

**MATERIALS QUALITY ASSURANCE  
PROCEDURES MANUAL**

**2003 EDITION  
April 8, 2010**



**CONSTRUCTION AND TECHNOLOGY  
DIVISION**

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Number of Copies Printed: \_\_\_\_\_ Total Cost: \$00.00 Cost Per Copy: \$00.00

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## SCOPE AND OBJECTIVES OF THE QUALITY ASSURANCE PROGRAM

### 1. Materials Quality Assurance Program Scope

Materials Quality Assurance (QA) sampling and testing procedures described in this manual have been developed by Michigan Department of Transportation (MDOT) in accordance with 23CFR637.

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.

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.

*HMA Production Manual* - Covers standards for Certification of Hot Mix Asphalt (HMA) plants; QA/QC testing requirements for MDOT projects; and mix design processing procedures. Prior to 2003, these topics were covered in three separate publications.

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

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

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

*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.

### 2. Materials Testing System (MTS)

In 2003, MDOT implemented an automated laboratory information management system configured to allow sample tracking from the time the sample is collected until the testing is complete and a test report is issued. The first phase of the implementation involves only the C&T laboratory in Lansing and Region Labs.

Within the MTS, each material tested has a specific Material Testing Protocol that includes observed and measured tests; intermediate and final calculations; and specification limits. Once the sample is logged into the MTS and testing is complete, the system performs calculations checks results against specification limits, flags failing test results and allows decisions to be made on the disposition of tested materials. All results along with details on supplier, contract, quantities represented etc. are stored and will be archived in a relational database for retrieval and analysis.

### 3. Objectives of the Materials QA Program

- 3.1 Design and implement sampling and testing procedures to assure the materials are in reasonably close conformity with plans and specifications.
- 3.2 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.
- 3.3 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.
- 3.4 Maintain a materials testing database to allow MDOT to evaluate new materials, analyze materials performance over time and to assist in materials acceptance decisions.
- 3.5 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.

### 4. Terminology

*AASHTO* - American Association of State Highway Officials

*AMRL* - AASHTO Materials Reference Laboratory

*ASTM* - American Society for Testing and Materials

*CCRL* - Cement and Concrete Reference Laboratory

*LIMS* - Laboratory Information Management System

*MTS* - Materials Testing System (aka LIMS)

*NIST* - National Institute of Standards and Technology

*NRL* - National Reference Laboratory

*PMC* - Project Materials Certification

*Acceptance (AST)* - Samples and tests 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.

*Certification Verification (CV)* - Samples and tests used to validate and monitor manufacturer's certifications of construction materials.

*Independent Assurance (IAT)* - 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 (FOI)* - 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 9.4 of this section will be considered FOI samples.

*Qualified Product (QP)* - Product evaluation or testing performed to determine if all requirements of the Qualification Procedure are met allowing a manufactured product to be used on MDOT projects without additional testing.

*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.

*Laboratory Comparative Samples* - Replicate samples prepared and distributed by the Central Laboratory to be tested by each MDOT Region laboratory to assure and make a matter of record the competency of MDOT Region materials personnel and the performance of testing equipment in those laboratories.

## 5. Personnel Qualifications

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

- 5.1 *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.
- 5.2 *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.
- 5.3 *Concrete* - A certified technician must perform all tests on fresh and hardened concrete
- 5.4 *Soil Density* - A qualified technician must perform all soil density tests.

## 6. Acceptance Sampling and Testing

Acceptance sampling and testing is conducted on MDOT construction projects according to the contract documents and this manual (and by reference those listed in 1.0 of this section). Together, these documents contain all the instructions to fulfill the requirements of this Materials QA program.

## 7. Independent Assurance Testing

All personnel conducting acceptance testing on the federally funded NHS are subject to independent verification according to Section E of this manual. The IAT serves to check the equipment and procedures being used as well as the personnel conducting the various acceptance tests.

## 8. Project Materials Certification

- 8.1 Project Materials Certification reviews commence upon completion of the final estimate for each project. The final review is the responsibility of the Region and Transportation Service Center (TSC). The TSC Manager will review and sign the final review document. This final review follows the procedures found in the MDOT Construction Manual, Division 1.
- 8.2 Project records including acceptance and independent assurance testing records are retained for all MDOT projects in accordance with 49CFR18.42. PMC is based, in part, on the records that are maintained by the Engineer within each project's construction file. 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.

## 9. Laboratory and Field Testing Equipment

- 9.1 Test procedures and test apparatus will be validated regularly.
- 9.2 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). The calibration frequencies will be strictly observed to ensure verifiable test results.
  - 9.2.1 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.
- 9.3 Laboratory Inspections
  - 9.3.1 *Central Laboratory Inspection* - In addition to the required equipment calibration, the central laboratory 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 and Technology (C&T) 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.
  - 9.3.2 *Region Laboratory Inspection* - An inspection of the equipment and procedures used in each region laboratory will be conducted periodically by central laboratory personnel. Results of this inspection will be reported to the Engineer of C&T and to the Region Delivery Engineer. The Engineer of C&T or a representative will review the report with the Region Delivery Engineer and an action plan will be developed to correct significant deficiencies.
- 9.4 Testing Laboratory Comparative Samples
  - 9.4.1 Region laboratory equipment calibration and uniformity of test methods will be verified periodically through comparative sample testing. Comparative samples of typical construction materials will be prepared by the central laboratory. One of each of these comparative samples will be distributed to each Region

laboratory for testing. Three comparative samples of each material will be retained and tested by the central laboratory. Results from the Region laboratories will be submitted to the central laboratory. Results of all comparative samples and conclusions of the central lab analysis will be distributed to each Region.

- 9.4.2 Results of the comparative testing will be reviewed by each laboratory for indications of possible errors in procedures or deficiencies in testing apparatus. The central laboratory and Region staff will collaborate to determine the source of error for test results that differ from the standard by two or more standard deviations and will jointly identify the proper corrective action.
  - 9.4.3 Multi-laboratory precision statements developed by the central lab for aggregate gradation results will be used by region laboratory to evaluate results of comparative testing
- 9.5 Field Testing Operations
- 9.5.1 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.

## RESPONSIBILITIES OF PERSONNEL

### 1. Scope

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

### 2. Region Engineer

- 2.1 Observe these procedures and implement 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.
- 2.2 Support all aspects of the Materials QA Program within the Region's jurisdiction. This includes acceptance sampling and 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, C&T Division Laboratory comparative samples and tests and tested stock.
- 2.3 Examine and approve all Region Project Reviews and Project Record Certification Reviews.
- 2.4 Resolve all deficiencies in materials sampling, testing and/or documentation required by the Engineer of Construction and Technology.
- 2.5 Examine all project reviews and project record certification Reviews required for the Project Materials Certificates.
- 2.6 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 C&T. Submit requests to the Engineer of C&T with the following information:
  - 2.6.1 The local agency.
  - 2.6.2 The project identification numbers.
  - 2.6.3 The specific contract items that need to be tested or inspected by C&T.
  - 2.6.4 A statement that the local agency cannot reasonably obtain the inspection or testing services from the private sector.
  - 2.6.5 A statement that the local agency is aware that they will be billed for C&T services.

### 3. Region Associate Engineer for Delivery or Operations

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

- 3.2 Supervise the Independent Assurance Testing program by selecting a Region IAT Coordinator from the Region staff who will manage the IAT program. Independent Assurance Tests are required by Federal Highway Administration policy on all federally funded projects. These tests cannot be delegated to the Contractor.
  - 3.3 Supervise project final review and project record certification review by selecting individuals from the Region staff who will review materials testing for proper quantities, method of measurement and adequate documentation.
  - 3.4 Supervise the coordination of Materials QA programs by selecting individuals who will obtain and submit certification verification samples as requested by the C&T staff and assist in the control of Tested Stock suppliers and approved suppliers.
4. Project or Resident Engineer
    - 4.1 Assure all testing orders are submitted by Contractors.
    - 4.2 Assure all material used in the work has been properly inspected and documented. This includes visual inspection of all material incorporated in the work.
    - 4.3 Request the necessary Independent Assurance Tests.
5. Engineer of Construction and Technology
    - 5.1 Oversee the development and application of the statewide Materials QA program.
    - 5.2 Budget for the acquisition of testing equipment and supplies and provide for the maintenance of the equipment whenever possible.
    - 5.3 Provide for the appropriate level of direct staffing and contract services necessary to support the Materials QA program.
6. Construction and Technology Division Staff
    - 6.1 Develop and monitor statewide materials acceptance procedures.
    - 6.2 Provide materials testing procedure training as required.
    - 6.3 Administer central laboratory and contractual sampling and testing.
    - 6.4 Monitor Region materials sampling and testing operations, review Region laboratories, test personnel and randomly review completed projects.
    - 6.5 Arrange for CCRL and AMRL inspections of the central laboratory and supply FHWA with copies of their findings.
    - 6.6 Monitor materials certification programs and request certification verification samples when required.

## USING COMMERCIAL TESTING AGENCIES

### 1. Scope

- 1.1 The use of a commercial testing agency is limited to those with whom contractual services have been established. Should the need for other agencies arise, MDOT may enter into a contract for their services under established MDOT procedures. Commercial testing agency services are considered when:
  - 1.1.1 Out-of-state sources of materials cause it to be uneconomical to use MDOT personnel for the necessary sampling and testing.
  - 1.1.2 A review of available personnel indicates that the necessary materials sampling and testing for scheduled projects cannot be fulfilled.
  - 1.1.3 The required inspection work is of a specialized nature.

### 2. Utilization

- 2.1 Selection of a commercial testing agency is based upon the range of services offered, staff, location, experience and past performance.
- 2.2 Instructions are issued to the materials supplier advising them to contact our agent when the material is available for inspection.
- 2.3 Our agent is authorized to inspect or sample the material and is furnished with the necessary information to do so.
- 2.4 The extent of inspections that are conducted by a testing agency is determined and coordinated by C&T.

### 3. Contract Administration

- 3.1 Upon completion of the work, our agent prepares the necessary documentation and forwards its reports to C&T.
- 3.2 Reports are reviewed for accuracy and completeness and are distributed to the field personnel.
- 3.3 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.
- 3.4 The agency invoices MDOT by Form 806, Payment Voucher, and this is reviewed, approved, coded, and processed.
- 3.5 Processing includes comparing reports with the invoice vouchers covering the work.
- 3.6 Additional work beyond the provisions of the contract requires State Administrative Board and FHWA approval prior to performing the work.
- 3.7 An agency's performance is evaluated on a continuing basis in relation to the services rendered and a comparison with other agencies when possible.

## DISPOSITION OF MATERIALS BASED ON LABORATORY TEST RESULTS

### 1. Scope

- 1.1 Disposition of materials subjected to laboratory testing is based, in part, on the results of laboratory tests. Technical and engineering judgment of Construction and Technology 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.

### 2. Disposition of Non-Specification Materials

- 2.1 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.
- 2.2 Type of sample considers the intended use of information gained through laboratory testing.
  - 2.2.1 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 Project Engineer. Acceptance sample IDs must include a contract ID purchase order number to which test results will be reported.
  - 2.2.2 Tested stock samples represent a portion of a supplier's inventory which has been set aside for use on state- and federally-funded projects (see Section F4). Test reports issued for these samples are referenced by the supplier each time material from the Tested Stock inventory is shipped to a project. The results of laboratory tests on Tested Stock samples are used to either accept or reject materials intended for use on MDOT projects.
  - 2.2.3 Certification verification samples are quality assurance samples for material accepted on the basis of the manufacturer's certification (see Section C). Except in the case of a critical failure when it is imperative incorporation of material from an approved certifier 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.
  - 2.2.4 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.

- 2.3 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.

- 2.4 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.
- 2.5 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).
- 2.6 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 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.

### 3. Notification

- 3.1 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.

#### 4. Test Reports

- 4.1 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 \_\_\_\_\_."

- 4.2 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.
- 4.3 Tested Stock test reports will have the words "Tested Stock" in the header. Tested Stock samples must meet all critical specification parameters 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.
- 4.4 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.
- 4.5 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 C&T must meet all specifications.

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

## TAGGING OR MARKING MATERIALS SAMPLED FOR PROJECTS

### 1. Scope

- 1.1 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.
- 1.2 "Out of State" tagging and marking is normally performed by outside agencies acting at the direction of MDOT in accordance with Section 3 of this procedure.
- 1.3 "In State" tagging and marking is normally performed by MDOT personnel in accordance with Section 4 of this procedure.
- 1.4 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.

### 2. Definitions

The following types of tags and markings are currently in use:

- 2.1 *Numbered Tags* - 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.
- 2.2 *Sampled Tags* - Yellowish-green colored wire-on tags used to indicate that samples have been taken and when numbered tags are not warranted or adaptable.
- 2.3 *Sampled Stickers* - Same as 2.2 except that these are pressure-sensitive tags without the wire ties.
- 2.4 *Approval Tags* - Red wire-on tags imprinted with the word "Approved" and with space for the sampler's name or initial, date, and project number. The presence of these tags indicates the material has been approved, that an approved or recommended-for-use test report is forthcoming, and that the material may be incorporated into the work.
- 2.5 *Approval Stickers* - Same as 2.4 except that these are pressure-sensitive tags without the wire ties.
- 2.6 *MDOT Approval Stamp* - "MDOT Approved" applied to fabricated materials with an inked rubber stamp to indicate acceptance of the item on which it is applied.
- 2.7 *"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.
- 2.8 *Orange "M"* - A painted letter "M" applied with a spray-can of orange colored paint.

### 3. Out-of-State

- 3.1 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.

- 3.2 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.
- 3.3 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.

4. In-State

- 4.1 Materials in this category are normally sampled, tested and/or inspected by MDOT personnel. However, there may be instances when private agencies are performing this function.
- 4.2 The materials in the following list have been determined to be adaptable to tagging or marking in some manner to indicate that samples have been taken or that samples have been taken and the material approved.
- 4.3 The absence of tags or marks on these materials should indicate to the recipient that sampling and testing has yet to be done.
  - 4.3.1 Exceptions to the above are for certifiable material accompanied by a certification.
  - 4.3.2 There may be occasions where certifications are no longer available for materials which are normally certified. In these cases, the material would have to be sampled and appropriate tags or marking applied.

4.4 Materials

| <u>MATERIAL</u>                 | <u>TAG/MARK</u> | <u>REMARKS</u>    |
|---------------------------------|-----------------|-------------------|
| Waterproofing Agent WOA         | Tag             | Each Container    |
| Waterproofing Primer RC-25      | Tag             | Each Container    |
| Bar Reinforcement               | Numbered Tag    | Each Bundle       |
| Fabric Reinforcement            | Numbered Tag    | Each Bundle       |
| Strand for Prestressed Concrete | Tag             | Each Reel         |
| Structural Steel                |                 | Each Beam         |
| Steel H-Piling                  | Tag             | Randomly in Order |
| Cylindrical Pipe Shells         | Tag             | Randomly in Order |
| Metallic Waterstop              | Tag             | Randomly in Order |
| Steel Beam Guardrail Materials  | Tag             | Randomly in Order |
| Anchor Bolts                    | Tag             | Randomly in Order |
| Concrete and Clay Pipe          | Orange "M"      | Each Piece        |
| Corrugated Steel Pipe           | Tag             | Randomly in Order |
| Metal End Sections              | Tag             | Randomly in Order |
| Structural Plate for Pipe       | Tag             | Randomly in Order |
| Sealers for Pipe Joints, Cold   | Applied Tag     | Each Container    |
| Gaskets, External Type          | Tag             | Each Roll         |
| Corrugated Plastic Tubing       | Tag             | Each Roll         |

| <u>MATERIAL</u>                                    | <u>TAG/MARK</u>          | <u>REMARKS</u>               |
|--|--------------------------|------------------------------|
| Round Posts  | Hammer "M"               | Each Post Top                |
| Dimension (Sawed) Posts and<br>Blocks              | Hammer "M"<br>and/or Tag | Each Post Top<br>Each Pallet |
| Brick  | Tag                      | Each Pallet                  |
| Concrete Block for Drainage<br>Structures          | Tag                      | Each Pallet                  |
| Masonry Units, Hollow Load and<br>Non-Load Bearing | Tag                      | Each Pallet                  |
| Structural Tile                                    | Tag                      | Each Pallet                  |
| Precast Units, Drainage Structures                 | Orange "M"               | Each Piece                   |
| Joint Sealer                                       | Tag                      | Each Container               |
| Fiber Joint Filler                                 | Tag                      | Randomly in Order            |
| Neoprene Joint Seals                               | Tag                      | Each Roll or Reel            |
| Epoxy Resin Materials                              | Tag                      | Each Container               |
| Load Transfer Assemblies                           | Numbered Tag             | Randomly in Order            |
| Longitudinal Joint Bars                            | Numbered Tag             | Each Bundle                  |
| Bituminized Cotton and Fiberglass<br>Fabric        | Tag                      | Randomly in Order            |
| Pavement Marking Paint                             | Tag                      | Randomly in Order            |
| Seed and Seeding Mixtures                          | Tag                      | Randomly in Order            |
| Chain Link and Woven Wire Fence<br>Fabric          | Tag                      | Randomly in Order            |
| Barbed Wire  | Tag                      | Randomly in Order            |
| Steel Fence Posts                                  | Tag                      | Randomly in Order            |
| Tension Wire                                       | Tag                      | Each Reel or Roll            |
| Liquid Epoxy Resin                                 | Tag                      | Each Container               |
| Membrane Curing Compound                           | Tag                      | Each Container               |
| Linseed Oil Curing Compound                        | Tag                      | Each Container               |
| Electrical Conduit                                 | Tag                      | Randomly in Order            |
| Sign Structures                                    | MDOT Appr. Stamp         | Each Structure               |

**PROCESSING OF MATERIALS SOURCE LIST (FORM 501)**

1. A complete and signed Materials Source List (Form 501) is required project documentation and is a requirement for payment of associated items of work. The Materials Source List is not a substitute for other required material quality assurance documentation. Prime Contractors are responsible for all Subcontractors' Materials Source List.
  - 1.1 The Contractor must provide a completed Materials Source List to the Project Engineer upon award of contract (refer to Subsection 105.01 of the Standard Specifications for Construction). The Materials Source List may be submitted before or at the preconstruction meeting.
  - 1.2 The Materials Source List must specify which materials will require testing and identify all materials that will be supplied by approved manufactures and/or suppliers.
  - 1.3 The Contractor must sign the Materials Source List certifying that all materials listed are from the specified approved sources.
  - 1.4 If the source of material changes, the Contractor must provide a revised Materials Source List to the Project Engineer prior to the material being incorporated into the project.
2. The Materials staff in the Region may assist the Engineer in determining the following:
  - 2.1 Which items originate locally? Acceptance instructions will be referenced in the last column.
  - 2.2 Which items originating elsewhere will be sampled or inspected on the project?
  - 2.3 Which items are to be supplied by sources with certification, QPL or Tested Stock privileges, as listed in the current Materials Source Guide?

**RANDOM SAMPLING BY THE CUBE ROOT METHOD**1. Scope

- 1.1 When the lot of material to be sampled is not obviously from a single run or batch of the producer, a number of the items or containers to be sampled shall be selected at random. They shall be equivalent to the cube root of the total number of items or containers in the lot and a sample shall 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.

| <u>Number of Items or<br/>Containers in Shipment</u> | <u>Number of Items or<br/>Containers to be Sampled</u> |
|--|--|
| 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.)   |

## RESAMPLING

### 1. Scope

- 1.1 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.

### 2. Basis for Resampling

- 2.1 Material tested in the laboratory shall be resampled only when requested by Construction and Technology staff. Material tested in the field shall be resampled only when requested by the TSC Manager or Project Engineer or his/her representative.
  - 2.1.1 Request by the Contractor, producer, or supplier is not a valid reason for resampling except when one of the reasons listed in 2.2 applies.
- 2.2 Requests for resampling should be made under the following conditions:
  - 2.2.1 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.)
  - 2.2.2 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.
  - 2.2.3 Test equipment malfunctioned, or improper test procedure was used, or sampling was known to have been performed incorrectly, regardless of results obtained on original sample.
  - 2.2.4 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.
  - 2.2.5 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.)

### 3. Number of Samples on Resampling

- 3.1 For material resampled under conditions of 2.2.1, 2.2.2, or 2.2.3.
  - 3.1.1 When material represented consists of a number of individual pieces, the resample shall 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 shall 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 shall be taken as directed, each representing a portion of the quantity.

- 3.2 For material resampled under conditions of 2.2.4 and 2.2.5, samples shall 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.).

## VISUAL INSPECTION

### 1. Scope

- 1.1 Visual inspections (VIs) are to be performed on all materials coming onto the jobsite and approval for use given by the Project Engineer or a delegated inspector. They should not be limited to small quantities of untested or uncertified materials, but are considered to be a routine procedure for all materials reaching the site. Damaged, suspicious, or non-uniform appearing material that has been tested or certified should not be approved for use until a passing retest can be obtained.

### 2. Materials Requiring a VI

The following types of materials and items are to be subjected to a VI, regardless of any previous testing and inspection.

- 2.1 *Tested Materials* – 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. Fabricated items such as paving mesh carry a tag indicating that they have been tested and approved. Watch for substitutions, or for damage due to handling and shipping. Just because a material or item has been tested does not mean it cannot be sampled and retested at any point if there are doubts about its quality or authenticity.
- 2.2 *Tested Stock Materials* – Tested Stock consists of various materials that are pretested, stored and maintained by producers or brokers at their facilities. When these items or materials are shipped to the site accompanied by a Shipment of Tested Stock Report, the same VI procedure described for “Tested Material” is to be followed.
- 2.3 *Certified Materials* – These 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 should contain specific information as to just what is being certified. The VI checks the material that is actually delivered for such things as quantity, batch or lot numbers, manufacturer, etc. The VI should also, of course, check for damage, workmanship and quality.
- 2.4 *Untested, Uncertified Materials or Products* – This category requires the most vigorous inspection. The material or product is checked for conformance to requirements, including the project proposal and MDOT’s Materials Source Guide.
- 2.5 *Summary* – Visual Inspection is a dynamic and important part of quality control. It should not be considered or used simply as a way to approve items without having to go through the rigors of sampling and testing. Inspectors, wherever they are, should be conscious of the fact that when they view a material or product they are performing a VI. However, it is a useful or effective VI only if there is a proper reaction when something is found to be wrong.

## GENERAL QUALITY ASSURANCE PROCEDURES FORMAT

### 1. Description

- 1.1 A quality assurance procedure is a definitive 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.
- 1.2 A procedure gives accepted methods for the performance of a given task.

### 2. Subject Headings

- 2.1 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

### 3. Title

- 3.1 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.

### 4. Scope

- 4.1 Information should be provided here to relate 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.
- 4.2 Any appropriate comments as to the limitations of the procedure should be made in the scope.

### 5. Referenced Documents

- 5.1 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.

### 6. Procedure

- 6.1 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.

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

## 7. Report

- 7.1 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.

## 8. Appendixes

- 8.1 Use appendixes to provide supplementary information to aid in understanding and utilizing the procedure.

## 9. General Guidelines

- 9.1 Describe the actions of the inspector, operator, etc. as necessary. The procedure should tell how, not necessarily why.
- 9.2 Give instructions in the imperative mood (“Measure the length...” not “The inspector should measure the length...”).
- 9.3 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.
- 9.4 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.
- 9.5 Present instructions in general context, not specific to MDOT. These procedures may be used by consultants and others.
- 9.6 Do not make reference to MDOT organization, inspectors official work station, specific supervisors, etc. unless necessary to the procedure.
- 9.7 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.

## **CONSTRUCTION PROJECT DOCUMENTATION REQUIRED FOR MINIMUM JOB CONTROL DEVIATIONS**

### 1. Scope

- 1.1 This procedure covers the deviation from minimum job control requirements on MDOT administered construction projects. Appropriate documentation shall 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.

### 2. Related Documents

- 2.1 Current Standard Specifications for Construction
- 2.2 Density Control Handbook
- 2.3 Construction Manual

### 3. Procedure

#### 3.1 *MDOT Projects*

- 3.1.1 Whenever a Resident or Project Engineer decides to deviate from any minimum job control requirement, identified in any of MDOT's procedures, publications or specifications, appropriate documentation shall be created.
- 3.1.2 The Engineer shall create and date the documentation immediately upon the decision to deviate from the minimum job control requirement.

#### 3.2 *Local Government Projects*

- 3.2.1 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 shall be created.
- 3.2.2 The Project Engineer shall create and date the documentation immediately upon the decision to deviate from the minimum job control requirement and shall obtain concurrence from the appropriate MDOT Engineer prior to filing the document.

### 4. Records

- 4.1 The document shall indicate the specific reasons that the decision is made.
- 4.2 Appropriate reasons may include applied statistical analysis, specific engineering principals, or other appropriate logic.
- 4.3 The document shall 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.

- 4.4 The documentation used for this operation shall be retained in the specific construction project's records.



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**OFFICE MEMORANDUM**

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DATE: January 15, 2009

TO: PROJECT FILE  
54321-JN12345**SAMPLE MEMO**FROM: Xxxxx Y. Zzzzzzzz, P.E.  
Resident/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 (150 meters) per width of 25 feet (7.5 meters) or less.

The minimum requirement is revised, for this project only, to: 1 density test per 750 feet (215 meters) per width of 25 feet (7.5 meters) 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 (4 kilometers) 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 (1 kilometer) section have passed. The material and methods are expected to remain the same and passing tests are also expected.

\_\_\_\_\_, P.E.  
Signature – Project/Resident Engineer

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

## **RANDOM SAMPLING FOR QUALITY ASSURANCE/QUALITY CONTROL PROJECTS**

### 1. Scope

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.

- 1.1 This procedure ensures the randomness of locations for collecting quality assurance and verification samples and random numbers used to determine sample units and/or location will not be shown to the Contractor to avoid possibly influencing the operation.
- 1.2 A random number generator function on a calculator or computer will be used 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. Each random number needed will be generated individually. A random number generator is not to be used to produce a separate table to replace the table included in this section.
- 1.3 If no calculator or computer random number generator is available, the random number table included here will be substituted.

### 2. Pavement Random Sampling

- 2.1 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 a stratified random process is used 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.

### 3. Structure Random Sampling

- 3.1 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 subplot for the purpose of sampling.

### 4. Appurtenant Item Random Sampling

- 4.1 Appurtenant items such as curb and gutter, barrier walls, sidewalk or driveways which are generally combined into lots for evaluation should be sampled 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 subplot based on volume or tonnage of material placed.

### 5. General Stratified Random Sampling Procedure

- 5.1 These procedures are followed to locate random samples within each lot and/or subplot.

- Refer to the project documents for definitions of lot and subplot and for sampling frequency.
- 5.2 The material to be included in a lot is determined prior to placement and divided into the required number of sublots to meet the sampling frequency specified. The beginning point of each lot and subplot must be recorded and/or marked. 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.
  - 5.3 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.

## 6. Using the Random Number Table

- 6.1 Numbers are selected at random without looking at the table.
- 6.2 It is best to use a pointer (mechanical pencil with the lead retracted or a letter opener) when selecting numbers.
- 6.3 Place the table conveniently so that selections will not be limited to a particular area of the table.
- 6.4 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.
- 6.5 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.
- 6.6 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. The leftmost number will be used 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.

## 7. Samples from the Transport Unit

- 7.1 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.
- 7.2 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.

## 8. HMA or Concrete Cores

- 8.1 Two separate random numbers are used to determine the longitudinal and transverse location of core samples.
- 8.2 Generate two individual numbers using a calculator or computer. The first number will be used to determine the random longitudinal distance and the second number will be used to determine the random transverse distance.
- 8.3 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.
- 8.4 The longitudinal location of the core within the subplot is determined by multiplying the length of pavement in the subplot by the first random number. The longitudinal measurement begins at the starting point for each subplot and continues in the direction of paving.
- 8.5 The transverse location is determined by multiplying the width of paving by the second random number. The start of measurement begins at the right edge of pavement when looking in the direction of increasing station numbers regardless of the direction of paving.
- 8.6 *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 takes precedence.  
  
*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 takes precedence.

## 9. Samples from the Grade

- 9.1 The transport unit to be sampled is randomly selected using the same procedure as for sampling from the transport unit.
- 9.2 The approximate total length of material that the randomly selected transport unit will place is computed and recorded.
- 9.3 Sets of two random numbers are selected using the procedure described for locating core samples.
- 9.4 The length of material placed from the randomly selected transport unit is multiplied 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.
- 9.5 If it is necessary to locate the sample transversely, this is done using the second random number selected in 9.3 and follows the procedure described for locating core samples.

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

- 10.1 Select the tonnage to be sampled by a random method.
- 10.2 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 three 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. This material will be placed in a bucket with all other increments sampled from that stockpile. This will form one composite sample.

## 11. Selection of Verification Sample

This procedure is to be followed in selecting which quality assurance sample split will be tested for verification.

- 11.1 Determine the number of samples from which a verification sample is to be selected. This will generally be only two or three samples.
- 11.2 Number the samples in the order in which they were collected.
- 11.3 Generate a number using a computer or calculator random number generator and multiply it by 10.
- 11.4 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.
- 11.5 If the number is not usable repeat the process until a usable number is selected.

## 12. Examples of Random Sampling

- 12.1 Example 1 demonstrates selecting random locations for sampling fresh concrete.
- 12.2 Example 2 demonstrates selecting random locations for sampling HMA mixture.
- 12.3 Example 3 demonstrates selecting random locations for HMA pavement cores.
- 12.4 Example 4 demonstrates selecting random locations for samples taken from the grade after material has been placed.

TABLE OF RANDOM NUMBERS

|    | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1  | 0.800 | 0.511 | 0.448 | 0.632 | 0.364 | 0.512 | 0.648 | 0.707 | 0.742 | 0.191 | 0.373 |
| 2  | 0.795 | 0.174 | 0.950 | 0.495 | 0.011 | 0.978 | 0.220 | 0.277 | 0.395 | 0.801 | 0.842 |
| 3  | 0.708 | 0.235 | 0.548 | 0.502 | 0.087 | 0.456 | 0.946 | 0.332 | 0.899 | 0.830 | 0.874 |
| 4  | 0.031 | 0.286 | 0.982 | 0.912 | 0.127 | 0.649 | 0.427 | 0.769 | 0.227 | 0.192 | 0.126 |
| 5  | 0.510 | 0.372 | 0.439 | 0.290 | 0.758 | 0.848 | 0.039 | 0.423 | 0.289 | 0.081 | 0.386 |
| 6  | 0.831 | 0.702 | 0.448 | 0.871 | 0.086 | 0.068 | 0.139 | 0.796 | 0.183 | 0.749 | 0.413 |
| 7  | 0.256 | 0.361 | 0.792 | 0.863 | 0.533 | 0.842 | 0.585 | 0.550 | 0.802 | 0.950 | 0.687 |
| 8  | 0.119 | 0.192 | 0.365 | 0.004 | 0.242 | 0.497 | 0.488 | 0.740 | 0.016 | 0.093 | 0.137 |
| 9  | 0.788 | 0.164 | 0.849 | 0.094 | 0.485 | 0.148 | 0.082 | 0.194 | 0.902 | 0.563 | 0.851 |
| 10 | 0.977 | 0.099 | 0.406 | 0.145 | 0.113 | 0.998 | 0.099 | 0.748 | 0.102 | 0.819 | 0.353 |
| 11 | 0.839 | 0.965 | 0.234 | 0.252 | 0.623 | 0.928 | 0.665 | 0.156 | 0.530 | 0.324 | 0.406 |
| 12 | 0.284 | 0.793 | 0.197 | 0.475 | 0.088 | 0.444 | 0.348 | 0.389 | 0.774 | 0.019 | 0.799 |
| 13 | 0.257 | 0.585 | 0.537 | 0.917 | 0.895 | 0.703 | 0.527 | 0.683 | 0.851 | 0.873 | 0.169 |
| 14 | 0.831 | 0.541 | 0.117 | 0.839 | 0.848 | 0.902 | 0.148 | 0.596 | 0.075 | 0.230 | 0.334 |
| 15 | 0.426 | 0.380 | 0.147 | 0.330 | 0.271 | 0.147 | 0.841 | 0.732 | 0.160 | 0.566 | 0.020 |
| 16 | 0.369 | 0.961 | 0.446 | 0.241 | 0.084 | 0.589 | 0.060 | 0.554 | 0.121 | 0.674 | 0.722 |
| 17 | 0.599 | 0.468 | 0.023 | 0.118 | 0.616 | 0.781 | 0.398 | 0.590 | 0.016 | 0.730 | 0.425 |
| 18 | 0.890 | 0.437 | 0.885 | 0.658 | 0.106 | 0.472 | 0.513 | 0.125 | 0.779 | 0.466 | 0.866 |
| 19 | 0.875 | 0.408 | 0.081 | 0.853 | 0.339 | 0.863 | 0.528 | 0.178 | 0.548 | 0.414 | 0.656 |
| 20 | 0.327 | 0.503 | 0.373 | 0.303 | 0.986 | 0.244 | 0.586 | 0.595 | 0.777 | 0.420 | 0.242 |
| 21 | 0.109 | 0.407 | 0.400 | 0.759 | 0.070 | 0.584 | 0.221 | 0.708 | 0.005 | 0.327 | 0.936 |
| 22 | 0.027 | 0.534 | 0.510 | 0.132 | 0.990 | 0.202 | 0.769 | 0.689 | 0.695 | 0.542 | 0.106 |
| 23 | 0.062 | 0.016 | 0.785 | 0.832 | 0.644 | 0.293 | 0.878 | 0.675 | 0.996 | 0.216 | 0.755 |
| 24 | 0.188 | 0.996 | 0.651 | 0.002 | 0.802 | 0.208 | 0.387 | 0.374 | 0.141 | 0.009 | 0.040 |
| 25 | 0.801 | 0.450 | 0.280 | 0.605 | 0.831 | 0.254 | 0.697 | 0.371 | 0.663 | 0.607 | 0.935 |
| 26 | 0.212 | 0.213 | 0.529 | 0.313 | 0.458 | 0.855 | 0.509 | 0.688 | 0.859 | 0.794 | 0.160 |
| 27 | 0.649 | 0.348 | 0.214 | 0.415 | 0.297 | 0.615 | 0.637 | 0.841 | 0.159 | 0.704 | 0.160 |
| 28 | 0.954 | 0.044 | 0.135 | 0.499 | 0.639 | 0.878 | 0.264 | 0.005 | 0.023 | 0.813 | 0.894 |
| 29 | 0.065 | 0.430 | 0.167 | 0.345 | 0.591 | 0.258 | 0.985 | 0.481 | 0.477 | 0.899 | 0.265 |
| 30 | 0.427 | 0.231 | 0.062 | 0.154 | 0.957 | 0.187 | 0.098 | 0.655 | 0.789 | 0.966 | 0.197 |
| 31 | 0.642 | 0.275 | 0.121 | 0.567 | 0.238 | 0.210 | 0.129 | 0.939 | 0.836 | 0.760 | 0.149 |
| 32 | 0.027 | 0.328 | 0.731 | 0.231 | 0.792 | 0.332 | 0.660 | 0.878 | 0.620 | 0.453 | 0.484 |
| 33 | 0.154 | 0.772 | 0.898 | 0.745 | 0.745 | 0.724 | 0.969 | 0.581 | 0.653 | 0.243 | 0.243 |
| 34 | 0.984 | 0.435 | 0.324 | 0.488 | 0.061 | 0.177 | 0.328 | 0.599 | 0.275 | 0.601 | 0.952 |
| 35 | 0.120 | 0.909 | 0.999 | 0.870 | 0.123 | 0.238 | 0.904 | 0.176 | 0.524 | 0.129 | 0.663 |

**EXAMPLE 1: Random Sampling of Fresh Concrete Sampling**

Given:

|                       |                        |
|-----------------------|------------------------|
| Grade                 | P1                     |
| width of pavement     | 24 feet                |
| thickness of pavement | 10 inches or 0.83 feet |
| lot size              | 5000 cubic yards       |
| transport unit volume | 10 cubic yards         |

Special Provision:

|                    |           |
|--------------------|-----------|
| sampling frequency | 5 per lot |
|--------------------|-----------|

Calculate:

|                          |   |
|--------------------------|---|
| cyd conc per foot paved  | $(\text{width} \times \text{thickness} \times \text{length}) \div 27 (24 \times 0.83) \div 27 = 0.74 \text{ cyd}$ |
| sublot size              | $\text{lot size} \div \text{sampling frequency} \quad 5000 \div 5 = 1000 \text{ cyd}$                             |
| length of subplot        | $\text{sublot size} \div \text{cyd per foot paved} \quad 1000 \div 0.74 = 1350 \text{ ft}$                        |
| transp units per subplot | $\text{sublot size} \div \text{transp unit volume} \quad 1000 \div 10 = 100$                                      |

Select Random Numbers: (Shown in Column B)

Layout of lot and approximate location of stratified random samples within each subplot.

|       |      |      |      |      |      |
|-------|------|------|------|------|------|
|       | ☼    | ☼    | ☼    | ☼    | ☼    |
| cyd   | 1000 | 2000 | 3000 | 4000 | 5000 |
| feet  | 1350 | 2700 | 4050 | 5400 | 6750 |
| units | 100  | 200  | 300  | 400  | 500  |

Tabulate data for locating samples by volume placed, transport unit, meters of concrete placed, etc.

| A = Sublot Number | B = Random Number | C = cyd in subplot to sample | D = unit in subplot to sample | E = unit in lot to sample | F = cyd in lot | G = feet from lot start |
|-------------------|-------------------|------------------------------|-------------------------------|---------------------------|----------------|-------------------------|
| 1                 | 0.330             | 330                          | 33                            | 33                        | 330            | 445                     |
| 2                 | 0.241             | 241                          | 24                            | 124                       | 1240           | 1675                    |
| 3                 | 0.118             | 118                          | 12                            | 212                       | 2120           | 2865                    |
| 4                 | 0.658             | 658                          | 66                            | 366                       | 3660           | 4946                    |
| 5                 | 0.853             | 853                          | 85                            | 485                       | 4850           | 6554                    |

Where:

|   |                                |
|---|--------------------------------|
| C = (B) × subplot size                                  | $0.33 \times 1000 = 330$       |
| D = (C) ÷ volume of transport unit                      | $330 \div 10 = 33$             |
| E = (A - 1) × (number of units per subplot) + (D)       | $(1 - 1) \times 100 + 33 = 33$ |
| F = (E) × volume of transport unit                      | $33 \times 10 = 330$           |
| G = (F) ÷ (cyd of concrete per foot of pavement placed) | $330 \div 0.74 = 445$          |

**EXAMPLE 2: Random Sampling of HMA Mixture**

Given:

width of pavement 24 feet  
 thickness of pavement 4 inches or 0.33 feet  
 lot size 3600 tons  
 capacity of transport unit 36 tons  
 tons per foot paved 0.46 tons

Special Provision:

sampling frequency 3 sublots per lot

Calculate:

sublot size lot size ÷ sampling frequency 3600 ÷ 3 = 1200 tons  
 length of subplot subplot size ÷ tons per foot paved 1200 ÷ 0.46 = 2600 ft  
 transp units per subplot subplot size ÷ capacity of transp unit 1200 ÷ 36 = 33 units

Select Random Numbers:

(Shown in Column B)

Layout of lot and approximate location of stratified random samples within each subplot.

|       |      |      |      |
|-------|------|------|------|
| ☀     | ☀    | ☀    |      |
| tons  | 1200 | 240  | 3600 |
| feet  | 2600 | 5200 | 7800 |
| units | 33   | 67   | 100  |

Tabulate data for locating samples by tonnage placed, transport unit or meters of pavement placed.

| A =<br>Sublot<br>Number | B =<br>Random<br>Number | C =<br>Sublot ton<br>to sample | D =<br>Sublot unit<br>to sample | E =<br>Cumulative<br>units in lot | F =<br>Cumulative<br>lot tonnage | G =<br>Cumulative<br>feet paved |
|-------------------------|-------------------------|--------------------------------|---------------------------------|-----------------------------------|----------------------------------|---------------------------------|
| 1                       | 0.637                   | 764                            | 22                              | 22                                | 792                              | 1721                            |
| 2                       | 0.264                   | 317                            | 9                               | 42                                | 1512                             | 3287                            |
| 3                       | 0.985                   | 1182                           | 33                              | 100                               | 3600                             | 7748                            |

Where:

C = (B) × subplot size 0.637 × 1200 = 764  
 D = (C) ÷ capacity of transport unit 764 ÷ 36 = 22  
 E = -A - 1) × (number of units per subplot) + (D) -1 - 1) × 33 + 22 = 22  
 F = (E) × capacity of transport unit 22 × 36 = 792  
 G = (F) ÷ (tons of HMA per foot of pavement placed) 792 ÷ 0.46 = 1721

EXAMPLE 3: Determining Random Core Sample Locations

Given:

width of pavement 24 feet  
 subplot size 1200 tons  
 tons per foot paved 0.46 tons





## QUALITY INDEX ANALYSIS (PERCENT WITHIN LIMITS)

### 1. Scope

- 1.1 The Department's Quality Assurance Acceptance Program uses a statistical evaluation of test results to estimate the percent of a lot which falls within specification limits or tolerances established for each quality index parameter and uses this percent within limits (PWL) to calculate the pay adjustment for each lot. Each material or pay item covered by this acceptance program has its own quality index parameter(s) on which acceptance and payment is based. Refer to specific sections of the Standard Specifications and to the contract for details.

### 2. Lot Size and Make Up

- 2.1 This procedure requires the acceptance and payment of discrete lots of material or pay items based on the evaluation of test results representing the lot. Prior to beginning any work that is covered by this acceptance procedure, individual lot size and make up shall be agreed upon by the Engineer. As work progresses the Contractor shall assign a unique identification number to each lot to which all quality control and quality assurance test results for the lot must be referenced.

