Concrete Coarse Aggregate
MTM 115	Michigan Test Method for Testing Concrete for Durability by Rapid Freezing in Air and Thawing in Water
MTM 206	Michigan Test Method for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders

5. AASHTO Standards

T 22	Compressive Strength of Cylindrical Concrete Specimens
T 23	Making and Curing Concrete Test Specimens in the Field
T 231	Capping Cylindrical Concrete Specimens

6. ASTM Standards

A 185	Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A 416	Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete
A 497	Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C 94	Standard Specification for Ready-Mixed Concrete
C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
C 138	Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete
C 143	Standard Test Method for Slump of Hydraulic Cement Concrete
C 172	Standard Practice for Sampling Freshly Mixed Concrete
C 173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C 595	Standard Specification for Blended Hydraulic Cements
C 617	Standard Practice for Capping Cylindrical Concrete Specimens
C 1231	Standard Practice for Use of Unbonded Caps in determination of Compressive Strength of Hardened Concrete Cylinders
C 1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar Bar Method)
C 1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar Bar Method)

7. PCI Safety and Loss Prevention Manual SLP-100

8. MDOT Accident Prevention Plan

4.04.03. Qualifications, Responsibilities, Duties, and Equipment

A. Qualifications of the QAI – QAI performing the fabrication inspection must possess the following qualifications:

1. Michigan Professional Engineer (PE) license or Precast/Prestressed Concrete Institute (PCI) Technician Level II;
2. Michigan Concrete Association (MCA) Level I Field Testing Technician certification or American Concrete Institute (ACI) Concrete Field Testing Technician – Grade I (except period of effectiveness will be reduced from 5 years to 3 years to match MCA); and
3. Michigan Certified Aggregate Technician (MCAT) Level I (only required for aggregate sampling).

B. Responsibilities of the QAI – QAI performing the fabrication inspection is not permitted to make changes to the contract and has the following responsibilities:

The Contractor, Fabricator, and MDOT will approach quality control and quality assurance as a team effort to facilitate accurate and timely construction. QAI's verification does not relieve the Fabricator from the responsibility to perform the required testing and inspection to produce a product satisfying the contract. Though QA inspection may include all aspects of fabrication, the QAI must not supersede QC, which is the responsibility of the Fabricator. If QC is not accomplishing its role then the Structural Fabrication Unit, Engineer, Contractor, and Fabricator must determine the necessary corrections.

QAI is the responsible party, representing the Engineer, who performs quality assurance verification inspection on the element after quality control (QC) inspects and approves the item of work. The QAI must be at the fabrication facility at all times during fabrication as required by the inspection procedure stated below. If issues arise, it will be at the Engineer's discretion whether to increase the level of QA inspection.

It is the Engineer's responsibility to engage the Engineer of Record (EOR) when making structural decisions. The Engineer is also responsible for following internal MDOT procedures for review and approval of shop drawings, fabrication procedures, request for information (RFI), nonconformance reports (NCR), and for professional decision making on fabrication problems that arise. The Engineer relies on the Structural Fabrication Unit to manage and assist when appropriate. The Engineer has the prerogative for holding a prefabrication meeting with the Fabricator to discuss and clarify the contract plans and specifications. The Engineer is the responsible party who ensures MDOT's fabrication QA program is followed for inspection and acceptance of the element.

Fabrication should proceed only with approved shop drawings. However, if the Fabricator must proceed prior to receipt of approved shop drawings (performing work at their own risk), ensure that the Structural Fabrication Unit is aware of this activity and await instruction on how to proceed. If the Engineer permits the work to proceed without approved shop drawings, proceed with basic QA functions using the non-approved shop drawings. Later, verify notes against approved drawings. Notify the Structural Fabrication Unit immediately if fabrication is not in conformance with the approved shop drawings.

C. Duties of the QAI – QAI performing the fabrication inspection has the following duties:

1. QAI must thoroughly understand the contract documents.

2. QAI must verify steel material certifications show compliance with Buy America contract requirements.
3. QAI must be proficient in performing fresh concrete tests, sampling aggregate and other materials, verifying material traceability, and inspecting concrete pours.
4. QAI must be proficient in writing reports and using computers.
5. QAI must notify the Engineer if production begins before approved shop drawings are on the shop floor and provided to the QAI.
6. QAI must communicate all concerns through QCI or whomever the Fabricator directs during the prefabrication meeting.
7. QAI must communicate with QCI to obtain the work schedule.
8. QAI must follow *MDOT's Structural Fabrication E-Construction Process* for closing out fabrication inspection file.

D. Deficiencies on Local Agency Projects – MDOT's QAI must notify the Structural Fabrication Unit if they observe fabrication or inspection deficiencies on local agency program (LAP) projects. The Structural Fabrication Engineer will report the deficiencies via email to the Engineer that is responsible for construction oversight of the local agency project and carbon copy the applicable CFS and Design Division LAP Engineers.

E. Inspection Facilities and Access – Facilities for the QAI must be provided by the Fabricator per contract documents. QAI must have access to all parts of the work at all times. The authority and general duties of the QAI are specified in Section 104.01.D and E of the MDOT SSC.

F. Inspection Equipment – QAI will be furnished with the following items by the Engineer:

1. Contract documents (MDOT SSC, special provisions, standard plans, special details, plan sheets, etc.)
2. Approved shop drawings (provided by Fabricator)
3. Access to MDOT's Fabrication Inspection & Construction System (FICS)
4. MDOT shop approval stamp

QAI must provide the following inspection equipment:

1. Computer with high speed internet access
2. Cell phone with camera
3. Flashlight
4. Temperature measuring devices capable of covering the range from 0°F to 200°F
5. Fresh concrete testing equipment (thermometer, slump cone kit, and air-meter)
6. Measuring devices (200 foot and 20 foot steel tape and calipers)
7. Straightedge and levels
8. Safety equipment
9. Other as needed for the project

4.04.04. <u>Inspection Procedure</u>

A. Prefabrication Meeting – Prefabrication meetings facilitate effective quality control and quality assurance on the project and are conducted by MDOT's Structural Fabrication Unit prior to the start of fabrication and preferably after shop drawings have been approved. The Structural Fabrication Unit, QAI, Fabricator, and QCI must be present, whereas the Engineer and Contractor should be present to ensure a team effort to facilitate accurate and timely construction. Quality assurance and quality control contact information will be shared during this meeting to ensure effective communication.

B. Fabrication Inspection – Prestressed concrete must be fabricated in accordance with the MDOT SSC and contract documents. QAI and QCI must pass annual MDOT independent assurance testing (IAT) prior to performing fresh concrete testing. Fabrication inspection must be performed as shown below:

1. Prestressed concrete fabrication inspection consists of verifying compliance with the approved shop drawings, contract documents, and approved NCRs. RFIs must be incorporated into the approved shop drawings for the QAI to inspect to.

2. An approved Materials Source List (MSL) is provided to the QAI by the Engineer so that the QAI knows what materials are being incorporated into the project and what the basis of acceptance is. The MSL is used to track material sampling by the QAI and to foster communication with QCI to ensure all required sampling and testing occurs in a timely manner to prevent impacts to the project schedule. It is the Fabricator's responsibility to notify the QAI when materials are available for sampling.

3. QAI begins by inspecting materials that will be used in the fabrication process and ensures they are being stored correctly, tagged for traceability purposes, and are in conformance with the contract documents. Next, the QAI inspects the Fabricator's operations to ensure the condition of the equipment and work area for conformance to the contract documents.

4. MDOT's Accident Prevention Plan states, "MDOT employees shall not engage in any act which would endanger another employee or themselves". QAI must notify the Engineer immediately if work conditions exist that are not safe. If the level of inspection diminishes below what is specified in this QA procedure, due to safety concerns, then the element will not be approved for use.

C. Strand Tensioning

1. *General Information* – While the strand is still visible, the QAI must inspect the strands to assure that they are free of oil or other foreign material. Strands not free of oil or foreign material, or that contain kinks, bends, nicks, or other defects (including scale or excessive rust) will be brought to QCs attention that incorporation of these nonconforming strands will render the element unacceptable and the element will not be approved for use.

   a. Strands are positioned to duplicate the strand pattern shown on the approved shop drawings. Changing the vertical position of the strands must have the approval of the Engineer. Changing the horizontal position of the strands to simplify fabrication or to accommodate two strand patterns on a bed is permitted provided the following is still achieved:

      i. Specified concrete cover;
      ii. Center to center distance of strands is at least 2 inches;
      iii. Number of strands per row is maintained; and
      iv. Resulting strand pattern is symmetrical about the vertical centerline of the element.

   b. Two strand patterns is permitted to be combined on a casting bed provided the following conditions are met and approved by the Engineer:

i. Bond breaker must be placed on each of the unrequired strands for the full length of each element. Bond breaker (rigid, oversized, and monolithic) material requires the approval of the Engineer.
ii. Maximum of two full length debonded strands per element.

c. All supports used to position the strand rows must be of adequate thickness to hold the true position of the strands.

d. Inspection of the tensioning operation consists of verifying the jack is calibrated and observing the accurate introduction of the initial load in each of the strands. Final stressing of the strands is performed by application of load into each strand or all the strands at once to produce an elongation equaling a ***net elongation*** (gross elongation minus live end seating). The QAI must verify the allowable stress in each strand by measuring the ***net elongation*** of the individual strands after the final stressing. The maximum load applied to each strand, as indicated by the pressure gauge of the tensioning device, is also recorded for back checking.

e. QAI must complete independent strand tensioning calculations for verification purposes with QC.

2. The QAI must verify the load (measured in pounds) and elongation (measured in inches) applied to each strand using the following procedures:

a. *Initial Load* - After all strands are positioned on the casting bed each strand is secured by a strand-vise at the dead end anchoring bulkhead of the casting bed. Each strand is individually fitted at the live end anchoring bulkhead (tensioning end) of the casting bed and an ***initial load*** is applied either one strand at a time or all at once. The ***initial load*** must be designated by the Fabricator and must not exceed 5000 pounds.

When the ***initial load*** is reached, a reference mark is made on the strand on the outside of the live end anchoring bulkhead such that measurement of continued elongation can be observed. The purpose of applying an ***initial load*** to each strand is to establish a constant starting point for measuring the ***net elongation*** measurements by eliminating slack in the system. At this time, the strand pattern is checked at each bulkhead to make certain all strands are in their correct position and none of the strands are crossed.

Final Load – Is the force required beyond ***initial load.***

b. *Net Elongation* – Using the strand mark from the previous step (after initial load) the final load is applied to the strand. The distance between the strand mark and the reference point must be measured to the nearest 0.0625 inches to determine when the ***net elongation*** *is reached*. If the measured elongation is equal to or slightly greater than (5 percent or less) the computed elongation, the tensioning operation is complete. Minor adjustments in the jacking operation are made to bring the reference mark to the desired measurement. When the tensioning operation for each strand is complete and before the tension is released from the jack, a second reference mark must be made on the strand at the inside of the anchoring plate and the strand-vise must then be tapped into position against the outside face of the anchoring plate. When the tension has been released from the jack the QAI must check the reference marks on the strand at the

inside of the anchoring plate to determine that no slippage of the strand-vise (live end seating loss) has occurred. If slippage has occurred, then it must be compared to the assumed live end seating loss used in the strand tensioning calculations. Any differences must be noted and communicated to QC.

c. *Strand Elongation* - The tensioning operation must be stopped immediately whenever the strand is elongating without a corresponding increase in the load, or the load increases without a continuing increase in strand elongation. In these occurrences, the following steps must be taken:

i. Strand elongation computation is checked;
ii. Casting bed length is verified;
iii. Modulus of elasticity of the strand is verified; and
iv. Factors restricting the free movement of the strand are reviewed.

Temperature changes may affect the hydraulic system of the tensioning apparatus resulting in variations in load readings.

d. *Tensioning Draped Strands* - QAI must be alert to the strand elongation and tensioning operation discussed above. In some cases, the number and efficiency of hold-down/hold-up hardware may restrict the free movement of a strand over the entire bed length resulting in a continuing elongation of strand without a corresponding increase in the load. When this situation occurs, the tensioning operation is stopped and the remaining elongation developed in the strand taken by tensioning the strand from the opposite end of the casting bed.

e. *Confirming Uniform Elongation of Draped Strands* - This can be accomplished by marking-off a 10 foot (or more if available) length of draped strand at the opposite end of the bed after the initial load operation has been completed. At the completion of the final measured elongation operation, the measured distance between the marks should have increased to the ***net elongation*** computation for a 10 foot strand length (or whatever was initially marked off).

f. *Wire Failure in Strand* - See PCI MNL 116 for acceptance of failure of individual wires in a pretensioning strand.

D. *Forming and Casting*

1. *General Information* - QAI must confirm the dimensional requirements of the bulkheads, side forms, bearing plates, steel reinforcement, void boxes, inserts, and any other devices per the approved shop drawings as part of their post-pour inspection. The only exception is that anything that cannot be inspected post-pour, must be inspected during pre-pour. It is important to emphasize that QA must not supersede QC so the QAI's inspection must come after QC has completed their inspection and approves the element. QAI then uses the QC inspection reports (if available) during their verification inspection.

2. *Concrete Forms* - Concrete forms must be maintained and remain true to the shapes and dimensions as shown on the approved drawings.

a. Metal forms must be used since they are designed and aligned to not restrict the longitudinal movement of the casting when the prestressing force is transferred. Forms must be well braced and stiffened against undesirable deformations under pressure of fresh concrete and must have smooth joints and inside surfaces accessible for adequate cleaning after each use.

b. Joints between panel forms must be made and maintained smooth and tight. Unless otherwise shown on approved shop drawings, all corners or intersections of surfaces exposed in the completed structure must be chamfered with a minimum dimension of 0.50 inches and all re-entrant angles must be rounded with a minimum radius of 0.75 inches.

c. Forms that are warped, distorted, damaged, or improperly cleaned must not be used. Wood forms may be used for bulkheads. The inside faces of all forms must be coated with an approved chemical release agent.

3. *Reinforcing Steel* – QAI must confirm that the reinforcing steel is of the correct size, free from defects, and properly positioned. The reinforcing steel must be free of oil, lubricants, foreign material, and excessive rust. If epoxy coated bars are to be used then nicks in the coating are not permitted.

   QAI must spot check that the reinforcing steel has been properly positioned and secured in accordance with the approved shop drawings and make certain that inserts have been placed where required.

4. Void Boxes - Void boxes must be of the dimensions and positioned in the form in accordance with the approved shop drawings.

   After the bar reinforcement assembly has been positioned in the formwork, the QAI must confirm that the void boxes are securely clamped to the formwork so they cannot move out of position during consolidation activities. After the unit has been cast, and immediately after the top has been struck-off, the top slab thickness must be confirmed by the QAI to assure that there has been no upward movement of the void box and that the top slab thickness is within the acceptable specification limits. The depth of concrete over the void boxes will be spot checked and any concerns noted and immediately shared with QC.

5. *Tests on Fresh Concrete* – QAI must perform testing as required in the contract documents and document the results in MDOT Form 0590. The Fabricator must collect additional fresh concrete for QAI to perform their tests as needed.

6. *Placing of Concrete* – The concrete must be promptly placed with minimum handling to avoid segregation of the materials and the displacement of the reinforcement. Each element must be cast in a continuous operation with minimal interruption between the placing of adjacent portions of concrete and each layer must be placed and consolidated before the preceding layer has taken initial set.

7. *Consolidation of Concrete* – A minimum amount of vibration necessary to thoroughly consolidate the concrete must be used. QAI must verify a rubber coated vibrator head is used when epoxy-coated or other coated reinforcement is used.

E. *Transfer of Prestress* – The tension in the strands must not be transferred to the concrete in the element until the concrete has attained the required compressive strength as indicated

by test results of QC compressive strength test cylinders which have been cast and match cured per the contract documents. QAI must witness this testing.

1. Forms are removed and the strands are released by simultaneously cutting both ends of the same strand using a torch or other method approved by the Engineer. The Fabricator must release strands in a symmetrical pattern about the vertical centerline. Extreme care must be exercised by the Fabricator to avoid damaging the concrete by superheating it with the torch.

2. Elements are moved from the casting bed to the yard upon completion of the transfer of prestress. After removal from the bed, the QAI must immediately inspect the element for any defects created during casting and perform post-pour inspections after QC has completed their inspection and approves the element. QAI must note any deficiencies on Form 0590 (Report of Field Tests, Intermediate, and Final Inspection Prestressed Concrete) and immediately notify the Fabricator and Engineer. The Engineer may request the QAI to complete a QA NCR and arrange a meeting with QC to discuss why the deficiency wasn't caught by QC.

F. *Curing Requirements* - Curing requirements for prestressed concrete must be as specified in subsection 708.03 of the MDOT SSC as modified by the contract documents. When steam or radiant heat curing is used, recording thermometers must be provided by the Fabricator that monitors the time/temperature relationship through the curing period while artificial heat is used. The QAI must verify that the recording thermometers are placed in critical locations for monitoring the time/temperature relationship during the curing period. Verify QC has the required number of recording thermometers per the contract documents and they are placed at locations where the anticipated heat generated by the concrete is the lowest and highest just after initial concrete set. Documentation from the Fabricator's recording thermometer must be given to the QAI for their review. Temperature requirements during the curing operation must be in accordance with the contract specifications.

G. *Material Requirements* – Materials must meet the requirements of the contract documents unless a RFI requesting alternate materials has been approved by the Engineer. Material must be from suppliers and producers listed in the MDOT MSG. Material from any other source must be tested for acceptance prior to incorporation into the project.

H. *Shipping Requirements* – Elements must attain the required compressive strength as indicated by test results of QC compressive strength test cylinders, which have been cast and match cured for this purpose as described per the contract documents. These cylinders must be cast with metal MDOT tags and the compression testing must be witnessed by the QAI.

4.04.05. Reports

A. The Engineer may require a periodic status report from the Structural Fabrication Unit; therefore, all reports are required to be completed in a timely and orderly manner using the applicable fillable Adobe portable document format (PDF) forms listed below that can be found on MDOT's website. Make entries as soon as possible after an event or conversation to ensure accuracy. Number the reports consecutively until completion of the work, with the last report noted "final".

B. QAI must complete an accurate and detailed account of fabrication for the project. The report must include a discussion of fabrication progress for all aspects of the work. It is intended to be a detailed record of the status of fabrication and should include number of

elements fabricated, documentation of specification and procedure compliance as well as documentation of conflicts, repairs, and other problems or discussion which could affect the project in anyway. If force account work is taking place, document each day that the work occurs in the shop and which elements are being worked.

C. Documentation is not a substitute for appropriate dialogue with the Fabricator, but should provide a record of important discussions. In some cases, the QAI is more familiar with the events or issues and therefore should review and comment on draft copies of the Structural Fabrication Unit's correspondence.

D. Reports must be assembled into one fabrication inspection Adobe portable document format (PDF) file and stored in MDOT's ProjectWise document storage program per *MDOT's Structural Fabrication Unit's E-Construction Process*. The Engineer will receive a fabrication inspection memorandum from the Structural Fabrication Engineer after fabrication inspection is complete. The memorandum is for informational purposes and is not used for acceptance.

E. Below is a list of various MDOT reports and a brief description of their purpose and use requirement. Similar forms can be used in place of the standard MDOT form if noted below.

1. *Report of Strand Tensioning (Form 0513)* – This form must be completed by QAI for each bed, which may contain several elements.

2. *Fresh Concrete and Strength Tests Report (Form 0590)* – This form must be completed by QAI for each casting bed, which may contain several elements.

3. *Repair Observation Report (Form 1981)* – This form is only used if QAI performs QA verification inspection on repairs that have been approved by the Engineer.

4. *Bar Reinforcement Report (Form 1985)* – This form is only used if QAI performs QA verification inspection on bar reinforcement for prefabricated bridge element systems (PBES) or other elements that contain large amounts of reinforcement as directed by the Engineer.

5. *Structural Precast Concrete Folder Checklist (Form 2001)* – This form must be completed by QAI for each project. The checklist is placed on top of the fabrication inspection folder when the project is complete.

6. *Pre and Post Pour Inspection Checklist (Form 5616)* – This checklist must be completed by QAI for a minimum of one element per project. The checklist is placed in the fabrication inspection folder when the project is complete.

7. *Structural Precast Concrete Shop Inspection Report (Form 5617)* – This form must be completed by QAI on a weekly basis for each project and should contain a brief narrative of the work performed over the reporting period. The report must contain the following information: Weather conditions, elements worked on, work activity, non-conformances, shipping, force account work (rare), and anything else deemed important by the QAI.

4.04.06. <u>Stockpile Payment</u>

A. This stockpile payment section directs the QAI on the requirements when stockpile payment inspection is requested by the Structural Fabrication Unit. The QAI must perform the following steps:

1. Verify fabricated material meets approved shop drawings (if applicable);
2. Verify stockpile quantity and include quantity in report;
3. Verify material is labeled for MDOT use only;
4. Verify material is correctly stored and protected from the elements; and
5. Provide a report summarizing the inspection and provide adequate photos that represent the general condition of the elements, how they're being stored, and piece marks.

4.04.07. Acceptance

A. The Fabricator is required to provide the QAI with a minimum of five (5) copies of the Bill of Lading for each shipment. QAI will stamp each copy of the Bill of Lading with the MDOT "Approved for Use" stamp. It is the Fabricator's responsibility to distribute the stamped copies of Bill of Lading to the following individuals:

1. QAI
2. Engineer
3. Fabricator
4. Contractor
5. Trucking company

The Bill of Lading is required to contain, at a minimum, the following information:

1. Shipping date
2. Description of cargo (quantity, element size, weight, etc.)
3. Element unique piece mark

4. MDOT project location (route, cross road/river, and city)
5. MDOT project information (structure number, control section, and job number)
6. Manufacturer's name and address

B. Acceptance consists of the following two part process:

1. Fabrication Inspection Acceptance: Structural elements must be inspected by the QAI after they are loaded for shipping. If the structural elements meet the contract requirements, the QAI will stamp them "Approved for Use". The elements must be stamped "Approved for Use" prior to shipping. Additionally, the QAI must stamp at least five copies of the Bill of Lading that is prepared by the Fabricator. The approval stamp is for use by the Department and does not relieve the Contractor of their responsibility to meet contract requirements.

2. Visual Inspection (VI) Acceptance: The Engineer must collect one copy of the stamped Bill of Lading and use it to verify the delivered structural elements. Additionally, the Engineer must verify that the elements are stamped and visually inspect them for signs of damage that may have occurred as a result of shipping and handling. This visual inspection should be documented in the field inspector's daily report.

4.05 STRUCTURAL STEEL FABRICATION

4.05.01. Scope

A. This structural steel fabrication inspection procedure should be used to aid the quality assurance inspector (QAI) in interpreting and enforcing the contract documents for structural steel elements. Fabrication inspection includes the time from verifying materials used for fabrication through loading for shipping to the construction site.

4.05.02. Reference Documents

A. QAI must have a thorough knowledge of the following references:

1. The following sections of the MDOT Standard Specifications for Construction (MDOT SSC) as modified by supplemental specification 12SS-001A – Errata, as applicable:

Section 104	Control of the Work
Section 105	Control of the Materials
Section 707	Structural Steel Construction
Section 711	Bridge Railings
Section 716	Shop Cleaning and Coating Structural Steel
Section 906	Structural Steel
Section 908	Miscellaneous Metal Products
Section 915	Bridge Coating Systems

2. The following special provisions, as applicable:

12SP-105A	Source of Steel and Iron (Buy America)
12SP-707A	Special Provision for Structural Steel and Aluminum Construction
12SP-707B	Special Provision for Fracture Critical Members
12SP-707C	Special Provision for Modular Expansion Joint System
12SP-707F	Special Provision for Structural Steel Construction Revisions
12SP-716A	Special Provision for Shop Cleaning and Coating Structural Steel Revisions
12SP-906B	Special Provision for Structural Steel Revisions

3. Contract plans and specifications

4. AASHTO/American Welding Society (AWS) D1.5:XXXX, Bridge Welding Code (as modified by 12SP-707A, Structural Steel and Aluminum Construction), hereafter called AWS D1.5

5. Construction Field Services Division (CFS) Materials Source Guide (MSG)

6. MDOT Structural Fabrication Quality Assurance Guidance Document

7. MDOT Welder Qualification Program

8. MDOT Structural Fabrication Unit E-Construction Process

9. Prefabrication meeting minutes (if available)

B. QAI must be familiar with the following references:

1. AWS 2.4:XXXX, Symbols for Welding and Nondestructive Testing
2. AWS A3.0:XXXX, Standard Welding Terms and Definitions
3. MDOT Structural Fabrication Request for Information Process
4. MDOT Shop Drawing Review Process
5. MDOT Structural Fabrication Nonconformance Process
6. Applicable SSPC specifications
7. Applicable coating test methods
8. Applicable ASTM and AASHTO specifications
9. MDOT Accident Prevention Plan

4.05.03. Qualifications, Responsibilities, Duties, and Equipment

A. Qualifications of the QAI – QAI performing the fabrication inspection must possess the following active qualification:

1. AWS Certified Welding Inspector (CWI)

B. Responsibilities of the QAI – QAI performing the fabrication inspection is not permitted to make changes to the contract and has the following responsibilities:

The Contractor, Fabricator, and MDOT will approach quality control and quality assurance as a team effort to facilitate accurate and timely construction. QAI's verification does not relieve the Fabricator from the responsibility to perform the required testing and inspection to produce a product satisfying the contract. Though QA inspection may include all aspects of fabrication, the QAI must not supersede QC, which is the responsibility of the Fabricator. If QC is not accomplishing its role then the Structural Fabrication Unit, Engineer, Contractor, and Fabricator must determine the necessary corrections.

QAI is the responsible party, representing the Engineer, who performs quality assurance verification inspection on the element after quality control (QC) inspects and approves the item of work. The QAI must be at the fabrication facility at all times during fabrication as required by the inspection procedure stated below. If issues arise, it will be at the Engineer's discretion whether to increase the level of QA inspection.

It is the Engineer's responsibility to engage the Engineer of Record (EOR) when making structural decisions. The Engineer is also responsible for following internal MDOT procedures for review and approval of shop drawings, fabrication procedures, request for information (RFI), nonconformance reports (NCR), and for professional decision making on fabrication problems that arise. The Engineer relies on the Structural Fabrication Unit to manage and assist when appropriate. The Engineer has the prerogative for holding a prefabrication meeting with the Fabricator to discuss and clarify the contract plans and specifications. The Engineer is the responsible party who

ensures MDOT's fabrication QA program is followed for inspection and acceptance of the element.

Fabrication should proceed only with approved shop drawings. However, if the Fabricator must proceed prior to receipt of approved shop drawings (performing work at their own risk), ensure that the Structural Fabrication Unit is aware of this activity and await instruction on how to proceed. If the Engineer permits the work to proceed without approved shop drawings, proceed with basic QA functions using the non-approved shop drawings. Later, verify notes against approved drawings. Notify the Structural Fabrication Unit immediately if fabrication is not in conformance with the approved shop drawings.

C. Duties of the QAI – QAI performing the fabrication inspection has the following duties:

1. QAI must thoroughly understand the contract documents.
2. QAI must verify steel material certifications show compliance with Buy America contract requirements.
3. QAI must be proficient in testing welders, sampling materials, verifying material traceability, and inspecting welds and coating systems.
4. QAI must be proficient in writing reports and using computers.
5. QAI must notify the Engineer if production begins before approved shop drawings are on the shop floor and provided to the QAI.
6. QAI must communicate all concerns through QCI or whomever the Fabricator directs during the prefabrication meeting.
7. QAI must communicate with QCI to obtain the work schedule.
8. QAI must follow *MDOT's Structural Fabrication E-Construction Process* for closing out fabrication inspection file.

D. Deficiencies on Local Agency Projects – MDOT's QAI must notify the Structural Fabrication Unit if they observe fabrication or inspection deficiencies on local agency program (LAP) projects. The Structural Fabrication Engineer will report the deficiencies via email to the Engineer that is responsible for construction oversight of the local agency project and carbon copy the applicable CFS and Design Division LAP Engineers.

E. Inspection Facilities and Access – Facilities for the QAI must be provided by the Fabricator per contract documents. QAI must have access to all parts of the work at all times. The authority and general duties of the QAI are specified in Section 104.01.D and E of the MDOT SSC.

F. Inspection Equipment – QAI will be furnished with the following items by the Engineer:

1. Contract documents (MDOT SSC, special provisions, standard plans, special details, plan sheets, etc.)
2. Approved shop drawings (provided by Fabricator)
3. Access to MDOT's Fabrication Inspection & Construction System (FICS)
4. MDOT shop approval stamp

QAI must provide the following inspection equipment:

1. Computer with high speed internet access
2. Cell phone with camera
3. Flashlight

4. Fillet weld gauges
5. Undercut gauges
6. Instrumentation for measuring voltage and amperage
7. Temperature measuring devices capable of covering the range from 0°F to 1650°F
8. Dry film thickness gauges
9. Wet film paint thickness gauge
10. Surface roughness comparator gauge
11. Extra course replica tape for measuring blasted steel surface profile
12. SSPC book of pictorial blast standards
13. Temperature and humidity measuring instruments
14. Measuring devices (200 foot and 20 foot steel tape and calipers)
15. Straightedge and levels
16. Safety equipment
17. Other as needed for the project

4.05.04. Inspection Procedure

A. Prefabrication Meeting – Prefabrication meetings facilitate effective quality control and quality assurance on the project and are conducted by MDOT's Structural Fabrication Unit prior to the start of fabrication and preferably after shop drawings have been approved. The Structural Fabrication Unit, QAI, Fabricator, and QCI must be present, whereas the Engineer and Contractor should be present to ensure a team effort to facilitate accurate and timely construction. Quality assurance and quality control contact information will be shared during this meeting to ensure effective communication.

B. Fabrication Inspection – Structural steel must be fabricated in accordance with the MDOT SSC and contract documents. Fabrication inspection must be performed as shown below:

1. Structural steel fabrication inspection consists of verifying compliance with the approved shop drawings, contract documents, and approved NCRs. RFIs must be incorporated into the approved shop drawings for the QAI to inspect to.

2. An approved Materials Source List (MSL) is provided to the QAI by the Engineer so that the QAI knows what materials are being incorporated into the project and what the basis of acceptance is. The MSL is used to track material sampling by the QAI and to foster communication with QCI to ensure all required sampling and testing occurs in a timely manner to prevent impacts to the project schedule. It is the Fabricator's responsibility to notify the QAI when materials are available for sampling.

3. QAI begins by inspecting materials that will be used in the fabrication process and ensures they are being stored correctly, tagged for traceability purposes, and are in conformance with the contract documents. Next, the QAI inspects the Fabricator's operations to ensure the condition of the equipment and work area for conformance to the contract documents.

4. MDOT's Accident Prevention Plan states, "MDOT employees shall not engage in any act which would endanger another employee or themselves". QAI must notify the Engineer immediately if work conditions exist that are not safe. If the

level of inspection diminishes below what is specified in this QA procedure, due to safety concerns, then the element will not be approved for use.

C. Before Welding – Below is a checklist for the QAI to use for fabrication inspection prior to the start of welding. The actual steps and their exact sequence will depend upon the type of structure, the method of erection, and the qualifications of the welders who are to do the work.

1. Verify mill test reports match the base metal for conformance with the specifications. Verify that QC is maintaining traceability of all materials to such degree that the heat number of each piece of steel that is used in the project can be tracked to its location in the structure. Obtain from the Fabricator, if necessary, the shipping records, storage locations, and scheduling for each piece of steel that they intend to use in connection with the assigned contract. Examine each piece of steel as it is received at the shop to see that it has no uncorrected defects, kinks, or bends resulting from improper handling while in the mill or shop or in transit from mill to shop. Verify that the material from the mill meets ASTM A6.

2. Verify all welders are MDOT qualified (see *MDOT's Welder Qualification Program*) and have appropriate fracture critical qualification, if applicable. Require requalification or supplementary welder tests if there are concerns. MDOT's SSC requires that all tack welders, welders, and welding operators are active MDOT qualified welders for the welding process, plate thickness, and position prior to welding.

3. Verify that the welding procedure specification (WPS) and welding sequences are agreed to and understood by QAI, QC, and Fabricator prior to welding. All WPSs are required to be reviewed and approved by MDOT's Structural Fabrication Unit. Contract documents require all WPSs to be qualified by a procedure qualification record (PQR) prior to welding. This qualification requirement is inclusive of all types of welds (butt welding, fillet welding, seal welding, plug welding, etc.). MDOT does not recognize prequalified AWS welding procedures, but we do accept properly documented evidence of previous PQRs that have not expired. See the contract documents for WPS and PQR requirements. The Fabricator is required to post approved WPS's at each welding station.

4. Make a general examination of the structural steel and verify the quality of fabrication. Pay attention to the plate edge preparation, which would affect control over welding. Notify QC of any observed deficiencies before weld joint fit up is complete so they can correct any deficiencies.

5. Check the fitting of joints that are to be welded, including dimensions of root face, angle of bevel, cleanliness, match marks, alignment of parts to be joined, and uniformity and size of root openings. Recheck root faces and angles of bevel because trimming and re-beveling of plate edges is sometimes performed during fitting. Check the prepared weld joint edges for evidence of possible undesirable internal defects such as laminations in the steel plate. Make dimensional checks of all critical measurements to assure a proper fit in the field.

6. Check the fixture, clamping, and pre-cambering arrangements used in the fabrication assembly setup for adequacy. Make certain tack welds are made by MDOT qualified welders and the welds are small, smooth, and of specified quality. Verify that runoff tabs or extension plates are in place to ensure complete welding beyond the plate edges.

D. During Welding

1. Verify all welding is being performed using the approved WPS and sequences (if applicable) and electrodes are used with suitable currents and polarity for the positions the electrodes are intended to be used. Refer to the approved WPS for all details of performing the weld in question.

2. During inclement weather, ensure that suitable windbreaks or shields are provided and welding is not performed on surfaces that are wet, exposed to rain or snow, or if a heavy fog is present. Check the ambient and steel temperatures at the start of welding and during welding to determine if the specified preheat and interpass temperature requirements are being observed. Use temperature-indicating crayons or other equivalent means to check these temperatures.

3. Check to make certain the correct electrodes (type and size) are available and are properly dried to prevent porosity and hydrogen cracking in the final welds. Low-hydrogen electrodes are susceptible to these types of defects if they are exposed to the atmosphere beyond the recommended limits. If electrodes and fluxes have been improperly stored or exposed to humidity in excess of the recommended limits, notify QC that reconditioning or rejection is required per the contract documents.

4. Intermittently observe the technique and performance of each welder to verify the approved WPS and suitable techniques are being followed. Inspect important or unique joints multiple times to ensure all weld passes meet project specifications. Arrange for the welder or the foreman to notify the QAI when such inspections at various stages may be made. Report any unusual or excessive distortion during welding to QC. Verify all corrective measures are being followed as approved by the Engineer to ensure the Fabricator's methods minimize locked-in stresses.

5. Verify the welding arc is only struck in the joint or other area on which metal is to be deposited and not at random locations on the base metal outside of the prepared joint. Arc strikes cause physical and metallurgical stress risers and can change the mechanical properties of the steel at isolated locations. These changes can result in fatigue failures. Verify that approval by the Engineer has been given to the Fabricator prior to ground bars, clips, or ties being welded to the base metal. Approval for such welding is only given by the Engineer when unavoidable. When steel ground bars are used instead of ground clamps to carry the welding current to the base metal, make certain the ground bars are carefully welded to the base metal at a runoff tab or securely clamped to any area where all mill scale has been removed. Verify the grounding lead is as close to the point of welding as is practical.

6. Inspect root passes with special care because it is very important the first weld materials deposited in the root of a multiple pass weld is properly performed. Closely examine the root pass in important complete joint penetration welds,

such as flange and web butt welds, t-joint, and corner joints to verify a sound pass that is free from cracks, inclusions, and lack of fusion.

7. Verify the root pass and every subsequent weld pass is cleaned with a wire brush and chipping hammer to thoroughly remove slag between weld passes to avoid inclusions. Ensure defects and substandard workmanship in any weld pass be removed by chipping or gouging before subsequent passes of metal are deposited. Peening or consolidating of weld metal by hammering is not permitted without the approval of the Engineer. Under conditions of very severe restraint, minimize weld cracking by acceptable techniques such as a cascade build-up sequence. Avoid any interruptions in the welding of a critical joint other than those necessary to change electrodes and quickly clean the slag from each pass before the next pass is deposited.

8. Verify the Fabricator is not creating re-entrants or local areas with high residual stresses in highly stressed parts of primary members. Where beam flanges do not match well at butt welded splices, the Fabricator should deposit the weld metal in such a way as to provide a smooth transition between the parts being joined. Verify that temporary fitting aids, such as plates and angles, are not applied at highly stressed locations and that temporary tack welds are not allowed.

9. Check all members to verify the welds are of proper size and length, are being made in the proper location to conform to the approved shop drawings, and are performed in such a manner as to produce weld metal conforming to the contract documents. To determine whether the weld metal is being deposited in such a manner as to penetrate well into the root of a joint without producing excessive slag inclusions or porosity, a field test may be conducted by making a T-joint with a fillet weld on only one side of the stem of the T. This joint can be broken open easily for visual examination. If welds are to be ground smooth and flush for any reason, verify grinding is performed so grinding marks are not left transverse to the direction of the main stress in a member. Verify welds are not being over ground so as to produce a "dished" surface. Verify the ends of welds are being ground smooth after runoff tabs are removed.

10. Identify with paint (do not steel stamp) each splice of primary member with the symbol of the welder doing the work. If two welders work on such a splice, show the symbol of each and record, in writing, the work each welder performed.

11. Record progress of fabrication on MDOT Form 0538. Include the dates that the work was completed and pertinent remarks regarding problems encountered and corrective action taken.

E. After Welding

1. Verify welds are cleaned of slag and weld spatter so they can be given a thorough final examination. Verify the surfaces of the welds are reasonably smooth and of suitable contour without evidence of undercut, overlap, excessive convexity, insufficient throat or leg size, unfilled craters at the ends of welds, or other defects in excess of the limits prescribed by the contract documents. Refer to the contract documents for the appearance of welds containing these various kinds of defects. Ensure all scars and defects, such as undercutting or remnant portions of tack welds and other scars that are left after the removal of

temporary fitting and erection clips are corrected to be within the tolerances specified.

2. Check the storage, loading, blocking, and handling of the welded members to avoid distortion or structural damage. Verify braces or lugs are not welded to the members.

3. Verify the final camber and required curvature (or sweep) of all girders after all fabrication steps have been completed by observing QC perform their inspection. The Engineer will notify the QAI if they are required to perform QA inspection using the appropriate MDOT forms. Any members that measure out of tolerance must be noted for corrective action and rechecked after the correction has been made.

F. Non-Destructive Testing (NDT) - Is the responsibility of the Fabricator per the contract documents. QAI verifies the NDT requirements of the contract are correctly performed and documented. Knowledge of the principles and procedures of NDT is essential for QAI to verify QC during NDT.

Ensure the required visual test (VT), penetrant test (PT), magnetic particle test (MT), ultrasonic test (UT), and radiographic test (RT) inspections are performed and documented as required in the contract documents. Verify that the weld surface and adjacent plate surfaces are in satisfactory condition prior to non-destructive testing (NDT).

Verify NDT QCIs are ASNT Level II or III by reviewing certification records.

Check the performance of NDT QCIs at frequent intervals to verify approved procedures are being used, all weld joints to be tested are examined in accordance with contract documents and results are recorded. QAI should witness NDT of all critical splices. Collect all NDT reports generated and submit to the Engineer with the final documentation package.

Verify QC identifies locations of all rejected welds. Observe the excavation defects and the use of MT inspection to verify no part of the defect remains. Verify that the Fabricator follows all approved weld repair plans.

Perform VT after blast-cleaning the base metal for weld surface defects, weld finish, and edge and hole finish requirements.

1. *NDT Inspection Methods -*

   a. Visual testing (VT) inspection of weldments must be in accordance with the contract documents.

   b. Penetrant testing (PT) inspection of weldments must be in accordance with the contract documents.

   c. Magnetic particle testing (MT) inspection of weldments must be in accordance with the contract documents.

   d. Ultrasonic testing (UT) inspection of weldments must be in accordance with the contract documents.

e. Radiographic testing (RT) inspection of weldments must be in accordance with the contract documents.

2. *Interpretation* - The interpretation of all NDT is the responsibility of the Fabricator's QC personnel. QAI is responsible for reviewing all of the Fabricator's interpretations and calling any disagreements to the attention of the Engineer. The Engineer's interpretation is final and they may also call for additional testing to further explore a discrepancy.

G. *Inspection of Shop Cleaning and Coating Fabricated Steel* - QAI is responsible to verify that QC is being effective and enforcing all cleaning and coating contract requirements. All MDOT steel bridge contracts specify a high technology coating system. Most steel bridges are completely shop coated (i.e. primer, intermediate, and top coat) by the Fabricator. The essential phases of inspecting a coating system is summarized below:

1. *Environmental Conditions* – Contract documents include specific controls on environmental conditions (e.g. temperature, humidity, cleanliness, air movement, shading, etc.). These conditions must be strictly enforced.

2. *Coating Materials* - All paints must be carefully mixed, thinned, and handled in accordance with the manufacturer's specifications. Verify QC is recording all batch numbers used for comparison to the certification documents. Verify the color numbers of the top coat for conformance to the approved shop drawings.

3. *Cleaning and Coating Equipment* - High technology coating systems employ the most sophisticated blast cleaning and spray painting equipment developed. A thorough knowledge of their operation and use is required by the QAI. QAI is responsible for evaluating the performance of the equipment prior to the coating of the structural steel. If any of the equipment is operating outside of the specification limits the coatings will not be properly applied and may fail (peeling) at some time after application.

4. *Steel Surface Conditions* - All grinding, weld repairs, and fabrication steps must be completed before blast cleaning and painting. Any remedial work performed after coating may be grounds for rejection of the coating system. The steel must be free of all traces of grease and oil before blast cleaning is performed.

5. *Surface Preparation* – Verify QC is monitoring surface cleanliness and surface profile using specialized equipment per the contract documents.

6. *Coating Application* - QAI must verify that the proper techniques of applying the high technology coating systems is being performed. Improper application techniques may "appear" to give acceptable results, but will lead to a greatly reduced performance life and possibly an early coating failure (blistering and peeling). QAI must verify QC is monitoring all environmental conditions before and during the coating process. Corrective actions must be taken on each coat of the painting system before the next coat is applied. Ensure that approved coating repair procedures are followed.

7. *Documentation* - Documentation of an approved coating on structural steel is comprised of the QC test reports on the coating evaluations and environmental conditions as well as a certificate of compliance from the paint manufacturer.

MDOT coating systems are in a Qualified Products List found in the MDOT MSG. The certificate of compliance attests that the painting materials supplied are the same as those submitted to MDOT for acceptance testing.

8. *Handling, Storage, and Repair* - QAI must verify all contract documents for handling, storage, and repair of shop painted steel are strictly followed. All paint damages during handling and loading by the Fabricator must be repaired using approved procedures prior to QAI's approval for shipping.

4.05.05. Suggested Radiographic Testing Procedures

A. Radiographic testing (RT) inspection of weldments as required by the contract must be performed in accordance with the applicable welding code as modified by the contract documents. The following procedure is a suggested format that meets the requirements of most MDOT contracts.

1. Fabricator must furnish a satisfactory viewer and darkroom facility for developing and viewing the radiographic film and also provide shop space and time for all radiographic work. All safety precautions as required must be followed and enforced by the Fabricator.

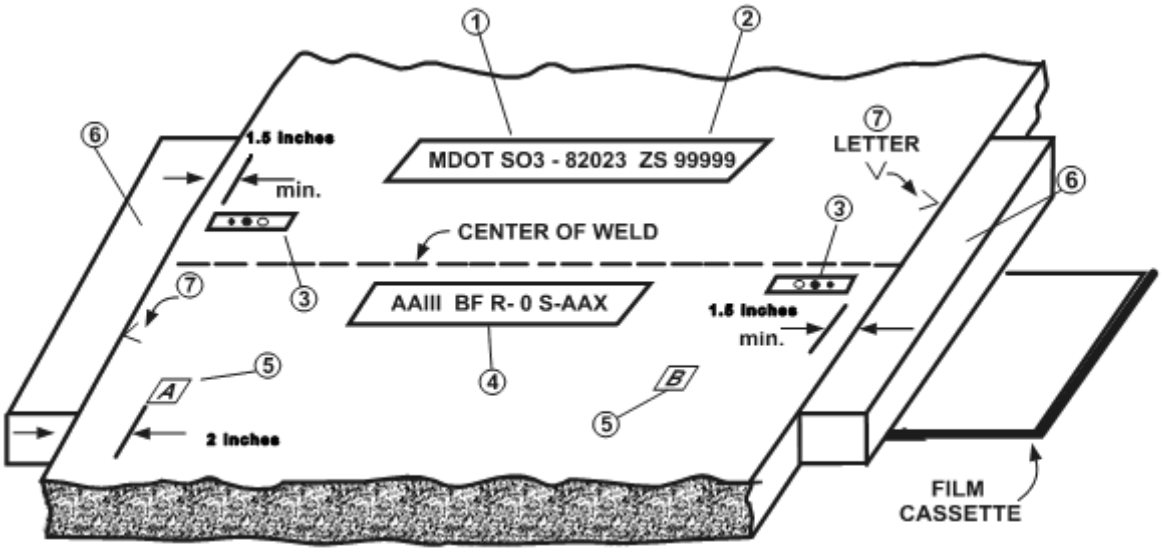
2. See the contract documents for RT inspection requirements. All joints must be free of dirt, scale, grease, etc. prior to inspection. Flange splices must be ground flush on both sides and webs ground flush at the area to be RT (one side). The direction of grinding must be perpendicular to the length of the weld. All runoff tabs or other appendages must be completely removed before RT inspection.

