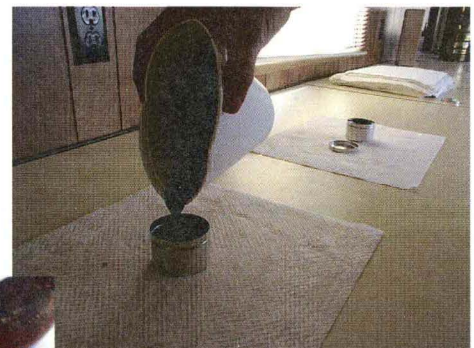
# HOT MIX ASPHALT SAMPLING TECHNICIAN



2007/2008



## TECHNICAL TRAINING AND CERTIFICATION PROGRAM

Iowa Department of Transportation

# TECHNICAL TRAINING & CERTIFICATION PROGRAM

## GENERAL

The purpose of the Technical Training & Certification Program is to ensure Quality Control (QC)/Quality Assurance (QA) and Acceptance of Aggregates, Hot Mix Asphalt (HMA), Portland Cement Concrete (PCC), Grade Inspection, Precast and Prestressed Concrete, and Pavement Profiles and to ensure proper documentation of quality control/quality assurance and acceptance procedures and test results by industry and Contracting Authority personnel.

This Instructional Memorandum (IM) explains the requirements to become certified and to remain certified to perform inspection and testing in the State of Iowa. This IM also describes the duties, responsibilities and the authority of persons assigned the position of Certified Technician in any of the above areas for construction or maintenance projects. Appendix C of this IM lists what tests and procedures the technician is qualified to perform for each level of certification they obtain.

Through a cooperative program of training, study, and examination, personnel of the construction industry, State DOT, and other Contracting Authorities will be able to provide quality management and certified inspection. Quality control/quality assurance and acceptance sampling, testing and inspection will be performed by certified personnel and documented in accordance with the IMs.

A technician who is qualified and holds a valid certification(s) shall perform quality control/quality assurance and acceptance at a production site, proportioning plant, or project site. Responsibilities cannot be delegated to non-certified technicians. The duties of a Certified Technician may be assigned to one or more additional Certified Technicians.

The Technical Training & Certification Program will be carried out in accordance with general policy guidelines established or approved by the Highway Division Director. A Board of Certification composed of the following members will advise the Director:

Director – Office of Materials
Director – Office of Construction
Representative of District Materials Engineers**
Representative of District Construction Engineers**
Representative of Associated General Contractors (AGC of Iowa)
Representative of Iowa Concrete Paving Association (ICPA)
Representative of Asphalt Paving Association of Iowa (APAI)
Representative of Iowa Ready Mixed Concrete Association (IRMCA)
Representative of Iowa Limestone Producers Association (ILPA)
Representative of County Engineers
Coordinator of Technical Training & Certification Program**

** Appointed by Program Director

The Director of the Office of Materials will be the Program Director. Coordinators will be appointed by the Program Director to assist in administration of the program and to handle such planning, administration, and coordinating functions as may be needed.

## TRAINING

The Iowa DOT will provide the training necessary to become certified or an agency approved by the Program Director. Producers/Contractors are encouraged to conduct their own pretraining program. A complete listing of training opportunities is available in the Technical Training & Certification Program's Information and Registration Booklet or at the Technical Training & Certification Program website, www.iowa.gov/dot/materials/training.htm. This book is available at any of the Iowa DOT Materials Offices. They may also be obtained from the ICPA, IRMCA, ILPA, and APAI.

## CERTIFICATION REQUIREMENTS

1. A candidate must attend instruction and pass the examination(s) for all levels of certification prepared and presented by the Program Director or someone designated by the Program Director. If the new candidate fails the examination, they will have one opportunity to retake the examination. The retake must be completed within six months of the original exam. If they fail the retake of the examination, they will need to attend the training again before taking the examination the third time. If an individual is recertifying they will have only one opportunity to take the examination. If they fail the examination they must take the applicable training before retaking the examination.

2. All prerequisites shall be met before the applicant may attend the next level of training for the certification desired. A listing of certification levels and prerequisites is located in Appendix A.

3. Once the candidate has met all the criteria and has received certification, it is recommended the Certified Technician work under the supervision of an experienced technician until they become efficient in the inspection and testing methods they will be performing.

   An individual requesting to become certified as a Precast/Prestress Concrete Technician is required to obtain forty hours of experience assisting in quality control inspection at an approved plant before certification will be issued. The experience must be documented and shall be approved by the District Materials Engineer. This experience must be completed within two years from the date the individual attended the training.