Lot size will normally be as agreed upon. In the event that operational conditions cause work to be interrupted before the lot size has been achieved, the reduced lot shall be added to the previous complete lot, or in the case of the first lot of material placed, added to the next complete lot. This combined lot shall be evaluated using all tests completed on the material in the lot.

### 3. Quality Index Analysis

- 3.1 The percentage of each lot within the specification limits established for each quality index parameter will be determined by the following general procedure.
- 3.1.1 The sampling locations within the lot will be determined by the Engineer using the random sampling procedure outlined in the Materials Quality Assurance Manual.
- 3.1.2 A measurement will be taken at each location, or a sample collected and the measurement made on the sample portion.
- 3.1.3 Use Formula 13-1 to determine the arithmetic mean ( $\bar{x}$ ) of the number ( $n$ ) of test results ( $x_i$ ).

$$\bar{x} = \frac{\sum x_i}{n} \quad \text{Formula 13-1}$$

- 3.1.4 Use Formula 13-2 to compute the standard deviation ( $S$ ) of the test results.

$$S = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}} \quad \text{Formula 13-2}$$

- 3.1.5 Use Formula 13-3 and the upper specification limit (USL) to compute the upper quality index ( $Q_U$ ). If an upper specification limit is not specified, the upper percent within limits will be 100. Round to the nearest 0.05 according to Section 6.6 of ASTM E 29.

$$Q_U = \frac{USL - \bar{x}}{S} \quad \text{Formula 13-3}$$

- 3.1.6 Use Formula 13-4 and the lower specification limit (LSL) to compute the lower quality index ( $Q_L$ ). If a lower specification limit is not specified, the lower percent within limits will be 100. Round to the nearest 0.05 according to Section 6.6 of ASTM E 29.

$$Q_L = \frac{\bar{x} - LSL}{S} \quad \text{Formula 13-4}$$

- 3.1.7 Estimate the percentage of materials ( $P_U$ ) that will fall within the upper specification limit (USL) by entering Table 13-1 with  $Q_U$ , using the column appropriate to the total number of tests ( $n$ ). If only an upper specification limit applies,  $P_U$  is the percent within limits (PWL).
- 3.1.8 Estimate the percentage of materials ( $P_L$ ) that will fall within the lower specification limit (LSL) by entering Table 13-1 with  $Q_L$ , using the column appropriate to the total number of tests ( $n$ ). If only a lower specification limit applies,  $P_L$  is the percent within limits (PWL).
- 3.1.9 Determine the quality level stated as percent within limits (PWL) using Formula 13-5.

$$PWL = (P_U + P_L) - 100 \quad \text{Formula 13-5}$$

- 3.1.10 If the percent defective (PD) is required to calculate pay adjustments, Formula 13-6 is used to calculate this value.

$$PD = 100 - PWL \quad \text{Formula 13-6}$$

- 3.1.11 Refer to specific sections of the standard specifications and to the contract documents for any retest provisions and rejection criteria which may apply.

#### 4. Payment

- 4.1 The related adjustment to the contract price will be determined using the estimated percent within limits by the method designated in the appropriate specification section or in the contract documents. On a lot-by-lot basis, the pay adjustment for each material or pay item covered by this procedure shall be computed by the Contractor. All calculations shall be provided by the Contractor to the Engineer for review and approval prior to payment.

**Table 13-1 Estimated Percent Within Limits**

| Q <sub>U</sub> or<br>Q <sub>L</sub> | Percent Within Limits for Given Sample Sizes (a) |         |        |        |        |       |       |       |       |       |
|-------------------------------------|--|---------|--------|--------|--------|-------|-------|-------|-------|-------|
|                                     | n=1 (b)  | n=2 (b) | n=3    | n=4    | n=5    | n=6   | n=7   | n=8   | n=9   | n=10  |
| 0.00                                | 50.00  | 50.00   | 50.00  | 50.00  | 50.00  | 50.00 | 50.00 | 50.00 | 50.00 | 50.00 |
| 0.05                                | 55.10  | 51.68   | 51.38  | 51.67  | 51.78  | 51.84 | 51.87 | 51.89 | 51.91 | 51.92 |
| 0.10                                | 60.20  | 53.36   | 52.76  | 53.33  | 53.56  | 53.67 | 53.74 | 53.78 | 53.82 | 53.84 |
| 0.15                                | 65.31  | 55.03   | 54.15  | 55.00  | 55.33  | 55.50 | 55.60 | 55.67 | 55.71 | 55.75 |
| 0.20                                | 70.41  | 56.71   | 56.54  | 56.67  | 57.10  | 57.32 | 57.46 | 57.54 | 57.60 | 57.65 |
| 0.25                                | 75.51  | 58.39   | 56.95  | 58.33  | 58.87  | 59.14 | 59.30 | 59.41 | 59.48 | 59.53 |
| 0.30                                | 80.61  | 60.07   | 58.37  | 60.00  | 60.63  | 60.94 | 61.13 | 61.25 | 61.34 | 61.40 |
| 0.35                                | 85.71  | 61.74   | 59.80  | 61.67  | 62.38  | 62.73 | 62.94 | 63.08 | 63.18 | 63.25 |
| 0.40                                | 90.82  | 63.42   | 61.26  | 63.33  | 64.12  | 64.51 | 64.74 | 64.89 | 65.00 | 65.07 |
| 0.45                                | 95.92  | 65.10   | 62.74  | 65.00  | 65.84  | 66.27 | 66.51 | 66.67 | 66.79 | 66.87 |
| 0.50                                | 100.00   | 66.78   | 64.25  | 66.67  | 67.56  | 68.00 | 68.26 | 68.43 | 68.55 | 68.63 |
| 0.55                                | 100.00   | 68.46   | 65.80  | 68.33  | 69.26  | 69.72 | 69.99 | 70.16 | 70.28 | 70.36 |
| 0.60                                | 100.00   | 70.13   | 67.39  | 70.00  | 70.95  | 71.41 | 71.68 | 71.85 | 71.97 | 72.06 |
| 0.65                                | 100.00   | 71.81   | 69.03  | 71.67  | 72.61  | 73.08 | 73.34 | 73.51 | 73.63 | 73.72 |
| 0.70                                | 100.00   | 72.49   | 70.73  | 73.33  | 74.26  | 74.71 | 74.97 | 75.14 | 75.25 | 75.33 |
| 0.75                                | 100.00   | 75.17   | 72.50  | 75.00  | 75.89  | 76.32 | 76.56 | 76.72 | 76.83 | 76.90 |
| 0.80                                | 100.00   | 76.85   | 74.36  | 76.67  | 77.49  | 77.89 | 78.12 | 78.26 | 78.36 | 78.43 |
| 0.85                                | 100.00   | 78.52   | 76.33  | 78.33  | 79.07  | 79.43 | 79.63 | 79.76 | 79.84 | 79.90 |
| 0.90                                | 100.00   | 80.20   | 78.45  | 80.00  | 80.62  | 80.93 | 81.10 | 81.21 | 81.28 | 81.33 |
| 0.95                                | 100.00   | 81.88   | 80.75  | 81.67  | 82.14  | 82.39 | 82.52 | 82.61 | 82.67 | 82.71 |
| 1.00                                | 100.00   | 83.56   | 83.33  | 83.33  | 83.64  | 83.80 | 83.90 | 83.96 | 84.00 | 84.03 |
| 1.05                                | 100.00   | 85.23   | 86.37  | 85.00  | 85.09  | 85.18 | 85.23 | 85.26 | 85.28 | 85.29 |
| 1.10                                | 100.00   | 86.91   | 90.16  | 86.67  | 86.52  | 86.50 | 86.51 | 86.51 | 86.51 | 86.50 |
| 1.15                                | 100.00   | 88.59   | 97.13  | 88.33  | 87.90  | 87.78 | 87.73 | 87.70 | 87.68 | 87.66 |
| 1.20                                | 100.00   | 90.27   | 100.00 | 90.00  | 89.24  | 89.01 | 88.90 | 88.83 | 88.79 | 88.76 |
| 1.25                                | 100.00   | 91.95   | 100.00 | 91.67  | 90.54  | 90.19 | 90.02 | 89.91 | 89.85 | 89.79 |
| 1.30                                | 100.00   | 93.62   | 100.00 | 93.33  | 91.79  | 91.31 | 91.07 | 90.94 | 90.84 | 90.78 |
| 1.35                                | 100.00   | 95.30   | 100.00 | 95.00  | 92.98  | 92.37 | 92.08 | 91.90 | 91.78 | 91.70 |
| 1.40                                | 100.00   | 96.98   | 100.00 | 96.67  | 94.12  | 93.37 | 93.02 | 92.81 | 92.67 | 92.56 |
| 1.45                                | 100.00   | 98.66   | 100.00 | 98.33  | 95.19  | 94.32 | 93.90 | 93.65 | 93.49 | 93.37 |
| 1.50                                | 100.00   | 100.00  | 100.00 | 100.00 | 96.20  | 95.19 | 94.72 | 94.44 | 94.26 | 94.13 |
| 1.55                                | 100.00   | 100.00  | 100.00 | 100.00 | 97.13  | 96.00 | 95.48 | 95.17 | 94.97 | 94.82 |
| 1.60                                | 100.00   | 100.00  | 100.00 | 100.00 | 97.97  | 96.75 | 96.17 | 95.84 | 95.62 | 95.46 |
| 1.65                                | 100.00   | 100.00  | 100.00 | 100.00 | 98.72  | 97.42 | 96.81 | 96.45 | 96.22 | 96.05 |
| 1.70                                | 100.00   | 100.00  | 100.00 | 100.00 | 99.34  | 98.02 | 97.38 | 97.01 | 96.76 | 96.59 |
| 1.75                                | 100.00   | 100.00  | 100.00 | 100.00 | 99.81  | 98.55 | 97.89 | 97.51 | 97.25 | 97.07 |
| 1.80                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 98.99 | 98.35 | 97.96 | 97.70 | 97.51 |
| 1.85                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 99.36 | 98.74 | 98.35 | 98.09 | 97.91 |
| 1.90                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 99.65 | 99.07 | 98.69 | 98.44 | 98.25 |
| 1.95                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 99.85 | 99.35 | 98.99 | 98.74 | 98.56 |

**Table 13-1 Estimated Percent Within Limits (continued)**

| Q <sub>U</sub> or<br>Q <sub>L</sub> | Percent Within Limits for Given Sample Sizes (a) |         |        |        |        |        |        |        |        |        |
|-------------------------------------|--|---------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                     | n=1 (b)  | n=2 (b) | n=3    | n=4    | n=5    | n=6    | n=7    | n=8    | n=9    | n=10   |
| 2.00                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 99.97  | 99.57  | 99.24  | 99.00  | 98.83  |
| 2.05                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 99.74  | 99.45  | 99.23  | 99.06  |
| 2.10                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 99.86  | 99.61  | 99.41  | 99.26  |
| 2.15                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 99.94  | 99.74  | 99.57  | 99.42  |
| 2.20                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 99.99  | 99.84  | 99.69  | 99.56  |
| 2.25                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 99.91  | 99.79  | 99.68  |
| 2.30                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 99.96  | 99.86  | 99.77  |
| 2.35                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 99.98  | 99.92  | 99.84  |
| 2.40                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 99.95  | 99.89  |
| 2.45                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 99.98  | 99.93  |
| 2.50                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 99.99  | 99.96  |
| 2.55                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 99.98  |
| 2.60                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 99.99  |
| 2.65                                | 100.00   | 100.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

a. Numbers in the body of this table are estimates of percent within limits (PWL) corresponding to specific values of Q, the quality index. For Q values less than zero, subtract the table value from 100.

b. Table values for n values of 1 and 2 are empirically derived. All other values are from the 2004 edition of AASHTO R9 Appendix C.

## GENERAL TESTED STOCK PROCEDURES

### 1. Scope

- 1.1 *Tested Stock* refers to stockpiled material that is sampled and tested by MDOT before being shipped to 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.
- 1.2 This procedure describes the steps involved in applying for Tested Stock privilege, establishing tested stockpiles and shipping Tested Stock to projects.
- 1.3 Materials allowed in Tested Stock, and the manufacturers and distributors who have been given Tested Stock privileges for specific materials, are listed in the Materials Source Guide.

### 2. General

- 2.1 The Construction and Technology Division, Materials Control, is responsible for overseeing the Tested Stock Program, including issuing and withdrawing Tested Stock privileges based on Division and Region recommendations.
- 2.2 It is the Contractor's responsibility to ensure all documentation for Tested Stock material to be incorporated into the project is accurate and is delivered as required by Section 6.
- 2.3 Tested Stock applications are classified as either manufacturer or distributor applications and are processed accordingly.
- 2.4 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.
- 2.5 When used in these procedures, *distributor* refers to a supplier or broker of highway materials who has no control, other than through careful handling, over the quality and workmanship of material shipped to an MDOT project.
- 2.6 Applicants granted Tested Stock privilege must agree, in writing, to comply with all requirements of these procedures. Failure to comply may result in withdrawal of Tested Stock privilege by MDOT.
- 2.7 Approved Tested Stock suppliers shall 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.

### 3. Application for Tested Stock Privilege

- 3.1 Manufacturers or distributors wishing to maintain Tested Stock of materials for use on state projects must submit a written application, including the information listed below, to:

Michigan Department of Transportation  
Construction and Technology Division

Materials Control  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909

Or fax written request to C&T at (517) 322-5664.

### 3.2 *Manufacturer*

- 3.2.1 Specific name of material(s) (MDOT designation) to be handled as Tested Stock including size, grade type, etc.
- 3.2.2 Reference to AASHTO, ASTM or MDOT Standard Specification covering the material(s).
- 3.2.3 Manufacturer's quality control procedure for each material. This can be a narrative description or a formal procedures manual.
- 3.2.4 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.
- 3.2.5 Names of other state DOTs using the material(s). Sample of material(s) if requested.

### 3.3 *Distributor*

- 3.3.1 Name of approved Tested Stock source supplying material(s).
  - 3.3.2 Specific name of material(s) (MDOT designation).
  - 3.3.3 MDOT Tested Stock test results for items, lot or batch of material to be placed in Tested Stock.
  - 3.3.4 If material does not come from an approved Tested Stock source, all information included in 3.2 must be submitted.
- 3.4 The evaluation which follows will include a review of MDOT's experience with the material and the manufacturer to determine if it is appropriate to allow the material as Tested Stock, a review of the quality control program and test reports to determine if the material is uniformly produced and consistently meets established specifications and contact with other agencies to determine their experience with the material and the manufacturer.
- 3.5 If the source and material are considered appropriate for Tested Stock, a site visit will be arranged to determine if there is adequate storage space to properly separate Tested Stock from "commercial material" and to discuss the program requirements.
- 3.6 The manufacturer or distributor will be notified, in writing, of approval or denial of Tested Stock privilege.

#### 4. Sampling and Acceptance of Tested Stock

- 4.1 The manufacturer or distributor shall 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 distributor's remaining Tested Stock in the event a change in specifications renders the material unusable on MDOT projects.
- 4.2 The manufacturer or distributor must notify C&T 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.
- 4.3 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.
- 4.4 It is the manufacturer's or distributor's responsibility to arrange for shipping of required samples to the MDOT Laboratory in Lansing for testing.
- 4.5 If the representative sample taken from the stockpiled material fails to meet all applicable 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.
- 4.6 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.
- 4.7 Tested Stock material may be accepted by the 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.

#### 5. Withdrawal and Reinstatement of Tested Stock Privilege

- 5.1 Failure to comply with these procedures is justification for withdrawal of Tested Stock privileges. A warning letter may be written pointing out the improper procedure and requesting action to rectify the problem.
- 5.2 Tested Stock privileges may be withdrawn if material intended for Tested Stock repeatedly fails to conform to specification requirements by any amount in any aspect.
- 5.3 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.

#### 6. Shipment of Tested Stock

- 6.1 When a shipment is made to a project from Tested Stock a *Shipment of Tested Stock Report* (Form 1922) must be completed and distributed as follows. The manufacturer or

distributor is responsible for obtaining, from the Contractor, all information required on the *Shipment of Tested Stock Report*, including project numbers and physical dimensions.

6.1.1 When a manufacturer or distributor is shipping to the jobsite:

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

6.1.1.2 A copy is to be retained by the manufacturer or distributor.

6.1.1.3 A copy must be faxed to C&T, (517) 322-5664, on the same day the material is shipped to the jobsite.

6.1.2 When a manufacturer is shipping to a distributor:

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

6.1.2.2 A copy is to be retained by the manufacturer.

6.1.2.3 A copy must be faxed to C&T, (517) 322-5664, on the same day the material is shipped to the distributor.

6.2 C&T 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.

6.3 Each Tested Stock source must maintain, at the stockpile location, a current inventory of all Tested Stock at that location. A review of inventory records and an actual count inventory will be performed annually for the purpose of adjustment of the records maintained at C&T and monitoring program compliance.

## 7. Limited Shelf Life Tested Stock Material

7.1 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 |
| All Curing Compounds | 1 year from date of manufacture             |
| Epoxies              | 1 year from date of manufacture             |

## TESTED STOCKPILES OF AGGREGATE

### 1. Scope

- 1.1 This procedure describes the requirements for maintaining pretested stockpiles of aggregates for use on MDOT projects.
- 1.2 Written authorization must be received by the producer, from MDOT, to maintain pretested stockpiles of aggregates.

### 2. Application For Tested Stock

- 2.1 The producer shall request the Tested Stock privilege for each production site, in writing, to the affected Region materials staff.
- 2.2 The Region materials staff shall 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.
  - 2.2.1 The Region shall make a recommendation to the Construction and Technology Division, Aggregate Quality Control Group, for confirmation or denial of the privilege.
  - 2.2.2 The Aggregate Quality Control Group reserves the option of visiting the production site to aid in its determination for granting permission for Tested Stock.

### 3. Testing

- 3.1 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.
- 3.2 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 shall be a minimum of 3 inches (75 mm) in height and clearly legible. The sign shall 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.

### 4. Record Keeping and Inventory Control

- 4.1 An up-to-date inventory of all tested stockpile aggregates shall be kept by the producer and made available to MDOT representatives upon request.
- 4.2 The inventory shall include the Michigan Series and Class, weights or volumes in each stockpile and weights or volumes and dates shipped to each project, numbered hot mix asphalt (HMA) or concrete plant.
- 4.3 If questionable, the quantities remaining in stockpiles must be determined by the producer to the satisfaction of MDOT.
  - 4.3.1 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.

#### 5. Shipment and Certification

- 5.1 Each authorized shipment shall be accompanied by a legible certification. The certification can be a part of the trip ticket or stamped on the back of it.
- 5.2 The certification shall include the following:
  - 5.2.1 A statement that the aggregate came from an approved tested stockpile.
  - 5.2.2 Source (pit number)
  - 5.2.3 Date of shipment
  - 5.2.4 Project number, HMA plant number or concrete plant number
  - 5.2.5 Michigan Series Number and Class Letter
  - 5.2.6 Weight or volume in shipment
- 5.3 The producer will forward one copy of the Weekly Shipment Summary, by the close of business each Monday, to C&T, Aggregate Quality Control Group, and the Region. In the case where another Region is involved, MDOT will furnish a duplicate to that Region.

#### 6. Withdrawal and Reinstatement of Certification Privileges

- 6.1 In instances of violation of these procedures, the privilege of certification may be rescinded after review and action by C&T and further shipments to MDOT projects will be tested on a project-by-project basis.
- 6.2 Withdrawn privileges may be reinstated by C&T if the certifier has corrected the problems to the satisfaction of MDOT.

## GENERAL MATERIALS CERTIFICATION PROCEDURES FOR APPROVED MANUFACTURER/SUPPLIER STATUS

### 1. Scope

- 1.1 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). There are two different types of certification documentation required depending on the type of material, the impact of the material on the safety and integrity of the project and the experience of MDOT and other agencies with the material.
- 1.2 Certifiable materials are designated under "Basis of Acceptance" in the Materials Acceptance Requirements Table of Section G. This table can also be found in the Materials Source Guide
- 1.3 Sections 1-7 of these General Procedures apply to all manufacturers and suppliers of certifiable materials. Sections 8-10 cover procedures which 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. Approved manufacturers and suppliers have established a record of providing specification materials and are continually evaluated.
- 1.4 Where necessary, additional detailed procedures have been written to cover certification of individual materials. These detailed procedures follow and include this General Materials Certification Procedure for Manufacturers/Suppliers.

### 2. General

- 2.1 The Construction and Technology Division is responsible for overseeing the Manufactures/Suppliers Certification Program, including issuing and withdrawing certification privileges based on Division and Region recommendations.
- 2.2 ***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 3.3 of this document.***
- 2.3 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.
- 2.4 When used in these procedures, a *supplier* refers to a construction supplier or broker of highway materials who has no control, other than through careful handling, over the quality and workmanship of material shipped to an MDOT project.
- 2.5 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 status in accordance with Section 8 to *certify specific* materials.

- 2.6 When used in these procedures, *Approved Supplier* refers to a supplier who has been given approved status in accordance with Section 9 to *supply certified specific* materials which are manufactured by Approved Manufacturer.

### 3. Certification Documentation

- 3.1 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.
- 3.2 Upon delivery to a supplier or a project, all certified material, either bundled or palleted, shall be stenciled, stamped or otherwise identified as per ASTM, AASHTO, or MDOT specification to allow the material to be recognized and checked against the manufacturers certification or suppliers certification document.
- 3.3 All *General Certification* documents must consist of all of the following:
- 3.3.1 A list of all applicable specifications (ASTM, AASHTO, MDOT or other designations as appropriate) which the material is certified to meet.
  - 3.3.2 Any applicable specification modifier such as class, grade, type, etc.
  - 3.3.3 A statement, signed by a responsible representative of the manufacturer or supplier, that the material represented by the certification meets all MDOT listed specification requirements.
  - 3.3.4 If material is certified by an Approved supplier, the manufacturer's name must be included on the certification.
  - 3.3.5 Contract number (Control Section/Job Number).
  - 3.3.6 Date of shipment.
  - 3.3.7 Name of Contractor.
  - 3.3.8 Name of material (MDOT designation/MDOT Spec #). The proper name of materials can be found in the Materials Source Guide as listed in the Materials Acceptance Requirements Table.
  - 3.3.9 Identification markings on shipment as required by Section 3.2.
  - 3.3.10 Quantity of material represented by the certification.
- 3.4 *Test Data Certification* - When this certification is specified as the basis of acceptance in the *Materials Acceptance Requirements Table*, in addition to the requirements of Section 3.3, the following information must also be included:
- 3.4.1 Laboratory test report(s) for samples obtained from the lot(s) of material represented by the certification and tested according to applicable specifications.

#### 4. Certifications Distribution

4.1 Certification documents must be distributed as follows:

4.1.1 Two copies must accompany the shipment; one for the Contractor's files and one for the project engineer's office.

4.1.2 One copy must be mailed or faxed on date of shipment to:

Michigan Department of Transportation  
Construction and Technology Division  
Materials Control  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Fax: (517) 322-5664

#### 5. Certification Verification Sampling and Testing

5.1 Material accepted on the basis of certification may be sampled and tested on a random basis by MDOT for the purpose of verifying the quality of the certified material, as detailed in the Certification Verification Procedures, Section C 2 of this manual.

#### 6. Acceptance/Rejection of Certified Materials

6.1 Certified material will be accepted by the Project Engineer if the sources of all applicable materials are listed on the project Testing Order (Form 501). If visual inspection at the project site shows the condition of the material to be unsatisfactory or a material source is not what was identified on the Testing Order, MDOT reserves the right to reject the material, conduct further inspection or test the material.

6.2 If any laboratory reports submitted as part of a Test Data certification or resulting from the testing of certification verification samples indicate that a critical parameter falls outside specification limits by a significant amount, C&T may recommend that the certified material be rejected. Prior to rejection of the material, an investigation of circumstances will be made. This may include consultation with Design, Traffic and Safety, or Maintenance Divisions and the Project Engineer.

#### 7. Withdrawal and Reinstatement of Certification Privileges

7.1 Failure to comply with any applicable certification procedures is justification for withdrawal of certification privileges. A warning letter will be written to the certifier, pointing out the failure and requesting action to rectify the problem.

7.2 Certification privileges will be withdrawn if the certified material deviates from specification requirements by a substantial amount in a critical aspect or if the material repeatedly fails to conform to specification requirements by any amount in any aspect.

7.3 Withdrawn certification privileges can be reinstated only if the certifier has corrected the identified deficiencies and has described the actions taken to prevent future shipment of

nonconforming material. In the case of an Approved Manufacturer, testing of samples or review of other data may be required.

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

8. Approved Manufacturer/Supplier Status

- 8.1 These materials, which are otherwise tested on a job specific basis, are designated under "Basis of Acceptance" in the Materials Acceptance Table, Section G. Lists of materials which are allowed to be certified only by Approved Manufacturers and those manufacturers who have been given this status are included in the Materials Source Guide. Suppliers who have been approved to supply materials manufactured by Approved Manufacturers are also listed in the Materials Source Guide.
- 8.2 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.
- 8.3 Approved Manufacturers/Suppliers must agree, in writing, to comply with all general certification requirements in addition to applicable procedures covering individual materials.

9. Application for Approved Manufacturer Status

- 9.1 The manufacturer of the material to be certified must contact C&T, in writing or by email to request consideration for Approval status. Requests must include the following information:
- 9.1.1 Specific name of the material to be certified (MDOT designation/Spec #).
- 9.1.2 Specific AASHTO, ASTM, MDOT Standard Specification or other specification covering the material.
- 9.1.3 Manufacturer's Quality Control Procedure for the material. This can be a narrative description or a formal procedures manual.
- 9.1.4 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.
- 9.1.5 Names of other state DOTs using the material.
- 9.1.6 Sample of the material if requested.
- 9.1.7 Sample certification form to be used when supplying material.

- 9.1.8 Shop drawing if required (i.e., concrete hand holes).
- 9.2 The evaluation may include the following steps:
  - 9.2.1 A review of MDOT's experience with the material and the manufacturer to determine if it is appropriate to allow certification of the material.
  - 9.2.2 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.
  - 9.2.3 Contacting other agencies to determine their experience with the material and the manufacturer.
  - 9.2.4 An onsite review of the manufacturing process and facility.
- 9.3 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.

#### 10. Approved Supplier Status

- 10.1 Once a manufacturer has been given Approval status for a material, a supplier may request approval to supply that material based on approved supplier status. This request must be made, in writing or by email, to the Construction and Technology Division.
- 10.2 The following modifications to the requirements of Section 3 are applicable when an Approved Manufacturer supplies material through an Approved Supplier.
  - 10.2.1 The certification from the Approved Manufacturer to the Approved Supplier is not required to show a project number.
  - 10.2.2 When any portion of this material is shipped without modification to a project, the Approved Supplier must issue a Supplier's certification which states that the material represented is the same material covered by the Approved Manufacturer's certification.
- 10.3 If the Approved Supplier has had additional processing performed 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 by MDOT on the basis of testing and/or inspection.

## CERTIFICATION VERIFICATION SAMPLING AND TESTING

### 1. Scope

- 1.1 Certification Verification will consist of periodic sampling and testing or field inspection of materials accepted on the basis of certification and shall be for the purpose of validating the quality of the manufacturer's product.
- 1.2 When the certification verification sample fails critical areas 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.
- 1.3 Materials listed in the Materials Source Guide as certifiable, but not listed in these procedures, may be sampled and tested as special circumstances warrant.
- 1.4 The frequency for Certification Verification may be adjusted at any time by the Michigan Department of Transportation as deemed necessary.

### 2. General Responsibilities

- 2.1 The Construction and Technology Division 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.
  - 2.1.1 If the sampling and/or inspection cannot be performed within five days of the receipt of these requests, C&T shall be notified by telephone.
- 2.2 Materials not listed in Schedule No. 1, but which also require regular Certification Verification sampling and/or inspection is listed in Schedule No. 2.
  - 2.2.1 It will be the responsibility of the Region materials staff to see that the Certification Verification required in Schedule No. 2 is performed.

### 3. Submitting Samples

- 3.1 When submitting samples to the laboratory for testing, the word's "Certification Verification" shall be entered on the Sample ID, Form 1923, in the area normally reserved for the project number.
- 3.2 If available, a copy of the certification representing the material sampled shall be attached to the Sample Identification.
- 3.3 Project numbers may be entered under remarks on the Sample Identification.

### 4. Field Inspection Reports

- 4.1 All field inspection reports submitted to C&T shall note "Certification Verification" in the area normally reserved for project number.
- 4.2 Project numbers may be shown under "Remarks".

- 4.3 A statement indicating whether the material does or does not meet specification requirements will be entered under "Remarks".
- 4.4 If available, a copy of the certification representing the material inspected shall accompany these field inspection reports.
- 4.5 Project Engineers will not receive copies of Certification Verification Field Inspection Reports except when failures occur in critical areas, per paragraph 1.2.

5. Laboratory Reports

- 5.1 Test reports issued by the Testing Laboratory will be reported as "Certification Verification" rather than for specific projects.
- 5.2 Project numbers, if shown on the Sample Identification, will be entered under "Remarks".
- 5.3 Project Engineers will not receive copies of "Certification Verification" test reports except when failures occur in critical areas, per paragraph 1.2.

6. Sampling Schedules

- 6.1 C&T will issue the appropriate instructions to the Region materials staff for sampling and/or inspection for those items in Schedule No. 1.
- 6.2 The Region materials staff is responsible 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.   |
| 905.06       | Welded Steel Wire Reinforcement (Mesh)                   | 65,000       | 300,000            | sq.ft. |
| 908.12       | Steel Beam Guardrail Elements                            | 1000         | 8,000              | pcs.   |
| 908.13*      | Steel Post For Guardrail                                 | 1000         | 5,000              | ea.    |
| 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.    |
| 912.09       | Post and Blocks for Beam Guardrail                       | 1,000        | 10,000             | ea.    |
| 913.03B      | Concrete Brick   | 10,000       | 300,000            | pcs.   |
| 913.05       | Concrete Block for Drainage Structures                   | 10,000       | 300,000            | pcs.   |
| 914.03       | Bituminized Fiber Joint Filler for Concrete Construction | 1,000        | 20,000             | sq.ft. |
| 914.07       | Dowel Bars, Uncoated                                     | 3,000        | 30,000             | ea.    |
| 914.07A      | Dowel Bars, Coated                                       | 3,000        | 30,000             | ea.    |
| 916.02       | Silt Fence   | 3,500        | 10,000             | ft.    |
| 917.12       | Seed Mixtures  | 15,000       | 22,000             | lbs.   |
| 919.04A      | Steel Posts For Signs                                    | 10,000       | 100,000            | 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 shall be shown on the Sample Identification, Form 1923.
- 908.13 *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 the Construction and Technology Division. The Sample Identification, Form 1923, shall include the sheet manufacturer's name and the pipe fabricator's name.

## SCHEDULE NO. 2 SPECIAL INSTRUCTIONS

- 901.03 *Portland Cement* - See Materials Source Guide.
- 901.07 *Fly Ash* - One for each five CV samples of Portland cement per plant. The fly ash sample shall be accompanied by a sample of the Portland cement with which it is being used.
- 902.01 *Aggregates* - See Section C 3 of this manual.
- 902.12 *Mineral Filler for HMA Mixtures* - See Manual for Certification of Hot Mix Asphalt Plants.
- 904.01A *Asphalt Binder* - See Manual for Certification of Hot Mix Asphalt Plants.
- 905.07 *Strand for Prestressed Concrete* - One per project.
- 909.04 *Concrete Pipe Products; RCP & NRCP and Related Items* - See Section C 5 of this manual.
- 910.03 *Geotextiles* - See Materials Source Guide for recommended guidelines for normal sampling frequency, additional samples may be taken as directed by the Engineer.

## TEMPORARY CONCRETE BARRIER

### 1. Scope

- 1.1 The Michigan Department of Transportation has authorized the certification of temporary concrete barriers in accordance with all General Certification requirements in Section C1. Additional certification requirements in this section apply to all certifiers of temporary concrete barriers. These additional requirements include pull-testing a specified number of loops and providing this test information to the Project Engineer before the barriers are put into service on a jobsite.
- 1.2 When used in this certification procedure, the term "Contractor" refers to the Prime Contractor on a project.

### 2. Referenced Documents

- 2.1 MDOT Publications
  - 2.1.1 MTM 716
  - 2.1.2 Standard Plan R-52-D Series
  - 2.1.3 MDOT Standard Specifications and Special Provisions

### 3. Certification Procedure

#### 3.1 *Contractor Responsibility*

- 3.1.1 The Contractor is required to test a minimum of 15 percent of the total number of barrier loops that are on new barrier sections or new retrofitted sections on a project. These tests shall conform to MTM 716. MDOT personnel shall be given the opportunity to witness these tests.
- 3.1.2 The equipment used by the Contractor to test barrier loops must be calibrated annually. A copy of the calibration certificate shall be provided to the MDOT materials personnel or the Project Engineer prior to the Contractor performing loop testing.
- 3.1.3 Type D Certification is required for all barrier sections. The certification must include all applicable information required by the General Certification Procedures in C 1. In addition, the following information is required:

Statement that the barrier sections meet all plan and proposal specifications for dimensional requirements, materials, fabrication and placement.

Number of barrier sections covered by the certification.

3.2 *MDOT Responsibility*

- 3.2.1 Construction personnel shall conduct a field inspection of the barrier in place before the Contractor's certification is accepted.
- 3.2.2 MDOT Construction and Technology personnel shall conduct pull testing of barrier loops at the frequency specified in MTM 716, Section 6.2.

NOTE: Dimensional checks and field inspection are detailed in MTM 716 and on Standard Plan R-52-D Series.

## PORTLAND CEMENT

### 1. General

- 1.1 The Construction and Technology Division will authorize plants having a satisfactory record of production of acceptable cement, to ship Portland cement to MDOT projects for immediate incorporation in the work, provided each shipment is accompanied by a producer certification that the cement meets MDOT specification requirements for the specified type of cement. Certification Verification samples from certified shipments will be taken by MDOT to confirm compliance with the specifications. Certified cement from authorized plants generally will not be tested by MDOT prior to use.

### 2. Certification of Quality of Cement

- 2.1 *By Producer* - Each shipment shall 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 Project Engineer or his/her representative. The form shall 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 (kilograms).
- This certification"

"The (producing company) certifies that the cement in this shipment, produced at (producing plant), conforms to the requirements of MDOT cement Type \_\_\_\_."

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

- 2.1.1 In addition, the Producer shall provide to C&T, 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.

- 2.2 *By Operators of Ready-Mix Plants* - In case of 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 bin that is used for MDOT work shall be certified by the cement company.

- 2.2.1 Operators of ready-mix plants supplying concrete under the "numbered concrete plant" concept shall certify all cement used in concrete delivered to MDOT projects on Form 1155. Form 1155 will be collected by the Region Materials staff.

- 2.2.2 Operators of all other ready mix plants supplying concrete shall certify all cement used in MDOT projects on each delivery ticket. In this case, the following is to be imprinted or stamped 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 \_\_\_\_\_"

### 3. Sampling and Testing of Certified Cement

- 3.1 Certification Verification samples of cement will be obtained at random from shipments to MDOT projects of the production of each mill authorized to certify cement. The sampling schedule may be found in the Materials Source Guide. The laboratory will randomly select and test a minimum of one of every ten samples (per producer, per type) submitted to confirm compliance of the cement with MDOT specification requirements.

### 4. Withdrawal and Reinstatement of Cement Certification Privileges

- 4.1 The Concrete Lab Supervisor will review the results of testing of Certification Verification samples for conformance to specification requirements. Authorization to certify Portland cement may be withdrawn by MDOT based on one or more serious departures from specification requirements, or a continuing pattern of minor variations, as determined by the Concrete Lab Supervisor.
- 4.2 Cement from a plant from which MDOT has withdrawn the above authorization may not be used on projects until each individual shipment has been tested and approved by MDOT.
- 4.3 Plants may regain authorization to ship certified cement, under the conditions of Sections 1 and 2, within the minimum period of time considered adequate by the Materials Research Engineer to provide satisfactory evidence that controls have been established to prevent future shipment of non-specification cement for use on MDOT projects.

### 5. Qualification of New Plants

- 5.1 Plants, for which MDOT does not have a record of past production, which desire to furnish cement for use on MDOT projects, may be required to furnish records of cement quality testing, samples for testing by MDOT, and/or such other information as the Concrete Lab Supervisor may determine to be necessary to establish adequate assurance that cement furnished under certification will in fact comply with the specification requirements.

## FLY ASH FOR USE IN PORTLAND CEMENT CONCRETE

### 1. General

- 1.1 The Construction and Technology Division of MDOT will authorize suppliers having a satisfactory record of furnishing acceptable fly ash from approved sources for use in Portland cement concrete to ship to MDOT projects for immediate incorporation into the work. Each shipment must be accompanied by a supplier certification indicating the fly ash meets MDOT specification requirements for the specified class. Certification Verification samples from certified shipments will be taken by MDOT to confirm compliance with the specifications. Certified fly ash from authorized plants generally will not be tested by MDOT prior to use.
- 1.2 The supplier shall 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 shall be furnished to MDOT upon request. Determination of Loss on Ignition and Fineness shall be made in order that certification will include test results from samples taken the day of the shipment or the previous working day.

### 2. Referenced Documents

- 2.1 ASTM C 618 Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete  
  
ASTM C 311 Test Method for Sampling and Testing Fly Ash or Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

### 3. Certification of Quality of Fly Ash for Use in Concrete

- 3.1 *By Supplier* - Each shipment shall 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 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 (kilograms).
  - This certification: "      (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 will be signed by a designated representative of the supplier.

- 3.1.1 In addition, the supplier shall provide C&T a copy of the test results for each

source on a monthly basis. The following information shall 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 Gravi
- Results based on composite sample (at least monthly):
  - Autoclave Soundness
  - Sum of  $\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3$
  - Strength Activity Index (With Portland Cement)
  - Water Requirement

3.2 *By Operators of Ready-Mix Plants* - In case of shipments to ready-mix plants which are supplying to commercial work at the same time they are supplying to State projects, all fly ash placed in the bin which is used for state work shall be certified as meeting MDOT requirements.

3.2.1 Operators of ready-mix plants supplying concrete under the "numbered concrete plant" concept shall certify all fly ash used in concrete delivered to MDOT projects on Form 1155.

3.2.2 Operators of all other ready mix plants supplying concrete shall certify all fly ash used in MDOT projects on each delivery ticket. In this case, the following is to be imprinted or stamped on the tickets:

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

Fly Ash \_\_\_\_\_ (supplier and plant) \_\_\_\_\_ Fly Ash \_\_\_\_\_ (class) \_\_\_\_\_"

3.2.3 This certification may be combined with certifications for cement and/or aggregates, provided the above information is shown.

3.2.4 Copies of Form 1155 will be distributed by the plant inspector.

#### 4. Sampling and Testing of Certified Fly Ash

4.1 Certification Verification samples of fly ash will be obtained at random from shipments to MDOT *projects* for each source authorized to certify fly ash. The sampling schedule may be found in Section C 2. The samples obtained in this manner will be tested to confirm compliance of the fly ash with MDOT specification requirements.

#### 5. Withdrawal and Reinstatement of Certification Privileges

5.1 The Project Engineer will review the results of testing of Certification Verification samples for conformance to specification requirements. Authorization to certify fly ash may be withdrawn by C&T based on one or more serious departures from specification requirements, or a continuing pattern of minor variations, as determined by the Project

Engineer.

- 5.2 Fly ash from a plant from which MDOT has withdrawn the above authorization may not be used on projects until each individual shipment has been tested and approved by MDOT.
- 5.3 Sources may regain authorization to ship certified fly ash, under the conditions of Sections 1 and 3, within the minimum period of time considered adequate by C&T to provide satisfactory evidence that controls have been established to prevent future shipment of non-specification fly ash for use on MDOT projects.

## PREQUALIFIED AGGREGATE SUPPLIER PROGRAM

### 1. Scope

- 1.1 The Michigan Prequalified Aggregate Supplier Program allows eligible aggregate Suppliers the opportunity to provide material to Michigan Department of Transportation or federally funded projects by assuming responsibility for quality control testing. Prequalified aggregate suppliers approved by MDOT's Construction and Technology Division with concurrence from the controlling MDOT Region will maintain compliance with the following procedures and other special instructions which may be issued to assure adequate quality control.

### 2. Definitions

*Supplier* - An aggregate producer or distribution point having ownership of the material.

*Controlling Region* - The MDOT Region in which the aggregate source or distribution point is located.

*Using Region* - The MDOT Region where the project is located.

*C&T* - Michigan Department of Transportation's Construction and Technology Division Aggregate Quality Control Group.

*Warning Band* - The upper and lower gradation limits before corrective action is started. This value is established by the supplier to maintain a uniform product.

### 3. Prerequisite Requirements

- 3.1 *Testing Area* - The area used for aggregate testing must meet Michigan Occupational Safety and Health Standards. It shall be large enough with ample work surfaces to conduct the prescribed tests. These tests require adequate lighting, good ventilation, a water supply, and a heated work area for use in cold weather. MDOT does not require the testing area to be located in a permanent structure.

- 3.2 *Equipment* - Scales must meet ASTM C 136 accuracy requirements for all sample sizes and be calibrated annually. The necessary wire cloth sieves meeting ASTM E 11 criteria shall be kept in the laboratory and in good condition. Aggregate drying equipment must meet the requirements listed in Michigan Test Methods 108 and 109. Mechanical splitters shall conform to ASTM C 702. All other equipment which is used in aggregate sampling and testing will be in good working order.