3. Radiographs must be taken and interpreted by experienced and qualified technicians or radiographers as approved by the Engineer. The radiographic film and a report of the technician's interpretation must be submitted to the Engineer for their final approval before the weld is accepted. The film type must be fine grain Class I or Class II. Dimensions must be a minimum of 4.5 inches by 17 inches. Areas too large to be RT inspected on one film will require additional exposures. Limit web shot film size to 15 inches and flange shot film size to 16 inches. Either x-rays or gamma rays may be used to produce radiographs. Double lead screens must be used to back the film. Screens may be either pure lead or antimony lead with a maximum of 6 percent antimony. Tin coated lead foil or fluorescent screens must not be used. If RT inspection discloses defective welds, the defective portions must be removed and the material re-welded. Additional films must be taken of all repaired welds at the expense of the Fabricator and then submitted to the Engineer for approval.

4. The interpretation of all radiographic films must be furnished to the Engineer by the Fabricator. The interpretation report must be submitted on a form as approved by the Engineer. Should the Engineer question the interpretation of the radiographic film by the technician, or should the Fabricator question the interpretation of the Engineer, a joint review will be made. The Engineer’s final interpretation will govern.

5. All radiographs must be positively identified by the Fabricator in accordance with AWS D1.5. Identification lettering of radiographs must be placed on the source

side along with the penetrometers. Lettering of repairs must show an "R" and the number of the repair, and must be placed next to the weld identification.



B. *Standard Radiographic Identification Layout* - (numbers refer to diagram above)

Explanation

① State structure number and control section.

② Fabricator's initials and shop contract number.

③ Penetrometers. Use penetrometers for nominal thickness of each plate, but penetrometer for thicker plate not to exceed penetrometer for thinner plate by more than ten.

④ Weld Identification. Identification should identify the exact location of the weld in relation to piece number and location.

⑤ Location Letters. Placement of location letters is necessary to relate the location of questionable areas or defects should repair be necessary. More location letters must be added in the event more than one shot is required.

⑥ Tight fitting steel edge blocks must have a thickness equal to or greater than the thickness of the weld on all weld ends.

⑦ Lead “V” must be placed at edge to delineate the top edge on the radiograph. Additional identification may be used as required. All lead numbers and penetrometers must be placed on the source side of the plate being radiographed.

The use of "blocks" as illustrated is required. The use of these edge blocks will give a better picture of the top and bottom edges and are especially useful when the limits of the film are being crowded (e.g. one shot on a 16 inch flange).

4.05.06. Reports

A. The Engineer may require a periodic status report from the Structural Fabrication Unit; therefore, all reports are required to be completed in a timely and orderly manner using MDOT's Fabrication Inspection & Construction System (FICS). Make entries as soon as possible after an event or conversation to ensure accuracy. Number the reports consecutively until completion of the work, with the last report noted "final".

B. QAI must complete an accurate and detailed account of fabrication for the project. The report must include a discussion of fabrication progress for all aspects of the work. It is intended to be a detailed record of the status of fabrication and should include number of elements fabricated, documentation of specification and procedure compliance as well as documentation of conflicts, repairs, and other problems or discussion which could affect the project in anyway. If force account work is taking place, document each day that the work occurs in the shop and which elements are being worked.

C. Documentation is not a substitute for appropriate dialogue with the Fabricator, but should provide a record of important discussions. In some cases, the QAI is more familiar with the events or issues and therefore should review and comment on draft copies of the Structural Fabrication Unit's correspondence.

D. Reports must be assembled into one fabrication inspection Adobe portable document format (PDF) file and stored in MDOT's ProjectWise document storage program per *MDOT's Structural Fabrication Unit's E-Construction Process*. The Engineer will receive a fabrication inspection memorandum from the Structural Fabrication Engineer after fabrication inspection is complete. The memorandum is for informational purposes and is not used for acceptance.

E. Below is a list of various MDOT reports and a brief description of their purpose and use requirement. Similar forms can be used in place of the standard MDOT form if noted below.

1. *Camber Measurements (Form 0507)* – This form (or a similar form) is only used by QAI to record the actual measured camber on a beam or girder and to compare it to the design plan camber if required by the Engineer. QAI is responsible for checking the deviation in camber from the plan camber and calling for correction of any readings that are out of tolerance. New ordinates should be recorded after such corrections are made.

2. *Shop Inspection of Structural Steel (Form 0538)* – This form must be completed by QAI on a weekly basis for each project and should contain a clear and brief narrative of the work performed over the reporting period and keep emotions of personal feelings out. The report must contain the following information: Weather conditions, elements worked on, work activity, non-conformances, shipping, force account work (rare), and anything else deemed important by the QAI.

3. *Magnetic Particle Inspection Report (Form 0538A)* – This form (or a similar form) is only used if QA magnetic particle testing inspection is required by the Engineer. Any defects noted must show an approved status after repairs and retesting are complete.

4. *Report of Ultrasonic Examination of Welds (Form 0538B)* – This form (or a similar form) is only used if QA ultrasonic testing inspection is required by the Engineer. Any defects noted must show an approved status after repairs and retesting are complete.

5. *Mill Certification Record for Fabricated Steel (Form 0538D)* – This form is completed by the QAI during the fabrication of a bridge. An entry is made for each girder in the bridge and the actual mill certification heat numbers for every plate used in fabricating the girder are recorded in an orderly sequence (including beams, cover-plates, webs, flanges, splice plates, etc.). A notation is made when the corresponding mill certification has been received and checked by the QAI.

6. *Field Inspection Report (Form 0566)* – This form (or similar form) is used only if QA field inspection is required by the Engineer. Any follow up work or additional inspection must be clearly noted and the report must be distributed as shown on the report. Subsequent reports on a problem should reference all previous reports issued.

7. *Sample Identification (Form 1923)* – This form must be submitted when welder testing and material sampling is required on a project. QAI must completely fill out the form and keep a copy in the fabrication inspection folder.

8. *Welder Qualification Field Data Report (Form 1929)* – This form is submitted with each test of a welder, welding operator, or welding procedure when weld testing is required. All the available parameters requested on the form must be completed since the approvals issued from these tests are conditional for the variables tested.

4.05.07. Stockpile Payment

A. This stockpile payment section directs the QAI on the requirements when stockpile payment inspection is requested by the Structural Fabrication Unit. The QAI must perform the following steps:

1. Verify plate/rolled material is traceable to the mill certifications and meets ASTM A6 (if applicable);
2. Verify fabricated material meets approved shop drawings (if applicable);
3. Verify stockpile quantity and include quantity in report;
4. Verify material is labeled for MDOT use only;
5. Verify material is correctly stored and protected from the elements; and
6. Provide a report summarizing the inspection and provide adequate photos that represent the general condition of the elements, how they're being stored, mill markings or piece marks, and mill certifications for plate/rolled material if applicable.

4.05.08. Acceptance

A. The Fabricator is required to provide the QAI with a minimum of five (5) copies of the Bill of Lading for each shipment. QAI will stamp each copy of the Bill of Lading with the MDOT "Approved for Use" stamp and will retain one copy for their records. It is the Fabricator's responsibility to distribute the remaining copies of Bill of Lading to the following individuals:

1. QAI
2. Engineer
3. Fabricator
4. Contractor
5. Trucking company

The Bill of Lading is required to contain, at a minimum, the following information:

1. Shipping date
2. Description of cargo (quantity, element size, weight, etc.)
3. Element unique piece mark
4. MDOT project location (route, cross road/river, and city)
5. MDOT project information (structure number, control section, and job number)
6. Manufacturer's name and address

B. Acceptance consists of the following two part process:

1. Fabrication Inspection Acceptance: Structural elements must be inspected by the QAI after they are loaded for shipping. If the structural elements meet the contract requirements, the QAI will stamp them "Approved for Use". The elements must be stamped "Approved for Use" prior to shipping. Additionally, the QAI must stamp at least five copies of the Bill of Lading that is prepared by the Fabricator. The approval stamp is for use by the Department and does not relieve the Contractor of their responsibility to meet contract requirements.

2. Visual Inspection (VI) Acceptance: The Engineer must collect one copy of the stamped Bill of Lading and use it to verify the delivered structural elements. Additionally, the Engineer must verify that the elements are stamped and visually inspect them for signs of damage that may have occurred as a result of shipping and handling. This visual inspection should be documented in the field inspector's daily report.

4.06 LIGHTING, SIGNAL, AND SIGN SUPPORT STRUCTURE FABRICATION

4.06.01. Scope

A. This lighting, signal, and sign support structure fabrication inspection procedure should be used to aid the quality assurance inspector (QAI) in interpreting and enforcing the contract documents for highway structures. Fabrication inspection includes the time from verifying materials used for fabrication through loading for shipping to the construction site. The following lighting, signal, and sign support structures are included in this inspection procedure:

1. Traffic sign support structures:

   a. Cantilever
   b. Truss
   c. Dynamic message sign
   d. Bridge sign connections
   e. Steel column breakaway

2. Tower lighting unit

3. Traffic signal mast arm pole and mast arm

4.06.02. Reference Documents

A. QAI must have a thorough knowledge of the following references:

1. The following sections of the MDOT Standard Specifications for Construction (MDOT SSC) as modified by supplemental specification 12SS-001A – Errata, as applicable:

Section 104	Control of the Work
Section 105	Control of the Materials
Section 707	Structural Steel Construction
Section 810	Permanent Traffic Signs and Supports
Section 819	Electrical and Lighting

2. The following special provisions, as applicable:

12SP-105A	Source of Steel and Iron (Buy America)
12SP-707A	Special Provision for Structural Steel and Aluminum Construction
12SP-707F	Special Provision for Structural Steel Construction Revisions
12SP-716B	Special Provision for Coating of Galvanized Lighting, Signal, Sign, and Miscellaneous Support Structures
12SP-810A	Special Provision for Anchor Bolt Inspection and Reporting and Payment Schedule for Overhead Support Structures
12SP-810B	Special Provision for Traffic Signal Mast Arm Pole and Mast Arm (Trunkline)
12SP-906B	Special Provision for Structural Steel Revisions

3. Contract plans and specifications

4. American Welding Society (AWS) D1.1:XXXX, Structural Welding Code – Steel (as modified by 12SP-707A, Structural Steel and Aluminum Construction), hereafter called AWS D1.1

5. Construction Field Services Division (CFS) Materials Source Guide (MSG)

6. MDOT Structural Fabrication Quality Assurance Guidance Document

7. MDOT Welder Qualification Program

8. MDOT Structural Fabrication Unit E-Construction Process

9. Prefabrication meeting minutes (if available)

B. QAI must be familiar with the following references:

1. AWS 2.4:XXXX, Symbols for Welding and Nondestructive Testing

2. AWS A3.0:XXXX, Standard Welding Terms and Definitions

3. MDOT Structural Fabrication Request for Information Process

4. MDOT Shop Drawing Review Process

5. MDOT Structural Fabrication Nonconformance Process

6. Applicable SSPC specifications

7. Applicable coating test methods

8. Applicable ASTM and AASHTO specifications

9. MDOT Accident Prevention Plan

4.06.03. <u>Qualifications, Responsibilities, Duties, and Equipment</u>

A. Qualifications of the QAI – QAI performing the fabrication inspection must possess the following active qualification:

1. AWS Certified Welding Inspector (CWI)

B. Responsibilities of the QAI – QAI performing the fabrication inspection is not permitted to make changes to the contract and has the following responsibilities:

The Contractor, Fabricator, and MDOT will approach quality control and quality assurance as a team effort to facilitate accurate and timely construction. QAI's verification does not relieve the Fabricator from the responsibility to perform the required testing and inspection to produce a product satisfying the contract. Though QA inspection may include all aspects of fabrication, the QAI must not supersede QC, which is the responsibility of the Fabricator. If QC is not accomplishing its role then the Structural Fabrication Unit, Engineer, Contractor, and Fabricator must determine the necessary corrections.

QAI is the responsible party, representing the Engineer, who performs quality assurance verification inspection on the element after quality control (QC) inspects and approves the item of work. The QAI must be at the fabrication facility at all times during fabrication as required by the inspection procedure stated below. If issues arise, it will be at the Engineer's discretion whether to increase the level of QA inspection.
It is the Engineer's responsibility to engage the Engineer of Record (EOR) when making structural decisions. The Engineer is also responsible for following internal MDOT procedures for review and approval of shop drawings, fabrication procedures, request for information (RFI), nonconformance reports (NCR), and for professional decision making on fabrication problems that arise. The Engineer relies on the Structural Fabrication Unit to manage and assist when appropriate. The Engineer has the prerogative for holding a prefabrication meeting with the Fabricator to discuss and clarify the contract plans and specifications. The Engineer is the responsible party who ensures MDOT's fabrication QA program is followed for inspection and acceptance of the element.

Fabrication should proceed only with approved shop drawings. However, if the Fabricator must proceed prior to receipt of approved shop drawings (performing work at their own risk), ensure that the Structural Fabrication Unit is aware of this activity and await instruction on how to proceed. If the Engineer permits the work to proceed without approved shop drawings, proceed with basic QA functions using the non-approved shop drawings. Later, verify notes against approved drawings. Notify the Structural Fabrication Unit immediately if fabrication is not in conformance with the approved shop drawings.

C. Duties of the QAI – QAI performing the fabrication inspection has the following duties:

1. QAI must thoroughly understand the contract documents.
2. QAI must verify steel material certifications show compliance with Buy America contract requirements.
3. QAI must be proficient in testing welders, sampling materials, verifying material traceability, and inspecting welds and coating systems.
4. QAI must be proficient in writing reports and using computers.
5. QAI must notify the Engineer if production begins before approved shop drawings are on the shop floor and provided to the QAI.
6. QAI must communicate all concerns through QCI or whomever the Fabricator directs during the prefabrication meeting.
7. QAI must communicate with QCI to obtain the work schedule.
8. QAI must follow *MDOT's Structural Fabrication E-Construction Process* for closing out fabrication inspection file.

D. Deficiencies on Local Agency Projects – MDOT's QAI must notify the Structural Fabrication Unit if they observe fabrication or inspection deficiencies on local agency program (LAP) projects. The Structural Fabrication Engineer will report the deficiencies via email to the Engineer that is responsible for construction oversight of the local agency project and carbon copy the applicable CFS and Design Division LAP Engineers.

E. Inspection Facilities and Access – Facilities for the QAI must be provided by the Fabricator per contract documents. QAI must have access to all parts of the work at all times. The authority and general duties of the QAI are specified in Section 104.01.D and E of the MDOT SSC.

F. Inspection Equipment – QAI will be furnished with the following items by the Engineer:

1. Contract documents (MDOT SSC, special provisions, standard plans, special details, plan sheets, etc.)
2. Approved shop drawings (provided by Fabricator)
3. Access to MDOT's Fabrication Inspection & Construction System (FICS)
4. MDOT shop approval stamp

QAI must provide the following inspection equipment:

1. Computer with high speed internet access
2. Cell phone with camera
3. Flashlight
4. Fillet weld gauges
5. Undercut gauges
6. Instrumentation for measuring voltage and amperage
7. Temperature measuring devices capable of covering the range from 0°F to 1650°F
8. Dry film thickness gauges
9. Wet film paint thickness gauge
10. Surface roughness comparator gage
11. Extra course replica tape for measuring blasted steel surface profile
12. SSPC book of pictorial blast standards
13. Temperature and humidity measuring instruments
14. Measuring devices (200 foot and 20 foot steel tape and calipers)
15. Straightedge and levels
16. Safety equipment
17. Other as needed for the project

4.06.04. Inspection Procedure

A. Prefabrication Meeting – Prefabrication meetings facilitate effective quality control and quality assurance on the project and are conducted by MDOT's Structural Fabrication Unit prior to the start of fabrication and preferably after shop drawings have been approved. The Structural Fabrication Unit, QAI, Fabricator, and QCI must be present, whereas the Engineer and Contractor should be present to ensure a team effort to facilitate accurate and timely construction. Quality assurance and quality control contact information will be shared during this meeting to ensure effective communication.

B. Fabrication Inspection – Structural steel must be fabricated in accordance with the MDOT SSC and contract documents. Fabrication inspection must be performed as shown below:

1. Structural steel fabrication inspection consists of verifying compliance with the approved shop drawings, contract documents, and approved NCRs. RFIs must be incorporated into the approved shop drawings for the QAI to inspect to.

2. An approved Materials Source List (MSL) is provided to the QAI by the Engineer so that the QAI knows what materials are being incorporated into the project and what the basis of acceptance is. The MSL is used to track material sampling by the QAI and to foster communication with QCI to ensure all required sampling and testing occurs in a timely manner to prevent impacts to the project schedule.

It is the Fabricator's responsibility to notify the QAI when materials are available for sampling.

3. QAI begins by inspecting materials that will be used in the fabrication process and ensures they are being stored correctly, tagged for traceability purposes, and are in conformance with the contract documents. Next, the QAI inspects the Fabricator's operations to ensure the condition of the equipment and work area for conformance to the contract documents.

4. MDOT's Accident Prevention Plan states, "MDOT employees shall not engage in any act which would endanger another employee or themselves". QAI must notify the Engineer immediately if work conditions exist that are not safe. If the level of inspection diminishes below what is specified in this QA procedure, due to safety concerns, then the element will not be approved for use.

C. Fabrication Inspection – Cantilever sign support, tower lighting unit, and traffic signal mast arm pole and mast arm structures must be fabricated in accordance with the MDOT SSC and contract documents. Welders must be qualified in accordance with MDOT's Welder Qualification Program prior to welding on structures. Visually inspect flanges using a straight edge for flatness to assure that full contact of flanges is obtained in an unbolted relaxed condition. Inspect structural elements for straightness, flange bolt hole alignment, and horizontal truss member camber per the contract documents. Truss Sign Supports Only – Witness the bolting and vertical horizontal truss sections to ensure proper alignment and bolt tightening procedures (truss sign supports only) per the MDOT SSC.

D. Before Welding – Below is a checklist for the QAI to use for fabrication inspection prior to the start of welding. The actual steps and their exact sequence will depend upon the type of structure, the method of erection, and the qualifications of the welders who are to do the work.

1. Verify mill test reports match the base metal for conformance with the specifications. Verify that QC is maintaining traceability of all materials to such degree that the heat number of each piece of steel that is used in the project can be tracked to its location in the structure. Obtain from the Fabricator, if necessary, the shipping records, storage locations, and scheduling for each piece of steel that they intend to use in connection with the assigned contract. Examine each piece of steel as it is received at the shop to see that it has no uncorrected defects, kinks, or bends resulting from improper handling while in the mill or shop or in transit from mill to shop. Verify that the material from the mill meets ASTM A6.

2. Verify all welders are MDOT qualified (see *MDOT's Welder Qualification Program*) and have appropriate fracture critical qualification, if applicable. Require requalification or supplementary welder tests if there are concerns. MDOT's SSC requires that all tack welders, welders, and welding operators are active MDOT qualified welders for the welding process, plate thickness, and position prior to welding.

3. Verify that the welding procedure specification (WPS) and welding sequences are agreed to and understood by QAI, QC, and Fabricator prior to welding. All WPSs are required to be reviewed and approved by MDOT's Structural Fabrication Unit. Contract documents require all WPSs to be qualified by a

procedure qualification record (PQR) prior to welding. This qualification requirement is inclusive of all types of welds (butt welding, fillet welding, seal welding, plug welding, etc.). MDOT does not recognize prequalified AWS welding procedures, but we do accept properly documented evidence of previous PQRs that have not expired. See the contract documents for WPS and PQR requirements. The Fabricator is required to post approved WPS's at each welding station.

4. Make a general examination of the structural steel and verify the quality of fabrication. Pay attention to the plate edge preparation, which would affect control over welding. Notify QC of any observed deficiencies before weld joint fit up is complete so they can correct any deficiencies.

5. Check the fitting of joints that are to be welded, including dimensions of root face, angle of bevel, cleanliness, match marks, alignment of parts to be joined, and uniformity and size of root openings. Recheck root faces and angles of bevel because trimming and re-beveling of plate edges is sometimes performed during fitting. Check the prepared weld joint edges for evidence of possible undesirable internal defects such as laminations in the steel plate. Make dimensional checks of all critical measurements to assure a proper fit in the field.

6. Check the fixture, clamping, and pre-cambering arrangements used in the fabrication assembly setup for adequacy. Make certain tack welds are made by MDOT qualified welders and the welds are small, smooth, and of specified quality. Verify that runoff tabs or extension plates are in place to ensure complete welding beyond the plate edges.

E. During Welding

1. Verify all welding is being performed using the approved WPS and sequences (if applicable) and electrodes are used with suitable currents and polarity for the positions the electrodes are intended to be used. Refer to the approved WPS for all details of performing the weld in question.

2. During inclement weather, ensure that suitable windbreaks or shields are provided and welding is not performed on surfaces that are wet, exposed to rain or snow, or if a heavy fog is present. Check the ambient and steel temperatures at the start of welding and during welding to determine if the specified preheat and interpass temperature requirements are being observed. Use temperature-indicating crayons or other equivalent means to check these temperatures.

3. Check to make certain the correct electrodes (type and size) are available and are properly dried to prevent porosity and hydrogen cracking in the final welds. Low-hydrogen electrodes are susceptible to these types of defects if they are exposed to the atmosphere beyond the recommended limits. If electrodes and fluxes have been improperly stored or exposed to humidity in excess of the recommended limits, notify QC that reconditioning or rejection is required per the contract documents.

4. Intermittently observe the technique and performance of each welder to verify the approved WPS and suitable techniques are being followed. Inspect important or unique joints multiple times to ensure all weld passes meet project

specifications. Arrange for the welder or the foreman to notify the QAI when such inspections at various stages may be made. Report any unusual or excessive distortion during welding to QC. Verify all corrective measures are being followed as approved by the Engineer to ensure the Fabricator's methods minimize locked-in stresses.

5. Verify the welding arc is only struck in the joint or other area on which metal is to be deposited and not at random locations on the base metal outside of the prepared joint. Arc strikes cause physical and metallurgical stress risers and can change the mechanical properties of the steel at isolated locations. These changes can result in fatigue failures. Verify that approval by the Engineer has been given to the Fabricator prior to ground bars, clips, or ties being welded to the base metal. Approval for such welding is only given by the Engineer when unavoidable. When steel ground bars are used instead of ground clamps to carry the welding current to the base metal, make certain the ground bars are carefully welded to the base metal at a runoff tab or securely clamped to any area where all mill scale has been removed. Verify the grounding lead is as close to the point of welding as is practical.

6. Inspect root passes with special care because it is very important the first weld materials deposited in the root of a multiple pass weld is properly performed. Closely examine the root pass in important complete joint penetration welds, such as pole to base plate and splices to verify a sound pass that is free from cracks, inclusions, and lack of fusion.

7. Verify the root pass and every subsequent weld pass is cleaned with a wire brush and chipping hammer to thoroughly remove slag between weld passes to avoid inclusions. Ensure defects and substandard workmanship in any weld pass be removed by chipping or gouging before subsequent passes of metal are deposited. Peening or consolidating of weld metal by hammering is not permitted without the approval of the Engineer. Under conditions of very severe restraint, minimize weld cracking by acceptable techniques such as a cascade build-up sequence. Avoid any interruptions in the welding of a critical joint other than those necessary to change electrodes and quickly clean the slag from each pass before the next pass is deposited.

8. Verify the Fabricator is not creating re-entrants or local areas with high residual stresses in highly stressed parts of primary members. Verify that temporary fitting aids, such as plates and angles, are not applied at highly stressed locations and that temporary tack welds are not allowed.

9. Check all members to verify the welds are of proper size and length, are being made in the proper location to conform to the approved shop drawings, and are performed in such a manner as to produce weld metal conforming to the contract documents. To determine whether the weld metal is being deposited in such a manner as to penetrate well into the root of a joint without producing excessive slag inclusions or porosity, a field test may be conducted by making a T-joint with a fillet weld on only one side of the stem of the T. This joint can be broken open easily for visual examination. If welds are to be ground smooth and flush for any reason, verify grinding is performed so grinding marks are not left transverse to the direction of the main stress in a member. Verify welds are not being over ground so as to produce a "dished" surface. Verify the ends of welds are being ground smooth after runoff tabs are removed.

10. Identify with paint (do not steel stamp) each splice with the symbol of the welder doing the work. If two welders work on such a splice, show the symbol of each and record, in writing, the work each welder performed.

11. Record progress of fabrication on MDOT Form 0538. Include the dates that the work was completed and pertinent remarks regarding problems encountered and corrective action taken.

F. After Welding

1. Verify welds are cleaned of slag and weld spatter so they can be given a thorough final examination. Verify the surfaces of the welds are reasonably smooth and of suitable contour without evidence of undercut, overlap, excessive convexity, insufficient throat or leg size, unfilled craters at the ends of welds, or other defects in excess of the limits prescribed by the contract documents. Refer to the contract documents for the appearance of welds containing these various kinds of defects. Ensure all scars and defects, such as undercutting or remnant portions of tack welds and other scars that are left after the removal of temporary fitting and erection clips are corrected to be within the tolerances specified.

2. Check the storage, loading, blocking, and handling of the welded members to avoid distortion or structural damage. Verify braces or lugs are not welded to the members.

3. Verify the final camber and required curvature (or sweep) of all members after all fabrication steps have been completed by observing QC perform their inspection. The Engineer will notify the QAI if they are required to perform QA inspection using the appropriate MDOT forms. Any members that measure out of tolerance must be noted for corrective action and rechecked after the correction has been made.

G. Non-Destructive Testing (NDT) - Is the responsibility of the Fabricator per the contract documents. QAI verifies the NDT requirements of the contract are correctly performed and documented. Knowledge of the principles and procedures of NDT is essential for QAI to verify QC during NDT.

Ensure the required visual test (VT), penetrant test (PT), magnetic particle test (MT), ultrasonic test (UT), and radiographic test (RT) inspections are performed and documented as required in the contract documents. Verify that the weld surface and adjacent plate surfaces are in satisfactory condition prior to non-destructive testing (NDT).

Verify NDT QCIs are ASNT Level II or III by reviewing certification records.

Check the performance of NDT QCIs at frequent intervals to verify approved procedures are being used, all weld joints to be tested are examined in accordance with contract documents and results are recorded. QAI should witness NDT of all critical splices and pole to base connection. Collect all NDT reports generated and submit to the Engineer with the final documentation package.

Verify QC identifies locations of all rejected welds. Observe the excavation defects and the use of MT inspection to verify no part of the defect remains. Verify that the Fabricator follows all approved weld repair plans.

Perform VT after blast-cleaning the base metal for weld surface defects, weld finish, and edge and hole finish requirements.

1. *NDT Inspection Methods* –

   a. Visual testing (VT) inspection of weldments must be in accordance with the contract documents.

   b. Penetrant testing (PT) inspection of weldments must be in accordance with the contract documents.

   c. Magnetic particle testing (MT) inspection of weldments must be in accordance with the contract documents.

   d. Ultrasonic testing (UT) inspection of weldments must be in accordance with the contract documents.

   e. Radiographic testing (RT) inspection of weldments must be in accordance with the contract documents.

2. *Interpretation* - The interpretation of all NDT is the responsibility of the Fabricator's QC personnel. QAI is responsible for reviewing all of the Fabricator's interpretations and calling any disagreements to the attention of the Engineer. The Engineer's interpretation is final and they may also call for additional testing to further explore a discrepancy.

H. *Inspection of Shop Cleaning and Coating Fabricated Steel* - QAI is responsible to verify that QC is being effective and enforcing all cleaning and coating contract requirements. All MDOT structures require hot-dip galvanizing (HDG) and may be coated using a high technology wet coating system or dry system per the contract documents. HDG must be inspected to verify conformance to the applicable ASTM and contract documents. The essential phases of inspecting a coating system is summarized below:

1. *Environmental Conditions* – Contract documents include specific controls on environmental conditions (e.g. temperature, humidity, cleanliness, air movement, shading, etc.). These conditions must be strictly enforced.

2. *Coating Materials* - All paints must be carefully mixed, thinned, and handled in accordance with the manufacturer’s specifications. Verify QC is recording all batch numbers used for comparison to the certification documents. Verify the color numbers of the top coat for conformance to the approved shop drawings.

3. *Cleaning and Coating Equipment* - High technology coating systems employ the most sophisticated blast cleaning and spray painting equipment developed. A thorough knowledge of their operation and use is required by the QAI. QAI is responsible for evaluating the performance of the equipment prior to the coating of the structural steel. If any of the equipment is operating outside of the specification limits the coatings will not be properly applied and may fail (peeling) at some time after application.

4. *Steel Surface Conditions* - All grinding, weld repairs, and fabrication steps must be completed before blast cleaning and painting. Any remedial work performed after coating may be grounds for rejection of the coating system. The steel must be free of all traces of grease and oil before blast cleaning is performed.

5. *Surface Preparation* – Verify QC is monitoring surface cleanliness and surface profile using specialized equipment per the contract documents.

6. *Coating Application* - QAI must verify that the proper techniques of applying the high technology coating systems is being performed. Improper application techniques may "appear" to give acceptable results, but will lead to a greatly reduced performance life and possibly an early coating failure (blistering and peeling). QAI must verify QC is monitoring all environmental conditions before and during the coating process. Corrective actions must be taken on each coat of the painting system before the next coat is applied. Ensure that approved coating repair procedures are followed.

7. *Documentation* - Documentation of an approved coating on structural steel is comprised of the QC test reports on the coating evaluations and environmental conditions as well as a certificate of compliance from the paint manufacturer. MDOT coating systems are in a Qualified Products List found in the MDOT MSG. The certificate of compliance attests that the painting materials supplied are the same as those submitted to MDOT for acceptance testing.
8. *Handling, Storage, and Repair* - QAI must verify all contract documents for handling, storage, and repair of shop painted steel are strictly followed. All paint damages during handling and loading by the Fabricator must be repaired using approved procedures prior to QAI's approval for shipping.

4.06.05. Reports

A. The Engineer may require a periodic status report from the Structural Fabrication Unit; therefore, all reports are required to be completed in a timely and orderly manner using MDOT's Fabrication Inspection & Construction System (FICS). Make entries as soon as possible after an event or conversation to ensure accuracy. Number the reports consecutively until completion of the work, with the last report noted "final".

B. QAI must complete an accurate and detailed account of fabrication for the project. The report must include a discussion of fabrication progress for all aspects of the work. It is intended to be a detailed record of the status of fabrication and should include number of elements fabricated, documentation of specification and procedure compliance as well as documentation of conflicts, repairs, and other problems or discussion which could affect the project in anyway. If force account work is taking place, document each day that the work occurs in the shop and which elements are being worked.

C. Documentation is not a substitute for appropriate dialogue with the Fabricator, but should provide a record of important discussions. In some cases, the QAI is more familiar with the events or issues and therefore should review and comment on draft copies of the Structural Fabrication Unit's correspondence.

D. Reports must be assembled into one fabrication inspection Adobe portable document format (PDF) file and stored in MDOT's ProjectWise document storage program per *MDOT's Structural Fabrication Unit's E-Construction Process*. The Engineer will receive

a fabrication inspection memorandum from the Structural Fabrication Engineer after fabrication inspection is complete. The memorandum is for informational purposes and is not used for acceptance.

E. Below is a list of various MDOT reports and a brief description of their purpose and use requirement. Similar forms can be used in place of the standard MDOT form if noted below.

1. *Shop Inspection of Structural Steel (Form 0538)* – This form must be completed by QAI on a weekly basis for each project and should contain a clear and brief narrative of the work performed over the reporting period and keep emotions of personal feelings out. The report must contain the following information: Weather conditions, elements worked on, work activity, non-conformances, shipping, force account work (rare), and anything else deemed important by the QAI.

2. *Magnetic Particle Inspection Report (Form 0538A)* – This form (or a similar form) is only used if QA magnetic particle testing inspection is required by the Engineer. Any defects noted must show an approved status after repairs and retesting are complete.

3. *Report of Ultrasonic Examination of Welds (Form 0538B)* – This form (or a similar form) is only used if QA ultrasonic testing inspection is required by the Engineer. Any defects noted must show an approved status after repairs and retesting are complete.

4. *Field Inspection Report (Form 0566)* – This form (or similar form) is used only if QA field inspection is required by the Engineer. Any follow up work or additional inspection must be clearly noted and the report must be distributed as shown on the report. Subsequent reports on a problem should reference all previous reports issued.

5. *Sample Identification (Form 1923)* – This form must be submitted when welder testing and material sampling is required on a project. QAI must completely fill out the form and keep a copy in the fabrication inspection folder.

6. *Welder Qualification Field Data Report (Form 1929)* – This form is submitted with each test of a welder, welding operator, or welding procedure when weld testing is required. All the available parameters requested on the form must be completed since the approvals issued from these tests are conditional for the variables tested.

4.06.06. <u>Stockpile Payment</u>

A. This stockpile payment section directs the QAI on the requirements when stockpile payment inspection is requested by the Structural Fabrication Unit. The QAI must perform the following steps:

1. Verify plate/rolled material is traceable to the mill certifications and meets ASTM A6 (if applicable);
2. Verify fabricated material meets approved shop drawings (if applicable);
3. Verify stockpile quantity and include quantity in report;
4. Verify material is labeled for MDOT use only;

5. Verify material is correctly stored and protected from the elements; and
6. Provide a report summarizing the inspection and provide adequate photos that represent the general condition of the elements, how they're being stored, mill markings or piece marks, and mill certifications for plate/rolled material if applicable.

4.06.07. Acceptance

A. The Fabricator is required to provide the QAI with a minimum of five (5) copies of the Bill of Lading for each shipment. QAI will stamp each copy of the Bill of Lading with the MDOT "Approved for Use" stamp and will retain one copy for their records. It is the Fabricator's responsibility to distribute the remaining copies of Bill of Lading to the following individuals:

1. QAI
2. Engineer
3. Fabricator
4. Contractor
5. Trucking company

The Bill of Lading is required to contain, at a minimum, the following information:

1. Shipping date
2. Description of cargo (quantity, element size, weight, etc.)
3. Element unique piece mark
4. MDOT project location (route, cross road/river, and city)
5. MDOT project information (structure number, control section, and job number)
6. Manufacturer's name and address

B. Acceptance consists of the following two part process:

1. Fabrication Inspection Acceptance: Structural elements must be inspected by the QAI after they are loaded for shipping. If the structural elements meet the contract requirements, the QAI will stamp them "Approved for Use". The elements must be stamped "Approved for Use" prior to shipping. Additionally, the QAI must stamp at least five copies of the Bill of Lading that is prepared by the Fabricator. The approval stamp is for use by the Department and does not relieve the Contractor of their responsibility to meet contract requirements.

2. Visual Inspection (VI) Acceptance: The Engineer must collect one copy of the stamped Bill of Lading and use it to verify the delivered structural elements. Additionally, the Engineer must verify that the elements are stamped and visually inspect them for signs of damage that may have occurred as a result of shipping and handling. This visual inspection should be documented in the field inspector's daily report.

4.07 LOAD TRANSFER ASSEMBLIES FOR TRANSVERSE JOINTS

4.07.01. Scope

A. This procedure covers the fabrication inspection of load transfer assemblies shipped to project sites or in-state supplier facilities.

B. MDOT reserves the right to perform sampling and inspection at the place of manufacture, if deemed necessary.

C. This procedure also provides for the acceptance of small quantities of load transfer assemblies using the basis of visual inspection.

4.07.02. Related Documents

A. Standard Specifications for Construction

B. Standard Plans

C. Materials Source Guide

4.07.03. Certification of Dowel Bars

A. All shipments of load transfer assemblies must be accompanied by a manufacturer's certification. This certification, properly prepared, will apply to and permit the acceptance of the dowel bars only. Fabrication inspection of the assemblies is required and must be performed prior to placing any assembly on the grade.

4.07.04. Material Identification

A. Assemblies shipped by the fabricator must be identified in such a manner that the inspector can be confident the certification applies to the material on hand. This identification must include, but is not limited to the following:

1. When shipment is made directly to a project site, each bundle (usually consisting of 15 assemblies) must bear a legible tag showing the following information:

   - Assembly fabricators name and plant location.
   - Project number.
   - Lot number or other identification that will also be shown on the accompanying certification.
   - Contractor's name.

2. When shipment is made to a supplier, the requirements of Section 4.07.04.A.1 apply, except a project number is not required and the supplier's name must be shown in lieu of the Contractor's name.

4.07.05. Inspection Procedure

A. The Contractor or supplier must arrange for inspection with the Region Materials Supervisor and must furnish necessary equipment and personnel needed to assist in the manipulation of the assemblies during the performance of the inspection.

B. The fabricator's certification for the shipment to be inspected must be reviewed by the inspector.

1. The inspector will perform a minimum of one inspection per manufacturer. The inspection should be conducted as soon as possible from the time of delivery to the project. At least one assembly from the shipment will be placed on a surface that will permit the inspector to determine wire sizes, assembly straightness, bar alignment, weld condition, dimensional measurements and any other inspection determined to be necessary.

2. The Inspector will document the results of the fabrication inspection on the Load Transfer Assembly Inspection Worksheet.

4.07.06. Visual Inspection

A. A maximum of 100 load transfer assemblies may be accepted using the basis of visual inspection (dowel bars need not be sampled) provided the inspector is familiar with and confident in the fabricator's quality of work.

4.07.07. Disposition

A. Assemblies may be rejected for failure to comply with physical dimensions and poor workmanship in fabrication or failure of dowel bars tested to meet specification requirements.

B. All assemblies not approved for use must be identified in such a manner that will preclude them from being re-inspected for MDOT use in the future. Assemblies not approved for use will be removed from the project site at the direction of the Construction/Project Engineer.

4.08 PRESERVATIVE TREATED WOOD PRODUCTS

4.08.01. Scope

A. This procedure covers the inspection and sampling of treated wood products.

4.08.02. Reference Documents

A. Standard Specifications for Construction.

B. Michigan Test Method 713.

4.08.03. Inspection

A. The inspection consists of a visual inspection for the species, quality, dimensional measurements, identification mark and treatment requirements as described in the specifications.

1. *Species* - Determine that the species conforms to those allowed in the specification for the item being inspected.

2. *Quality* - Inspect individual pieces for defects as described in the specification for the grade specified.

3. *Dimensions* - Compare cross-section and length with plans or specifications.

4. *Identification Mark* – An identification mark in the form of a brand is required on guardrail posts and blocks.

5. *Treatment* - A Report of Treatment is required as evidence of satisfactory treatment. A Report of Treatment must be furnished by the treatment plant for each charge of material treated showing time of each stage of the treatment, pressures and temperatures used, quantity of material treated and the amount and analysis of preservative used.

4.08.04. Sampling

A. Sampling will be done according to MTM 713.

4.09 THICKNESS OF ZINC AND EPOXY COATINGS APPLIED TO A FERROUS BASE

4.09.01. Scope

A. These procedures cover the use of instruments based on magnetic principles and apply to field thickness measurements only. The Test Method provides for the use of the Positector or Elcometer 456 gage (See Note 1).

NOTE 1: Either gage should not be used on round stock whose diameter is less than 1¼ inch.

TEST METHOD – Elcometer 345, Elcometer 456 or Positector.

4.09.02. Apparatus

A. The testing apparatus is electrically operated utilizing a probe which must be placed directly on the surface. The coating thickness is read directly on the instrument meter.

4.09.03. Test Specimens

A. When this test method is used, the specimen is the coated structure or article on which the thickness is to be evaluated.

4.09.04. Calibration of Apparatus

A. Calibration can be accomplished through either the use of the bare substrate of the coated material and non-magnetic thickness shims or the use of National Institute of Standards and Technology thickness calibration standards.

B. Calibrate the apparatus to read the thickness stated on the calibration standards in the desired range of use.

C. Hold the instrument firmly on the surface and perpendicular to the measuring plane during calibration and use.

1. If the instrument reading does not agree with the calibration standards, thickness adjustment is necessary. This must be done only after the instrument has been removed from the surface of the calibration block or surface to be coated (See Note 2).

   NOTE 2: Attempting to adjust this instrument while the magnet is in contact with a surface being measured will result in damage, necessitating expensive repair or replacement.

2. After removing the instrument from the surface, adjust the reading according to the furnished instruction manual until the reading agrees with the thickness of the calibration standards selected.

4.09.05. Procedure

A. Use the instrument only after it has been calibrated in accordance with Section 4.09.04.

B. Take no measurements closer than 1 inch to an edge or 3 inches to another mass of steel unless absolutely necessary.

C. Assure the coating is dry prior to use of the instrument.

D. Inspect the magnet tip and surface to ensure they are clean.

E. Take readings in areas free of vibration, electrical, or magnetic fields.

F. If readings are encountered outside the range of accuracy determined during calibration, repeat the calibration procedure in that range. Check the calibration frequently during use to ensure the instrument continues to read properly.

G. Take a sufficient number of readings to characterize the sample.

1. For surfaces which are generally large, as found in Metal End Sections or Corrugated Steel Pipe, a recommended minimum is five determinations at random for every 100 ft^2 of surface area. Each of the five determinations should be the mean of three separate gage readings within a ½ inch diameter circle.

2. For small surfaces, as found in Steel Reinforcement or Steel Posts, a recommended minimum is five determinations each, on opposite sides.

4.09.06. Rejections

A. Items may be rejected for failure to conform to coating thickness specifications as determined by the Test Method, or for any other failure of specification requirements for the particular material inspected.

4.10 TEMPORARY TRAFFFIC CONTROL CERTIFICATION AND ACCEPTANCE PROCEDURE

4.10.01. Scope

This procedure covers the documentation and inspection requirements for temporary traffic control devices and materials. This refers to those devices or materials listed under Part 6 of the most current edition of the MMUTCD, section 812 and 922 of the standard specifications, or associated special provisions. Note this procedure does not apply to temporary concrete barrier (TCB) and temporary pavement markings. For procedures related to inspection and acceptance of TCB and temporary pavement markings, please refer to 922.04 and 922.06 respectively.

4.10.02. General

A. Classification – All temporary traffic control devices are classified based on the FHWA document titled "Information: Identifying Acceptable Highway Safety Features," [HTML, PDF] which established four categories of work zone devices.

1. Category I devices are those lightweight devices which could be self-certified by the vendor.

2. Category II devices are other lightweight devices that need individual crash testing.

3. Category III devices are barriers and other fixed or massive devices that also need crash testing.

4. Category IV devices are trailer mounted lighted signs, arrow panels, etc. These devices are not required to be crash tested.

B. For questions about device classification based on this system, please contact the Traffic Incident and Work Zone Management Unit.

C. MDOT Contacts - The following personnel may be contacted if questions arise regarding submittal of documentation and/or evaluation of devices or materials covered herein:

Work Zone Delivery Engineer
System Operation & Management Section
Operations Field Services
6333 Lansing Road
Lansing, Michigan 48917
517-636-0300

4.10.03. Referenced Documents

A. MDOT Standard Specifications for Construction

Section 812 Temporary Traffic Control for Construction Operations
Section 922 Temporary Traffic Control

B. Michigan Manual on Uniform Traffic Control Devices - Part 6

C. ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features

D. FHWA – Crashworthy Work Zone Traffic Control Devices

4.10.04. Duties of the Inspector

A. Materials and Sampling – It is the inspector's duty to ensure all temporary traffic control materials and devices used in the project are visually inspected and correspond to the information in the certification letter provided by the contractor, and meet all the requirements of the Standard Specification for Construction, or associated Special Provisions. All links within the tables must be verified as working before accepting the Traffic Control Certification Letter.

4.10.05. Acceptance

A. The contractor must provide the engineer with a certification letter in the format of the sample provided. Check the Workzone ProjectWise folder, document titled Temporary Traffic Control Certification Letter for the most current version of the letter. If you don't have ProjectWise access contact the Work Zone Delivery Engineer for the most current version. This sample letter details the information required for each device category. The file name must be saved and submitted as detailed under Division 1 Supplemental Information e-Construction.

B. Category I Devices – These devices must be visually inspected to make sure that the material and design are in agreement with the self-certification letter provided by the contractor. Upon visual inspection, the device must be in acceptable condition as outlined in the ATSSA Quality Guidelines, and documented in an IDR.

C. Category II & III Devices – These devices must have a crash test letter provided, and must be visually inspected upon installation to verify that they are assembled correctly and are in acceptable condition, and documented in an IDR. Any documentation to allow modification to the original design must be included with a certification letter. If WZD-100 or WZD-125 are used in their entirely, no additional documentation is required.

1. Crash test letters and any documents approving modifications should utilize a link to the Workzone Projectwise folder. Please contact the Work Zone Delivery Engineer to have an approval letter added to the folder.

D. Category IV Devices – These devices must meet all of the requirements set forth in section 812 and 922 of MDOTs Specification for Construction, the MMUTCD Part 6, and any associated Special Provisions. Visual inspection includes conformance with the specifications, as well as verification of the condition of the device.

1. As currently configured and deployed, these devices provide a net benefit to motorists. Substantial crash experience to date shows that crashes with these devices are rare. They have been identified by FHWA as portable, usually trailer-mounted, devices such as area lighting supports, flashing arrow panels, temporary traffic signals, and changeable message signs which are often used in or adjacent to the traveled way. The AASHTO/FHWA agreement states that time is needed to conceive and evaluate alternative measures for making these devices crashworthy, to examine the use and crash histories of existing devices, and to review and, if needed, develop safer, cost-effective strategies for the placement or replacement of these devices that will provide motorists with

needed information for driving in work zones.

2. (FHWA Policy Memo http://www.fhwa.dot.gov/legsregs/directives/policy/ra.htm)

E. Device Sheeting – Must meet current MDOT standards as spelled out in the project documents, or in section 812 and 922 of MDOTs Specification for Construction. Sheeting will be visually inspected on each device for retroreflective qualities, and acceptance must be documented in an IDR.

F. General Material Certification - Documentation of this is covered as part of the self-certification letter; this should be verified with a visual inspection and documented in an IDR.

4.10.06. Rejection

A. Temporary Traffic Control Devices and Materials - These items must be visually inspected and approved as detailed above before payment can be made. Any devices or materials that fail initial inspection must be repaired or replaced, then re-inspected for acceptance before payment will be made.

B. Unacceptable devices must be rejected, which include those devices that do not meet the requirements listed in the standard specifications or the special provisions, as well as those included in MMUTCD part 6. Devices or materials will also be rejected if they are not in acceptable condition per the ATSSA Quality guidelines (for those devices covered by that document), or per the discretion of the engineer.

