1.01 SCOPE AND OBJECTIVES OF THE QUALITY ASSURANCE PROGRAM

1.01.01. Introduction

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.01.03. Personnel Qualifications

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

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

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

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

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

1.01.04. Acceptance Sampling and Testing

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

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

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

1.01.06. Project Record Retention

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

1.01.07. Laboratory and Field Testing Equipment

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

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

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

C. Laboratory Quality Systems

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

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

D. Field Testing Operations

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

1.02.01. **Scope**

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

1.02.02. **Region Engineer**

A. Observe these procedures and 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.

B. 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, Construction Field Services (CFS) Division Central Materials Laboratory comparative samples and tests, and tested stock.

C. Examine and approve all Project Record Certification Reviews.

D. Determine the lack of available local agency and consultant personnel to perform inspection and testing services for local agency projects receiving federal or state funds and request the services of the Bureau of Field Services (BFS). Submit requests to the Deputy Director of BFS with the following information:

1. The local agency.

2. The project identification numbers.

3. The specific contract items that need to be tested or inspected by BFS.

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

5. A statement that the local agency is aware that they will be billed for BFS services.

1.02.03. **Region Associate Engineer**

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

B. 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.

C. Supervise project final review by selecting individuals from the Region staff who will review materials testing for proper quantities, method of measurement and adequate documentation.
D. Supervise the coordination of Materials QA programs by selecting individuals who will obtain and submit certification verification samples as requested by the CFS staff and assist in the control of Tested Stock suppliers and approved suppliers.

1.02.04. Project or Construction Engineer

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

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

C. Request the necessary Independent Assurance Tests.

1.02.05. Deputy Director of Bureau of Field Services

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

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

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

1.02.06. Construction Field Services Division Staff

A. Develop and monitor statewide materials acceptance procedures.

B. Provide materials testing procedure training as required.

C. Administer central laboratory and contractual sampling and testing.

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

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

F. Monitor materials certification programs and request certification verification samples when required.
1.03 USING COMMERCIAL TESTING AGENCIES

1.03.01. **Scope**

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

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

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

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

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

1.03.02. **Utilization**

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

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

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

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

1.03.03. **Contract Administration**

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

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

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

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

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

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

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

H. The agency must use the appropriate MDOT Form/s.
1.04 PROCESSING OF MATERIALS SOURCE LIST (FORM 501)

1.04.01. **Scope**

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

1.04.02. **Contractor Responsibilities**

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

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

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

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

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

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

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

1.04.03. **Region Materials Staff/Engineer Responsibilities**

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

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

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

3. Which items are to be supplied by sources with certification, QPL, or tested stock privileges, as listed in the current Materials Source Guide.
1.05 RANDOM SAMPLING BY THE CUBE ROOT METHOD

1.05.01. **Scope**

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

<table>
<thead>
<tr>
<th>Number of Items or Containers in Shipment</th>
<th>Number of Items or Containers to be Sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-8</td>
<td>2</td>
</tr>
<tr>
<td>9-27</td>
<td>3</td>
</tr>
<tr>
<td>28-64</td>
<td>4</td>
</tr>
<tr>
<td>65-125</td>
<td>5</td>
</tr>
<tr>
<td>126-216</td>
<td>6</td>
</tr>
<tr>
<td>217-343</td>
<td>7</td>
</tr>
<tr>
<td>344-512</td>
<td>8</td>
</tr>
<tr>
<td>513-729</td>
<td>9</td>
</tr>
<tr>
<td>730-1000</td>
<td>10</td>
</tr>
<tr>
<td>1001-1331</td>
<td>11</td>
</tr>
<tr>
<td>(etc.)</td>
<td>(etc.)</td>
</tr>
</tbody>
</table>
1.06.01. **Scope**

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

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

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

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

1.06.02. **Pavement Random Sampling**

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

1.06.03. **Structure Random Sampling**

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

1.06.04. **Appurtenant Item Random Sampling**

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

1.06.05. **General Stratified Random Sampling Procedure**

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

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

1.06.06. Using the Random Number Table

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

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

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

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

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

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

1.06.07. Samples from the Transport Unit

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

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

1.06.08. HMA or Concrete Cores

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

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

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

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

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

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

1.06.09. **Samples from the Grade**

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

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

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

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

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

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

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

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

1.06.11. **Selection of Verification Sample**

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

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

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

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

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

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

1.07.01. Scope

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

1.07.02. Procedures

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

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

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

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

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

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

1.07.03. Summary

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

1.08.01. **Scope**

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

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

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

1.08.02. **Definitions**

The following types of tags and markings may be used:

A. **Numbered 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.

B. **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.

C. **Sampled Stickers** - Same as 1.08.02B except that these are pressure-sensitive tags without the wire ties.

D. **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.

E. **Approval Stickers** - Same as 1.08.02D except that these are pressure-sensitive tags without the wire ties.

F. **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.

G. **"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.

H. **Orange "M"** - A painted letter "M" applied with a spray-can of orange colored paint.
1.08.03. Out-of-State

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

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

C. An exception to this would be where the "Sampled" tag is used, in which case the material should not be used until confirmation of approval is received.
1.09 DISPOSITION OF MATERIALS BASED ON LABORATORY TEST RESULTS

1.09.01. Scope

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

1.09.02. Disposition of Non-Specification Materials

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

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

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

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

3. Certification verification samples are quality assurance samples for material accepted on the basis of the manufacturer’s certification (see Chapter 3.03). Except in the case of failure to meet a critical parameter, when it is imperative that incorporation of material be prevented, the results of laboratory testing of these samples are not used to accept or reject material. Instead, the results are used to verify material accepted on the basis of the manufacturer’s certification does, in fact, meet all required specifications.
4. Other samples may be tested for information in the course of material research or investigation. Aggregate source, qualified product samples and concrete cores used to verify pavement thickness and depth of steel are included in this category. The results of these laboratory tests may be used to determine the acceptability of new materials for use on future projects or the need to take corrective action on an existing project.

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

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

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

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

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

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

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

Any report which must be superseded due to an error or omission on the original report will include the statement “The report supersedes Report of Sample ID______, dated due to ________________.”

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

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

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

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

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

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

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

1.10.01. **Scope**

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

1.10.02. **Basis for Resampling**

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

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

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

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

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

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

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

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

1.10.03. **Number of Samples Upon Resampling**

A. For material resampled under conditions of 1.10.02B1, 1.10.02B2, or 1.10.02B3, when material represented consists of a number of individual pieces, the resample must consist of twice the number of samples as submitted in the original sampling, unless a greater number is required by the specification. When material represented is a bulk material (such as stockpiled aggregates, liquids in tanks or drums, etc.), the resample must be one sample but should be obtained by compositing approximately twice as many increments as for the original sample. An exception is made when the intent is to determine the variation within the bulk material, in which case a number of samples must be taken as directed, each representing a portion of the quantity.
B. For material resampled under conditions of 1.10.02B4 and 1.10.02B5, samples must be taken at the normal sampling frequency (unless instructed otherwise) and should not be labeled or considered as resamples. If material is not represented by a new number (batch, lot, heat, etc.), add remarks to sample identification to indicate how material has been changed (reprocessed, culled, new material, etc.).
1.11 CONSTRUCTION PROJECT DOCUMENTATION REQUIRED FOR MINIMUM JOB CONTROL DEVIATIONS

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

1.11.02. Related Documents
   
   A. Current Standard Specifications for Construction
   B. Density Control Handbook
   C. Construction Manual

1.11.03. Procedure
   
   A. MDOT Projects
      
      1. Whenever a Construction/Project Engineer decides to deviate from any minimum job control requirement identified in any of MDOT’s procedures, publications, or specifications, appropriate documentation must be created.
      
      2. The Construction/Project Engineer will create and date the documentation immediately upon the decision to deviate from the minimum job control requirement.

   B. Local Government Projects
      
      1. Whenever a Local Project Engineer decides to deviate from any minimum job control requirement identified in any of MDOT’s procedures, publications, or specifications, appropriate documentation must be created.
      
      2. The Local Project Engineer will create and date the documentation immediately upon the decision to deviate from the minimum job control requirement and must obtain concurrence from the appropriate MDOT Engineer prior to filing the document.

1.11.04. Records
   
   A. The document must indicate the specific reasons that the decision is made.
   
   B. Appropriate reasons may include applied statistical analysis, specific engineering principals, or other appropriate logic.
   
   C. The document must indicate the date of the recommendation, the name and date that the appropriate individual concurs with the recommendation, the job reference information, and any other extenuating information.
D. The documentation used for this operation must be retained in the specific construction project’s records.

E. Sample documentation attached.
DATE: January 01, 2012

TO: PROJECT FILE
54321-JN12345

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

SUBJECT: Job Control Requirement Deviation

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

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

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

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

cc: Region Materials Supervisor
  Construction Engineer (for local agency projects only)
1.12 GENERAL QUALITY ASSURANCE PROCEDURES FORMAT

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

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

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

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

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

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

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

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

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

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

1.12.08. Appendices

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

1.12.09. General Guidelines

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

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

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

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

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

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

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