- 3.2.1 Failure to maintain equipment meeting proper standards may result in the loss of prequalified status.

- 3.3 *Personnel* - The supplier will employ or have under contract a Michigan Certified Aggregate Technician (MCAT). If the sampling and testing are not performed by an MCAT, then an MCAT shall witness the sampling and testing being conducted.

- 3.3.1 Failure to maintain current MCAT certification can result in the loss of prequalified status.

#### 4. Aggregate Supplier Prequalification Requirements

4.1 The aggregate supplier will submit a written request to C&T asking for admission into the Prequalified Supplier Program. C&T will forward a copy of the letter to the controlling Region office. The letter shall include the following items:

- Source name(s)
- Aggregate Source Inventory (ASI) number(s)
- Contact person
- An alternate contact person
- Work telephone number(s) for each person
- Location or type of testing facility
- The specific Michigan aggregate series (MDOT designation) produced or supplied at each source which is to be prequalified.

4.1.1 When a supplier wants to add another source or aggregate series to this program, the supplier shall notify the controlling Region in writing. A copy of the request will be forwarded to C&T. The source will be added if current laboratory facilities are used for quality control. A joint inspection by C&T and controlling MDOT Region will be required before approval if the laboratory facilities have not been previously inspected. All other requirements in this program must be met for the new source.

4.1.2 Should ownership of a prequalified source change, the new owner shall notify C&T in writing. A copy of the letter will be forwarded to the controlling Region. C&T will coordinate with the controlling Region to schedule an inspection and review of the quality control plan. All prerequisite requirements must be met.

4.2 Sampling and testing procedures followed by the supplier shall be in accordance with Michigan Test Methods, ASTM and AASHTO standards as referenced in Standard Specifications for Construction, MDOT Materials Source Guide, Procedures for Aggregate Inspection, Materials Quality Assurance Procedures Manual, appropriate supplemental specifications and/or special provisions.

4.3 *Documentation* - All test results will be kept for a minimum of three calendar years. An approximation of each week's production for each prequalified aggregate will be documented. This information shall be available upon request to MDOT.

4.4 *Quality Control Plan* - The supplier shall establish and maintain a process control program that has been reviewed and approved by C&T and controlling MDOT Region. This program will aid the supplier in producing uniform materials.

4.4.1 A quality control plan will include at least the following information unless a waiver is granted for a specific item:

4.4.1.1 Production Sampling Frequency and Location

- What plant checks are routinely performed?
- Where and when samples are obtained.
- Approximate amount of material covered by each test.

- 4.4.1.2 Major events including plant start up, screen changes, and breakdowns which affect aggregate production must be documented.
- 4.4.1.3 Analysis of Test Results to produce a control chart which will be posted in a prominent location and kept up to date.
  - The update interval will be stated.
- 4.4.1.4 Action Plan for suppliers who produce their own aggregates when material is outside warning band or specification limits:
  - List what operational procedures will be followed to bring the material back within specification.
  - State when and where sampling and testing the new production will occur.
  - The supplier will halt or divert the new production from adding to the existing stockpile if the test results indicate the material is still outside specification limits.
  - In addition, the disposition of any material failing to meet specifications will be recorded.
  - What method is going be used to distinguish the failing material from the specification material.
- 4.4.1.5 All other suppliers when the supplier is a dock, concrete plant or transfer point and a failing test result occurs:
  - The failing aggregate will be removed from the stockpile until specification material is located.
  - The supplier will increase their testing frequency for the aggregate remaining in the stockpile.
  - The disposition of all failing material will be recorded.
  - What method is going to be used to distinguish the failing material from the specification material?
- 4.4.1.6 The load-out sampling and testing frequency will be specified.
- 4.4.2 A copy of the Quality Control Plan will be sent to C&T and the controlling MDOT Region for review. An acknowledgment will be sent by C&T to the supplier upon completion of review.
- 4.4.3 Quality Control Plan changes must be reviewed by both C&T and the controlling Region. An acknowledgment will be sent by C&T to the supplier after the review is finished.

## 5. Supplier Notification of Shipment

- 5.1 The supplier shall notify the controlling MDOT Region's Materials Supervisor by facsimile the same day as the first aggregate shipment for each calendar year.

5.2 Each aggregate shipment delivered to a project or concrete plant shall be accompanied by a delivery ticket containing the MDOT aggregate source number, date of shipment, control section number, job number, or concrete plant number (if applicable), Michigan series number and class letter of aggregate, weight or volume shipped, supplier's name, telephone number and location. In addition, the following statement shall be printed or stamped on each trip ticket: "I attest that aggregate as delivered from this prequalified source meets specification requirements for listed Michigan series and class for quantity stated. Date\_\_\_\_\_ Signature\_\_\_\_\_." This statement must be signed by an authorized company representative.

5.2.1 Lack of delivery tickets or proper documentation can be cause for rejection of the aggregate.

5.3 The supplier will generate a summary report each week whether or not any material is shipped and FAX it to both the controlling Region's Materials Supervisor and C&T by the close of business on Monday of the week following shipment. The weekly summary report shall have the date it is generated, be sequentially numbered and include the following information for each type of aggregate; quantity and date shipped, the destination including MDOT project number, concrete plant number (if applicable), or Purchase Order Number.

5.3.1 When the supplier does not anticipate any aggregate shipments to MDOT or federal aid projects for several weeks, they may write "Until further notice, no state work" on the last weekly summary. Once this report is transmitted, the supplier will not be required to continue sending the weekly summaries. *Notification by FAX to the controlling MDOT Region's Materials Supervisor must be made on the same day shipments resume to federally funded or MDOT projects during the construction season.*

5.3.2 At the close of the construction season, the supplier may write "Last shipment for the season" on the weekly summary report.

5.3.3 Failure of the supplier to provide the controlling MDOT Region and C&T with weekly shipping summaries may result in suspension of prequalified status as stated in Section 9. In addition, improper use of the options in paragraphs 5.3.1 and 5.3.2 could also lead to a suspension of prequalified status.

5.3.4 C&T shall notify the supplier and affected MDOT Regions by certified mail of suspension of prequalified status.

5.3.5 Withdrawn prequalified privileges may be reinstated by consensus agreement between C&T and the controlling MDOT Region after the supplier has corrected their problems to the satisfaction of MDOT in accordance with Section 10.

## 6. MDOT Monitoring and Quality Assurance Program

6.1 Each Region's Materials Supervisor will have on file a copy of each supplier's weekly summary and a copy of each aggregate test run by region personnel on materials used within their region on MDOT projects.

- 6.2 MDOT's C&T Division will coordinate with the controlling MDOT Region in conducting a laboratory inspection of prequalified aggregate suppliers' equipment, procedures, and personnel prior to admission to the program and every two years thereafter. If significant production changes are made or if problems are indicated by other aspects of the monitoring program, more frequent inspections may occur. This inspection shall cover but is not limited to the following; the testing area, equipment, and quality control plan. In addition, MDOT will evaluate the supplier's sampling and testing procedures.
- 6.2.1 If a consulting firm is used by the supplier for quality control testing, C&T in conjunction with the controlling MDOT Region must conduct an inspection of the consulting firm's laboratory prior to admission to the program and every two years thereafter.
- 6.2.2 If a Prequalified Supplier switches consulting firms, their prequalified status will be suspended until a new inspection and approval of the testing facilities can be obtained. Should the new consulting firm be already participating in this program, the inspection may be waived.
- 6.2.3 A formal report will be prepared by C&T following each biennial inspection. A copy will be sent to the supplier and to the controlling MDOT Region. Deficiencies will be listed and requirements for corrective action given, including a time frame. Follow-up monitoring or testing may be done to assure that deficiencies are rectified. Failure by the supplier to correct deficiencies may result in loss of prequalified status.
- 6.3 The controlling Region will conduct Independent Assurance Tests on the supplier's quality control technician(s) according to the frequency given in the Independent Assurance Sampling and Testing chapter of the Materials Quality Assurance Procedures Manual.
- 6.3.1 If test results exceed Independent Assurance comparison limits, an investigation will immediately be made to determine the cause of the differences and what corrective action needs to be taken.

## 7. MDOT Quality Assurance Testing

- 7.1 MDOT's Region materials personnel will obtain random quality assurance (reduced acceptance) samples on each prequalified aggregate series. The aggregate may be randomly tested at any time prior to use. However, the sampling should be conducted as close as possible to the point where the material is incorporated into a mixture or the project. The minimum testing frequency for Coarse, Dense-Graded, Open-Graded, Fine and Granular Material Class I will be one test per 10,000 tons of material shipped. The minimum testing frequency for Granular Material Class II and IIA will be one test per 10,000 cyd. The minimum testing frequency for Granular Material Class III will be one test per 30,000 cyd. The minimum testing frequency for Granular Material Class IIIA will be one test per 3,000 cyd.
- 7.1.1 When more than 5000 tons of a single aggregate type is being shipped per week, the minimum testing frequency may be further reduced to one test per 30,000 tons provided the supplier has a two-year history of quality assurance

(reduced acceptance) tests exceeding 90 percent compliance with specifications.

- 7.1.2 The project quality assurance samples will be checked against the appropriate specification requirements and not to the supplier's load out test results.
- 7.2 The controlling MDOT Region will retain a copy of all quality assurance test records for a minimum of three years.
  - 7.2.1 A copy or computer record of the quality assurance test results will be forwarded to C&T.

## 8. Failing Material Resolution

- 8.1 If a quality assurance sample taken from the source or point of use does not meet Standard Specifications, the controlling MDOT Region will immediately notify the supplier by telephone and inform the supplier of the resample time and location. In addition, the supplier's quality control tests will be reviewed.
  - 8.1.1 **Aggregate Resample at Source** - If the original sample was taken from the stockpile's shipping face at the aggregate's source, which includes docks or yards, two resamples will be obtained from the same stockpile's shipping face using the mini-stockpile sampling method. If the average of the original and two resamples meet specifications, then the material is approved for use and no further action is necessary. If the average of the first test and two resamples do not meet specifications, then the failing material will be removed from the stockpile until specification material is located within the stockpile. Continued production of borderline material will result in three months' probation. Should the supplier refuse to remove the failing material, their prequalified status will be revoked and the Project Engineer, Contractor, and C&T informed immediately.
  - 8.1.2 **Aggregate Resample at Point of Use** - If the original sample was procured at a point of use, two resamples will also be from either the same location or another point of use provided the aggregate is from the same source. If the average of the original sample and two retests meet specifications, the material will be approved for use and no other action is required. However, more frequent sampling may be prudent. If the average of the original sample and the two retests fail to meet specifications, the technician will immediately inform the Project Engineer, Contractor, supplier, and C&T. All shipments from the source will stop until the supplier can sample their aggregate and are certain their material meets specifications. The supplier will not be allowed to ship the disputed material until the controlling Region's materials personnel have confirmed the supplier's test results. Continuing to provide non-specification aggregate will result in three months' probation.

## 9. Removal From Program

- 9.1 *Probation* - This condition means a supplier has been classified as noncompliant with this program by MDOT. Any infraction from the following list can result in a supplier being placed on probation:

- Delivering non-specification material to MDOT or federal aid projects.
- Failure to maintain a MCAT technician.
- Failure to maintain equipment meeting the requirements stated in this document.
- Failure to maintain proper documentation.
- Failure to follow approved quality control plan.
- Failure to notify the controlling Region when aggregate shipment starts.
- Failure to send MDOT the weekly shipment summaries.
- If the percentage of MDOT test results meeting specification requirements drops below 90 percent.

9.1.1 While on probation, the supplier will send copies of their quality control test results to the controlling Region and C&T. The controlling Region will increase their testing frequency. Probation is the first step toward a supplier losing their prequalified status.

9.2 Repeat infractions will result in loss of prequalified status.

9.3 The occurrence of any other type of infraction while on probation may result in the loss of prequalified Supplier status.

9.4 The following infractions can result in the immediate loss of prequalified status:

- Being uncooperative with MDOT in removing failing aggregate from a stockpile.
- Refusing to supply MDOT with copies of quality control records when requested.
- Falsification of any documents or test results.
- Shipping from a non-prequalified source.
- The percentage of Quality Assurance test results meeting specification requirements drops below 80 percent.

## 10. Restoration to Prequalified Status

10.1 The following steps must be taken for a supplier who has had their prequalified status removed:

- Reapply in accordance with this program.
- Update all application documentation.
- Specifically address the reason for losing the prequalification privilege and propose appropriate remediation of the original problem.

The controlling Region Materials Supervisor in conjunction with C&T will review the new application. Reinstatement to the program will place the supplier on a probationary status. The supplier will be re-evaluated after twelve months to see if their standing can be upgraded.

## CERTIFICATION PROCEDURES FOR ASPHALT BINDER

### 1. Scope

- 1.1 The Construction and Technology Division will allow suppliers to certify asphalt binder for use on MDOT projects if the following criteria are met.
- 1.2 Approved Asphalt Binder Certifier - a supplier that provides asphalt binder to meet MDOT specifications. A certifier may be a refinery, terminal or hot mix asphalt (HMA) producer. If any modifications or blending of binder from different sources is made at the HMA plant, the HMA producer shall be the certifier. A supplier must be approved at each location.
- 1.3 Laboratory - must be either the approved certifier's laboratory or a commercial laboratory. The laboratory shall be AASHTO accredited.
- 1.4 Letters and samples referred to in these procedures should be sent to:

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

### 2. Applying for Initial Certification Privileges

- 2.1 Applying for certification privileges must be done in writing and must contain the following information:
  - 2.1.1 Certifier's name.
  - 2.1.2 Location.
  - 2.1.3 List of grades which will be certified.
  - 2.1.4 A Quality Control Plan for review and approval by MDOT.
  - 2.1.5 Test results for five production runs of binder. This must be accomplished for each grade of binder that will be certified.
  - 2.1.6 Two 1.0 quart (1 liter) samples of each binder grade shall be submitted with the application letter.
  - 2.1.7 All specification tests pertaining to the binder grade must be performed for each grade of binder to be certified. The specification requirements for asphalt binder can be found in the current Standard Specifications for Construction. These test results shall be submitted in a report.
  - 2.1.8 An example copy of the Certification Document (meeting the requirements of Section 5).

- 2.1.9 The AASHTO Materials Reference Laboratory Reports for HMA Proficiency Samples from the past two years. These will be submitted by the laboratory that performs the quality assurance testing for the certifier.
    - 2.1.10 A current copy of the AASHTO accreditation certificate.
    - 2.1.11 A written and signed statement that the certifier will abide by the certification requirements.
  - 2.2 MDOT will consider the request for certification privileges and may grant provisional approval to certify asphalt binder for an MDOT project. Based on continued satisfactory field and laboratory performance of asphalt binder from this location, the provisional approval for certification will be on a project-by-project basis for one construction season.
  - 2.3 If certification privileges are granted, the applying supplier will be notified in writing by MDOT. The list containing the MDOT Approved Certifiers of asphalt binder, and the grades of binder which they are approved to certify, is found on the MDOT public website under the Construction and Technology section.
  - 2.4 The MDOT bituminous laboratory is limiting requests, for both initial certification and the addition of binder grades, to the months of November through April. During this period, MDOT will handle any sample testing involved without cost to the binder supplier. Any requests, for either initial certification or the addition of binder grades, 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 will be paid by the binder supplier.
3. Obtaining Certification Privileges for Additional Grades of Binder
  - 3.1 Application for Certification Privileges must be in writing and must contain the following:
    - 3.1.1 List of grades which will be certified.
    - 3.1.2 Two 1.0 quart (1 liter) samples of each binder grade shall be submitted with the application letter.
    - 3.1.3 All specification tests pertaining to the binder grade must be performed for each grade of binder to be certified.
  - 3.2 The MDOT bituminous laboratory is limiting requests, for both initial certification and the addition of binder grades, to the months of November through April. During this period, MDOT will handle any sample testing involved without cost to the binder supplier. Any requests, for either initial certification or the addition of binder grades, 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 will be paid by the binder supplier.
4. Annual and Monthly Requirements

On a monthly basis, from May through October, the approved certifier will submit quality control test reports that comply with the quality control plan referred to in Subsection 2.1.4. This shall be done for each grade supplied for MDOT projects during the previous month.

## 5. Certification Document

Each shipment shall be accompanied by a certification document. The certification document shall be transmitted to the Contractor. The certification document shall contain the following:

- a. Approved certifier's name.
- 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. Place of production.
- f. Source of shipment, if other than place of production.
- g. Purchaser (and/or consignee) and point of delivery.
- h. MDOT project and control section numbers.
- i. Bill of lading number.
- j. Carrier and truck or car number.
- k. The certification statement: "The (name of approved certifier) certifies that the asphalt binder, as transported to the Contractors plant, conforms to the MDOT specifications." This certification will be signed by a representative of the approved certifier.

## 6. MDOT Monitoring

Daily Certification Verification (CV) Samples (original samples of asphalt binder taken at the asphalt plant before incorporation into the mixture) will be taken and tested in accordance with the specification requirements described in the current Standard Specifications for Construction. These samples are taken to verify that the certified asphalt binder meets the required specifications.

The certification verification testing tolerance limits will be described by special provisions located in the project proposal.

## 7. Withdrawal and Reinstatement of Certification Privileges

- 7.1 When any test result, on a certification verification sample, is out of specification, MDOT will notify the approved certifier and Contractor by phone and in writing. The C&T laboratory will determine the extent of the deficiencies through the following concurrent actions. These actions will be coordinated by the C&T laboratory.
  - 7.1.1 The Project Engineer will be notified.
  - 7.1.2 MDOT will increase CV sample testing for the consecutive days surrounding the original failing tests from the project.
  - 7.1.3 MDOT will increase the amount of CV sample testing on the binder grade in question from other HMA plants.
  - 7.1.4 The C&T laboratory will require that the approved certifier and Contractor will investigate all aspects of material loading, handling and delivery.

- 7.1.5 MDOT will witness the sampling of the material from a transport truck when deliveries are made to a HMA plant. Samples will be taken by the Contractor according to Section 10, Sampling From Tank Cars, Vehicle Tanks, Distributor Trucks or Recirculating Storage Tanks of AASHTO T 40 (2007). There will be four one gallon (3.8 liter) samples taken: for testing by MDOT, an independent AASHTO certified laboratory, a retained sample and a sample for the binder certifier. MDOT's test results will be used to determine specification compliance. The AASHTO certified laboratory results will be used for information. MDOT reserves the right to determine if the material meets all specification requirements.
- 7.2 If two consecutive samples from separate transport trucks are found to be out of specification by more than the tolerance limits, the approved certifier will be notified by fax and certified letter that they have lost their certification privileges for the subject binder only. All MDOT regions will also be notified. 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.
- 7.3 Certification privileges can be reinstated only if the certifier has corrected the identified deficiencies and has described the actions taken to prevent future shipment of nonconforming asphalt binder.

## CERTIFICATION PROCEDURES FOR EMULSIFIED ASPHALT

### 1. Scope

- 1.1 The Construction and Technology Division will allow suppliers to certify emulsified asphalt for use on MDOT projects if the following criteria are met.
- 1.2 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.
- 1.3 Laboratory - Must be either the approved certifier's laboratory or a commercial laboratory.
- 1.4 Letters and samples referred to in these procedures should be sent to:

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

### 2. Applying for Initial Certification Privileges

- 2.1 Applying for certification privileges must be done in writing and must contain the following information:
  - 2.1.1 Certifier's name.
  - 2.1.2 Locations.
  - 2.1.3 List of the types of emulsified asphalt which will be certified.
  - 2.1.4 A Quality Control Plan for review and approval by MDOT.
  - 2.1.5 Test results for five production runs of emulsified asphalt. This must be accomplished for each type of emulsified asphalt that will be certified.
  - 2.1.6 Two 1 gallon (3.79 liter) samples of each type of emulsified asphalt shall be submitted with the application letter.
  - 2.1.7 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 shall be submitted in a report.
  - 2.1.8 An example copy of the Certification Document (meeting the requirements of Section 5).
  - 2.1.9 The AASHTO Materials Reference Laboratory Reports for Emulsified Asphalt

Proficiency Samples from the past two years or a current copy of the AASHTO accreditation certificate for emulsified asphalt testing. These will be submitted by the laboratory that performs the quality control testing for the certifier.

- 2.1.10 A written and signed statement that the certifier will abide by certification requirements.
  - 2.2 If certification privileges are granted, the applying supplier will be notified in writing by MDOT. 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 public website under the Construction and Technology Division section.
  - 2.3 The C&T laboratory is limiting requests, for both initial certification and obtaining privileges for additional types of emulsified asphalt, to the months of November through April. During this period, MDOT will handle any sample testing involved without cost to the emulsified asphalt supplier. Any requests of this nature received during the months of May through October will be sent to a third party, ASSHTO accredited laboratory, chosen by MDOT. The cost of sample testing will be paid by the emulsified asphalt supplier.
3. Obtaining Certification Privileges for Additional Types of Emulsified Asphalt
    - 3.1 Application for Certification Privileges must be in writing and must contain the following:
      - 3.1.1 List of types of emulsified asphalt which will be certified.
      - 3.1.2 Two 1.0 gallon samples of each type of emulsified asphalt shall be submitted with the application letter.
      - 3.1.3 All specification tests must be performed for each type of emulsified asphalt to be certified.
    - 3.2 The C&T laboratory is limiting requests, for both initial certification and obtaining privileges for additional types of emulsified asphalt, to the months of November through April. During this period, MDOT will handle any sample testing involved without cost to the emulsified asphalt supplier. Any requests of this nature received during the months of May through October will be sent to a third party, ASSHTO accredited laboratory, chosen by MDOT. The cost of sample testing will be paid by the emulsified asphalt supplier.
4. Monthly Requirements
    - 4.1 On a monthly basis, from May through October, the approved certifier will submit quality control test reports that comply with the quality control plan referred to in Subsection 2.1.4. This shall be done for each type of emulsified asphalt supplied to MDOT projects during the previous month.
5. Certification Document
    - 5.1 Each shipment shall be accompanied by a certification document. The certification document shall be transmitted to the Contractor. The certification document shall

contain the following:

- Approved certifier's name.
- Type of emulsified asphalt.
- Tank number.
- Quantity of emulsified asphalt shipped to the MDOT projects (gallons at 60°F).
- Name and location of the manufacturer.
- Source of shipment, if other than the place of manufacture.
- Purchaser (and/or consignee) and point of delivery.
- MDOT project and control section numbers.
- Bill of lading number.
- Carrier and truck or car number.
- A certification statement: "The \_\_\_\_\_ (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.

## 6. MDOT Monitoring

- 6.1 Certification Verification (CV) samples will be submitted by the certifier directly to the MDOT HMA laboratory 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 MDOT HMA 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 current Standard Specifications for Construction and also with requirements described in special provisions located in the contract document. These samples are taken to verify that the certified emulsified asphalt meets the required specifications.
- 6.2 CV samples shall consist of two ½ gallon (1.89 liter) containers of emulsified asphalt accompanied by a completed MDOT Sample Identification form (Form 1923 found on the MDOT public website).

## 7. Withdrawal and Reinstatement of Certification Privileges

- 7.1 When any test result, on a certification verification sample, is out of specification, MDOT will notify the approved certifier by phone and in writing. The C&T laboratory will increase the amount of CV sample testing on the type of emulsified asphalt in question.
- 7.2 If another CV sample, taken after the approved certifier was initially notified of a deficiency (7.1), is found to be out of specification, the approved certifier will be notified by fax and certified letter that they have lost their certification privileges for the subject type of emulsified asphalt only. All MDOT regions will also be notified. 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.
- 7.3 Certification privileges can be reinstated only if the certifier has corrected the identified deficiencies and has described the actions taken to prevent future shipment of nonconforming emulsified asphalt.

## CONCRETE PIPE, CULVERT, AND RELATED ITEMS

### 1. Purpose

- 1.1 To provide a means by which the Michigan Department of Transportation may acquire - from specific qualified sources - concrete pipe, precast units for drainage structures and sections for culverts of the required quality while eliminating the necessity of testing on a project-by-project basis.

### 2. Scope

- 2.1 These procedures include the certification of all concrete pipe, precast units for drainage structures and sections for culverts manufactured and tested in accordance with current ASTM or AASHTO specifications. Concrete brick, block and manhole bases are accepted from approved certifiers' lists on the basis of a General certification and are not covered by this procedure.

- 2.2 The items certified by this procedure shall be manufactured and tested according to the requirements of the following:

|             |              |  |
|-------------|--------------|--|
| 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 Box Sections for Culverts, Storm Drains, and Sewers.                 |

### 3. Testing Procedures

#### 3.1 Concrete Pipe and Precast Units for Drainage Structures

- 3.1.1 Each production run of pipe or precast units for drainage structures intended for use on MDOT projects shall be tested in accordance with current ASTM specifications. The frequency of testing shall be that which the supplier determines necessary to assure compliance with specification requirements.

#### 3.2 Precast Concrete Sections for Culverts

- 3.2.1 Testing frequency shall be as specified in ASTM C 1504, ASTM C 1577, or Special Provisions of the Contract.

- 3.2.2 Compressive strength shall be determined in accordance with the applicable ASTM or AASHTO specification.
  - 3.2.3 Section dimensions and geometry, and type and location of reinforcement shall be verified and reported for each segment.
  - 3.2.4 The producer shall certify the aggregates, cement and steel reinforcement used meet the requirements according to ASTM C 1504, ASTM C 1577, or Special Provisions of the Contract, as applicable.
  - 3.2.5 For sizes with span lengths over 10 feet through 20 feet, the owner may perform Quality Assurance testing and inspection as deemed appropriate.
  - 3.2.6 For sizes with span lengths in excess of 20 feet, the owner will perform Quality Assurance testing and inspection as deemed appropriate.
- 3.3 Acceptance of Precast Culvert Sections over 20 feet in length.
- 3.3.1 After loading, and prior to shipping, each section shall be stamped or tagged "Approved for Use" by the inspector. The stamp or tag is for use by the Department and shall not relieve the Contractor of the responsibility for the quality of materials or workmanship.

#### 4. Conducting Tests

- 4.1 The required quality control testing may be conducted by an independent testing laboratory, professional engineer or any responsible representative designated by the manufacturer, except as provided in Sections 3.2.5 and 3.2.6 above.

#### 5. Load Testing Equipment

- 5.1 In accordance with the requirements of Section 909.02 of the Standard Specifications for Construction, each pipe and tile manufacturer will be required to provide a suitable standard testing machine in good working order and accurately calibrated.
- 5.2 Manufacturers producing only Precast Units for Drainage Structures under these procedures will not be required to provide a standard testing machine, if an independent testing laboratory is engaged to perform the testing. Independent testing laboratories shall provide a standard testing machine.
  - 5.2.1 All testing machines will be calibrated by the Standard Methods of Verification of Testing Machines, ASTM E 4.
- 5.3 To meet these requirements, pipe testing machines will be verified yearly in accordance with the following schedule:
  - 5.3.1 On-site verification will be required beginning on the next anniversary due date with succeeding on-site verification each third year thereafter.
  - 5.3.2 Off-site verification will be permitted for each of the two intervening years.

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 machine usually conducted at a place other than the pipe manufacturing plant.

5.4 Report and Certification - In addition to the information listed in ASTM E 4, Section 20 and 21, the report submitted to C&T, will include 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.

5.4.1 The calibration table shall be prominently posted near the testing equipment.

## 6. Test Reports

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

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

## 7. Product Identification

7.1 Concrete Pipe and Precast Units for Drainage Structures

7.1.1 Markings shall be clearly legible and made with a permanent type marking medium. Each unit shall be marked 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

7.2 Precast Concrete Sections for Culverts

7.2.1 Sections shall be marked according to the requirements of ASTM C 1504, ASTM C 1577, or Special Provisions of the Contract.

## 8. Records

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

## 9. Manufacturer's Certification

- 9.1 The manufacturer shall complete a certification containing appropriate information from 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

- 9.2 Two copies of the certification shall accompany the shipment and one copy shall be mailed, on the day of shipment, to:

Michigan Department of Transportation  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909

or faxed to the Construction and Technology Division at (517) 322-5664.

## 10. Stockpiling

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

## 11. Certification Verification

- 11.1 MDOT will verify the manufacturer's certification and procedures by certification verification testing a minimum of once per year.

- 11.2 The Certification Verification will consist of one or more of the following:

11.2.1 Random sampling and testing.

11.2.2 Review of inventory records.

11.2.3 Inspection of stockpiling practices.

11.2.4 Observation of manufacturing process.

12. Withdrawal and Reinstatement of Certification Privileges

- 12.1 In instances of violation of the certification procedure, the privilege of certification may be rescinded after review and action by C&T and further shipments to MDOT projects will be tested on a project-to-project basis.
- 12.2 Withdrawn certification privileges can be reinstated by C&T if the certifier has corrected their problems to the satisfaction of MDOT.

## CONCRETE PAVEMENT CORING

### 1. Scope

- 1.1 Before the MDOT accepts a concrete pavement project, cores are taken to determine the thickness of the pavement and the depth of pavement reinforcement are in accordance with specification requirements.

### 2. Related Documents

- 2.1 MDOT Standard Specifications for Construction
- 2.2 Test Method MTM 201
- 2.3 ASTM Standards - ASTM C 42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- 2.4 AASHTO Standards - T 148 Measuring Length of Drilled Concrete Cores

### 3. Procedure

- 3.1 The concrete pavement coring work unit consists of a crew leader and an assistant equipped with a passenger vehicle and a truck mounted drill.
- 3.2 After each letting, C&T provides to the crew leader, in condensed form, a listing of all projects awarded. The project information includes the project number, location, date of bid, type of work, the Contractor and the Project Engineer. Upon receipt of this information, the crew leader and Pavement Unit Engineer jointly determine the order in which the projects are to be cored. By maintaining contact with the Contractor, Project Engineers and TSC office personnel the degree of completion of pavement for each project is determined. Depending upon the schedule of traffic closures, the project may be cored all at once or piecemeal. The project office provides the crew leader with applicable project plans, supplemental specifications and Special Provisions before coring starts. The crew leader is responsible for determining, through the Project Engineer, construction changes affecting the coring requirements.
- 3.3 In general an attempt is made to complete the coring requirements of a project before it is opened to traffic. Specifically, projects or areas of projects that contain single lanes must be cored before being opened to traffic.
- 3.4 On pavements recently constructed, the Project Engineer must be contacted to determine whether the pavement has attained sufficient strength to support the weight of the core drill truck.
- 3.5 The location and number of cores to be taken from each project is governed by the requirements outlined in MTM 201. The classification of cores is described in the Standard Specifications.
- 3.6 Cores are taken from the pavement in accordance with ASTM C 42 and measured in accordance with AASHTO T 148. No core will be taken less than 2 feet (0.6 m) from a transverse joint or less than 1 foot (0.3 m) from either a longitudinal pavement joint or

the edge of pavement. If lane ties exist, no core will be taken less than 2 feet (0.6 m) from either a longitudinal pavement joint or the edge of pavement.

- 3.7 As each core is drilled, the core number, stationing, location relative to a noted reference line, (e.g., edge of pavement, centerline, edge of ramp) length of core and depth of reinforcement is logged in a field notebook maintained by the crew leader. At the completion of each day's coring the field notes are transferred to the Pavement Core Record (Form 502) for the permanent record.
- 3.8 Each core taken is numbered consecutively starting with core No. 1 at the beginning of each calendar year and continuing to the end of the calendar year.

#### 4. Report and Records

- 4.1 Each project number requires an individual Pavement Core Record (Form 502). Each individual lane is entered on the form in its entirety, in uninterrupted pavement station sequence. Each lane is fully described under "Remarks" by road plans orientation including as constructed POB, POE, thickness, width, location, limits of bridges and gaps and station equations.
- 4.2 Form 502 is submitted to the Pavement Unit Engineer for review at the end of each week. The form is then distributed to the Project Engineer and the TSC office.
- 4.3 Ten percent of the cores taken from each project, and all cores deficient in thickness or steel depth and their companion "additional" cores are retained and submitted to the central laboratory for review. A minimum of one core from each project shall be submitted. Each core submitted to the central laboratory is identified by a core number and project job number marked on the core.
- 4.4 The crew leader completes the Core Drill Weekly Activity Report (Form 535) at the end of each week. The crew leader will return the reports.
- 4.5 The following forms are to be completed and submitted to the central laboratory with the cores:
  - 4.5.1 *Sample Identification (Form 1923)* - One Sample Identification Form for each project, listing all the core numbers being submitted for that project.
  - 4.5.2 *Pavement Core Record (Form 502)* - One Pavement Core Record for each project, to include the following:
    - Control Section and Job Number
    - Contractor
    - Core number(s)
    - Measured core depth
    - Measured depth of steel
    - Date cored
    - Operator's name

## CONCRETE PIPE INSPECTION

### 1. Scope

- 1.1 This procedure is to supplement the normal sampling, testing and inspection of concrete pipe by listing various exceptions to the applicable documents.
- 1.2 These exceptions are found in Sections 3, 4 and 5 of this document.

### 2. Applicable Documents

2.1 Standard Specifications for Construction.

2.2 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       |

2.3 MDOT Materials Source Guide

### 3. Basis of Acceptance

- 3.1 Pipe less than 3 feet (1 meter) in diameter will be tested by the three edge bearing method of full sized units of pipe unless otherwise specifically authorized.
- 3.2 Pipe 3 feet (1 meter) 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.
- 3.3 In special cases, and with prior approval, concrete strength may be determined by making and testing at least two 6 x 6 inch (15 x 30 mm) cylinders from the concrete used in casting the pipe.
  - 3.3.1 Cylinders are to be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

4. Calibration of Testing Devices

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

4.2 The "Certification of Calibration" will be posted near the testing equipment.

5. Reports

5.1 The results of inspection will be reported on "Pipe and Tile", Form 1920.

**CORRUGATED METAL PIPE AND METAL END SECTIONS FABRICATION**1. Scope

- 1.1 Corrugated Metal Pipe and Metal End Sections are generally furnished for use on MDOT projects on the basis of the fabricators certification.
- 1.2 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.

2. Applicable Documents

## 2.1 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

## 2.2 Materials Quality Assurance Manual

- C 2 Certification Verification Sampling and Testing
- D 14 Coating Thickness Determination

3. Procedure3.1 *Corrugated Metal Pipe*

- 3.1.1 This inspection is primarily a visual inspection of an order of completely fabricated pipe and consists essentially of dimensional measurements and workmanship. It includes, but is not limited to, the inspection and/or reporting of such items as follows:
  - 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.
- 3.1.2 Assistance needed for proper inspection will be provided by the fabricator or contractor depending on where the inspection is being conducted.

- 3.1.3 Uncertified sheets used in the fabricated order will require sampling and testing when their number exceeds the visual inspection limits found in Section G of this manual.
- 3.1.4 Determination of the metallic coating thickness by the use of a magnetic thickness gage, or positector will be permitted on allowable "visual inspection" quantities only.
- 3.1.5 Among others, the following defects are specified as constituting poor workmanship and the presence of any or all of them in any individual pipe or in general in any shipment shall be sufficient cause for rejection of uncertified material:
- 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.

- 3.1.6 Steel coupling bands are to be coated with the same coating (zinc or aluminum) as is on the pipe to be coupled. Aluminum coupling bands are to be used with aluminum pipe.

## 3.2 *Metal End Sections*

- 3.2.1 This inspection is primarily a visual inspection and consists essentially of dimensional measurements, determination of coating thickness and workmanship.
- 3.2.2 The metallic coating on steel end sections shall be the same as the coating on the pipe except zinc-coated steel end sections may be used with aluminum-coated steel pipe.
- 3.2.3 Aluminum end sections are to be used with aluminum pipe.
- 3.2.4 Determination of the coating thickness may be by the use of a magnetic thickness gage or positector.

- 3.2.5 The end sections are to be furnished with the appropriate coupling band and connector section.
- 4. Identification of Material
  - 4.1 Acceptance Testing
    - 4.1.1 A sufficient number of pieces of pipe, coupling hands and end sections will be tagged with red approval tags so the order can be identified at the project site.
    - 4.1.2 Each tag will show the date of inspection, Control Section ID, Job Number and inspector's name.
- 5. Certification Verification
  - 5.1 A sufficient number of pieces in the shipment will be checked and reported to validate the quality of the manufacturer's product.
  - 5.2 Information may be reported for each piece of material checked or if appropriate, averages of several measurements, weights, etc. may be reported.
  - 5.3 The remarks section of all certification verification inspection reports shall include a statement as to whether the material does or does not meet specification requirements.
- 6. Reports
  - 6.1 Inspection of corrugated metal pipe and end sections will be reported on Corrugated Metal Pipe, Form 1919.

## GLASS BEAD SAMPLING

### 1. Procedure

- 1.1 A number of bags shall be selected at random, from separate pallets, equivalent to the cube root of the total bags in the shipment. In order to alleviate the probability of segregation, mix the contents of each of the bags selected by rolling them through at least two revolutions.
- 1.2 Lay one of the selected bags on a board, open the bag's self-seal closure and insert a thin-walled 1 inch by 36 inch (25 mm by 1 meter) tube diagonally through the beads. Insert the tube through the vertical center-line of the beads until the tube fore-end reaches the bag corner, which seals further entry of beads into the tube.
- 1.3 Seal the bag closure about the tube and tilt the board with the bag of beads thus allowing the sample to flow out of the tube into a container. About 1 pound (500 g) of beads is collected by this process.
- 1.4 Repeat 1.2 and 1.3 on the remaining bags selected.
- 1.5 Consolidate the samples representing a single shipment into one container and forward at least 4 pounds (2 kg) to the laboratory for testing.
- 1.6 The average gross bag weight shall be noted in the remarks section of the I.D. form.
  - 1.6.1 The average gross bag weight shall be determined by selecting ten bags, at random, from each shipment and weighing them to the nearest 0.5 pound (or smallest graduation of the scale being used). The average of these ten weights (to the nearest 0.5 pound) would be the average gross bag weight as reported in the I.D. form.

NOTE 1: In determining weights of individual bags of beads, the scale should be set up and brought to balance with a standard 50-pound (22.7 kg) weight on the scale and the weight indicator set to read 50 pounds (22.7 kg). This method would assure that the scales are accurate in the 50-pound (22.7 kg) range.

NOTE 2: If the material is received in boxes, open one box in each shipment so at least half of the surface is exposed. Using a scoop, criss cross diagonally across the surface. Empty material into a sample bag. Collect at least 4.5 pounds (2 kg) of material and submit to the laboratory. Reseal the bag inside the box after collecting the sample.

## LANE TIE AND CONCRETE ANCHOR TESTING

### 1. Scope

- 1.1 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.

### 2. Summary

- 2.1 Lane tie or anchor pull-out tests consist of applying load to contractor installed devices by use of a testing frame and calibrated hydraulic cylinder. The load is applied at a uniform rate by a hand operated hydraulic pump and monitored with a pressure gage. Extrusion of the devices from the concrete is measured by a dial indicator.
- 2.2 The testing method has evolved as a result of pull-out tests performed by the MDOT Research Laboratory.

### 3. Applicable Documents

- 3.1 Lane tie load sustaining requirements may be covered by the current edition of MDOT's Standard Specifications for Construction 602.03F and 914.10, Standard Plan R-41 series, or Supplemental Specifications included with the project proposal.

### 4. Equipment and Supplies

#### 4.1 Testing Equipment

- Testing frame; including hydraulic cylinder.
- Hydraulic pump unit; including hose and hydraulic pressure gage.
- 50 pound (22.7 kg) weight with attached  $\frac{3}{4}$  inch (19mm) diameter rod.
- Dial indicator kit.
- Drawbar and wedge fixture.

#### 4.2 Additional Equipment

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

- 4.3 Each district has been supplied with testing equipment, including a pressure vs. load calibration sheet for the assigned equipment.

## 5. Selection of Sample

- 5.1 There shall be no lane tie pull-out tests performed until the concrete has attained a flexural strength of 550 psi (3.8 MPa) [653 psi (4.5 MPa) for certain torque anchors].
- 5.2 From each project on which tests are requested, select a minimum of 15 samples for testing. Whenever possible, 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 checked. The number of times that a job must be checked will depend on the total number of meters of bulkhead joints with anchoring devices. Such policy shall be set by the Project Engineer.

## 6. Test Procedure - Anchoring Devices Used as Lane Ties

- 6.1 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.**

- 6.2 Slightly preload the anchoring device 100 lbf (450 N) to 200 lbf (900 N), by applying pressure with the hydraulic cylinder.

- 6.3 Position and preload dial indicator to measure extrusion of the anchoring device. Zero 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.**

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

- 6.5 Monitor both the pressure gage and dial indicator until one of the following occurs:

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

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

- 6.5.2 If there is not sufficient movement of the anchor to reach 1/16 inch (1 mm) extrusion, load to 12,000 lbf (53,400 N) and stop. Record the capacity as 12,000 lbf (53,400 N).

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

| Sample Number | Load at Initial Slippage | Load at 1mm Extrusion | Ultimate Load | Ultimate Extrusion |
|---------------|--------------------------|-----------------------|---------------|--------------------|
|---------------|--------------------------|-----------------------|---------------|--------------------|

- 6.7 The additional information on the data sheets is not essential; however, it can provide a

useful reference.

- 6.8 If the 12,000 lbf (53,400 N) load is not reached, the ultimate load is taken 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. Be sure that gripping devices are not slipping.
- 6.9 The lane ties are acceptable if the average load per meter of joint equals or exceeds the requirements of Section 602.03F of the Standard Specifications.