C. Payment will not be made for any devices rejected upon initial inspection; quantities of rejected devices must be noted in the IDR and submitted to the contractor.

D. Device Sheeting - If device sheeting is rejected to due visual appearance, additional documentation detailing the specifics of the sheeting, such as Manufacturer, ASTM D Code, and a product specification sheet may be requested from the contractor for verification.

E. Material Certification - If any item is rejected due to visual appearance, additional specifications may be requested from the contractor for verification.

4.11 NON-PRESTRESSED STRUCTURAL PRECAST CONCRETE FABRICATION

4.11.01. Scope

A. This non-prestressed structural precast concrete fabrication inspection procedure should be used to aid the quality assurance inspector (QAI) in interpreting and enforcing the contract documents for non-prestressed concrete elements. Fabrication inspection includes the time from verifying materials used for fabrication through loading for shipping to the construction site. The following non-prestressed structural precast concrete elements are included in this inspection procedure:

1. Culverts (if required by the contract or as directed by the Engineer)
2. Prefabricated bridge element systems
3. Mechanically stabilized earth panels (if required by the contract or as directed by the Engineer)
4. Sound wall posts and panels (if required by the contract or as directed by the Engineer)

4.11.02. Reference Documents

A. QAI must have a thorough knowledge of the following references:

1. The following sections of the MDOT Standard Specifications for Construction (MDOT SSC) as modified by supplemental specification 12SS-001A – Errata, as applicable:

   Section 104 Control of the Work
   Section 105 Control of the Materials
   Section 406 Precast Three-Sided, Arch, and Box Culverts

2. The following special provisions, as applicable:

   12SP-105A Source of Steel and Iron (Buy America)
   12SP-604C QC and Acceptance of PCC for Structural Precast Concrete
   12SP-706D Mechanically Stabilized Earth Retaining Wall System

3. Contract plans and specifications

4. Construction Field Services Division (CFS) Materials Source Guide (MSG)

5. MDOT Structural Fabrication Unit E-Construction Process

6. MDOT Structural Fabrication Quality Assurance Guidance Document

7. Prefabrication meeting minutes (if available)

B. QAI must be familiar with the following references:

1. MDOT Structural Fabrication Request for Information Process

2. MDOT Shop Drawing Review Process

3. MDOT Structural Fabrication Nonconformance Process

4. Michigan Test Methods

MTM 102	Michigan Test Method for Abrasion Resistance of Aggregate by the Los Angeles Machine
MTM 108	Michigan Test Method for Materials Finer than No. 75 Sieve in Mineral Aggregates by Washing
MTM 109	Michigan Test Method for Sieve Analysis of Fine, Dense Graded, Open Graded, and Coarse Aggregates in the Field
MTM 114	Michigan Test Method for Making Concrete Specimens for Freeze-Thaw Testing of Concrete Coarse Aggregate
MTM 115	Michigan Test Method for Testing Concrete for Durability by Rapid Freezing in Air and Thawing in Water
MTM 206	Michigan Test Method for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders

5. AASHTO Standards

T 22	Compressive Strength of Cylindrical Concrete Specimens
T 23	Making and Curing Concrete Test Specimens in the Field
T 231	Capping Cylindrical Concrete Specimens

6. ASTM Standards

A 185	Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A 416	Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete
A 497	Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C 94	Standard Specification for Ready-Mixed Concrete
C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
C 138	Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete
C 143	Standard Test Method for Slump of Hydraulic Cement Concrete
C 172	Standard Practice for Sampling Freshly Mixed Concrete
C 173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C 595	Standard Specification for Blended Hydraulic Cements
C 617	Standard Practice for Capping Cylindrical Concrete Specimens
C 1231	Standard Practice for Use of Unbonded Caps in determination of Compressive Strength of Hardened Concrete Cylinders
C 1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar bar Method)
C 1567	Standard Test Method for Determining the Potential Alkali-Silica

Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar bar Method)

C. MDOT Accident Prevention Plan

4.11.03. Qualifications, Responsibilities, Duties, and Equipment

A. Qualifications of the QAI – QAI performing the fabrication inspection must possess the following qualifications:

1. Michigan Concrete Association (MCA) Level I Field Testing Technician certification or American Concrete Institute (ACI) Concrete Field Testing Technician – Grade I (except period of effectiveness will be reduced from 5 years to 3 years to match MCA); and
2. Michigan Certified Aggregate Technician (MCAT) Level I (only required for aggregate sampling).

B. Responsibilities of the QAI – QAI performing the fabrication inspection is not permitted to make changes to the contract and has the following responsibilities:

The Contractor, Fabricator, and MDOT will approach quality control and quality assurance as a team effort to facilitate accurate and timely construction. QAI's verification does not relieve the Fabricator from the responsibility to perform the required testing and inspection to produce a product satisfying the contract. Though QA inspection may include all aspects of fabrication, the QAI must not supersede QC, which is the responsibility of the Fabricator. If QC is not accomplishing its role then the Structural Fabrication Unit, Engineer, Contractor, and Fabricator must determine the necessary corrections.

QAI is the responsible party, representing the Engineer, who performs quality assurance verification inspection on the element after quality control (QC) inspects and approves the item of work. The QAI must be at the fabrication facility at all times during fabrication as required by the inspection procedure stated below. If issues arise, it will be at the Engineer's discretion whether to increase the level of QA inspection.

It is the Engineer's responsibility to engage the Engineer of Record (EOR) when making structural decisions. The Engineer is also responsible for following internal MDOT procedures for review and approval of shop drawings, fabrication procedures, request for information (RFI), nonconformance reports (NCR), and for professional decision making on fabrication problems that arise. The Engineer relies on the Structural Fabrication Unit to manage and assist when appropriate. The Engineer has the prerogative for holding a prefabrication meeting with the Fabricator to discuss and clarify the contract plans and specifications. The Engineer is the responsible party who ensures MDOT's fabrication QA program is followed for inspection and acceptance of the element.

Fabrication should proceed only with approved shop drawings. However, if the Fabricator must proceed prior to receipt of approved shop drawings (performing work at their own risk), ensure that the Structural Fabrication Unit is aware of this activity and await instruction on how to proceed. If the Engineer permits the work to proceed without approved shop drawings, proceed with basic QA functions using the non-approved shop drawings. Later, verify notes against approved drawings. Notify the Structural Fabrication Unit immediately if fabrication is not in conformance with the

approved shop drawings.

C. Duties of the QAI – QAI performing the fabrication inspection has the following duties:

1. QAI must thoroughly understand the contract documents.
2. QAI must verify steel material certifications show compliance with Buy America contract requirements.
3. QAI must be proficient in performing fresh concrete tests, sampling aggregate and other materials, verifying material traceability, and inspecting concrete pours.
4. QAI must be proficient in writing reports and using computers.
5. QAI must notify the Engineer if production begins before approved shop drawings are on the shop floor and provided to the QAI.
6. QAI must communicate all concerns through QCI or whomever the Fabricator directs during the prefabrication meeting.
7. QAI must communicate with QCI to obtain the work schedule.
8. QAI must follow *MDOT's Structural Fabrication E-Construction Process* for closing out fabrication inspection file.

D. Deficiencies on Local Agency Projects – MDOT's QAI must notify the Structural Fabrication Unit if they observe fabrication or inspection deficiencies on local agency program (LAP) projects. The Structural Fabrication Engineer will report the deficiencies via email to the Engineer that is responsible for construction oversight of the local agency project and carbon copy the applicable CFS and Design Division LAP Engineers.

E. Inspection Facilities and Access – Facilities for the QAI must be provided by the Fabricator per contract documents. QAI must have access to all parts of the work at all times. The authority and general duties of the QAI are specified in Section 104.01.D and E of the MDOT Standard Specifications for Construction.

F. Inspection Equipment – QAI will be furnished with the following items by the Engineer:

1. Contract documents (MDOT SSC, special provisions, standard plans, special details, plan sheets, etc.)
2. Approved shop drawings (provided by Fabricator)
3. Access to MDOT's Fabrication Inspection & Construction System (FICS)
4. MDOT shop approval stamp

QAI must provide the following inspection equipment:

1. Computer with high speed internet access
2. Cell phone with camera
3. Flashlight
4. Temperature measuring devices capable of covering the range from 0°F to 200°F
5. Fresh concrete testing equipment (thermometer, slump cone kit, and air-meter)
6. Measuring devices (200 foot and 20 foot steel tape and calipers)
7. Straightedge and levels
8. Safety equipment
9. Other as needed for the project

4.11.04. <u>Inspection Procedure</u>

A. Prefabrication Meeting – Prefabrication meetings facilitate effective quality control and

quality assurance on the project and are conducted by MDOT's Structural Fabrication Unit prior to the start of fabrication and preferably after shop drawings have been approved. The Structural Fabrication Unit, QAI, Fabricator, and QCI must be present, whereas the Engineer and Contractor should be present to ensure a team effort to facilitate accurate and timely construction. Quality assurance and quality control contact information will be shared during this meeting to ensure effective communication.

B. Fabrication Inspection – Non-prestressed concrete must be fabricated in accordance with the MDOT SSC and contract documents. QAI and QCI must pass MDOT independent assurance testing (IAT) prior to performing fresh concrete testing on an annual basis. Fabrication inspection must be performed as shown below:

1. Non-prestressed concrete fabrication inspection consists of verifying compliance with the approved shop drawings, contract documents, and approved NCRs. RFIs must be incorporated into the approved shop drawings for the QAI to inspect to.

2. An approved Materials Source List (MSL) is provided to the QAI by the Engineer so that the QAI knows what materials are being incorporated into the project and what the basis of acceptance is. The MSL is used to track material sampling by the QAI and to foster communication with QCI to ensure all required sampling and testing occurs in a timely manner to prevent impacts to the project schedule. It is the Fabricator's responsibility to notify the QAI when materials are available for sampling.

3. QAI begins by inspecting materials that will be used in the fabrication process and ensures they are being stored correctly, tagged for traceability purposes, and are in conformance with the contract documents. Next, the QAI inspects the Fabricator's operations to ensure the condition of the equipment and work area for conformance to the contract documents.

4. MDOT's Accident Prevention Plan states, "MDOT employees shall not engage in any act which would endanger another employee or themselves". QAI must notify the Engineer immediately if work conditions exist that are not safe. If the level of inspection diminishes below what is specified in this QA procedure, due to safety concerns, then the element will not be approved for use.

C. Forming and Casting

1. *General Information* - QAI must confirm the dimensional requirements of the bulkheads, side forms, bearing plates, steel reinforcement, void boxes, inserts, and any other devices per the approved shop drawings as part of their post-pour inspection. The only exception is that anything that cannot be inspected post-pour, must be inspected during pre-pour. It is important to emphasize that QA must not supersede QC so the QAI's inspection must come after QC has completed their inspection and approves the element. QAI then uses the QC inspection reports (if available) during their verification inspection.

2. *Concrete Forms* - Concrete forms must be maintained and remain true to the shapes and dimensions as shown on the approved drawings.

a. Metal forms must be used since they are designed to be rigid for repetitive castings without deforming or weakening due to the heat from the hydration process. Forms must be well braced and stiffened against undesirable deformations under pressure of fresh concrete and must have smooth joints and inside surfaces accessible for adequate cleaning after each use.

b. Joints between panel forms must be made and maintained smooth and tight. Unless otherwise shown on approved shop drawings, all corners or intersections of surfaces exposed in the completed structure must be chamfered with a minimum dimension of 0.50 inches and all re-entrant angles must be rounded with a minimum radius of 0.75 inches.

c. Forms that are warped, distorted, damaged, or improperly cleaned must not be used. Wood forms may be used for bulkheads. The inside faces of all forms must be coated with an approved chemical release agent.

3. *Reinforcing Steel* – QAI must confirm that the reinforcing steel is of the correct size, free from defects, and properly positioned. The reinforcing steel must be free of oil, lubricants, foreign material, and excessive rust. If epoxy coated bars are to be used then nicks in the coating are not permitted.

   QAI must spot check that the reinforcing steel has been properly positioned and secured in accordance with the approved shop drawings and make certain that inserts have been placed where required.

4. *Tests on Fresh Concrete* – QAI must perform testing as required in the contract documents and document the results in MDOT Form 0590. The Fabricator must collect additional fresh concrete for QAI to perform their tests as needed.

5. *Placing of Concrete* – The concrete must be promptly placed with minimum handling to avoid segregation of the materials and the displacement of the reinforcement. Each element must be cast in a continuous operation with minimal interruption between the placing of adjacent portions of concrete and each layer must be placed and consolidated before the preceding layer has taken initial set.

6. *Consolidation of Concrete* – A minimum amount of vibration necessary to thoroughly consolidate the concrete must be used. QAI must verify a rubber coated vibrator head is used when epoxy-coated or other coated reinforcement is used.

D. *Curing Requirements* - Curing requirements for non-prestressed concrete must be as specified in the contract documents. When steam or radiant heat curing is used, recording thermometers must be provided by the Fabricator that monitors the time/temperature relationship through the curing period while artificial heat is used. The QAI must verify that the recording thermometers are placed in critical locations for monitoring the time/temperature relationship during the curing period. At least three recording thermometers must be placed at locations where the anticipated heat generated by the concrete is the lowest and highest just after initial concrete set. Documentation from the Fabricator's recording thermometer must be given to the QAI

for their review. Temperature requirements during the curing operation must be in accordance with the contract specifications.

E. *Material Requirements* – Materials must meet the requirements of the contract documents unless a RFI requesting alternate materials has been approved by the Engineer. Material must be from suppliers and producers listed in the MDOT MSG. Material from any other source must be tested for acceptance prior to incorporation into the project.

F. *Shipping Requirements* – Elements must attain the required compressive strength as indicated by test results of QC compressive strength test cylinders, which have been cast and match cured for this purpose as described per the contract documents. These cylinders must be cast with metal MDOT tags and the compression testing must be witnessed by the QAI.

4.11.05. Reports

A. The Engineer may require a periodic status report from the Structural Fabrication Unit; therefore, all reports are required to be completed in a timely and orderly manner using the applicable fillable Adobe portable document format (PDF) forms listed below that can be found on MDOT's website. Make entries as soon as possible after an event or conversation to ensure accuracy. Number the reports consecutively until completion of the work, with the last report noted "final".

B. QAI must complete an accurate and detailed account of fabrication for the project. The report must include a discussion of fabrication progress for all aspects of the work. It is intended to be a detailed record of the status of fabrication and should include number of elements fabricated, documentation of specification and procedure compliance as well as documentation of conflicts, repairs, and other problems or discussion which could affect the project in anyway. If force account work is taking place, document each day that the work occurs in the shop and which elements are being worked.

C. Documentation is not a substitute for appropriate dialogue with the Fabricator, but should provide a record of important discussions. In some cases, the QAI is more familiar with the events or issues and therefore should review and comment on draft copies of the Structural Fabrication Unit's correspondence.

D. Reports must be assembled into one fabrication inspection Adobe portable document format (PDF) file and stored in MDOT's ProjectWise document storage program per *MDOT's Structural Fabrication Unit's E-Construction Process*. The Engineer will receive a fabrication inspection memorandum from the Structural Fabrication Engineer after fabrication inspection is complete. The memorandum is for informational purposes and is not used for acceptance.

E. Below is a list of various MDOT reports and a brief description of their purpose and use requirement. Similar forms can be used in place of the standard MDOT form if noted below.

1. *Fresh Concrete and Strength Tests Report (Form 0590)* – This form must becompleted by QAI for each casting bed, which may contain several elements.

2. *Repair Observation Report (Form 1981)* – This form is only used if QAI performs QA verification inspection on repairs that have been approved by the Engineer.

3. *Bar Reinforcement Report (Form 1985)* – This form is only used if QAI performs QA verification inspection on bar reinforcement for prefabricated bridge element systems (PBES) or other elements that contain large amounts of reinforcement as directed by the Engineer.

4. *Structural Precast Concrete Folder Checklist (Form 2001)* – This form must be completed by QAI for each project. The checklist is placed on top of the fabrication inspection folder when the project is complete.

5. *Pre and Post Pour Inspection Checklist (Form 5616)* – This checklist must be completed by QAI for a minimum of one element per project. The checklist is placed in the fabrication inspection folder when the project is complete.

6. *Structural Precast Concrete Shop Inspection Report (Form 5617)* – This form must be completed by QAI on a weekly basis for each project and should contain a brief narrative of the work performed over the reporting period. The report must contain the following information: Weather conditions, elements worked on, work activity, non-conformances, shipping, force account work (rare), and anything else deemed important by the QAI.

4.11.06. Stockpile Payment

A. This stockpile payment section directs the QAI on the requirements when stockpile payment inspection is requested by the Structural Fabrication Unit. The QAI must perform the following steps:

1. Verify fabricated material meets approved shop drawings (if applicable);
2. Verify stockpile quantity and include quantity in report;
3. Verify material is labeled for MDOT use only;
4. Verify material is correctly stored and protected from the elements; and
5. Provide a report summarizing the inspection and provide adequate photos that represent the general condition of the elements, how they're being stored, and piece marks.

4.11.07. Acceptance

A. The Fabricator is required to provide the QAI with a minimum of five (5) copies of the Bill of Lading for each shipment. QAI will stamp each copy of the Bill of Lading with the MDOT "Approved for Use" stamp and will retain one copy for their records. It is the Fabricator's responsibility to distribute the remaining copies of Bill of Lading to the following individuals:

1. QAI
2. Contractor
3. Fabricator
4. Contractor
5. Trucking company

The Bill of Lading is required to contain, at a minimum, the following information:

1. Shipping date
2. Description of cargo (quantity, element size, weight, etc.)
3. Element unique piece mark

4. MDOT project location (route, cross road/river, and city)
5. MDOT project information (structure number, control section, and job number)
6. Manufacturer's name and address

B. Acceptance consists of the following two part process:

1. Fabrication Inspection Acceptance: Structural elements must be inspected by the QAI after they are loaded for shipping. If the structural elements meet the contract requirements, the QAI will stamp them "Approved for Use". The elements must be stamped "Approved for Use" prior to shipping. Additionally, the QAI must stamp at least five copies of the Bill of Lading that is prepared by the Fabricator. The approval stamp is for use by the Department and does not relieve the Contractor of their responsibility to meet contract requirements.

2. Visual Inspection (VI) Acceptance: The Engineer must collect one copy of the stamped Bill of Lading and use it to verify the delivered structural elements. Additionally, the Engineer must verify that the elements are stamped and visually inspect them for signs of damage that may have occurred as a result of shipping and handling. This visual inspection should be documented in the field inspector's daily report.

4.12 "BUY AMERICA" Requirements For Steel and Iron Products

4.12.01. Scope

A. This procedure covers the process for submitting "Buy America" certification for products/materials/components that contain steel/iron that will be permanently incorporated into MDOT construction projects.

4.12.02. Referenced Documents

A.
- MDOT Standard Specifications for Construction
  Section 105: Control of Materials
- Bureau of Highway Instructional Memorandum 2013-01 Special Provision for Source of Steel and Iron (Buy America) or as superceded.
- 23CFR635.410 – Buy America Requirements

B. Contract Documents

12SP105(A) Special Provision for Steel And Iron (Buy America)

C. Construction Field Services Division Materials Source Guide

4.12.03. General

A. The manufacturer must provide a signed and dated certification statement on company letterhead that the product(s) meets and complies with Title 23 of the Code of Federal Regulations (CFR), Section 635.410. A link to the applicable CFR section is available at the following FHWA website: http://www.fhwa.dot.gov/construction/cqit/buyam.cfm

B. If the product(s) contain any amount of foreign steel/iron, or if any processes (coating, bending, cutting, etc.) that affect the steel/iron are completed non-domestically, the manufacturer must provide the invoice cost of these materials as related to the final cost of the product. Products may still be considered for use but will need to be evaluated by the prime contractor as falling under the minimal monetary amount for foreign steel/iron materials.

C. The manufacturer must maintain step certification documentation for the steel/iron and provide copies upon request. Step certification is defined as the certification by each manufacturer or fabricator for their specific process (step) that the product, material, or component was fabricated, manufactured, and/or processed in the United States.

D. Manufacturer certification will be valid for the calendar year in which they are received. Recertification must be submitted by January 1st of the following year or the manufacturer will be removed from the MDOT Buy America compliance list. Sample certification language is provided in section 4.12.04 of this document.

E. Refer to Bureau of Highway Instructional Memorandum 2013-01 for project specific Buy America certification statement submissions for products containing steel/iron that will be permanently incorporated.

4.12.04. Sample Certification Language

A. Full Compliance

I, _____ *(company representative)* certify that _____'s *(company name)* _____ *(product name)* is in full compliance with the FHWA Buy America requirements. If any of our process(es) or materials change that affect our compliance with the FHWA Buy America requirements we will immediately inform MDOT.

B. Partial Compliance

I, _____ *(company representative)* certify that _____'s *(company name)* _____ *(product name)* is in full compliance with the FHWA Buy America requirements except for $_____ of foreign steel/iron in each product. If any of our process(es) or materials change that affect our compliance with the FHWA Buy America requirements we will immediately inform MDOT.

4.12.05. Distribution

A. Submit all "Buy America" certification statements to the address shown below.

Michigan Department of Transportation
Construction Field Services Division
Attn: Construction Operations Engineer
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909
Phone: 517-636-6334

Note: Project specific Buy America certification statements per Bureau of Highway Instructional Memorandum 2013-01 must be submitted to the respective Construction/Project Engineer.

4.12.06. Withdrawal and Reinstatement of "Buy America" Compliant Status

A. Failure to comply with any applicable certification procedures is justification for withdrawal of certification privileges. A warning letter will be written to the manufacturer, pointing out the failure and requesting action to rectify the problem.

B. Certification privileges will be withdrawn if the certified material deviates from specification requirements.

C. Withdrawn certification privileges can be reinstated only if the manufacturer has corrected the identified deficiencies and has described the actions taken to prevent future shipment of nonconforming material.

D. Additional requirements covering the withdrawal and reinstatement of certification privileges may be included in the detailed procedures for individual materials.

4.13 OPTIMIZED AGGREGATE GRADATION

4.13.01. Scope

A. This procedure covers the processes for determining optimized aggregate gradations for Portland Cement Concrete (PCC).

4.13.02. Reference Documents.

A. MDOT Standard Specifications for Construction

B. ASTM and AASHTO Standards:

ASTM D 4791 Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

AASHTO T 11 Materials Finer than No. 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

AASHTO T 27 Sieve Analysis of Fine and Coarse Aggregates

AASHTO T 248 Reducing Samples of Aggregate to Testing Size

C. Michigan Test Methods (MTM):

MTM 107 Sampling Aggregates

MTM 108 Materials Finer than No. 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

MTM 109 Sieve Analysis of Fine, Dense Graded, Open Graded and Coarse Aggregates in the Field

MTM 110 Determining Deleterious and Objectionable Particles in Aggregates

4.13.03. Materials

A. Refer to subsection 902.03.C in the Standard Specifications for Construction for coarse, intermediate, and fine aggregate size definitions and physical requirements. Additionally:

1. No more than 15 percent of aggregates from a quarried carbonate source may pass the #4 sieve.

2. Aggregate with a freeze-thaw dilation greater than 0.040 percent retained on the 1/2 inch sieve cannot constitute more than five percent of the total combined aggregate.

B. General Aggregate Requirements

1. Aggregate Sources. A listing of aggregate sources meeting the specified values for freeze-thaw dilation and absorption is available from the Engineer.

2. Stockpiles. The Contractor must provide a detailed stockpile management plan, describing process controls for shipping, handling, and storage of each aggregate

(including the use of radial stackers with elevating conveyors) to minimize segregation and contamination, including proposed method(s) for aggregate quality control.

Production mixes can only be produced from stockpiles tested under the Contractor's Quality Control Plan for materials that represent that day's production gradation.

3. Preconditioning. All coarse and intermediate aggregates must be maintained at a minimum of saturated surface-dry condition prior to batching concrete.

4. Verification of Physical Requirements. The Contractor must provide the Engineer with written verification from the aggregate supplier(s) that the coarse, intermediate, and fine aggregates meet the specified physical requirements. Acceptable verification must include records of the supplier's quality control tests and supporting documentation, including most current MDOT freeze thaw test results.

C. Aggregate Particle Size Requirements

1. Maximum aggregate size for each optimized gradation will depend on the minimum concrete pavement thickness and application:

a. Pavements with a minimum thickness of concrete ≥ 6 inches = 2 inch maximum particle size aggregate

b. Pavements with a minimum thickness of concrete < 6 inches = 1½ inch maximum particle size aggregate

c. All other applications = 1½ inch maximum particle size aggregate

4.13.04. <u>Procedure</u>

A. Sampling

1. Obtain three samples of each individual coarse, intermediate, and fine aggregate using the mini-stockpile method in accordance with MTM 107. One mini-stockpile of each individual coarse, intermediate, and fine aggregate can be used to obtain all three samples of each individual coarse, intermediate, and fine aggregate.

Development of the initial Job Mix Formula may utilize historical pit gradations along with the aggregate samples described above.

2. All sampling must be performed by a Michigan Certified Aggregate Technician (MCAT).

B. Mechanical Analysis

1. Ensure that all coarse, intermediate, and fine aggregate samples are free of excess moisture (free moisture) prior to individually combining and subsequently reducing samples of aggregate to testing size.

2. Combine the three samples from each individual coarse and intermediate aggregate and reduce using Method B (Quartering) from AASHTO T 248. Combine the three samples from each fine aggregate and reduce using Method C (Miniature Stockpile Sampling) from AASHTO T 248. After combining and reducing samples, perform a

mechanical analysis on each of the coarse, intermediate and fine aggregate samples in accordance with AASHTO T 11 and AASHTO T 27. Use the following nest of sieves for the mechanical analysis: 2 inch, 1½ inch, 1 inch, 3/4 inch, 1/2 inch, 3/8 inch, No.4, No. 8, No. 16, No. 30, No. 50, and No. 100.

3. All mechanical analyses must be performed by a Michigan Certified Aggregate Technician (MCAT).

C. Use the gradations for each of the coarse, intermediate, and fine aggregates as determined in subsections 4.13.04.A and 4.13.04.B of this procedure for all calculations described in subsection 4.13.04.D of this procedure.

D. Determination of Optimum Aggregate Proportions

1. Combining Aggregate Gradations

Multiply the relative percentage for each classification of individual aggregate by the percent passing for each respective sieve. Add the resulting values based on each sieve size, for all aggregate classifications and divide by 100.

Note: "Relative Percentage" is the percent that each individual aggregate classification represents of the total combined aggregate blend. The sum of the relative percentages must equal 100 percent.

$$P = \frac{C(c) + I(i) + F(f)}{100}$$

P = Theoretical combined percent passing of a given sieve
C,I,F = Percent passing given sieve for Coarse, Intermediate, and Fine aggregate classification, respectively.
c,i,f = Relative percentage of total aggregate content.

Example from Table 1:

Theoretical combined percent passing the ½ inch sieve (P1/2 inch)

$$P_{1/2\ \text{inch}} = \frac{35(51.0) + 100(8.0) + 100(41.0)}{100} = 66.9\%\ \text{passing}$$

Convert the theoretical combined gradation percent passing to the theoretical combined gradation percent retained by subtracting the theoretical combined percent passing on the top sieve from 100. The theoretical combined gradation percent retained for each subsequent sieve is then calculated by subtracting its respective theoretical combined gradation percent passing from the preceding larger sieve's theoretical combined gradation percent passing.

This procedure may require a number of iterations to determine the desired proportion for each course, intermediate, and fine aggregate in efforts to produce an optimized combined gradation that meets the requirements for the project. There are software programs available to assist in the process.

Table 1: Example of Combining Aggregate Gradations

	Aggregate Classification				
Sieve	Coarse Aggregate	Intermediate Aggregate	Fine Aggregate	Theoretical Combined Gradation %Passing	Theoretical Combined Gradation %Retained
Relative Percent	51.0	8.0	41.0		
	Percent Passing				
2 inch	100	100	100	100.0	0.0
1½ inch	100	100	100	100.0	0.0
1 inch	83	100	100	91.3	8.7
¾ inch	65	100	100	82.2	9.1
½ inch	35	100	100	66.9	15.3
⅜ inch	14	100	100	56.1	10.8
No. 4	2.1	33	96	43.1	13.0
No. 8	0.9	2.8	82	34.3	8.8
No. 16	0.8	2.3	63	26.4	7.9
No. 30	0.7	1.8	37	15.7	10.7
No. 50	0.5	1.2	9.4	4.2	11.5
No. 100	0.4	0.7	1.0	0.7	3.5

a. Additional Requirements

The following conditions must also be met by the optimized aggregate blend:

1. The maximum theoretical combined gradation percent retained on a single sieve must be on a sieve larger than the ⅜ inch sieve.

2. The maximum theoretical combined gradation percent retained value must be equal to or greater than the theoretical combined gradation percent retained on any sieve smaller than the ½ inch sieve.

3. The sum of the theoretical combined gradation percent retained on any two adjacent sieves must be at least 10 percent, except for the maximum sieve size, nominal maximum sieve*, No. 100, and No. 200 sieves.

4. The theoretical combined gradation percent retained must be at least four percent for each sieve, except for the maximum sieve size, nominal maximum sieve*, No. 100, and No. 200 sieves, and at least eight percent retained on the 1 inch sieve for optimized blends with 2 inch maximum size aggregate or at least four percent retained on the ¾ inch sieve for optimized blends with 1½ inch maximum size aggregate. Optimized blends with 1½ inch maximum size aggregate may have up to 2.5 percent retained on the 1½ inch sieve.

   *The nominal maximum sieve is the 1½ inch sieve for an aggregate with a 2 inch maximum size and the 1 inch sieve for an aggregate with a 1½ inch maximum size.

2. Coarseness Factor

Use the optimized aggregate blend and the following formula to calculate a Coarseness Factor (CF).

$$CF = \frac{\text{[combined \% retained on 3/8 inch sieve and above]}}{\text{[combined \% retained on No.8 sieve and above]}} \times 100$$

Example (see Table 1):

$$CF = \frac{10.8+15.3+9.1+8.7}{8.8+13.0+10.8+15.3+9.1+8.7} \times 100 = 66.8 \approx 67$$

3. Workability Factor

Use the optimized aggregate blend and the following formula to calculate a Workability Factor (WF).

WF* = Combined % Passing No.8 Sieve

Example (see Table 1):

WF = 34.3 ≈ 34

*Increase the calculated WF by 2.5 percent for each increase of 94 pounds of cementitious material over 564 pounds per cubic yard.

4. CF vs. WF Chart

Plot the coarseness factor vs. workability factor (CF calculated in subsection 4.13.04.D.2 and the WF calculated in subsection 4.13.04.D.3) on the CF vs WF chart (see Figure 1).

a. Job Mix Formula (JMF) Zone

The Contractor's initial proposed optimized aggregate gradation to be used in production, as submitted to the Engineer in the Initial Mix Design, must plot within the Job Mix Formula Zone Boundary of the CF vs WF chart (see Figure 1).

b. Operating Zone

The Contractor must not use an optimized aggregate gradation for production that plots outside of the Operating Zone Boundary (Suspension Limit Boundary) of the CF vs WF chart (see Figure 1).

5. Loss by Wash (LBW)

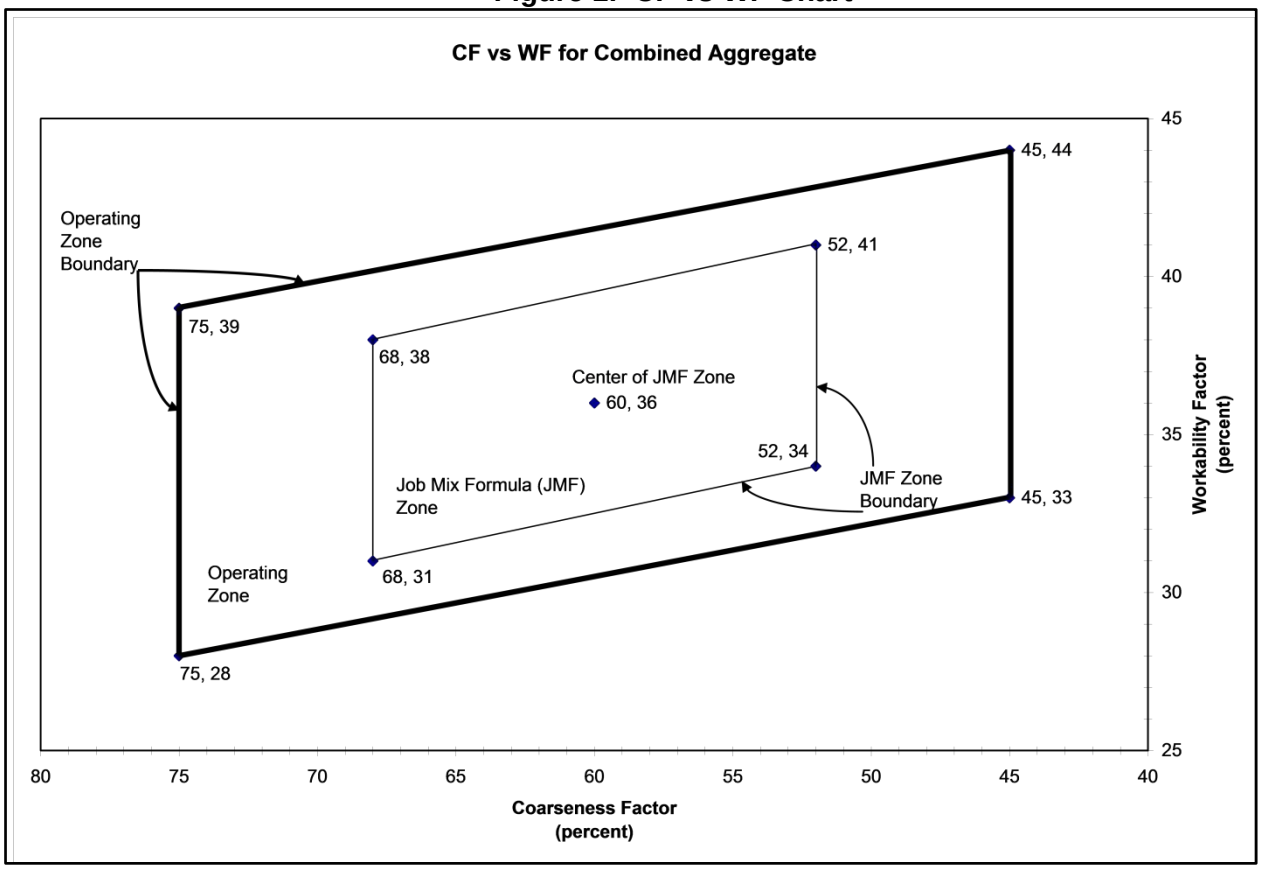
The Loss by Washing (MTM 108) for each coarse, intermediate and fine aggregate must be according to subsection 4.13.03.A of this procedure.

6. Finalized Combined Gradation Report

The Contractor must submit to the Engineer a report containing the individual gradation analysis report for each course, intermediate, and fine aggregate, and the Combined Aggregate Gradation documentation (see Table 1) and corresponding Coarseness Factor and Workability Factor charts (see Figure 1) with each Job Mix Formula for the Engineers approval prior to concrete production.

7. Prior to initial startup, the Engineer may sample the on-site production stockpiles for coarse, intermediate, and fine aggregate to verify the optimized aggregate gradation in accordance with subsection 4.13.04 of this procedure.

Figure 1: CF vs WF Chart



4.13.05. <u>Process Control During Concrete Production</u>

A. Production Gradation

A Production Gradation is a combined aggregate gradation (described in section 4.13.04 of this procedure) that is used during concrete production.

Aggregate samples must be taken from the production face of each aggregate stockpile using the mini-stockpile method in accordance with MTM 107.

Ensure that all coarse, intermediate, and fine aggregate samples are free of excess moisture (free moisture) prior to individually combining and subsequently reducing samples of aggregate to testing size.

Perform a mechanical analysis for each individual aggregate in accordance with MTM 109 utilizing the sieve nest listed in subsection 4.13.04.B.2 of this procedure. Verify the Loss by Washing of each aggregate in accordance with MTM 108.

1. Produce aggregate batch weights to reflect most current Production Gradation results.

   a. Concrete Paving Using On-Site Batch Plant. The Contractor must produce one Production Gradation prior to initial startup and one randomly during each subsequent day of production, thereafter, that represents materials to be used during the next day's production. When approved by the Engineer, projects using 20 cubic yards or less of concrete per day (reduced production) may reduce the subsequent random Production Gradation frequency to one test per week of production. If additional aggregate is to be added to the production stockpile during the period of reduced production, it must be sampled and tested by the Contractor for compliance prior to inclusion into the production stockpile, or physically separated from the current production stockpile until such a time when it can be sampled and tested for compliance. Production Gradation must meet the requirements for optimized aggregate gradation described in subsection 4.13.04 of this procedure. Each of these Production Gradations must be performed and completed, including aggregate proportion adjustments, to ensure that the CF vs WF will plot within the Action Limits Boundary (see subsection 4.13.05.B of this procedure) prior to use.

   b. Concrete Production Using Commercial Batch Plant. If the aggregates are being provided by aggregate sources meeting the requirements of the Department's Prequalified Aggregate Supplier Program, the Contractor may utilize the aggregate source's current weekly gradation analysis reports to maintain gradation quality control of daily concrete production for the combined aggregate proportions. Prior to initial startup and at least weekly during concrete production, thereafter, each of the designated on-site production stockpiles for coarse, intermediate, and fine aggregate must be sampled and tested by the Contractor to verify that the combined aggregate gradation for the JMF will plot within the Operating Zone Boundary (Suspension Limit Boundary) of the CF vs WF chart described in subsection 4.13.04.D.4.b of this procedure. If the Contractor provides documentation to the Engineer verifying an ongoing history of reasonable conformance between the on-site production stockpile gradation test results and the aggregate source's weekly gradation analysis reports, the Engineer may permit the frequency of weekly stockpile quality control testing to be further reduced for quantity of concrete produced during weeks of reduced production (20 cubic yards or less of concrete per day). The Contractor's proposed reduced frequency of on-site production stockpile quality control testing must then be approved by the Engineer at the preproduction meeting and documented in the Contractor's Quality Control Plan. Production Gradation must meet the requirements for optimized aggregate gradation described in subsection 4.13.04 of this procedure. Aggregate proportion adjustments may then be required to ensure that the CF vs WF will plot within the Action Limit Boundary (see subsection 4.13.05.B of this procedure).

      If the current weekly gradation analysis reports for the aggregate sources meeting the requirements of the Department's Prequalified Aggregate Supplier Program are not available or the aggregates are being provided by aggregate sources not meeting the requirements of the Department's Prequalified

Aggregate Supplier Program, the aggregates must be sampled at the batch plant, tested by the Contractor for compliance and approved by the Department prior to initial startup and at least weekly during concrete production, thereafter. If additional aggregate is delivered to the concrete production facility, it must be either sampled and tested by the Contractor for compliance prior to inclusion into the production stockpile or physically separated from the current production stockpile until such a time when it can be sampled and tested for compliance. Production Gradation must meet the requirements for optimized aggregate gradation described in subsection 4.13.04 of this procedure. Aggregate proportion adjustments may then be required to ensure that the CF vs WF will plot within the Action Limit Boundary (see subsection 4.13.05.B of this procedure).

A moving average of the two most recent and consecutive initial startup and daily random Production Gradations may be used to represent the materials to be used during the next day's production.

2. The Contractor must provide a Production Gradation Report verifying the completion, and results, of a Production Gradation to the Engineer prior to any production for that day. The Contractor must also provide a Production Gradation Report to the Engineer for any additional Production Gradation performed under the Contractor's Quality Control (see subsection 4.13.06.A.1.b of this procedure).

   a. The Production Gradation Report must include, but is not limited to, the following:

      1. Contract Number (Control Section/Job Number)

      2. Name of Contractor

      3. Date of Sampling and Testing and date test represents

      4. Individual aggregate gradations

      5. Combined aggregate gradations including the Theoretical Combined Gradation Percent Retained for each sieve (see Table 1)

      6. Optimized aggregate proportions – report in relative percentages and resulting batch weights

      7. CF and WF calculations

      8. Signed by a responsible representative of the Contractor

B. Corrective Action Limits

1. Action Limits must be determined and documented by the Contractor in the Quality Control Plan. Action Limits must not extend beyond the Operating Zone Boundary (Suspension Limit Boundary) described in subsection 4.13.04.D.4.b of this procedure (see Figure 2). Any Production Gradation (subsection 4.13.05.A of this procedure) that plots outside of the Action Limits will require the Contractor to perform all necessary corrective actions detailed in the Quality Control Plan (see subsection 4.13.06.A.1.c of this procedure) to return to within the documented Action Limits

Boundary. The Contractor must notify the Engineer whenever the process approaches an Action Limit.

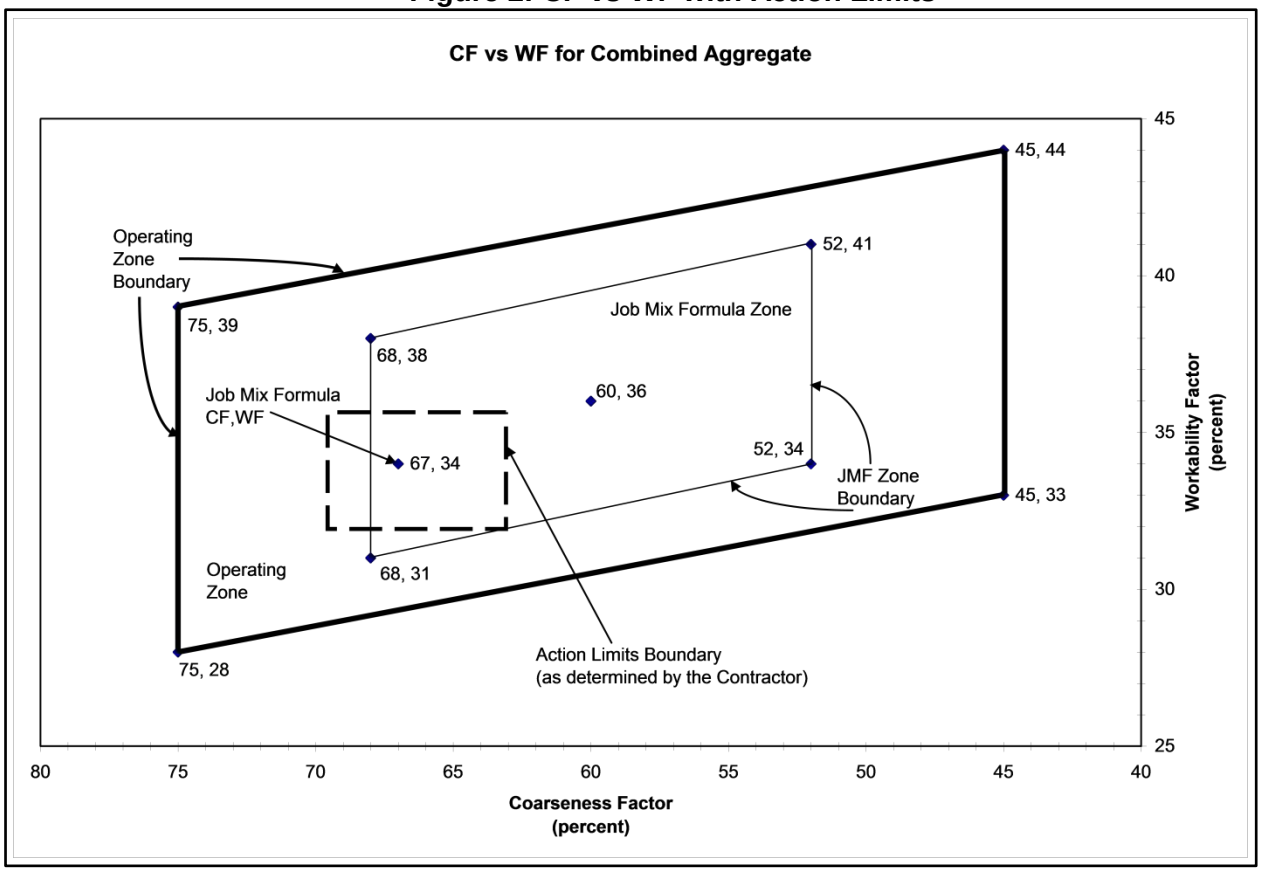
C. Suspension of Work Limits

1. The Contractor must stop production and perform all necessary corrective actions detailed in the Quality Control Plan (see subsection 4.13.06.A.1.c of this procedure) to return to within the documented Action Limits Boundary if any Production Gradation (subsection 4.13.05.A of this procedure) has a plotted CF vs WF value that is outside the Operating Zone Boundary (Suspension Limit Boundary) described in subsection 4.13.04.D.4.b of this procedure. The Contractor must notify the Engineer whenever the process approaches a Suspension Limit.

   After corrective action has been performed, a new Production Gradation (subsection 4.13.05.A of this procedure) must be established to verify that the corrective actions were successful. Production will not be allowed to continue until a new Production Gradation (subsection 4.13.05.A of this procedure) results in a CF vs WF that plots within the Action Limits Boundary. This new Production Gradation (subsection 4.13.05.A of this procedure) must then be used for process control and a new Production Gradation Report must be given to the Engineer.

2. The Contractor must stop production, perform all necessary corrective actions detailed in the Quality Control Plan (see subsection 4.13.06.A.1.c of this procedure), and notify the Engineer and Region Materials Supervisor if any combined individual gradation (see subsections 4.13.04.A and 4.13.04.B of this procedure) does not meet the requirements described in section 4.13.07 of this procedure. Resume production only after receiving a Notice to Resume Work (Form 1165) from the Engineer.

Figure 2: CF vs WF with Action Limits



4.13.06. Quality Control for Optimized Aggregate Gradation

A. Quality Control Plan

1. Elements of the Plan

The plan must address all elements that affect the quality of the aggregate, including but not limited to, the following:

a. Stockpile management (see subsection4.13.03.B.2 of this procedure).

b. The frequency of sampling and testing including additional Production Gradation beyond the minimum required in subsection 4.13.05.A.1 of this procedure.

c. Corrective Actions

1. Corrective actions to be taken when CF vs WF is outside of Action Limits Boundary.

2. Corrective actions to be taken when CF vs WF is outside of Operating Zone Boundary (Suspension Limit Boundary).

3. Corrective actions to be taken when an averaged gradation is non-compliant with section 4.13.07 of this procedure.

d. Methods for verifying Production Gradations.