4. Registered Professional Engineers, engineering graduates, and geology graduates from accredited institutions will be exempt from the training requirement in the areas they have had instruction. In order to obtain certification for any technical level, these persons must pass all applicable tests for the level of certification they wish to obtain. All certificates issued in accordance with these requirements will be subject to the same regulations concerning expiration, recertification, etc., as applies to certificates obtained via training and examinations.

Out-of-state technicians will be issued certifications when the following criteria are met:

1. The applicant must be certified in another state or shall have received equivalent training, if the state does not have a certification program, in each level of certification they are requesting.

2. The applicant must pass an examination for each level of certification desired, which will be administered by the Iowa Department of Transportation. Failure of the examination shall require the applicant to take the applicable schooling before they can retake the exam.

3. The applicant must follow the prerequisite requirements of the Technical Training & Certification Program.

Out-of-state applications should be submitted to the District Materials Office closest to the home location of the applicant. Copies of all the applicant's certifications must accompany the application.

## CERTIFICATION

Upon successfully completing the requirements for certification, the Program Director will issue a certificate and a pocket certification card. This certification is not transferable. A certification shall be valid for five years.

## CERTIFICATION IDENTIFICATION

The certificate will contain letters that identify the District of record, the certificate holder, certification number, the level of certification, and the expiration date of each level.

The assigned certification number may change if the certificate holder changes their residence.

## RENEWAL OF CERTIFICATION

A certification shall be valid through December 31st of the fifth year. A 90-day grace period will be allowed. If the individual has not renewed their certification within the 90-day grace period, they are automatically decertified. The individual may obtain certification by taking the examination for the level of certification they are requesting. If the individual does not take the examination within one year after their certification(s) expire, i.e., 12/31/expiration year, they must retake all applicable schooling and pass the examinations. If an applicant becomes decertified in any level of certification and that certification is a prerequisite for other levels of certification the applicant will also be decertified in those related levels of certification.

All certified technicians will be required to pass an examination in each level of certification they hold before recertification will be issued. Failure of any level shall require the applicant to retake the applicable schooling and pass the test.

The certificate holder shall be responsible for applying for certification renewal and for maintaining a current address on file with the appropriate District Materials Office.

Technicians certified as Level I HMA and/or Level II PCC shall attend a minimum of two update classes each in the five-year period between certification and each recertification. The Iowa DOT or an agency or organization approved by the TTCP will hold these classes. These update classes will be listed in the Technical Training & Certification Program Booklet and on the program website, or the certified technician may contact the Iowa DOT for information. If an individual does not attend the two update classes required before their certification expires, they must take the entire schooling and pass the examination for the certification required.

The certified technician will not receive credit for the following:

1. More than one update per training season in each level of certification.
2. An update taken during the same training season in which the individual recertified.

## UNSATISFACTORY PERFORMANCE NOTICE

A certified technician failing to perform the required specified duties or inadequately performing these duties, will receive an Unsatisfactory Notice (Office of Materials IM 213, Appendix B).The notice will be from the District Materials Engineer in the District where the failure occurred. This notice and all supporting documentation will be placed in the technician's permanent file with the District Materials Office in which the technician resides. The notice will also be placed on the statewide computer file.

## SUSPENSION & DECERTIFICATION

A three-month suspension will be given upon receipt of two Unsatisfactory Performance Notices. Technicians that are suspended shall not perform any duties of the applicable certification, including any duties for which the affected certification is a prerequisite.

Technicians are eligible to be reinstated after the three-month suspension and successful completion of the applicable recertification test(s).

Technicians are subject to decertification when they receive a third Unsatisfactory Performance Notice.

Certified Technicians will be decertified for any of the following reasons:

The certificate will become invalid for the following reasons:

1. Failure of the certificate holder to renew the certificate prior to regular expiration as described above.

2. Use of false or fraudulent information to secure or renew the certificate.

3. Use of false or fraudulent actions or documentation by the certificate holder.

4. Not performing tests and technician duties properly and in accordance to specifications.

Action will be effective on the date the Program Director issues the suspension or decertification notice.

Technicians that are decertified shall not perform any duties requiring certification. Technicians may request reinstatement after one year.

Appeals and reinstatement requests shall be submitted in writing to the Program Director. Appeals and reinstatement requests will be considered by the Certification Board.

If reinstatement is authorized, the applicant must attend and successfully complete the applicable certification courses.

## FUNCTIONS & RESPONSIBILITES

A certificate holder at each production site, project site, proportioning plant, or laboratory will perform duties. The certified technician shall perform quality control testing in accordance with specified frequencies and submit designated reports and records.

The specification requirement for materials testing by a certified technician does not change the supplier's responsibilities to furnish materials compliant with the specification requirements.