## 7. Test Procedure - Anchoring Devices for Applications Other Than Lane Ties

- 7.1 The procedure for testing anchoring devices used for applications other than lane ties is the same as the procedure used for lane ties. If testing is required, the requirements for load sustaining capabilities and extrusion shall be as stated in the project plans or supplemental specifications.

## PRESTRESSED CONCRETE FABRICATION INSPECTION

### 1. Scope

- 1.1 This procedure should be used to aid the inspector in interpreting and enforcing the specification for precast concrete beam fabrication, and shall apply to other miscellaneous prestressed element fabrication. This includes the time from which the casting beds are prepared through loading for shipping to the construction site.

### 2. Referenced Documents

- 2.1 Standard Specifications for Construction (Section 708)

- 2.2 Michigan Test Methods 205 and 206

- 2.3 AASHTO Standards

T 22 Compressive Strength of Cylindrical Concrete Specimens.

- 2.4 ASTM Standards

A 185 Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

A 416 Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

A 497 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 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 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.

- 2.5 Construction and Technology Division Material Source Guide.

### 3. Qualifications

- 3.1 *Qualifications and Responsibilities of the Inspection Agency* - The agency responsible for the fabrication inspection of prestressed concrete shall have on its staff a registered professional Engineer or a Prestressed Concrete Institute (PCI) Level II Certified Technician. The Engineer or PCI Level II Technician is the responsible party, representing the owner, to ensure that all provisions of the contract are met relating to

- the fabrication of the prestressed concrete components. An inspector shall be on-site at the fabrication facility during all phases of fabrication.
- 3.1.1 It is the owner's responsibility to obtain the necessary services of a professional Engineer when making structural decisions. The Engineer is responsible for the review and approval of the shop drawings, fabrication and concreting procedures, and for professional decision making, as required. The Engineer has the prerogative for holding a prefabrication meeting with the manufacturer to discuss and clarify the contract plans and specifications. The Engineer is the responsible party, representing the owner, to ensure that provisions of the contract are met relating to the design and fabrication of prestressed concrete.
  - 3.2 *Qualification and Duties of the Inspector* - The work requires the inspector to be proficient in performing tests on fresh concrete. These tests include slump, air content, temperature, and making compressive test specimens. The inspector must be certified as a concrete technician through a program conforming to the guidelines established by the American Concrete Institute for Certification of Concrete Field Testing Technicians and be at least a Level I Prestressed Concrete Technician through the Prestressed Concrete Institute.
    - 3.2.1 The inspector shall be provided with a complete set of approved shop drawings and all applicable specifications for each project. Production shall not start until the inspector has received approved shop drawings.
  - 3.3 *Deficiencies on Local Agency Projects* - When fabrication or inspection deficiencies are found on local agency projects by an inspector not directly responsible for inspection of the local agency project, the deficiencies shall be reported (by telephone) to the resident Engineer responsible for construction oversight. A confirming letter shall be sent to the resident Engineer with copies distributed to C&T and the Local Agency Programs Section of the Design Division.

#### 4. Inspection Procedure

- 4.1 Before actual operations on a contract are started, a prefabrication meeting may be required with the owner or agency representing the owner, the inspector and the manufacturer to ensure the factors affecting acceptance of the beams or elements are understood. This meeting would also provide an opportunity for all parties to discuss and clarify specifications, special details and manufacturing methods and procedures particular to the project. All details should be discussed and agreed upon at this prefabrication meeting. Minutes of the meeting shall be recorded and filed with other project documents.
  - 4.1.1 Inspection of prestressed concrete is similar to inspection of any other work performed during bridge construction. It consists mainly of seeing that the plans and specifications are followed. After becoming familiar with the shop drawings and specifications, the inspector shall ensure that he has copies of the certificates for certified materials, or has received approved test results for all materials to be used in the fabrication of the beams or elements.

- 4.1.2 MDOT's Materials Source Guide shall be reviewed for names of manufacturers authorized to certify, materials that may be certified, and sampling frequencies for other materials.
  - 4.1.3 In addition to the following specific inspection duties, the inspector shall note and record any specification deficiencies in any other materials and operations. Examples would include condition of the casting bed and form work, curing of the beams or elements, handling, storage in the yard, and loading for shipment.
- 4.2 *Strand Tensioning*
- 4.2.1 *General Information* - While the untensioned strands are being positioned on the casting bed, the inspector shall observe the strands to assure that all strands are free of oil or other foreign material. Strands with kinks, bends, nicks or other defects, including scale or excessive rust, shall not be permitted.
    - 4.2.1.1 Strands are positioned to duplicate the strand pattern shown on the approved shop drawings. To combine two strand patterns on a bed, or to simplify fabrication, there is no limit to the lateral movement of fully bonded strands or the number of strands moved provided specified concrete cover, the 2 inches (50 mm) spacing between strands, and the number of strands per row is maintained and the resulting strand pattern is symmetrical about the centerline of the beam or element. Changing the vertical position of the strands must have the approval of the Engineer.
    - 4.2.1.2 When two strand patterns are combined on a casting bed a bond breaker is placed on each of the unrequired strands for the full length of each beam or element. A maximum of two full length debonded strands per beam or element is permitted.
    - 4.2.1.3 All supports used to position the rows of stands at the ends of the unit and at intervals along the casting bed shall be of adequate thickness to hold the stands in the true position.
    - 4.2.1.4 The inspection of the tensioning operation consists primarily of observing the accurate introduction of the prestressing force in each of the strands. Final stressing of the strands is performed by application of tension to each strand to produce a measured elongation, recorded in inches, equaling a *COMPUTED ELONGATION*. The inspector shall determine the allowable specified stress by measuring the elongation of the individual strands. The maximum load applied to each strand, as indicated by the pressure gauge of the tensioning device, is also recorded.
  - 4.2.2 The inspector shall determine the amount of load or stress induced in each strand by the following procedures:
    - 4.2.2.1 *Initial Load* - After all strands have been strung on the casting bed each strand is secured by a strand-vise at the anchor end of the casting bed. At the tensioning end of the casting bed each strand is individually fitted,

in turn, in a jacking device and an *INITIAL LOAD* applied. The *INITIAL LOAD* shall be designated by the fabricator but shall not exceed 5000 lbf. (22.2 kN).

When the *INITIAL LOAD* is reached, a reference mark is made on the strand on the outside of the jacking device. The *INITIAL LOAD* is applied to each strand to establish a constant starting point for the *FINAL MEASURED ELONGATION* measurements. 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.

NOTE: In determining the elongation required, attention is called to the consideration that must be given to the elongation obtained when the *INITIAL LOAD* is applied. The *INITIAL LOAD*, converted to theoretical inches of elongation, is subtracted from the *COMPUTED ELONGATION* to determine the *FINAL MEASURED ELONGATION* required.

4.2.2.2 *Final Measured Elongation* - Each strand at the anchor end of the bed is marked at the inside of the anchoring bulkhead after the *INITIAL LOAD* has been applied. At the completion of the *FINAL MEASURED ELONGATION* operation any slippage of the strand through the strand-vice is noted and the slippage measurement is deducted from the elongation measurement to determine the *FINAL MEASURED ELONGATION*. Each strand shall then be tensioned. The distance between the reference mark on the strand and the outside of the jacking device shall be measured to the nearest 0.0625 inches (2 millimeters) to determine when the *FINAL MEASURED ELONGATION* has been attained. If the measured elongation is equal to or slightly greater than (5 percent or less) the computed elongation, the tensioning operation is completed. Minor adjustments in the jacking operation are made to bring the reference mark to the desired measurement. When the tensioning operation for each strand has been completed and before the tension is released from the jack, a second reference mark shall be made on the strand at the *inside* of the anchoring plate and the strand-vice then tapped into position against the outside face of the anchoring plate. When the tension has been released from the jack the inspector shall check and reference marks on the strand at the inside of the anchoring plate to determine that no slippage of the strand-vice has occurred.

4.2.2.3 *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 strand elongation computation is checked, the casting bed length is confirmed, the modulus of elasticity of the strand is verified, and 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. One broken strand wire per beam or element is acceptable.

4.2.2.4 *Tensioning Draped Strands* - In tensioning draped strands the inspector must be alert to the strand elongation - loading rate 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.

4.2.2.5 A uniform elongation over the entire bed length in a draped strand tensioning operation, with tensioning at one end only, may be confirmed by marking-off a 10 foot (3 meter) (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 *FINAL MEASURED ELONGATION* computation for 10 feet (3 meters) of strand length.

### 4.3 *Forming and Casting*

4.3.1 *General Information* - As the fabrication operation proceeds, the inspector shall confirm the dimensional requirements of the bulkheads, side forms, bearing plates, steel reinforcement, void boxes, inserts and any other devices necessary or required by the plans and specifications.

4.3.2 *Concrete Forms* - Concrete forms shall be maintained during their use true to the shapes and dimensions shown on the approved drawings.

4.3.2.1 Only metal forms shall be used. These are designed and aligned so that they will 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 shall have smooth joints and inside surfaces accessible for adequate cleaning after each use.

4.3.2.2 Joints between panel forms shall be made and maintained smooth and tight. Unless otherwise shown on plans, all corners or intersections of surfaces exposed in the completed structure shall be mitered with a minimum dimension of 0.50 inches (13 millimeters) and all re-entrant angles shall be rounded with a minimum radius of 0.75 inches (20 millimeters).

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

4.3.3 *Reinforcing Steel* - The inspector shall confirm that the reinforcing steel is of the correct size, free from defects and properly positioned. The reinforcing steel must be free of oil or lubricants, and excessive rust. If epoxy coated bars are to be used, excessive nicks in the coating are not permitted.

- 4.3.3.1 The inspector shall confirm that the reinforcing steel has been properly positioned and secured in accordance with the plans and make certain that inserts have been placed where required.
- 4.3.4 *Void Boxes* - Void boxes, when required, shall be of the dimensions and positioned in the form in accordance with plans.
  - 4.3.4.1 After the positioning of the bar reinforcement assembly in the form, the inspector shall confirm that the void boxes are securely clamped to the form so they cannot move out of position during the consolidation of the concrete. After the unit has been cast, and immediately after the top has been struck-off, the top slab thickness shall be confirmed by the inspector 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 measured on 2 foot (600 millimeters) centers (longitudinally).
- 4.3.5 *Tests on Fresh Concrete* - The fabricator shall provide the personnel and equipment necessary for obtaining samples of fresh concrete and perform the following tests.
  - 4.3.5.1 *Slump* - The inspector shall make observations of the consistency of the freshly mixed concrete for each unit as measured by the slump test in accordance with ASTM C 143. Use Form 551 to record slump tests results.
  - 4.3.5.2 *Air Content* - An air content test shall be made on the first batch of concrete for each days production to determine conformity with specification requirements. Additional air tests shall be made on concrete for each beam or element unit. Tests will be performed in accordance with ASTM C 231 or C 173 as appropriate for the testing device used. Air tests shall be reported on Report of Field Tests, Form 551. In the event the concreting operation is halted two hours or more, an air check shall be made on the first batch of the subsequent concrete production.
  - 4.3.5.3 *Temperature* - The air, fresh concrete, and curing temperatures (when required) shall be reported. Temperatures shall be recorded on Report of Field Tests, Form 0551.
- 4.3.6 *Placing of Concrete* - The concrete shall be promptly placed with minimum handling to avoid segregation of the materials and the displacement of the reinforcement, and the minimum vibration necessary to thoroughly consolidate the concrete. Each unit shall be cast in a continuous operation with no interruption in excess of 45 minutes between the placing of contiguous portions of concrete and each layer shall be placed and consolidated before the preceding layer has taken initial set.
- 4.4 *Transfer of Prestress* - The tension in the strands shall not be transferred to the concrete in the beam or element unit until the concrete has attained the required

compressive strength as indicated by the test results of the cylinders which have been cast and cured for this purpose as described in the Standard Specifications.

- 4.4.1 The strands are then released by simultaneously cutting with a torch at each end of the casting bed, or other department-approved method, maintaining symmetry about the vertical centerline.
- 4.4.2 Upon completion of the concrete curing process and the cutting of the strands, the forms are removed and the units moved from the casting bed. After removal from the bed, the inspector shall immediately inspect the beam or element for any defects created during the concreting operation and thoroughly check the dimensions. The inspector shall note any defects or corrections required on Report Form 0551. Distribution will be made to C&T and the Manufacturer.
- 4.5 *Curing Requirements* - Curing requirements for prestressed concrete beams or elements shall be as specified in Subsection 708.03 of the Standard Specifications and as modified by the contract specifications. When steam or radiant heat curing is used, recording thermometers shall be provided by the fabricator showing the time/temperature relationship through the curing period from placing concrete to transfer of prestress. The inspector shall determine where the recording thermometers shall be placed to monitor the time/temperature relationship during the curing period. At least two recording thermometers shall be placed at locations where the anticipated heat generated by the concrete is the lowest and highest just after initial concrete set. The inspector shall verify the fabricator's control of time/temperature relationship by the placement of the inspection agency's recording thermometer in the same beam or element line. Documentation from the fabricator's time/temperature recording shall be given to the inspector for compliance and acceptance. Temperature requirements during the prestressed concrete beam or element curing operation shall be in accordance with the contract specifications.
- 4.6 *Material Requirements* - Materials shall meet the requirements of the specifications. Where certification is permitted, the certification shall be only from suppliers and producers authorized by MDOT to certify the material. Material from any other source must be tested before use. Certification verification samples are required as instructed.

## 5. Reports and Records

- 5.1 All reports are required to be completed in a timely manner, through the Fabrication Inspection and Construction System (FICS) website. All records and reports shall be kept current and in an orderly manner. Reports will be retained in online files and not sent to the Project Engineer. The Project Engineer of record will receive a letter or memorandum from C&T for material & fabrication acceptance.
- 5.2 For each project, the following forms are available on the FICS website

| <u>MDOT FORM</u> | <u>Title</u>  |
|------------------|---|
| 0513             | Report of Strand Tensioning<br>Use: 1 per bed use. May be for several beams or elements.<br>The report is submitted no later than the day following the tensioning. |

- 0551 Report of Field Tests, Intermediate and Final Inspection  
Use: 1 per casting day per bed. After completing intermediate inspection, a copy of this report is given to the fabricator. This report is continually updated until product is shipped.
- 0590 Summary of Field Tests and Cylinder Results  
Use: 1 per job. Report is updated as 28-day (or shipping) test cylinder results are determined.

## 6. Acceptance

- 6.1 No units shall be shipped without approval by the inspector at the time of loading. After loading, and prior to shipping, each beam or element shall be stamped or tagged "Approved for Use" by the inspector at a location near the piece mark. The stamp or tag is for use by the Department and shall not relieve the Contractor of the responsibility for the quality of materials and workmanship.

## 7. Concrete Testing Equipment

Thermometer  
Recording Thermometers  
Air Meter  
Slump Cone Kit

## 8. Miscellaneous Equipment

Computer with internet access

Cell phone

200 foot (60 meter) steel measuring tape; 20 foot (5 meter) steel measuring tape, Safety equipment (steel toe boots/shoes, hardhat, safety glasses, etc.)

## SCALES INSPECTION

### 1. Scope

- 1.1 The Michigan Department of Transportation requires each scale used to supply materials as a pay item to a project be inspected and tested by a private agency or by the Michigan Department of Agriculture to determine if the scale meets applicable specification requirements. MDOT maintains the right to inspect or check all scale systems, private scale inspectors and inspection agencies. This procedure applies only to MDOT's inspections.

### 2. Related Documents

- 2.1 The authority of, and general instructions to, the MDOT scale inspector are described in the Standard Specifications for Construction under Section 104.01–E - Authority to Inspect Scales.
- 2.2 References to scales and their specific specification requirements are described in the sections of the Standard Specifications for Construction as follows:

|                |  |
|----------------|--|
| Section 104.01 | Authority of Department, Authority to Inspect Scales                     |
| Section 109.01 | Measurement of Quantities, Measuring Weight on Scales                    |
| Section 302.03 | Aggregate Base Courses, Construction, Placing and Compacting             |
| Section 502.03 | HMA Pavements, Construction, Weighing Loads                              |
| Section 601.03 | PCC Pavement Mixtures, Construction, NRMCA Certified Batching Plants     |
| Section 601.03 | PCC Pavement Mixtures, Construction, Non-NRMCA Certified Batching Plants |
- 2.3 U.S. Department of Commerce, National Institute of Standards and Technology (NIST), Handbook 44.
- 2.4 National Ready Mixed Concrete Association (NRMCA) Quality Control Manual, Section 3, Certification of Ready Mixed Concrete Production Facilities.

### 3. Inspection Procedure

- 3.1 Each scale inspector is provided with a copy of the Standard Specifications, the NIST Handbook 44 and the NRMCA Quality Control Manual, Section 3.
- 3.2 If a scale comes into question during a random check or otherwise, MDOT personnel will contact C&T to schedule a scale check.
- 3.3 The inspector operates a van-type truck with gross-vehicle-weight of 47,000 pounds (21,319 kg). Each truck is equipped with twenty 1,000 pound (453.59 kg) and twenty 50 pound (22.68 kg) test weights.
- 3.4 When a scale has met all specification requirements and is accepted for use, the scale inspector will tag the scale by placing an Approved sticker, Form 526, on the scale in a prominent location. For each scale tagged, Form 526 will show the material being

weighed (cement, oil, fine or coarse aggregate, etc.), the scale serial number and the plant or scale location.

- 3.5 At the completion of the scales inspection for a project, the scale inspector will complete in detail one copy of the applicable report form. Reports are to be filled out in ink and must be legible. Report forms for all work completed each day are to be forwarded to C&T.
- 3.6 The scale inspector will, upon completion of the inspection, contact the Region Materials Supervisor, Project Engineer with the inspection results.

#### 4. Report and Records

- 4.1 Report forms for reporting scales inspection are as follows:
  - 4.1.1 *Calibration of Platform Scales, Form 521B* - This form is used for reporting the inspection results of platform scales.
  - 4.1.2 *Proportioning Scales Report, Form 521C* - This form is used for reporting the inspection results of concrete and HMA proportioning batch plant scales and belt conveyor weighing systems.

## STRUCTURAL STEEL FABRICATION

### 1. Scope

- 1.1 *Qualifications and Responsibilities of Inspection Agency* - The agency responsible for the fabrication inspection of structural steel should have a registered professional engineer on its staff who is qualified to practice welding engineering. The Engineer is responsible for the review and approval of the shop drawings detailing the methods of fabrication and welding, conducting the welding procedure and welder qualification tests and/or professional decision making on fabrication and welding problems that arise. He/she is responsible for holding a fabrication meeting with the structural steel fabricator to discuss and clarify the contract plans and specifications. The Engineer is the responsible party, representing the owner, who ensures all the provisions of the contract are met in relation to welding, fabrication, painting and materials requirements.
- 1.2 The agency must also provide on-site fabrication inspection by personnel qualified and certified as welding inspectors under the AWS Standard for Qualification and Certification of welding inspectors, QC-1. The welding inspector should have enough welding experience to be able to differentiate satisfactory and poor welding techniques on sight and to recognize and identify satisfactory welding procedures by description. He/she should also have enough knowledge of the nondestructive testing (NDT) methods, techniques, and procedures to inspect welds and to know when to call for and how to use the results of such nondestructive tests to guide the repair of discovered defects. The inspector's duties are described in the next section. The agency must also provide on-site inspection of the shop painting of structural steel by personnel who are qualified in the application and inspection of high technology paint systems specified in MDOT contracts. (This painting inspector may be same person as the welding inspector providing he/she has been adequately trained in addition to the welding inspection requirements.)

### 2. General

- 2.1 *Duties of the Welding Inspector* - Before he/she is assigned to a project, an inspector should have a thorough knowledge of structural welding and of his/her duties as an inspector. He/she should be supplied with a complete set of shop drawings, standard specifications, and special contract documents for that contract. A complete set of inspection tools and gages is required.
- 2.2 Before actual welding operations on a project are started, a pre-fabrication meeting should be held with the inspection agency's Engineer, the inspector and the fabricator to ensure understanding of contract specifications, fabrication and welding procedures, and project requirements. All details of the fabrication should be discussed, agreed upon, and recorded in written minutes of the meeting.
- 2.3 Inspection of welding is similar to inspection of any other work performed during bridge construction. It consists of ensuring the plans and specifications are followed. Before welding is started in a shop or at a field location, the inspector should observe that the steel is not bent or damaged and has no visible external defects exceeding the tolerances prescribed in ASTM A 6. He/she should ensure that it is prepared and assembled with proper fitting for sound welds and for maintenance of correct dimensions and alignment. He/she should also ascertain that suitable provisions are

made so the shrinkage during welding can be accommodated without causing distortion or shrinkage cracks. He/she must be certain shop jigs and fixtures, erection falsework, and other supporting devices are arranged so the welder is not unduly restricted in his/her movements and is able to see the point where he/she is welding and is able to weld in the proper position. Materials will be sampled according to the Materials Source Guide.

- 2.4 After welding has started, the inspector observes the welding procedures, techniques, and sequences to ensure the welds meet the requirements of the plans and specifications. The various steps of the welding procedure, especially for multiple pass butt welds, must be performed carefully to ensure the surfaces are clean where the weld metal is to be deposited, the weld is being made in accordance with the approved procedures and distortion is not becoming serious. All objectionable distortions should be recorded and called to the fabricator's attention even if they do not appear serious enough to require correction. If the fabricator does not correct these distortions, the Engineer should be notified before the work advances so far that the correction is difficult.
- 2.5 The inspector should refer to the Engineer all decisions he/she is not authorized to make, he/she is not capable of making because of his/her lack of experience and knowledge of engineering and welding theory, or that he/she thinks would affect the function of any part of the structure in an important way. The inspector will convey the Engineer's interpretations of the plans to the fabricator.

### 3. Referenced Documents

#### 3.1 Standard Specifications for Construction

|                |   |
|----------------|---|
| Section 707    | Structural Steel Construction                   |
| Section 711.03 | Structured Steel and Pipe Railings              |
| Section 716    | Shop Cleaning and Coating of Structural Steel   |
| Section 906    | Structural Steel, Materials Details             |
| Section 908    | Miscellaneous Metal Products, Materials Details |
| Section 915    | Bridge Coating Systems                          |

#### 3.2 Contract Documents:

|      |  |
|------|--|
| 707A | Special Provision for Structural Steel and Aluminum Construction |
| 707B | Special Provision for Fracture Critical Members                  |
| 707C | Special Provision for Modular Expansion Joint Systems            |
| 716A | Special Provision for Shop Cleaning and Coating Structural Steel |

#### 3.3 American Welding Society Bridge Welding Code, AWS D1.5-XX

#### 3.4 American Welding Society Structural Welding Code-Steel, AWS D1.1-XX

#### 3.5 Materials Source Guide

### 4. Procedures

- 4.1 *Prior to Welding* - The following checklist is suggested as a general guide in making welding inspections in the shop or in the field. 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. The checklist pertains particularly to welding and related operations and does not include all of the items that should be checked.
- 4.1.1 At the fabricating plant, check the mill test reports on the base metal for conformance with the specifications with regard to chemical and physical properties to the extent that they are specified. Develop a workable system for identifying the heat number of each piece of steel that is used in contract fabrication and recording its location in the structure. Obtain from the fabricator, if necessary, the shipping records, storage locations, and scheduling for each piece of steel that he/she intends to use in connection with the assigned contract. Examine each piece of steel as it is received at the shop or construction site 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 or shop to construction site.
  - 4.1.2 Check the records or other evidence of welders' qualifications and investigate the continuity of their work since the date of qualification tests. Have requalification or supplementary check tests made of a welder's ability, if needed. Standard Specifications require that all tackers, welders and welding operators be qualified prior to welding. In a new fabricating shop, previous records are not accepted and a complete testing program is required.
  - 4.1.3 Ensure that the welding procedures and sequences are agreed to and understood by the inspector, the Contractor, the foreman and the welders performing the work. Make certain the Contractor has proper instructions regarding the number and type of procedure qualification tests required and such tests are satisfactorily performed and recorded. Standard Specifications require *all welding procedures* be qualified by test prior to any job welding. This qualification requirement is inclusive of all types of weld procedures, i.e. butt welding, fillet welding, seal welding, plug welding, etc. No welding procedures are considered to be prequalified, regardless of what the AWS Specifications allow or what previous procedure tests produced by the fabricator may indicate. See the Standard Specifications and the contract documents for testing requirements on the procedure test welds. Post the welding procedure data, such as amperage, voltage and travel speed at each welding station.
  - 4.1.4 Make a general examination of the structural steel and give particular attention to the quality of fabrication, including accuracy of plate edge preparation, which would affect control over welding. Require any necessary correction to be made before fitting of welded joints is done. Check the appearance and dimensions of shop welds and make certain no welding has been done previously at unspecified locations. Record and call to the fabricator's attention any unspecified welding. Also notify the Engineer so that he/she may specify corrective measures.
  - 4.1.5 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 rebeveling of plate edges is sometimes done during fitting. Check the prepared edges of the weld joints 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.

- 4.1.6 Check the fixture, clamping, and precambering arrangements used in the fabrication assembly setup for adequacy. Make certain tack welds are made by qualified welders and the welds are small, smooth, and of specified quality. See that runoff or extension bars or plates are in place to ensure complete welding beyond the edges of the plates.

## 4.2 *Welding in Progress*

- 4.2.1 During inclement weather, see that suitable windbreaks or shields are provided and welding is not done on surfaces that are wet or exposed to rain or snow. Check the ambient temperature and temperature of steel at start of 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.
- 4.2.2 Check to make certain the correct types and sizes of electrodes are available and they are dried properly to prevent porosity and cracking in the final welds, especially if low-hydrogen electrodes are specified. If electrodes and fluxes have been stored improperly or exposed to humidity in excess of the tolerances permitted, require reconditioning as prescribed by the specifications.
- 4.2.3 At suitable intervals, observe the technique and performance of each welder to be certain the approved welding procedures and suitable techniques are being used to conform to the requirements of the applicable specifications. At important joints, especially if some unusual condition warrants special attention, inspect multiple pass welds at more than one stage of progress. Arrange for the welder or the foreman to notify the inspector when such inspections at various stages may be made.
- 4.2.4 Require all welding be done by the approved procedures and sequences and make certain electrodes are used with suitable currents and polarity and in positions for which the electrodes are intended to be used. Refer to the approved welding procedure specification for all details of performing the weld in question. Report any unusual or excessive distortion during welding and take corrective measures agreed to by the Engineer and the fabricator to hold distortion and locked-in stresses to a minimum.
- 4.2.5 Require that the welding arc be struck only in the groove or other area on which metal is to be deposited and not at random on the base metal outside of the prepared joint. Arc strikes cause physical and metallurgical stress risers that can and often do result in fatigue failures. Do not permit any welding of ground bars, clips and ties. Approval for such welding is given only by the Engineer and only 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. Keep the grounding lead as close to the point of welding as is practical.

- 4.2.6 Inspect root passes with special care because it is very important the first weld materials deposited in the root of a multiple pass weld be done properly. Closely examine the root pass in important groove welds, such as butt welds in flanges and webs, to make certain it has been made properly and is free from cracks, inclusions or lack-of-fusion.
- 4.2.7 Require the root pass and every subsequent weld pass to be cleaned by the use of a wire brush and chipping hammer to thoroughly remove slag between weld passes to avoid inclusions, before the next weld pass is made. Have defects and substandard workmanship in any weld pass removed by chipping or gouging before subsequent passes of metal are deposited. Do not permit peening or consolidating of weld metal by hammering without the approval of the Engineer. Do not permit peening on root passes or final surface passes of a weld under any circumstances. Under conditions of very severe restraint, minimize weld cracking by other more acceptable techniques, such as using 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 a layer before the next one is deposited.
- 4.2.8 Take particular care not to create re-entrants or local areas with high residual stresses in highly stressed parts of principal members. Where beam flanges do not match well at butt welded splices, require that the weld metal be deposited in such a way as to provide a smooth transition between the parts being joined. Be certain that temporary fitting aids, such as plates and angles, are not applied at highly stressed locations and that temporary tack welds are not allowed.
- 4.2.9 Check all members to make certain the welds are of proper size and length, are being made in the proper location to conform to drawings and are performed in such a manner as to produce weld metal conforming to the requirements of the specifications. 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, have grinding done so grinding marks are not left transverse to the direction of the main stress in a member. Check to make certain welds are not being overground so as to produce a "dished" surface. Require the ends of welds be ground smooth on removal of the runoff tabs.
- 4.2.10 Identify with paint each splice of an important member with the symbol of the welder doing the work, but do not steel stamp this identification on the member. If two welders work on such a splice, show the symbol of each and record, in writing, the work each man performed.
- 4.2.11 Record progress of fabrication on Shop Inspection of Structural Steel Form 538. Include dates work was completed and pertinent remarks regarding problems encountered and corrective action taken.

### 4.3 *After Welding*

- 4.3.1 Require welds to be cleaned of slag and weld spatter so they can be given a thorough final examination. Be certain 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 specifications. Refer to the specifications 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 for the quality of the steel.
- 4.3.2 Ensure the required radiographic, ultrasonic, magnetic particle, or dye penetrant tests are performed and documented as specified. Check to see the weld surfaces and adjacent plate surfaces are in satisfactory condition for the NDT process to be used.
- 4.3.3 Specification requires qualifications for NDT equipment and certified level II or higher (following ASNT SNT-TC-1A guidelines) operators. Check records and obtain evidence of acceptable qualifications. If there are no specific requirements, refer the matter to the Engineer so he/she may specify what tests are necessary to ensure the adequacy of the testing equipment.
- 4.3.4 Check the performance of NDT operators at frequent intervals to verify approved procedures are being used, all weld joints to be tested are examined in accordance with specified requirements and results are properly recorded and identified. The testing of critical flange and web butt splices by the Contractor should be witnessed by the inspector. Collect all NDT reports generated and submit to the Engineer with the final documentation package.
- 4.3.5 Ensure rejected welds are properly identified and marked for repair and defect locations are clearly marked. Observe the excavation defects, use magnetic particle tests to verify no part of the defect remains. Require repaired welds be inspected by the specified NDT method.
- 4.3.6 Check visually after blast-cleaning for weld surface defects and general pickup such as grinding welds, where required, grinding edges, and cleaning holes. Make a final visual inspection check prior to coating.
- 4.3.7 Check the storage, loading, blocking, and handling of the welded members to avoid distortion or structural damage. Do not permit welding of braces or lugs to the members.
- 4.3.8 Check and report on the appropriate forms the final camber and required curvature (or sweep) of all girders after all fabrication steps have been completed. Any members that measure out of tolerance must be noted for corrective action and rechecked after the correction has been made.

- 4.4 *Inspection for Cleaning and Coating Fabricated Steel* - The painting inspector is responsible for the enforcement of all the contract specifications and requirements for the cleaning and coating of the structural steel. All MDOT steel bridge contracts specify high technology coating systems. Most steel bridges are totally shop coated (i.e., primer and final top coats) by the fabricator. Advanced training in the application and evaluation of these systems is mandatory for successful inspection. At present MDOT is the only agency that provides this paint inspection training. This is offered periodically as time and personnel are available. The essential phases of painting inspection are summarized as follows.
- 4.4.1 *Check the Environmental Conditions* - The contract special provisions for painting will include specific controls on environmental conditions, e.g. temperature, humidity, cleanliness, air movement, shading, etc. These specified conditions must be strictly enforced.
- 4.4.2 *Inspection of Coating Materials* - All paints used must be carefully mixed, thinned and handled in accordance with the specifications. Record all batch numbers used to be compared to the certification documents. Check the color numbers of the top coat for conformance to the contract specifications.
- 4.4.3 *Inspection of 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 inspector. The inspector 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 (peel off) at some time after application.
- 4.4.4 *Inspection of Steel Surface Conditions* - All grinding, welding repairs, and fabrication steps must be completed before blast cleaning and painting. Any remedial work done 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 done.
- 4.4.5 *Inspection of the Surface Preparation* - The contract specifications require an exact surface cleanliness standard and a surface "peak" profile requirement. These must be measured using specialized equipment and strictly enforced. After approval, the temperature of the steel and the surrounding air must be maintained within the specified limits. Humidity requirements must also be strictly observed.
- 4.4.6 *Inspection of Coating Application* - The inspector needs to be knowledgeable in the proper techniques of applying the high technology coating systems. Improper application techniques may "appear" to give an acceptable result but will lead to a greatly reduced performance life and possibly an early coating failure (blistering and peeling). After each of the coatings are applied it is the responsibility of the inspector to ensure the *temperature and humidity* are properly controlled (see contract specifications) over the required curing time. After each coating has cured the inspector must check the dry film thickness for conformance to the contract requirements before *the next coat is applied*. General appearance of the coating must be approved by the inspector, noting

any objectionable runs, sags, rough texture or dry spray. Corrective actions must be taken on each coat of the painting system before the next coat is applied. Ensure that approved written coating repair procedures are followed.

- 4.4.7 *Documentation* - A log of the coating sequence may prove to be very valuable if a problem develops. It is suggested that the inspector maintain this log if at all possible. Documentation of an approved coating on the structural steel is comprised of the inspector's test reports on the coating evaluations and the submission of a Certificate of Compliance by the paint manufacturer on the coatings used. MDOT coating systems are approved by yearly testing by MDOT which leads to inclusion on a Qualified Products List found in the contract special provisions. The Certificate of Compliance attests to the fact the painting materials supplied are the same as those submitted to MDOT for acceptance testing.
- 4.4.8 *Handling, Storage and Shipping* - The painting inspector must work closely with the welding inspector to ensure all the contract special provisions concerning the handling, storage and shipping of shop painted steel are strictly observed. The steel is stamped or tagged "Approved For Use" by the welding inspector only after the structure is loaded for shipping and properly padded and secured to prevent damage in transit. All damage to the paint done during handling and loading by the fabricator must be repaired using the approved procedures prior to the inspector's final stamp of approval. If this is not possible because of inclement weather conditions, the fabricator must submit to the inspector a written documentation of the damaged areas so they can be distinguished from the coating damage done during the unloading and erection of the structure.
- 4.5 *Interpretation of Drawings and Specifications* - Although plans and specifications have been checked and usually are complete by the time a project has reached the construction stage, there is always a possibility of omissions or dimensional errors. Therefore, they should be checked to assure sufficient and correct information is given to complete the work properly. In case of conflict between the approved shop drawings and the contract plans and specifications, the contract documents shall govern.
- 4.5.1 The plans and specifications cannot always predict and cover clearly some conditions such as injury to steel in handling and transportation, the effect of unusual weather conditions, and the effect of method of assembly or erection. The inspector should evaluate the effect of any such unusual conditions on the quality of the welding and reach an agreement with the Contractor with regard to any necessary corrections or changes that should be made. All remedial or repair work must have the approval of the Engineer prior to performing the work and must be documented in writing in the contract files.
- 4.5.2 For various reasons, plans for a structure must sometimes be changed after construction work has started. In addition, the removal of materials or parts of a structure and their replacement may alter welding conditions. In such cases, the inspector should analyze the conditions carefully to make certain, if they affect the suitability of the welding procedures or sequences, proper revisions are approved by the Engineer in advance of the start of the welding on that portion of the structure. It is essential that he/she refer such matters to the Engineer for advice and guidance.

- 4.5.3 The workmanship clauses of welding specifications usually include information that can be used in interpreting drawings and in determining suitable dimensional tolerances for weld grooves and for the finished work. When inaccuracies in preparation of plate edges and in fitting at welded joints result in weld-groove dimensions which vary from those shown on the approved detail drawings by more than the specified workmanship tolerances, the matter must be referred to the Engineer for approval or correction.
- 4.6 *Nondestructive Testing* - By contract, nondestructive testing of steel fabrication is the responsibility of the fabricator's Quality Control personnel. The inspector represents the owner in a Quality Assurance role to certify the nondestructive testing requirements of the contract have been properly performed and documented. The methods of nondestructive testing applicable to welded structures are radiographic, ultrasonic, magnetic particle, and liquid dye penetrant. Knowledge of the principles and procedures of these methods is essential to ensure the operators are satisfactorily performing and test results are correctly interpreted.
- 4.6.1 *Procedures* - Radiographic testing of weldments must be in accordance with all the requirements of the contract plans and specifications. A written radiographic procedure must be submitted to the Engineer for approval prior to any contract work. This written procedure must include a drawing which clearly shows the positioning of penetrometers, film and identification markers (see Section 7, Suggested Radiographic Testing Procedures).
- 4.6.1.1 The detailed ultrasonic testing procedure for welds in structures is usually prescribed by the applicable specifications. A typical procedure is included in the AWS Welding Code. The procedure involves the calibration of the equipment so sensitivity is at a specified level and sound travel is suitable for the thickness of the welded plate to be inspected. The calibration is required before testing starts and at frequent intervals during testing. A written procedure specification for ultrasonic testing must be submitted for the Engineer's approval prior to any contract work. The inspector is responsible for submitting to the Engineer the proper documents that establish the ultrasonic operator is qualified in accordance with the contract specifications and all the ultrasonic inspection reports generated during the progress of the work.
- 4.6.1.2 Magnetic particle and liquid dye penetrant testing must be performed as indicated by contract plans and specifications. Each inspection test should follow standard recommended practices and methods as designated: ASTM E 709 - Magnetic Particle Examination and ASTM E 165 - Liquid Penetrant Inspection Method. The inspector is responsible for witnessing and reviewing these inspection tests, as well as determining the test performer is qualified. Test results should be documented in the project file and mentioned on the weekly inspection report.
- 4.6.2 *Interpretation* - The interpretation of all nondestructive testing is primarily the requirement of the fabricator's Quality Control personnel. The inspector is

responsible to the owner for reviewing all the fabricator's interpretations and calling any disagreements to the attention of the Engineer. The Engineer's interpretation is final and he/she may also call for additional testing to further explore a discrepancy.

#### 5. Weekly Inspection Report and Project Close-out

The inspector shall complete an accurate and detailed account of fabrication for each project. The weekly "Shop Inspection Report" will be sent to the Engineer for approval and distribution. The report shall 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 pieces or units fabricated, documentation of specification and procedure compliance as well as documentation of conflicts, repairs, and other problems or discussions which could affect the project in any way. The inspector's final report shall include steel mill certifications, NDT reports, coating documentation, a letter of compliance and final shipping statements all supplied by the fabricator. All inspection reports, NDT reports, letters of compliance and final shipping statements must reference applicable control section and project numbers. The letter of compliance will be written to MDOT and state that all materials and workmanship are according to Standard Specifications and the materials used are 100 percent melted and manufactured in the United States. Final shipping statements will provide the location where materials were shipped from and to, the number of pieces, and a description of the pieces shipped.

#### 6. Inspector's Equipment

To perform the necessary Quality Assurance Inspection duties, the inspector must have the following equipment for evaluating the work:

##### 6.1 *Welding Inspection*

- All pertinent contract specifications
- Fillet weld gages
- Measuring devices - tapes, calipers, etc.
- Straight edge and levels
- Undercut gages
- Surface roughness comparator gage
- Instrumentation for measuring voltage and amperage
- Temperature measuring devices capable of covering the range from 40°F to 1650°F (4°C to 900°C)
- Required safety equipment - hard hat, steel-toe shoes, glasses, welding hood, flashlight, etc.
- Packet of forms for job documentation
- Office supplies
- Approval stamps and tags
- Office space, desk and phone supplied by the fabricator as a contract requirement

##### - *Coating Inspection*

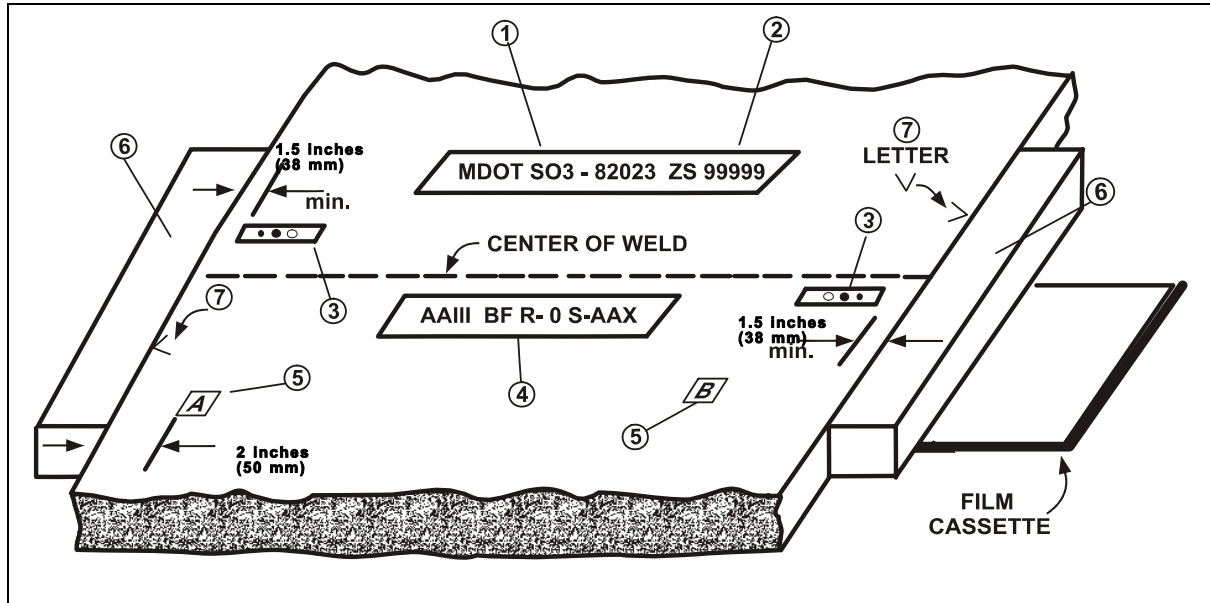
- Testex Replica Tape kit for measuring blasted steel surface profile
- S.S.P.C. Book of Pictorial Blast Standards
- Temperature and humidity measuring instruments
- Wet film paint thickness gage

Dry film paint thickness gages - Positector type (with calibrated standards) and Tooke gage

## 7. Suggested Radiographic Testing Procedures

- 7.1 The radiographic inspection of weldments as required by the contract shall be performed in accordance with the applicable AWS Welding Code as modified by the contract special provisions. The following procedure is a suggested format that meets the requirements of most MDOT contracts.
- 7.1.1 The Contractor shall furnish a satisfactory viewer and darkroom facility for developing and viewing the radiographic film. The Contractor shall also provide shop space and time for all radiographic work. All safety precautions as required shall be followed and enforced by the Contractor.
- 7.1.2 Radiographic inspection shall be conducted on 100 percent of all tension flange butt welds and compression flange butt welds. All web splices shall be radiographed for 12 inches (305 mm), but not less than 1/3 the length of the web weld beginning at the point of maximum tension, plus 12 inches (305 mm) of the web splice beginning at the compression end. (This includes splices connecting pin plates to webs.) All other areas to be radiographed shall be at the discretion of the Engineer. All joints to be radiographed shall be free of dirt, scale, grease, etc. Flange splices shall be ground flush on both sides and webs ground flush at the area to be radiographed (one side). The direction of grinding shall be perpendicular to the length of the weld. All runoff tabs or other appendages shall be completely removed before radiographic inspection.
- 7.1.3 Radiographs shall 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 shall be submitted to the Engineer for his/her final approval before the weld is accepted. The film type shall be of fine grain nature, Class I or Class II. Dimensions shall be 4.5 inches (115 mm) by 17 inches (430 mm) minimum. When areas to be radiographed are too large for one film, the additional exposures will become necessary. The limits for one film shall be 15 inches (380 mm) for web shots and 16 inches (400 mm) for flange shots. Either x-rays or gamma rays may be used to produce radiographs. Double lead screens shall 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 shall not be used. If radiographic inspection discloses defective welds, the defective portions shall be removed and the material rewelded. Additional films shall be taken of all repaired welds at the expense of the Contractor, and then submitted to the Engineer for approval.
- 7.1.4 The interpretation of all radiographic films shall be furnished to the Engineer by the Contractor. The interpretation report shall 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 Contractor question the interpretation of the Engineer, a joint review shall be made. The Engineer's final interpretation will govern.