B. Documentation

The Contractor must maintain records of all inspections and tests. The records must indicate the nature and number of observations made, the number and type of deficiencies found, the quantities represented by the test, and any corrective action taken. Copies must be submitted to the Engineer as work progresses.

1. A control chart and running tabulation of individual test results must be prepared for the following tests. These must be available to the Engineer at any time and submitted to the Engineer weekly in a format acceptable to the Engineer, including:

   a. Gradations for both individual and combined aggregates

   b. Moisture content of aggregates

   c. Coarseness Factor

   d. Workability Factor

2. Submit within 24 hours of sampling a copy of all documentation for each Production Gradation to the Engineer; including a copy of the respective Production Gradation Report (see subsection 4.13.05.A.2 of this procedure). Report coarse, intermediate, and fine aggregate proportions from each Production Gradation in relative percentage and resulting batch weights for each aggregate. Attach a copy of all respective concrete production batch tickets to the documentation for each Production Gradation.

C. Non-Compliant Materials

The Contractor must establish and maintain an effective and positive system for controlling non-compliant materials, including procedures for their identification, isolation and disposal. Reclaiming or reworking of non-complying materials must be in accordance with procedures acceptable to the Engineer.

All non-compliant materials and products must be separated and clearly identified to prevent use, shipment, and contamination with conforming materials.

The Contractor must take prompt action to correct and document conditions that have resulted, or could result, in the incorporation of non-compliant materials and update the Quality Control plan if necessary.

D. All sampling and testing performed under the Contractor's Quality Control Plan for optimized aggregate gradation must be performed by a Michigan Certified Aggregate Technician (MCAT). Each quality control person performing quality control sampling of aggregates on the project will be required to demonstrate to MCAT certified Department personnel proper sampling of course, intermediate and fine aggregate prior to batching concrete. The sampling will be conducted at the concrete batching facility. Aggregate samples will be taken from the production face of each aggregate stockpile using the mini-stockpile method according to MTM 107.

4.13.07. Aggregate Physical Properties Reports

A. Prior to the pre-production meeting, the Contractor must submit test reports from the aggregate producer verifying that the aggregates meet the physical requirements of this procedure. The reports must include, but are not limited to:

1. Coarse Aggregate:

- Freeze-thaw Report (MDOT report)
- Flat and Elongation Report (Aggregate Producer report)
- Mechanical Analysis (Aggregate Producer report)
  - Includes Gradation, Loss By Washing and Deleterious results
  - Deleterious results will include at least the following: Soft Particles %, Chert Particles %, Sum of Soft and Chert %, sum of Coke and Coal %, and Clay-Ironstone %

2. Intermediate Aggregate:

- Freeze-thaw Report (MDOT report)
- Mechanical Analysis (Aggregate Producer report)
  - Includes Gradation, Loss By Washing, and Deleterious results
  - Deleterious results include at least the following: Soft Particles %, Chert Particles %, Sum of Soft and Chert %, sum of Coke and Coal %, and Clay-Ironstone %

3. Fine Aggregate:

- Organic Impurities results (Aggregate Producer report)
- Mechanical Analysis (Aggregate Producer report)
  - Includes Gradation, Loss By Washing, and Fineness Modulus

4.13.08. Acceptance During Concrete Production

A. Acceptance of the coarse, intermediate and fine aggregates will be conducted in accordance with the Department's Procedures for Aggregate Inspection, except for the following:

1. Each individual production stockpile of intermediate and fine aggregate will be sampled at the same time as the corresponding coarse aggregate and tested concurrently, regardless of the individual quantities of intermediate and fine aggregate that have been used, to date, for the optimized aggregate mixture at the time the coarse aggregate is sampled.

a. Concrete Paving Using On-Site Batch Plant. The minimum sampling and testing frequency for each individual aggregate will be one per 5,000 tons of coarse aggregate used in the optimized aggregate mixture (one per project for projects less than 5,000 tons).

b. Concrete Production Using Commercial Batch Plant. As determined by the Engineer at the preproduction meeting, the minimum sampling and testing frequency for each individual aggregate will be based on either of the following criteria:

1. Quantity of Aggregate Used. The minimum sampling and testing frequency for each individual aggregate will be one per 5,000 tons of coarse aggregate used in the optimized aggregate mixture (one per project for projects less than 5,000 tons). For optimized aggregate mixtures that include one or more non-prequalified aggregate sources, the minimum sampling and testing frequency will be increased to ensure that all non-prequalified aggregates will be sampled and tested at a minimum frequency of one per 1,000 tons (one per project for projects less than 1,000 tons).

2. Volume of Concrete Produced. The minimum sampling and testing frequency for each individual aggregate will be one per 2,000 cubic yards of concrete produced for each Grade of concrete utilizing optimized aggregate gradations (minimum one per project per Grade of concrete).

2. Sampling for acceptance will be conducted at the concrete batching facility. Aggregate samples will be taken from the production face of each aggregate stockpile using the mini-stockpile method in accordance with MTM 107.

3. The Department will perform a mechanical analysis for each individual aggregate in accordance with MTM 109 utilizing the sieve nest listed in subsection 4.13.04.B.2 of this procedure.

   a. The Department will verify the Loss by Washing of each aggregate in accordance with MTM 108. Acceptance will be based on the Loss by Washing requirements specified in subsection 4.13.03.A of this procedure.

   b. The Department will verify the ability of the aggregates to be optimized. The mechanical analyses generated from the acceptance tests for each individual coarse, intermediate, fine aggregate will be compared to those provided by the Contractor that were used to generate the actual Production Gradation for the concrete representing the period of production when the acceptance samples were obtained. Acceptance of the combined aggregate gradation will be based on the ability of the combined aggregate gradation to plot within the Operating Zone Boundary (Suspension Limit Boundary) of the CF vs WF chart described in subsection 4.13.04.D.4.b of this procedure, using the mechanical analysis acceptance test results obtained in subsection 4.13.08.A.3 of this procedure, proportioned in their respective relative percentages as provided by the Contractor, above.

5.01 INDEPENDENT ASSURANCE PROGRAM

5.01.01 Scope

A. The FHWA, in accordance with Title 23, of the Code of Federal Regulations, Part 637, requires that all states develop a procedure for qualifying all testing personnel and laboratories used in acceptance decisions for Federal aid on projects on the National Highway System.

B. The Michigan Department of Transportation's (MDOT) Independent Assurance Program consists of two parts: Independent Assurance Test Procedures (5.02) and the Laboratory and Technician Qualification Programs (5.03).

C. Qualified sampling and testing personnel, other than those performing the Quality Assurance (QA) sampling and testing, should perform the Independent Assurance (IA) tests. Likewise, equipment other than that used for QA should be used for IA sampling and testing.

D. MDOT uses a system approach for its Independent Assurance Program. The IAT testing frequency for all testers and equipment is based on time. The purpose is to cover all the testers and equipment over a period of one year.

E. The MDOT Laboratory and Technicians Qualification Programs (5.03) contain criteria and guidelines for establishing and implementing a quality management system for use by construction materials laboratories. The essential elements of the laboratory quality systems include setting up and implementing policies regarding equipment maintenance and calibration, technician qualification and continued training, test results and document control, corrective action in case of nonconforming work, and participation in proficiency sample or inter-laboratory comparison testing Program(s). The areas covered by the program are: Hot Mix Asphalt, Concrete, Aggregate, and Aggregate Density.

5.02 INDEPENDENT ASSURANCE TEST (IAT) PROCEDURES

5.02.01. Scope

A. Independent assurance samples and tests (IATs) are one aspect of this program. IAT results are not used directly for determining the quality and acceptability of the materials and workmanship on a project, but serve as checks on the reliability of the results obtained in project acceptance sampling and testing.

B. The requirement for conducting IATs extends only to those federal aid projects on National Highway System routes.

C. The IAT program requirements apply to all persons (testers) conducting acceptance sampling and testing on covered projects. This includes MDOT technicians, consultant construction engineering personnel conducting acceptance testing as MDOT representatives, and local agency technicians or consultants.

D. The IAT program covers HMA mixtures, concrete, aggregates, and soil and HMA density.

E. These procedures provide a minimum framework on which to base independent sampling and testing frequencies. Testers may have a wide range of experience and abilities. Their performance should be carefully monitored through review of project test reports and IATs, with frequencies of IATs adjusted to fit the program needs.

5.02.02. Construction Field Services (CFS) Division Responsibilities

A. CFS provides assistance to the regions by maintaining Independent Assurance Testing procedures for each of the four areas requiring IATs.

B. CFS *technical coordinators* review IAT reports, assist in solving problems and compile annual reports of the number of IATs conducted, the number of discrepancies, trends, and areas for improvements. Technical coordinators are selected from the following areas of CFS:

- Soil and HMA Density - Density Technology Unit
- Concrete - Field Engineering
- Aggregate - Aggregate Quality Control
- HMA Mixtures - Bituminous Services Unit

C. The CFS technical coordinators will work with the statewide coordinator to summarize their findings, including a section that describes the nature of unsatisfactory IAT's and the corrective measures to be taken to reduce them, and include these in the annual IAT report to FHWA.

D. A *statewide coordinator* is appointed by CFS and is responsible for compiling a comprehensive annual IAT report for distribution to the regions and FHWA.

5.02.03. Region Responsibilities

A. *IAT coordinators* are appointed by the region or TSC. Within the constraints of the IAT program, it is the responsibility of the IAT coordinator and the Construction/Project Engineer to determine the need for tests and to designate appropriate personnel to conduct the IAT. The IAT coordinators have the following responsibilities for the program.

1. Review IAT reports in a timely manner and identify problem areas, identify trends, and make recommendations for improvement.

2. Review the program periodically with the CFS technical coordinators.

3. Ensure that equipment is checked as required and that this is noted on the IAT reports.

4. Notify appropriate Engineer if an individual refuses to participate in an IAT.

5.02.04. Location of IAT

A. Conduct the IAT on the jobsite while the tester is in the process of running normal acceptance testing for job control. A key part of the IAT is witnessing the sampling to determine if proper procedures are being followed. Carefully check the calibration and condition of sampling and testing equipment used.

5.02.05. IAT Technician

A. The region/TSC IAT coordinator will assign appropriate personnel to conduct IATs. IATs should be conducted by technicians not normally involved in the acceptance testing for the project. At the discretion of the IAT coordinator, exceptions may be made due to circumstances such as remoteness of the project or staffing limitations. Details concerning the qualifications of the IAT technician are included in the following IAT program areas.

5.02.06. Review of IAT Results

A. IAT test results are sent to the region/TSC IAT coordinator who will forward originals to the Construction/Project Engineer and copies to the appropriate CFS technical coordinators. Unless stated otherwise in these procedures, it is the responsibility of the region/TSC IAT coordinator to investigate unsatisfactory IATs, determine the cause, and take corrective action. Any corrective action should be well documented for the project file with copies sent to the appropriate CFS technical coordinator. Unsatisfactory IATs on local agency projects should be brought to the attention of the engineer in charge of the project. Detailed guidelines for evaluation of IAT results are included in the appropriate IAT program areas. However, failure to demonstrate the following will result in an unsatisfactory IAT.

1. Proper equipment to conduct sampling and testing.

2. Equipment properly calibrated and in good working order.

3. Sampling and testing conducted according to prescribed MDOT methods.

4. Willingness to participate in an IAT. (Indicate refusal in the remarks section of the IAT report.)

5.02.07. HMA Mixtures IAT Program

A. Qualifications of HMA Mixtures IAT Technician

1. At a minimum, the HMA IAT Technician must have successfully completed the QC/QA Certification Course currently approved by MDOT.

B. Conducting HMA Mixture IATs

1. One IAT, per test procedure, per HMA testing technician, per year is required. The IAT must be conducted early in the construction season and early in the acceptance testing process so deficiencies in testing or equipment can be reconciled.

2. Tests covered by the HMA mixtures are listed in Section 5.02.07.C. An IAT for a Marshall testing protocol is not acceptable for a person that will be performing Superpave testing and vice versa.

3. The IAT sample is obtained at the same time, location, and manner as the quality assurance sample for the project. The sample size will be twice the size of the typical quality assurance sample. The sampling will be performed by a qualified sampling technician.

4. The qualified sampling technician will split the IAT sample. Split the sample before it cools down to avoid the need for reheating one portion of the specimen twice. Both portions of the sample will be brought to the designated MDOT region HMA laboratory. The HMA testing technician, whom the IAT is being performed on, will test one portion of the sample (the field sample) in the same manner as the quality assurance samples for the project.

5. Equipment or procedural errors observed by the IAT technician during the IAT test will be noted on Form 1843. The IAT technician will make recommendation for pass/fail.

6. The IAT Technician will submit, in a timely manner, the field sample test result(s) with the proper identification and the remaining portion of the IAT split sample to the CFS Division's HMA testing laboratory (the laboratory sample).

7. The laboratory and field sample test results will be tabulated by the CFS HMA technical coordinator using Form 1842 and transmitted to the Construction/Project Engineer, HMA testing technician, IAT technician, region/TSC IAT coordinator, and Statewide HMA technical coordinator.

8. All IAT results will be reviewed by the CFS HMA Technical Services Unit. When an unsatisfactory test is reported, the Construction/Project Engineer, IAT technician, and region/TSC IAT coordinator will be notified by telephone or e-mail as soon as possible. This notification will be documented on Form 1842.

C. Evaluating HMA Mixture IAT Results - In addition to the requirements in Section 5.02.06, the following limits should be used when evaluating HMA mixture independent assurance tests. All deviations outside these ranges are considered unsatisfactory and require action.

HMA TEST	UNSATISFACTORY DEVIATION
Asphalt Contents (MTM 325)	varying by more than 0.5 percent
Aggregate Gradation	
1 inch to 3/8 inch sieve	± 5.0 percent
#4 to #8 sieve	± 4.0 percent
#16 to #50 sieve	± 3.0 percent
#100 to #200 sieve	± 1.0 percent
Crushed Content	varying by more than 15 percent
Maximum Theoretical Specific Gravity	varying by more than ± 0.019
Marshall Bulk Specific Gravity	varying by more than ± 0.026
Gyratory Bulk Specific Gravity @ N_{DESIGN}	varying by more than ± 0.020
NOTE: If it is apparent that inadequate or no inspection is being provided by the responsible tester, an unsatisfactory IAT should be reported with an explanation in the remarks section.	

5.02.08. Concrete IAT Program

A. Qualifications of Concrete IAT Technician

1. IAT Technicians must be certified, as appropriate, and experienced with concrete acceptance testing.

2. IATs for prestressed/precast concrete will be conducted and evaluated by Operations Field Services Division, Structural Fabrication Unit personnel. Copies of the IAT report will be sent to the region/TSC IAT Coordinator in which the fabrication plant is located and where the precast and prestressed concrete members will be used.

B. Conducting Concrete IATs

1. One IAT, per test procedure, as applicable, per concrete testing technician, per year is required. The IAT must be conducted early in the construction season and early in the acceptance testing process so deficiencies in testing or equipment can be reconciled.

2. Covered tests are those listed in 5.02.08.C

3. The IAT technician will witness sampling of fresh concrete and observe the tester performing the slump and air tests. An occasional comparison slump and air test should be performed by the IAT technician on separate equipment as a check on the acceptance test equipment.

4. A minimum of two cylinders; cast at the same time from the same source and cured under similar conditions should be used for the concrete compressive strength IAT. The cylinders should be at least 28-days old. The IAT technician will observe the tester break at least one cylinder using a compression machine that is used for quality assurance testing at the laboratory where the tester works. An occasional comparison compression test (cylinder break) should be run by the IAT technician preferably on separate equipment as a check on acceptance test equipment.

5. Technicians conducting acceptance tests on prestressed/precast concrete members must also be checked on prestressed strand tensioning calculations and preparing concrete cylinders.

C. Evaluating Concrete IAT Results

1. The requirements listed in section 5.02.06 must be met for a satisfactory IAT. Additionally, the limits shown in the table below are used to evaluate concrete independent assurance tests.

2. If the IAT result is unsatisfactory, the IAT technician will explain to the tester why the test was unsatisfactory and how it can be corrected. Every effort should be made to correct equipment or procedural problems at this time. The IAT should then be repeated until the problem is corrected and a satisfactory test is completed.

3. If unsatisfactory tests continue, the IAT coordinator will consult the region or TSC for action.

CONCRETE TEST	UNSATISFACTORY DEVIATION
Slump	varies more than 1 inch from comparison test results
Air content	varies more than 1 percent from comparison test results
Compressive Strength	varies more than 5 percent from comparison test results
NOTE: If it is apparent that inadequate or no inspection is being provided by the responsible tester, an unsatisfactory IAT should be reported with an explanation in the remarks section.	

4. All deviations outside these ranges will result in an unsatisfactory IAT.

5.02.09. Aggregate IAT Program

A. Qualifications of Aggregate IAT Technician

1. IAT Technicians must be a Michigan Certified Aggregate Technician (MCAT) and experienced with aggregate acceptance testing. Technician must be certified Level I or II, as appropriate, for the level of the tests being conducted.

B. Conducting Aggregate IATs

1. One IAT, per test procedure, per aggregate testing technician, per year is required. The IAT must be conducted early in the construction season and early in the acceptance testing process so deficiencies in testing or equipment can be reconciled.

2. Covered tests are those listed in 5.02.09.C

3. The IAT sample will be split, with one portion of the split tested by the technician running the acceptance tests. The IAT split sample should be tested on different equipment and reported within five days on Form 504.

4. The test results of the acceptance sample and the IAT split are sent to the IAT coordinator who will forward copies to the Construction/Project Engineer and the CFS, Aggregate Quality Control Group.

C. Evaluating Aggregate IAT Results

1. The requirements listed in section 5.02.06 must be met for a satisfactory IAT. Additionally, the limits shown in the table below are used to evaluate aggregate independent assurance tests.

2. If the IAT result is unsatisfactory, the IAT technician will explain to the tester why the test was unsatisfactory and how it can be corrected. Every effort should be made to correct equipment or procedural problems at this time. The IAT should then be repeated until the problem is corrected and a satisfactory test is completed.

3. If unsatisfactory tests continue, the IAT coordinator will consult the region or TSC for action.

AGGREGATE TYPE and TEST	UNSATISFACTORY DEVIATION
FINE AGGREGATE	
Gradation	Greater than 5 percent difference any sieve
Fineness Modulus	Greater than 0.1 difference
Loss by Washing	Greater than 0.8 percent difference
COARSE AGGREGATE	
Gradation	Greater than 5 percent difference any sieve
Deleterious	Greater than 1.5 percent difference
Loss by Washing	Greater than 0.6 percent difference
DENSE-GRADED and GRANULAR MATERIALS	
Gradation	Greater than 5 percent difference any sieve
Deleterious (HMA Top Course)	Greater than 3 percent difference
Loss by Washing (23A, Class IIA, Class III)	Greater than 2 percent difference
Loss by Washing (all other)	Greater than 1 percent difference
Crushed	Greater than 15 percent difference

4. All deviations outside these ranges will result in an unsatisfactory IAT.

5.02.10. Soil and HMA Density IAT Program

A. Qualifications of Density IAT Technician

1. IAT Technicians must be certified, as appropriate, and experienced with density acceptance testing.

2. Soil and HMA Density IATs are usually conducted by the Area Density Specialist.

3. CFS Density Technology Unit personnel will also conduct IATs.

B. Conducting Soil and HMA Density IATs

1. Soil and HMA Density IATs consist of witnessing the tester run in-place density test(s) and establish a maximum density.

2. One IAT, per test procedure, as applicable, per density testing technician, per year is required. The IAT must be conducted early in the construction season and early in the acceptance testing process so deficiencies in testing or equipment can be reconciled.

3. The following tests may be witnessed during a soil and HMA density IAT:

- Speedy Moisture Tester
- T-99 (1 Point)
- Michigan Cone (1 Point)
- Michigan Modified T-180
- Nuclear Density Gauge

4. If density testing is performed with equipment or methods not found in the MDOT Density Testing and Inspection Manual, the IAT must be listed as "unacceptable" with an explanation provided in the remark section. Contact the CFS Soil and HMA Density technical coordinator for advice on resolving this issue.

5. Record witnessed IATs on Form 0509 and distribute copies as noted on the form. The form must be signed by the IAT technician.

C. Evaluating Soil and HMA Density IAT Results

1. The requirements listed in section 5.02.06 must be met for a satisfactory IAT.

2. If the IAT result is unsatisfactory, the IAT technician will explain to the tester why the test was unsatisfactory and how it can be corrected. Every effort should be made to correct equipment or procedural problems at this time. The IAT should then be repeated until the problem is corrected and a satisfactory test is completed.

3. If unsatisfactory tests continue, the IAT coordinator will consult the region or TSC for action.

5.03 LABORATORY AND TECHNICIAN QUALIFICATION PROGRAMS

5.03.01. Hot Mix Asphalt (HMA)

A. HMA Quality Assurance (QA) Laboratory

1. QA Laboratory Qualification Process – Title 23, of the Code of Federal Regulations, Part 637, states that all states develop a procedure for qualifying all testing personnel and laboratories used in acceptance decisions for Federal aid on projects on the National Highway System.

2. The Michigan Department of Transportation (MDOT) Lansing Construction Field Services (CFS) Laboratory shall be American Association of State Highway and Transportation Officials (AASHTO) accredited in applicable HMA test procedures. A qualified laboratory must meet the following requirements to work on any MDOT project:

   a. QA laboratories will be assessed by AASHTO Materials Research Laboratory (AMRL). The AMRL assessments will follow the AMRL regional cycle (currently every 18 months).

   Note 1: The AMRL assessment is not for accreditation but for process and equipment reviews– See ***Appendix A: Minimum Test Methods Required for Quality Control/Quality Assurance QC/QA Laboratory Qualification*** *for minimum requirements.*

   b. QA laboratories must meet the minimum requirements of AASHTO R-18 documents with regard to the Quality System Manual (QSM). The AASHTO R-18 requirements will be applicable, at a minimum, to the test procedures listed in **Appendix A**.

3. QA laboratories must be evaluated by the MDOT CFS staff annually to ensure compliance with the requirements of the AASHTO R-18 document. Record of the evaluation will be included in the QA laboratories' QSM.

4. The MDOT Lansing CFS must conduct yearly HMA Round Robin for all QA & Quality Control (QC) testing laboratories.

   a. The results of the Round Robin will be compared to specific tolerance requirements. If test tolerances are not met, the testing processes and equipment will be reviewed and discussed. If a determination explaining the differences cannot be found, a second Round Robin sample will be run at any laboratory that did not verify.

   b. If the results of the second Round Robin sample are not within the required tolerances, Central Materials Laboratory staff will review testing procedures, equipment, and processes to determine the cause of failure to verify.

   c. The laboratory must participate and successfully complete the Round Robin as it is one of the requirements to be considered a qualified laboratory.

d. The CFS Round Robin must be completed prior to the region Round Robin.

e. QA laboratories will be identified on the Round Robin report whereas QC laboratories will be provided discreet identification numbers upon request.

5. QA laboratories must employ qualified technicians.

B. HMA QC Laboratory

1. QC laboratories must meet the following minimum criteria in order to perform testing on any MDOT project:

a. QC laboratories must meet the minimum requirements of AASHTO R-18 document with regard to the QSM. The AASHTO R-18 requirements will be applicable, at a minimum, to the test procedures listed in **Appendix A**.

b. QC laboratories must be evaluated by an internal/external source annually to ensure compliance with the requirements of the AASHTO R-18 document. Record of the evaluation will be included in the QC laboratory's QSM.

c. QC laboratories must employ qualified technicians.

d. QC laboratories must participate and successfully complete the MDOT CFS HMA Round Robin. This requirement applies to ALL laboratories that provide QC and/or local acceptance. See **Section 5.03.01.A.4** of this document for more information on the MDOT CFS HMA Round Robin.

C. HMA Qualified Technicians

1. HMA Qualified Technicians must obtain and maintain the following:

a. HMA QA Technicians:

1. Technicians performing QA on HMA must become certified and maintain their certification through a program approved by the MDOT. The current MDOT approved HMA technician certification program is being administered at Ferris State University – QC/QA Technician Certification Program.

2. Technicians must be evaluated on a yearly basis using an internal and/or external source. The Independent Assurance Testing (IAT) process located in *MDOT's Materials Quality Assurance Procedures Manual (MQAPM)* will be used for this evaluation. A copy of the technician evaluation will be included in the QA Laboratory's QSM.

b. HMA QC Technicians:

1. Technicians performing QC on HMA must become certified and maintain their certification through a program approved by the MDOT. The current MDOT approved HMA technician certification program is being administered at Ferris State University – QC/QA Technician Certification Program.

2. HMA QC Technicians must be evaluated on a yearly basis using an internal and/or external source.

a. The checklist in the **Qualified Hot Mix Testing** will be completed when evaluating a technician. A copy of the technician evaluation will be included in the QC Laboratory's QSM. It is the responsibility of the technician to have a copy of this evaluation available at any QC laboratory in which he/she is working.

OR

b. The IAT process located in *MDOT's MQAPM* can be used for this evaluation.

D. Maintaining Records

1. The MDOT Lansing CFS shall maintain a database to include the following information for QA/QC HMA testing facilities:

a. Laboratory name.

b. Last AMRL assessment date. (Required for QA laboratories only.)

c. Previous AMRL assessment date. (Required for QA laboratories only.)

d. AMRL Proficiency date. (Required for QA laboratories only.)

e. Internal/External evaluation date.

f. Round Robin date.

2. The MDOT Lansing CFS shall maintain a database to include the following information for QC/QA HMA technicians:

a. HMA certification number.

b. Expiration date.

c. QA IAT date.

d. QC technician evaluation.

3. It is the responsibility of the laboratory supervisor or the individual QC/QA technician to supply the MDOT Lansing CFS with the necessary information to keep the databases updated.

4. The MDOT Lansing CFS will annually review databases and inform the laboratory supervisor and/or individual QC/QA technician of any deficiencies or required corrective actions.

E. Disqualification of Laboratories & Technicians

1. QC/QA Laboratories

a. It will be the responsibility of the MDOT Lansing CFS to maintain up-to-date information on the program thereby ensuring that requirements of this document have been adequately met.

1. Deficiencies will be reported to the MDOT Statewide Quality System Engineer, laboratory supervisor, or applicable technician.

b. Failure to correct a deficiency within a 20 working day period will result in notification of the facility deficiency to the Engineer of CFS. The notification will include a recommendation of up to, and including, disqualification from testing on MDOT projects.

c. Upon correcting all deficiencies, a laboratory can be reinstated by the Engineer of CFS to resume testing on MDOT projects.

2. QC/QA Technicians

a. Falsifying Data – Permanent removal for testing on MDOT projects. Reinstatement cannot be considered.

b. Failure to meet the requirements of MDOT's IAT program or a laboratory internal/external review.

c. Failure to obtain recertification through a program approved by MDOT.

d. Upon correcting all deficiencies, a technician can be reinstated by the Engineer of CFS to resume testing on MDOT projects.

Appendix A

MINIMUM TEST METHODS REQUIRED FOR QC/QA LABORATORY QUALIFICATION

TEST METHOD	AASHTO, ASTM, MTM[1]	AMRL Laboratory Assessment	AMRL Proficiency Testing	Internal Review / IAT[3]
Reducing Samples of Hot Mix	HMA Production Manual			√
Quantitative Extraction of Bitumen from Bituminous Paving Mixtures (Method E)	T164, D2172, MTM 325	√	√	√
Bulk Specific Gravity of Compacted Bituminous Mixtures using Saturated Surface-Dry Specimens	T166, D2726, MTM 315	√	√	√
Sieve Analysis of Fine and Coarse Aggregate[2]	T27, C136 MTM 109	√	√	√
Mechanical Analysis of Extracted Aggregate[2]	T30, D5444, MTM 311	√	√	√
Maximum Specific Gravity of Bituminous Paving Mixtures	T209, D2041, MTM 314	√	√	√
Asphalt Content by Ignition Method	T308, MTM 319	√	√	√
Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures	T 269, D3203	√	√	√
Preparing and Determining the Density of HMA Specimens by Means of the SHRP Gyratory Compactor	T 312, D6925, MTM 315	√	√	√

The current Michigan Test Method (MTM) shall be used during internal reviews. If an MTM is not available, use the appropriate AASHTO or American Society for Testing and Materials (ASTM) as indicated in the applicable Special Provisions.

[1]: The current/latest versions of AASHTO/MTM/ASTM test procedures will apply. For AMRL laboratory assessment and proficiency testing, the test method will be determined by the MDOT Lansing CFS HMA Unit.

[2]: For AMRL laboratory assessment, either method can be reviewed to satisfy the requirements for Sieve Analysis.

[3]: Current Michigan MTM/IAT checklists shall be used for documentation of the review.

5.03.02 Concrete

A. Concrete Quality Assurance (QA) Laboratory

1. QA Laboratory Qualification Process – Title 23, of the Code of Federal Regulations, Part 637, states that all States develop a procedure for qualifying all testing personnel and laboratories used in acceptance decisions for Federal aid projects on the National Highway System.

2. The Michigan Department of Transportation (MDOT) Central Construction Field Services (CFS) laboratory must maintain American Association of State Highway and Transportation Officials (AASHTO) accreditation in applicable Concrete Technology QA test procedures (Appendix B.1).

3. A qualified QA laboratory must meet the following requirements in order to be able to perform testing on any MDOT project:

a. QA must, at a minimum, meet the requirements of the AASHTO R-18 document (available at AASHTO online bookstore) with regard to maintaining a laboratory Quality System Manual (QSM). The AASHTO R-18 document requirements will be applicable, at a minimum, to the test procedures listed in Appendix B.1.

b. The QA laboratories must employ qualified technicians (See Section 5.03.02.C.).

c. QA laboratories must be evaluated by MDOT Lansing CFS staff annually to ensure compliance with the requirements of the AASHTO R-18. Record of the evaluation will be kept in the QA laboratory's QSM.

d. QA laboratories must successfully complete a MDOT Lansing CFS laboratory conducted annual statewide proficiency or "Round Robin" program for concrete cylinder compression strength evaluation. This program will include both QA and Quality Control (QC) laboratories.

e. The results of the Round Robin will be compared to specific tolerance requirements of *2×Standard Deviation*. For QA laboratories that fail to meet the test tolerances, the testing processes and equipment must be reviewed. If an acceptable explanation can be determined, it shall be documented and included as part of the Round Robin records. If an acceptable explanation of the differences cannot be determined, the laboratory in question may be required to run additional test samples, until acceptable test results meeting proficiency tolerances are achieved.

B. Concrete QC Laboratories

1. QC laboratories must, at a minimum, meet the requirements of the AASHTO R-18 document with regard to maintaining a laboratory QSM. The AASHTO R-18 document requirements will apply to all applicable test procedures listed in Appendix B.1.

2. The QC laboratories must employ qualified technicians.

3. QC laboratories must be evaluated by an internal and/or external source[1] annually to ensure compliance of their respective QSM with the AASHTO R-18 document. The internal audit checklist provided in Appendix B.2; or internal audit check sheets available in the AASHTO R-18 document and also on the AASHTO Materials Research Laboratory website (www.amrl.net), may be used to document the laboratory evaluation. A copy of the evaluation will be included in the respective QC laboratory's QSM.

4. QC laboratories must participate in the annual statewide proficiency or "Round Robin" concrete cylinder compression strength evaluation that will be administered by the MDOT. The results of the Round Robin will be compared to specific tolerance requirements of D2S.

C. Concrete Qualified Technicians

1. Concrete Technology QA Technicians

a. Technicians performing QA testing must acquire and maintain their certification (See Appendix B.1 for types of certification required) through programs conducted or approved by the MDOT.

b. Technicians performing QA testing must be evaluated on a yearly basis[2]. The Independent Assurance Testing (IAT) procedure which is located in the *MDOT Materials Quality Assurance Procedures Manual (MQAPM)* will be used for this evaluation.

c. A copy of each technician evaluation will be included in the QA laboratory's QSM.

2. Concrete QC Technicians

a. Technicians performing QC testing must acquire and maintain their certification through a program conducted or approved by the MDOT.

b. Technicians must be evaluated on a yearly basis using an internal and/or external[3] source.

c. A copy of the technician evaluation will be included in the QC laboratories' QSM. It is the responsibility of the technician to have a copy of this evaluation available at any QC laboratory in which he/she is working.

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1. Internal/External Evaluation of Technicians: Technicians will be evaluated for technical proficiency in all applicable concrete test procedures from the list in Appendix A. This evaluation will either be carried out by the qualified Supervisor of the private testing Laboratory (internal evaluation) or by a recognized outside source (external evaluation) that maintains current certification in all applicable test procedures as listed in Appendix B.1.

2. The IAT will be required for those years when the technician in question will be, or is anticipated to perform materials testing on projects as categorized in Section 5.03.02.01(A)

3. Internal/External Evaluation of Technicians: Technicians will be evaluated for technical proficiency in all applicable concrete test procedures from the list in Appendix A. This evaluation will either be carried out by the qualified Supervisor of the private testing Lab (internal evaluation) or by a recognized outside source (external evaluation) that maintains current certification in all applicable test procedures as listed in Appendix B.1.

D. Maintaining Records

1. The MDOT will maintain a database which will include the following information for participating Concrete QA Laboratories:

   a. Laboratory name, address, phone.

   b. Name, phone, cell phone, email of Laboratory Supervisor or Laboratory Quality System Manager.

   c. Round Robin date including deficiency/corrective action dates.

   d. Copy (paper or electronic) of laboratory QSM.

2. The MDOT will maintain a database which will include the following information for QA Concrete Laboratory testing technicians:

   a. QA technician qualification status (i.e. certification & date of expiration).

   b. QA technician IAT dates.

3. The MDOT will maintain a database which will include the following information for participating Concrete QC Laboratories:

   a. Laboratory name, address, phone.

   b. Name, phone, cell phone, email of Laboratory Supervisor or Laboratory Quality System Manager.

   c. Round Robin date including deficiency/corrective action dates.

   d. Information regarding laboratory QSM.

4. The MDOT will maintain a database which will include the following information for QC Concrete Laboratory testing technicians:

   a. QC technician qualification status (i.e. certification & date of expiration).

   b. Internal/External evaluation date.

E. Disqualification of Laboratories & Technicians

1. Quality Control/Quality Assurance (QC/QA) Laboratories

   a. It will be the responsibility of the MDOT to determine if a deficiency has occurred in a laboratory. A “deficiency” is defined as a deviation from the requirements set forth by this document.

   b. The “deficient” laboratory will be issued a Notice of Non-Compliance; and the deficiency(s) and date of notification will be documented in the applicable databases.

c. Failure to correct a deficiency within 20 working days of Notice of Non-Compliance will result in notification of the facility deficiency to the Engineer of CFS. The notification will originate from MDOT Laboratory Quality Systems. Engineer and will include a recommendation, up to disqualification, from testing on MDOT projects.

d. Upon correcting all deficiencies, a laboratory may be reinstated by the Engineer of CFS to resume testing on MDOT projects.

2. QC/QA Technicians

a. Falsification of Test Results – Technicians found falsifying data will be disqualified from testing on all MDOT and Federal aid projects. Disqualification may be permanent as determined by the Engineer of CFS.

b. Failure to meet the requirements of MDOT's IAT program (QA technicians); or an internal/external review (QC technicians).

c. Failure to obtain recertification through a program conducted or approved by MDOT.

d. Upon correcting all deficiencies, a technician may be reinstated by the Engineer of CFS to resume testing on MDOT and Federal aid projects.

Appendix B.1

MINIMUM TEST PROCEDURES REQUIRED FOR MDOT QC/QA LABORATORY QUALITY PROGRAM

Procedure	ASTM/AASHTO Designation	QC/QA Technician Certification Requirement
Slump of Concrete	C 143 / T199	MCA Level I
Unit Weight of Concrete	C 138 / T121	MCA Level I
Air Content (Volumetric Method)	C 173 / T196	MCA Level I
Air Content (Pressure Method)	C 231 / T152	MCA Level I
Making and Curing Concrete Test Specimens	C 192 / T126	MCA Level I
Compressive Strengths of Cylindrical Specimens	C 39 / T22	MCA Certification OR MDOT Course
Temperature of Freshly Mixed Portland-Cement Concrete	C 1064 / T309	MCA Level I
Sampling Freshly Mixed Cement Concrete	T141	MCA Level I

Appendix B.2

MDOT Laboratories Internal Audit Checklist

Name of Laboratory	
Address	
Phone	
Fax	
Date	

1. Person responsible for managing the lab's quality system activities.

Name	
Title	
Phone	
Email	

2.

Are all applicable reference standards up to date and available to lab staff *(YES/NO)*	

3.0 Technician Qualification

3.1 List ALL Technicians that perform or are expected to perform testing on MDOT projects during the current construction year;

Add rows to the Table, if needed.

(1) Technician Name	(2) Certification Number	(3) Certification Expiration Date	(4) Test Procedure/s	(5) IAT Date for current year	(6) IAT performed by: (Name & Title)

[A]: See Section 3.2 of "Concrete Laboratory and Technician Qualification Program"

3.2

Has the Laboratory trained/evaluated the competencies of ALL technicians who are performing tests on MDOT projects (per AASHTO R-18, Section 5.5). (***YES/NO)***, if ***"NO"*** state reason/s below.	
Reason/s:	

3.3

Do the Technicians listed in 4.1 comply with the certification requirement as stipulated by MDOT. ***(YES/NO)***, if ***"NO"*** state reason/s below.	
Reason/s:	

4.0 Equipment Calibration, Standardization, Check, Maintenance (C/S/Ch/M)

4.1 Fill information regarding lab equipment that is used on MDOT projects

Add rows to the Table, if needed.

(1) Is equipment new for current year, (YES/NO)	(2) Equipment	(3) Maintenance Requirement Write: S = Standardization C = Calibration Ch = Check M = Maintenance	(4) Per AASHTO R-18, what is the minimum time interval required for performing **"Requirement"** mentioned in Column (3)	(5) Most recent date when **"Requirement"** in Column (3) was performed	(7) Are minimum time intervals for maintenance being met; (YES/NO)

4.2

Does the lab have certification and other documentation that establish the traceability of calibration of in-house reference standards (fluids, thermometers, gauge blocks, calipers, weights etc.) to NIST. ***(YES/NO)***, if ***"NO"*** state reason/s below.	
Reason/s:	

4.3

Has the lab calibrated/standardized/checked ALL applicable testing equipment that may be used in testing on MDOT projects. ***(YES/NO)***, if ***"NO"*** state reason/s below.	
Reason/s:	

5.0 Person responsible for coordinating lab's internal audit.

Name	
Title	
Phone	
Email	
Signature	

6.0

	YES/NO
7.1 Do internal audits of the lab occur at a minimum interval of every 12 months	
7.2 Are the requirements, *as set by the AASHTO R-18 Sections 5.6 & 5.7*, for **"Internal audits and Management Reviews"** being met.	
7.3 Are the requirements, *as set by the AASHTO R-18 Section 5.8*, for **"Corrective Action"** being met.	
7.4 Are the requirements, *as set by the AASHTO R-18 Sections 5.9*, for **"Records Retention"** being met.	

QUALITY SYSTEM MANUAL REQUIREMENTS

Type "YES" if the answer is YES; leave cell empty if the answer is NO.

	Changes Made (YES/NO)	Manual Updated (YES/NO)
a) Legal Name and Address		
b) Organizational Chart/s		
c) Staff Position descriptions		
d) Staff biographical sketches		
e) Staff training methods		
f) Staff evaluation methods		
g) Staff training/evaluation forms		
h) Equipment inventory list		
i) Equipment calibration/check list		
j) Procedure describing in-house calibrations/checks		
k) In-house equipment calibration/check procedures		
l) Equipment calibration/check certificates		
m) Procedures followed to produce test records		
n) Procedures followed to prepare, check, and amend test reports		
o) Test report forms		
p) Procedures for sample identification, storage, retention, and disposal		
q) Policies relative to on-site inspections and corrective action		
r) Policies relative to proficiency sample testing and corrective action		
s) Policies relative to handling external technical complaints		
t) Policies relative to internal quality system (audit) reviews		
u) Policies relative to subcontracting		

Describe any changes and/or updates made to the Laboratory Quality Manual;

5.03.03 Aggregate

A. Definitions

1. **AASHTO R-18: "Standard Recommended Practice for Establishing and Implementing a Quality Management System (QMS) for Construction Materials Testing Laboratories"** is available for purchase and download at the American Association of State Highway and Transportation Officials (AASHTO) bookstore. This document contains criteria and guidelines for establishing and implementing a QMS for use by construction materials laboratories. The essential elements of the laboratory QMS based on the AASHTO R-18 document include, but are not limited to, setting up and implementing policies regarding equipment maintenance and calibration, technician qualification and continuing education, test results and document control and corrective action in case of nonconforming work. In addition, the AASHTO R-18 also requires participation in proficiency sample or inter-laboratory comparison testing program/s. An example of such is the Round Robin testing program. The AASHTO R-18 also requires the creation and continued updating of a Laboratory Quality System Manual (QSM). This manual will contain information and records verifying that all requirements of the AASHTO R-18 are being met at the laboratory.

2. **Department:** Michigan Department of Transportation (MDOT) Lansing Construction Field Services (CFS), MDOT Region Material Sections or Construction Staff or any other part of MDOT associated with materials testing.

3. **MDOT MQAPM:** Michigan Department of Transportation Materials Quality Assurance Procedures Manual.

4. **MDOT PQASP:** Michigan Department of Transportation Pre-Qualified Aggregate Supplier Program

5. **Internal Audit of Laboratory:** Per requirements of the AASHTO R-18 document, each participating laboratory must have a process for conducting annual internal audits of its QMS. This audit will include review of the laboratory's QSM and making sure that all requirements of the laboratory's quality systems per AASHTO R-18 document are being met and that the QSM is up-to-date. The findings of the internal audit shall be documented. The MDOT Aggregate Laboratories Internal Audit Checklists or internal audit check sheets available in the AASHTO R-18 (Appendix X1) may be used to document the laboratory internal audit. Copy of the completed document should be placed in the laboratory's QSM. The internal audit can be performed by an **internal source** or an **external source**.

6. **Internal Audit Conducted by an Internal Source** means that the laboratory internal audit is performed by the Laboratory Supervisor or whoever is in charge of laboratory's quality systems program.

7. **Internal Audit Conducted by an External Source** means that someone not employed by the laboratory performs the laboratory internal audit. Examples of internal audit of a laboratory, conducted by an external source, are Independent

Assurance Tests (IATs)[4], on-site laboratory reviews conducted by AASHTO Materials Research Laboratory (AMRL) etc. An external source includes a source that maintains training and current certification in all applicable test procedures that are listed in Appendix C.

B. Aggregate QA Laboratory

1. QA Laboratory Qualification Process – Title 23, of the Code of Federal Regulations, Part 637, states that all States develop a procedure for qualifying all testing personnel and laboratories used in acceptance decisions for Federal aid projects on the National Highway System.

2. The MDOT Central CFS Aggregate Laboratory must maintain AASHTO accreditation in Aggregate QA test procedures that are listed below:

Test Method	Designation
Material Finer than 75 µm (No. 200) Sieve	T11 / C117
Bulk Density and Voids in Aggregate	T19 / C29
Organic Impurities in Sands	T21 / C40
Sieve Analysis of Aggregates	T27 / C136
Fine Aggregate Specific Gravity and Absorption	T84 / C128
Coarse Aggregate Specific Gravity and Absorption	T85 / C127
Abrasion of Coarse Aggregate	T96 / C131
Sand Equivalent Test	T176 / D2419
Reducing Samples of Aggregate to Test Size	T248 / C702
Moisture Content of Aggregate by Oven Drying	T255 / C566
Uncompacted Void Content of Fine Aggregate	T304 / C1252
Flat, Elongated, or Flat and Elongated Particles	---- / D4791
Fractured Particles in Coarse Aggregate	---- / D5821

3. A qualified QA laboratory must meet the following requirements in order to be able to perform testing for MDOT:

a. QA laboratory must meet the requirements of the MDOT MQAPM and MDOT PQASP.

b. QA laboratory must meet the requirements of the AASHTO R-18 document with regard to maintaining a Laboratory QMS. The QMS shall be available to the laboratory staff in the form of a QSM). The tests listed in Appendix C shall be included in the QMS.

c. Annual internal audits of QA laboratories (Section 5.03.03.A.(5-7)) will be conducted to ensure compliance with the MDOT MQAPM and AASHTO R-18. This audit will cover all the tests listed in Appendix C. The “MDOT Aggregate Laboratories Internal Audit Checklist” or internal audit check sheets available in the AASHTO R-18 (Appendix X1) may be used to document the internal audit. Copies of the internal audit records will be included in the respective QA laboratory’s QSM.

[4.] IATs can only be used to evaluate a technician’s proficiency in a particular test procedure and to check the accuracy of the equipment used in the IAT. Therefore, IATs are not substitute for a complete internal audit of all elements of a laboratory’s QMS.

d. QA laboratories must employ qualified technicians (See Section 5.03.03.D.).

e. MDOT Lansing CFS staff will biennially evaluate QA laboratories to ensure compliance with the requirements of the MDOT MQAPM and AASHTO R-18. Record of the evaluation will be kept in the QA laboratory's QSM.

f. QA laboratories must participate in the annual proficiency testing programs administered by AMRL for coarse aggregate and fine aggregate. The following provide the inputs that shall be submitted to AMRL for each proficiency test.