- 7.1.5 All radiographs shall be positively identified by the Contractor in accordance with AWS D1.5-XX and Section 6. Identification lettering of radiographs shall be placed on the source side along with the penetrometers. Lettering of repairs shall show an "R" and the number of the repair, and shall be placed next to the weld identification.



7.2 *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 shall have a thickness equal to or greater than the thickness of the weld on all weld ends.
- ⑦ Lead vees shall 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.

- 7.2.1 The use of "blocks" as illustrated is required. The use of these edge blocks will give a better picture of the edges, both top and bottom; and are especially useful when the limits of the film are being crowded (i.e., one shot on a 16 inch (400 mm) flange).

8. Inspection Forms for Job Documentation

- 8.1 The use and disposition of various job control forms for structural steel fabrication inspection is described below. Forms similar to the ones shown may be substituted but the main topics requiring documentation should remain as shown. The forms are described below and examples are in the appendix.
- 8.2 *Shop Inspection of Structural Steel, Form 538* - This form is completed by the in-shop inspector on a weekly basis on each separate bridge structure and should be a brief narrative of the work done over the reporting period. Any problems encountered in the work should be mentioned. The distribution of the report needs to be mainly to the Engineer representing the owner, the Project Engineer and the C&T job file. (Other distributions may be made as required.) The inspector retains a copy for his own job file for each separate bridge structure.
- 8.3 *Status of Work - Shop Inspection of Structural Steel, Form 538C* - This form is used by the in-shop inspector to keep an accurate progress log on the status of each girder being fabricated on a bridge. The form should be kept up to date on each separate bridge under inspection. The form is kept in the *inspector's job file* only until the job is complete at which time a copy is submitted to C&T. The form is very useful for allowing anyone to determine the exact status of each bridge girder and also for determining the approximate time various fabrication and painting steps were performed.
- 8.4 *Mill Certification Record for Fabricated Steel, Form 538D* - This form is completed by the in-shop inspector 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 constructing the girder are recorded in an orderly sequence (including beams, cover-plates, webs, flanges, splice plates). A notation is made when the corresponding mill certification has been received and checked by the inspector. This documentation is retained by the inspector until the job is complete and then is submitted to C&T, attached to the mill certification test reports. When the mill certifications for a job have been completely received and checked by the inspector, who reports this on Form 538, *Shop Inspection of Structural Steel*, the form is then distributed to the Project Engineer and other interested parties. The mill certifications and letter of compliance are retained in the C&T files and are not sent to the Project Engineer.
- 8.5 *Sample Identification, Form 1923* - This form should be submitted with every welder or welding procedure qualification test and every material or bolt sample taken for a job. Instructions for filling out the form are on the reverse side of the form. The inspector should keep a copy of all such submittals in his job folder.
- 8.6 *Welding Qualification Report, Form 1929* - This form is submitted with each test of a welder, welding operator or welding procedure. All the available particulars requested on the form must be completed since the approvals issued from these tests are conditional for the variables tested.
- 8.7 *Camber Measurements, Form 507* - This form is used by the in-shop inspector to record the actual measured camber (MC) on a beam or girder and to compare it to the design plan camber (PC). The inspector 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. The inspector retains this form in the shop file for submittal to the C&T file when the job is complete.

- 8.8 *Magnetic Particle Inspection Report, Form 538A* - This form is used by the in-shop inspector to record all magnetic particle testing done on the bridge beams, girders or components. Any defects noted must show an approved status after repairs and retesting are complete. The form is retained by the inspector and submitted to the C&T file when the job is complete.
- 8.9 *Field Inspection Report, Form 566* - This form is completed by either the inspector or the Engineer when a field investigation or inspection is conducted. The completed report should be distributed to the Engineer, Project Engineer, the District Field Engineer, and the C&T file. Any follow-up work or inspection required should be clearly noted and the responsible parties notified. Subsequent reports on a problem should reference all previous reports issued.

## 9. Acceptance

- 9.1 After loading, and prior to shipping, structural components shall be stamped or tagged "Approved for Use" by the inspector. The stamp or tag is for use by the Department and shall not relieve the Contractor of the responsibility for the quality of materials and workmanship.

## TRAFFIC SIGN SUPPORT STRUCTURE FABRICATION

### 1. Scope

1.1 This procedure covers the fabrication inspection of the following traffic sign support structures:

- Cantilever Sign Supports
- Truss Sign Supports
- Dynamic Message Sign Supports
- Bridge Connections
- Steel Column Breakaway Sign Supports
- Fasteners

### 2. General

2.1 *Inspection Facilities and Equipment* - The inspector shall have access to all parts of the work at all times. The authority and general duties of the inspector are specified in Section 104.01C of the MDOT Standard Specifications for Construction. The inspector will be furnished with the following items:

- Standard Plans and Supplemental Specifications for Signing Items
- Forms
- Shop Inspection of Structural Steel (Form 538)
- Sample Identification (Form 1923)
- Welding Qualification Report (Form 1929)
- MDOT approval stamp or red "Approval" tags

### 3. Referenced Documents

3.1 Standard Specifications for Construction

|                   |  |
|-------------------|--|
| Subsection 105.05 | Approval of Materials                        |
| Section 707       | Structural Steel Construction                |
| Section 810       | Permanent Traffic Signs and Supports         |
| Section 906       | Structural Steel                             |
| Subsection 908.15 | Anchor Bolts, Nuts, and Washers              |
| Section 919       | Permanent Traffic Sign and Support Materials |

3.2 Contract Documents

|      |  |
|------|--|
| 707A | Special Provision for Structural Steel and Aluminum Construction |
| 810A | Special Provision for Sign Support and Light Standards           |

3.3 Materials Quality Assurance Procedures Manual, Section D10, Structural Steel Fabrication

3.4 American Welding Society Structural Welding Code - Steel AWS D1.1-XX

3.5 Materials Source Guide

#### 4. Duties of the Inspector

- 4.1 *Materials and Sampling* - It is the duty of the inspector to ensure all materials used in the fabrication of traffic sign support structures are according to the plans, meet the requirements specified in the Standard Specifications for Construction and Special Provisions, and are sampled according to the Materials Source Guide.

#### 5. Procedures

- 5.1 *Cantilever Sign Supports* - Cantilever sign support structures shall be fabricated according to the Standard Specifications and standard plans. Welders must be qualified according to AWS D1.1 and the Special Provisions before any welding is performed on the structures. The fabrication inspection shall be done in the following manner:

- 5.1.1 Obtain mill test reports for structural steel or aluminum.
  - 5.1.2 Qualify all welders by test prior to commencing production.
  - 5.1.3 Allow only qualified welders to do the welding using approved welding procedures.
  - 5.1.4 Visually inspect welds for proper cross-section, cracks, porosity, continuity, overlap and undercutting. Areas in the welds that are found to have flaws shall be repaired.
  - 5.1.5 Weld areas shall be cleaned of weld spatter and smoke residue prior to application of the galvanized coating.
  - 5.1.6 Materials shall be handled in a manner that will prevent damage to the members and the coating.
  - 5.1.7 Visually inspect galvanized coatings for areas of damage, check the galvanizing thickness, and repair according to Subsection 716.03.E of the Standard Specifications.
  - 5.1.8 Visually inspect flanges for flatness to assure that full contact of flanges is obtained in an unbolted, relaxed condition.
  - 5.1.9 Compare all dimensions on the standard drawings with the dimensions of the finished structure.
  - 5.1.10 Document fabrication progress weekly and report on Form 538, Shop Inspection of Structural Steel.
  - 5.1.11 After loading and prior to shipping, identify the accepted structure with a MDOT approval stamp or tag and record approval in weekly progress report.
- 5.2 *Truss Sign Supports* - The inspector shall follow the procedure outlined for the inspection of cantilever sign supports in addition to the following:

- 5.2.1 Witness the bolting of vertical and horizontal truss sections to ensure proper alignment and bolt tightening procedures. Bolt tightening shall be according to Subsection 707.03.D.9.c, Turn-of-Nut Tightening.
  - 5.2.2 Where camber is called for in the horizontal truss, the inspector will assure, by measurement, the camber required is present and ensure proper alignment of the flange bolt holes.
  - 5.3 *Dynamic Message Sign (DMS) Supports* - DMS supports shall be fabricated according to the design plans and Standard Specifications. Fabrication inspection shall be accomplished in the manner outlined under cantilever and truss sign supports.
  - 5.4 *Bridge Connections* - Bridge connections shall be fabricated according to design standard plans and Standard Specifications. Fabrication inspection shall be accomplished in the manner outlined under cantilever sign supports.
  - 5.5 *Steel Column Breakaway Sign Supports* - Steel column breakaway sign supports shall be fabricated according to the Standard Specifications and standard plans. Fabrication inspection shall be accomplished in the manner outlined under cantilever sign supports.
6. Acceptance
- 6.1 After loading, and prior to shipping, each sign support structure shall be stamped or tagged "Approved for Use" by the inspector. The stamp or tag is for use by the Department and shall not relieve the Contractor of the responsibility for the quality of materials and workmanship.

## **LOAD TRANSFER ASSEMBLIES FOR TRANSVERSE JOINTS**

### 1. Scope

- 1.1 This procedure covers the fabrication inspection of load transfer assemblies shipped to project sites or in-state supplier/broker facilities.
- 1.2 MDOT reserves the right to perform sampling and inspection at the place of manufacture, if deemed necessary.
- 1.3 This procedure also provides for the acceptance of small quantities of load transfer assemblies on the basis of visual inspection.

### 2. Related Documents

- 2.1 Standard Specifications for Construction
- 2.2 Standard Plans

### 3. Certification of Dowel Bars

- 3.1 All shipments of load transfer assemblies shall be accompanied by an acceptable certification. This certification, properly prepared, will apply to and permit the acceptance of the dowel bars only. Fabrication inspection of the assemblies will be required and must be performed prior to placing any assembly on the grade. Inspection of assemblies that are not accompanied by acceptable certification is provided for in 5.3.

### 4. Material Identification

- 4.1 Assemblies shipped by the fabricator shall be identified in such a manner that the inspector can be confident the certification applies to the material on hand. This identification will include, but is not limited to the following:
  - 4.1.1 When shipment is made directly to a project site, each bundle (usually consisting of 15 assemblies) shall 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.
  - 4.1.2 When shipment is made to a supplier/broker, Section 4.1.1 above is modified to eliminate the need for a project number and the supplier's/broker's name shall be shown in lieu of the Contractor's name.

### 5. Inspection Procedure

- 5.1 The Contractor or supplier/broker shall arrange for inspection with the Region Materials Supervisor and shall furnish necessary equipment and personnel needed to assist in the manipulation of the assemblies in order to perform the inspection.
- 5.2 The fabricator's certification for the shipment to be inspected shall be reviewed by the inspector.
  - 5.2.1 If the certification is found to be acceptable by the inspector, fabrication inspection will be made. If the certification is not available or is unacceptable, see Section 5.3.
  - 5.2.2 A minimum of one of every 20 bundles, selected by the inspector, will be opened and at least one assembly from each opened bundle 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.
  - 5.2.3 If the fabrication is acceptable and the certifications for the dowel bars are satisfactory, the inspector shall attach a numbered metal locking tag (commonly called deer tags) to each bundle accepted. This inspection will be reported on Field Inspection Report, Form 566.
  - 5.2.4 Minimum distribution of Form 566 (certifications for the dowel bars attached) will be: original to Project Engineer, one copy to district materials supervisor and one copy to C&T.
- 5.3 When certification of the dowel bars is not available or is unacceptable, the dowel bars will be sampled and tested in accordance with Section G of this manual. Samples will be obtained only after fabrication inspection is made per Sections 5.2.2 and 5.2.3.
  - 5.3.1 Dowel bar samples shall be taken from acceptable assemblies and submitted to the central laboratory, accompanied by Field Inspection Report, Form 566 and Sample I.D., Form 1923.
  - 5.3.2 Each bundle represented will be tagged with a dated "Sampled Tag".
  - 5.3.3 Upon notification of approval of the dowel bars by the laboratory, the assemblies will be tagged as in Section 5.2.3.

## 6. Visual Inspection

- 6.1 A maximum of 20 load transfer assemblies may be accepted on 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.

## 7. Rejection

- 7.1 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.

- 7.2 All rejected assemblies shall be identified in such a manner that will preclude them from being reinspected for MDOT use in the future. Rejected assemblies will be removed from the project site at the direction of the Project Engineer.

## PRESERVATIVE TREATED WOOD PRODUCTS

### 1. Scope

1.1 This procedure covers the inspection and sampling of treated wood products.

### 2. Reference Documents

2.1 Standard Specifications for Construction.

2.2 Michigan Test Method 713.

### 3. Inspection

3.1 The inspection consists of a visual inspection for the species, quality, dimensional measurements, identification mark and treatment requirements as described in the specifications.

3.1.1 *Species* - Determine that the species conforms to those allowed in the specification for the item being inspected.

3.1.2 *Quality* - Inspect individual pieces for defects as described in the specification for the grade specified.

3.1.3 *Dimensions* - Compare cross-section and length with plans or specifications.

3.1.4 *Identification Mark* - Required on guardrail posts and blocks to be in the form of a brand.

3.1.5 *Treatment* - A Report of Treatment is required as evidence of satisfactory treatment. A Report of Treatment shall 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. This report should accompany the inspector's Report of Field Inspection, Form 566.

### 4. Sampling

4.1 Sampling will be done according to MTM 713.

## **THICKNESS OF ZINC AND EPOXY COATINGS APPLIED TO A FERROUS BASE**

### 1. Scope

- 1.1 These procedures cover the use of instruments based on magnetic principles and apply to field thickness measurements only. Test Method A provides for the use of banana type gages and Test Method B provides for the use of the Positector gage (See Note 1).

NOTE 1: Banana type gages may be used on any size or shape surface. Positector gage should not be used on round stock whose diameter is less than 1¼ inch (32 mm).

### TEST METHOD A - Banana Type Gages

### 2. Apparatus

- 2.1 Permanent magnet, small, attached directly to a horizontal lever arm which is attached to a helical spring. Increasing force is applied to the magnet by turning a graduated dial coils the helical spring. The readings obtained are shown directly on the instrument scale.

### 3. Test Specimens

- 3.1 When this test method is used, the specimen is the coated structure or article on which the thickness is to be evaluated.

### 4. Calibration of Apparatus

- 4.1 Calibration of the instrument is required prior to, during and after each use.
- 4.2 Calibrate the instrument in the environment in which it is to be used. However, stay free of stray magnetic fields such as power lines, generators or welding equipment. There shall be no vibration apparent on the test piece when the instrument is being calibrated.
- 4.3 Calibration can be accomplished through either the use of bare substrate similar to that of the coated material and non-magnetic thickness shims or the use of National Institute of Standards and Technology thickness calibration standards.
- 4.4 For calibration using bare substrate, a non-magnetic thickness shim (verified with a micrometer) is selected in the expected thickness range of use.
- 4.4.1 Lay the selected shim in full contact with the bare substrate and bring the instrument magnet in direct contact with the shim. Hold the shim so it will not flex during calibration. Remove the magnet from the shim by slowly rotating the dial scale ring clockwise. Observe the thickness shown on the instrument scale at the moment the magnet breaks contact with the surface.
- 4.4.2 If the instrument scale does not agree with the shim thickness, adjustment is required. This can be accomplished by inserting the calibration tool into the slot or recesses in the side of the instrument (located at the center of the scale dial)

and adjust the scale until the number corresponding to the shim thickness lines up with the hairline. Check the calibration using shims of lesser and greater thickness to determine the range of accuracy.

- 4.5 Calibration using thickness calibration standards requires first that the instrument be adjusted to read the thickness stated on the calibration block in the desired range of use. Temperature fluctuations during testing is reason to periodically check the calibration of the instrument.
  - 4.5.1 Bring the magnet in contact with the selected block and remove the magnet by slowly rotating the dial scale ring clockwise. If the instrument scale does not agree with the selected calibration block, adjustment is required and should be made in accordance with Section 4.4.2.

## 5. Procedure

- 5.1 Use the instrument only after it has been calibrated in accordance with Section 4.
- 5.2 Assure the coating is dry prior to use of the instrument.
- 5.3 Inspect the magnet tip and surface to assure they are clean.
- 5.4 Take readings in areas free of vibration, electrical or magnetic fields.
- 5.5 If readings are encountered outside the range of accuracy determined during calibration in Sections 4.4 or 4.5, repeat the calibration procedure in that range. Check the calibration frequently during use to assure the instrument continues to read properly.
- 5.6 Take a sufficient number of readings to characterize the sample.
  - 5.6.1 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<sup>2</sup> (10 m<sup>2</sup>) of surface area. Each of the five determinations should be the mean of three separate gage readings within a ½ inch (13 mm) diameter circle.
  - 5.6.2 For surfaces that are generally small, as found in Steel Reinforcement or Steel Posts, a recommended minimum is five determinations each on opposite sides.

### TEST METHOD B - Positector

## 6. Apparatus

- 6.1 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.

## 7. Test Specimens

- 7.1 The test specimens described in Section 3 are suitable.

## 8. Calibration of Apparatus

- 8.1 Calibrate the instrument on the National Institute of Standards and Technology thickness calibration standards.
- 8.2 Calibration shall be made to read the thickness stated on the calibration standards in the desired range of use.
- 8.3 Hold the instrument firmly on the surface and perpendicular to the measuring plane during calibration and use.

8.3.1 If the instrument reading does not agree with the calibration standards, thickness adjustment is necessary. This shall be done only after the instrument has been removed from the surface of the calibration block (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.

8.3.2 After removing the instrument from the surface, rotate the recessed button located near the top left side in either direction until the reading agrees with the thickness of the calibration standards selected.

## 9. Procedure

- 9.1 Use the instrument only after it has been calibrated in accordance with Section 8.
- 9.2 Take no measurements closer than 1 inch (25 mm) to an edge or 3 inches (75 mm) to another mass of steel unless absolutely necessary.
- 9.3 Follow steps in Sections 5.2 thru 5.6.2

## 10. Rejections

- 10.1 Items may be rejected for failure to conform to coating thickness specifications as determined by either Test Method A or Test Method B, or for any other failure of specification requirements for the particular material inspected.

## TOWER LIGHTING UNIT FABRICATION

### 1. Scope

1.1 This procedure covers the fabrication inspection of tower lighting units.

### 2. General

2.1 *Inspection Facilities and Equipment* - The inspector shall have access to all parts of the work at all times. The authority and general duties of the inspector are specified in Section 104.01.C of the MDOT Standard Specifications. The inspector shall be furnished with the following items:

- Forms (see Appendix)
- Shop Inspection of Structural Steel (Form 538)
- Sample Identification (Form 1923)
- Welder Qualification Procedure Report (Form 1929)
- MDOT approval stamp or red "Approval" tags

### 3. Referenced Documents

#### 3.1 Standard Specifications for Construction

|                  |                                 |
|------------------|---------------------------------|
| Section 105.05   | Approval of Materials           |
| Section 707      | Structural Steel Construction   |
| Section 819.03.H | Tower Lighting Unit             |
| Section 908.15   | Anchor Bolts, Nuts, and Washers |
| Section 918.10   | Tower Lighting Unit             |

#### 3.2 Contract Documents

707A Special Provision for Structural Steel and Aluminum Construction  
810A Special Provision for Sign Support and Light Standards

3.3 Materials Quality Assurance Manual, Section D10, Structural Steel Fabrication

3.4 American Welding Society Structural Welding Code - Steel AWS D1.1-XX

3.5 Materials Source Guide

### 4. Duties of the Inspector

4.1 *Materials and Sampling* - It is the duty of the inspector to make certain all materials used in the fabrication of tower lighting units are according to the project plans and shop drawings, meet the requirements specified in the Standard Specifications for Construction and contract documents, and are sampled according to the Materials Source Guide.

### 5. Procedures

- 5.1 Tower lighting units shall be fabricated according to the Standard Specifications, Special Provisions, and the project plans and shop drawings. Welders must be qualified according to AWS D1.1 and the project specifications before any welding is performed on the tower units. Fabrication inspection shall be done in the following manner:
  - 5.1.1 Obtain mill test reports for structural steel.
  - 5.1.2 Qualify all welders by test prior to commencing production.
  - 5.1.3 Allow only qualified welders to do the welding using approved welding procedures.
  - 5.1.4 Visually inspect welds for proper cross-section, cracks, porosity, continuity, overlap, and undercutting.
  - 5.1.5 Witness ultrasonic inspection (UT) of the full penetration slip joint welds and magnetic particle testing (MT) of all other fillet and partial penetration welds. Collect all UT and MT documentation for project records.
  - 5.1.6 Areas of the welds that are found to have flaws shall be repaired.
  - 5.1.7 Weld areas shall be cleaned of weld spatter and smoke residue prior to application of the galvanized coating.
  - 5.1.8 Materials shall be handled in a manner that will prevent damage to the tower sections and the galvanized coating.
  - 5.1.9 Visually inspect galvanized coatings for damage, check the galvanizing thickness and repair according to subsection 716.03.E of the Standard Specifications.
  - 5.1.10 Visually inspect the tower sections for straightness.
  - 5.1.11 Compare all dimensions on the project plans and shop drawings with the dimensions of the finished structure by tower section.
  - 5.1.12 Document fabrication progress weekly and report on Form 538, Shop Inspection of Structural Steel.
  - 5.1.13 After loading and prior to shipping, identify the accepted tower sections with a MDOT approval stamp or tag and record the approval in the weekly progress report.

## 6. Acceptance

- 6.1 After loading, and prior to shipping, each tower lighting unit section shall be stamped or tagged "Approved for Use" by the inspector. The stamp or tag is for use by the Department and shall not relieve the Contractor of the responsibility for the quality of materials and workmanship.

## TRAFFIC SIGNAL MAST ARM POLE AND MAST ARM

### 1. Scope

- 1.1 This procedure covers the fabrication inspection of traffic signal mast arm poles and mast arms.

### 2. General

- 2.1 *Inspection Facilities and Equipment* - The inspector shall have access to all parts of the work at all times. The authority and general duties of the inspector are specified in Section 104.01.C of the MDOT Standard Specifications. The inspector shall be furnished with the following items:

- Forms (see Appendix)
- Shop Inspection of Structural Steel (Form 538)
- Sample Identification (Form 1923)
- Welder Qualification Procedure Report (Form 1929)
- MDOT approval stamp or red "Approval" tags

### 3. Referenced Documents

- 3.1 Standard Specifications for Construction

- Section 105.05 Approval of Materials  
Section 707 Structural Steel Construction  
Section 908.15 Anchor Bolts, Nuts, and Washer

- 3.2 Contract Documents

- 707A Special Provision for Structural Steel and Aluminum Construction  
810A Special Provision for Sign Support and Light Standards  
810B Special Provision for Traffic Signal Mast Arm Pole and Mast Arm (Trunkline)

- 3.3 Materials Quality Assurance Manual, Section D10, Structural Steel Fabrication

- 3.4 American Welding Society Structural Welding Code - Steel AWS D1.1-XX

- 3.5 Materials Source Guide

### 4. Duties of the Inspector

- 4.1 *Materials and Sampling* - It is the duty of the inspector to make certain all materials used in the fabrication of traffic signal mast arm poles and mast arms are according to the project plans and shop drawings, meet the requirements specified in the Standard Specifications for Construction and contract documents, and are sampled according to the Materials Source Guide.

### 5. Procedures

- 5.1 Traffic signal mast arm poles and mast arms shall be fabricated according to the Standard Specifications, Special Provisions, and the project plans and shop drawings.

Welders must be qualified according to AWS D1.1 and the project specifications before any welding is performed on the poles. Fabrication inspection shall be performed in the following manner:

- 5.1.1 Obtain mill test reports for structural steel.
- 5.1.2 Qualify all welders and welding procedures by test prior to commencing production.
- 5.1.3 Allow only qualified welders to do the welding using approved welding procedures.
- 5.1.4 Visually inspect the number, type, location and condition of welds. Check for proper cross-section, cracks, porosity, continuity, overlap, and undercutting.
- 5.1.5 Compare all dimensions on the project plans and shop drawings with the dimensions of the finished structure by pole and arm section.
- 5.1.6 Witness ultrasonic inspection (UT) and magnetic particle testing (MT) as described in the Special Provision for Traffic Signal Mast Arm Pole and Mast Arm. Collect all UT and MT documentation for project records.
- 5.1.7 Areas of the welds found to have flaws shall be repaired.
- 5.1.8 Weld areas shall be cleaned of weld spatter and smoke residue prior to application of the galvanized coating.
- 5.1.9 Visually inspect flanges for flatness to assure full contact of flanges is obtained in an unbolted, relaxed condition.
- 5.1.10 Materials shall be handled in a manner that will prevent damage to the pole and arm sections and the galvanized coating.
- 5.1.11 Visually inspect galvanized coatings for damage, check the galvanizing thickness and repair according to subsection 716.03.E of the Standard Specifications.
- 5.1.12 Visually inspect the pole and arm sections for straightness.
- 5.1.13 Document fabrication progress weekly and report on Form 538, Shop Inspection of Structural Steel.
- 5.1.14 After loading and prior to shipping, identify each accepted pole and arm section with a MDOT approval stamp or tag and record the approval in the weekly progress report.

## 6. Acceptance

- 6.1 After loading, and prior to shipping, each traffic signal mast arm pole and arm section shall be stamped or tagged "Approved for Use" by the inspector. The stamp or tag is for use by the Department and shall not relieve the Contractor of the responsibility for the quality of materials and workmanship.

## INDEPENDENT ASSURANCE TEST (IAT) PROCEDURES

### 1. Scope

- 1.1 The Federal Highway Administration requires each state to have an approved program of materials and construction sampling and testing. Independent assurance samples and tests 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.
- 1.2 The requirement for conducting IATs extends only to those federal aid projects on National Highway System routes.
- 1.3 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, local agency technicians or consultants, and Contractor personnel performing QC/QA testing on concrete and hot mix asphalt QC/QA projects.
- 1.4 The IAT program covers soil and HMA density, concrete, aggregates and HMA mixtures.
- 1.5 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.

### 2. Construction and Technology Division Responsibilities

C&T provides assistance to the regions by maintaining Independent Assurance Testing procedures for each of the four areas requiring IATs.

- 2.1 C&T *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 C&T:
  - Soil and HMA Density - Density Technology
  - Concrete - Field Engineering
  - Aggregate - Aggregate Quality Control
  - HMA Mixtures - Bituminous Services Unit
- 2.2 A *statewide coordinator* is appointed by C&T and is responsible for compiling a comprehensive annual IAT report for distribution to the regions and FHWA.

### 3. Region Responsibilities

*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 resident/delivery 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.

- 3.1 Review IAT reports in a timely manner and identify problem areas, identify trends, and make recommendations for improvement.
- 3.2 Conduct IATs as appropriate.
- 3.3 Review the program periodically with the C&T technical coordinators.
- 3.4 Ensure that equipment is checked as required and that this is noted on the IAT reports.
- 3.5 Notify appropriate Engineer if an individual refuses to participate in an IAT.

#### 4. Location of IAT

The IAT will be conducted 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. The calibration and condition of sampling and testing equipment used should be carefully checked.

#### 5. IAT Technician

The IAT coordinator will assign qualified personnel to conduct IATs. IATs should be performed 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. This should be the exception rather than the rule. Additional details concerning the qualifications of the IAT technician are included in the specific materials sections.

#### 6. Review of IAT Results

IAT test results are sent to the Region or TSC IAT coordinator who will forward originals to the Resident/Delivery Engineer and copies to the appropriate C&T technical coordinators. Unless stated otherwise in these procedures, it is the responsibility of the 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 C&T 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 specific materials sections. However, failure to demonstrate the following will result in an unsatisfactory IAT.

- 6.1 Proper equipment to conduct sampling and testing.
- 6.2 Equipment properly calibrated and in good working order.
- 6.3 Sampling and testing conducted according to prescribed MDOT methods.
- 6.4 Willingness to participate in an IAT. (Indicate refusal in the remarks section of the IAT report.)

## 7. Soil and HMA Density IAT Program

### 7.1 Qualifications of Density IAT Technician

7.1.1 Soil and HMA Density IATs are conducted by the area density Supervisor/Specialist.

7.1.2 Density Technology personnel will also conduct IATs.

### 7.2 Conducting Soil and HMA Density IATs

7.2.1 Soil and HMA Density IATs consist of witnessing the tester run in-place density test(s) and establish a maximum density.

7.2.2 Tests used to determine maximum and in-place density of soil and HMA materials are those listed here:

- Stove Moisture Method
- Speedy Moisture Tester
- T-99 (1 Point)
- Michigan Cone (1 Point)
- Michigan Modified T-180
- Michigan Modified Marshall
- Nuclear Gauge

7.2.3 Consultants may be performing density tests with equipment or methods not found in the MDOT procedures. While the equipment and/or methods may yield valid results, MDOT is not prepared to conduct IATs on them. In this instance, the IAT would be listed as "unacceptable" with an explanation in the remarks. C&T, Density Technology should be contacted for advice on resolving this issue.

7.2.4 SPECIAL NOTE: Nuclear Moisture/Density gauges must be calibrated once a year and verified on MDOT's calibration blocks annually.

7.2.5 All density tests (in-place and maximum density) are recorded and signed by the tester on Form 582B (582BM). These forms are considered a daily report. The original completed form is retained in the project file with copies sent to the region or TSC office and to C&T, Density Technology. Witnessed IATs are recorded on Form 509 (509M). The distribution of copies for witnessed IATs will be as noted on Form 509 (509M).

7.2.6 Form 509 (509M) is also used to report an unsatisfactory test. The form is to be signed by the IAT technician and must include a brief explanation. 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 IAT is completed.

7.2.7 A follow-up IAT must be conducted within five working days of the unsatisfactory IAT to ensure that equipment and procedures are satisfactory.

7.2.8 If unsatisfactory tests continue, the IAT coordinator will consult the region or TSC for action.

7.3 Frequency of Soil and HMA Density IAT - Each person performing acceptance density testing will have a minimum of one satisfactory IAT per season/ per type of density test being performed.

7.4 Evaluating Soil and HMA Density IAT Results

7.4.1 The requirements listed in Section 6 must be met for a satisfactory IAT.

8. Concrete IAT Program

8.1 Conducting Concrete IATs

8.1.1 The concrete IAT program consists of witnessing sampling of fresh concrete and observing the tester run slump and air tests. An occasional comparison slump and air test should be run by the IAT technician on separate equipment as a check on the acceptance test equipment.

8.1.2 Technicians conducting acceptance tests on prestressed/precast concrete members must also be checked on prestressed strand tensioning calculations and preparing concrete cylinders.

8.1.3 IATs for prestressed/precast concrete will be conducted and evaluated by C&T, Structural Fabrication personnel. Copies of the IAT report will be sent to the IAT coordinator for the region in which the fabrication plant is located and to the resident Engineer.

8.1.4 If the IAT result is unsatisfactory, the problem must be corrected and the IAT repeated.

8.2 Frequency of Concrete IAT - Each person performing concrete acceptance testing must have a minimum of one satisfactory IAT per season.

8.3 Evaluating Concrete IAT Results - In addition to the requirements in Section 6, the following limits are used to evaluate concrete independent assurance tests. All deviations outside these ranges are considered unsatisfactory and require action.

| CONCRETE TEST  | UNSATISFACTORY DEVIATION                                     |
|--|--|
| Slump  | varies more than 1 inch (25 mm) from comparison test results |
| Air content  | varies more than 1 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. |  |

9. Aggregate IAT Program

9.1 Conducting Aggregate IATs

9.1.1 Covered tests are those listed in 9.3

9.1.2 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 (preferably within two days).

9.1.3 The test results of the acceptance sample and the IAT split are sent to the IAT coordinator who will forward copies to the project Engineer and the C&T, Aggregate Quality Control Group.

9.2 Frequency of Aggregate IAT - Each tester performing aggregate acceptance testing must have a minimum of one satisfactory IAT per season.

9.3 Evaluating Aggregate IAT Results - In addition to the requirements in Section 6, the following limits are used to evaluate aggregate independent assurance tests. All deviations outside these ranges are considered unsatisfactory and require 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          |

10. HMA Mixtures IAT Program

10.1 Qualifications of HMA Mixtures IAT Technician

10.1.2 HMA mixture IATs will be conducted by the IAT technician. The IAT technician will either be the region HMA mix inspector or an IAT technician who has been

jointly recommended by the C&T Division's HMA Technical Services Unit and the region IAT coordinator. At a minimum, the HMA IAT Technician must have successfully completed the QC/QA Qualification Course currently approved through Ferris State University.

## 10.2 Conducting HMA Mixture IATs

10.2.1 Tests covered by the HMA mixtures are listed in Section 10.4. An IAT for a Marshall testing protocol is not acceptable for a person that will be performing Superpave testing and vice versa. The IAT database will serve as the check on whether a technician has been through the appropriate IAT process for the HMA design method (Superpave or Marshall) for which they will be performing acceptance testing.

10.2.2 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 (30,000 g). The sampling will be performed by a qualified sampling technician.

10.2.3 The qualified sampling technician will split the IAT sample. The sample must be split before it cools down to avoid the need for reheating one portion of the specimen twice. This could possibly influence the test results. 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 (herein referred to as the field sample) in the same manner as the quality assurance samples for the project.

10.2.4 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.

10.2.5 The IAT Technician will submit, in a timely manner, the field test result(s) with the proper identification and the remaining portion of the IAT split sample to the C&T Division's HMA testing laboratory (herein referred to as the laboratory sample).

10.2.6 The laboratory and field sample test results will be tabulated using Form 1842 and transmitted to the project engineer, HMA testing technician, IAT technician, region IAT coordinator, and Statewide HMA technical coordinator.

10.2.7 All IAT results will be reviewed by the C&T HMA Technical Services Unit. When an unsatisfactory test is reported, the project engineer, IAT technician, and region IAT coordinator will be notified by telephone or e-mail as soon as possible. This notification will be documented on Form 1842.

10.2.8 A follow-up IAT must be conducted within five working days of an unsatisfactory IAT to ensure that equipment and procedures are satisfactory. If unsatisfactory tests continue, the IAT technician will consult the region or TSC for action.

10.3 Frequency of HMA Mixture IAT - One IAT, meeting all tested parameters, per HMA testing technician, per year will be 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.

- 10.4 Evaluating HMA Mixture IAT Results - In addition to the requirements in Section 6, 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 3325)  | varying by more than 0.5 percent |
| Aggregate Gradation  |                                  |
| 1 inch (25 mm) to 3/8 inch (9.5 mm) sieve  | ± 5.0 percent                    |
| #4 (4.75 mm) to #8 (2.36 mm) sieve   | ± 4.0 percent                    |
| #16 (1.18 mm) to #50 (300 µm) sieve  | ± 3.0 percent                    |
| #100 (150 µm) to #200 (75 µm) 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 <sub>DESIGN</sub>   | 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. |                                  |

- 10.5 The Statewide HMA technical coordinator for the IAT Program will prepare an annual IAT report. The report will include a section that describes the failure rates in the various areas, and the corrective measures to be taken to reduce these failures.

## GENERAL QUALIFIED PRODUCTS LIST

### 1. Scope

- 1.1 The Qualified Products List (QPL) is a list of manufacturers and materials for certain 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 lists are found in the Materials Source Guide.

### 2. Documentation Requirements

- 2.1 Items incorporated into MDOT projects that are selected from a QPL are required to be documented by using one of the following methods:
  - 2.1.1 Notation on an IDR by naming the manufacturer, product, and stating that the labeling of material was checked and verified.
  - 2.1.2 Placement of label or copy of label, tag, etc. in the Project File.
  - 2.1.3 Monthly Report on Material Inspection (Form 1158) in the file naming the product and manufacturer as verified in the field.
- 2.2 As always, proper cross-referencing is required in order to trace the documentation for these items.

**QUALIFICATION PROCEDURE  
FOR  
CONCRETE PAVEMENT REPAIR,  
GROUT FOR FULL-DEPTH CONCRETE PAVEMENT REPAIRS**

1. Scope

- 1.1 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 MDOT's Qualified Products List for a qualification period of three years.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below:

Materials Technology Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5695

- 2.2 *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.

- 2.3 *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 the physical requirements section of this document.

- 2.4 *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 Qualified Products List 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.

3. Evaluation

- 3.1 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 Qualified Products List. 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.

4. Disqualification

- 4.1 A product may be removed from the Qualified Products List 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.

## 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 *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.
- 6.2 *Insertability of Bars* - Cast 20 x 18 x 12 inch (500 x 450 x 300 mm) 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 (38 mm) diameter by 8 inch (200 mm) deep holes. The holes, measured from their center, shall be at least 2½ inches (63 mm) away from any edge of the block and at least 2½ inches (63 mm) 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 (35 mm) 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.
- 6.3 *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 (7 mm).

7. 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)**

1. Scope

- 1.1 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 for a qualification period of three years.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - 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 Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5695

- 2.2 *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.
- 2.3 *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 7, Physical Requirements. Descriptions of the test procedures are attached.
- 2.4 *Evaluation Scheduling* - Completed submittals will be evaluated by MDOT throughout the year.

3. Evaluation

- 3.1 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 Qualified Products List. 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.

4. Disqualification

- 4.1 A product may be removed immediately from the Qualified Products List if any problems develop related to installation or performance.

5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

### 6.1 Preliminary Information and Preparation for Specimens

- 6.1.1 *Type of Non-Shrink Grout* - Specify whether non-shrinking mortar or grout, non-metallic (H-1), is Grade A (pre-hardening volume-adjusting), Grade B (post-hardening volume-adjusting), or Grade C (combination volume-adjusting). Record on the Physical Requirements Sheet attached.
- 6.1.2 *Preparation of Specimens* - The specimens and procedures will follow ASTM C 1107.

### 6.2 Required Independent Laboratory Testing

- 6.2.1 *Consistency* - The consistency of the material will be testing in accordance with ASTM C 109 and ASTM C 939 as applicable.
- 6.2.2 *Yield* - The yield for the material will be tested in accordance with ASTM C 138.
- 6.2.3 *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.
- 6.2.4 *Early Age Height Change* - Determine the early-age height change of grout in accordance with the applicable portions of Test Method C 827.
- 6.2.5 *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.

## 7. Physical Requirements

To be completed by independent testing laboratory:

### 7.1 *Required Grout/Mortar Information:*

Grade of Non-Shrink Grout: A, B, or C (circle one)

### 7.2 *Required Independent Laboratory Testing Data:*

A) Fluid (freshly mixed grout at manufacturers minimum recommended temperature)

Temperature as tested: \_\_\_\_\_ °F (°C) Water Added

Consistency (10-30 seconds by flow cone required) as tested: \_\_\_\_\_ seconds

Yield as tested: \_\_\_\_\_ cubic foot (m³)

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)

| Grade Classification (A, B, or C) | Actual % Change 1 Day | Actual % Change 3 Days | Actual % Change 14 Days | Actual % Change 28 Days |
|-----------------------------------|-----------------------|------------------------|-------------------------|-------------------------|
|                                   | %                     | %                      | %                       | %                       |

B) Fluid (freshly mixed grout at manufacturers maximum recommended temperature)

Temperature as tested: \_\_\_\_\_ °F (°C) Water Added

Consistency (10-30 seconds by flow cone required) as tested: \_\_\_\_\_ seconds

Yield as tested: \_\_\_\_\_ cubic foot (m³)

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)

| Grade Classification (A, B, or C) | Actual % Change 1 Day | Actual % Change 3 Days | Actual % Change 14 Days | Actual % Change 28 Days |
|-----------------------------------|-----------------------|------------------------|-------------------------|-------------------------|
|                                   | %                     | %                      | %                       | %                       |

C) Fluid (retained in mixer grout at manufacturers minimum recommended temperature)

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 (m<sup>3</sup>)

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)

| Grade Classification (A, B, or C) | Actual % Change 1 Day | Actual % Change 3 Days | Actual % Change 14 Days | Actual % Change 28 Days |
|-----------------------------------|-----------------------|------------------------|-------------------------|-------------------------|
|                                   | %                     | %                      | %                       | %                       |

D) Fluid (retained in mixer grout at manufacturers maximum recommended temperature)

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 (m<sup>3</sup>)

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) |                 |

| Time    | Required Strength   | Actual Strength |
|---------|---------------------|-----------------|
| 28 Days | 5000 psi (34.5 MPa) |                 |

Early Age Height Change: \_\_\_\_\_ % (ASTM C1107)

Height Change of Moist Cured Hardened Grout: (ASTM C1107)

| Grade Classification (A, B, or C) | 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 (m<sup>3</sup>)

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)

| Grade Classification (A, B, or C) | 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 (m<sup>3</sup>)

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)

| Grade Classification (A, B, or C) | 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**

1. Scope

- 1.1 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 MDOT's Qualified Products List.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation* - Submit a completed copy of MDOT Form 1022 (Qualified Products Evaluation) and Table 1, as required by this procedure to the MDOT address listed below:

Construction and Technology Division  
Materials Technology Group  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5695

- 2.2 *Product Data Sheets* - Include product literature describing the product's use and the following information:

2.2.1 Substrate preparation

2.2.2 Bonding slurry requirements

2.2.3 Mixing and working times

2.2.4 Allowable temperature range for placement

2.2.5 Type of mixer recommended

2.2.6 Component ratios of mixed ingredients

2.2.7 Amount of coarse aggregate extension for deep patches and any incompatibility with aggregate types

2.2.8 Type and duration of curing required

2.2.9 Use of admixtures not included in the product.

- 2.3 *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.

- 2.4 *Evaluation Scheduling* - MDOT will be allowed 40 days to review and verify the submittal.
- 2.5 *Sample Submittal* - Submit 50 pounds (25 kg) of prepackaged hydraulic fast-set mortar for testing to the address listed in 2.1.

### 3. Evaluation

- 3.1 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 Qualified Products List. 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.
- 3.2 MDOT must be notified in writing of any change in the product formulation. Formulation changes require re-evaluation of the product.

### 4. Disqualification

- 4.1 A product may be removed from the Qualified Products List if any problem develops during mixing, casting, or with performance.

### 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 The following testing must be conducted by an independent testing laboratory.
- 6.2 *Extension with Coarse Aggregate* - All specimens will be cast from a uniform mix design, extended with coarse aggregate 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.
- 6.3 *Number of Specimens* - The physical properties at each specimen age will be the average of a minimum of three specimens.
- 6.4 *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.
- 6.5 *Compressive Strength* - The compressive strength of the material will be determined by using 4 in. x 8 in. (102 mm x 203 mm) cylinders according to ASTM C 39.

- 6.6 *Slant Shear-Bond Strength* - Test material for bond strength according to ASTM C 882 and as modified below.
- 6.6.1 Prepare 3 in. or 4 in. (76 mm or 102 mm) diameter dummy sections using 517 pounds of cement per yd<sup>3</sup> (307 kg per m<sup>3</sup>) 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 in. (102 mm) 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.
- 6.6.2 Place the dummy section in the lightly oiled 3 in. x 6 in. (76 mm x 152 mm) mold for 3 in. (76 mm) dummy section and 4 in. x 8 in. (102 mm x 203 mm) mold for 4 in. (102 mm) 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.
- 6.7 *Modulus of Elasticity in Compression* - The modulus will be determined by using either 4 in. x 8 in. (102 mm x 203 mm) or 6 in. x 12 in. (152 mm x 305 mm) 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 (2.8 MPa) and 2000 psi (13.8 MPa). 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.
- 6.8 *Thermal Coefficient of Expansion* - The specimens and length of comparator will conform to ASTM C 490. The specimens will be 2 in. x 2 in. x 11.25 in. (51 mm x 51 mm x 286 mm) with an effective gage length of 10 in. (254 mm). The coefficient will be determined from readings taken at 0°F (-18°C) and 104°F (40°C).
- 6.8.1 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.
- 6.8.2 Use the following equation to determine the coefficient:
- $$\frac{L_{104} - L_0}{10 \times 104} = \text{in/in/}^\circ\text{F} \quad \left( \frac{L_{40} - L_{-18}}{254 \times 58} = \text{mm/mm/}^\circ\text{C} \right)$$
- 6.9 *Initial Plastic Shrinkage* - Use ASTM C 1090 to determine the initial plastic shrinkage.
- 6.10 *Surface Scaling* - Make two slab specimens 6 in. (150 mm) diameter x ¾ - 1 in. (20-25 mm) 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:

- 6.10.1 Precondition specimens by ponding at room temperature for 24 hours with fresh water.
- 6.10.2 Subject specimens to 12 freeze-thaw cycles while ponded with fresh water.
- 6.10.3 Subject specimens to 24 freeze-thaw cycles while ponded with a three percent solution of sodium chloride (NaCl).
- 6.10.4 Subject specimens to 12 freeze-thaw cycles while ponded with fresh water.
- 6.10.5 The depth of the ponding solution will be maintained at approximately ¼ in. (7 mm). 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.
- 6.10.6 The accumulated total of scale volume per unit area for each slab will be determined as follows:

$$\text{Scale} = \frac{\text{Dry Weight of Scale, g}}{\text{Dry Bulk Specific Gravity} \times \text{Ponded Area, cm}^2} = \frac{\text{cm}^3}{\text{cm}^2}$$

- 6.11 *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 (1.5 liters) of material.

## 7. 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)  | 150 (10.3)    |
|   | Actual   |             |             |  |               |
| Modulus of Elasticity, Compression psi (MPa)                | Required | N/A         | N/A         | [4.0 - 6.0] x 10 <sup>6</sup><br>(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 <sup>-6</sup><br>([9.0-14.4] x 10 <sup>-6</sup> ) | N/A           |
|   | Actual   |             |             |  |               |
| Initial Plastic Shrinkage, max. (%)                         | Required | 0.10        | N/A         | N/A  | N/A           |
|   | Actual   |             |             |  |               |
| Surface Scaling, max (cm <sup>3</sup> /cm <sup>2</sup> )    | 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)  
 \_\_\_\_\_ (PrintName)

Laboratory Name and Address: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Date Tests Were Conducted: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

**QUALIFICATION PROCEDURE  
FOR  
PENETRATING WATER REPELLENT TREATMENT FOR  
STRUCTURAL CONCRETE SURFACES**

1. Scope

- 1.1 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 MDOT's Qualified Products List for a period of three years.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below:

Materials Technology Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5695

- 2.2 *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.**
- 2.3 *Evaluation Based on the Following Standards* - Submit one quart (one liter) to be evaluated by the MDOT Materials Technology Group 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.
- 2.4 *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 Qualified Products List 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.

3. Evaluation

- 3.1 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 Qualified Products list. 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.

#### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

#### 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 The following testing must be conducted by an independent testing laboratory.
- 6.2 *Reduction of Chloride Intrusion* - This shall be tested according to NCHRP Report 244, series II with a five day air drying period.
- 6.3 *Reduction of Water Absorption* - This shall be tested according to NCHRP Report 244, series II with a five day air drying period.
- 6.4 *Submittal of Independent Laboratory Data* - This independent test data must be written either by the independent laboratory or in a letter on their letterhead.
- 6.5 *Scaling Resistance* - The slab specimens shall be 6 inches (150 mm) in diameter by  $\frac{3}{4}$  to 1 inch (19 to 25 mm) 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  $\frac{1}{4}$  inch (6.4 mm). 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:

$$\text{Scale Volume} = \frac{\text{Dry Weight of Scale, gm}}{\text{Dry Bulk Sp Gr of Concrete, gm/mm}^3 \times \text{Ponded Area, mm}^2} = \frac{\text{mm}^3}{\text{mm}^2}$$

- 6.6 *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 (1 mm) equals some convenient amount on the graduated scale. Five measurements at approximate equal spacings across the cross-section shall be taken. The reported depth of penetration shall be an average of these five measurements.
- 6.7 *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 (31 MPa), air content of 5 to 8 percent, and slump of 4 to 6 inches (100 to 150 mm). The coarse aggregate shall be a Michigan Series 26A limestone or equivalent. No admixtures other than an air-entraining agent shall be used.
- 6.8 *Curing 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.

**TEST REPORT SHEET  
FOR  
PENETRATING WATER REPELLENT TREATMENT FOR  
STRUCTURAL CONCRETE SURFACES**

To be completed by an independent testing laboratory:

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 <sup>3</sup> /mm <sup>2</sup> |        | 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**

1. Scope

- 1.1 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 MDOT's Qualified Products List for a qualification period of five years.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - 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 and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-1235

- 2.2 *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.
- 2.3 *Evaluation Based on the Following Standards* - Evaluations will be based on a case by case basis.
- 2.4 *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 Qualified Products List 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.

3. Evaluation

- 3.1 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 Qualified Products List. 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.

4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

## 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 No testing is required.

## 7. 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 320°F (-143 to 160°C)

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**

1. Scope

- 1.1 This document covers the procedure to be followed by producers to have an Adhesive Anchor System included on the MDOT's Qualified Products List.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - There is no form required for submittal; however, information about the product shall be submitted to the following MDOT address:

Structural Research Unit  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5707

- 2.2 *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.

2.2.1 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.

2.2.2 Submit product safety data sheets.

- 2.3 *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 (400 MPa) reinforcing steel in tension at a maximum embedment of 9d (9 times the nominal bolt diameter) for bolt diameters  $\frac{3}{8}$  to  $\frac{7}{8}$  inches (9.52 to 22.22 mm) and at a maximum embedment of 12d (12 times the bar diameter) for reinforcing steel sizes #4 to #8 (metric #13 to #25). 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.

2.3.1 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.

2.3.2 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  $\frac{1}{16}$  inch (1.60 mm) displacement in 4000 psi (28 MPa) concrete.

- 2.3.3 Submit a minimum of 10 ounces (300 cubic centimeters) of epoxy and/or three capsules per anchor size  $\frac{1}{2}$  and  $\frac{7}{8}$  inch (12.70 and 22.22 mm), a dispenser, four nozzles and any special equipment necessary for installation and evaluation by MDOT.
3. Evaluation
    - 3.1 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 Qualified Products List. 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.
  4. Disqualification
    - 4.1 A product may be immediately removed from the Qualified Products List 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.
  5. Requalification
    - 5.1 A product that has been disqualified and removed from the Qualified Products List 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

### 1. Scope

- 1.1 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.

### 2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - There is no form required for submittal. However, information about the product can be submitted to the following MDOT address:

Experimental Studies Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5707

- 2.2 *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.

- 2.2.1 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.

- 2.3 *Evaluation Based on the Following Standards* - Submit three mechanical expansion anchors per size for evaluation by MDOT.

- 2.3.1 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<br>(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 |

- 2.3.2 Mechanical expansion anchors shall develop 50 percent of the proof tensile load at less than or equal to 1/16 inch displacement.

- 2.4 *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

Qualified Products List 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.

### 3. Evaluation

- 3.1 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 Qualified Products List. 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.

### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

### 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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**

1. Scope

- 1.1 This document covers the procedure to be followed by producers in order to have a mechanical reinforcement splice approved for MDOT use.

2. Submittal Procedure

- 2.1 *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  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, Michigan 48909  
Telephone: (517) 322-5707

- 2.2 *Report of Tests* - The producer shall include test results from an independent testing laboratory demonstrating that the mechanical reinforcement splice meets the following criteria:

2.2.1 All splices tested shall develop a tensile strength of 125 percent of the reinforcing bar's yield strength.

2.2.2 All splices tested shall develop fatigue strength of 12,000 psi (83 MPa) tension at greater than 1,000,000 cycles.

2.2.3 To be considered for "High Strength" splices, all splices tested shall conform to the following criteria:

2.2.3.1 Splices shall develop a tensile strength of 150 percent of the reinforcing bars yield strength.

2.2.3.2 Splices shall develop a fatigue strength of 18,000 psi (124 MPa) tension at greater than 1,000,000 cycles.

2.2.3.3 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.

2.3 *Sample Submittal*

- 2.3.1 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:

NOTE: MDOT currently accepts soft-converted metric reinforcement sizes.

Small Size - Submit 4 samples; minimum size equals #4 (#13) 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 (#9, #22, or #25) bars can be submitted.

Large Size - Submit 4 samples; maximum size equals #11 (#36) 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 (300 mm) exposed length beyond the prepared splice. The bars shall be Grade 60 psi (400 MPa) and supplied by the producer.

### 3. Evaluation

- 3.1 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. Please note: Only splices having collinear axes 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.

### 4. Disqualification

- 4.1 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.

### 5. Requalification

- 5.1 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**

1. Scope

- 1.1 This document covers the procedure manufacturers must follow to have embedded galvanic anodes included on MDOT's Qualified Product List.

2. Product Submittal

- 2.1 *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 Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5655

- 2.2 *Product Data* - Submit product data documenting the quantity of zinc in each anode, as well as the components of the material encasing the anode.
- 2.3 *Product Sample* - The manufacturer shall submit a sample of the product to the address listed above.
- 2.4 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.

3. Performance Evaluation

- 3.1 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.
- 3.1.1 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.
- 3.1.2 MDOT shall provide the labor, tools, materials and equipment necessary to complete the patch.
- 3.2 The embedded galvanic anodes at the test site will be monitored on a regular basis for a period of twelve months.

- 3.3 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.

#### 4. Acceptance Requirements

- 4.1 The embedded galvanic anodes must meet the following requirements to be approved for use on MDOT projects:
  - 4.1.1 *Field Performance* - The anodes are required to provide a protective current equal to or greater than 0.4 mA each after 90 days.
  - 4.1.2 *Service Life* - The anodes must provide a minimum of ten years service life.
- 4.2 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.

#### 5. Disqualification

- 5.1 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. Requalification

- 6.1 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**

1. Scope

- 1.1 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 MDOT's Qualified Products List for a qualification period of three years.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below.

Materials Technology Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5695

- 2.2 *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as equipment needed to install, and installation procedures of, the sealant submitted.

- 2.3 *Evaluation Based on the Following Standards* - Submit one 28-ounce (850 mL) or two 10-ounce (300 mL) 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 7. Note: Testing does not have to be conducted by an independent laboratory.

- 2.4 *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 Qualified Products List 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.

3. Evaluation

- 3.1 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 Qualified Products List. 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.

4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

## 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 *Material* - The sealant shall be a one-component elastomeric polyurethane sealant (Federal Specification TT-S-00230C, Type 2, Class A or B; ASTM C 920, Type S, Grade NS, Class 25), that does not require a primer for proper bonding to a painted steel beam. The sealant shall be packaged in cartridge form.
- 6.2 *Sample Preparation* - Cure the sealant samples for 21 days at  $73 \pm 3^{\circ}\text{F}$  ( $23 \pm 2^{\circ}\text{C}$ ) and  $50 \pm 5$  percent relative humidity.
- 6.3 *Flow* - The flow shall be tested according to ASTM C 639 and shall not be more than 0.3 inches (8 mm).
- 6.4 *Solids Content* - The solids content shall be tested according to ASTM D 2822 (Subsection 9.2). The sealant shall be a minimum of 90 percent solids.
- 6.5 *Peel Strength* - The peel strength shall be tested according to ASTM C 794 and shall be more than 7.5 pounds per inch (1.33 newtons per mm) of width. Two test specimens shall be prepared on panels painted with a urethane top coat.

7. 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, and that the material complies with the specification(s) stated in Section 6.1.*

\_\_\_\_\_ (Name) \_\_\_\_\_ (Date)

\_\_\_\_\_ (Title)

\_\_\_\_\_ (Company)

## QUALIFICATION PROCEDURE FOR LOW DUST ABRASIVES

### 1. Scope

- 1.1 This procedure describes the requirements for an abrasive to be placed on MDOT's Prequalified Materials List for Requirements for Approval of Low Dust Abrasives.

### 2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below.

Structural Section - Paint Systems  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5722

- 2.2 *Product Data Sheets and Material Safety Data Sheets* - Submit the Product and Material Safety Data Sheets for each product submitted for evaluation.

2.2.1 A 50-pound (25 kg) sample must be submitted.

- 2.3 *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.

### 3. Evaluation

- 3.1 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 a Qualified Products List. 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.

### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

### 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Physical Requirements

- 6.1 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.
- 6.2 It will have a gradation such that the abrasive will produce a uniform profile of 1 to 2.8 mils (25-70 microns), as measured with the extra course Testex Replica Tape.
- 6.3 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 or certified results of the analysis for free silica indicating <1 percent by weight free silica. The free silica content will be determined by the use of infrared spectroscopy or by other analytical procedures, such as wet chemical or x-ray diffraction analyses.
- 6.4 The manufacturer must certify and submit documentation that the abrasive, 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                 |

- 6.5 Technical information regarding the above requirements, Product and Materials Safety Data Sheets and 50 pounds (25 kg) samples, will be submitted to:

Structural Section - Paint Systems  
 Construction and Technology Division  
 8885 Ricks Road  
 P.O. Box 30049  
 Lansing, MI 48909  
 Telephone: (517) 322-5722

- 6.6 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 Qualified Products List.
- 6.7 Products may be deleted from the Qualified Products List by MDOT at any time they fail to meet any of the above requirements.

## QUALIFICATION PROCEDURE FOR DETECTABLE WARNING SURFACES

### 1. Scope

- 1.1 This document covers the requirements for detectable warning surfaces to be placed on the Qualified Products List. The qualified product list for detectable warning surfaces includes cast-in-place and surface applied products.

### 2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - 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 and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-6448

- 2.2 *Product Information* - Include product information as listed below:

- 2.2.1 *Product Data Sheets* - Enclose product literature for detectable warning surfaces describing the use, restrictions, cost and anticipated benefit to MDOT's transportation system.
- 2.2.2 *Supporting Evaluation* - Enclose a list of other state DOT's or agencies (contact person, telephone number) who have approved your material for use.
- 2.2.3 *Sample Specification* - Enclose a sample specification for product usage.

- 2.3 *Evaluation Based on the Following Standards:*

- 2.3.1 Any product to be considered for this Qualified Products List must meet the requirements of the Americans with Disabilities Act and must conform to MDOT Standard Plan R-28 Series.
- 2.3.2 If a company has a new product that it wants included in the Qualified Products List, it must provide a trial installation in the State of Michigan. The company must notify the MDOT contact listed in Section 2.1 of this procedure prior to installation of the product.

### 3. Evaluation

- 3.1 *Field Evaluation:*

- 3.1.1 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.

- 3.1.2 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.
  - 3.2 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.
4. Disqualification
  - 4.1 A product may be immediately removed from the Qualified Products List 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.
5. Requalification
  - 5.1 A product that has been disqualified and removed from the Qualified Products List 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 APPLIED PAVEMENT MARKING MATERIALS**

1. Scope

- 1.1 This document covers the requirements for fluid pavement marking materials to be placed on MDOT's Qualified Products List.
- 1.2 The procedure covers:
- Longitudinal Lines - 1 Year Product
  - Longitudinal Lines - 3 to 5 Year Product
  - Special Markings - 3 to 5 Year Product (Legends, Symbols, Arrows, Crosswalks, and Stop Bars)

2. Submittal Procedure

- 2.1 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-four months of data.
- 2.2 Send the results from NTPEP, product data sheets, and other pertinent information to:
- MDOT Pavement Marking Engineer  
Traffic Operations Section  
425 West Ottawa Street  
P.O. Box 30050  
Lansing, MI 48909
- 2.3 The NTPEP report must provide retroreflectivity and product durability data. The material thickness used for NTPEP evaluation of sprayable thermoplastic may exceed 35 mils. Fluid pavement markings must have the following minimum properties on hot mix asphalt and Portland cement concrete to qualify for MDOT field evaluation:

|                   |                |                            | White   | Yellow  |
|-------------------|----------------|----------------------------|---------|---------|
| 1 yr Product      | Skip Readings  | Initial retroreflectivity  | 375 mcd | 200 mcd |
|                   |                | 9 month retroreflectivity  | 120 mcd | 80 mcd  |
|                   | Wheel Readings | Durability - 12 month      | 6       | 6       |
| 3 to 5 yr Product | Skip Readings  | Initial retroreflectivity  | 400 mcd | 280 mcd |
|                   |                | 24 month retroreflectivity | 175 mcd | 120 mcd |
|                   | Wheel Readings | Durability - 24 month      | 8       | 8       |

3. Evaluation

- 3.1 The submitted NTPEP report will be reviewed by MDOT's Pavement Marking Business Team (PMBT).

If the product meets the requirements specified in Section 2.3, a sample amount of product and location for installation will be determined by the PMBT for field evaluation. The sample material will be 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 Year Product:

Retroreflectivity readings for longitudinal lines must be 100 millicandellas for white and 60 millicandellas for yellow after one winter. Retroreflectivity measurements will be taken by MDOT.

Longitudinal lines - 3 to 5 Year Product:

Retroreflectivity readings for longitudinal lines must be 250 millicandellas for white and 150 millicandellas for yellow after one winter. Retroreflectivity measurements will be taken by MDOT.

Special Markings - 3 to 5 Year Product (Legends, Symbols, Arrows, Crosswalks, and Stop Bars):

MDOT requires 90 percent of the marking to be fully adhered to the pavement after one winter.

MDOT reserves the right to verify submitted test information or re-evaluate a product at any time.

- 3.2 Once the material has been in place for an entire winter, the PMBT will review the material a second time. Approval from the PMBT will result in the product being added to the Qualified Products List. The Manufacturer will be notified in writing concerning the results of the evaluation.
- 3.3 Every January, the Manufacturer must submit the following statement: “ \_\_\_\_\_ (Manufacturer name) certifies that the composition and manufacture of \_\_\_\_\_ (product name) has not changed since its last certification.” This certification statement must be signed by a designated representative of the Manufacturer.

#### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to installation or performance of the material. The Manufacturer will receive written notification, including reasons for disqualification.

#### 5. Requalification

- 5.1 A product which has been disqualified and removed from the Qualified Products List 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**

1. Scope

- 1.1 The Construction and Technology Division of MDOT will authorize manufacturers to ship approved products to MDOT projects for immediate incorporation into the work.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation* - The manufacturer will submit the following at the time of application for addition to the Qualified Products List and once every seven years thereafter, to the MDOT address listed below:

- 2.1.1 Full ASTM C 260 Testing Report or Full ASTM C 494 Testing Report, see Section 2.2.

The results must be from tests performed no greater than two years prior to submittal. Use the summary sheets located in the appendix to submit all Full ASTM test results in both hard copy and electronically (use the contact below to receive an electronic copy).

- 2.1.2 Certification and Product Data, Submit certification and product data as specified in Section 3.1 of this procedure.

- 2.1.3 Sample, see Section 3.2.

- 2.1.4 Abbreviated ASTM C 260 Testing Report or Abbreviated ASTM C 494 Testing Report, see Section 4.

The results must be from tests performed no greater than 12 months prior to submittal. Use the summary sheets located in the appendix to submit all Abbreviated ASTM test results in both hard copy and electronically (use the contact below to receive an electronic copy).

Materials Technology Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5695

- 2.2 *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.

- 2.3 *Referenced Documents*

### 2.3.1 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

### 2.3.2 Standard Specifications for Construction, Section 903

## 3. Product Data

3.1 The manufacturer will submit, at the time of application for addition to the Qualified Products List and every January thereafter, the following product data and certification:

3.1.1 Manufacturer name

3.1.2 Product name

3.1.3 Admixture type

3.1.4 Recommended dosage or dosage range

3.1.5 Chloride ion content, percent

3.1.6 pH

3.1.7 Specific gravity

3.1.8 Total solids, percent

3.1.9 Indication if admixture is lignin (lignosulfonate) based

3.1.10 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.

3.2 Sample - Furnish a one-quart sample of the material to the address listed in Section 2.

## 4. Testing Procedure and Evaluation for Abbreviated ASTM Testing (Local Cement Testing)

4.1 *General Test Procedure for Abbreviated Evaluation* - This testing is to be performed by an independent laboratory conforming to ASTM C 1077.

4.1.1 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.

- 4.1.2 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.
  - 4.1.3 Use the summary sheets located in the appendix to submit all Local Cement test results in both hard copy and electronically (use the contact in Section 2 to receive an electronic copy).
  - 4.1.4 Test admixtures at the minimum dosage rate to be reported on the Qualified Products List.
- 4.2 *Mix Properties*
- 4.2.1 Cement Content - 517 lb/yd (MDOT Grade P2 or equivalent).
  - 4.2.2 Air Content -  $6.5 \pm 1.5$  percent for control. Air content of test concrete will be within 0.5 percent of control.
  - 4.2.3 Slump -  $3\frac{1}{2} \pm \frac{1}{2}$  inch for the control and the test concrete. Slump of test concrete will be within 1 inch of control.
  - 4.2.4 High Range Water Reducing Admixtures - Mix design for test batches will be redesigned for less water than reference batches.
- 4.3 *Materials Requirements*
- 4.3.1 Cement - Type I Portland cement. Use three brands of cement (in common use in Michigan) individually, or as specified for the individual testing.
  - 4.3.2 Aggregate - 2NS and 6A. Use moist aggregates of known moisture content.
  - 4.3.3 Materials should be of such temperature as to produce a concrete having a temperature of  $68 \pm 4^{\circ}\text{F}$ .
- 4.4 *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.
- 4.4.1 Mix for three minutes, allow concrete to rest for three minutes, then remix for two minutes.
- 4.5 *Tests and Properties*

- 4.5.1 Slump - all batches.
  - 4.5.2 Air Content - all batches.
  - 4.5.3 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.
  - 4.5.4 Water Content - Expressed as water-cement ratio by mass. Use the net water in the batch (total water, less water absorbed by aggregates).
  - 4.5.5 Time of Set - ASTM C 403, for retarders and accelerators, otherwise as instructed.
5. Mid Range Water Reducers and Retarding Mid Range Water Reducers
- 5.1 Section 1 through 4 applies to mid range admixtures except as modified below.
  - 5.2 Submit the full ASTM C 494 report required by Subsection 2.2 as a Type A or F for normal set or as a Type D or G for retarding.
  - 5.3 Submit a report as required by Subsection 4.1 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.
  - 5.4 Reduce water of the control batch by at least 9 percent.
  - 5.5 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. Product Review

- 6.1 *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.
- 6.2 *Disqualification* - A product may be removed immediately from the Qualified Products List if any field performance problems develop related to product material or manufacturing.
- 6.3 *Requalification* - A product which has been disqualified and removed from the Qualified Products List 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.

**QUALIFICATION PROCEDURE  
FOR  
EPOXY COATING FOR STEEL REINFORCEMENT**

1. Scope

- 1.1 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 MDOT's Qualified Product List.

2. Submittal Procedure

- 2.1 Submit the following criteria to the MDOT address listed below.

Structural Section - Paint Systems  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5722

- 2.2 *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.

- 2.3 *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.

3. Evaluation

- 3.1 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 Qualified Products List. 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.

4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

5. Requalification

- 5.1 A product disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 The testing procedure is conducted by an independent testing agency, who in return verifies that all of MDOT's requirements are met.

## QUALIFICATION PROCEDURE FOR SHEAR CONNECTOR STUDS

### 1. Scope

- 1.1 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 MDOT's Qualified Products List for a qualification period of two years.

### 2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below:

Structural Fabrication Unit  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-1235

- 2.2 *Product Data Sheets* - Include manufacturer's name and address, trade name, model number and design drawings, and any other pertinent information.

- 2.3 *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.

- 2.4 *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 Qualified Products List 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.

### 3. Evaluation

- 3.1 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 Qualified Products List. 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.

### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

## 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 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.

## 7. Physical Requirements

- 7.1 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.
- 7.2 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**

1. Scope

- 1.1 This document covers the recycled rubber adjusting ring requirements and procedure to be followed by manufacturers in order to have their product included on MDOT's Qualified Products List.

2. Submittal Procedure

- 2.1 *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 Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5707

- 2.2 *Sample* - The producer shall submit a minimum 10-inch cut away sample of the proposed adjustment riser to the address listed above.
- 2.3 *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 Qualified Products List 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.
- 2.4 *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 <sup>3</sup><br>(± 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<br>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 Surfacing, and Polymer Concretes | $6 \times 10^{-5}$ in/in/°F                       |
| Heat Resistance (70 hours at 70°C)             | D 573 | Rubber-Deterioration in an Air Oven  | Hardness - 10 max<br>Tensile/elongation - 25% max |
| Brittleness at low temperature                 | D 746 | Brittleness Temperature of Plastic and Elastomers by Impact  | Pass @ -40°F                                      |

### 3. Evaluation

- 3.1 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.

### 4. Disqualification

- 4.1 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.

### 5. Requalification

- 5.1 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**

1. Scope

- 1.1 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 Qualified Products List for watertight joints.

2. Submittal Procedure

- 2.1 *Request for Product Evaluation* - A written request for product evaluation must be submitted to the following address:

Construction and Technology Division  
Geotechnical Services Unit  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5677

- 2.2 *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.

2.2.1 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 (600 mm) diameter), must be submitted if requested.

2.2.2 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.

- 2.3 *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 in order to be considered as a qualified product.

- 2.4 *Evaluation Schedule* - A complete application, including independent laboratory test reports, must be received by the Geotechnical Services Unit on or before February 1 in order for a new product to be evaluated and placed on the Qualified Products List for use in the upcoming construction season. Subsequent modification of the QPL will be at the discretion of MDOT.

3. Evaluation

- 3.1 Pipe Diameters Up to 24 inch (600 mm).

3.1.1 The manufacturer must provide independent laboratory test reports verifying the

sewer or culvert joint system has been tested according to 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.

- 3.1.2 Once the independent laboratory has certified the test results, the watertight joint system will be listed on the Qualified Products List by manufacturer, product name and diameter of pipe.
  - 3.1.3 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.
  - 3.1.4 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 in order to keep the product on the QPL.
- 3.2 Pipe Diameters Over 24 inch (600 mm).
- 3.2.1 Watertight joints for culvert or sewer pipe greater than 24 inch (600 mm) do not require pressure testing in order 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 (600 mm) diameter (or smaller) watertight joint which uses the same configuration.
  - 3.2.2 Watertight joints greater than 24 inch (600 mm) must use a single or double gasket configuration and must be geotextile wrapped a minimum of three feet on each side of the joint. A Type A certification must be submitted for the geotextile wrap in accordance with the Materials Source Guide.  
  
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.
  - 3.2.3 Approved watertight joint configurations for pipe diameters greater than 24 inch (600 mm) will be listed on the QPL subject to the same annual certification and re-evaluation requirements as for smaller diameter pipe joint systems.
  - 3.2.4 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.

#### 4. Disqualification

- 4.1 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.

## 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 MDOT does not conduct the testing on watertight sewer and culvert joint systems, but the testing procedure and physical requirements can be found in MTM 723.

**QUALIFICATION PROCEDURE  
FOR  
POLYMER COATED CORRUGATED STEEL PIPE**

1. Scope

- 1.1 This document covers the procedure to be followed by producers in order to have a polymer coated corrugated steel pipe approved for MDOT use.

2. Submittal Procedure

- 2.1 *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:

Structural Section  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5682

- 2.2 *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:

2.2.1 Steel pipe made from zinc-coated sheet conforming to AASHTO M 218.

2.2.2 Polymeric coating must be ethylene acrylic acid film conforming to AASHTO M 246, Grade 250/250 polymer on zinc coated steel sheet.

2.2.3 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:

2.2.3.1 Stone shall be  $\frac{3}{8}$  inch (9.5 mm) in size and the maximum loss from the Los Angeles Abrasion test (MTM 102) shall be 40 percent. Only natural aggregate shall be used.

2.2.3.2 Aggregate shall be propelled by 550 gallons per minute (2080 liters per minute) of flowing seawater down a 12 degree slope.

2.2.3.3 A total of 50,000 lbs. (110,400 kg) of aggregate shall be passed through the pipe over a ten day period in uniform increments.

2.2.3.4 To pass Level I testing, no galvanized substrate is allowed to show after testing. Certified independent test results must be submitted for review.

### 2.3 *Sample Submittal*

- 2.3.1 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 (1m) long.

### 3. Evaluation

- 3.1 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.

### 4. Disqualification

- 4.1 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.

### 5. Requalification

- 5.1 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**

1. Scope

- 1.1 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 Qualified Products List for Class B installations for a qualification period of five years.

2. Submittal Procedure

- 2.1 *Request for Product Design Calculations Review* - A written request for product design calculations review must be submitted to the following address:

Flexible Pipe Specialist  
Municipal Utilities  
Design Division  
425 West Ottawa  
Lansing, MI 48933  
Telephone: (517) 241-0082

- 2.2 *Product Information* - Include all material specifications and design drawings including pipe geometry. Provide 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.
- 2.3 *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 selection of factors and parameters if they differ from the values listed below. Submit calculations in either Microsoft Excel or Mathsoft Mathcad format.
- 2.4 *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.

|             |   |           |  |
|-------------|---|-----------|--|
| $Y_{EV}$    | = | 1.95      | Load Factor for permanent load                                   |
| $Y_{LL}$    | = | 1.75      | Load Factor for vehicular live load                              |
| $Y_{WA}$    | = | 1.3       | Load Factor for hydrostatic pressure                             |
| $\Phi$      | = | 1.00      | Resistance Factor for flexure and minimum wall area and buckling |
| $\Phi_s$    | = | 0.90      | Resistance Factor for soil stiffness                             |
| $\eta_{EV}$ | = | 1.0       | Load Modifier applied to vertical earth loads                    |
| $P_{SP}$    | = | 0.120 kcf | Geostatic earth pressure   |
| $h_w$       | = | 8.0 feet  | Height of water surface above top of pipe                        |

|            |   |            |  |
|------------|---|------------|--|
| $\gamma_w$ | = | 0.0624 kcf | Unit weight of water                                     |
| $\Delta$   | = | 5%         | Allowable deflection of pipe                             |
| 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.)

### 3. Evaluation

- 3.1 The submitted calculations will be reviewed for conformance with Section 12 of the current *AASHTO LRFD Bridge Design Specifications*.

### 4. Disqualification

- 4.1 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.

### 5. Requalification

- 5.1 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

### 1. Scope

- 1.1 This document covers the policies and procedures for the Qualified Products List 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 Qualified Products List status for their silt fence geotextiles.

### 2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - 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 and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-1208

- 2.2 *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 9.10.04 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.

- 2.2.1 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.

#### 2.3 *Evaluation Based on the Following Standards* -

- 2.3.1 *Sample* - Two product samples, full width by 6.5 feet (2 meter) length, taken from separate lots (production runs) shall be provided for specification conformance testing.

- 2.3.2 *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 Qualified Products List.

- 2.4 *Evaluation Scheduling* - Manufacturers of products on the Qualified Products List 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 Qualified Products List status. MDOT reserves the right to verify submitted test information or re-evaluate a product for specification conformance at any time.

### 3. Evaluation

- 3.1 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.

### 4. Disqualification

- 4.1 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 Qualified Products List. 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.

### 5. Requalification

- 5.1 A product which has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 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 <sup>-1</sup> | 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**

1. Scope

- 1.1 This document covers the physical requirements for Recycled Rubber/Plastic Offset Blocks for use as offset blocks for Standard and Thrie Beam Guardrail on W-Beam steel posts only. It includes the procedures to be followed by manufacturers or suppliers in order to have their products included on MDOT's Qualified Products List.
- 1.2 MDOT reserves the right to randomly sample product from lots or jobsite as required to verify conformance.

2. Submittal Procedure

- 2.1 Submit a cover letter along with the required information listed in Sections 2.2 and 2.3 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 Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5707

- 2.2 *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:
- 2.2.1 Current and clearly legible MSDS.
- 2.2.2 Certification that the product is crash worthy to the requirements of NCHRP Report 350, and the product has FHWA approval for use on the National Highway System.
- 2.2.3 Certification that the product submitted has the same composition and physical/mechanical properties as the material used in the crash test.
- 2.3 *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 7 of this procedure. Descriptions of the applicable test methods are included in Section 6 of this procedure.
- 2.4 *Evaluation Scheduling* - Completed submittals will be evaluated by MDOT throughout the year.

### 3. Evaluation

- 3.1 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.

### 4. Disqualification

- 4.1 A product may be removed immediately from the QPL if any problems develop related to installation or performance.

### 5. Requalification

- 5.1 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. Testing Procedure

#### 6.1 *Plastic Blockouts*

- 6.1.1 ASTM D 570, Test Method for Water Absorption of Plastics.
- 6.1.2 ASTM D 6108, Test Method for Compressive Properties of Unreinforced and Reinforced Plastic Lumber.
- 6.1.3 ASTM D 6111, Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement.
- 6.1.4 ASTM D 6341, Test Method for Determination of the Linear Coefficient of Thermal Expansion of Plastic Lumber and Plastic Lumber Shapes between -30 and 140°F.

#### 6.2 *Recycled Rubber/Tire Scrap Blockouts*

- 6.2.1 ASTM D 575, Test Method for Rubber Properties in Compression.
- 6.2.2 ASTM D 395, Test Method for Rubber Properties in Compression Set.
- 6.2.3 ASTM C 531, Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- 6.2.4 ASTM D 573, Test Method for Rubber Deterioration in an Air Oven.
- 6.2.5 ASTM C 642, Test Method for Density, Absorption, and Voids in Hardened Concrete.

6.2.6 ASTM D 1148, Test Method for Rubber Deterioration - Heat and Ultraviolet Light Discoloration of Light-Colored Surfaces.

7. Physical and Material Property Requirements

- 7.1 **Certified to pass NCHRP Report 350 crash test, and be recyclable after collision.**
- 7.2 UV light resistant. Additives for UV light protection allowed to 0.1 percent.
- 7.3 Moisture absorption limited to 1.0 percent.
- 7.4 Minimum compressive strength of 450 psi.
- 7.5 Specific gravity between 0.9 and 1.2.
- 7.6 Thermal coefficient of expansion  $33 \times 10^{-6}$  /°F or less.
- 7.7 Plastics - Material composition consisting of minimum 30 percent recycled polyethylene.
- 7.8 Rubber - Material composition consisting of minimum 30 percent recycled rubber tire cord.
- 7.9 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.
- 7.10 Provision shall be made to prevent rotation of the GOB on the post (routed, extra bolt hole, etc).
- 7.11 The height of the top of the block does not exceed the height of the rail.
- 7.12 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**

1. Scope

- 1.1 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 MDOT's Qualified Products List (QPL).
- 1.2 MDOT reserves the right to randomly sample product from lots or jobsite as required to verify conformance.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation* - The manufacturer will submit a cover letter along with the required information listed in Sections 2.2 and 2.3 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 Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909

- 2.2 *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:
- 2.2.1 Current and clearly legible MSDS.
- 2.2.2 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.
- 2.3 *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 of this procedure. The physical and mechanical properties of the product must meet the requirements given in Section 7 of this procedure.
- 2.4 *Evaluation Scheduling* - Completed submittals will be evaluated by MDOT throughout the year.

3. Evaluation

- 3.1 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.

#### 4. Disqualification

- 4.1 A product may be removed immediately from the QPL if any problems develop related to installation or performance.

#### 5. Requalification

- 5.1 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. Testing Procedures

- 6.1 ASTM D 545, Test Method for Preformed Expansion Joint Fillers for Concrete Construction (Nonextruding and Resilient Types)

#### 7. Physical and Material Property Requirements

- 7.1 The material must be compressed to 50 percent of its original thickness with three of its edges restrained and meet the following requirements:
- 7.1.1 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.
  - 7.1.2 The extrusion of the free edge cannot exceed ¼ inch.
  - 7.1.3 The loss in weight of the compressed material cannot be more than 3 percent of the original weight.
  - 7.1.4 After compression test, the material must recover 70 percent of its original thickness in no more than 10 minutes.
- 7.2 Minimum density of 19 lb/cu ft.
- 7.3 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**

1. Scope

- 1.1 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 MDOT's Qualified Products List for a qualification period of three years.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below:

Materials Technology Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5695

- 2.2 *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.

- 2.3 *Evaluation Based on the Following Standards* - Submit a completed copy of the Physical Requirements Test Results form to the MDOT Materials Technology Group 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 (one liter) of each component in the proportion they are mixed to be evaluated by the Materials Technology Group.

- 2.4 *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 Qualified Products List 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.

3. Evaluation

- 3.1 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 Qualified Products List. 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.

4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

## 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 *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.
- 6.2 *Viscosity* - Viscosity shall be tested on a Brookfield Viscometer No. 2 spindle at 10 r.p.m. at standard laboratory temperature  $70 \pm 3^{\circ}\text{F}$  ( $21 \pm 2^{\circ}\text{C}$ ). The viscosity shall be 6 poise maximum.
- 6.3 *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  $70 \pm 3^{\circ}\text{F}$  ( $21 \pm 2^{\circ}\text{C}$ ). The gel time shall be between 15 and 80 minutes.
- 6.4 *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 (27.6 MPa) minimum.
- 6.5 *Elongation* - The elongation shall be tested in accordance with ASTM D 638 after curing for 96 hours. The elongation shall be 1 percent minimum.