Fine Aggregate Proficiency Test Inputs
Material Finer Than 75-µm (No. 200) Sieve **Total Oven Dry Mass of Specimen Before Washing** (0.1 g) – T11/C117
Material Finer Than 75-µm (No. 200) Sieve **Percentage Finer Than 75-µm sieve by washing** (0.01 g) – T11/C117
Sieve Analysis of Aggregates **Total Material Passing the 4.75-mm (No. 4) Sieve** (0.1 percent) – T27/C136
Sieve Analysis of Aggregates **Total Material Passing the 2.36-mm (No. 8) Sieve** (0.1 percent) – T27/C136
Sieve Analysis of Aggregates **Total Material Passing the 1.18-mm (No. 16) Sieve** (0.1 percent) – T27/C136
Sieve Analysis of Aggregates **Total Material Passing the 600-µm (No. 30) Sieve** (0.1 percent) – T27/C136
Sieve Analysis of Aggregates **Total Material Passing the 300-µm (No. 50) Sieve** (0.1 percent) – T27/C136
Sieve Analysis of Aggregates **Total Material Passing the 150-µm (No. 100) Sieve** (0.1 percent) – T27/C136

Coarse Aggregate Proficiency Test Inputs
Material Finer Than 75-µm (No. 200) Sieve **Percentage Finer Than 75-µm sieve by washing** (0.1 g) – T11/C117
Sieve Analysis of Aggregates **Total Material Passing the 25.0-mm (1-in.) Sieve** (0.1 percent) – T27/C136
Sieve Analysis of Aggregates **Total Material Passing the 19.0-mm (3/4-in.) Sieve** (0.1 percent) – T27/C136
Sieve Analysis of Aggregates **Total Material Passing the 12.5-mm (1/2-in.) Sieve** (0.1 percent) – T27/C136
Sieve Analysis of Aggregates **Total Material Passing the 9.5-mm (3/8-in.) Sieve** (0.1 percent) – T27/C136
Sieve Analysis of Aggregates **Total Material Passing the 4.75-mm (No. 4) Sieve** (0.1 percent) – T27/C136

1. The results from proficiency testing will be compared to 2×Standard Deviation tolerance requirements. QA laboratories that fail to meet test tolerances will conduct a review of the testing processes and equipment. A copy of the results of this review will be documented and included in the QSM. If an acceptable explanation of the differences cannot be determined, the

laboratory in question may be required to run additional test samples, until acceptable test results meeting proficiency tolerances are achieved.

C. Aggregate Quality Control (QC) Laboratories

1. The "MDOT Aggregate Laboratory and Technician Qualification Program" applies only to QC laboratories that are also "MDOT PQASP" approved.

2. MDOT PQASP QC laboratories must follow the program in the MDOT MQAPM **"General Materials Certification Procedures for Approved Manufacturers/Supplier Status"**. The Pre-Qualified Aggregate Supplier QC laboratories must identify which of the test procedures listed in Appendix C will be part of their QC processes.

3. MDOT PQASP QC laboratories must follow the AASHTO R-18 document with regard to developing and maintaining a Laboratory QMS. The QMS shall be available to the laboratory staff in the form of a QSM. The MDOT PQASP QC laboratories must identify which of the test procedures listed in Appendix C will be part of their QMS. The AASHTO R-18 document requires that the laboratory QMS shall, at a minimum, contain the following information:

   a. **Management Requirements (Section 5 and Appendix X1 of AASHTO R-18):** QMS, Document Control, Organization, Staff, Technician Training and Evaluation, Internal Audits, Corrective Action, Records Retention.

   b. **Technical Requirements (Section 6 and Appendix B1 of AASHTO R-18):** Equipment Calibration, Standardization, Checks and Maintenance, Measurement Standards, Sample Management, Test Records and Reports, Subcontracting, Assuring the Quality of Results.

4. The MDOT PQASP QC laboratories must employ qualified technicians (See Section 5.03.03.D.).

5. Either an internal or external source will conduct the annual internal laboratory audit (see section 5.03.03.A.(5-7)) of the QC laboratory to ensure compliance with the MDOT MQAPM and AASHTO R-18 guidelines. This audit will cover all the tests mentioned in the laboratory's QSM and MDOT MQAPM QC Plan. The "MDOT Aggregate Laboratories Internal Audit Checklist" or internal audit check sheets available in the AASHTO R-18 (Appendix X1), may be used to document the laboratory evaluation. A copy of the evaluation will be included in the respective QC laboratory's QSM.

6. QC laboratories are not required to participate in AASHTO Materials Research Laboratory proficiency testing program.

D. Aggregate Qualified Technicians

1. Aggregate QA Technicians:

a. Technicians performing QA testing must acquire and maintain an appropriate level of qualification through the Michigan Certified Aggregate Technician Certification Program.

b. Technicians performing QA testing must be evaluated according to the procedures set forth in the MDOT MQAPM

c. Include a copy of each technician's evaluation (i.e. IAT[5]) in the QA laboratory's QSM. Furthermore, electronic copies of completed IAT forms must be uploaded onto ProjectWise (Statewide Groups/IAT/Aggregate/*current year*).

2. Aggregate QC Technicians:

a. Technicians performing QC testing at MDOT PQASP laboratories must acquire and maintain an appropriate level of qualification through the Michigan Certified Aggregate Technician Certification Program.

b. Include a copy of each technician's record of annual evaluation[6] in the QC Laboratory's QSM. If the technician is working at more than one laboratory, copy of the record will be available at each location where he/she is working.

E. Maintaining Records

1. The MDOT will maintain a database that will include the following information for participating Aggregate QA laboratories:

a. Laboratory name, address, phone.

b. Contact information of Laboratory Supervisor and/or Laboratory Quality System Manager.

c. Participation in proficiency testing program/s which shall include any corrective action records.

d. CFS laboratory reviews.

e. Quality Control/Quality Assurance (QC/QA) laboratories Internal Audit Checklists which are to be submitted annually by the laboratories specified in the requesting memorandum.

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5. Refer to the MDOT MQAPM for information on IATs.

6. Annual Evaluation of lab technicians is completed as part of a lab's annual internal audit (Section 5.03.03.01 E-G). Additional technician evaluations may be carried out on an as-needed basis.

2. The MDOT will maintain a database that will include the following information for QA Aggregate laboratory testing technicians:

   a. QA technician qualification status (i.e. certification & date of expiration).

   b. QA technician's IAT dates.

3. The MDOT will maintain a database that will include the following information for participating MDOT PQASP QC laboratories:

   a. Laboratory name, address, phone.

   b. Contact information of Laboratory Supervisor and/or Laboratory Quality System Manager.

4. The MDOT will maintain a database that will include the following information for QC Aggregate laboratory testing technicians:

   a. QC technician qualification status (i.e. certification & date of expiration).

F. Disqualification of Laboratories and Technicians

1. QC/QA Laboratories:

   a. It will be the responsibility of the Department to act once a deficiency has occurred in a laboratory. A "deficiency" is defined as a deviation from the requirements set forth by this document, the MDOT PQASP in the MDOT MQAPM and the AASHTO R-18 document.

   b. The "deficient" laboratory will be issued a Notice of Non-Compliance by MDOT Lansing CFS.

   c. Failure to correct a deficiency(s) within 20 working days of Notice of Non-Compliance will result in notification of the facility deficiency to the Engineer of CFS. The notification will originate from the MDOT Laboratory Quality Systems (LQS) Engineer and will include a recommendation, up to and including disqualification, from testing on MDOT and Federal aid projects.

   d. If a laboratory is disqualified, that laboratory may apply for reinstatement after correcting the deficiency(s). The Engineer of CFS will review the application to resume testing on MDOT and federal aid projects.

2. QC/QA Technicians:

   a. Technician Deficiencies:

      1. Falsification of Test Results – Technicians found falsifying test reports will be disqualified from testing on all MDOT and Federal aid projects. Disqualification may be permanent as determined by the Engineer of CFS.

2. Failure to meet the requirements of MDOT IAT program.

3. Failure to acquire and/or maintain certification through a program conducted or approved by MDOT.

b. Failure to pass proficiency sample test program.

c. It will be the responsibility of the Department to determine if a deficiency involving a technician has occurred.

d. The "deficient" technician will be issued a Notice of Non-Compliance; and the deficiency(s) and date of notification will be documented in the applicable databases.

e. Failure to correct a deficiency within 20 working days of Notice of Non-Compliance will result in notification of the technician deficiency to the Engineer of CFS. The notification will originate from the MDOT LQS Engineer and will include a recommendation, up to disqualification, from testing on MDOT and Federal aid projects.

f. If a technician is disqualified, they may apply for reinstatement after correcting the deficiency(s). The Engineer of CFS and Controlling Region Materials Supervisor will review the application to resume testing on MDOT and Federal aid projects.

Appendix C

MINIMUM TEST METHODS REQUIRED FOR QC/QA[7] LABORATORIES

Procedure	MTM/AASHTO/ASTM Designation
Sampling Aggregates	MTM 107
Sampling Open Graded Drainage Course Compacted in Place	MTM 119
Reducing Samples of Aggregates to Testing Size	T248/C702
Percent Finer than 75-µm by Washing	MTM 108
Sieve Analysis	MTM 109
Determining Deleterious Particles in Aggregate	MTM 110
Determining Percentage of Crushed Particles in Aggregate	MTM 117
Organic Impurities in Fine Aggregate for Concrete	T21/C40
Flat, Elongated, or Flat and Elongated Particles in Coarse Aggregate	ASTM 4791

[7] Depending on the type of aggregate/s supplied to MDOT; not all tests listed above would necessarily be applicable to any particular Quality Control laboratory.

5.03.04 Field Density Testing

A. Field Density Technician Qualifications

1. Technicians performing field density testing must be certified and evaluated as necessary by Independent Assurance Test (IAT) in accordance with the following criteria:

a. Certification

1. Technicians performing Quality Assurance testing on departmental projects must become certified and maintain certification through a program conducted or approved by the MDOT Geotechnical Services Section, Density Technology Unit.

b. Independent Assurance Tests (IAT)

1. NHS routes

a. Technicians who perform density testing on federal aid projects on the National Highway System (NHS) must be evaluated by an IAT. IAT procedures outlined in the MDOT Quality Assurance Procedures Manual will be used for this evaluation.

2. Non NHS routes

a. Evaluation by IAT is not required; however, MDOT reserves the right to evaluate technician proficiency using IAT procedures outlined in the MDOT Quality Assurance Procedures Manual.

B. Maintaining Records

1. Lansing C&T Geotechnical Services Section maintains a data base which includes the following information for Field Density Testing Technicians:

a. Radiation safety training data

b. Density certification training dates

c. Certification number

d. Expiration date

e. Technician name and address*

* The technician is responsible for informing the department of address change.

2. The database is updated periodically as training sessions are conducted

C. Disqualification of Technicians

1. Falsifying Data

   a. Technicians found falsifying data will be disqualified from acceptance testing on MDOT and federal aid projects. The term of disqualification may be permanent and will be determined by the Engineer of C&T.

2. Failure to obtain Recertification

   a. Technicians who allow their certification to lapse are not qualified to perform density testing on MDOT or federal aid projects. Reinstatement will be considered only after successful completion of a training program conducted or approved by the MDOT Geotechnical Services Section, Density Technology Unit. The specific coursework necessary for reinstatement will be determined by the Engineer of C&T.

3. Failure to meet the requirements of the IAT program

   a. NHS routes

      1. Technicians who fail to meet the requirements of the IAT program as outlined in the MDOT Quality Assurance Procedures Manual will be disqualified from acceptance testing on NHS routes.

   b. Non NHS routes

      1. MDOT reserves the right to evaluate and disqualify technicians from density testing using IAT procedures outlined in the MDOT Quality Assurance Procedures Manual. If evaluation is deemed necessary, technicians failing to meet these requirements may be disqualified from density testing.

4. Other actions deemed detrimental to the MDOT Quality Assurance Program

6.01 GENERAL QUALIFIED PRODUCTS LIST

6.01.01. Scope

A. The Qualified Products List (QPL) is a list of manufacturers and products that have been laboratory or field tested by MDOT or by a third party and have been found to meet specifications and performance criteria. Each QPL has its own evaluation procedure and requirements for remaining on the list. The Qualified Products Lists are found in the Materials Source Guide (MSG).

6.01.02. Documentation Requirements

A. Items incorporated into MDOT projects that are selected from a QPL are required to be documented with a General Certification meeting the requirements of Section 3.01.03 of this manual.

B. Proper cross-referencing is required in order to trace the documentation for these items. All Qualified Products require a Visual Inspection (VI).

6.01.03. Buy America Information

A. Buy America Certification – To be included on the Buy America Compliance Listing. See Chapter 4.12 of this Manual for details. Buy America compliance lists of Qualified Products are published on the internet at the following link; http://www.michigan.gov/mdot/0,1607,7-151-9622_11044_11367---,00.html

QUALIFICATION PROCEDURE FOR OVERBAND CRACK FILLER (Alt 2)

6.02.01. Scope

A. This document covers the physical requirements for Crack Fillers in Pavements and the procedure to be followed by producers in order to have their products included on the MDOT's Qualified Products List (QPL) for a qualification period of three years.

6.02.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)*- Submit a completed copy of the evaluation form to the MDOT address listed below:

Materials Technology Group
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5043

B. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as manufacturer's name and address, manufacturer's trade name, model number, etc. of the Crack Filler submitted. Descriptions of the test procedures are attached.

C. *Evaluation Based on the Following Standards* – Submit a completed copy of the Physical Requirements for Overband Crack Fill to the MDOT HMA Laboratory for compliance with Subsection 502.02.B.2 of the Standard Specifications for Construction. Testing will then be conducted by MDOT.

D. *Evaluation Scheduling* – Completed Qualification Procedure, including evaluation forms and products submittal, must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all materials submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be made at the discretion of MDOT.

6.02.03. Evaluation

A. The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The manufacturer will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.02.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of product materials, manufacturing, or changes made by either MDOT or the product manufacturer.

6.02.05. Requalification

B. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the qualification period.

6.02.06. Testing Procedure

A. The following testing will be conducted by MDOT Construction Field Services Testing laboratory. Submit a 3 to 5 lb sample in a "sample release box".

6.02.07. Physical Requirements for Overband Crack Filler

	SPEC. REQUIREMENTS		TEST RESULTS			TESTED BY
	MINIMUM	MAXIMUM				
POUR TEMP: F						
MELTING TIME: Min						
PENETRATION @ 77F, 150 g, 5 SEC., CONE: dmm	50	90				
Flexibility, -29F, 1", 90Deg, 10sec	SHALL PASS					
BOND TEST @ -20 F (50% EXTENSION):			1	2	3	
1st CYCLE:	SHALL PASS					
2nd CYCLE:	SHALL PASS					
3rd CYCLE:	SHALL PASS					
RESILIENCE PERCENT:	45	75				
CHECKED BY:	DATE REPORTED:					

QUALIFICATION PROCEDURE FOR CONCRETE PAVEMENT REPAIR, GROUT FOR FULL-DEPTH CONCRETE PAVEMENT REPAIRS

6.03.01. Scope

A. This document covers the physical requirements for adhesive systems for grouting dowel and tie bars for full-depth concrete pavement repairs and the procedures to be followed by producers in order to have their products included on the MDOT's Qualified Products List (QPL) for a qualification period of three years.

6.03.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below:

Materials Technology Group
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5695

B. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as bar and hole preparation, mixing and working times, gel and final cure times, etc., of the adhesive system submitted.

C. *Evaluation Based on the Following Standards* - Submit two cartridge and four to six static mixing nozzles and nuts. If a mixing gun other than a standard hand-operated mixing gun is required, include it in the shipment. The MDOT Materials Technology Group will evaluate for compliance with the requirements set forth in Section 6.03.07 Physical Requirements, of this document.

D. *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all materials submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

6.03.03. Evaluation

A. The submitted information will be reviewed and tests will be set up. If the product meets the physical requirements of Table 1, it will be placed on the QPL. MDOT reserves the right to re-evaluate a product at any time. The submitter will be notified in writing concerning the result of the evaluation.

6.03.04. Disqualification

A. A product may be removed from the QPL should any problem develop during mixing, placing, or in performance. MDOT must be notified in writing of any change in the product formulation. Specific changes may require re-evaluation of the product.

6.03.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submission of a written request, along with acceptable evidence that the problems causing the disqualification have been corrected.

6.03.06. Testing Procedure

A. *Gel Time* - The gel time shall be tested in accordance with ASTM C 881, except the 30 minutes will be a maximum rather than a minimum and the samples shall be 100 grams.

B. *Insertability of Bars* - Cast 20 x 18 x 12 inch deep blocks of concrete according to ASTM C 192. Moist curing shall occur until the blocks have reached an age of 14 days, when they will then be removed from the moist environment. Then drill a maximum of twelve 1½ inch diameter by 8 inch deep holes. The holes, measured from their center, shall be at least 2½ inches away from any edge of the block and at least 2½ inches away from any other hole. Remove dirt and debris from holes with compressed air or wire brush. Store the blocks until they are needed. One block can be used until all holes have been utilized. When ready to test, gun enough material into one hole to completely fill the space around the bar after it is inserted. Then insert a 1¼ inch diameter bar slowly into the hole, rotating to allow any air voids to escape. This is all done with the long axis of the hole and bar positioned horizontally. The bar shall be able to be inserted in less than 30 seconds. This test shall then be repeated once.

C. *Loss of Adhesive Material* - After the insertability test, the excess adhesive is troweled flush with the concrete. The system shall then be allowed to fully cure at which time the amount of adhesive that has flowed out from the space between the top of the bar and the top of the hole is measured. This depth from the face of the concrete at the edge of the hole to the adhesive shall not be more than ¼ inch.

6.03.07. Physical Requirements for Adhesive Systems for Grouting Dowel and Tie Bars for Full-Depth Concrete Pavement Repairs

	Result	Spec
Gel Time, minutes		30 max.
Insertability of bars, seconds		30 max.
Loss of adhesive material, inch (mm)		¼ (7) max.

Comments:_____

Material: **PASSES** or **FAILS** (circle one)

MDOT testing by: _____ Date: _____

QUALIFICATION PROCEDURE FOR NON-SHRINKING MORTAR AND GROUT, PREMIXED, TYPE H-1 (NON-METALLIC)

6.04.01. Scope

A. This document covers the physical requirements for non-shrinking mortars and grouts and the procedure to be followed by producers in order to have their products included on MDOT's Qualified Products List (QPL) for a qualification period of three years.

6.04.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)*- Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below. Portions of the physical requirements report sheet that may require test data to be furnished by the submitter must be completed in full.

Materials Technology Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Email: MDOT-ConcreteEngineer@michigan.gov

B. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc. of the non-shrinking mortar or grout submitted.

C. *Evaluation Based on the Following Standards* - Include a report of tests conducted by an independent laboratory. The physical properties of the product must be filled out and meet the requirements given in Section 6.04.07, Physical Requirements. Descriptions of the test procedures are attached.

D. *Evaluation Scheduling* - Completed submittals will be evaluated by MDOT throughout the year.

6.04.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.04.04. Disqualification

A. A product may be removed immediately from the QPL if any problems develop related to installation or performance.

6.04.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the qualification period.

6.04.06. Testing Procedure

A. Preliminary Information and Preparation for Specimens

1. *Preparation of Specimens* - The specimens and procedures will follow ASTM C 1107.

B. Required Independent Laboratory Testing

1. *Consistency* - The consistency of the material will be testing in accordance with ASTM C 109 and ASTM C 939 as applicable.

2. *Yield* - The yield for the material will be tested in accordance with ASTM C 138.

3. *Compressive Strength* - The compressive strength of the material will be tested in accordance with ASTM C 109 and modified as indicated in Section 11.5.1-11.5.3 of ASTM C 1107.

4. *Early Age Height Change* - Determine the early-age height change of grout in accordance with the applicable portions of Test Method C 827.

5. *Height Change of Hardened Grout* - Determine height change of hardened grout at 1, 3, 14 and 28 days in accordance with Test Method C 1090 and report.

6.04.07. Physical Requirements

A. To be completed by independent testing laboratory:

1. *Required Independent Laboratory Testing Data:*

a. Fluid (freshly mixed grout at 45°F)

Temperature as tested: _____ °F (°C) Water Added

Consistency (10-30 seconds by flow cone required) as tested: _____ seconds
Yield as tested: _____ cubic foot

Compressive Strengths:

Time	Required Strength	Actual Strength
3 Days	2500 psi (17.2 MPa)	
7 Days	3500 psi (24.1 MPa)	
28 Days	5000 psi (34.5MPa)	

Early Age Height Change: _____ % (ASTM C 1107)

Height Change of Moist Cured Hardened Grout: (ASTM C 1107)

Actual % Change 1 Day	Actual % Change 3 Days	Actual % Change 14 Days	Actual % Change 28 Days
%	%	%	%

b. Fluid (freshly mixed grout at 90°F)

Temperature as tested: _____ °F (°C) Water Added

Consistency (10-30 seconds by flow cone required) as tested: _____ seconds

Yield as tested: _____ cubic foot

Compressive Strengths:

Time	Required Strength	Actual Strength
1 Day	1000 psi (6.9 MPa)	
3 Days	2500 psi (17.2 MPa)	
7 Days	3500 psi (24.1 MPa)	
28 Days	5000 psi (34.5 MPa)	

Early Age Height Change: _____ % (ASTM C 1107)

Height Change of Moist Cured Hardened Grout: (ASTM C 1107)

Actual % Change 1 Day	Actual % Change 3 Days	Actual % Change 14 Days	Actual % Change 28 Days
%	%	%	%

c. Fluid (retained in mixer grout at 45°F)

Temperature as tested: _____ °F (°C) Water Added

Age as tested: _____ minutes

Consistency (10-30 seconds by flow cone required) as tested: _____ seconds

Yield as tested: _____ cubic foot

Compressive Strengths:

Time	Required Strength	Actual Strength
3 Days	2500 psi (17.2 MPa)	
7 Days	3500 psi (24.1 MPa)	
28 Days	5000 psi (34.5 MPa)	

Early Age Height Change: _____ % (ASTM C 1107)

Height Change of Moist Cured Hardened Grout: (ASTM C 1107)

Actual % Change 1 Day	Actual % Change 3 Days	Actual % Change 14 Days	Actual % Change 28 Days
%	%	%	%

d. Fluid (retained in mixer grout at 90°F)

Temperature as tested: _____ °F (°C) Water Added

Age as tested: _____ minutes

Consistency (10-30 seconds by flow cone required) as tested: _____ seconds

Yield as tested: _____ cubic foot

Compressive Strengths:

Time	Required Strength	Actual Strength
1 Day	1000 psi (6.9 MPa)	
3 Days	2500 psi (17.2 MPa)	
7 Days	3500 psi (24.1 MPa)	
28 Days	5000 psi (34.5 MPa)	

Early Age Height Change: _____ % (ASTM C1107)

Height Change of Moist Cured Hardened Grout: (ASTM C1107)

Actual % Change 1 Day	Actual % Change 3 Days	Actual % Change 14 Days	Actual % Change 28 Days
%	%	%	%

e. Flowable at 73.4 ± 5°F (23 ± 2.8°C)

Temperature as tested: _____ °F (°C) Water Added

Consistency (125-145 by 5 drops/3 seconds flow table) as tested: _____ seconds

Yield as tested: _____ cubic foot

Compressive Strengths:

Time	Required Strength	Actual Strength
1 Day	1000 psi (6.9 MPa)	
3 Days	2500 psi (17.2 MPa)	
7 Days	3500 psi (24.1 MPa)	
28 Days	5000 psi (34.5 MPa)	

Early Age Height Change: _____ % (ASTM C 1107)

Height Change of Moist Cured Hardened Grout: (ASTM C 1107)

Actual % Change 1 Day	Actual % Change 3 Days	Actual % Change 14 Days	Actual % Change 28 Days
%	%	%	%

f. Plastic at 73.4 ± 5°F (23 ± 2.8°C)

Temperature as tested:_____ °F (°C) Water Added

Consistency (100-125 by 5 drops/3 seconds flow table) as tested: _____ seconds

Yield as tested: _____ cubic foot

Compressive Strengths:

Time	Required Strength	Actual Strength
1 Day	1000 psi (6.9 MPa)	
3 Days	2500 psi (17.2 MPa)	
7 Days	3500 psi (24.1 MPa)	
28 Days	5000 psi (34.5 MPa)	

Early Age Height Change: _____ % (ASTM C 1107)

Height Change of Moist Cured Hardened Grout: (ASTM C 1107)

Actual % Change 1 Day	Actual % Change 3 Days	Actual % Change 14 Days	Actual % Change 28 Days
%	%	%	%

I hereby certify that the above information submitted is actual physical laboratory test data obtained according to the requirements specified in the Qualification Procedure and Testing Procedure for the product.

Person Responsible For Testing: _____ (Signature)

_____ (Print Name)

Laboratory Name and Address: _____

_____

_____

Date Tests Were Conducted: _____

Telephone Number: _____

QUALIFICATION PROCEDURE FOR PREPACKAGED HYDRAULIC FAST-SET MATERIALS FOR PATCHING STRUCTURAL CONCRETE

6.05.01. Scope

A. This document covers the physical requirements for prepackaged hydraulic mortars for use in structural concrete repairs and the procedure to be followed by producers in order to have their products included on the MDOT's Qualified Products List (QPL).

6.05.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the form and Table 1, as required by this procedure to the MDOT address listed below:

Materials Technology Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5695

B. *Product Data Sheets* - Include product literature describing the product's use and the following information:

1. Substrate preparation
2. Bonding slurry requirements
3. Mixing and working times
4. Allowable temperature range for placement
5. Type of mixer recommended
6. Component ratios of mixed ingredients
7. Amount of coarse aggregate extension for deep patches and any incompatibility with aggregate types
8. Type and duration of curing required
9. Use of admixtures not included in the product.

C. *Evaluation Based on the Following* - Submit a report of tests conducted by an independent laboratory. The physical properties of the product must meet the requirements given in Table 1 of this procedure. Descriptions of the test methods are included in this procedure.

D. *Evaluation Scheduling* - MDOT will be allowed 40 days to review and verify the submittal.

E. *Sample Submittal* - Submit 50 pounds of prepackaged hydraulic fast-set mortar for testing to the address listed in 6.05.02.A.

6.05.03. Evaluation

A. The submitted information and test data will be reviewed for conformance to the specified requirements. If the product meets the requirements it will be included on the QPL. The submitter will be notified in writing concerning the result of the evaluation. MDOT reserves the right to verify submitted test results or re-evaluate a product at any time by conducting its own tests.

B. MDOT must be notified in writing of any change in the product formulation. Formulation changes require re-evaluation of the product.

6.05.04. Disqualification

A. A product may be removed from the QPL if any problem develops during mixing, casting, or with performance.

6.05.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected.

6.05.06. Testing Procedure

A. The following testing must be conducted by an independent testing laboratory.

B. *Extension with Coarse Aggregate* - All specimens will be cast from a uniform mix design, extended with a natural, clean, surface dry pea stone coarse aggregate of the size and gradation recommended by the manufacturer at the maximum rate recommended by the producer. However, the coarse aggregate extension shall not exceed 60 percent of the combined weights of the cementitious material plus the fine aggregate. The extension rate at which the aggregate is tested for qualification will be included on the Qualified Product List as the maximum aggregate extension. The recommended mix design must produce a material that is basically self-consolidating and self-leveling.

C. *Number of Specimens* - The physical properties at each specimen age will be the average of a minimum of three specimens.

D. *Curing of Specimens* - All specimens will be cured as recommended by the producer during the initial 24 hours. Subsequent curing will be air curing at laboratory temperature and humidity. Specimens will be cured in this manner until testing.

E. *Compressive Strength* - The compressive strength of the material will be determined by using 4 inch x 8 inch cylinders according to ASTM C 39.

F. *Slant Shear-Bond Strength* - Test material for bond strength according to ASTM C 882 and as modified below.

1. Prepare 3 inch or 4 inch diameter dummy sections using 517 pounds of cement per yd^3 of concrete. Saw cut cylinders at 30° to result in a dummy section meeting the dimensional requirements given in Figure 1 of ASTM C 882. The 4 inch diameter dummy sections will be 4/3 times the dimensioning specified in Figure 1 of ASTM C 882. Grind the bond face of the specimen to a uniform texture with a No. 36 grit aluminum oxide grinding abrasive.

2. Place the dummy section in the lightly oiled 3 inch x 6 inch mold for 3 inch dummy section and 4 inch x 8 inch mold for 4 inch dummy section. Position the dummy section with the slant side up. Place the prepared hydraulic mortar in the mold in three layers of approximately equal volume. Rod the bottom layer as thoroughly and deeply as possible. Strike off the top of the specimen. Cover, cure, and test according to ASTM C 882.

G. *Modulus of Elasticity in Compression* - The modulus will be determined by using either 4 inch x 8 inch or 6 inch x 12 inch cylinders. Cast and test according to ASTM C 469. The cylinders will be loaded in compression and the strain read at a minimum of 5 equal intervals between 400 psi and 2000 psi. The reported modulus will be the average of the results at these intervals. The specimens will be at least 28 days old at the time of testing.

H. *Thermal Coefficient of Expansion* - The specimens and length of comparator will conform to ASTM C 490. The specimens will be 2 inches x 2 inches x 11.25 inches with an effective gage length of 10 inches. The coefficient will be determined from readings taken at 0°F (-18°C) and 104°F (40°C).

1. The specimens will be wrapped in an insulating material and conditioned for 96 hours at each temperature. If the measurements are taken at room temperature, they will be taken within 15 seconds of removal from the conditioning environment. If the specimen fails to return to its original length after the final measurement at laboratory temperature, the test will be repeated.

2. Use the following equation to determine the coefficient:

$$\frac{L_{104} - L_0}{10 \times 104} = \text{in/in/°F} \qquad \left(\frac{L_{40} - L_{-18}}{254 \times 58} = \text{mm/mm/°C} \right)$$

I. *Initial Plastic Shrinkage* - Use ASTM C 1090 to determine the initial plastic shrinkage.

J. *Surface Scaling* - Make two slab specimens 6 inch diameter x ¾ - 1 inch thick. Cure specimens for 28 days prior to initiation of testing. Install metallic tape dikes around the perimeter so that the dykes will pond water. The specimens will be conditioned in a freeze-thaw machine conforming to ASTM C 666, Procedure B, or subjected to daily freeze-thaw cycles. The daily cycle will consist of 16 to 18 hours in a freezing environment measuring 0°F to 16°F (-18°C to 9°C) followed by 6 to 8 hours at laboratory temperature. The testing and ponding schedule of specimens undergoing either procedure will consist of:

1. Precondition specimens by ponding at room temperature for 24 hours with fresh water.

2. Subject specimens to 12 freeze-thaw cycles while ponded with fresh water.

3. Subject specimens to 24 freeze-thaw cycles while ponded with a three percent solution of sodium chloride (NaCl).

4. Subject specimens to 12 freeze-thaw cycles while ponded with fresh water.

5. The depth of the ponding solution will be maintained at approximately ¼ inch. Each time the ponding solution is changed, all loose scale will be carefully removed, oven dried and weighed. After the scale has been removed, the slabs will be rinsed with water prior to ponding with the fresh solution.

6. The accumulated total of scale volume per unit area for each slab will be determined as follows:

$$\text{Scale} \quad = \frac{\text{Dry Weight of Scale, g}}{\text{Dry Bulk Specific Gravity x Ponded Area, cm}^2} = \frac{\text{cm}^3}{\text{cm}^2}$$

K. *Working Time* - The working time will be the time measured from the addition of the mix water to the point when the material is no longer workable. Conduct the test at standard laboratory conditions using a minimum of 1.5 quarts of material.

6.05.07. Physical Requirements

To be completed by independent testing laboratory:

Table 1: Test Results with Maximum Coarse Aggregate Extension

		2 hour	4 hour	28 days	50 F-T cycles
Compressive Strength, ASTM C 39 min. psi (MPa)	Required	2000 (13.8)	2500 (17.2)	4500 (31.0)	N/A
	Actual				
Slant Shear Bond Strength, ASTM C 882 mod., min., psi (MPa)	Required	250 (1.7)	375 (2.6)	1500 (10.3)	1500 (10.3)
	Actual				
Modulus of Elasticity, Compression psi (MPa)	Required	N/A	N/A	[4.0 - 6.0] x 10^6 (27,580 -41,370)	N/A
	Actual				
Thermal Coefficient of Expansion in/in/°F (mm/mm/°C)	Required	N/A	N/A	[5.0 - 8.0] x 10^{-6} ([9.0-14.4] x 10^{-6})	N/A
	Actual				
Initial Plastic Shrinkage, max. (%)	Required	0.10	N/A	N/A	N/A
	Actual				
Surface Scaling, max (cm³/cm²)	Required	N/A	N/A	N/A	0.01
	Actual				
Min. Working Time (minutes)	Required	10	N/A	N/A	N/A
	Actual				

* Please include actual mix design quantities used for obtaining these results.

I hereby certify that the above information submitted is actual physical laboratory test data obtained according to the requirements specified in the Qualification Procedure and Testing Procedure for the product.

Person Responsible For Testing: _____ (Signature)

_____ (Print Name)

Laboratory Name and Address:

_____

_____

_____

Date Tests Were Conducted: _____

Telephone Number: _____

QUALIFICATION PROCEDURE FOR PENETRATING WATER REPELLENT TREATMENT FOR STRUCTURAL CONCRETE SURFACES

6.06.01. Scope

A. This document covers the physical requirements for penetrating water repellent treatments for structural concrete surfaces and the procedures to be followed by producers in order to have their products included on the MDOT's Qualified Products List (QPL) for a period of three years.

6.06.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below:

Materials Technology Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5695

B. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as the independent laboratory test data required. **This independent test data must be either in a report written by the independent laboratory or in a letter on their letterhead.**

C. *Evaluation Based on the Following Standards* - Submit one quart to be evaluated by the MDOT Materials Technology Unit for compliance with the physical requirements in this document (except those required from an independent testing laboratory). The canister shall be labeled with the following: name of product, lot number, shelf life, and coverage rate.

D. *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all materials submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of the Department.

6.06.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.06.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of product materials, manufacturing, or plan dimension changes made by either the Department or the product manufacturer.

6.06.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply to requalification of the product at the expiration of the qualification period.

6.06.06. Testing Procedure

A. The following testing must be conducted by an independent testing laboratory.

B. *Reduction of Chloride Intrusion* - This shall be tested according to NCHRP Report 244, series II with a five day air drying period.

C. *Reduction of Water Absorption* - This shall be tested according to NCHRP Report 244, series II with a five day air drying period.

D. *Submittal of Independent Laboratory Data* - This independent test data must be written either by the independent laboratory or in a letter on their letterhead.

E. *Scaling Resistance* - The slab specimens shall be 6 inches in diameter by ¾ to 1 inch thick and be made of concrete with the mix design stated below. Metallic tape dikes sealed with silicone caulk shall be installed around the perimeter such that the dikes will pond water. The specimens shall be conditioned in a freeze-thaw machine conforming to ASTM C 666, Procedure B, or subjected to a daily freeze-thaw cycle consisting of 16 to 18 hours in a freezing environment of 0 to 16°F (-17 to -9 °C) followed by 6 to 8 hours at laboratory temperature. The ponding schedule for both procedures shall consist of a 24-hour preconditioning with the specimens ponded with fresh water. The depth of the ponding liquid shall be maintained at approximately ¼ inch. Each time the ponding solution is changed, all loose scale shall be very carefully removed, oven dried, and weighed. After the scale has been removed, the slabs shall be rinsed with water prior to ponding with a fresh solution. The specimen shall be cured as specified for 28 days prior to applying the sealant at the manufacturers recommended coverage rate. The sealant shall then be allowed to air-dry for three days before beginning the testing.

The accumulated total of scale volume per unit area for each slab shall be determined as follows:

$$\text{Scale Volume} = \frac{\text{Dry Weight of Scale, gm}}{\text{Dry Bulk Sp Gr of Concrete, gm/mm}^3 \times \text{Ponded Area, mm}^2} = \frac{\text{mm}^3}{\text{mm}^2}$$

F. *Depth of Penetration* - This shall be measured by breaking a treated specimen of the same size as was used for scaling resistance testing. Three measurements shall be taken by viewing the cross-section at the break under a microscope with an eyepiece having a graduated scale. The microscope shall be adjusted until 0.04 inch equals some convenient amount on the graduated scale. Five measurements at approximate

equal spacing's across the cross-section shall be taken. The reported depth of penetration shall be an average of these five measurements.

G. *Concrete Mix Design* - The concrete mix to be used for MDOT testing shall be a 7-sack mix having a design strength of 4500 psi, air content of 5 to 8 percent, and slump of 4 to 6 inches. The coarse aggregate shall be a Michigan Series 26A limestone or equivalent. No admixtures other than an air-entraining agent shall be used.

H. C*uring of Concrete Specimens* - The concrete specimens shall be cured for 14 days in a 100 percent humidity environment and then 14 days at ambient laboratory conditions.

6.06.07. Physical Requirements

To be completed by an independent testing laboratory:

TEST REPORT SHEET
FOR
PENETRATING WATER REPELLENT TREATMENT FOR
STRUCTURAL CONCRETE SURFACES

Name of Product: _____

	Result	Spec
Independent laboratory data furnished?		Yes
Federal VOC compliant?		Yes
Reduction of Chloride Intrusion, %		85 min.
Reduction of Water Absorption, %		85 min.
Scaling Resistance, mm^3/mm^2		0.05 max.
Depth of Penetration, inches (mm)		0.1 min.(2.3)

Comments: _____

_____

I hereby certify that the above information submitted is actual physical laboratory test data obtained according to the requirements specified in the Qualification Procedure and Testing Procedure for the product.

Person Responsible For Testing: _____ (Signature)

_____ (Print Name)

Laboratory Name and Address: _____

_____

_____

Date Tests Were Conducted: _____

Telephone Number: _____

QUALIFICATION PROCEDURE FOR BUSHINGS FOR PINS AND LINK PLATES IN STRUCTURAL STEEL CONSTRUCTION

6.07.01. Scope

A. This document covers the physical requirements for bushings for pins and link plates and the procedure to be followed by producers in order to have their products included on the MDOT's Qualified Products List (QPL) for a qualification period of five years.

6.07.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below. Portions of the physical requirements report sheet that may require test data to be furnished by the submitter must be completed in full.

Structural Fabrication Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-1235

B. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc. of the bushings for pins and link plates submitted.

C. *Evaluation Based on the Following Standards* - Evaluations will be based on a case by case basis.

D. *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all materials submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

6.07.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.07.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of product materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer.

6.07.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the qualification period.

6.07.06. Testing Procedure

A. No testing is required.

6.07.07. Physical Requirements

Bearing Capacity	psi (kPa)
Static	30,000 (206,850)
Dynamic	15,000 (103,425)
PV Intermittent	50,000 (344,750)
PV Continuous	10,000 (68,950)

Fibers: Nomex/Teflon

Temperature Range: -225 to 320ºF (-143 to 160ºC)

Friction: .02 to .20

Shaft Finish: 8 to 16 rms

Shaft Clearance:

Shaft Diameter	Clearance
dia. ≤ 5 inch (127 mm)	0.20 inch (0.50 mm)
dia. > 5 inch (127 mm)	0.30 inch (0.80 mm)

QUALIFICATION PROCEDURE FOR ADHESIVE SYSTEMS FOR STRUCTURAL ANCHORS AND LANE TIES

6.08.01. Scope

A. This document covers the procedure to be followed by producers to have an Adhesive Anchor System included on the MDOT's Qualified Products List (QPL).

6.08.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information to the following MDOT address:

Experimental Studies
Structural Section
Bridge Field Services
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5707

B. *Product Data Sheets* - Submit two copies of product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc.

1. Include product literature describing the product's use and other pertinent information such as mixing, working times and component ratios of mixed ingredients. Also include spacing and edge distance reduction factors, anchor type, application, packaging, limitations, and installation details.

2. Submit product safety data sheets.

C. *Evaluation Based on the Following Standards* - The resin adhesive anchor system must demonstrate its ability to develop 125 percent the yield strength of an ASTM A 307 bolt and Grade 60 reinforcing steel in tension at a maximum embedment of 9d (9 times the nominal bolt diameter) for bolt diameters ⅜ to ⅞ inches and at a maximum embedment of 12d (12 times the bar diameter) for reinforcing steel sizes #4 to #8. The adhesive anchor must also demonstrate its ability to develop the yield strength of the bolt and reinforcing steel when subjected to shear at these embedment depths. The tensile stress area of the bolt (nominal area for reinforcing steel) will be used when determining the yield load. Test results, in accordance with ASTM E 488, are required from an independent laboratory for verification of the tensile and shear capacities.

1. Long term load (creep) tests should be performed in accordance with ASTM E 1512 or ICC-ES AC308. These results shall be submitted prior to acceptance.

2. Resin adhesive anchor systems, when subjected to tension, shall develop 125 percent of the yield strength of the reinforcing steel or bolt at less than or equal to $^{1}/_{16}$ inch displacement in 4000 psi concrete.

3. Submit sufficient epoxy adhesive for ten anchor installations of ½ in threaded rod and/or reinforcement, a dispenser, four nozzles and any special equipment necessary for installation.

6.08.03. Evaluation

A. The submitted information and test data will be reviewed for conformance to the specified requirements. The product's susceptibility to corrosion, method of load transfer, installation procedure, workmanship, reliability and requirements specific to a particular design will also be evaluated. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. The MDOT reserves the right to verify submitted test information or re-evaluate a product anytime by conducting its own tests.

B. Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT no later than March 1 to be included in that year's evaluation. Addition of new products to the Qualified Product List will be made once a year upon receipt of all materials submitted by March 1 or at the discretion of MDOT.

6.08.04. Disqualification

A. A product may be immediately removed from the QPL should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

6.08.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR MECHANICAL EXPANSION ANCHORS

6.09.01. Scope

A. This document covers the procedure to be followed by producers in order to have a mechanical expansion anchor included on the MDOT's Qualified Products List (QPL).

6.09.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information to the following MDOT address:

Experimental Studies Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5707

B. *Product Data Sheets* - Submit a copy of product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc.

1. The producer shall include verified test results from an independent testing laboratory including static load tests for tension and shear, testing in accordance with ASTM E 488.

C. *Evaluation Based on the Following Standards* - Submit three mechanical expansion anchors per size for evaluation by MDOT.

1. Mechanical expansion anchors shall meet the following proof tensile loads (125 percent yield strength x tensile stress area) and shear loads (yield strength x tensile stress area) when attached to a 4,000 psi hardened concrete:

125% Yield (Load)		Bolt Diameter, inch				
		3/8"	1/2"	5/8"	3/4"	7/8"
Tension (Pull-out)	lbf	3,510	6,390	10,170	15,030	20,790
Shear	lbf	2,808	5,112	8,136	12,024	16,632

2. Mechanical expansion anchors shall develop 50 percent of the proof tensile load at less than or equal to 1/16 inch displacement.

6.09.03. Evaluation

A. The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. The products susceptibility to corrosion, method of load transfer, installation procedure, workmanship, reliability, and requirements specific to a particular design, will also be evaluated. If the product meets the requirements it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.09.04. Disqualification

A. A product may be immediately removed from the QPL should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

6.09.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR MECHANICAL REINFORCEMENT SPLICING

6.10.01. Scope

A. This document covers the procedure to be followed by producers in order to have a mechanical reinforcement splice approved for MDOT use.

6.10.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

B. *Product Data Sheets* - Submit a copy of product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc. of the sample submitted to the MDOT address listed below:

Experimental Studies Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5707

C. *Report of Tests* - The producer shall include test results from an independent testing laboratory demonstrating that the mechanical reinforcement splice meets the following criteria:

1. All splices tested shall develop a tensile strength of 125 percent of the reinforcing bar's yield strength.

2. All splices tested shall develop fatigue strength of 12,000 psi tension at greater than 1,000,000 cycles.

3. To be considered for "High Strength" splices, all splices tested shall conform to the following criteria:

   a. Splices shall develop a tensile strength of 150 percent of the reinforcing bars yield strength.

   b. Splices shall develop a fatigue strength of 18,000 psi tension at greater than 1,000,000 cycles.

   c. Slices shall slip no more than 0.01 inch for bar sizes up to #14, and no more than 0.03 inch for bar size #18, when subjected to slip testing in accordance with ASTM 1034.

4. If required to be epoxy coated, the mechanical splice must be coated in conformance to MDOT standard specifications for construction subsection 905.03.C. Submit certification that the coating used was from the Qualified Products List.

D. *Sample Submittal*

1. The producer shall provide splices for verification testing by MDOT in order to verify independent test data. When special equipment is not required to prepare the splice, the producer shall provide the samples unassembled with installation instructions. If special equipment is required to prepare the splice, arrangements shall be made where a representative of MDOT can witness the assembly of the test samples. If this is not feasible, the producer shall prepare the test samples and supply information on the procedure used to prepare each splice. The following number of test samples shall be provided:

   Small Size - Submit 4 samples; minimum size equals #4 or smallest splice available if larger than minimums shown here. A combination of small size bars can be submitted.

   Medium Size - Submit 4 samples; a combination of #3, #7 or #8 bars can be submitted.

   Large Size - Submit 4 samples; maximum size equals #11 or largest splice available if smaller than the maximums shown. A combination of large bar sizes may be submitted.

   Test sample bars shall have 12 inches exposed length beyond the prepared splice. The bars shall be Grade 60 ksi and supplied by the producer.

6.10.03. Evaluation

A. The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. The product will also be reviewed for general workman-ship, corrosion protection, ease of installation, and any requirements specific to a given design. Please note: Only splices having collinear axis after splicing will be approved, i.e., offset bar splices will not be accepted. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or reevaluate a product at any time by conducting its own tests.

6.10.04. Disqualification

A. A product may be immediately disqualified from MDOT use should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

6.10.05. Requalification

A. A product that has been disqualified will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR EMBEDDED GALVANIC ANODES

6.11.01. Scope

A. This document covers the procedure manufacturers must follow to have embedded galvanic anodes included on the MDOT's Qualified Product List (QPL).

6.11.02. Product Submittal

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

B. *Product Literature* – Submit product literature describing the anode's use, restrictions (if any) on the patch material surrounding the anode, maximum anode spacing, and minimum service life. Include additional pertinent information, such as manufacturer's name and address, manufacturer's trade name, model number, etc., to the MDOT address listed below:

Experimental Studies Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5655

C. *Product Data* – Submit product data documenting the quantity of zinc in each anode, as well as the components of the material encasing the anode.