7. 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**

1. Scope

- 1.1 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 MDOT's Qualified Products List for a qualification period of three years.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below.

Materials Technology Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5695

- 2.2 *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.
- 2.3 *Evaluation Based on the Following Standards* - Submit a completed copy of the Physical Requirements for Bond Release Agents (Section 7 form) to the MDOT Materials Technology Group 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.
- 2.4 *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 Qualified Products List 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.

3. Evaluation

- 3.1 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 Qualified Products List. 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.

#### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

#### 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 *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).
- 6.2 *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 (32.5 mm) diameter, and 18 inches (468 mm) 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.
- 6.3 *Test Procedure Requirements* - The required test procedures for independent testing shall be as described in MTM 614.
- 6.4 *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.
- 6.5 *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 included in this Qualification Procedure packet.

7. 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 (414 kPa)

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**

1. Scope

- 1.1 This document covers the physical requirements for preformed waterproofing membranes. Producers must follow this procedure in order to have their products included on MDOT's Qualified Products List.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation* - Submit completed copies of MDOT Form 1022 (Qualified Products Evaluation) and the attached Table 1, as required by this procedure, to the MDOT address listed below:

Materials Technology Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-6110

- 2.2 *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.
- 2.3 *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 ft. x 3 ft. sample of the preformed membrane.
- 2.4 *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 Qualified Products List 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.

3. Evaluation

- 3.1 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 Qualified Products List. 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.
- 3.2 MDOT must be notified in writing of any change in the product.

#### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

#### 5. Requalification

- 5.1 A product that had been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 *Independent Testing Laboratory* - The following testing must be conducted by an independent testing laboratory.
- 6.2 *Thickness* - The thickness of the material shall be run according to ASTM D 1777.
- 6.3 *Tensile Strength* - The tensile strength shall be determined as described in ASTM D 882. The specimen size shall be 1 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).
- 6.4 *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.
- 6.5 *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).
- 6.6 *Permeance* - Permeance shall be measured according to ASTM E 96 (water method). The results will be measured in perms (1 perm = 57 ng/Pa·s·m<sup>2</sup>).
- NOTE: "ng" refers to nanograms (1 x 10<sup>-9</sup> grams)
- 6.7 *Pliability* - Material shall be conditioned to -20°F 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.
- 6.8 *Reinforcement* - All membranes must contain a heat resistant woven or non-woven backing.
- 6.9 *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".

#### 7. Physical Requirements

To be conducted and completed by an independent testing laboratory.

**Table 1: Test Results**

| Test Method  | Test Result | Spec       |
|--|-------------|------------|
| Thickness, inches<br>ASTM D 1777                           |             | 0.065 min. |
| Tensile Strength, pounds/inch<br>ASTM D 882                |             | 50 min.    |
| Elongation, %<br>ASTM D 882                                |             | 30 min.    |
| Puncture, lbf<br>ASTM E 154                                |             | 200 min.   |
| Water Vapor Transmission, Perm<br>ASTM E 96 (water method) |             | 0.1 max.   |
| Pliability<br>ASTM D 146                                   |             | No Cracks  |
| Fabric Reinforcement                                       |             | Yes        |
| Peel Adhesion, pounds/inch<br>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

### 1. Scope

- 1.1 This document covers the requirements for bridge coating systems and the procedures for coating manufacturers to have their products included on MDOT's Qualified Products List. The qualification period is for five years from the date of acceptance.

### 2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the address listed below.

Structural Section - Coatings Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5722

- 2.2 *Product Data Sheets* - Only products with volatile organic content equal to or less than 3.3 lb/gal (400 g/L) will be accepted. Do not submit systems that we have already tested more than once.

2.2.1 All products must be from the standard product line of the submitting company, e.g. special products just for Michigan are not allowed.

2.2.2 All testing is to be done through the National Transportation Product Evaluation Program (NTPEP) following the guidelines as per AASHTO R 31.

2.2.3 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.

2.2.4 The coats will have a maximum "dry to top coat" time of 24 hours at 50°F and at 4 mil dry film thickness above the minimum for each coat.

2.2.5 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 green (14062 or 24062 Federal Standard 595b Paint Color).

2.2.6 Submit certification stating that the primer meets the requirements for Slip-Co-Efficient and Creep Resistance for ASTM A 490 Class "B". 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.

### 3. Evaluation

- 3.1 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 Qualified Products List. 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.

4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to products, materials, or manufacturing. The manufacturer will receive notification including reasons for disqualification.

5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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 AND SEED MIXTURES (VARIETIES)**

1. Scope

- 1.1 This document covers the requirements for grass seed varieties to be accepted on the Qualified Products List.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below:

Pavement and Roadside  
Maintenance Division  
6333 Lansing Road  
Lansing, MI 48917  
Telephone: (517) 322-3312

- 2.2 *Product Information* - Include product information as listed below:

2.2.1 *Product Data Sheets* - Enclose product literature for grass seed varieties describing the use, restrictions, cost, and anticipated benefit to MDOT's transportation system.

2.2.2 *Test Reports* - Include test, research and evaluation reports conducted by an independent entity. Product literature is not sufficient. Copies of actual test reports are required. MDOT may perform in-house testing for informational purposes.

2.2.3 *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.

- 2.3 *Evaluation Based on the Following Standards* - The product will be evaluated in two ways:

2.3.1 If a company has a new grass seed variety that is nearly identical to materials on the list, it has been included with the condition that its field performance be equal to or better than other materials.

2.3.2 If a company has a new grass seed variety that is different, yet is presented as doing the same job of other prequalified grass seed varieties, the company's representative will allow the material to be field tested at no cost to MDOT on an MDOT construction project so that its performance and installation can be observed under "real construction field conditions".

- 2.4 *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT after September 15 and no later than January 15 to be included in that year's evaluation and field performance testing. Addition of new products to the Qualified Products List 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.

### 3. Evaluation

- 3.1 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 2.3.1 or 2.3.2) prior to proceeding with the field testing. Once the product meets all the requirements of this procedure it will be included on the Qualified Products List. 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.

### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to performance. The manufacturer will receive notification including reasons for disqualification.

### 5. Requalification

- 5.1 A product which has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 This product is tested based upon its effectiveness and efficiency in its field performance. The area to be field tested shall be 600 square yards (500 sq m) maximum.

**QUALIFICATION PROCEDURE  
FOR  
MULCH BLANKETS**

1. Scope

- 1.1 This document covers the requirements for straw and/or excelsior mulch blankets to be placed on the Qualified Products List. The qualified product list for mulch blankets includes high velocity mulch blankets (917.15.B1) and mulch blankets (917.15.B2) as described in the Standard Specifications for Construction.

2. Submittal Procedure

- 2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the MDOT address listed below. This packet can be obtained from any of the MDOT contacts listed in Section 2.4 of this procedure.

Pavement and Roadside  
Maintenance Division  
6333 Lansing Road  
Lansing, MI 48917  
Telephone: (517) 322-3312

- 2.2 *Product Information* - Include product information as listed below:

2.2.1 *Product Data Sheets* - Enclose product literature for mulch blankets describing the use, restrictions, cost and anticipated benefit to MDOT's transportation system.

2.2.2 *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.

2.2.3 *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.

2.2.4 *Sample Specification* - Enclose a sample specification for product usage (not proprietary).

- 2.3 *Evaluation Based on the Following Standards* - The product will be evaluated in two ways:

2.3.1 If a company has a new material that is nearly identical to materials on the list, it has been included with the condition that its field performance be equal to or better than other materials.

2.3.2 If a company has a new material that is different, yet is presented as doing the same job of other prequalified materials, the company's representative will allow

the material to be field tested at no cost to MDOT on an MDOT construction project so that its performance and installation can be observed under “real construction field conditions”.

- 2.4 *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT after September 15 and no later than January 15 to be included in that year’s evaluation and field performance testing. Addition of new products to the Qualified Products List will be made only once per 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.

### 3. Evaluation

- 3.1 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 2.3.1 or 2.3.2) prior to proceeding with the field testing. Once the product meets all the requirements of this procedure, it will be included on the Qualified Products List. 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.

### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

### 5. Requalification

- 5.1 A product which has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 This product is tested based upon its effectiveness and efficiency in its field performance. The area to be field tested shall be 600 square yards (500 sq m) maximum.

**QUALIFICATION PROCEDURE  
FOR  
MULCH BINDERS (TACKIFIERS)**

1. Scope

- 1.1 This document covers the requirements for mulch binder (tackifiers) to be accepted on the Qualified Products List.
- 1.2 This qualification procedure will be used for the following types of mulch binders (tackifiers):
- latex base
  - wood fiber
  - recycled newsprint
  - quar gum
- 1.3 Other types of mulch binders (tackifiers) will be evaluated following this procedure when requested.

2. Submittal Procedure

- 2.1 *New Materials Products Evaluation Form 1022* - Submit a completed copy of Form 1022 (included in the Qualification Procedure packet) to the MDOT address listed below:
- Pavement and Roadside  
Maintenance Division  
6333 Lansing Road  
Lansing, MI 48917  
Telephone: (517) 322-3312
- 2.2 *Product Data Sheets* - Include product literature describing the use of mulch binder (tackifiers) and any other pertinent information.
- 2.3 *Evaluation Based on the Following Standards* - The product will be evaluated in two ways:
- 2.3.1 If a company has a new material that is nearly identical to materials on the list, it has been included provisionally with the condition that during the first year its field performance be equal to or better than other materials.
- 2.3.2 If a company has a new material that is different, yet is presented as doing the same job of other prequalified materials, the company's representative will allow the material to be field tested at no cost to MDOT on an MDOT Construction Project so that its performance and installation can be observed under "real construction field conditions".
- 2.4 *Evaluation Scheduling* - There is no time schedule for re-evaluating products. However, any time the field performance is questionable, re-evaluation is considered necessary.

3. Evaluation

- 3.1 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 Qualified Products List. 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.

#### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

#### 5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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. Testing Procedure

- 6.1 This product is qualified for use based upon its effectiveness and efficiency in its field performance.

**QUALIFICATION PROCEDURE  
FOR  
LIGHT WEIGHT COMPOSITE HANDHOLE**

1. Scope

- 1.1 This document covers the procedure manufacturers must follow to have a light weight composite handhold approved for use on MDOT projects.

2. Submittal Procedure

- 2.1 *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 Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-5707

- 2.2 *Report of Tests* - Provide independent laboratory test report(s) stating that the structural capacity of the pull box and cover is rated as follows:

2.2.1 Handhole covers shall have a minimum static coefficient of friction of 0.5.

2.2.2 Handhole covers shall withstand a vertical test load of 20,800 lb distributed over a 10 x 10 inch area.

2.2.3 Handhole boxes shall withstand a vertical test load of 20,800 lb distributed over a 5 x 10 inch area.

2.2.4 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.

Structural capacity shall be tested in accordance with the *Western Underground Committee, Guide 3.6, Non-Concrete Enclosures*.

- 2.3 *Sample Submittal* - MDOT reserves the right to request a sample if further analysis is required.

3. Evaluation

- 3.1 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.

4. Disqualification

- 4.1 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.

5. Requalification

- 5.1 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**

1. Scope

- 1.1 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 MDOT's Qualified Products List (QPL).
- 1.2 MDOT reserves the right to randomly sample product from lots or jobsite as required to verify conformance.

2. Submittal Procedure

- 2.1 Submit a cover letter and a frangible light standard transformer base along with the required information listed in Section 2.2 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:

Structures Unit, Experimental Studies Group  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, Michigan 48909  
Telephone: (517) 322-5707

- 2.2 *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:
- 2.2.1 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.
- 2.2.2 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.
- 2.2.3 Submit a copy of the test report by an independent facility of the dynamic performance (crash) test outlined in the standards in 2.2.1 above.
- 2.2.4 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.

- 2.2.5 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.
3. Evaluation
    - 3.1 **Certified to meet NCHRP Report 350 and AASHTO dynamic performance criteria.**
    - 3.2 Frangible light standard transformer bases must conform to the dimensional tolerances given in the FHWA approved drawing submitted in Section 2.2. 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.
    - 3.3 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.
  4. Disqualification
    - 4.1 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.
  5. Requalification
    - 5.1 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**

1. Scope

- 1.1 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.

2. Evaluation Procedure

- 2.1 The Michigan Department of Transportation specification requirements for permanent signing are shown in the “Retroreflective Sign Sheeting Material Guidelines” table in this procedure.
- 2.2 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 Qualified Products List. 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.
- 2.2.1 All sheeting samples must pass ASTM D 4956 and federal specification L-S-300C physical test requirements with a rating of “no effect.”
- 2.2.2 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.”
- 2.2.3 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.”

3. Fabrication Requirements

The manufacturer must comply with steps 3.1, 3.2, and 3.3 listed below prior to sample submittal.

- 3.1 Manufacturers must provide documentation from an independent agency that shows successful fabrication and field performance of their sheeting.
- 3.2 Manufacturers must provide documentation that details performance life of sheeting (minimum of 80 percent reflectivity maintained at ten years).

- 3.3 All fabrication testing will be done by MDOT Operations 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.
- 3.4 The manufacturer will supply MDOT with the following size sheeting samples: 1 -12.75 in. x 50 yd. roll and 1 - 36 in. x 25 yd. roll of green sheeting; 1 - 48 in. x 25 yd. roll of yellow sheeting; 1 - 24 in. x 50 yd. roll of white sheeting; 1 - 24 in. x 50 yd. roll of black vinyl; 1 - 24 in. x 25 yd. roll of blue translucent film; 1 - 2 in. x 50 yd. roll of white sheeting; 1 - 48 in. x 50 yd. roll of slip sheeting; 1 gallon of black ink and 1 gallon of blue ink.
- 3.5 Testing will be done on standard MDOT signing substrates: 0.080 aluminum, aluminum extrusion, and plywood.
- 3.6 The MDOT Operations Division Central Sign Shop will report any significant fabrication problems to the Traffic Signing Unit, Operations Division and a determination will be made whether to proceed with the field test.

#### 4. Field Test Requirements

Field tests are necessary for initial placement on the Qualified Products List and for reinstatement of a product that has been removed from the QPL. Field Test Parameters are:

- 4.1 The MDOT shall choose the location of the test site.
- 4.2 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.
- 4.3 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.
- 4.4 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.

#### 5. Evaluation Scheduling

- 5.1 The MDOT reserves the right to verify submitted test information or to modify acceptance criteria for retroreflective sheeting at any time.

#### 6. Submittal Procedure

- 6.1 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

| <b>Retroreflective Sign Sheeting Material Guidelines</b>  |  |
|---|--|
| Sign Category   | Material Type  |
| Yellow Warning Signs<br>[W series (non school related), E13-1, E13-2, E11-1, OM-1, OM-2, OM-3]  | ASTM Type IX<br>Fluorescent Yellow                                 |
| School Signs<br>(S1-1, S4-3, S4-5, S4-5a, school portion of S5-1, W16-7p, W16-9p, W16-2, W16-2a)                                      | ASTM Type IX<br>Fluorescent Yellow Green                           |
| Freeway Guide Signs<br>White legends; borders; arrows; and white portion of route markers, shields, and auxiliaries<br><br>Background | ASTM Type IX<br>White<br><br>ASTM Type IV<br>Green, Brown, or Blue |
| Non Freeway Guide Signs   | ASTM Type IV   |
| Regulatory Signs  | ASTM Type IV   |

**QUALIFICATION PROCEDURE  
FOR  
FLEXIBLE PLASTIC DELINEATOR POSTS, GROUND MOUNT**

1. Scope

- 1.1 This document covers the requirements for flexible delineator posts and the procedure to be followed by manufacturers in order to have their products included on MDOT's Qualified Product List.

2. Submittal Procedure

- 2.1 *Sampling* - Flexible delineator post samples are submitted directly to the National Testing Product Evaluation Program (NTPEP) for evaluation in their testing program. Posts must undergo summer and winter impact testing.

- 2.2 *Report of Tests* - The manufacturer must submit the following information when requesting product approval.

2.2.1 A letter indicating NTPEP testing has been completed within the past three years and includes the dates of test. A copy of NTPEP test results does not have to be submitted unless specifically requested by the MDOT.

2.2.2 Manufacturer name and address, product literature, model number, installation instructions, and any other pertinent information.

- 2.3 *Evaluation Based on the Following Standards* - The MDOT initially approves flexible delineator posts based on NTPEP test results. Once the product is evaluated and approved, it is placed on the Qualified Products List for at least two years. Continued use of the product is dependent upon satisfactory laboratory and/or field performance.

- 2.4 *MDOT Contacts* - The following personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Division of Operations  
Traffic Operations Section  
425 West Ottawa Street  
P.O. Box 30050  
Lansing, MI 48909  
Telephone: (517) 335-2624

- 2.5 *Evaluation Scheduling* - New product submittals will be evaluated by MDOT throughout the year.

3. Evaluation

- 3.1 The MDOT reviews NTPEP data for conformance to the specified requirements. The survival rate after winter and summer impact testing is the primary factor in selecting products. If the product meets the requirements, it will be included on the Qualified Products List. 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.

4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

5. Requalification

- 5.1 A product that has been disqualified and removed from the Qualified Products List 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 COLD PLASTIC TAPE

### 1. Scope

- 1.1 This document covers the physical requirements for preformed pavement marking materials to be followed by producers in order to have their product included on MDOT's Qualified Products List.
- 1.2 This procedure covers:
- Longitudinal Lines
  - Legends, Symbols and Arrows
  - Crosswalk and Top Bars

### 2. Submittal Procedure

- 2.1 *MDOT Contacts* - The following personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Division of Operations  
Traffic Operations Section  
425 West Ottawa Street  
P.O. Box 30050  
Lansing, MI 48909  
Telephone: (517) 373-3340

- 2.2 *Product Data Sheets* - Include product literature describing the use of pavement marking materials, and other pertinent information as required by Penn DOT.
- 2.3 *Evaluation Based on the Following Standards* - MDOT initially approves pavement marking materials based on laboratory and field testing provided by the Penn DOT from the NASHTO Regional Test Deck. Once the product is evaluated and approved, it is placed on the Qualified Products List for at least two years. Continued use of the product is dependant upon satisfactory laboratory test verification and field performance.
- 2.4 *Evaluation Scheduling* - Penn DOT receives samples for field and laboratory testing of pavement marking materials on the even numbered years.

### 3. Evaluation

- 3.1 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 Qualified Products List. The submitter of products placed on the Qualified Products List 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.

#### 4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.
- 4.2 The formulation of the product is continually verified by testing random samples taken from the filling line at the manufacturer's plant. The first ten batches produced at the start of the season are tested for conformance with specification requirements. If all requirements are met on these samples, then random samples are taken through the year to ensure continued conformance with specifications. The manufacturer is notified of any out-of-specification results and continued failures are grounds for removal from the Qualified Products List. Products may also be removed from the approved list due to continued application or field performance problems.

#### 5. Requalification

- 5.1 A product which has been disqualified and removed from the Qualified Products List 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  
TEMPORARY PAVEMENT MARKING MATERIALS**

1. Scope

- 1.1 This document covers the physical requirements for temporary pavement marking materials to be followed by producers in order to have their product included on MDOT's Qualified Products List.

2. Submittal Procedure

- 2.1 *MDOT Contacts* - The following personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Division of Operations  
System Operation & Management Section  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
Telephone: (517) 322-6794

- 2.2 *Product Data Sheets* - Include product literature describing the use of pavement marking materials, and other pertinent information as required by Penn DOT.

- 2.3 *Evaluation Based on the Following Standards* - MDOT initially approves pavement marking materials based on laboratory and field testing provided by the Penn DOT from the NASHTO Regional Test Deck. Once the product is evaluated by Penn DOT, 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 Qualified Products List. Continued use of the product is dependant upon satisfactory field performance.

- 2.4 *Evaluation Scheduling* - Penn DOT receives samples for field and laboratory testing of pavement marking materials on the even numbered years.

3. Evaluation

- 3.1 The submitted information will be reviewed and samples will be evaluated for conformance to the specified requirements. If the product meets the requirements it will be included on the Qualified Products List. The submitter of products placed on the Qualified Products List 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.

4. Disqualification

- 4.1 A product may be immediately removed from the Qualified Products List 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.

- 4.2 The manufacturer is notified of any out-of-specification results and continued failures are grounds for removal from the Qualified Products List. Products may also be removed from the approved list due to continued application or field performance problems.

## 5. Requalification

- 5.1 A product which has been disqualified and removed from the Qualified Products List 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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|---|---------------------|------------------------------|-------------|-----------------------|--|
| <b>401.03G</b><br>End Section Grate for Culverts  | VI                  | -                            | -           | -                     | See Standard Plans for Sizes   |
| <b>404</b><br>Precast Concrete End Rings  | VI                  | -                            | -           | -                     |  |
| <b>502-SP</b><br>Protective Polymer Coating For HMA Pavement at Snowmobile Trail Crossing   | See Remark          | None                         | -           | -                     | See Special Provision  |
| <b>603.03B</b><br>Adhesive Systems for Grouting Dowel Bars and Tie Bars for Full-Depth Concrete Pavement Repairs  | QPL                 | -                            | -           | -                     | Must be a Qualified Product (712.03J)  |
| 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). |                     |                              |             |                       |  |
| <b>603.03B12</b><br>Bond Breaker Tape   | VI                  | -                            | -           | -                     |  |
| <b>702.02A</b><br>Standard Mortars and Grouts   | VI                  | -                            | -           | -                     |  |
| <b>702.02B</b><br>Non-Shrinking Mortar and Grout, Type H-1(Non-Metallic) Pre Mixed  | QPL                 | -                            | -           | -                     | Must be a Qualified Product  |
| <b>702.02C</b><br>Admixture for Expansive Grout, Type E-1   | Gen 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.   |                     |                              |             |                       |  |
| <b>703</b><br>Prepackaged Hydraulic Fast Set Mortar   | QPL                 | -                            | -           | -                     | Must be a Qualified Product  |
| <b>704</b><br>Steel Sheet Piling  | VI                  | -                            | -           | -                     |  |
| <b>706.03K.4-SP</b><br>Expansion Joint Devices for Bridges  | See Remark          | -                            | -           | -                     | Approved devices are in Special Provision. Contractor must supply list of those used and provide shop drawings |
| <b>706.03S</b><br>Penetrating Water Repellent (Protective Coating for Concrete)   | QPL                 | -                            | -           | -                     | Must be a Qualified Product (706.03S)  |

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|--|------------------------|------------------------------|------------------------|-----------------------|---|
| <b>707.02</b><br>Bushings for Pins and Link Plates   | QPL                    | -                            | -                      | -                     | Must be a Qualified Product (707.02)  |
| <b>708.03A</b><br>Prestressed Concrete Bridge Beams  | Fabrication Inspection | -                            | -                      | -                     | QA Manual Section D8  |
| <b>710.02</b><br>Asphalt Cement (WOA)  | Test or Tested Stock   | 1 per batch                  | 1 qt                   | 5 gal.                | Water-proofing Agent  |
| <b>710.03D</b><br>Waterproofing Shotcrete  | VI                     | -                            | -                      | -                     |   |
| <b>712.03A1c</b><br>Abrasive, Low Dusting (See 715.02)   |                        |                              |                        |                       |   |
| <b>712.03J</b><br>Adhesive Anchor Systems for Structural Anchors and Lane Ties   | QPL                    | -                            | -                      | -                     | Must be a Qualified Product (712.03J)   |
| <b>712.03K</b><br>Structure Expansion Anchors (Mechanical Expansion Anchors)   | QPL<br>See Remark      | -                            | -                      | -                     | Must be a Qualified Product (712.03K). Pull-out testing is required per QA Manual Sec. D6 |
| <b>712.03L</b><br>Mechanical Reinforcement Splicing, Other Types of Splices, Swaged  | Test<br>QPL            | 1 per proj.<br>1 per proj.   | 5 splices<br>2 splices | -                     | See Note. Must be a Qualified Product (712.03L)   |
| NOTE: The contractor must make test splices, witnessed by the Engineer, on the smallest and largest bar sizes that are to be spliced. Test splice consists of 2 pieces of reinforcing bar joined by the coupler with a minimum of 12 inches of bar exposed on each end of the coupler. |                        |                              |                        |                       |   |
| <b>712.03X</b><br>Grout Under Masonry Plates   | VI                     | -                            | -                      | -                     |   |
| <b>712.03Y</b><br>Embedded Galvanic Anodes   | QPL<br>See Remark      | -                            | -                      | -                     | Must be a Qualified Product. See SP for Construction Process                              |
| <b>713.02B</b><br>Sealant for Perimeter of Beam Repairs  | QPL                    | -                            | -                      | -                     | Must be a Qualified Product (713.02B)   |
| <b>715.02</b><br>Coating Systems for New Hanger Assemblies   | QPL<br>See Remark      | -                            | -                      | -                     | Must be a Qualified Product (915.01)  |
| <b>715.02</b><br>Abrasive, Low Dusting   | QPL                    | -                            | -                      | -                     | Must be a Qualified Product (715.02)  |

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| Spec. No. and<br>Material Name  | Basis of<br>Acceptance              | Sample<br>Frequency<br>If Required | Sample<br>Size | Maximum<br>V.l.<br>Quantity | Remarks<br>(QPL Reference)   |
|---|-------------------------------------|------------------------------------|----------------|-----------------------------|--|
| <b>716.02</b><br>Abrasive, Low Dusting<br>(See 715.02)                                    |                                     |                                    |                |                             |  |
| <b>803.02</b><br>Pipe Railing for Steps<br>(Galvanized)                                   | VI                                  | -                                  | -              | -                           |  |
| <b>803.02-SP</b><br>Detectable Warning Surfaces   | QPL                                 | -                                  | -              | -                           | Must be a Qualified Product  |
| <b>804.01</b><br>Glare Screen   | VI                                  | -                                  | -              | -                           | Included in Concrete Spec.   |
| <b>808.03B</b><br>Temporary Fence Materials   | VI                                  | -                                  | -              | -                           |  |
| <b>811.03D1</b><br>Waterborn, Liquid Pavement<br>Marking Materials                        | QPL                                 | -                                  | -              | -                           | Must be a Qualified Product<br>QA Manual Section F1  |
| <b>811.03D2</b><br>Regular (Solvent), Liquid<br>Pavement Marking Materials                | QPL                                 | -                                  | -              | -                           | Must be a Qualified Product<br>QA Manual Section F1  |
| <b>811.03D3</b><br>Epoxy, Liquid Pavement<br>Marking Materials                            | QPL                                 | -                                  | -              | -                           | Must be a Qualified Product<br>QA Manual Section F1  |
| <b>811.03D3</b><br>Polyurea, Liquid Pavement<br>Marking Materials                         | QPL                                 |                                    |                |                             | Must be a Qualified Product<br>QA Manual Section F1  |
| <b>811.03D4</b><br>Thermoplastic, Liquid<br>Pavement Marking Materials                    | QPL                                 | -                                  | -              | -                           | Must be a Qualified Product<br>QA Manual Section F1  |
| <b>811.03D5</b><br>Cold Plastic Tape, Permanent<br>(Long Line, Legends and<br>Crosswalks) | QPL                                 | -                                  | -              | -                           | Must be a Qualified Product<br>QA Manual Section F1  |
| <b>811.03D6</b><br>Thermoplastic, Sprayable,<br>Liquid Pavement Marking<br>Materials      | QPL                                 | -                                  | -              | -                           | Must be a Qualified Product<br>QA Manual Section F1  |
| <b>901</b><br>Cement  | Appr Mfr *                          | See Remark                         | 10 lb          | 45 ton                      | See Special Instructions, Test<br>Data Certification to C&T                                |
| <b>901.06</b><br>Ground Granular Blast-<br>Furnace Slag (GGBFS)                           | Appr Mfr *<br>With Cement<br>Sample | See Remark<br>for Cement           | 10 lb          |                             | See Special Instructions for<br>Cement and Fly Ash note. Test<br>Data Certification to C&T |

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| Spec. No. and<br>Material Name   | Basis of<br>Acceptance              | Sample<br>Frequency<br>If Required | Sample<br>Size | Maximum<br>V.I.<br>Quantity | Remarks<br>(QPL Reference)  |
|--|-------------------------------------|------------------------------------|----------------|-----------------------------|---|
| <b>901.07</b><br>Fly Ash, Pozzolanic<br>Admixtures for Concrete  | Appr Mfr *<br>With Cement<br>Sample | -                                  | 10 lb          | -                           | Test Data Certification to C&T.<br>See Note.  |
| NOTE: The fly ash sample is to be accompanied by a sample of the cement with which it is being used. MDOT-furnished plastic-lined cement sample bags will hold 4540 g when FULL. |                                     |                                    |                |                             |   |
| <b>902</b><br>Coarse Aggregates  | Test<br>See Remark                  | 1 per 1000 ton                     | 60 lb          | 100 ton                     | If Prequalified Supplier, see QA<br>Manual Section C-6 Part 7 for<br>sample frequency |
| <b>902</b><br>Dense-Graded Aggregates  | Test<br>See Remark                  | 1 per 1000 ton                     | 60 lb          | 500 ton                     | If Prequalified Supplier, see QA<br>Manual Section C-6 Part 7 for<br>sample frequency |
| <b>902</b><br>Open-Graded Aggregates   | Test<br>See Remark                  | 1 per 1000 ton                     | 60 lb          | 100 ton                     | If Prequalified Supplier, see QA<br>Manual Section C-6 Part 7 for<br>sample frequency |
| <b>902</b><br>Granular Material Class I  | Test<br>See Remark                  | 1 per 1000 ton                     | 60 lb          | 100 ton                     | If Prequalified Supplier, see QA<br>Manual Section C-6 Part 7 for<br>sample frequency |
| <b>902</b><br>Granular Material Class II<br>(Subbase) and Class IIA  | Test<br>See Remark                  | 1 per 3000 cyd                     | 60 lb          | 500 cyd                     | If Prequalified Supplier, see QA<br>Manual Section C-6 Part 7 for<br>sample frequency |
| <b>902</b><br>Class II (Abutment B. F.)  | Test<br>See Remark                  | 1 per structure                    | 60 lb          | 100 cyd                     | If Prequalified Supplier, see QA<br>Manual Section C-6 Part 7 for<br>sample frequency |
| <b>902</b><br>Granular Material Class III  | Test<br>See Remark                  | 1 per 10,000 cyd                   | 60 lb          | 500 cyd                     | If Prequalified Supplier, see QA<br>Manual Section C-6 Part 7 for<br>sample frequency |
| <b>902</b><br>Granular Material Class IIIA   | Test<br>See Remark                  | 1per 1000 cyd                      | 25 lb          | 100 cyd                     | If Prequalified Supplier, see QA<br>Manual Section C-6 Part 7 for<br>sample frequency |
| <b>902</b><br>Fine Aggregate   | Test<br>See Remark                  | 1 per 1000 tons                    | 25 lb          | 100 ton                     | If Prequalified Supplier, see QA<br>Manual Section C-6 Part 7 for<br>sample frequency |
| <b>902</b><br>Mineral Filler for HMA<br>Mixtures   | Appr Mfr *<br>See Remark            | 1 per proj.                        | 1 qt           | 10 ton                      | Refer to Asphalt Binder<br>Procedures Manual, General<br>Certification to C&T         |

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|--|---------------------|------------------------------|-------------|-----------------------|---|
| <b>903.01</b><br>Air Entraining Admixtures   | QPL                 | -                            | -           | -                     | Must be a Qualified Product (903.01)  |
| <b>903.02</b><br>Concrete Accelerators<br>1. Calcium Chloride<br>2. All Others       | VI<br>QPL           | -                            | -           | -                     | For calcium chloride note the chemical composition. Other accelerators must be Qualified Products (903.02). |
| <b>903.03</b><br>Water Reducing and Water Reducing Retarding Admixtures for Concrete | QPL                 | -                            | -           | -                     | Must be a Qualified Product (903.03)  |
| <b>903.04</b><br>Latex Admixture for Concrete  | Appr Mfr *          | 1 per lot                    | 1 qt        |                       | General Certification to C&T  |

|  |                      |                               |            |                                    |  |
|--|----------------------|-------------------------------|------------|------------------------------------|--|
| <b>903.05</b><br>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. |                      |                               |            |                                    |  |
| <b>903.06B</b><br>Interim Curing (Linseed Oil Based)   | Test Data Cert       | 1 per lot or batch            | 1 qt       | 50 gal.                            | See Note for 903.05 above  |
| <b>903.06C</b><br>Insulating Blanket   | Test Data Cert       | -                             | -          | 10 sheets                          |  |
| <b>903.06D</b><br>Polystyrene Insulation   | Test Data Cert       | -                             | -          | -                                  |  |
| <b>904.03A</b><br>Asphalt Binder for HMA Mixtures  | Appr Mfr *           | 1 per day's production of mix | 1 pint     | 5 ton per day or 27 tons per proj. | Refer to <i>Procedure Manual for Certification of Hot Mix Asphalt Plants</i> for additional requirements.      |
| <b>904.03B</b><br>Liquid Asphalt (MC)  | Test or Tested Stock | 1 per batch                   | See Remark |                                    | 1 gal. from the top and 1 gal. from the bottom of tank   |
| <b>904.03B</b><br>Liquid Asphalt (RC-250)  | Test or Tested Stock | 1 per batch                   | 2 qt       | 5 gal.                             |  |
| <b>904.03C</b><br>Emulsified Asphalt   | Appr Mfr *           | 1 per batch                   | See Remark | 1000 gal.                          | 1 gal. from the top and 1 gal. from the bottom of the tank. Submit sample in plastic or glass containers only. |

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|---|---------------------------------|------------------------------|----------------------------|-----------------------|---|
| <b>904.03D</b><br>Polymer Modified Asphalt Cement for Overband Crack Fill   | Gen Cert<br>See Remark          | -                            | -                          | -                     | Contractor Certified or Supplier Certified  |
| <b>904.03E</b><br>Polyester Fibers for Overband Crack Fill  | Gen Cert                        | -                            | -                          | -                     |   |
| <b>905.03</b><br>Bar Reinforcement (Uncoated)   | Appr Mfr *                      | 1 per proj.<br>per mfr.      | See Remark                 | 500 lb                | 2 pcs. One 24 in. min. & one 36 in. min. Second piece must be 48 in. min. for #9, #10, #11 bars. Test Data Cert to C&T.   |
| <b>905.03</b><br>Bar Reinforcement (Epoxy Coated Spiral)<br>1. Bar<br>2. Epoxy Coating Companies<br>3. Epoxy Coating Material   | Appr Mfr *<br>Appr Mfr *<br>QPL | 1 per proj.<br>per mfr.      | See Note                   | 500 lb                | Test Data Cert to C&T<br>Test Data Cert to C&T<br>(905.03C1)  |
| NOTE: Sample ID to include name of epoxy coating company, epoxy resin trade name and lot number, bar manufacturer and heat number. Sample size, 3 pieces, 1 of which is 24 in. min. and 2 of 36 in. min. A third piece shall be 48 in. min. for #9, #10, and #11 bars   |                                 |                              |                            |                       |   |
| <b>905.03C</b><br>Bar Reinforcement (Epoxy Coated)<br>1. Bar<br>2. Epoxy Coating Companies<br>3. Epoxy Coating Material   | Appr Mfr *<br>Appr Mfr *<br>QPL | 1 per proj.<br>per mfr.      | See Note                   | 500 lb                | Test Data Cert to C&T<br>Test Data Cert to C&T<br>(905.03C1)  |
| NOTE: Sample ID to include name of epoxy coating company, epoxy resin trade name and lot number, bar manufacturer and heat number. Sample size, 3 pieces, 1 of which is 24 in. min. and 2 of 36 in. min. A third piece shall be 48 in. min. for #9, #10, and #11 bars.  |                                 |                              |                            |                       |   |
| <b>905.03D</b><br>Bar Chairs and Wire Ties for Epoxy Coated Steel Reinforcement   | VI                              | -                            | -                          | -                     |   |
| <b>905.06</b><br>Welded Steel Wire Reinforcement (Mesh)   | Appr Mfr *                      | 1 per proj.<br>per mfr.      | See Remark                 | 500 syd               | Test Data Cert. to C&T. See Note.   |
| NOTE: 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. |                                 |                              |                            |                       |   |
| <b>905.07</b><br>Strand for Prestressed Concrete  | Appr Mfr *                      | 1 per heat                   | 2 pcs. each<br>80 in. long |                       | Obtain sample 5 ft. from end of reel. Test Data Cert. to C&T  |
| <b>905.08</b><br>Tendons for Post Tensioning of Box Beams - Prestressing Strand   | Appr Mfr *<br>See Remark        | 1 per heat                   | 2 pcs. each<br>80 in. long |                       | Sampling and testing may be waived if strand from same reel is tested for beam fabrication. Test Data Cert. to C&T. Obtain sample at least 5 ft from end of reel. |

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|---|-------------------------------------|---|--|-----------------------|--|
| <b>905.08</b><br>Tendons for Post Tensioning of Box Beams - Bar   | Test                                | 1 per heat per proj.                    | 15 in.                                     |                       | Test Data certification must be attached to Sample Identification form for lab testing.  |
| <b>906</b><br>Structural Steel  | Fabrication Inspection              | -                                       | -  | -                     | QA Manual Section D-10   |
| <b>906.05</b><br>Foundation Piles: H Piling, Steel Shells and Pile Points   | Test Data Cert                      | -                                       | -  | -                     |  |
| <b>906.05</b><br>Pile Cutoffs   | Gen Cert                            | -                                       | -  | -                     |  |
| <b>906.06</b><br>High Strength Steel Bolts  | Test                                | 1 per dia per length per heat per proj. | 3 each bolts, nuts & washers               |                       | Bolt, nut & washer Test Data Cert must identify the manufacturer and must be attached to the Sample ID   |
| <b>906.08</b><br>Shear Developers (Studs)   | QPL or Test Data Cert<br>See Remark | -                                       | -  | -                     | (906.08) Other stud shear developers may be used provided the supplier certifies that the studs meet the requirements of AWS D1.5-96, All section 7. |
| <b>907.03</b><br>Woven Wire Fencing Materials<br>A. Woven Wire<br>B. Barbed Wire<br>C. Smooth Line Wire   | VI                                  | 1 per proj. per mfr.                    | Full width of roll<br>5 ft<br>6 ft<br>4 ft |                       |  |
| <b>907.03</b><br>D. Steel Posts   | VI                                  | 1 per proj. per mfr.                    | See Remark                                 | See Remark            | 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. |                                     |   |  |                       |  |
| <b>907.03</b><br>E. Treated Wood Posts  | Appr Mfr * or Tested Stock          | Each charge                             | 22 cores                                   | 25 posts              | General Certification to C&T   |
| <b>907.03</b><br>F. Gates<br>G. Fence Fittings and Hardware   | VI                                  | -                                       | -  | -                     |  |
| <b>907.04</b><br>Steel Chain Link Fence Materials<br>A. Fabric  | Test or Tested Stock                | See Remark                              | 5 ft full width of roll                    | 250 ft                | 1 per height and/or mesh size, per project and 1 per mfr. per proj.  |
| <b>907.04</b><br>B. Tension Wire  | Gen Cert                            | 1 per proj. per mfr.                    | 5 ft                                       | 500 ft                |  |

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| Spec. No. and Material Name   | Basis of Acceptance        | Sample Frequency If Required    | Sample Size         | Maximum V.l. Quantity | Remarks (QPL Reference)  |
| <b>907.04</b><br>C. Post for Fence and Gates (Steel)  | Gen Cert                   | 1 per proj. per mfr.            | See Remark          | See Remark            | 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. |                            |                                 |                     |                       |  |
| <b>907.04</b><br>D. Gates<br>E. Fence Fitting and Hardware  | VI                         | -                               | -                   | -                     |  |
| <b>907.04</b><br>F. Top Rail (Horz. Rail)   | Test                       | 1 per proj. per mfr. See Remark | 5 ft                | 250 ft                | Weigh 5 rails to determine the average weight per foot and include the weight info on Sample ID. |
| 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. |                            |                                 |                     |                       |  |
| <b>907.04</b><br>G. Post for Chain Link Pedestrian Fence (Structure Fencing)  | Test                       | 1 per proj. per mfr. See Remark | 5 ft straight piece | 25 post               | Weigh 5 posts to determine the average weight per foot and include the weight info on Sample ID. |
| 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. |                            |                                 |                     |                       |  |
| <b>907.04</b><br>H. Rail for Braces for Chain Link Pedestrian Fence   | Test                       | 1 per proj. and 1 per mfr.      | 5 ft                | 250 ft                | Weigh 5 rails to determine the average weight per foot and include the weight info on Sample ID. |
| 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. |                            |                                 |                     |                       |  |
| <b>907.05</b><br>High Tensile Wire Fence<br>A. Wire   | Test                       | 1 per proj. per mfr.            | 6 ft                | 250 ft                |  |
| <b>907.05</b><br>B. Treated Wood Posts for High Tensile Wire Fence  | Appr Mfr * or Tested Stock | Each charge                     | 22 cores            | 25 posts              | See Note, General Cert to C&T  |
| NOTE: All post must be treated including Northern White Cedar. General Certification document required for Northern White Cedar in lieu of approved manufacturer.   |                            |                                 |                     |                       |  |
| <b>907.05</b><br>C. Hardware  | VI                         | -                               | -                   | -                     |  |
| <b>907.06</b><br>Protective Fence   | VI                         | -                               | -                   | -                     |  |
| <b>908.03</b><br>Malleable Iron, Steel, and Gray Iron Casting and Manhole Casting   | VI                         | -                               | -                   | -                     |  |

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|--|------------------------------------|-------------------------------------|---|-----------------------|---|
| <b>908.05</b><br>Alternate, Adjustable Gray Iron Castings for Manholes, Drainage Structures, and Covers  | QPL                                | -                                   | -   | -                     |   |
| <b>908.07</b><br>Sheet Lead  | Gen Cert                           | -                                   | -   | 25 sft                |   |
| <b>908.08</b><br>Sheet Copper  | Test                               | 1 per consignment                   | 13 in. square or equivalent area                            | 25 sft                | May be accepted in field if weight requirements can be documented   |
| <b>908.09</b><br>Aluminum Bridge Railing   | See Note                           | -                                   | -   | -                     |   |
| NOTE: Test Data Certification, requires a mill certification and a visual inspection of the material. The project engineer is to arrange for this inspection which should include dimensional and thorough visual checks on all material especially for blowholes on posts and caps. |                                    |                                     |   |                       |   |
| <b>908.09</b><br>Cast Aluminum Alloy Posts   | Test Data Cert                     | -                                   | -   | -                     |   |
| <b>908.10A</b><br>Tubing, Steel Railing (Galvanized)<br>Base Plate and Post Elements   | Test or Tested Stock<br>See Remark | 1 per heat per proj.                | 1 base plate, 1 post min. 15 in. length                     |                       | Test Data Cert. Document must be attached to the sample ID. Test report to P.E.   |
| <b>908.10B</b><br>Rail Elements (Tube)   | Test or Tested Stock<br>See Remark | 1 per heat per proj.                | 48 in. long, galv.  |                       | Chemical analysis must include silicon. Test Data Cert. Document must be attached to the sample ID. Test Report to P.E. |
| <b>908.10C</b><br>Hardware (Anchor Studs)  | Test                               | 1 per heat per diameter per project | A bolt, nut, washer, coupling and base plate, if applicable |                       |   |
| <b>908.11</b><br>Hardware for Timber Construction  | VI                                 | -                                   | -   | -                     |   |
| <b>908.12</b><br>Guardrail, Steel Beam Elements, End Sections  | Appr Mfr *                         | 1 per proj. per mfr.                | 1 piece at least 3 ft length                                | 125 ft                | Including Anchorage, Bridge, Shoes, Departing End Terminals. Test Data Cert to C&T                                      |
| <b>908.12A</b><br>Guardrail Approach Terminals   | Appr Mfr *                         | -                                   | -   | -                     | Test Data Cert. to C&T  |
| <b>908.12</b><br>B. Hardware<br>C. Steel Sleeves, Soil Plates, Bearing Plates, Backup Plates   | VI                                 | -                                   | -   | -                     | Item supplied by guardrail supplier   |
| <b>908.12</b><br>Wire Rope   | Gen Cert                           | -                                   | -   | -                     |   |

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|--|------------------------|-------------------------------------|--|-------------------------------|--|
| <b>908.13</b><br>Steel Posts for Beam Guardrail  | Appr Mfr *             | -                                   | 1 post   | 25 posts                      | Test Data Cert. to C&T   |
| <b>908.14</b><br>Reflective Washers  | VI<br>See Remark       | -                                   | -  | -                             | Inspect galvanizing, dimensions and type of sheeting   |
| <b>908.15</b><br>Anchor Bolts, Anchor Studs, Anchor Rods and Anchor Base Plates                                  | Test<br>**See Remark   | 1 per heat per diameter per project | 1 bolt, nut, washer, coupling and base plate if applicable | -                             | Non MDOT Standard Plan Bolts require Shop Drawings along with the Test Data Cert Document. ** For cantilever foundations: 1 per heat per dia. per foundation, max 3 per project. |
| <b>909.01</b><br>Adjusting Rings for Manholes and Drainage Castings, (Alternative Materials and Recycled Rubber) | QPL                    | -                                   | -  | -                             |  |
| <b>909.03</b><br>Watertight Joint Systems  | QPL                    | -                                   | -  | -                             |  |
| <b>909.03</b><br>Gasket, Compression (O-Rings)   | VI                     | -                                   | -  | -                             | Part of Watertight Joint System  |
| <b>909.04A</b><br>Reinforced Concrete Pipe   | Appr Mfr *             | 1% of number of pcs. of each size   | See Remark   | 5 pieces of 42 in. or smaller | See Special Instructions General Cert. to C&T  |
| <b>909.04B</b><br>Reinforced Concrete Elliptical Pipe  | Appr Mfr *             | 1% of number of pcs. of each size   | See Remark   | 5 pieces of 42 in. or smaller | See Special Instructions General Cert. to C&T  |
| <b>909.04C</b><br>Non-Reinforced Concrete Pipe   | Appr Mfr *             | See Remark                          | See Remark   | 10 pcs.                       | See Special Instructions General Cert. to C&T  |
| <b>909.04D</b><br>Precast Concrete Box Sections  | Appr Mfr *             | -                                   | -  | -                             | General Cert. to C&T<br>Box = 4 sided  |
| <b>909.04E</b><br>Precast Concrete End Section for Culverts and Sewers   | Appr Mfr *             | 1% of number of pcs.                | Full size units  | 10 pcs.                       | Strength test by coring or cylinders, VI dimensions and conditions. Test for air content. Test Data Cert. to C&T.  |
| <b>909.04G</b><br>Precast Concrete Three-Sided or Arch Culverts  | Appr Mfr<br>See Remark | -                                   | -  | -                             | For span lengths up to 12 ft, General Cert. to C&T. Spans from 12-20 ft, QA inspection may be required. Spans greater than 20 ft. require QA inspection.                         |

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|--|--|--|------------------------------------|------------------------------|---|
| <b>909.05A</b><br>Corrugated Steel Pipe  | Appr Mfr *                                 |  | See Remark                         |                              | See Special Instructions<br>General Cert. to C&T  |
| <b>909.05A</b><br>Gasket, External Rubber Type   | VI   | 1 per lot or shipment                                | 18 in. length full width of gasket |                              | Part of Watertight Joint System   |
| <b>909.05A1</b><br>Corrugated Steel Sheets (Galvanized)  | Gen Cert                                   | See Remark   | See Remark                         |                              | See Special Instructions  |
| <b>909.05A</b><br>Polymer Coated, Galvanized Corrugated Steel Pipe                                       | QPL  | -  | -                                  | -                            | Coating must be from Qualified Products List (909.05-SP)  |
| <b>909.05A4</b><br>Coupling Bands  | Gen Cert                                   | -  | -                                  | 5 pcs.                       |   |
| <b>909.05B</b><br>Corrugated Aluminum Alloy Sheet  | Gen Cert                                   | See Remark   | See Remark                         | 25 sheets                    | See Special Instructions  |
| <b>909.05B</b><br>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. |
| <b>909.05C</b><br>Metal End Section  | Gen Cert                                   | -  | -                                  | 4 pcs.                       |   |
| <b>909.05D</b><br>Steel Pipe (Jacked-in-Place)   | VI   | -  | -                                  | -                            |   |
| <b>909.06</b><br>Culverts, Class B (CPE)<br>Storm Sewers, Class B (CPE & CPVC)                           | QPL  | -  | -                                  | -                            | Must be a Qualified Product   |
| <b>NOTE:</b> Water Tight Joint Systems (909.03) must be approved prior.                                  |  |  |                                    |                              |   |
| <b>909.06A</b><br>Corrugated Polyethylene Pipe (CPE), (Smooth Lined Type S or Corrugated Type C)         | Test or Tested Stock if $\geq 12$ in. dia. | $\geq 12$ in. dia.<br>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<br>See special instruction No. 909.06            |
| <b>909.06B</b><br>1. Corrugated Polyvinyl Chloride (PVC) Pipe (Smooth Lined Type S or Corrugated Type C) | Test                                       | $\geq 12$ in. dia<br>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   |
| <b>909.06B</b><br>2. Smooth Polyvinyl Chloride Pipe for Sanitary Sewer Pipe                              | Test                                       | 1 per 6000 ft  | 1 piece, 5 ft in. length           | 600 ft                       | If bell and spigot joint, sample from bell end  |

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|--|-------------------------------------|-----------------------------------|---------------|------------------------------|---|
| <b>909.06B</b><br>3. Corrugated Polyvinyl Chloride (PVC) Pipe (Smooth Lined Type S) for Sanitary Sewer Pipe                      | Test                                | 1 per 1000 ft                     | See Remark    | 12 in. dia. and over, 100 ft | Over 12 in. dia.- one 10 ft. length and one 6 ft. length plus coupling  |
| <b>909.07</b><br>Pipe for Underdrains<br>1. Corrugated Steel Pipe  | Appr Mfr *                          | See Remark                        | See Remark    |                              | See Special Instructions for 909.05A, Test Data Cert. to C&T  |
| <b>909.07</b><br>Pipe for Underdrains<br>2. Corrugated Aluminum Alloy Pipe   | Gen Cert                            | 1 for 1000 ft                     | 6 in. x 3 in. | 250 ft                       |   |
| <b>909.07A</b><br>Pipe for Underdrains<br>3. Smooth Plastic Pipe (Outlet Pipe)   | Test                                | 1 per 2500 ft or fraction thereof | 5 ft length   | 250 ft                       |   |
| <b>909.07B</b><br>Pipe for Underdrains<br>4. Corrugated Plastic Tubing (Perforated and Non-Perforated) (Wrapped and Non-Wrapped) | Appr Mfr *<br>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. |
| <b>909.07</b><br>Pipe for Underdrains<br>5. Porous Concrete Pipe   | VI                                  | -                                 | -             | -                            |   |
| <b>909.07</b><br>Pipe for Underdrains<br>6. Perforated Concrete Pipe   | VI                                  | -                                 | -             | -                            |   |
| <b>909.07</b><br>Pipe for Underdrains<br>7. Perforated Clay Pipe   | VI                                  | -                                 | -             | -                            |   |
| <b>909.07C</b><br>Outlet Endings (For Underdrains)   | VI                                  | -                                 | -             | -                            |   |
| <b>909.08A</b><br>Bridge Decks Downspouts<br>1. Polyethylene (PE) Plastic Pipe   | VI                                  |                                   |               |                              |   |
| <b>909.08B</b><br>Other Downspouts<br>1. Corrugated Steel Pipe   | Appr Mfr *                          | See Remark                        | See Remark    |                              | See Spec. 909.07 Corrugated Steel Pipe. Test Data Cert. to C&T  |
| <b>909.08B</b><br>Other Downspouts<br>2. Corrugated Aluminum Alloy Pipe  | Gen Cert                            | 1 per 1000 ft                     | 6 in. x 3 in. | 250 ft                       |   |

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| Spec. No. and Material Name  | Basis of Acceptance  | Sample Frequency If Required           | Sample Size                             | Maximum V.I. Quantity                                  | Remarks (QPL Reference)  |
|--|----------------------|--|---|--|--|
| <b>909.08B</b><br>Other Downspouts<br>3. Corrugated or Smooth Lined Corrugated Polyethylene Pipe | Test or Tested Stock | See Remark                             | See Remark                              | <12 in. dia. up to 250 ft<br>>12 in. dia. up to 100 ft | See Spec. 909.06A  |
| <b>909.08C</b><br>Bridge Deck Drain Extensions (Polyethylene)                                    | Gen Cert             | -                                      | -                                       | -  |  |
| <b>909.09</b><br>Cold Applied Pipe Joint Sealer (Mastic)   | Test                 | 1 per shipment from a single container | 1 qt                                    | 10 gal.  |  |
| <b>909.10</b><br>Drainage Marker Post  | See Delineator Posts | -                                      | -                                       | -  |  |
| <b>910.03A</b><br>Geotextiles<br>1. Blankets   | Test Data Cert       | See Remark                             | See Remark                              | See Remark   | See Special Instruction 910.03   |
| <b>910.03A</b><br>Knitted Sock Pipe Wrap   | See Remark           | -                                      | -                                       | -  | See 909.07 Certified with Corrugated Plastic Tubing.   |
| <b>910.03B</b><br>Liner for Rip-Rap  | Test Data Cert       | See Remark                             | See Remark                              | See Remark   | See Special Instruction 910.03   |
| <b>910.03B</b><br>Liner for Heavy Rip-Rap  | Test Data Cert       | See Remark                             | See Remark                              | See Remark   | See Special Instruction 910.03   |
| <b>910.03C</b><br>Separator/Stabilization Geotextile   | Test Data Cert       | See Remark                             | See Remark                              | See Remark   | See Special Instruction 910.03   |
| <b>910.03D</b><br>Geogrids   | Test                 | 1 per type per proj.                   | 1 pc. 6 ft long full roll width         | -  | Sample must be <u>rolled</u> not folded  |
| <b>910.04</b><br>Silt Fence Geotextile   | QPL                  | -                                      | -                                       | -  | Must be a Qualified Product  |
| <b>910.05A</b><br>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  |
| <b>910.05B</b><br>Wall Drain   | Test                 | 1 per 1000 ft or less                  | 1 pc. 6 ft. long plus 3 syd filter-wrap | 100 sft  |  |
| <b>911</b><br>Water  | Test<br>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. |

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|---|----------------------------|-----------------------------------|------------------------|-----------------------|--|
| <b>912.06</b><br>Structural Timber and Lumber   | Appr Mfr *                 | Each Charge                       | 22 cores<br>See Remark |                       | 48 cores if treatment is creosote<br>General Cert. to C&T  |
| <b>912.07</b><br>Timber Piles   | VI                         | -                                 | -                      | -                     |  |
| <b>912.08</b><br>Treated Wood Fence Posts   | Appr Mfr * or Tested Stock | Each Charge                       | 22 cores               | 25 posts              | See Note. General Cert to C&T  |
| NOTE: All post must be treated including Northern White Cedar. General Certification document required for Northern White Cedar in lieu of approved manufacturer. |                            |                                   |                        |                       |  |
| <b>912.08B</b><br>Guide Posts, Guard and Mail Box Posts   | Appr Mfr *                 | Each Charge                       | 22 cores               | 25 posts              | Cedar post need not be treated.<br>General Cert. to C&T  |
| NOTE: All post must be treated except Northern White Cedar. General Certification document required for Northern White Cedar in lieu of approved manufacturer.    |                            |                                   |                        |                       |  |
| <b>912.09</b><br>Wood Guardrail Post and Blocks (Dimension Sawed)   | Appr Mfr * or Tested Stock | Each Charge                       | 22 cores               |                       |  |
| <b>912.09Q</b><br>Recycled Plastic or Rubber Guardrail Offset Blocks  | QPL                        | -                                 | -                      | -                     | Must be a Qualified Product. May only be used on Steel Posts (912.09Q)   |
| <b>912.10</b><br>Timber for Rustic Construction   | Gen Cert                   | -                                 | -                      | -                     |  |
| <b>913.03</b><br>Clay and Sand Lime Brick and Block   | Test                       | 1 per 250,000 or fraction thereof | 6 pcs.                 | 1000 pcs.             |  |
| <b>913.03B</b><br>Concrete Brick  | Appr Mfr *                 | 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. General Cert. to C&T   |
| <b>913.05</b><br>Concrete Block   | Appr Mfr *                 | See Remark                        | 4 pcs.                 | 1000 pcs.             | One from lot of 10,000 or fraction thereof; 2 from lots more than 10,000. General Cert. to C&T   |
| <b>913.06</b><br>Precast Reinforced Concrete Units for Drainage   | Appr Mfr *                 | 1% 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. General Cert. to C&T |
| <b>913.07</b><br>Precast Concrete Bases, Sumps  | Appr Mfr *                 | 5% of total                       |                        | 10 pcs. total         | General Cert. to C&T   |

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| Spec. No. and<br>Material Name   | Basis of<br>Acceptance                   | Sample<br>Frequency<br>If Required              | Sample<br>Size     | Maximum<br>V.I.<br>Quantity | Remarks<br>(QPL Reference)   |
|--|--|---|--------------------|-----------------------------|--|
| <b>913.08</b><br>Structural Tile   | Test                                     | 1 per proj.                                     | 6 tiles            | 1000 tiles                  |  |
| <b>913.09</b><br>Slope Pavement Blocks   | Appr Mfr *                               | 1 per 25,000                                    | 6 blocks           | 1000 pcs.                   | General Cert. to C&T   |
| <b>914.03</b><br>Bituminized Fiber Joint Filler  | Appr Mfr *                               | 1 per 1000 sft or<br>fraction thereof           | 2 ft<br>See Remark | 150 sft                     | Sample for structure to be at least<br>5 in. wide. ¼ in. filler need not be<br>sampled. General Cert. to C&T |
| <b>914.03B</b><br>Recycled Rubber Joint Filler   | QPL                                      | -   | -                  | -                           | Must be a Qualified Product  |
| <b>914.04A</b><br>Hot-Poured Joint Sealant   | Test or<br>Tested Stock                  | 1 per batch<br>from a single<br>container       | 5 lb.              | 100 lb                      | Do not submit melted samples   |
| <b>914.04B</b><br>Backer Rod for Use with Hot-<br>Poured Joint Sealant                     | VI                                       | -   | -                  | -                           |  |
| <b>914.04C</b><br>Neoprene Joint Seals   | Appr Mfr * or<br>Tested Stock            | 1 per size<br>per lot                           | See Remark         | 100 ft                      | See Special Instructions. General<br>Cert. to C&T  |
| <b>914.04D</b><br>Lubricant Adhesive for<br>Neoprene Joint Seals                           | Gen Cert                                 | -   | -                  | -                           |  |
| <b>914.05</b><br>Epoxy Binder, For Joint Spall<br>Repair                                   | Test or<br>Tested Stock                  | 1 per lot or<br>batch number                    | See Remark         | 5 gal.                      | See Special Instructions   |
| <b>914.06</b><br>Epoxy Resin Adhesive and<br>Temporary Seal (Crack<br>Injection)           | QPL                                      | -   | -                  | -                           | Must be a Qualified Product<br>(914.06)  |
| <b>914.07</b><br>Transverse Pavement Joints<br>1. Dowel Bars<br>2. Epoxy Coating Companies | Appr Mfr *<br>Appr Mfr *                 | 1 per proj.<br>per mfr.                         | 1 bar              | 240 bars                    | Test Data Cert. to C&T<br>Coating must be Qualified Product<br>(905.03c)                                     |
| <b>914.07A</b><br>Transverse Pavement Joints<br>3. Epoxy Coating Material                  | QPL                                      | 1 per proj.<br>per mfr.                         | 1 bar              | 240 bars                    | Test Data Cert. to C&T. Coating<br>must be Qualified Product<br>(905.03c)                                    |
| <b>914.07</b><br>Dowel Bar Expansion Caps  | VI                                       | -   | -                  | -                           | Caps must conform to Standard<br>Plan R-40 Series  |
| <b>914.07</b><br>1. Load Transfer<br>2. Assemblies/Dowel Baskets                           | Appr Mfr<br>VI Fabrication<br>Inspection | 1 per 3000<br>assemblies or<br>fraction thereof | Full size unit     | 20<br>assemblies            | QA Manual Section D12  |

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|---|------------------------------|--|-------------|-----------------------|---|
| <b>914.07A</b><br>Bond Release; Coatings for Dowel Bars<br>1. Bituminous Material<br>2. Alternate Bond Release Agents                             | Gen Cert<br>QPL              | -                                      | -           | 20 gal max            | Must be a Qualified Product or meet Standard Spec 914.07A   |
| <b>914.08</b><br>End-of-Pour Joint Devices<br>A. Hook Bolts   | VI                           | -                                      | -           | -                     | See 914.09C   |
| <b>914.08</b><br>B. Deformed Bars<br>Bars<br>Epoxy Coating  | Appr Mfr *<br>QPL            | 1 per proj.<br>per mfr.                |             | 500 lb                | Test Data Cert. to C&T<br>Epoxy Coating must be Qualified Product (905.03C)                                     |
| <b>914.09</b><br>Straight and Bent Tie Bars for Longitudinal Pavement Joints (Lane Ties)<br>Bars<br>Epoxy Coating                                 | Appr Mfr *<br>QPL            | 1 per proj.<br>per mfr.                | See Remark  | 500 lb                | Test Data Cert. to C&T. 1 pc. 24 in. and 2 pcs. 36 in. Coating must be a Qualified Product (905.03C). See Note. |
| NOTE: Epoxy Coating must be a Qualified Product. Sample ID to include name of Coater, Bar manufacturer, Resin manufacturer, and Resin trade name. |                              |  |             |                       |   |
| <b>914.09C</b><br>Hook Bolts  | VI                           | -                                      | -           | -                     |   |
| <b>914.10</b><br>Bolts for Structure Expansion Anchors  | Test                         | 1 per 5000 pcs.<br>or fraction thereof | 1 bolt      | 250 units             |   |
| <b>914.11</b><br>Preformed Waterproofing Membrane and Joint Waterproofing Membrane  | QPL<br>See Remark            | -                                      | -           | -                     | Must be a Qualified Product (710.02). Do not use on Treated Wood Materials                                      |
| <b>914.12</b><br>Elastomeric Bearing Pads   | Test Data Cert<br>See Remark | -                                      | -           | -                     | Show Test Result for Shear Modulus, ASTM D4014  |
| <b>915</b><br>Coating Systems for Steel Structures, Hanger Assemblies and End Diaphragms  | QPL                          | -                                      | -           | -                     | Must be a Qualified Product (915.01)  |
| <b>916.01A</b><br>Cobblestone   | VI                           | -                                      | -           | -                     |   |
| <b>916.01C</b><br>Riprap  | VI                           | -                                      | -           | -                     |   |

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|---|---------------------|------------------------------|-------------|-----------------------|--|
| <b>916.02</b><br>Silt Fence<br>Fabricated fence<br>Fabric   | Appr Mfr *<br>QPL   | See Remark                   | See Remark  | 500 ft                | General Certification to C&T<br>1 sample for the first 3000 ft or fraction thereof; 1 sample for each additional 10,000 feet 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). |
| <b>NOTE:</b> Sample to include identifying markings of fabricator. Indicate on sample ID description of markings. Note where markings were found. |                     |                              |             |                       |  |
| <b>917.03</b><br>Nursery Stock  | VI                  | -                            | -           | -                     |  |
| <b>917.04</b><br>Tree Wrapping Material   | VI                  | -                            | -           | -                     |  |
| <b>917.05</b><br>Balling Material   | VI                  | -                            | -           | -                     |  |
| <b>917.06A</b><br>Wire for Bracing and Guying   | VI                  | -                            | -           | -                     |  |
| <b>917.06B</b><br>Hose for Bracing and Guying   | VI                  | -                            | -           | -                     |  |
| <b>917.06C</b><br>Stakes for Bracing and Guying   | VI                  | -                            | -           | -                     |  |
| <b>917.10</b><br>Chemical Fertilizer for Grass Seed   | VI<br>See Remark    | -                            | -           | -                     | Provide the bag label, showing the guaranteed analysis.  |
| <b>917.12</b><br>Seeding Mixtures<br>Seed Varieties   | Appr Mfr *<br>QPL   | 1 per lot<br>per shipment    | ¼ lb        | 100 lbs               | General Cert. to C&T.<br>Varieties of seed must be Qualified Product (917.12)  |
| <b>917.13</b><br>Sod  | VI                  | -                            | -           | -                     |  |
| <b>917.13A</b><br>Pegs for Sodding  | VI                  | -                            | -           | -                     |  |
| <b>917.14</b><br>Mulching Materials for Nursery Stock   | VI                  | -                            | -           | -                     | Only shredded bark, wood chips not allowed.  |
| <b>917.15B</b><br>High Velocity Mulch Blankets and Standard Mulch Blanket   | QPL                 | -                            | -           | -                     | Must be a Qualified Product (917.15B). High velocity - netting 2 sides. Standard - netting 1 side  |

## MATERIALS ACCEPTANCE REQUIREMENTS

See Miscellaneous area at the end of table for materials deleted from the 2003 Standard Specifications for Construction.  
**\* Must be tested unless provided by an Approved Manufacturer.**

| Spec. No. and Material Name   | Basis of Acceptance  | Sample Frequency If Required | Sample Size                            | Maximum V.l. Quantity | Remarks (QPL Reference)   |
|---|----------------------|------------------------------|--|-----------------------|---|
| <b>917.15C5</b><br>Mulch Anchoring - Latex, Recycled Newsprint, Wood Fiber, Guar Gum, Other Tackifiers  | QPL                  | -                            | -                                      | -                     | Must be a Qualified Product (917.15C5)  |
| <b>917.16</b><br>Weed Control (Herbicides)  | Test Data Cert       | -                            | -                                      | -                     |   |
| <b>918.01</b><br>Flexible Metal Conduit   | VI                   | -                            | -                                      | -                     |   |
| <b>918.01A</b><br>Electrical Conduit, Rigid (Galvanized Steel)  | Test or Tested Stock | 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  |
| <b>918.01B &amp; C</b><br>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  |
| <b>918.01D</b><br>Electrical Conduit (Polyethylene) 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 |
| <b>918.01F</b><br>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  |
| <b>918.02</b><br>Grounding System   | VI                   | -                            | -                                      | -                     |   |
| <b>918.02C</b><br>Grounding Rods  | VI                   | -                            | -                                      | -                     |   |
| <b>918.03</b><br>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. |                      |                              |  |                       |   |
| <b>918.06</b><br>Precast Concrete Handholes and Manholes for Electrical and Telephone Connections   | Appr Mfr *           | 1% per size                  | -                                      | 10 pcs.               | General Cert. to C&T  |
| <b>918.06E</b><br>Light Weight Composite Handholes  | QPL                  | -                            | -                                      | -                     | Must be a Qualified Product (918.06)  |

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| <b>MATERIALS ACCEPTANCE REQUIREMENTS</b> |
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| Spec. No. and<br>Material Name  | Basis of<br>Acceptance     | Sample<br>Frequency<br>If Required  | Sample<br>Size                              | Maximum<br>V.I.<br>Quantity                | Remarks<br>(QPL Reference)   |
|---|----------------------------|-------------------------------------|---|--|--|
| <b>918.08</b><br>Light Standards                                      | VI<br>Test Data Cert       | -                                   | -   | -  |  |
| <b>918.08C</b><br>Light Standards, Frangible<br>Transformer Bases     | QPL                        | -                                   | -   | -  |  |
| <b>918.09</b><br>Luminaries   | Gen Cert                   | -                                   | -   | -  |  |
| <b>918.10A</b><br>Tower Lighting Units                                | Fabrication<br>Inspection  | -                                   | -   | -  | QA Manual Section D15  |
| <b>918.11E</b><br>Guy Wire  | Test                       | 1 per size                          | 10 ft                                       | -  |  |
| <b>919</b><br>Steel Sleeves for Wood Posts                            | Gen Cert                   | -                                   | -   | -  |  |
| <b>919.02</b><br>Signs (Permanent)                                    | See Remark                 | -                                   | -   | -  | See Joint Construction IM 1997-B<br>and IM 1997-C. General Cert.<br>must be attached and inspected at<br>project site.       |
| <b>919.02A1</b><br>Metal Sections (Extruded<br>Aluminum)              | Tested Stock<br>See Remark | 1 from each<br>width in<br>shipment | 12 in. long and<br>full width of<br>section |  | A Test Data Cert must be attached<br>to Sample ID form   |
| <b>919.02A2</b><br>Plywood  | See Remark                 | -                                   | -   | -  | Grade mark on materials serves<br>as certification   |
| <b>919.02A3</b><br>Aluminum Sheet                                     | Tested Stock<br>See Remark | 1 per lot or<br>shipment            | Min. of 12 in.<br>square                    | 100 sft                                    | See C&T Instructional Memo<br>1997-B. Tested Stock, Test Data<br>Certification must be included                              |
| <b>919.02B1</b><br>Reflective Sheeting                                | QPL<br>See Remark          | 1 per run or lot                    | See Remark                                  | 1 roll, for<br>less than 3<br>in. in width | Must be A Qualified Product<br>(919.02B) 4 pcs. each 12 in.<br>square. For rolls less than 12 in.<br>width, at least 7.5 ft. |
| <b>919.02C</b><br>Sign Hardware                                       | Gen Cert<br>See Remark     | -                                   | -   | -  | Identifying marks on items may<br>serve as certification   |
| <b>919.03A</b><br>Delineators<br>1. Plastic Reflectors                | Gen Cert                   | 1 per shipment<br>per color         | 21 pcs.                                     | 25 pcs. each<br>color                      |  |
| <b>919.03B</b><br>Delineators<br>2. Reflective Sheeting<br>Reflectors | Gen Cert                   | 1 per shipment<br>per color         | 2 pcs. each<br>color                        | 25 pcs. each<br>color                      |  |

## MATERIALS ACCEPTANCE REQUIREMENTS

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| Spec. No. and Material Name  | Basis of Acceptance                  | Sample Frequency If Required | Sample Size | Maximum V.l. Quantity | Remarks (QPL Reference)   |
|--|--------------------------------------|------------------------------|-------------|-----------------------|---|
| <b>919.03D</b><br>Delineator Posts<br>1. Steel   | Gen Cert                             | 1 per proj.<br>per mfr.      | 1 post      | 80 post               |   |
| <b>919.03D</b><br>Delineator Posts<br>2. Plastic   | QPL                                  | -                            | -           | -                     | Must be Qualified Product (919.03D)   |
| <b>919.04</b><br>Steel, Galvanized Sign Posts  | Test Data Cert                       | 1 per proj.<br>per mfr.      | See Remark  | 20 posts              | Sample 30 in. length min. weigh 5 posts to determine weight per foot. Put on ID; Posts for Temporary signs may be painted |
| <b>919.05</b><br>Wood Sign Posts   | Appr Mfr * or Tested Stock           | Each charge                  | 22 cores    | 20 posts              | General Cert. to C&T  |
| <b>919.06</b><br>Break-Away Column Sign Supports   | Fabrication Inspection<br>See Remark | -                            | -           | -                     | QA Manual Section D11 and Subsection 919.07 of Standard Specifications  |
| <b>919.07</b><br>Sign Support Structures   | Fabrication Inspection<br>See Remark | -                            | -           | -                     | QA Manual Section D11   |
| <b>920.01B</b><br>Glass Beads  | Gen Cert                             | 1 from each lot              | 2 lb        | 500 lbs               |   |
| <b>920.01C</b><br>Raised Pavement Markers  | QPL                                  | -                            | -           | -                     | Must be a Qualified Product (920.01C)   |
| <b>921.02</b><br>Span Wire   | Gen Cert                             | 1 per size                   | 6 ft        |                       |   |
| <b>921.03</b><br>Traffic Signals and Mounting Assemblies   | See Note                             | -                            | -           | -                     |   |
| <b>NOTE:</b> 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. |                                      |                              |             |                       |   |
| <b>921.05</b><br>Traffic Signal Strain Poles   | VI and Test Data Cert                | -                            | -           | -                     |   |
| <b>922.02</b><br>Traffic Maintenance and Control Temp Signs, Reflective Sheeting   | VI                                   | -                            | -           | -                     |   |
| <b>922.03</b><br>Traffic Maintenance and Control, A. Cones and B. Drums  | VI                                   | -                            | -           | -                     |   |

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| <b>MATERIALS ACCEPTANCE REQUIREMENTS</b> |
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| Spec. No. and Material Name  | Basis of Acceptance | Sample Frequency If Required | Sample Size | Maximum V.I. Quantity | Remarks (QPL Reference)   |
|--|---------------------|------------------------------|-------------|-----------------------|---|
| <b>922.03D</b><br>Traffic Maintenance and Control Type III Barricade, Reflective Sheeting          | VI                  | -                            | -           | -                     |   |
| <b>922.03E</b><br>Traffic Maintenance and Control Temporary Concrete Barriers                      | Test Data Cert      | Each proj.                   | -           | -                     | Contractor testing and Cert Verification per MTM-716 & NCHRP 350. For JJ Easy Hook – Gen. Cert. No testing required.      |
| <b>922.03E1</b><br>Barrier Reflector Markers Temporary and Permanent                               | VI                  | -                            | -           | -                     |   |
| <b>922.04A</b><br>Traffic Maintenance and Control Temporary Pavement Markings; Type R and NR Tape  | QPL                 | -                            | -           | -                     | Must be a Qualified Product (922.04)  |
| <b>922.04A</b><br>Traffic Maintenance and Control Temporary Pavement Markings; Paint               | QPL                 | -                            | -           | -                     | Must be a Qualified Product   |
| <b>922.04B</b><br>Temporary Raised Pavement Markers  | QPL                 | -                            | -           | -                     | Must be a Qualified Product   |
| <b>922.05</b><br>Traffic Maintenance and Control Lighted Arrows; Type B and C (Solar Assist)       | QPL                 | -                            | -           | -                     | Must be a Qualified Product   |
| <b>922.05B</b><br>Traffic Maintenance and Control Warning Flashers and Lights; Type A, B, C        | VI<br>See Remark    | Each proj.                   | 3 each type |                       | Units submitted for test when required by project engineer will be returned to the contractor upon completion of testing. |
| <b>922.05C</b><br>Portable Changeable Message Signs  | VI                  | -                            | -           | -                     | Contractor to allow two week lead time for inspection.  |
| <b>922.07</b><br>Traffic Maintenance and Control Sign Paddles and Vests                            | VI<br>See Remark    | -                            | -           | -                     | High visibility vest meeting MDOT work zone safety and mobility policy.   |
| <b>922.08A</b><br>Traffic Maintenance and Control Dust Palliative<br>1. Calcium Chloride Solids    | VI & Test Data Cert | 1 per proj.                  | 5 lb        | 5000 lb               |   |
| <b>922.08A</b><br>Traffic Maintenance and Control Dust Palliative<br>2. Calcium Chloride Solutions | VI & Test Data Cert | 1 per proj.                  | 1 qt        | 1000 gal.             |   |

## MATERIALS ACCEPTANCE REQUIREMENTS

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|--|------------------------|--------------------------------------|--|-----------------------|---|
| Spec. No. and Material Name  | Basis of Acceptance    | Sample Frequency If Required         | Sample Size                              | Maximum V.l. Quantity | Remarks (QPL Reference)   |
| <b>Misc. #2</b><br>Cast Iron and Ductile Iron (Watermain and Culverts)   | Gen Cert               | -                                    | -  | 250 ft.               |   |
| <b>Misc. #3</b><br>Clay Pipe   | Gen Cert               | See Remark                           | See Remark                               | 10 pieces             | See Special Instructions  |
| <b>Misc. #5</b><br>Galvanized Slotted Drain Pipe   | VI<br>See Remark       | -                                    | -  | -                     | MDOT approval of Design is required. Coating thickness checked at project site.   |
| <b>Misc. #7</b><br>ABS Pipe  | Test                   | 1 per 6000 ft                        | 1 piece, 6 ft in length.                 | 600 ft                | If bell and spigot joint, sample from bell end.   |
| <b>Misc. #8</b><br>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             |   |
| <b>Misc. #9</b><br>Aluminum Alloy Structural Plates  | Gen Cert               | -                                    | -  | -                     |   |
| <b>Misc. #13</b><br>Pavement Warning Strips  | VI                     | -                                    | -  | -                     |   |
| <b>Misc. #14</b><br>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. |
| <b>Special Provision #1</b><br>Liner for Culverts<br>A. Polyethylene Plastic Pipe  | Gen Cert               | -                                    | -  | -                     |   |
| <b>Special Provision #2</b><br>B. Reinforced Plastic Mortar Pipe   | Gen Cert               | -                                    | -  | -                     |   |
| <b>Special Provision #3</b><br>Railroad Ballast  | Test                   | 1 per 5000 ton                       | 60 lb                                    | 500 tons              | See UPTRAN Specifications for Trackwork   |
| <b>Special Provision #6</b><br>Truck Mounted Attenuator  | Gen Cert               | -                                    | -  | -                     | See Special Provision in Contract   |
| <b>Special Provision #7</b><br>Traffic Signal Mast Arm Pole and Mast Arm (Trunkline )  | Fabrication Inspection | -                                    | -  | -                     | See QA Manual Section D-16  |

\*\*\*\*\* See following pages for SPECIAL INSTRUCTIONS (Pages 23 - 28) \*\*\*\*\*

**SPECIAL INSTRUCTIONS**901 Cement

Certification Verification Sampling Schedule - Per the following

| <u>Quantity of Concrete to State Projects (per week)*</u> | <u>Frequency</u>   |
|---|--------------------|
| Less than 500 cyds.                                       | 1 per 1000 cyd.    |
| 500 cyds. to 2000 cyds.                                   | 1 every month      |
| 2000 cyds. to 6000 cyds.                                  | 1 every other week |
| Over 6000 cyds.   | 1 per 12,000 cyd.  |

The plastic lined cement sample bags furnished by the laboratory will hold 10 pounds when full.

\*Quantity estimated and based upon work in area, season of the year, orders, past experiences, etc.

907.03 Woven Wire Fencing Materials, Steel Posts

Size of Sample - 5 posts. If compliance with weight requirements can be accurately determined in the field by weighing 5 posts selected at random (with ground plates removed), only 1 post need be submitted for a sample. Include complete weight information on sample identification.

NOTE: An alternate zinc/clear coat system shall be applied for pipe sections only. This alternate coating system shall consist of 2 ounces/square feet of zinc coating on all surfaces of the pipe according to ASTM A123. A clear acrylic coating having a minimum thickness of 7.6 microns shall be applied to the exterior surface after galvanizing.

907.04 Steel Chain Link Fence Materials, Posts for Fence and Gates (Steel)

Size of Sample - 5 posts. If compliance with weight requirements can be accurately determined in the field by weighing 5 posts selected at random (with ground plates removed), only one post need be submitted for a sample. Include complete weight information on sample identification.

Maximum for VI - Gate posts, 15 each; line posts, 25 each.

NOTE: An alternate zinc/clear coat system will be allowed for pipe sections only. This alternate coating system shall comply with subsection 907.03D of 2003 Standard Specifications for Construction.

909.04A Reinforced Concrete Pipe

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.

#### 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:

| <u>Concrete Pipe</u>  | <u>Number of Samples</u>                |
|-----------------------|---|
| 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 |

#### 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:

| <u>Diameter of Pipe</u>     | <u>Quantity Represented (maximum)</u> |
|-----------------------------|---------------------------------------|
| 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:

| <u>Diameter of Pipe</u> | <u>Length of Sheet</u>    | <u>Quantity Represented (max)</u> |
|-------------------------|---------------------------|-----------------------------------|
| 12 inches or less       | 44 inches or less         | 2500 feet                         |
| 15 through 54 inches    | 50 to 175 inches, approx* | 1000 feet                         |
| 60 inches and over      | 190 inches and over*      | 500 feet                          |

\*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.

Less than 25 sheets may be visually inspected.

#### 909.06A Corrugated Polyethylene Pipe (Smooth Lined Type S or Corrugated)

Sampling Frequency - Straight Lengths, 12-inch diameter and over - 1 per 1000 feet

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 feet 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 feet 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 and Technology Division.

Size of Sample - Over 12-inch diameter - one 10-foot length and one 6-foot length plus coupling

Maximum for VI - 12-inch diameter and over - 100 feet

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.

#### 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-foot 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-foot 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.

909.07 Corrugated Polyethylene Pipe (Tubing) (Perforated and Non-Perforated) (Wrapped and Non-Wrapped)

Sampling Frequency - From Coils - 1 per 5000 feet

Size of Sample - One 10-foot length plus coupling. For perforated tubing wrapped in geotextile fabric, tie fabric securely into place before cutting sample. Do not disturb fabric after cutting.

909.08A Downspouts for Bridge, Polyethylene (PE) Plastic Pipe

Normal Sampling Frequency -  
From Coils - 1 per 5000 ft.

Straight Lengths, Less than 12 inches dia. - 1 per 2500 ft.

Straight Lengths, 12 inches in dia. and over - 1 per 1000 ft.

Size of Sample - Over 12 inches in diameter - one 10-foot length and one 6-foot length plus coupling.

Maximum for VI - Less than 12 inches dia. - 250 ft.  
12 inches dia. and over - 100 ft.

NOTE: Suppliers shall provide MDOT inspector with list of date codes on pipe in stockpile to be tested prior to sampling.

Perforated Pipe

See subsection 909.06A of the Standard Specifications for Construction.

910.03 Geotextiles

Sampling Frequency - Obtain Certification Verification samples for geotextiles when the quantity of each material type on any particular project exceeds the following amounts:

| <u>Geotextile</u>       | <u>First Sample</u> | <u>Additional Samples</u> |
|-------------------------|---------------------|---------------------------|
| Blanket                 | 1200 syd.           | 7,500 syd.                |
| Liner for Riprap        | 1200 syd.           | 5,000 syd.                |
| Separator/Stabilization | 1200 syd.           | 25,000 syd.               |
| Liner for Heavy Riprap  | 1200 syd.           | 4,000 syd.                |

Size of Sample - Sample shall be a minimum of 3 ft. long by the full roll width, with a 3 syd. minimum.

Maximum for VI - 360 syd. (3200 sq. ft.)

NOTE: Woven geotextile must be **rolled**, not folded, and shipped in a manner to prevent creases in the fabric.

#### 914.04C Neoprene Joint Seal

Sample - Each sample to be a minimum of 1 yard (straight or loosely rolled - no kinks) (2 ft. for bridge seals). Samples shall to be collected, randomly within each lot of production.

#### 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

#### 917.12 Grass Seed Sampling Information

Sample - For lots of 1 to 6 bags, sample each bag. For lots of more than 6 bags, sample 5 bags plus at least 10 percent of the bags in the lot. It is not necessary to sample more than 30 bags in any single lot.

NOTE: Samples are to be sent to Lansing Maintenance Division.

Acceptance by the Project Engineer is based on visual inspection of original, sewn-on bag tickets for verification of quantity and source of seed. The guaranteed analysis on the ticket will constitute the certification of this product by the Approved Certifier.

#### 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:

| <u>Clay Pipe</u>      | <u>Number of Samples</u>                |
|-----------------------|---|
| 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