D. *Product Sample* - The manufacturer shall submit a sample of the product to the address listed above.

E. The submitted information will be reviewed and additional samples may be requested to test for compliance with the specified requirements. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.11.03. Performance Evaluation

A. The performance of the embedded galvanic anodes will be evaluated by laboratory or field installation and monitoring the product in an MDOT selected test site.

1. The manufacturer shall provide the labor, tools, materials and equipment necessary for proper installation of the embedded galvanic anodes into the test site. This includes, but is not limited to, the anode lead wires and junction box with access for monitoring of the performance of the anodes over the evaluation period.

2. MDOT shall provide the labor, tools, materials and equipment necessary to complete the patch.

B. The embedded galvanic anodes at the test site will be monitored on a regular basis for a period of twelve months.

C. Alternatively, in-service performance information can be submitted from a third party independent testing facility. The test must be performed over a minimum six month period, indicate the steady state current requirements as outlined below, and provide the estimated service life.

6.11.04. Acceptance Requirements

A. The embedded galvanic anodes must meet the following requirements to be approved for use on MDOT projects:

1. *Field Performance* – The anodes are required to provide a protective current equal to or greater than 0.4 mA each after 90 days.

2. *Service Life* – The anodes must provide a minimum of ten years service life.

B. Provisionary acceptance of the embedded galvanic anodes will be granted after 90 days if the anodes meet the requirements above. Full acceptance of the product will be granted after twelve months of satisfactory performance.

6.11.05. Disqualification

A. A product may be immediately disqualified from MDOT use should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

6.11.06. Requalification

A. A product that has been disqualified will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. A new trial installation may be required.

QUALIFICATION PROCEDURE FOR SEALANT FOR PERIMETER OF BEAM PLATES

6.12.01. Scope

A. This document covers the physical requirements for sealant for perimeter of beam repair and the procedures to be followed by producers in order to have their products included on the MDOT's Qualified Products List (QPL) for a qualification period of three years.

6.12.02. Submittal Procedure

A. *Qualified Products Evaluation Form (From #1022Q)* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below.

Materials Technology Group
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5695

B. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as equipment needed to install, installation procedures of the sealant submitted, and Material Safety Data Sheets.

C. *Evaluation Based on the Following Standards* - Submit one 28-ounce or two 10-ounce cartridges to be evaluated by the MDOT Materials Technology Group for compliance with the specifications set forth in this document. Complete, sign, and date the Physical Requirements in Section 6.12.07. Note: Testing **must** be conducted by an independent laboratory.

D. *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all materials submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

6.12.03. Evaluation

A. The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.12.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of products materials, manufacturing or plan dimension changes made by either MDOT or the product manufacturer. The manufacturer will receive

notification including reasons for disqualification.

6.12.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6.12.06. Testing Procedure

A. *Material* - The sealant shall be a one-component elastomeric polyurethane or polyurethane blended sealant (Federal Specification TT-S-00230C, Type 2, Class A or B; ASTM C 920, Type S, Grade NS, minimum Class 25), that does not require a primer for proper bonding to a painted steel beam. The sealant shall be packaged in cartridge form.

B. *Sample Preparation* - Cure the sealant samples for 21 days at 73 ± 3°F (23 ± 2°C) and 50 ± 5 percent relative humidity.

C. *Flow* - The flow shall be tested according to ASTM C 639 and shall not be more than 0.3 inches.

D. *Solids Content* - The solids content shall be tested according to ASTM D 6511 (Section 7). The sealant shall be a minimum of 90 percent solids.

E. *Peel Strength* - The peel strength shall be tested according to ASTM C 794 and shall be more than 7.5 pounds per inch of width. Two test specimens shall be prepared on panels painted with a urethane top coat.

6.12.07. Physical Requirements

	Result	Spec
Flow, inches (mm)		0.3 (8) max.
Solids Content, %		90 min.
Peel Strength, pounds per inch (newtons per mm) of width		7.5 (1.33) min.

Comments: _____

_____

_____

Material: **PASSES** or **FAILS** (circle one)

I certify to the accuracy of the above physical requirements test results and that testing was conducted in compliance with the procedures stated in Section 6.12.06, and that the material complies with the specification(s) stated in Section 6.12.06.A.

QUALIFICATION PROCEDURE FOR LOW DUST ABRASIVES

6.13.01. Scope

A. This procedure describes the requirements for an abrasive to be placed on the MDOT's Prequalified Products List (QPL) for Requirements for Approval of Low Dust Abrasives.

6.13.02. Submittal Procedure

A. *Qualified Products Evaluation Form (From #1022Q)* - Submit a copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below.

Structural Section
Operations Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909
Telephone: (517) 322-5722

B. *Product Data Sheets and Material Safety Data Sheets* - Submit the Product and Material Safety Data Sheets for each product submitted for evaluation.

1. A 50-pound (25 kg) sample must be submitted.

C. *Evaluation Based on the Following Standards* - The abrasive will be listed on a generic basis as either medium or low dust in the SSPC Painting Manual, Volume 1 or certified by the California Air Resources Board (CARB) on a trade name basis.

6.13.03. Evaluation

A. The abrasive will be evaluated by MDOT for embedment into the steel, and the surface profile produced. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. The Michigan Department of Transportation reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.13.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of product materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer.

6.13.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6.13.06. Physical Requirements

A. It will be listed on a generic basis as a medium or low dust abrasive in the Steel Structures Painting Manual, Volume 1, or it is certified by the CARB on a trade name basis, and/or a field evaluation.

B. It will have a gradation such that the abrasive will produce a uniform profile of 1 to 2.8 mils, as measured with the extra course Testex Replica Tape.

C. The material will be listed on a generic basis in the Steel Structures Painting Manual, Volume 1, as an abrasive with <1 percent by weight free silica(crystalline) or certified results of the analysis for free silica indicating <1 percent by weight free silica(crystalline). The free silica(crystalline) content will be determined by the use of infrared spectroscopy or by other analytical procedures, such as wet chemical or x-ray diffraction analyses.

D. The manufacturer must certify and submit documentation that the abrasive, when tested by EPA Method 1311 before blasting, contains less than the maximum allowable limit for each of the elements listed in the following table:

ELEMENT	MAXIMUM ALLOWABLE LIMIT
Arsenic	2.5 ppm
Barium	50 ppm
Cadmium	0.5 ppm
Chromium	2.5 ppm
Lead	0.5 ppm
Mercury	0.1 ppm
Selenium	0.5 ppm
Silver	2.5 ppm

E. Technical information regarding the above requirements, Product and Materials Safety Data Sheets and 50 pound samples, will be submitted to:

Structural Section
Operations Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5722

F. The material will be evaluated by MDOT as to its dusting characteristics, embedment into the steel, and the surface profile it produced. If the product is judged to perform satisfactorily, it will be approved to be on the QPL.

G. Products may be deleted from the QPL by MDOT at any time they fail to meet any of the above requirements.

QUALIFICATION PROCEDURE FOR DETECTABLE WARNING SURFACES

6.14.01. Scope

A. This document covers the requirements for detectable warning surfaces to be placed on the MDOT's Qualified Products List (QPL). The QPL for detectable warning surfaces includes cast-in-place and surface applied products.

6.14.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the Michigan Department of Transportation address listed below.

Materials Technology Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-6448

B. *Product Information* - Include product information as listed below:

1. Product Data Sheets - Enclose product literature for detectable warning surfaces describing the use, restrictions, cost and anticipated benefit to MDOT's transportation system.

2. Supporting Evaluation - Enclose a list of other state DOT's or agencies (contact person, telephone number) who have approved your material for use.

3. Sample Specification - Enclose a sample specification for product usage.

C. *Evaluation Based on the Following Standards*:

1. Any product to be considered for this QPL must meet the requirements of the Americans with Disabilities Act and must conform to MDOT Standard Plan R-28 Series.

2. If a company has a new product that it wants included in the QPL, it must provide a trial installation in the State of Michigan. The company must notify the MDOT contact listed in Section 6.14.02.A of this procedure prior to installation of the product.

6.14.03. Evaluation

A. *Field Evaluation*:

1. The submitter must arrange for a trial installation of its product in the State of Michigan. The supplier must be on-site for installation of the product. A field evaluation of the product will be scheduled after the product has been in service for one year.

2. The product will be evaluated during installation and after it has been in service for one year. If the product has performed satisfactorily and has retained a minimum of 95 percent of its truncated domes, the field evaluation will be considered successful.

B. The submitted information and field evaluation will be reviewed for conformance to the specified requirements. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to re-evaluate a product at any time by conducting its own tests.

6.14.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of product materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer. The manufacturer will receive notification including reasons for disqualification.

6.14.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request, along with the acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR FLUID PAVEMENT MARKING MATERIALS

6.15.01. Scope

A. This document covers the requirements for fluid applied pavement marking materials to be placed on the MDOT's Qualified Products List (QPL).

B. The procedure covers:

Longitudinal Lines - 1 yr Product
Longitudinal Lines - 3 to 5 yr Product
Special Markings - 3 to 5 yr Product (Legends, Symbols, Arrows, Crosswalks, and Stop Bars)

6.15.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information required below.

B. The Manufacturer must provide a report from the pavement marking material category of the National Transportation Product Evaluation Program (NTPEP) for the submitted product(s). Northern (snow plow) site NTPEP data is required for fluid applied pavement marking materials. For a one year product, the NTPEP report must have a minimum of nine months of data and include one winter plowing season. For a three to five year product, the NTPEP report must have a minimum of twenty-one months of data and include two winter plowing seasons. If a product is currently installed on a northern NTPEP test deck but does not have the full nine or twenty-one months completed, a test section may be placed in Michigan for concurrent evaluation provided the product meets the initial retroreflectivity requirements outlined in section D, and the Manufacturer agrees to restripe the test section with an approved material if significant premature failure occurs. If no northern NTPEP deck is currently available, MDOT will attempt to seek an alternate evaluation method with the condition that the Manufacturer will get the product on the next available northern deck.

C. Send the results from NTPEP, product data sheets, completed form #1022Q, and other pertinent information, for initial review, to:

MDOT Pavement Marking Engineer
Traffic Operations
425 W. Ottawa Street
P.O. Box 30050
Lansing, Michigan 48909

D. The NTPEP report provides retroreflectivity and product durability data. Fluid pavement marking materials must have the following minimum properties to qualify for a MDOT field evaluation:

			White	Yellow
1 year Product	Skip Readings	Initial retroreflectivity	375 mcd	200 mcd
		9 month retroreflectivity	120 mcd	80 mcd
	Wheel Readings	Durability - 9 month	6	6
3 to 5 year Product	Skip Readings	Initial retroreflectivity	400 mcd	280 mcd
		21 month retroreflectivity	175 mcd	120 mcd
	Wheel Readings	Durability - 21 month	7	7

6.15.03. Evaluation

A. The submitted NTPEP report will be reviewed by MDOT's Pavement Marking Engineer.

If the product meets the requirements specified in section 6.15.02.C, a sample amount of product and the location for installation will be determined by the PMIT for field evaluation. The sample material will be specified and placed according to MDOT specifications. The cost of the material will be negotiated between the Manufacturer and the Contractor.

Products must be heavy metal free.

Ease of application will be assessed and visual inspection of the material will be performed during the field evaluation. The following requirements must also be met:

Longitudinal Lines - 1 yr Product:
Retroreflectivity readings for longitudinal lines must be 100 millicandellas for white and 60 millicandellas for yellow after 1 winter. If possible, MDOT will schedule retroreflectivity measurements to be taken as part of the annual spring retroreflectivity contract. Otherwise, it will be the responsibility of the manufacturer to hire a third party with a mobile retroreflectometer to perform measurements.

Longitudinal Lines – 3 to 5 yr Product:
MDOT requires 90% of the markings to be fully adhered to the pavement after 1 winter. Retroreflectivity must be 250 millicandellas for white and 150 millicandellas for yellow after 12 months. If possible, MDOT will schedule retroreflectivity measurements to be taken as part of the annual spring retroreflectivity contract. Otherwise, it will be the responsibility of the manufacturer to hire a third party with a mobile retroreflectometer to perform measurements.

Special Markings – 3 to 5 yr Product (Legends, Symbols, Arrows, Crosswalks and Stop Bars):
MDOT requires 90% of the marking to be fully adhered to the pavement after 1 winter.

MDOT reserves the right to verify submitted test information or re-evaluate a product at any time.

B. Once the material has been in place for an entire winter, the PMIT will review the material. Approval from the PMIT will result in the product being added to the QPL. The Manufacturer will be notified in writing concerning the results of the evaluation.

C. Every January, a form letter will be sent to the Manufacturer requesting certification that the composition and manufacture of their product(s) (to be listed by name in the letter) has not changed since its last certification. This certification letter must be signed by a designated

representative of the Manufacturer. Failure to sign and return the letter may result in removal from the QPL.

6.15.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance of the material. The Manufacturer will receive written notification, including reasons for disqualification.

6.15.05. Re-qualification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request from the Manufacturer, along with the acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR PREFORMED APPLIED PAVEMENT MARKING MATERIAL

6.16.01. Scope

A. This document covers the requirements for preformed applied pavement marking materials to be placed on the MDOT's Qualified Products List (QPL).

B. The procedure covers:

Longitudinal Lines – 3 to 5 yr Product
Special Markings – 3 to 5 yr Product (Legends, Symbols, Arrows, Crosswalks, and Stop Bars

6.16.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information required below.

B. The Manufacturer must provide a report from the pavement marking material category of the National Transportation Product Evaluation Program (NTPEP) for the submitted product(s). Northern (snow plow) site NTPEP data is required for preformed applied marking materials. The product must have gone through at least two winters and the NTPEP report must have a minimum of twenty-one months of data. If a product is currently installed on a northern NTPEP test deck but does not have the full twenty-one months completed, a test section may be placed in Michigan for concurrent evaluation provided the product meets the initial retroreflectivity requirements outlined in section D, and the Manufacturer agrees to restripe the test section with an approved material if significant premature failure occurs. If no northern NTPEP deck is currently available, MDOT will attempt to seek an alternate evaluation method with the condition that the Manufacturer will get the product on the next available northern deck.

C. Send the results from NTPEP, product data sheets, completed form #1022Q, and other pertinent information, for initial review, to:

MDOT Pavement Marking Engineer
Traffic Operations
425 W. Ottawa Street
P.O. Box 30050
Lansing, Michigan 48909

D. The NTPEP report provides retroreflectivity results and product durability data. Preformed applied pavement markings must have the following minimum properties to qualify for a MDOT field evaluation:

			White	Yellow
3 to 5 year Product	Skip Readings	21 month retroreflectivity	150 mcd	100 mcd
	Wheel Readings	Durability - 21 month	7	7

6.16.03. Evaluation

A. The submitted NTPEP report will be reviewed by MDOT's Pavement Marking Engineer. If the product meets the requirements specified in section 6.16.02.D, a sample amount of product and the location for installation will be determined by the PMIT for field evaluation. Minimum sample size will be 100 square feet. The sample material will be specified and placed according to MDOT specifications. The cost of material will be negotiated between the Manufacturer and the Contractor.

Products must be heavy metal free.

Ease of application will be assessed and visual inspection of the material will be performed during the field evaluation. The following requirements must also be met:

Longitudinal Lines – 3-5 yr Product:
MDOT requires 90% of the markings to be fully adhered to the pavement after 1 winter. Retroreflectivity must be of 175 millicandellas for white and 125 millicandellas for yellow after 1 winter. If possible, MDOT will schedule retroreflectivity measurements to be taken as part of the annual spring retroreflectivity contract. Otherwise, it will be the responsibility of the manufacturer to hire a third party with a mobile retroreflectometer to perform measurements.

Special Markings – 3-5 yr Product (Legends, Symbols, Arrows, Crosswalk and Stop Bars):
MDOT requires 90% of the markings to be fully adhered to the pavement after 1 winter.

MDOT reserves the right to verify submitted test information or re-evaluate a product at any time.

B. Once the material has been in place for an entire winter, the PMIT will review the material a second time. Approval from the PMIT will result in the product being added to the QPL. The Manufacturer will be notified in writing concerning the results of the evaluation.

C. Every January, a form letter will be sent to the Manufacturer requesting certification that the composition and manufacture of their product(s) (to be listed by name in the letter) has not changed since its last certification." This certification letter must be signed by a designated representative of the Manufacturer. Failure to sign and return the letter may result in removal from the QPL.

6.16.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance of the material. The Manufacturer will receive written notification including reasons for disqualification.

6.16.05. Re-qualification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request from the Manufacturer, along with the acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR ADMIXTURES FOR CONCRETE

6.17.01. Scope

A. The Construction Field Services Division of MDOT will authorize manufacturers to ship approved products to MDOT projects for immediate incorporation into the work.

6.17.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information required below.

B. *Qualified Products Evaluation* - The manufacturer will submit the following at the time of application for addition to the Qualified Products List (QPL) and once every seven years thereafter, to the MDOT address listed below:

1. Full ASTM C 260 Testing Report or Full ASTM C 494 Testing Report, see Section 6.17.02.C.

   The results must be from tests performed with a batch date no greater than 30 months prior to submittal. Submit all Full ASTM test results in both hard copy and electronically (use the contact below to receive an electronic copy of the forms).

2. Certification and Product Data, Submit certification and product data as specified below.

   a. Manufacturer name

   b. Product name

   c. Admixture type

   d. Indication if admixture is lignin (lignosulfonate) based

   e. Chloride ion content, percent

   f. pH

   g. Specific gravity

   h. Total solids, percent

   i. Recommended dosage or dosage range

   j. Certification statement - "The *(manufacturer name)* certifies that the admixture conforms to the requirements of *(ASTM C 260 for air-entraining admixtures or ASTM C 494 for chemical admixtures)*." This certification statement will be signed by a designated representative of the manufacturer.

3. Sample - Furnish a one-quart sample of material, in a container with a completed safety data sticker, to the address listed below.

4. Abbreviated ASTM C 260 Testing Report or Abbreviated ASTM C 494 Testing Report, see Section 6.17.05.

   The results must be from tests performed with a batch date no greater than 12 months prior to submittal. Submit all Abbreviated ASTM test results in both hard copy and electronically (use the contact below to receive an electronic copy of the forms).

   Materials Technology Group
   Construction Field Services Division
   8885 Ricks Road
   P.O. Box 30049
   Lansing, Michigan 48909
   MDOT-ConcreteEngineer@michigan.gov

C. *Evaluation Based on the Following Standards* - ASTM C 260 will be used to evaluate air-entraining admixtures for concrete. ASTM C 494 will be used to evaluate chemical admixtures for concrete. Provide a report including the results of testing the admixture according to the applicable specification. The report must include a description of all materials used, the numerical results of all required tests on both plastic and hardened concrete and a comparison with the specification requirements.

D. All incomplete submittals will be rejected and a new complete package will need to be submitted.

E. *Referenced Documents* -

1. ASTM Standards

   C 192 Test Method for Making and Curing Concrete Test Specimens in the Laboratory
   C 260 Standard Specification for Air-Entraining Admixtures for Concrete
   C 494 Standard Specification for Chemical Admixtures for Concrete
   C 233 Standard Test Method for Air-Entraining Admixtures for Concrete
   C 403 Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
   C 1077 Practice for Laboratories Testing Concrete and Concrete Aggregates

2. Standard Specifications for Construction, Section 903

6.17.03. Yearly Update Procedure

A. The manufacturer will submit the following by the 1st of January every year after acceptance to the QPL, to the MDOT address listed in section 6.17.02.B.4:

1. Product information, see section 6.17.02.B.2.a through h.

2. Recommended dosage or dosage range present on the QPL

3. ASTM certification statement, see section 6.17.02.B.2.j.

4. No changes to product certification statement – "*(manufacturer name)* certifies that the admixture's formula and materials have not changed since approved to the QPL." This certification statement will be signed by a designated representative of the manufacturer.

6.17.04. Dosage or Dosage Range Request of Change Procedure

A. The manufacturer will submit the following to request a change to the dosage or dosage range on the QPL, to the MDOT address listed in section 6.17.02.B.4:

1. Product information, see section 6.17.02.B.2.a through c.

2. Current QPL dosage or dosage range

3. Recommended dosage or dosage range

4. Request of change statement – This statement will provide an engineering or construction explanation for the requested change in dosage or dosage range.

6.17.05. Testing Procedure and Evaluation for Abbreviated ASTM Testing (Local Cement Testing)

A. *General Test Procedure for Abbreviated Evaluation* - This testing is to be performed by an independent laboratory conforming to ASTM C 1077.

1. Evaluate an air-entrained concrete containing the specific admixture against an air-entrained reference concrete not containing the admixture. If the product being submitted for approval is an air-entraining (AE) admixture, make the reference concrete using a vinsol resin AE admixture.

2. General - Make the reference batch and corresponding test batch on the same day. The reference batch should usually be made first to prevent any carry-over of the admixture under test. One reference batch and one test batch for a given set of conditions will be adequate unless duplicates are requested. One reference batch may serve as basis of comparison for several test batches made using different admixtures, dosage rates, etc., as long as all are made with the same cement(s). Submit summary report of test results, with data sheets attached.

3. Submit all Local Cement test results in both hard copy and electronically (use the contact in Section 6.17.02.B.4 to receive an electronic copy of the forms).

4. Test admixtures at the minimum dosage rate to be reported on the QPL.

B. *Mix Properties*

1. Cement Content - 517 lb/yd (MDOT Grade P2 or equivalent).

2. Air Content - 6.5 ± 1.5 percent for control. Air content of test concrete will be within 0.5 percent of control.

3. Slump - 3½ ± ½ inch for the control and the test concrete.

4. High Range Water Reducing Admixtures - Mix design for test batches will be redesigned for less water than reference batches.

C. *Materials Requirements*

1. Cement - Type I Portland cement. Use three brands of cement (in common use in Michigan) individually, or as specified for the individual testing.

2. Aggregate - 2NS and 6A. Use moist aggregates of known moisture content from MDOT approved sources.

3. Materials should be of such temperature as to produce a concrete having a temperature of 68 ± 4°F.

D. *Mixing* - Add all solid materials to mixer and a portion of the water. Add the admixtures with some of the water immediately at the start of mixing, except high range water reducing admixtures will be added approximately 90 seconds after start of mixing. For C 494 testing, add air-entraining admixture separately from chemical admixtures.

1. Mix for three minutes, allow concrete to rest for three minutes, then remix for two minutes.

E. *Tests and Properties*

1. Slump - all batches.

2. Air Content - all batches.

3. Compressive Strength - Test a minimum of two cylinders 4 x 8 or 6 x 12 inches for each test age. Test types A, C, D, E, and air-entrainers at 3 days, 7 days and 28 days. Test types F and G at 1 day, 3 days, 7 days and 28 days.

4. Water Content - Expressed as water-cement ratio by mass. Use the net water in the batch (total water, less water absorbed by aggregates).

5. Time of Set - ASTM C 403, for retarders and accelerators, otherwise as instructed.

6.17.06. Mid Range Water Reducers and Retarding Mid Range Water Reducers

A. Sections 6.17.01 through 6.17.05 apply to mid-range admixtures except as modified below.

B. Submit the full ASTM C 494 report required by Subsection 6.17.02.B as a Type A or F for normal set or as a Type D or G for retarding.

C. Submit a report as required by Subsection 6.17.05.A General Test Procedure for Abbreviated Evaluation. Testing must indicate conformance with the physical requirements listed in Table 1. Test admixture at the minimal dose for the mid range water reducer dosage range.

D. Reduce water of the control batch by at least 9 percent.

E. Time of Set - ASTM C 403 for Retarders. Retarding mid-range water reducers must conform to the time of setting requirements given in Table 1 of ASTM C 494 for Type D.

Table 1

Physical Requirements Concrete with Mid Range Water Reducer					
	Fresh Concrete	1 Day	3 Days	7 Days	28 Days
Water Content, max % of control	91	N/A	N/A	N/A	N/A
Slump, inches	3 - 4	N/A	N/A	N/A	N/A
Air Content, Control Batch, %	5 - 8	N/A	N/A	N/A	N/A
Air Content, Test Batch, %	± 0.5 of control batch	N/A	N/A	N/A	N/A
Compressive Strength, min % of control	N/A	120	115	115	110
Flexural Strength, min % of control	N/A	N/A	100	N/A	100

6.17.07. Product Review

A. *Acceptance* - The submitted information will be reviewed for conformance to the specified requirements. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

B. *Disqualification* - A product may be removed immediately from the QPL if any field performance problems develop related to product material or manufacturing.

C. *Requalification* - A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for re-qualification of the product.

APPENDIX

(See contact listed in Section 6.17.02.B.4 to obtain the electronic version needed for submittal.)

QUALIFICATION PROCEDURE FOR EPOXY COATING FOR STEEL REINFORCEMENT

6.18.01. Scope

A. This document covers the physical requirements for epoxy coatings for steel reinforcement and the procedure to be followed by the producers to have their products included on the MDOT's Qualified Product List (QPL).

6.18.02. Submittal Procedure

A. Submit the following criteria to the MDOT address listed below.

Structural Section - Paint Systems
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5722

B. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

C. *Product Data Sheets* - Include product literature describing the products use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc.

D. *Evaluation Based on the Following Standards* - The testing is conducted by an independent testing agency to ensure that the product meets ASTM A 775 and MDOT's requirements.

6.18.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product anytime by conducting its own tests.

6.18.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance results from product materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer.

6.18.05. Requalification

A. A product disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

QUALIFICATION PROCEDURE FOR SHEAR CONNECTOR STUDS

6.19.01. Scope

A. This document covers the physical requirements for stud shear developers and the procedure to be followed by producers in order to have their products included on the MDOT's Qualified Products List (QPL) for a qualification period of two years.

6.19.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below:

Structural Fabrication Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-1235

B. *Product Data Sheets* - Include manufacturer's name and address, trade name, model number and design drawings, and any other pertinent information.

C. *Evaluation Based on the Following Standards* - Finished studs shall be of uniform quality and condition, free from injurious laps, fins, seams, cracks, twists, bends, or other injurious defects. Finish shall be as produced by cold drawing, cold rolling, or machining.

D. *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT no later than January 15 to be included in that years evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all materials submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

6.19.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.19.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of product materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer.

6.19.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6.19.06. Testing Procedure

A. Tensile properties shall be determined in accordance with the applicable sections of the methods for mechanical testing of steel products In AASHTO T 244. The yield strength shall be determined by the 0.2 percent offset method.

6.19.07. Physical Requirements

A. Shear connector studs shall conform to the requirements for cold-finished carbon steel of AASHTO M 169, cold-drawn bar, Grades 1015 or 1020, either semi- or fully-killed. If flux-retaining caps are used, the steel for the caps shall be cold-rolled, of a low carbon grade suitable for welding, and shall conform to ASTM A 109.

B. Tensile properties as determined by tests of bar stock after drawing or of finished studs shall conform to the following minimum requirements:

Tensile Strength	60,000 psi (415 mPa)
Yield Strength	50,000 psi (345 mPa)
Elongation	20 percent in 2 inches (50 mm)
Reduction of Area	50 percent

QUALIFICATION PROCEDURE FOR RECYCLED RUBBER ADJUSTING RINGS

6.20.01. Scope

A. This document covers the recycled rubber adjusting ring requirements and procedure to be followed by manufacturers in order to have their product included on the MDOT's Qualified Products List (QPL).

6.20.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

B. *Product Data Sheet* - Submit a copy of product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc., to the MDOT address listed below:

Experimental Studies Unit
Operations Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5707

C. *Sample* - The producer shall submit a minimum 10-inch cut away sample of the proposed adjustment riser to the address listed above.

D. *Test Reports* - The producer shall include test results from an independent testing laboratory showing results from the following tests:

Physical Properties	ASTM Test Method	ASTM Title	Test Requirements
Density	C 642	Test Method for Density, Absorption, and Voids in Hardened Concrete	1.0 g/cm^3 (± 0.1)
Durometer hardness, molded and interior surfaces	D 2240	Rubber Property-Durometer Hardness	75 A ± 5
Tensile strength and elongation	D 412	Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension	230 psi 300%
Compression deformation, initial and final	D 575	Rubber Properties in Compression	140 psi
Compression set	D 395	Rubber Properties in Compression Set	25% max

Freeze and thaw when exposed to deicing agents	C 672	Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals	no loss after 50 cycles
Coefficient of thermal expansion	C 531	Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes	$6x10^{-5}$ in/in/^{o}F
Heat Resistance (70 hours at 70°C)	D 573	Rubber-Deterioration in an Air Oven	Hardness - 10 max Tensile/elongation - 25% max
Brittleness at low temperature	D 746	Brittleness Temperature of Plastic and Elastomers by Impact	Pass @ -40°F

6.20.03. Evaluation

A. The submitted information will be reviewed and samples may be tested for compliance with the specified requirements. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation.

6.20.04. Disqualification

A. A product may be immediately disqualified from MDOT use should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

6.20.05. Requalification

A. A product that has been disqualified will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification as stated in this procedure also apply for requalification of the product.

QUALIFICATION PROCEDURE FOR WATERTIGHT JOINTS SYSTEMS FOR SEWERS AND CULVERTS

6.21.01. Scope

A. This document describes the procedure to be followed by drainage product manufacturers who wish to have sewer and culvert pipe joint systems evaluated for addition to the MDOT's Qualified Products List (QPL) for watertight joints.

6.21.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

B. *Request for Product Evaluation* - A written request for product evaluation must be submitted to the following address:

Geotechnical Services Unit
Construction and Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5677

C. *Product Information* - Include all material specifications, design drawings, field assembly diagrams and applicable Material Safety Data Sheets. All joint system components must meet applicable material requirements of the MDOT Standard Specifications for Construction.

1. A sample of the watertight joint, including a minimum of three feet of pipe on each side of the joint and the geotextile wrap (for pipe over 24 inch diameter), must be submitted if requested.

2. MDOT requires 14 days prior notice of the intended laboratory testing of watertight joints so the testing may be witnessed. This notification may be made in writing to the address above or by calling (517) 322-5677.

D. *Independent Laboratory Testing Results* - Results of independent laboratory tests must be submitted for evaluation. This testing must be conducted in accordance with Michigan Test Method 723. The joint system must meet the watertight requirements specified in MTM 723 to be considered as a qualified product.

E. *Evaluation Schedule* - A complete application, including independent laboratory test reports, must be received by the Geotechnical Services Unit on or before February 1 for a new product to be evaluated and placed on the QPL for use in the upcoming construction season. Subsequent modification of the QPL will be at the discretion of MDOT.

6.21.03. Evaluation

A. Pipe Diameters Up to 24 inches.

1. The manufacturer must provide independent laboratory test reports verifying the sewer

or culvert joint system has been tested in accordance with MTM 723 and has been found to be within the watertight limits stated in the test method. Laboratory test results are valid as long as the joint system has not been altered in any way.

2. Once the independent laboratory has certified the test results, the watertight joint system will be listed on the QPL by manufacturer, product name and diameter of pipe.

3. The manufacturer must submit an annual certification statement documenting the joint system has not been altered from the time it was laboratory tested and placed on the QPL. If the annual certification is not received, the product will be dropped from the QPL and will not be approved for use on MDOT projects until certification is received.

4. The manufacturer will be advised of the annual certification requirement with the notification that the product has been approved and placed on the QPL. After this notification, it will be the manufacturer's responsibility to submit annual certification. If the joint system has been altered, the manufacturer will be required to submit independent laboratory test results to keep the product on the QPL.

B. Pipe Diameters Over 24 inches.

1. Watertight joints for culvert or sewer pipe greater than 24 inches do not require pressure testing to be approved for use on MDOT projects, provided the manufacturer can document the performance of the identical joint configuration in a smaller diameter. The manufacturer must submit independent laboratory test reports in accordance with MTM 723 for a 24 inch diameter (or smaller) watertight joint which uses the same configuration.

2. Watertight joints greater than 24 inches must use a single or double gasket configuration and must be geotextile wrapped a minimum of three feet on each side of the joint. Provide the manufacturer's product label for the geotextile wrap.

   NOTE: At the manufacturer's option, these larger diameter pipes may be tested in accordance with MTM 723 and all documentation submitted as for smaller pipes.

3. Approved watertight joint configurations for pipe diameters greater than 24 inches will be listed on the QPL subject to the same annual certification and re-evaluation requirements as for smaller diameter pipe joint systems.

4. MDOT retains the right to field test the joint system or to require that the manufacturer submit additional independent laboratory test results if problems are encountered with installation or performance of the watertight sewer or culvert systems.

6.21.04. <u>Disqualification</u>

A. A product may be immediately removed from the Qualified Product List should any problems develop related to installation or performance of the joint system or the associated pipe materials. Removal from the QPL will result in immediate loss of approved status on all active and proposed projects. If a product is removed from the QPL, it will not be approved for use on a state- or federally-funded project until the manufacturer has demonstrated, to the satisfaction of the Geotechnical Services Unit, the material or joint mechanism has been redesigned and shown to meet all applicable specifications.

6.21.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product.

6.21.06. Testing Procedure

A. MDOT does not conduct the testing of watertight sewer and culvert joint systems, the testing procedure and physical requirements can be found in MTM 723.

QUALIFICATION PROCEDURE FOR POLYMER COATED CORRUGATED STEEL PIPE

6.22.01. Scope

A. This document covers the procedure to be followed by producers in order to have a polymer coated corrugated steel pipe approved for MDOT use.

6.22.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

B. *Product Data Sheets* - Submit a copy of product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc. of the sample submitted to the MDOT address listed below:

Experimental Studies Group
Operations Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5707

C. *Report of Tests* - The producer shall include test results from an independent testing laboratory demonstrating that the polymer coated corrugated steel pipe meets the following criteria:

1. Steel pipe made from zinc-coated sheet conforming to AASHTO M 218.

2. Polymeric coating must be ethylene acrylic acid film conforming to AASHTO M 246, Grade 250/250 polymer on zinc coated steel sheet.

3. Polymeric coated pipe must pass the Coating Test Protocol as published by the National Corrugated Steel Pipe Association (NCSPA), Invert Abrasion Testing of CSP Coatings, Appendix B, March 2002. All three tiers shall be evaluated, with tier 3 being evaluated at Level I. The abrasive conditions for Level I testing are defined as follows:

   a. Stone shall be ⅜ inch in size and the maximum loss from the Los Angeles Abrasion test (MTM 102) shall be 40 percent. Only natural aggregate shall be used.

   b. Aggregate shall be propelled by 550 gallons per minute of flowing seawater down a 12 degree slope.

   c. A total of 50,000 lbs. of aggregate shall be passed through the pipe over a ten day period in uniform increments.

   d. To pass Level I testing, no galvanized substrate is allowed to show after testing. Certified independent test results must be submitted for review.

D. *Sample Submittal*

1. The producer shall provide polymer coated corrugated steel pipe and sheet for verification testing by MDOT in order to verify independent test data. Test samples shall be 3 feet long.

6.22.03. Evaluation

A. The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. The product will also be reviewed for general workmanship, corrosion protection, ease of installation, and any requirements specific to a given design. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.22.04. Disqualification

A. A product may be immediately disqualified from MDOT use should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

6.22.05. Requalification

A. A product that has been disqualified will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR CLASS B PLASTIC PIPE

6.23.01. Scope

A. This document describes the procedure to be followed by plastic pipe manufacturers who wish to have 12-inch to 24-inch diameter sewer and culvert pipe evaluated for addition to the MDOT's Qualified Products List (QPL) for Class B installations for a qualification period of five years. The Watertight Joint and Plastic Pipe acceptance requirements also apply.

6.23.02. Submittal Procedure

A. Request for Product Design Calculations Review – A written request for product design calculations review must be submitted to the following address:

Flexible Pipe Specialist
Michigan Department of Transportation
Special Structures Unit, Bridge Development
425 W. Ottawa
Lansing, Michigan 48933
Telephone: (517) 241-0082

B. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

C. Product Information – Include all material specifications and design drawings including pipe geometry. Provide approved third party verification for the idealized wall profile geometry for each diameter of pipe. **Pipe must already be listed on the QPL for *Watertight Joint Systems for Sewers and Culverts* in order to be considered for review under this qualification procedure.**

D. Load-and-Resistance Factor Design (LRFD) Calculations – Include product design calculations prepared in accordance with Section 12 of the current *American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications*. Demonstrate, through the calculations, adequate strength and service for depths of cover from 10- to 16-feet. Assumed values for factors and other parameters shall be conservative and indicative of a typical embankment installation in Michigan. Provide an explanation for the selection of factors and parameters if they differ from the values listed below. Submit calculations in either Microsoft Excel or Mathsoft Mathcad format.

E. Factor and Parameter Values – Use the following factors and parameters in the Section 12 equations. Follow the LRFD specifications and commentary for factors and parameters not listed below.

$\gamma_{EV} = 1.3$	Load Factor for vertical pressure from dead load of earth fill
$\gamma_{LL} = 1.75$	Load Factor for live load
$\gamma_{WA} = 1.3$	Load Factor for hydrostatic pressure
$\Phi_{bck} = 0.70$	Resistance Factor for buckling
$\Phi_{s} = 0.90$	Resistance Factor for soil stiffness

Φ_T = 1.00	Resistance Factor for thrust effects
Φ_f = 1.00	Resistance Factor for flexure
η_{EV} = 1.0	Load Modifier applied to vertical earth loads
H_w = 0 to 8.0 feet	Depth of water table above spring line of pipe, evaluate in 1 foot increments
γ_w = 62.4 lb/cf	Unit weight of water
γ_s = 120 lb/cf	Wet unit weight of soil
Δ_A < 5%	Total allowable deflection of pipe, reduction of vertical diameter
$\Delta_T < \Delta_A$	Total allowable deflection less then allowable deflection
D_L = 1.5	Deflection Lag Factor
K_B = 0.10	Bedding coefficient
$K_{\gamma E}$ = 1.50	Installation Factor
K_{WA} = 1.30	Factor for uncertainty in level of ground water table
LLDF = 1.15	Live Load distribution factor
m = 1.20	Multiple presence factor
Df reduction	Shape factor for corrugated PE pipe in table 12.12.3.10.2b-1 to be reduced by 1.0 from table value to account for effect of Low Hoop Stiffness ratio.
Soil type	Sn
90%	Degree of Compaction - standard Proctor backfill density

(MDOT follows the suggested practice of the AASHTO LRFD Bridge Specification's Commentary to design for a standard Proctor backfill density 5 percent less than specified by the contract documents.)

6.23.03. Evaluation

A. The submitted calculations will be reviewed for conformance with Section 12 of the current *AASHTO LRFD Bridge Design Specifications*.

6.23.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance. A product may also be removed due to specification changes made by either MDOT or the product manufacturer. Removal from the QPL will result in immediate loss of approved status on all active and proposed projects. If a product is removed from the QPL, it will not be approved for use on a state or federally-funded project until the manufacturer has demonstrated, to the satisfaction of the Municipal Utilities Unit, the material has been redesigned and shown to meet all applicable specifications and requirements.

6.23.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

QUALIFICATION PROCEDURE FOR SILT FENCE GEOTEXTILE

6.24.01. Scope

A. This document covers the policies and procedures for the MDOT's Qualified Products List (QPL) for silt fence geotextile. The MDOT Construction and Technology Division will follow these procedures to determine whether to grant Qualified Product status to specific silt fence products and to maintain the list of Qualified Products. Manufacturers of silt fence geotextile must follow these procedures to be granted and to maintain QPL status for their silt fence geotextiles.

6.24.02. Submittal Procedure

A. *Qualified Products Evaluation Form (From #1022Q)* - Manufacturers, or distributors/fabricators serving as a representative of the manufacturer, may submit a silt fence geotextile product for Qualified Products evaluation. The submittal shall consist of a written request for Qualified Products status and must include all of the components listed below. Only complete submittals will be reviewed by MDOT. Send complete submittals to:

Geotechnical Services Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-1208

B. *Product Data Sheets* - The manufacturer shall certify each specified property value as a minimum value (mean quality control result less two standard deviations) in accordance with the ASTM Method designated for each property in Section 910.04 of the Standard Specifications for Construction (see Testing Requirements), and that the product meets all properties specified by MDOT. The certification shall be signed by an authorized official of the manufacturer.

1. Results of actual quality control testing of the lots of material represented by the sample must be submitted. All specified properties must be included in the quality control testing. This documentation shall include a description of the normal frequency and distribution of quality control sampling.

C. *Evaluation Based on the Following Standards* -

1. Sample - Two product samples, full width by 6.5 feet length, taken from separate lots (production runs) shall be provided for specification conformance testing.

2. Independent Sample - The manufacturer or distributor/fabricator shall provide MDOT with the means to obtain a third, independent, random sample by a MDOT representative. This sample will be evaluated and tested for specification conformance at MDOT's option. The independent sample may be waived for manufacturers with other products already on the QPL.

D. *Evaluation Scheduling* - Manufacturers of products on the QPL which have not been routinely tested (through Approved Certifier testing) within the calendar year will be requested to submit a sample for testing to maintain QPL status. MDOT reserves the right to verify submitted test information or re-evaluate a product for specification conformance at any time.

6.24.03. Evaluation

A. Qualified Product submittals will be reviewed for completeness. The certification and quality control documentation will be checked for conformance to the latest published specification. The sample(s) will be tested for all properties required by the specification. Sample test results will be compared to certification and quality control documents.

6.24.04. Disqualification

A. Manufacturers of Qualified Products which demonstrate non-conformance to specifications will be sent written notification. A written response from the manufacturer which satisfactorily identifies the cause of non-conformance will be required. Products which are found to have subsequent specification deviations may be removed from the QPL. A product may be immediately removed as a result of problems related to the performance, durability or quality control, or any materials, manufacturing, or specification changes made by either the manufacturer or by MDOT.

6.24.05. Requalification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request which identifies the problem(s) causing the disqualification, and provides acceptable evidence that the problem(s) have been resolved. The requirements for qualification specified in this document also apply for requalification.

6.24.06. Testing Procedure

A. Silt fence geotextile will be tested for the following physical properties in accordance with the ASTM designation noted.

Material Properties	Test Method	Specification Requirement
Grab Tensile Strength, lbf (N)	D 4632	100 (450) minimum
Grab Elongation, %	D 4632	40 maximum
Trapezoid Tear Strength, lbf (N)	D 4533	45 (200) minimum
Apparent Opening Size, inches (mm)	D 4751	0.02 (0.6) maximum
Permittivity (Falling Head), sec^{-1}	D 4491	0.1 minimum

NOTE: U.V. Resistance (ASTM D 4355) will not be performed by MDOT. The manufacturer's certified test results will be acceptable.

QUALIFICATION PROCEDURE FOR RECYCLED RUBBER/PLASTIC OFFSET BLOCKS FOR GUARDRAIL WITH STEEL POSTS

6.25.01. Scope

A. This document covers the physical requirements for Recycled Rubber/Plastic Offset Blocks for use as offset blocks for W-Beam and Thrie Beam Guardrail on steel posts only. It includes the procedures to be followed by manufacturers or suppliers in order to have their products included on the MDOT's Qualified Products List (QPL).

B. MDOT reserves the right to randomly sample product from lots or jobsite as required to verify conformance.

6.25.02. Submittal Procedure

A. Submit a cover letter along with the required information listed in Sections 6.25.02.B and 6.25.02.C to the MDOT address listed below. The cover letter should state the name of the designated company contact person to whom inquiries may be made.

Experimental Studies Unit
Operations Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5707

B. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

C. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as manufacturer's name and address, model and lot number, dimensional sheets, material composition, instructions for use, and the following information:

1. Current and clearly legible MSDS.

2. Certification that the product is crash worthy to the requirements of NCHRP Report 350 or MASH, and the product has FHWA approval for use on the National Highway System.

3. Certification that the product submitted has the same composition and physical/mechanical properties as the material used in the crash test.

D. *Evaluation Based on the Following Standards* - Submit a sample and a report of tests conducted by an independent laboratory. The physical and mechanical properties of the product must meet the requirements given in Section 6.25.07 of this procedure. Descriptions of the applicable test methods are included in Section 6.25.06 of this procedure.

6.25.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.25.04. Disqualification

A. A product may be removed immediately from the QPL if any problems develop related to installation or performance.

6.25.05. Requalification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the qualification period.

6.25.06. Testing Procedure

A. *Plastic Blockouts*

1. ASTM D 570, Test Method for Water Absorption of Plastics.

2. ASTM D 6108, Test Method for Compressive Properties of Unreinforced and Reinforced Plastic Lumber.

3. ASTM D 6111, Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement.

4. ASTM D 6341, Test Method for Determination of the Linear Coefficient of Thermal Expansion of Plastic Lumber and Plastic Lumber Shapes between -30 and 140ºF.

B. *Recycled Rubber/Tire Scrap Blockouts*

1. ASTM D 575, Test Method for Rubber Properties in Compression.

2. ASTM D 395, Test Method for Rubber Properties in Compression Set.

3. ASTM C 531, Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

4. ASTM D 573, Test Method for Rubber Deterioration in an Air Oven.

5. ASTM C 642, Test Method for Density, Absorption, and Voids in Hardened Concrete.

6. ASTM D 1148, Test Method for Rubber Deterioration - Heat and Ultraviolet Light Discoloration of Light-Colored Surfaces.

6.25.07. Physical and Material Property Requirements

A. **Certified to pass NCHRP Report 350 or MASH crash test, and be recyclable after collision.**

B. UV light resistant. Additives for UV light protection allowed to 0.1 percent.

C. Moisture absorption limited to 1.0 percent.

D. Minimum compressive strength of 450 psi.

E. Specific gravity between 0.9 and 1.2.

F. Thermal coefficient of expansion 33 x 10-6 /ºF or less.

G. Plastics - Material composition consisting of minimum 30 percent recycled polyethylene.

H. Rubber - Material composition consisting of minimum 30 percent recycled rubber tire cord.

I. Guardrail offset blocks must conform to the dimensional tolerances listed in the current MDOT standard plan R-60 series, 'Guardrail, Types A, B, BD, T, & TD', Wood Offset Blocks for Guardrail, Type B and Type BD, Type T and Type TD, For Use on Steel Posts.

J. Provision shall be made to prevent rotation of the GOB on the post (routed, extra bolt hole, etc).

K. The height of the top of the block does not exceed the height of the rail.

L. The dimensions are in reasonable conformance with the dimensions of standard wood blocks, and are such that proper mounting height of the rail, proper alignment of post bolt holes, and proper bearing surface of the block to the rail is achieved. They must be interchangeable with standard wood blocks in a replacement situation.

QUALIFICATION PROCEDURE FOR RECYCLED RUBBER JOINT FILLER FOR CONCRETE CONSTRUCTION

6.26.01. Scope

A. This document covers the physical requirements for Recycled Rubber Joint Material for use as joint filler in standard concrete construction. It includes the procedures to be followed by manufacturers or suppliers in order to have their products included on the MDOT's Qualified Products List (QPL).

B. MDOT reserves the right to randomly sample product from lots or jobsite as required to verify conformance.

6.26.02. Submittal Procedure

A. *Qualified Products Evaluation* - The manufacturer will submit a cover letter along with the required information listed in Sections 6.26.02.B and 6.26.02.C to the MDOT address listed below. The cover letter should state the name of the designated company contact person to whom inquiries may be made. Mail to:

Experimental Studies Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909

B. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

C. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as manufacturer's name and address, model and lot number, dimensional sheets, material composition, instructions for use, and the following information:

1. Current and clearly legible MSDS.

2. Certification that the product meets or exceeds all of the performance requirements from ASTM D 1751 except the minimum asphalt content of 35 percent is waived.

D. *Evaluation Based on the Following* - Submit a sample and a report of tests conducted by an independent laboratory. Descriptions of the applicable test methods are included in Section 6.26.06 of this procedure. The physical and mechanical properties of the product must meet the requirements given in Section 6.26.07 of this procedure.

E. *Evaluation Scheduling* - Completed submittals will be evaluated by MDOT throughout the year.

6.26.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.26.04. Disqualification

A. A product may be removed immediately from the QPL if any problems develop related to installation or performance.

6.26.05. Requalification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the qualification period.

6.26.06. Testing Procedures

A. ASTM D 545, Test Method for Preformed Expansion Joint Fillers for Concrete Construction (Nonextruding and Resilient Types)

6.26.07. Physical and Material Property Requirements

A. The material must be compressed to 50 percent of its original thickness with three of its edges restrained and meet the following requirements:

1. The stress required to compress the product must range between 100 psi and 750 psi. If the product has a nominal thickness less than ½ inch, the acceptable compression stress changes to between 100 psi and 1250 psi.

2. The extrusion of the free edge cannot exceed ¼ inch.

3. The loss in weight of the compressed material cannot be more than 3 percent of the original weight.

4. After compression test, the material must recover 70 percent of its original thickness in no more than 10 minutes.

B. Minimum density of 19 lb/cu ft.

C. Maximum water absorption in a 24 hour period is 15 percent volume for a product with a nominal thickness of ½ inch or more and 20 percent volume for product has a nominal thickness less than ½ inch.

QUALIFICATION PROCEDURE FOR EPOXY RESIN ADHESIVE

6.27.01. Scope

A. This document covers the physical requirements for epoxy resin adhesives and the procedures to be followed by producers in order to have their products included on the MDOT's Qualified Products List (QPL) for a qualification period of three years.

6.27.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below:

Materials Technology Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5695

B. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as working time, strength properties, and recommended equipment for the epoxy submitted.

C. *Evaluation Based on the Following Standards* - Submit a completed copy of the Physical Requirements Test Results form to the MDOT Materials Technology Unit for compliance with Subsection 914.06 of the Standard Specifications for Construction. This data can be from the manufacturers or an independent laboratory. Submit one quart of each component in the proportion they are mixed to be evaluated by the Materials Technology Unit.

D. *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

6.27.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.27.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of product materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer. The manufacturer will receive

notification including reasons for disqualification.

6.27.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6.27.06. Testing Procedure

A. *Number of Specimens* - The properties of tensile strength and elongation will be determined by representative values obtained from five samples. Viscosity and gel time will be measured once.

B. *Viscosity* - Viscosity shall be tested on a Brookfield Viscometer No. 2 spindle at 10 r.p.m. at standard laboratory temperature 70 ± 3°F (21 ± 2°C). The viscosity shall be 6 poise maximum.

C. *Gel Time* - The gel time shall be tested in accordance with ASTM C 881 except the sample shall be 100 grams tested at standard laboratory temperature 70 ± 3°F (21 ± 2°C). The gel time shall be between 15 and 80 minutes.

D. *Tensile Strength* - The tensile strength shall be tested in accordance with ASTM D 638 after curing for 96 hours. The tensile strength shall be 4000 psi minimum.

E. *Elongation* - The elongation shall be tested in accordance with ASTM D 638 after curing for 96 hours. The elongation shall be 1 percent minimum.

6.27.07. Physical Requirements for Epoxy Resin Adhesive for Grouting Cracks by Pressure Intrusion

To be completed by manufacturers or independent testing laboratory:

	Result	Spec
Viscosity, poises		6 max.
Gel Time, minutes		15-80
Tensile Strength, psi (MPa)		4000 (27.6) min.
Elongation, percent		1 min.

Comments:_____

_____

_____

I hereby certify that the above information submitted is actual physical laboratory test data obtained according to the requirements specified in the Qualification Procedure and Testing Procedure for the product.

Person Responsible For Testing:_____(Signature)

_____(Print Name)

Laboratory Name and Address:_____

_____

_____

Date Tests Were Conducted:_____

Telephone Number:_____

QUALIFICATION PROCEDURE FOR BOND RELEASE AGENTS FOR EPOXY COATED DOWEL BARS

6.28.01. Scope

A. This document covers the physical requirements for bond release agents for epoxy coated dowel bars for load transfer in concrete pavement joints and the procedure to be followed by producers in order to have their products included on the MDOT's Qualified Products List (QPL) for a qualification period of three years.

6.28.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below.

Materials Technology Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5695

B. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as manufacturer's name and address, manufacturer's trade name, model number, etc. of the bond release agent submitted. Descriptions of the test procedures are attached.

C. *Evaluation Based on the Following Standards* - Submit a completed copy of the Physical Requirements for Bond Release Agents form, Section 6.28.07, to the MDOT Materials Technology Unit for compliance with Subsection 914.07 of the Standard Specifications for Construction. Testing must be conducted by an independent testing agency. Submit two epoxy coated dowel bar specimens with bond release agent applied to the MDOT laboratory.

D. *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and products submittal, must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all materials submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be made at the discretion of MDOT.

6.28.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.28.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of product materials, manufacturing or plan dimension changes made by either MDOT or the product manufacturer.

6.28.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the qualification period.

6.28.06. Testing Procedure

A. *Number of Specimens* - The number of specimens required for independent testing shall be as described in the Michigan Test Method for Bond Release Agents for Epoxy Coated Dowel Bars (MTM 614).

B. *Material and Apparatus Requirements* - Material and apparatus requirements for independent testing of the release agent on coated dowel bars shall be as described in MTM 614. The steel dowel bars used in testing shall be straight, smooth, 1.25-inch diameter, and 18 inches in length meeting the requirements of Subsection 914.07 of the Standard Specifications for Construction. The coating shall be an approved epoxy meeting the requirements of Subsection 905.03 of the Standard Specification for Construction.

C. *Test Procedure Requirements* - The required test procedures for independent testing shall be as described in MTM 614.

D. *Specification Requirements* - The specification requirements for independent testing described in MTM 614 shall be as specified in Subsection 914.07 of the Standard Specifications for Construction.

E. *Report* - The report of independent testing shall include the information outlined in Section 4 of MTM 614. This information must be reported on the Physical Requirements for Bond Release Agents sheet, Section 6.28.07, included in this Qualification Procedure packet.

6.28.07. Physical Requirements for Bond Release Agents

To be completed by independent testing agency:

Product use: **Bond Release Agent**

Producer: _____

Product Name: _____

Pull-out Resistance Test:

Maximum Shear Bond Stress Achieved _____ 60 psi

Comments: _____

_____

_____

I hereby certify that the above information submitted is actual physical laboratory test data obtained according to the requirements specified in the Qualification Procedure and Testing Procedure for the product.

Person Responsible For Testing: _____ (Signature)

_____(Print Name)

Laboratory Name and Address:_____

_____

_____

Date Tests Were Conducted:_____

Telephone Number:_____

QUALIFICATION PROCEDURE FOR PREFORMED WATERPROOFING MEMBRANES FOR VERTICAL AND HORIZONTAL APPLICATIONS

6.29.01. Scope

A. This document covers the physical requirements for preformed waterproofing membranes. Producers must follow this procedure in order to have their products included on the MDOT's Qualified Products List (QPL).

6.29.02. Submittal Procedure

A. *Qualified Products Evaluation* - Submit completed copies of MDOT Form 1022Q (Qualified Products Evaluation) and the attached Table 1, as required by this procedure, to the MDOT address listed below:

Materials Technology Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-6110

B. *Product Data Sheets* - Include product literature describing the product's typical application, limitations, and other pertinent information such as surface preparation, repairing, priming, use of adhesives on green concrete, and coverage rates.

C. *Evaluation Based on the Following Standards* - Submit a report of tests conducted by an independent laboratory. The physical properties of the product must meet the requirements given in Table 1 of this procedure. Descriptions of the test methods are included in this procedure. Submit a 3 foot x 3 foot sample of the preformed membrane.

D. *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all material submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

6.29.03. Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformation to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting additional testing on independently obtained samples.

B. MDOT must be notified in writing of any change in the product.

6.29.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of product material, manufacturing, or plan dimension changes made by either MDOT or the product's manufacturer.

6.29.05. Requalification

A. A product that had been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the accepted evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification.

6.29.06. Testing Procedure

A. *Independent Testing Laboratory* - The following testing must be conducted by an independent testing laboratory.

B. *Thickness* - The thickness of the material shall be run according to ASTM D 1777.

C. *Tensile Strength* - The tensile strength shall be determined as described in ASTM D 882. The specimen size shall be 1 inch x 6 inch. Cross head speed shall be 2 inches/minute with a 4-inch initial jaw separation. Record breaking load in force per unit of width (lb/in).

D. *Elongation* - The maximum elongation of the membrane will also be recorded during Tensile Strength (ASTM D 882) testing, as a percent of original jaw separation.

E. *Puncture* - Puncture resistance shall be measured according to ASTM E 154. Lower the test machine at a rate of 0.2 inches per minute. Continue the test until maximum load is reached. Record results as a maximum load in pound-force (lbf).

F. *Permeance* - Permeance shall be measured according to ASTM E 96 (water method). The results will be measured in perms (1 perm = 57 $ng/Pa \cdot s \cdot m^2$).

NOTE: "ng" refers to nanograms (1×10^{-9} grams)

G. *Pliability* - Material shall be conditioned to -20ºF for 2 hours. Bend through 180 degrees at a uniform speed in approximately 2 seconds over a 1 inch mandrel. Examine specimens for cracks. Any cracks in the specimen will constitute a failure.

H. *Reinforcement* - All membranes must contain a heat resistant woven or non-woven backing.

I. *Peel Adhesion* - Peel Adhesion shall be measured according to ASTM D 903. Record the force in pounds per inch. Membranes must be "peel and stick".

6.29.07. Physical Requirements

To be conducted and completed by an independent testing laboratory.

Table 1: Test Results

Test Method	Test Result	Spec
Thickness, inches ASTM D 1777		0.065 min.
Tensile Strength, pounds/inch ASTM D 882		50 min.
Elongation, % ASTM D 882		30 min.
Puncture, lbf ASTM E 154		200 min.
Water Vapor Transmission, Perm ASTM E 96 (water method)		0.1 max.
Pliability ASTM D 146		No Cracks
Fabric Reinforcement		Yes
Peel Adhesion, pounds/inch ASTM D 903		6 min.

Comments: _____

_____

_____

Material: **PASSES** or **FAILS** (circle one)

I hereby certify that the above information submitted is actual physical laboratory test data obtained according to the requirements specified in this Qualification Procedure.

Person Responsible For Testing: _____(Signature)

_____ (Print Name)

Laboratory Name and Address:_____

_____

_____

Date Tests Were Conducted:_____

Telephone Number:_____

QUALIFICATION PROCEDURE FOR BRIDGE COATING SYSTEMS

6.30.01. Scope

A. This document covers the requirements for bridge coating systems and the procedures for coating manufacturers to have their products included on the MDOT's Qualified Products List (QPL). The qualification period is for five years from the date of acceptance.

6.30.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the address listed below.

Experimental Studies Unit
Operations Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5722

B. *Product Data Sheets* - Only products with volatile organic content equal to or less than 3.3 lb/gal will be accepted. Do not submit systems that we have already tested more than once.

1. All products must be from the standard product line of the submitting company, e.g. special products just for Michigan are not allowed.

2. All testing is to be done through the National Transportation Product Evaluation Program (NTPEP) following the guidelines as per AASHTO R 31.

3. All products must be non-detect by EPA Method 1311, Toxicity Characteristic Leaching Procedure (TCLP) for lead and chromium with documentation from an independent laboratory.

4. The coats will have a maximum "dry to top coat" time of 24 hours at 50ºF and at 4 mil dry film thickness above the minimum for each coat.

5. Organic zinc primers must meet the definition for an organic zinc-rich primer as per SSPC-Paint 20, Type II. The primer is to be tinted to contrast with steel blast cleaned to a SSPC-SP10 near white blast. The intermediate coat shall be white and the top coat shall be gray (X6134 Federal Standard 595 Paint Color) ("X" signifies that the gloss is a 1 or 2)..

6. The average adhesion of the coating system is to be greater than or equal to 10.5 (MPA).

7. The average of the Baseline Gloss is to be greater than or equal to 35, the average Gloss Retention in percentage is to be greater than or equal to 40, and the average Delta E (ΔE) after 6 cycles is to be less than or equal to 4.0.

8. Submit certification stating the primer was tested and performed in accordance with "Appendix A, Testing Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints," Specification for Structural Joints Using ASTM A 325 or A 490 Bolts, as adopted by the Research Council on Structural Connections. The testing performed for the certification must have been completed no more than ten years prior to the application of the primer by the contractor.

6.30.03. Evaluation

A. The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. If the product meets the requirements it will be included on the QPL List for five years from date of acceptance. The manufacturer after five years may apply for a one time only, three year extension by submitting data confirming the products have not been altered. The submitter will be notified in writing concerning the favorable results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.30.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to products, materials, or manufacturing. The manufacturer will receive notification including reasons for disqualification.

6.30.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR GRASS SEED VARIETIES

6.31.01. Scope

A. This document covers the requirements for grass seed varieties to be accepted on the MDOT's Qualified Products List (QPL). Seed varieties must be viable for roadside conditions.

6.31.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the evaluation form to the MDOT address listed below:

Roadside Development Section
Design Division
425 W. Ottawa Street
Lansing, Michigan 48909
Telephone: (517) 373-0182

B. *Product Information* - Include complete product information as listed below:

1. *Product Data Sheets* - Enclose product literature for grass seed varieties describing the use, restrictions, cost, and anticipated benefit to MDOT's transportation system.

2. *Test Reports* - Include test, research and evaluation reports conducted by an independent seed testing entity. Product literature is not sufficient. Copies of actual test reports are required. MDOT may perform testing for informational purposes.

3. *Supporting Evaluation* - Enclose installation references, field performance data and a list of other state DOT's or agencies (contact person, telephone number) who have approved your material or product for use.

C. *Evaluation Scheduling* - Completed Qualification Procedure, including evaluation forms and product submittal, must be received by MDOT after October 15 and no later than March 15 to be included in that year's evaluation. Addition of new products to the QPL will be made only once a year upon completion of evaluations for all materials submitted by the March 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

6.31.03. Evaluation

A. The submitted information will be reviewed and samples may be tested (if required) for conformance to the specified requirements of the Michigan Certification of Seed Law, Act No, 221 and the Michigan Seed Law Act No, 329. Once the product meets all the requirements of this procedure it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.31.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to performance. The manufacturer will receive notification including reasons for disqualification.

6.31.05. Requalification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6.31.06. Testing Procedure

A. The testing procedure is conducted by an independent testing agency, who in return verifies that all of MDOT's requirements are met.

B. Grass seed varieties must conform to the Michigan Crop Improvement Association's certifying criteria.

QUALIFICATION PROCEDURE FOR MULCH BLANKETS

6.32.01. Scope

A. This document covers the requirements for straw and/or excelsior mulch blankets to be placed on the MDOT's Qualified Products List (QPL). The qualified product list for mulch blankets includes high velocity mulch blankets (917.15.B.1) and mulch blankets (917.15.B.2) as described in the Standard Specifications for Construction.

6.32.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the form to the MDOT address listed below:

Roadside Development Section
Design Division
425 W. Ottawa Street
Lansing, Michigan 48909
Telephone: (517) 373-0128

B. *Product Information* - Include product information as listed below:

1. *Product Data Sheets* - Enclose product literature for mulch blankets describing the use, restrictions, cost and anticipated benefit to MDOT's transportation system.

2. *Test Reports* - Include test reports conducted by an independent testing laboratory indicating that the material meets all applicable national standards or specifications, such as ASTM or AASHTO. Product literature is not sufficient. Copies of actual test reports are required. MDOT may perform in-house testing for informational purposes.

3. *Supporting Evaluation* - Enclose a list of other state DOT's or agencies (contact person, telephone number) who have approved your material or product for use.

4. *Sample Specification* - Enclose a sample specification for product usage (not proprietary).

C. *Evaluation Based on the Following Standards* - The product will be evaluated in one of two ways:

1. If a company has a new mulch blanket that is nearly identical to materials on the list, and with the condition that its field performance be equal to or better than other materials

2. If a company has a new material that is different, yet is presented as performing the same as other prequalified materials, the company's representative will provide the material to be field tested at no cost to MDOT on an MDOT construction project so that its field installation and performance can be observed.

D. *Evaluation Scheduling* - Completed Qualification Procedure, including evaluation forms and product submittal, must be received by MDOT after September 15 and no later than March 15 to be included in that year's evaluation and field performance testing. Addition of new products to

the QPL will be made only once per year upon completion of evaluations for all materials submitted by the March 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

6.32.03. Evaluation

A. The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. The submitter will be notified in writing concerning the way the product will be evaluated (Section 6.32.02.C.1 or 6.32.02.C.2) prior to proceeding with the field testing. Once the product meets all the requirements of this procedure, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.32.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of products materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer. The manufacturer will receive notification including reasons for disqualification.

6.32.05. Requalification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6.32.06. Testing Procedure

A. This product is tested based upon its effectiveness and efficiency in its field performance. The area to be field tested will be as directed by the Engineer.

QUALIFICATION PROCEDURE FOR MULCH BINDERS (TACKIFIERS)

6.33.01. Scope

A. This document covers the requirements for mulch binder (tackifiers) to be accepted on the MDOT's Qualified Products List (QPL).

B. This qualification procedure will be used for the following types of mulch binders (tackifiers):

- latex base
- wood fiber
- recycled newsprint
- guar gum

C. Other types of mulch binders (tackifiers) will be evaluated following this procedure when requested.

6.33.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* - Submit a completed copy of the form to the MDOT address listed below:

Roadside Development Section
Design Division
425 W. Ottawa Street
Lansing, Michigan 48909
Telephone: (517) 373-0128

B. *Product Data Sheets* - Include product literature describing the use of mulch binder (tackifiers) and any other pertinent information.

C. *Evaluation Based on the Following Standards* - The product will be evaluated in one of two ways:

1. If a company has a new mulch binder that is nearly identical to materials on the list, and with the condition that its field performance be equal to or better than other materials

2. If a company has a new material that is different, yet is presented as performing the same as other prequalified materials, the company's representative will provide the material to be field tested at no cost to MDOT on an MDOT Construction Project so that its field installation and performance can be observed.

D. *Evaluation Scheduling* - Completed Qualification Procedure, including evaluation forms and product submittal, must be received by MDOT after September 15 and no later than March 15 to be included in that year's evaluation and field performance testing. Addition of new products to the QPL will be made only once per year upon completion of evaluations for all materials submitted by the March 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

6.33.03. Evaluation

A. The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. If the product meets the requirements it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.33.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of products materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer. The manufacturer will receive notification including reasons for disqualification.

6.33.05. Requalification

A. A product that has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6.33.06. Testing Procedure

A. This product is qualified for use based upon its effectiveness and efficiency in its field performance.

QUALIFICATION PROCEDURE FOR LIGHT WEIGHT COMPOSITE HANDHOLE

6.34.01. Scope

A. This document covers the procedure manufacturers must follow to have a light weight composite handhold approved for use on the MDOT projects.

6.34.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

B. *Product Data Sheets* - Submit a copy of product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc., to the MDOT address listed below:

Experimental Studies Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5707

C. *Report of Tests* - Provide independent laboratory test report(s) stating that the structural capacity of the pull box and cover is rated as follows:

1. Handhole covers shall have a minimum static coefficient of friction of 0.5.

2. Handhole covers shall withstand a vertical test load of 20,800 lb distributed over a 10 inch x 10 inch area.

3. Handhole boxes shall withstand a vertical test load of 20,800 lb distributed over a 5 inch x 10 inch area.

4. Handhole boxes shall withstand a lateral sidewall test load of 1,200 psf distributed over an area 24 inches wide by the depth of the box.

5. Handhole boxes and covers shall be designed and suitable for installation and use through a temperature range of -45.6°C (-50°F) to +90°C (194°F)

Structural capacity shall be tested in accordance with TIER 15 of the current *ANSI/SCTE 77 Specification for Underground Enclosure Integrity*. Permanent deflection cannot exceed 10% of maximum deflection listed in the standard. The ultimate load and mode of failure shall be included in the final report.

D. *Material Requirements* - The composite handhold materials, dimensions, and markings must conform to section 918.06.D of the 2012 MDOT *Standard Specifications for Construction*.

E. *Sample Submittal* – MDOT – reserves the right to request a sample if further analysis is required.

6.34.03. Evaluation

A. The submitted information will be reviewed and samples may be requested to test for compliance with the specified requirements. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.34.04. Disqualification

A. A product may be immediately disqualified from MDOT use should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

6.34.05. Requalification

A. A product that has been disqualified will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR FRANGIBLE LIGHT STANDARD TRANSFORMER BASE ASSEMBLY

6.35.01. Scope

A. This document covers the qualification procedures for Frangible Light Standard Transformer Base Assembly for placing luminaries in the roadway clear zone. It includes the procedures to be followed by manufacturers or suppliers in order to have their products included on the MDOT's Qualified Products List (QPL).

B. MDOT reserves the right to randomly sample product from lots or jobsite as required to verify conformance.

6.35.02. Submittal Procedure

A. Submit a cover letter and a frangible light standard transformer base along with the required information listed in Section 6.35.02.B for each product to the MDOT address listed below. The cover letter should state the name of the designated company contact person to whom inquiries may be made. Mail to:

Experimental Studies Unit
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909
Telephone: (517) 322-5707

B. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

C. *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as manufacturer's name and address, model and lot number, dimensional sheets, hardware, material composition, and the following information:

1. Certification that the product is crash worthy to the requirements of NCHRP Report 350 Test Level 3, and meets the additional requirements of the American Association of State Highway and Transportation Officials (AASHTO) *"Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals"* Section 12, Breakaway Supports.

2. Submit a copy of the FHWA approval letter for the product use on the National Highway System. Provide certification that the product submitted has the same chemistry, mechanical properties, and geometry as the FHWA approved product.

3. Submit a copy of the test report by an independent facility of the dynamic performance (crash) test outlined in the standards in 6.35.02.B.1 above.

4. Provide clear instructions for installation, including base bolt size, anchor bolt size, washer configuration and material, distance base tabs project beyond the nut for the

specified bolt circle, and nut tightening procedures. Lock washers must be included with the base bolts and anchor bolts.

5. Provide information on the design strength of the frangible light standard transformer base, including maximum pole mounting height and weight, and ability to carry the loads as specified in AASHTO *"Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals"* Section 3, Loads.

6.35.03. Evaluation

A. **Certified to meet NCHRP Report 350 and AASHTO dynamic performance criteria.**

B. Frangible light standard transformer bases must conform to the dimensional tolerances given in the FHWA approved drawing submitted in Section 6.35.02.B. The base tabs must project a minimum of ½ the anchor bolt diameter beyond the nut for the specified bolt circle. Base tabs must be able to withstand snug tightening with a lock washer and a 1:20 beveled washer in place without damage.

C. Completed submittals will be evaluated by MDOT throughout the year. The submitted information will be reviewed for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

6.35.04. Disqualification

A. A product may be removed immediately from the QPL if any problems develop related to installation or performance. The submitter will be notified in writing of the effective date of product removal.

6.35.05. Requalification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the qualification period.

QUALIFICATION PROCEDURE FOR RETROREFLECTIVE SHEETING/PERMANENT SIGNING

6.36.01. Scope

A. This document covers requirements for retroreflective sheeting used in permanent signing and the procedure manufacturers must follow to have their products included on the MDOT Qualified Products List (QPL).

6.36.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information required to the MDOT address listed below.

MDOT Traffic Signing Engineer
Design Division
425 West Ottawa Street
P.O. Box 30050
Lansing, MI 48909
Telephone: 517-335-2624

B. Upon the approval of new retroreflective sheeting, the following information is needed in order to add the product to the QPL. This information is to be supplied along with the Traffic Signing Unit Supervisor's approval letter of the new retroreflective sheeting.

- Company name
- Company address
- Company point of contact
- Phone number for contact
- MDOT name of material
- MDOT Specification Number
- Manufacturer specific product name
- Any applicable notes the Traffic Signing Unit Supervisor would like added to the list

Retroreflective Sign Sheeting Material Guidelines

Sign Category	Material Type
Yellow Warning Signs [W series (non school related), E13-1, E13-2, E11-1, OM-1, OM-2, OM-3]	ASTM Type IX Fluorescent Yellow
School Signs (S1-1, S4-3, S4-5, S4-5a, school portion of S5-1, W16-7p, W16-9p, W16-2, W16-2a)	ASTM Type IX Fluorescent Yellow Green

Sign Category	Material Type
Freeway Guide Signs White legends; borders; arrows; and white portion of route markers, shields, and auxiliaries Background	ASTM Type IX White ASTM Type IV Green, Brown, or Blue
Non Freeway Guide Signs	ASTM Type IV
Regulatory Signs	ASTM Type IV
Route Markers	ASTM Type IX

6.36.03. Evaluation Procedure

A. The Michigan Department of Transportation specification requirements for permanent signing are shown in the "Retroreflective Sign Sheeting Material Guidelines" table in this procedure.

B. MDOT requires that all materials be tested by the National Transportation Product Evaluation Program (NTPEP) and meet the criteria listed below prior to any consideration being given regarding sign fabrication and field testing. NTPEP testing is a requirement for all new suppliers or for suppliers attempting to requalify a product that was removed from the QPL. There will be no exceptions. All sheeting and ink colors used for permanent signing must be tested (typically white, yellow, red, green, blue, and brown). The NTPEP test deck samples from Minnesota will be the basis for the outdoor weathering review.

1. All sheeting samples must pass ASTM D 4956 and federal specification L-S-300C physical test requirements with a rating of "no effect."

2. After two years of weathering at 45 degrees, all sheeting samples must pass the visual panel comparison of the shrinkage, cracking, and blistering with a rating of "none evident" and must pass the color fastness test with a rating not less than "good."

3. After two years of weathering at 45 degrees, all sheeting samples will be reviewed for loss of reflectivity and color change by comparing data with the initial coefficient of reflection and initial chromaticity color coordinates. Pass/fail determinations will be made on an individual basis, although samples must retain a minimum 90 percent reflectivity based on a control sample. Samples with chromaticity color coordinate changes will be determined a failure if the color fastness test is a rating less than "good."

6.36.04. Fabrication Requirements

A. The manufacturer must comply with steps 1, 2, and 3 listed below prior to sample submittal.

1. Manufacturers must provide documentation from an independent agency that shows successful fabrication and field performance of their sheeting.

2. Manufacturers must provide documentation that details performance life of sheeting (minimum of 80 percent reflectivity maintained at ten years).

3. All fabrication testing will be done by MDOT Design Division Central Sign Shop. The manufacturer shall provide MDOT with the sheeting, ink, and any necessary substrates. The inks shall not require clear coating. All sheeting and ink shall be manufactured by the company providing the materials for testing. All materials will remain the property of MDOT.

B. The manufacturer will supply MDOT with the following size sheeting samples: 1 –12.75 inch x 50 yard roll and 1 – 36 inch x 25 yard roll of green sheeting; 1 – 48 inch x 25 yard roll of yellow sheeting; 1 – 24 inch x 50 yard roll of white sheeting; 1 – 24 inch x 50 yard roll of black vinyl; 1 – 24 inch x 25 yard roll of blue translucent film; 1 – 2 inch x 50 yard roll of white sheeting; 1 – 48 inch x 50 yard roll of slip sheeting; 1 gallon of black ink and 1 gallon of blue ink.

C. Testing will be done on standard MDOT signing substrates: .080 aluminum, aluminum extrusion, and plywood.

D. The MDOT Design Division Central Sign Shop will report any significant fabrication problems to the Traffic Signing Unit, Design Division and a determination will be made whether to proceed with the field test.

6.36.05. Field Test Requirements

A. Field tests are necessary for initial placement on the QPL and for reinstatement of a product that has been removed from the QPL. Field Test Parameters are:

1. The MDOT shall choose the location of the test site.

2. The signs shall be fabricated by MDOT personnel in the presence of the manufacturer and shall be identified as experimental with a tag on the back of the sign. Sign substrates will consist of .080 aluminum, aluminum extrusion, and plywood.

3. Signs will be reviewed by MDOT personnel. All reviews shall be documented with date, sign number, condition of sign, and any other pertinent data. Problems that will result in rejection of the product include, but are not limited to: wrinkling, topcoat splitting, peeling, loss of reflectivity, and color change.

4. The manufacturer will be notified in writing concerning the results of the field study. From the time of sign installation, two years may be taken by MDOT to conclude the field evaluation. Completion of a successful field test indicates that the product will be approved for one year. At the end of the one-year period, continued approval will be based on successful fabrication and field performance in Michigan.

6.36.06 Evaluation Scheduling

A. MDOT reserves the right to verify submitted test information or to modify acceptance criteria for retroreflective sheeting at any time.

QUALIFICATION PROCEDURE FOR FLEXIBLE PLASTIC DELINEATOR POSTS

6.37.01. Scope

A. This document covers the requirements for ground and surface mount flexible delineator posts to be placed on the MDOT's Qualified Product List (QPL).

6.37.02. Submittal Procedure

A. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

B. The Manufacturer must provide a report from the National Transportation Product Evaluation Program (NTPEP) for the submitted product. The product must have gone through summer and winter impact testing. If testing was not completed within the last three years (from date of the product evaluation request submittal), the Manufacturer must provide written certification that no design or material changes have been made to the product since the testing.

C. For an initial review, send the results from NTPEP, product data sheets, completed form #1022Q, and other pertinent information, to:

MDOT Delineation Engineer
Traffic Operations Division
425 West Ottawa Street
P.O. Box 30050
Lansing, Michigan 48909

6.37.03. Evaluation

A. The submitted NTPEP report will be reviewed by MDOT's Delineation Engineer. The survival rate and condition after summer and winter impact testing are the primary factor in approving products. If the NTPEP results are satisfactory, the product will be added to the QPL. The manufacturer will be notified in writing of the results of the evaluation.

MDOT reserves the right to verify submitted test information or re-evaluate a product at any time.

6.37.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance of the product. The Manufacturer will receive written notification including reasons for disqualification.

6.37.05. Requalification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request from the Manufacturer, along with the acceptable evidence that the problems causing the disqualification have been corrected.

QUALIFICATION PROCEDURE FOR STEEL CLAMPS FOR TRAFFIC SIGNAL STRAIN POLES

6.38.01 Scope

A. This document covers the procedures to be followed by manufacturers or suppliers in order to have their products included on MDOT's Qualified Products List (QPL). It includes the physical requirements for steel clamps for use as traffic signal strain pole span wire installations.

B. MDOT reserves the right to randomly sample product from lots or jobsite as required to verify conformance. To remain on the QPL, samples of each size manufactured must be submitted on an annual basis, and when the manufacturing process changes.

6.38.02 Submittal Procedure

A. Submit a cover letter and a along with samples and the following information to the MDOT address listed below at the time of application for addition to the Qualified Products List and every January thereafter. The cover letter should state the name of the designated company contact person to whom inquiries may be made.

Experimental Studies Group
Construction Field Services Division
8885 Ricks Road
P.O. Box 30049
Lansing, Mi 48909
Telephone: (517) 322-5707

B. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

C. Product Data Sheets -Include product literature containing pertinent information such as manufacturer's name and address, model and lot number, material composition, instructions for use, and the following information:

1. Mill certificate from raw material supplier that the steel meets the requirements of ASTM A36.

2. Mill certificate from the bolt supplier that the bolts meet the requirements of ASTM A449.

3. Certification that the product meets or exceeds all of the requirements listed in the current version of the Michigan Department of Transportation Special Detail SIG-010A *"Span Wire T.S. on Steel or Wood Poles."*

4. Shop drawings of all size clamps submitted for QPL approval, showing steel clamp cross-section, including pertinent dimensions, location and meaning of lot identification numbers, and bend radii.

D. Evaluation based on the following – For each clamp size manufactured, submit a sample, including all mounting hardware, and a mill certification test report. A listing of the

applicable test method(s) is included in Section 6 of this procedure. The physical and mechanical properties the product must meet are given in Section 7 of this procedure.

E. Evaluation Scheduling -Completed submittals will be evaluated by MDOT throughout the year.

6.38.03 Evaluation

A. The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements, it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

B. MDOT must be notified in writing of any change in the product design or manufacture. Changes to the product require re-evaluation of the product.

6.38.04 Disqualification

A. A product may be removed immediately from the QPL if any problems develop related to installation or performance.

6.38.05 Requalification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the qualification period.

6.38.06 Testing Procedures

A. ASTM E1417 – Standard Practice for Liquid Penetrant Testing

B. ASTM F606 – Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

6.38.07 Physical and Material Property Requirements

A. The steel must be in conformance to ASTM A36 as determined by the submittal of the mill certification.

B. The minimum bend radius must be equal to or greater than 1.5 times the thickness (1.5t).

C. The steel clamp segments must exhibit no cracking, as indicated by the liquid dye penetrant test, after subjected to a tensile force of 4,000 lb. applied to the clevis of the mounted assembly at a 5 degree angle.

D. The supplied bolts must pass the wedge tension test in ASTM F606, Section 3.5, with a minimum load of 19,200 lb.

QUALIFICATION PROCEDURE FOR TEMPORARY PAVEMENT MARKING MATERIALS

6.39.01. Scope

A. This document covers the physical requirements for temporary pavement marking materials to be followed by producers in order to have their product included on the MDOT's Qualified Products List (QPL).

6.39.02. Submittal Procedure

A. *MDOT Contacts* - The following personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Work Zone Delivery Engineer
System Operation & Management Section
Operations Field Services
6333 Lansing Road
Lansing, Michigan 48917
517-636-0300

B. *Qualified Products Evaluation Form (Form #1022Q)* – Submit a completed copy of the form with the product information.

C. *Product Data Sheet*s – The manufacturer must provide a report from the pavement marking material category of the National Transportation Product Evaluation Program (NTPEP) for the submitted product(s). Pennsylvania or Minnesota NTPEP data is required for pavement marking materials, unless MDOT's Work Zone Delivery Engineer determines other states NTPEP test results to be acceptable. For a temporary product, the NTPEP report must have a minimum of five months of data.

D. *Evaluation Based on the Following Standards* - MDOT initially approves pavement marking materials based on laboratory and field testing provided by NTPEP. Once the product is evaluated by NTPEP, it may be placed on several pilot projects chosen by MDOT. The pilot materials will then be evaluated based on specific performance factors determined by the department. The evaluation period will be a minimum of one construction season. Once the product is evaluated and approved, the product may be placed on the QPL. Continued use of the product is dependent upon satisfactory field performance.

1. Listed below in tables 1 and 2 are the NTPEP testing requirements for markings in section 922.06A.

Table 1: Average Retroreflectivity Readings. Reflectivity minimum requirements for black are not required and should be near zero.

		White	Yellow
Skip Readings	Initial retroreflectivity	≥ 375 mcd	≥ 200 mcd
	5 month retroreflectivity	≥ 280 mcd	≥ 150 mcd

Table 2: Pull-up and Discernability Average Readings

Color (white, yellow, black, etc..)	Internal Tape Strength	Adhesive Bond Rating	Tackiness After Removal	Discernability after removal	Discernability after 30 days
Initial readings	≤ 1	≤ 6	≤ 5	≤ 9	≤ 5
5 month Readings	≤ 3	≤ 6	≤ 5	≤ 8	≤ 5

2. The NTPEP testing requirements for markings in section 922.06B are as follows; after a four week test period over 80% of the markers must be at or above a 4 on the marker rating scale, the markers must have a reflective front and back strip intact, and no more then 2% of the markers can have separated from the roadway. Reflectivity requirements do not apply to black markings.

6.39.03. Evaluation

A. The submitted NTPEP report will be reviewed and samples will be evaluated for conformance to the specified requirements in section 6.38.02.C. If the product meets the requirements and passes the evaluation on the pilot project, the material will be included on the QPL. The submitter of products placed on the QPL will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own evaluation.

6.39.04. Disqualification

A. A product may be immediately removed from the QPL should any problems develop related to installation or performance as a result of products, materials, or manufacturing changes made by either MDOT or the product manufacturer. The manufacturer will receive notification including reasons for disqualification.

B. The manufacturer is notified of any out-of-specification results and continued failures are grounds for removal from the QPL. Products may also be removed from the approved list due to field performance problems.

6.39.05. Requalification

A. A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. MDOT may require the product be re-evaluated on a pilot project.

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MATERIALS ACCEPTANCE REQUIREMENTS

See Miscellaneous area at the end of table for materials deleted from the 2012 Standard Specifications for Construction.
*** Must be tested unless provided by an Approved Manufacturer.**
**** When the Basis of Acceptance is not "Test", the sampling criteria below may be used when there are concerns with material quality.**

Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
401.03E End Section Grate for Culverts	VI	-	-	-	See Standard Plans for Sizes.
401.03E Precast Concrete Headwalls	Gen Cert	-	-	-	24" or less. For larger than 24" construct per Section 706 of Standard Specifications.
404.02C Underdrain Outlet Endings	VI	-	-	-	See Standard Plans.
501.02 Asphalt, Release Agents	VI	-	-	-	
NOTE: Must be approved by the project engineer. No fuel or oil based agents.					
502.02B Overband Crackfill, Asphalt Rubber (Alt. 2)	Gen Cert	-	-	-	Must be a Qualified Product (502.02B).
603.03B2 Adhesive Systems for Grouting Dowel Bars and Tie Bars for Full-Depth Concrete Pavement Repairs	Gen Cert	-	-	-	Must be a Qualified Product (603.03B2).
NOTE: Use for grouting to existing concrete in the same direction of traffic in the same lane as the repair. For grouting lane ties (deformed bars positioned transverse to the direction of traffic located between traffic lanes) select from Adhesive Anchor Systems for Structural Anchors and Lane Ties (712.03J).					
603.03B11 Bond Breaker Tape	VI	-	-	-	
702.02A Standard Mortars and Grouts	VI	-	-	-	
702.02B Non-Shrinking Mortar and Grout, Type H-1(Non-Metallic) Pre-Mixed	Gen Cert	-	-	-	Must be a Qualified Product (702.02B).
702.02C Admixture for Expansive Grout, Type E-1	Test Data Cert	-	-	-	
NOTE: Certification to include manufacturers recommended dosage per sack of cement. Include all General Certification documentation and sample of the cement with which it is being used with CV samples.					
703 Prepackaged Hydraulic Fast Set Mortar	Gen Cert	-	-	-	Must be a Qualified Product (703).
706.03K4 Expansion Joint Devices for Bridges	See Remark	-	-	-	See project plans for list of approved devices and details.
706.03S Penetrating Water Repellent (Protective Coating for Concrete)	Gen Cert	-	-	-	Must be a Qualified Product (706.03S).

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
707.02 Bushings for Pins and Link Plates	Gen Cert	-	-	-	Must be a Qualified Product (707.02).
708.03A Prestressed Concrete	Fabrication Inspection	-	-	-	MQAP Manual Section 4.04.
710.03D Waterproofing Shotcrete	VI	-	-	-	
712.03A1c Abrasive, Low Dusting	Gen Cert	-	-	-	See Section 715.02.
712.03D Epoxy Mastic	VI	-	-	-	
712.03J Adhesive Anchor Systems for Structural Anchors and Lane Ties	Gen Cert	-	-	-	Must be a Qualified Product (712.03J).
712.03K Structure Expansion Anchors (Mechanical Expansion Anchors)	Gen Cert See Remark	-	-	-	Must be a Qualified Product (712.03K). Pull-out testing is required see MQAP Manual Section 4.03.
712.03L Mechanical Reinforcement Splicing	Gen Cert See Note	1 per project	2 splices	-	See Special Instructions. Must be a Qualified Product (712.03L).
712.03X Grout Under Masonry Plates	VI	-	-	-	
712.03Y Embedded Galvanic Anodes	Gen Cert See Remark	-	-	-	Must be a Qualified Product (712.03Y).
713.02B Sealant for Perimeter of Beam Repairs	Gen Cert	-	-	-	Must be a Qualified Product (713.02B).
715.02 Coating Systems for New Hanger Assemblies	Gen Cert See Remark	-	-	-	Must be a Qualified Product (915).
715.02 Abrasive, Low Dusting	Gen Cert	-	-	-	Must be a Qualified Product (715.02).
715.02 Abrasive, Steel Grit	VI	-	-	-	Verify uniform profile after blasting of 1 to 2.8 mils per SSPC.
716.02 Abrasive, Low Dusting	Gen Cert	-	-	-	See Section 715.02.

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**** When the Basis of Acceptance is not "Test", the sampling criteria below may be used when there are concerns with material quality.**

Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
803.02B Detectable Warning Surfaces	Gen Cert	-	-	-	Must be a Qualified Product (803.02B).
804.01 Glare Screen	VI	-	-	-	Included in Concrete Spec.
808.03C Temporary Fence Materials	VI	-	-	-	
810.03O Bridge Sign Connections	Fabrication Inspection	-	-	-	MQAP Manual Section 4.06
811.03D1 Waterborne, Liquid Pavement Marking Materials	Gen Cert	-	-	-	Must be a Qualified Product. MQAP Manual Section 6.15. Must be a Qualified Product (811.03D1).
811.03D2 Low Temperature Waterborne, Liquid Pavement Marking Materials	Gen Cert	-	-	-	Must be a Qualified Product. MQAP Manual Section 6.15. Must be a Qualified Product (811.03D2).
811.03D3 Regular Dry Paint, Liquid Pavement Marking Materials	Gen Cert	-	-	-	Must be a Qualified Product. MQAP Manual Section 6.15. Must be a Qualified Product (811.03D3).
811.03D4 Cold Plastic Tape, Liquid Pavement Marking Materials	Gen Cert	-	-	-	Must be a Qualified Product. MQAP Manual Section 6.16. Must be a Qualified Product (811.03D4).
811.03D5 Thermoplastic Liquid Pavement Marking Materials	Gen Cert	-	-	-	Must be a Qualified Product. MQAP Manual Section 6.15. Must be a Qualified Product (811.03D5).
811.03D5 Thermoplastic, Blocks Rumble Strips and Snowmobile Crossings	Gen Cert	-	-	-	Must be a Qualified Product. MQAP Manual Section 6.15. Must be a Qualified Product (811.03D5).
811.03D6 Thermoplastic, Sprayable, Liquid Pavement Marking Materials	Gen Cert	-	-	-	Must be a Qualified Product. MQAP Manual Section 6.15. Must be a Qualified Product (811.03D6).
811.03D7 Polyurea, Liquid Pavement Marking Materials	Gen Cert	-	-	-	Must be a Qualified Product. MQAP Manual Section 6.15. Must be a Qualified Product (811.03D7).
811.03D8 Modified Urethane, Liquid Pavement Marking Materials	Gen Cert	-	-	-	Must be a Qualified Product. MQAP Manual Section 6.15. Must be a Qualified Product (811.03D8).
811.03D9 Preformed Thermoplastic, Preformed Pavement Marking Material	Gen Cert				Must be a Qualified Product. MQAP Manual Section 6.15. Must be a Qualified Product (811.03D9).
901 Cement	Appr Mfr	See Remark	10 lb	45 ton	See Special Instructions, see MQAP Manual Section 3.06.
901.06 Slag Cement	Appr Mfr	-	10 lb	-	See Special Instructions for Cement.

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
901.07 Fly Ash, Pozzolanic Admixtures for Concrete	Appr Mfr	-	10 lb	-	See Special Instructions for Cement.
902 Coarse Aggregates	Test	See Remark	50 lb	100 ton	Refer to Chapter 3 of the Procedures for Aggregate Inspection Manual for sampling information. **See Current List** of all **Prequalified Aggregate Sources at Construction Field Services Web Page.** Actual Current List of Prequalified Aggregate Sources web page address: http://www.michigan.gov/documents/mdot/MDOT_PrequalifiedAggregateSourceList_387538_7.pdf
902 Dense-Graded Aggregates	Test	See Remark	50 lb	500 ton	
902 Open-Graded Aggregates	Test	See Remark	50 lb	100 ton	
902 Granular Material Class I	Test	See Remark	50 lb	100 ton	
902 Granular Material Class II (Subbase) and Class IIA	Test	See Remark	50 lb	500 cyd	
902 Class II (Abutment B. F.)	Test	See Remark	50 lb	100 cyd	
902 Granular Material Class III	Test	See Remark	50 lb	500 cyd	
902 Granular Material Class IIIA	Test	See Remark	25 lb	100 cyd	
902 Fine Aggregate	Test	See Remark	25 lb	100 ton	
902 Mineral Filler for HMA Mixtures	Test See Remark	1 per project	1 qt	10 ton	Refer to Section 902.11 of the 2012 Standard Specifications.
903.01 Air Entraining Admixtures	Gen Cert	-	-	-	Must be a Qualified Product (903.01).
903.02 Water Reducing and Water Reducing Retarding Admixtures for Concrete	Gen Cert	-	-	-	Must be a Qualified Product (903.02).
903.03 Latex Admixture for Concrete	Appr Mfr	1 per lot	1 qt	-	
903.04 Concrete Accelerators 1. Calcium Chloride 2. All Others	 VI Gen Cert	 - -	 - -	 - -	For calcium chloride note the chemical composition. Other accelerators must be Qualified Products (903.04).

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
903.06 Membrane Curing Compound	Test Data Cert	1 per lot or batch	1 qt	200 gal	
NOTE: Curing compounds must not be used after ONE year from manufacture. Date of manufacture must be clearly printed on the outside of containers.					
903.07A Interim Curing (Linseed Oil Based)	Test Data Cert	1 per lot or batch	1 qt	50 gal	See Note for 903.06 above.
903.07C Insulating Blanket	Test Data Cert	-	-	10 sheets	
903.07D Polystyrene Insulation	Test Data Cert	-	-	-	
904.03A Asphalt Binder for HMA Mixtures	See Remark	1 per batch	(2) 1 qt containers	-	See Special Instructions.
904.03B Liquid Asphalt (MC)	Gen Cert	1 per batch	See Remark	-	1 gal from the top and 1 gal from the bottom of tank.
904.03B Liquid Asphalt (RC-250)	Gen Cert	1 per batch	2 qt	5 gal	
904.03C Emulsified Asphalt	Appr Mfr * See Remark	See Remark	See Remark	-	See Special Instructions.
905.03 Bar Reinforcement (Uncoated)	Appr Mfr *	1 per project per mfr per size	See Remark	500 lb	See Special Instructions.
905.03 Bar Reinforcement (Epoxy Coated) 1. Bar 2. Epoxy Coating Companies 3. Epoxy Coating Material (905.03C)	 Appr Mfr * Appr Mfr * Gen Cert	 1 per project per mfr per size	See Note	500 lb	See Special Instructions. Epoxy coating must be a Qualified Product (905.03C).
905.03D Bar Chairs and Wire Ties for Epoxy Coated Steel Reinforcement	VI	-	-	-	
905.06 Welded Steel Wire Reinforcement (Mesh)	Appr Mfr *	1 per project per mfr	See Remark	500 syd	See Special Instructions.
905.07 Strand for Prestressed Concrete	Appr Mfr *	1 per heat	2 pcs each 60 in long	-	See Special Instructions.

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
905.08 Tendons for Post Tensioning of Box Beams (Prestressing Strand)	Appr Mfr * See Remark	1 per heat	2 pcs each 60 in long	-	See Special Instructions.
905.08 Tendons for Post Tensioning of Box Beams (Post Tensioning Bar)	Test	1 per heat per project	2 pcs each 30 in long	-	
906.04 Structural Steel	Fabrication Inspection	-	-	-	MQAP Manual Section 4.05.
906.05 Foundation Piles (Steel H Piling and Special Sections, Steel Shells for Cast-in- Place Concrete Piles and Pile Points)	Test Data Cert	-	-	-	
906.05 Pile Cutoffs	Gen Cert	-	-	-	
906.06 Steel Piles (Temporary and Permanent Steel Sheet Piling)	Gen Cert	-	-	-	
906.07 High Strength Steel Bolts, Nuts, and Washers for Structural Joints	Test	1 assembly per dia per length per heat per project	3 assemblies	-	See Special Instructions.
906.08 Pins and Link Plates for Steel Bridge Construction	Fabrication Inspection	-	-	-	MQAP Manual Section 4.05
906.09 Shear Developers (Studs)	Gen Cert	-	-	-	Must be a Qualified Product (906.09).
907.03A - C Woven Wire Fence (Woven Wire Fabric, Barbed Wire, Smooth Line Wire)	Test Data Cert	1 per project per mfr	Full width of roll 5 ft 6 ft 4 ft	400 ft	
907.03D Woven Wire Fence (Steel Posts)	Test Data Cert	1 per project per mfr	1 post	25 posts	
907.03E Woven Wire Fence (Treated Wood Posts)	See Remark	-	-	-	See Section 912.07B.
907.03F Woven Wire Fence (Gates)	VI	-	-	-	

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
907.04A Steel Chain Link Fence (Fabric)	Test Data Cert	See Remark	5 ft full width of roll	250 ft	1 per height and/or mesh size, per project and 1 per mfr per project.
907.04B Steel Chain Link Fence (Tension Wire)	Gen Cert	1 per project per mfr	3 ft	500 ft	
907.04C Steel Chain Link Fence (Post for Fence and Gates), (Pedestrian Fence and Structure Fencing (Steel))	Test Data Cert	1 per project per mfr	1 post	25 posts	See Special Instructions.
NOTE: An alternative zinc/clear coat system will be allowed for pipe sections only. This alternative coating system shall comply with subsection 907.03D of the Standard Specifications for Construction.					
907.04C Steel Chain Link Fence (Top Rail), ((Horz. Rail) (Pedestrian Fence))	Test Data Cert	1 per project per mfr See Remark	5 ft	250 ft	See Special Instructions.
907.04D & E Steel Chain Link Fence (Gates, Fence Fittings and Hardware)	VI	-	-	-	
907.05A High Tensile Wire Fence (Wire)	Test	1 per project per mfr	3 ft	250 ft	
907.05B High Tensile Wire Fence (Treated Wood Posts)	See Remark	-	-	-	See Section 912.07B.
907.05C High Tensile Wire Fence (Hardware)	VI	-	-	-	
907.06 Protective Fence	VI	-	-	-	
908 Castings, Manhole **908.03** Malleable Iron **908.04** Steel **908.05** Gray Iron	VI	-	-	-	
908.07 Sheet Lead	Gen Cert	-	-	25 sft	
908.08 Sheet Copper	Gen Cert	1 per consignment	13 in square or equivalent area	25 sft	May be accepted in field if weight requirements can be documented.

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
908.09A Tubing, Steel Railings (Base Plate, Angle, and Non-Tubular Post Elements)	Fabrication Inspection	1 per heat per project	1 base plate, 1 post 9 in length	-	MQAP Manual Section 4.05. See Special Instructions.
908.09B Tubing, Steel Railings (Rail Elements and Tubular Post Elements)	Fabrication Inspection	1 per heat per project	36 in long, galv	-	MQAP Manual Section 4.05. See Special Instructions.
908.09C Tubing, Steel Railings (Hardware)	Test	1 assembly per heat per diameter per project	1 assembly	-	See Special Instructions.
908.10 Hardware for Timber Construction	VI	-	-	-	
908.11A Guardrail, Steel Beam Elements, End Sections	Appr Mfr *	1 per project per mfr	1 piece at least 1 ft length	125 ft	Including Anchorage, Bridge, Shoes, Departing End Terminals.
908.11A Guardrail Approach Terminals	Appr Mfr *	-	-	-	
908.11B & C B. Hardware C. Steel Sleeves, Soil Plates, Bearing Plates, Backup Plates	VI	-	-	-	Item supplied by guardrail supplier.
908.11B Wire Rope	Gen Cert	-	-	-	
908.12 Steel Posts for Beam Guardrail	Appr Mfr *	1 per 1000 posts or fraction thereof	1 post	25 posts	
908.13 Reflective Washers	VI See Remark	-	-	-	Inspect galvanizing, dimensions and type of sheeting.
908.14 Anchor Bolts, Nuts, and Washers	Test	1 assembly per heat per diameter per project	1 assembly	-	See Special Instructions.
908.14D Anchor Bolts and Nuts for Other Purposes	Gen Cert	1 assembly per heat per diameter per project	1 assembly	-	See Special Instructions.
909.01 Recycled Rubber Adjusting Rings for Manholes and Drainage Castings	Gen Cert	-	-	-	Must be a Qualified Product (909.01).

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
909.03 Watertight Joint Systems	Gen Cert	-	-	-	Must be a Qualified Product (909.03).
909.03 Gasket, Compression (O-Rings)	VI	-	-	-	Part of Watertight Joint System.
909.03 Gasket, External Rubber Type	VI	1 per lot or shipment	18 in length full width of gasket	-	Part of Watertight Joint System.
909.04A Reinforced Concrete Pipe	Appr Mfr *	1 percent of number of pcs of each size	See Remark	5 pieces of 42 in or smaller	See Special Instructions.
909.04B Reinforced Concrete Elliptical Pipe	Appr Mfr *	1 percent of number of pcs of each size	See Remark	5 pieces of 42 in or smaller	See Special Instructions.
909.04C Non-Reinforced Concrete Pipe	Appr Mfr *	See Remark	See Remark	10 pcs	See Special Instructions.
909.04D Precast Concrete Box Sections	Appr Mfr * See Remark	-	-	-	Spans 20 ft. and greater require QA inspection. QA inspection may be required for spans from 10-20 ft Box = 4 sided. See MQAP Manual section 4.11.
909.04E Precast Concrete End Section for Culverts and Sewers	Appr Mfr *	1 percent of number of pcs	Full size units	10 pcs	Strength test by coring or cylinders, VI dimensions and conditions. Test for air content. .
909.04G Precast Concrete Three-Sided or Arch Culverts	Appr Mfr See Remark	-	-	-	Spans 20 ft. and greater require QA inspection. QA inspection may be required for spans from 10-20 ft, See MQAP Manual section 4.11.
909.05A Corrugated Steel Pipe	Appr Mfr *	See Remark	See Remark	-	See Special Instructions. General Cert to Construction Field Services.
909.05A1 Corrugated Steel Sheets (Galvanized)	Gen Cert	See Remark	See Remark	-	See Special Instructions.
909.05A1 Polymer Coating, Galvanized Corrugated Steel Pipe	Gen Cert	-	-	-	Coating must be from Qualified Products List (909.05A1).
909.05A4 Coupling Bands	Gen Cert	-	-	5 pcs	

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
909.05B Corrugated Aluminum Alloy Sheet	Gen Cert	See Remark	See Remark	25 sheets	See Special Instructions.
909.05B Corrugated Aluminum Alloy Pipe	Gen Cert	1 per 1000 ft	See Remark	250 ft	Sample Size: A 6 in by 3 in (minimum) section cut from the end of the pipe avoiding the seams. Do not damage coating.
909.05C Steel End Section	Gen Cert	-	-	4 pcs	
909.05D 1. Steel Pipe (Jacked-in-Place)	Gen Cert	-	-	-	
909.05D 2. Casing, Steel Pipe	VI	-	-	-	
909.06 1. Corrugated Polyethylene Pipe (CPE/HDPE), (Smooth Lined Type S)	Test or Tested Stock if ≥12 in. dia	≥12 in. dia 1 per 1000 ft straight lengths	See Remark	12 in. dia and over, 100 ft	Over 12 in. dia- one 10 ft length and one 6 ft length plus coupling. See Special Instructions.
909.06 2. Corrugated Polyvinyl Chloride (CPV) Pipe	Test	1 per 1000 ft straight lengths	See Remark	12 in. dia and over, 100 ft	Over 12 in. dia- one 10 ft and one 6 ft. length plus coupling.
909.06 3. Class B (CPE/HDPE & CPV)	Gen Cert See Note	-	-	-	Must be a Qualified Product (909.06).
NOTE: Watertight Joint Systems (909.03) and Pipe (401 & 402; Class B Bury) must be listed on QPL. Pipe (909.06) must be accepted by "Test" or "Tested Stock" for use on project.					
909.06 4. Smooth Polyvinyl Chloride (PVC) Pipe and Fittings for Sanitary Sewer	VI	1 per 6000 ft	1 piece, 5 ft in length	-	If bell and spigot joint, sample from spigot end.
909.07A Pipe for Underdrains Smooth Perforated Plastic Pipe (PVC)	Test	1 per 2500 ft or fraction thereof	5 ft length	250 ft	
909.07B Pipe for Underdrains Corrugated Plastic Tubing (Perforated and Non-Perforated) (Wrapped and Non-Wrapped)	Appr Mfr * 4-, 6-, or 8-in dia	1 per 5000 ft sample from coils	See Remark	250 ft	Sample Size, one 10 ft length plus coupling. For perforated tubing wrapped in fabric, tie fabric securely in place before cutting sample.
909.07C Outlet Pipe for Underdrains 1. Polyvinyl Chloride (PVC) Pipe	Test	1 per 2500 ft or fraction thereof	5 ft length	250 ft	See 404.02C for Underdrain Outlet Endings.

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
909.07C Outlet Pipe for Underdrains 2. Corrugated Steel Pipe	Appr Mfr *	See Remark	See Remark	-	See Special Instructions for 909.05A,. See 404.02C for Underdrain Outlet Endings.
909.07C Outlet Pipe for Underdrains 3. Corrugated Aluminum Alloy Pipe	Gen Cert	1 for 1000 ft	6 in x 3 in	250 ft	See 404.02C for Underdrain Outlet Endings. See 909.05B.
909.08A Bridge Deck Downspouts	VI	-	-	-	
909.08B Culvert, Downspouts 1. Corrugated Steel Pipe	Appr Mfr *	See Remark	See Remark	-	See 909.05A Corrugated Steel Pipe.
909.08B Culvert, Downspouts 2. Corrugated Aluminum Alloy Pipe	Gen Cert	1 per 1000 ft	6 in x 3 in	250 ft	See 909.05B.
909.08B Culvert, Downspouts 3. Corrugated Polyethylene Pipe (Corrugated Lined Type C) (CPE/HDPE)	Test	See Remark	See Remark	<12 in. dia up to 250 ft >12 in. dia up to 100 ft	See 909.06 (1)
909.08C Bridge Deck Drain Extensions (Polyethylene)	Gen Cert	-	-	-	
909.09 Cold Applied Pipe Joint Sealer (Mastic)	Test	1 per shipment from a single container	1 qt	10 gal	
909.10 Drainage Marker Post	See Delineator Posts	-	-	-	
910.03A Geotextiles 1. Blankets 2. Filter Bags	Test	See Remark	See Remark	See Remark	See Special Instruction 910.03. Anticipate up to 28 calendar days for the testing of geotextile samples.
910.03A Knitted Sock Pipe Wrap	See Remark	-	-	-	See 909.07B Certified with Corrugated Plastic Tubing.
910.03B Liner for Rip-Rap	Test	See Remark	See Remark	See Remark	See Special Instruction 910.03. Anticipate up to 28 calendar days for the testing of geotextile samples.
910.03B Liner for Heavy Rip-Rap	Test	See Remark	See Remark	See Remark	See Special Instruction 910.03. Anticipate up to 28 calendar days for the testing of geotextile samples.

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
910.03C Separator/Stabilization Geotextile	Test	See Remark	See Remark	See Remark	See Special Instruction 910.03. Anticipate up to 28 calendar days for the testing of geotextile samples.
910.03D Geogrids	Test	1 per type per project	1 pc 6 ft long full roll width	-	Sample must be rolled not folded. Anticipate up to 28 calendar days for the testing of geotextile samples.
910.04 Silt Fence; (Geotextile Fabric only)	Gen Cert	-	-	-	Must be a Qualified Product (910.04).
910.05A Prefabricated Drainage System	Appr Mfr *	1 per 10,000 ft or less	1 pc 6 ft long plus 3 syd filter-wrap	-	Test Data Cert must be attached to sample ID Form.
910.05B Wall Drain	Test	1 per 1000 ft or less	1 pc 6 ft long plus 3 syd filter-wrap	100 sft	
911 Water	Test See Remark	1 per source	1 qt	-	Water approved for drinking by the Michigan Dept of Public Health may be used without sampling and testing.
912.05 Structural Timber and Lumber	Appr Mfr *	Each Charge	22 cores See Remark	-	48 cores if treatment is creosote.
912.06 Timber Piles	VI	-	-	-	
912.07B Treated Wood; Fence Posts, Guide Posts, Guard Posts and Mail Box Posts	VI	-	-	-	
912.08 Wood Posts and Blocks for Guardrail and Highway Signs (Dimension Sawed)	Appr Mfr *	Each Charge	22 cores	-	Cedar post need not be treated.
NOTE: All post must be treated except Northern White Cedar. General Certification document required for Northern White Cedar in lieu of approved manufacturer.					
912.08Q Recycled Plastic or Rubber Guardrail Offset Blocks	Gen Cert	-	-	-	Must be a Qualified Product. May only be used on Steel Posts (912.08Q).
912.09 Timber for Rustic Construction	Gen Cert	-	-	-	

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
913.03 Clay and Sand Lime Brick and Block	Test	1 per 250,000 or fraction thereof	6 pcs	1000 pcs	
913.03C Concrete Brick	Test Data Cert	See Remark	6 pcs	1000 pcs	1 from each 10,000 bricks or fraction thereof; 2 from lots more than 10,000 to 100,000; 3 from each lot over 100,000.
913.05 Concrete Block	Test Data Cert	See Remark	4 pcs	1000 pcs	One from lot of 10,000 or fraction thereof; 2 from lots more than 10,000.
913.06 Precast Reinforced Concrete Units for Drainage Structures (Tops, Risers, Sump Bases and Adj. Rings)	Appr Mfr *	1 percent per size	See Remark	10 pcs total	Submit QA cylinder test results and core samples. Submit sample 1-3 sq.in. from wall of unit if absorption is required.
913.07 Precast Concrete Bases, for Drainage Structures	Appr Mfr *	5 percent of total	-	10 pcs total	
913.08 Structural Tile	Test	1 per proj.	6 tiles	1000 tiles	
913.09 Slope Pavement Blocks	Appr Mfr *	1 per 25,000	6 blocks	1000 pcs	
914.03 Bituminized Fiber Joint Filler	Test Data Cert	1 per 1000 sft or fraction thereof	2 ft See Remark	150 sft	Sample for structure to be at least 5 in. wide. ¼ in. filler need not be sampled.
914.03B Recycled Rubber Joint Filler	Gen Cert	-	-	-	Must be a Qualified Product (914.03B).
914.04A Hot-Poured Joint Sealant	Test or Tested Stock	1 per batch from a single container	5 lb.	100 lb	Do not submit melted samples.
914.04B Backer Rod for Use with Hot-Poured Joint Sealant	VI	-	-	-	
914.05 Epoxy Binder, For Joint Spall Repair	Test or Tested Stock	1 per lot or batch number	See Remark	5 gal	See Special Instructions.
914.06 Epoxy Resin Adhesive and Temporary Seal (Crack Injection)	Gen Cert	-	-	-	Must be a Qualified Product (914.06).

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
914.07 Transverse Pavement Joints 1. Dowel Bars	Appr Mfr	-	1 bar	1200 bars	Bond Release Agent must be a Qualified Product (914.07A). See Special Instructions 914.07.
2. Dowel Baskets (Load Transfer Assemblies)	Appr Mfr	-	Full size unit	100 assemblies	Fabrication Inspection required, MQAP Manual Section 4.07.
914.07A Coatings for Dowel Bars 1. Epoxy Coating Companies	Appr Mfr *	1 per project per mfr	1 bar	240 bars	
2. Epoxy Coating Material	Gen Cert	-	-	-	Coating must be a Qualified Product (905.03C).
3. Bond Release a. Bituminous Material b. Alternate Bond Release Agents	 Gen Cert Gen Cert	 - -	 - -	 20 gal max -	Must be a Qualified Product (914.07A) or meet Standard Spec 914.07A.
914.07C Dowel Bar Expansion Caps	VI	-	-	-	Caps must conform to Standard Plan R-40 Series.
914.08 End-of-Pour Joint Devices	VI	-	-	-	
914.08 Deformed Bars 1. Bars 2. Epoxy Coating	 Appr Mfr * Gen Cert	 1 per project per mfr	-	500 lb	Epoxy Coating must be Qualified Product (905.03C).
914.09 Straight and Bent Tie Bars for Longitudinal Pavement Joints (Lane Ties) 1. Bars 2. Epoxy Coating	 Appr Mfr * Gen Cert	 1 per project per mfr	2 bar	500 lb	Coating must be a Qualified Product (905.03C). See Note.
914.10 Bolts for Structure Expansion Anchors	Test	1 per 5000 pcs or fraction thereof	1 bolt	250 units	
914.11 Preformed Waterproofing Membrane and Joint Waterproofing Membrane	Gen Cert See Remark	-	-	-	Must be a Qualified Product (914.11). Do not use on Treated Wood Materials.
914.12 Elastomeric Bearings	Test Data Cert	-	-	-	

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
915 Bridge Coating Systems	Gen Cert	-	-	-	Must be a Qualified Product (915).
916.01A Cobblestone	VI	-	-	-	
916.01C Riprap	VI	-	-	-	
916.02 Silt Fence 1. Fabricated Fence 2. Fabric (see 910.04) **NOTE:** Sample to include identifying markings of fabricator. Indicate on sample ID description of markings. Note where markings were found.	Appr Mfr * Gen Cert	See Remark	See Remark	500 ft	1 sample for the first 3000 ft or fraction thereof; 1 sample for each additional 10,000 ft or fraction thereof; 1 piece 8 ft long by full fence height include 2 attached posts and lath. As per 910.04 of Standard Specifications, fabric must be from the Qualified Product List (910.04).
916.07 Turbidity Curtain	VI				
917.03 Nursery Stock	VI	-	-	-	
917.04 Tree Wrapping Material	VI	-	-	-	
917.05 Balling Material	VI	-	-	-	
917.06A Wire for Bracing and Guying	VI	-	-	-	
917.06B Hose for Bracing and Guying	VI	-	-	-	
917.06C Stakes for Bracing and Guying	VI	-	-	-	
917.08 Compost	VI	-	-	-	
917.10 Chemical Fertilizer for Grass Seed	VI See Remark	-	-	-	Provide the bag label, showing the guaranteed analysis.
917.12 Grass Seeding Mixtures Grass Seed Varieties	VI See Remarks Gen Cert	1 per lot per shipment	1/2 lb	1100 lbs	For projects that include more than 5 acres of seeding, see Grass Seed Testing Special Provision in contract. Varieties of seed must be Qualified Product (917.12).
917.13 Sod	VI	-	-	-	

MATERIALS ACCEPTANCE REQUIREMENTS

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
917.13A Pegs for Sodding	VI	-	-	-	
917.14 Mulching Materials for Nursery Stock	VI	-	-	-	Only shredded bark, wood chips not allowed.
917.15B1 & 2 High Velocity Mulch Blankets and Standard Mulch Blanket	Gen Cert	-	-	-	Must be a Qualified Product (917.15B 1 & 2). High velocity - netting 2 sides. Standard - netting 1 side.
917.15C Mulch Anchoring - Latex, Recycled Newsprint, Wood Fiber, Guar Gum, Other Tackifiers	Gen Cert	-	-	-	Must be a Qualified Product (917.15C).
917.16 Weed Control (Herbicides)	Test Data Cert	-	-	-	
918.01 Flexible Metal Conduit	VI	-	-	-	
918.01A Electrical Conduit, Rigid (Galvanized Steel)	Gen Cert	See Remark	6 ft, include coupling, if applicable	400 ft	1 sample for 2500 ft or fraction thereof; 2 samples over 2500 to 10,000 ft; 1 sample for each additional 10,000 ft.
918.01B & C Electrical Conduit (Polyvinyl Chloride) Schedule 40 and 80	Gen Cert	See Remark	6 ft sample w/ bell end incl coupling	400 ft	1 sample for 2500 ft or fraction thereof; 2 samples over 2500 to 10,000 ft; 1 sample for each additional 10,000 ft.
918.01D & E Electrical Conduit (Polyethylene/HDPE) Schedule 40 and 80	Gen Cert	See Remark	See Remark	400 ft	1 sample for 2500 ft or fraction thereof; 2 samples over 2500 to 10,000 ft; 1 sample for each additional 10,000 ft; 6 ft plus a separate section consisting of 2- 18 in. long pcs. connected by the joint.
918.01F Electrical Conduit (Rigid Fiberglass)	Gen Cert	See Remark	6 ft sample w/ bell end incl. coupling	400 ft	1 sample for 2500 ft or fraction thereof; 2 samples over 2500 to 10,000 ft; 1 sample for each additional 10,000 ft.
918.02 Grounding System	VI	-	-	-	
918.02C Grounding Rods	VI	-	-	-	

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
918.03 Electrical Cable	See Note	-	-	-	
NOTE: Suitability and compliance with specifications will be determined by the agency responsible for maintaining the system. This agency shall provide the project engineer with a memo or other appropriate form indicating that the inspection (including review of Test Data Cert) has been made and that the material is acceptable.					
918.06 Precast Concrete Handholes and Manholes for Electrical and Telephone Connections	Appr Mfr *	1 percent per size	-	10 pcs	
918.06D Light Weight Composite Handholes	Gen Cert	-	-	-	Must be a Qualified Product (918.06D).
918.08 Light Standards (Steel and Aluminum Light Standards)	Gen Cert	-	-	-	
918.08C Light Standards, Frangible Transformer Bases	Gen Cert	-	-	-	Must be a Qualified Product (918.08C).
918.09 Luminaries	Gen Cert	-	-	-	
918.10A Tower Lighting Units	Fabrication Inspection	-	-	-	MQAP Manual Section 4.06.
918.11A Guy Wire	Test	1 per size	3 ft	-	
919 Steel Sleeves for Wood Posts	Gen Cert	-	-	-	
919.02 Signs (Permanent)	See Remark	-	-	-	General Cert must be attached and inspected at project site.
919.02A1 Metal Sections (Extruded Aluminum)	Tested Stock See Remark	1 from each width in shipment	12 in. long and full width of section	-	Test Data Cert must be attached to the Sample ID form.
919.02A2 Plywood	Gen Cert See Remark	-	-	-	Grade mark on materials serves as certification.
919.02A3 Aluminum Sheet	Tested Stock See Remark	See Note	Min. of 12 in. square	100 sft	Test Data Cert must be attached to the Sample ID form.
NOTE: 2 samples per heat per Tested Stock Supplier up to 10,000 sft; 4 samples per heat per Tested Stock Supplier over 10,000 sft.					

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
919.02B1 Reflective Sheeting	Gen Cert See Remark	1 per run or lot	See Remark	1 roll, for less than 3 in. in width	Must be a Qualified Product (919.02B1) 4 pcs each 12 in. square. For rolls less than 12 in. width, at least 7.5 ft.
919.02C Sign Hardware	Gen Cert See Remark	-	-	-	Identifying marks on items may serve as certification.
919.03A Delineators 1. Plastic Reflectors	Gen Cert	1 per shipment per color	21 pcs	25 pcs each color	
919.03B Delineators 2. Reflective Sheeting Reflectors	Gen Cert	1 per shipment per color	2 pcs each color	25 pcs each color	
919.03D Delineator Posts 1. Steel	Gen Cert	1 per project per mfr	1 post	80 post	
919.03D Delineator Posts 2. Plastic	Gen Cert	-	-	-	Must be a Qualified Product (919.03D).
919.04 Steel, Galvanized Sign Posts	Test Data Cert	1 per project per mfr	See Remark	20 posts	Sample 30 in. length min. length. Posts for temporary signs may be painted.
919.05 Wood Sign Posts	Appr Mfr *	Each charge	22 cores	20 posts	General Cert to Construction Field Services. See 912.08.
919.06 Breakaway Column Sign Supports	Fabrication Inspection	-	-	-	MQAP Manual Section 4.06.
919.07 Cantilever Sign Supports	Fabrication Inspection	-	-	-	MQAP Manual Section 4.06.
919.08 Truss Sign Supports	Fabrication Inspection	-	-	-	MQAP Manual Section 4.06.
920.02 Glass Beads	Gen Cert	1 from each lot	2 lb	500 lbs	
921.02 Span Wire	Gen Cert	1 per size	3 ft	-	
921.03 Traffic Signals and Mounting Assemblies	See Note	-	-	-	

NOTE: Compliance with specifications will be determined by the agency responsible for maintaining the system. Agency must provide the project engineer with a memo or other appropriate form indicating that the inspection has been made and the material is acceptable.

MATERIALS ACCEPTANCE REQUIREMENTS

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
921.05 Traffic Signal Strain Pole	Gen Cert	-	-	-	
921.05A Strain Pole Band Clamps	Gen Cert	-	-	-	Must be a Qualified Product (921.05A).
921.08B Traffic Loop Sealant	Gen Cert	2 from each lot	Tubes	-	
922.02 Temporary Traffic Control Temporary Signs	See Remark	-	-	-	See MQAP Manual Section 4.10.
922.02B Temporary Traffic Control Reflective Sheeting (Signs)	See Remark	-	-	-	See MQAP Manual Section 4.10.
922.02D Temporary Traffic Control Sign Covers	See Remark	-	-	-	See MQAP Manual Section 4.10.
922.03 Temporary Traffic Control A. Cones B. Drums	See Remark	-	-	-	See MQAP Manual Section 4.10.
922.03E Temporary Traffic Control Type III Barricade, Reflective Sheeting	See Remark	-	-	-	See MQAP Manual Section 4.10.
922.04 Temporary Traffic Control Temporary Concrete Barriers (TCB)	Test Data Cert See Remark	Each project	-	-	Contractor must provide certifications and documentation confirming the TCB provided meets the requirements of subsection 922.04.A of the Standard Specifications for Construction.
922.04A Barrier Reflector Markers Temporary and Permanent	See Remark	-	-	-	See MQAP Manual Section 4.10.
922.06A Temporary Traffic Control Temporary Pavement Markings; Type R and NR Tape	Gen Cert	-	-	-	Must be a Qualified Product (922.06A).
922.06A2 Temporary Traffic Control Temporary Pavement Markings; Paint	Gen Cert	-	-	-	Must be a Qualified Product (811.03D).
922.06B Temporary Traffic Control Temporary Raised Pavement Markers	Gen Cert	-	-	-	Must be a Qualified Product (922.06B).

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
922.06C Temporary Traffic Control Pavement Marking Cover	Gen Cert	-	-	-	Must be a Qualified Product (922.06C).
922.07A Temporary Traffic Control Lighted Arrows; Type B and C (Solar Assist)	See Remark	-	-	-	See MQAP Manual Section 4.10.
922.07B Temporary Traffic Control Warning Flashers and Lights; Type A, B, C	See Remark	Each project	3 each type	-	See MQAP Manual Section 4.10.
922.07C Temporary Traffic Control Portable Changeable Message Signs	See Remark	-	-	-	See MQAP Manual Section 4.10.
922.11 Temporary Traffic Control Sign Paddles and Vests	See Remark	-	-	-	See MQAP Manual Section 4.10.
922.12A Temporary Traffic Control Dust Palliative 1. Calcium Chloride Solids	Test Data Cert	1 per project	5 lb	5000 lb	
922.12A Temporary Traffic Control Dust Palliative 2. Calcium Chloride Solutions	Test Data Cert	1 per project	1 qt	1000 gal	
923 Watermain Materials	Gen Cert	-	-	250 ft of pipe	See contract documents as applicable.
Misc. #2 Culvert, Cast and Ductile Iron	Gen Cert	-	-	250 ft	
Misc. #3 Clay Pipe	Gen Cert	See Remark	See Remark	10 pieces	See Special Instructions.
Misc. #5 Galvanized Slotted Drain Pipe	VI See Remark	-	-	-	MDOT approval of Design is required. Coating thickness checked at project site.
Misc. #7 ABS Pipe	Test	1 per 6000 ft	1 piece, 6 ft in length	600 ft	If bell and spigot joint, sample from bell end.
Misc. #8 Corrugated Galvanized Steel Structural Plated	Gen Cert	1 per 100 plates or fraction thereof	1 piece at least 3 in. by 3 in.	10 plates	
Misc. #9 Aluminum Alloy Structural Plates	Gen Cert	-	-	-	

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Spec. No. and Material Name	Basis of Acceptance	Sample Frequency If Required by the Engineer**	Sample Size	Maximum VI Quantity	Remarks (QPL Reference)
Misc. #13 Pavement Warning Strips	VI	-	-	-	
Misc. #14 Bituminized Cotton Fabric and Fiberglass Fabric	Gen Cert	See Remark	1 piece full width of roll, min of 3 ft	5 rolls	1 per 100 rolls (50 sft per roll) or fraction thereof; for lots of more than 100 rolls - 1 sample plus 1 for each 500 rolls or fraction thereof. Do not sample from first 3-4 ft of roll.

********** See following pages for SPECIAL INSTRUCTIONS **********

SPECIAL INSTRUCTIONS

712.03L Mechanical Reinfocement Splicing

The contractor must make test splices, witnessed by the Engineer, on the largest bar sizes that are to be spliced. See Bridge Field Services Advisory (BFSA) 2012-03. Test splice consists of 2 pieces of reinforcing bar joined by the coupler with 12 inches of bar exposed on each end of the coupler.

901 Cement

Samples of fly ash and slag cement must be accompanied by a sample of the Portland cement with which it is being used. The plastic lined cement sample bags furnished by the laboratory will hold 10 pounds when full.

904.03A Asphalt Binder for HMA Mixtures

If the Asphalt Binder is supplied from a source currently on the Approved Asphalt Binder Certifier List, a certification meeting the requirements of Section 3.04.05 of the Materials Quality Assurance Procedures Manual is required. See the contract documents for sampling, acceptance, and daily monitoring requirements.

If the binder is supplied from a source that is **not** currently shown in the Approved Asphalt Binder Certifier List, the asphalt binder must be sampled, tested, and approved for use prior to incorporation into the project. See contract documents for sampling, acceptance, and monitoring requirements.

See Current List of Asphalt Binder Certifiers at Construction Field Services Web Page.

Instructions to Construction Field Services web page: From MDOT home page (michigan.gov/mdot), click on about MDOT (left side), then click on Highway Field Services, and then click Construction Field Services. The Approved Asphalt Binder Certifier List is under Resources & Publications.

Actual Current List of Approved Asphalt Binder Certifier web page address: http://michigan.gov/documents/AppBinderCertlist_49824_7.pdf

904.03C Emulsified Asphalt

Size of Sample – For CV Sampling see Section 3.05.06 of the *Materials Quality Assurance Procedures Manual*. For all other sampling see contract documents for criteria. Submit the samples in plastic containers only.

905.03 Bar Reinforcement (Uncoated)

Sample size must be 2 pieces, one 24 in. and one 36 in. Sample ID must include the name of the bar manufacturer, lot number, and heat number. Test Data Cert must be sent to Construction Field Services.

905.03C Bar Reinforcement (Epoxy Coated)

Sample size must be 2 pieces, one 24 in. and one 36 in. Sample ID must include the name of the epoxy coating company, epoxy resin trade name, name of bar manufacturer, lot number, and heat number. Test Data Cert must be sent to Construction Field Services. Epoxy coating must be a Qualified Product (905.03C).

905.06 Welded Steel Wire Reinforcement

Sample size must be one piece, full width of fabric with two transverse wires. Longitudinal wires must extend 6 in. to 8 in. either side of transverse wires. Sampling not required when larger wire is less than 0.13 in. (w1.5) in dia. Include on sample ID the size that the wires are supposed to be. Sample may be folded or cut into approx. 3 ft. sections. If cut, pieces should be wired together and identified. Test Data Cert must be sent to Construction Field Services.

905.07 Strand for Prestressed Concrete

Do not obtain sample from within 5 feet of the end of the reel. Test Data Cert must be sent to Construction Field Services.

905.08 Tendons for Post Tensioning of Box Beams – Prestressing Strand

Do not obtain sample from within 5 feet of the end of the reel. Test Data Cert must be sent to Construction Field Services.

906.07 High Strength Steel Bolts

An assembly is typically a combination of a bolt, nut, and washer but may be any combination of a bolt, nut, washer, lock washer, etc. depending on the project specifications. Test Data Certs must identify the manufacturer of each component of the assemblies and must be attached to the sample ID.

907.04C Steel Chain Link Fence-Posts for Fence and Gates

An alternative zinc/clear coat system will be allowed for pipe sections only. This alternative coating system shall comply with subsection 907.03D of the Standard Specifications for Construction.

907.04C Steel Chain Link Fence-Top Rail, Horizontal Rail

An alternative zinc/clear coat system will be allowed for pipe sections only. This alternative coating system shall comply with subsection 907.03D of the Standard Specifications for Construction.

908.09A Tubing, Steel Railings (Base Plate, Angle, and Non-Tubular Post Elements)

Provide a Test Data Certification document along with Sample ID.

908.09B Tubing, Steel Railings (Rail Elements and Tubular Post Elements)

Provide a Test Data Certification document along with Sample ID.

908.09C Tubing, Steel Railings (Hardware)

An assembly is typically a combination of a bolt, nut, and washer but may be any combination of a bolt, nut, washer, lock washer, etc. depending on the project specifications.

908.14 Anchor Bolts, Nuts, and Washers

An assembly is typically a combination of a bolt, nut, and washer but may be any combination of a bolt, nut, washer, lock washer, etc. depending on the project specifications. For Type C, D, E and J cantilevers, the sampling frequency is 1 assembly per heat, per diameter, per foundation, for a max of 3 per project. Full length bolts are required for testing but if the total length is less than 20", a second sample must be submitted for testing. Non MDOT standard plan bolts require shop drawings along with a test data cert. Stainless steel anchors bolts are not required to be tested.

908.14D Anchor Bolts and Nuts for Other Purposes

A General Cert is acceptable for stainless steel anchor bolts, pedestal foundations for pedestrian signals, push buttons, controller cabinets, and Hawks signals and repeaters. Anchor bolts for all other purposes require testing. An assembly is typically a combination of a bolt, nut, and washer but may be any combination of a bolt, nut, washer, lock washer, etc. depending on the project specifications.

909.04A Reinforced Concrete Pipe
909.04B

Size of Sample - Full size units for strength test. For absorption tests, 26-inch square to 81-inch square in area from the wall of each piece of pipe tested.

Number of Samples - One percent of the number of pieces of each size.

Reinforced concrete pipe 42-inch diameter and larger may be tested by coring. Size of core will be 4-inch nominal diameter (but not less than 3 ¼ inches actual). Up to 1 percent of the number of pieces of pipe for each size, but not less than 3 pieces, will be selected for coring. One core will be drilled and tested from each of these test pieces. Reinforcement will be inspected prior to incorporation in the pipe.

Maximum for VI – 5 pieces of 42" diameter and smaller.

909.04C Nonreinforced Concrete Pipe

Size of Sample - Same as reinforced concrete pipe.

Number of Samples - One percent of the number of pieces, but not less than 2 pieces of each size except that at the option of the department the following sampling schedule will apply for 4 inches through 24 inches in diameter sewer pipe for quantities of 500 or more:

Sampling Schedule - Per the following:

Concrete Pipe	Number of Samples
500 to 1,000 pieces	6
1,001 to 2,000 pieces	8
2,001 to 5,000 pieces	11
Over 5,000 pieces	2 samples per 1,000 or fraction thereof

Maximum for VI – 10 pieces.

909.05A Corrugated Steel Pipe

Size of Sample - A 6-inch by 3-inch (minimum) section cut from the pipe. The sample should be taken from the end of the pipe avoiding the seams. Care should be taken to assure the coating is not damaged during sampling.

Number of Samples - Per the following:

Diameter of Pipe	Quantity Represented (maximum)
12 inches or less	2500 ft
15 inches through 54 inches	1000 ft
60 inches and over	500 ft

Less than 5 percent of the quantity in the above table may be visually inspected.

909.05A1 Corrugated Galvanized Steel Sheets

Size of Sample - One strip the full width of the sheet and 3 ½ inches in the direction of the length of the sheet. The strip may be cut from the end of the sheet for material coated in coils. If the sheets were individually coated after being cut to length, as indicated by heavy accumulations of zinc at one end, the sample strip shall be cut from the end opposite the heavy accumulation and after cutting 4 inches from the end of the sheet.

Number of Samples - Per the following:

Diameter of Pipe (max)	Length of Sheet	Quantity Represented
12 inches or less	44 inches or less	2500 ft
15 through 54 inches	50 to 175 inches, approx*	1000 ft
60 inches and over	190 inches and over*	500 ft

*Larger pipe may be made from combination of shorter sheets. Less than 5 percent of the quantity in the table above may be visually inspected.

NOTE: Normally each heat and thickness is to be sampled. Exception may be made where quantities are limited and/or mixtures of heat numbers are excessive.

909.05B Corrugated Aluminum Alloy Sheets

Size of Sample - A transverse strip full width of the sheet and at least 3 inches in length cut from the end of the sheet.

Number of Samples - A sample shall be taken from each of 3 different sheets for lots weighing 5 tons or less, from 4 sheets for lots weighing more than 5 tons and less than 10 tons, and from 5 sheets for lots weighing 10 tons or more.

Maximum for VI – 25 sheets.

909.06 Corrugated Polyethylene Pipe (Smooth Lined Type S or Corrugated Type C)

Sampling Frequency - Straight Lengths, 12-inch diameter and over - 1 per 1000 ft

If the manufacturer has developed a history of five consecutive passing tests over the past two years for a given diameter of pipe (12 to 24-inch), at the discretion of the MDOT testing laboratory the sampling frequency may become 1 per 2500 ft for that diameter of pipe provided the stockpile consists of pipe manufactured with a single “Plant” and “Date” code. The Tested Stockpile sampling frequency of one sample per 1000 ft of pipe (12 to 36-inch) may be re-instituted if the manufacturer experiences three failing test results for a given diameter of pipe over a one year period. Up to date information on sampling frequency may be acquired from MDOT’s Construction Field Services Division.

Size of Sample - Over 12-inch diameter - one 10-ft length and one 6-ft length plus coupling

Maximum for VI - 12-inch diameter and over - 100 ft

For perforated pipe wrapped in geotextile fabric, tie fabric securely in place on sample before cutting pipe sample. Do not disturb fabric after cutting.

Suppliers shall provide MDOT inspector with list of date codes on pipe in stockpile to be tested prior to sampling.

Each size pipe is a different material. Stockpile each pipe size separately.

Preparation of 30 & 36 Inch Diameter Corrugated Polyethylene Pipe

The manufacturer will be responsible for preparing the sample specimens and delivering them to the laboratory for testing.

Preparation by manufacturer of each 20 foot length of pipe sample include:

1. Cut three specimens from each length of pipe sampled, at least once the diameter in length. (For 30 in. pipe this would mean three specimens just over 30 inches in length, cuts may be made in the valley of the first corrugation beyond 30 inches, etc.)

2. Cut 1 specimen from each length of pipe sampled at least 60 inches in length.

3. Assemble a joint from each length of pipe sampled with approximately 6 inches of pipe protruding from each end of the joint.

4. Mark all specimens cut from the sample length of pipe so they can be identified at the laboratory as having come from the same length of pipe.

Call the CFS- Materials Testing Laboratory in Lansing with any questions regarding the above instructions. (517-322-1217)

Perforated Pipe

Twelve inches in diameter and above shall be tested for acceptance on a project-by-project basis when specified by Special Provision (No Tested Stock).

Soil tight sleeves shall be submitted with a pipe section 12 inches minimum length and gasket fully inserted into one end of the sleeve. A second gasket shall be supplied already installed on either the 10-ft specimen or on a separate specimen at least 12 inches in length, from the same stockpile.

Single Gasket Bell and Spigot Fused Coupling System - Couplers shall be submitted as attached part of 10-ft specimen and a second piece of the specimen, minimum of 12 inches in length, with gasket installed shall be included with the sample.

Each size pipe is a different material. Stockpile each pipe size separately.

For perforated pipe and tubing wrapped in geotextile fabric, tie fabric securely in place on sample before cutting pipe sample. Do not disturb fabric after cutting.

910.03 Geotextiles

Sampling Frequency - Obtain samples to represent the required quantity of geotextile according to the following schedule:

Geotextile	First Sample	Additional Samples
Blanket	500 to 1500 syd	7,500 syd or less
Liner for Riprap	500 to 1500 syd	5,000 syd or less
Separator/Stabilization	500 to 1500 syd	25,000 syd or less
Liner for Heavy Riprap	500 to 1500 syd	4,000 syd or less

Maximum for VI - 500 syd (4500 sq ft)

Size of Sample - Sample must be a minimum of 75 sft, taken across the full roll width. For rolls over 15 ft wide, sample must be a minimum of 5 ft long, taken across the full roll width.

Geotextile samples submitted for testing must be identified with the lot number and/or roll number, the name of the manufacturer, and the product or style number.

NOTES:

Geotextiles must be unwrapped one full roll circumference prior to sampling.

Geotextiles must be **rolled**, not folded, and shipped in a manner to prevent creases in the fabric.

914.05 Epoxy Binder, For Joint Spall Repair

Normal Sampling Frequency - 1 per lot or batch number

Size of Sample - For material mixed at 1:1 ratio - 2 quart, 1 quart of each component: For material mixed at 2:1 ratio - 1/2 gallon of resin and 1 quart of curing agent. Material limited to shelf life of one year from date of manufacture. Material must be labeled with date of manufacture. MAY BE “TESTED STOCK” ITEM.

Maximum for VI - 5 gallons

914.07 Load Transfer Assemblies; Dowel Baskets

Fabrication Inspection required per Chapter 4.07 of the Materials Quality Assurance Procedures Manual.

Assemblies must meet the requirements of Standard Plan, R-40-H.
All shipments of load transfer assemblies will be accompanied by proper certification documentation.

- Certification from steel (dowel bar) manufacturer.
- Certification from epoxy coating company.
- Documentation on epoxy coating.
- Certification from assembly manufacturer.
- Documentation on bond release.

When shipment is made to a project, each bundle will bear a legible tag with the following information:

- Assembly manufacturer name and plant location.
- Control section/project number.
- Lot number or other identification that will also be shown on the accompanying certification.
- Supplier and/or contractor's name.

Misc. #3 **Clay Pipe**

Normal Sampling Frequency - One percent of the number of pieces, but not less than 2 pieces of each size except that at the option of the department the following sampling schedule will apply for 4-inch through 24-inch diameter sewer pipe for quantities of 500 or more:

Sampling Schedule - Per the following:

Clay Pipe	Number of Samples
500 to 1,000 pieces	6
1,001 to 2,000 pieces	8
2,001 to 5,000 pieces	11
Over 5,000 pieces	2 samples per 1,000 or fraction thereof

Size of Sample - Full size units for strength test. For absorption tests, 26 inches square to 82 inches square in area from the wall of each piece of pipe tested.

Maximum for VI - 10 pieces