The District Materials Engineer and/or Project Engineer will be responsible for monitoring the sampling, testing, production inspection activities and quality control performed by the contractor. A monitor shall have satisfactorily completed the training and be certified for the level of technician they are monitoring.

The District Materials Engineer and/or Project Engineer will have authority and responsibility to question and where necessary, require changes in operations and quality control to ensure specification requirements are met.

## QUALITY CONTROL, TESTING, & DOCUMENTATION

The QC Technician shall be present whenever construction work related to production activity, such as stockpiling or other preparatory work, requires record development and/or documentation is in progress. The QC Technician's presence is normally required on a continuing basis beginning one or more days before plant operation begins and ending after plant shut down at the completion of the project. The work shall be performed in a timely manner and at the established frequencies.

The QC Technician's presence is not normally required during temporary plant shut downs caused by conditions, such as material shortages, equipment failures, or inclement weather.

All quality control activities and records shall be available and open for observation and review by representatives of the contracting authority.

Reports, records, and diaries developed during progress of construction activities will be filed as directed by the Contracting Authority and will become the property of the Contracting Authority.

Quality control activities, testing, and records will be monitored regularly by Contracting Authority representatives. The Project Engineer or District Materials Engineer will assign personnel for this function.

Monitor activities will be reported and filed at prescribed intervals with the Project Engineer, District Materials Engineer, producer, contractor, and the contractor's designated producer.

At no time will the monitor inspector issue directions to the contractor, or to the QC Technician. However, the monitor inspector will have the authority and responsibility to question, and where necessary, reject any operation or completed product, which is not in compliance with contract requirements.

## ACCEPTANCE

Completed work will be accepted on the basis of specification compliance documented by acceptance test records, and monitor inspection records. Specification noncompliance will require corrective action by the producer, contractor, or by the contractor's designated producer, and review of events and results associated with noncompliance by the Project Engineer.

## CERTIFICATION LEVELS

| CERTIFICATION LEVEL | TITLE | PRE-REQUISITES |
|---|---|---|
| | **AGGREGATE** | |
| Level I Aggregate | Certified Sampling Technician | None |
| Level II Aggregate | Certified Aggregate Technician | Level I Aggregate |
| | **PORTLAND CEMENT CONCRETE** | |
| Level I PCC** | PCC Testing Technician | None |
| Level II PCC | PCC Plant Technician | Level II Aggregate & Level I PCC |
| Level III PCC | PCC Mix Design Technician | Level II PCC |

**American Concrete Institute (ACI) Grade I certification will be acceptable as a portion of the Level I PCC training.

| CERTIFICATION LEVEL | TITLE | PRE-REQUISITES |
|---|---|---|
| | **HOT MIX ASPHALT** | |
| HMA Sampler | HMA Sampler | None |
| Level I HMA | HMA Technician | Level II Aggregate |
| Level II HMA | HMA Mix Design Technician | Level I HMA |
| | **PROFILOGRAPH** | |
| Profilograph | Profilograph Technician | None |
| | **PRESTRESS** | |
| Prestress | Prestress Technician | Level I PCC or ACI Grade I *If the technician will be performing gradations, they will need to be Aggregate Level II- certified.* |

## UNSATISFACTORY PERFORMANCE NOTICE

Issued To: ____________________________ Date: ____________________

____________________________

____________________________

This notice is to inform you that your performance as a Certified Inspector/Technician was unsatisfactory for the reason(s) listed below.

This notice will be placed in your permanent file with the District Materials Office in which you reside. It will also be placed on the statewide computer file.

The goal of the Technical Training and Certification Program (TTCP) is to work with contractors, producers, cities, and counties to continually improve the quality of Iowa's construction projects. We hope you will work with us to achieve this goal.

Unsatisfactory Performance:

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

____________________________
District Materials Engineer

cc: Program Director – Materials Engineer, Ames
TTCP Coordinator
Resident Construction Engineer

## CERTIFIED TECHNICIANS QUALIFICATIONS

Tests and Procedures the Certified Technician is qualified to perform for each level of certification.

### LEVEL I AGGREGATE

- IM 204 - Inspection of Construction Project Sampling & Testing (when material is incorporated)
- IM 209, App. C - Aggregate Specification Limits & Sampling & Testing Guide (when material is produced)
- IM 301 - Aggregate Sampling Methods

### LEVEL II AGGREGATE

- IM 216 - Guidelines for Verifying Certified Testing Results
- IM 302 - Sieve Analysis of Aggregates
- IM 306 - Determining the Amount of Material Finer Than #200 (75μm) Sieve in Aggregate
- IM 307 - Determining Specific Gravity of Aggregate
- IM 308 - Determining Free Moisture & Absorption of Aggregate
- IM 336 - Methods of Reducing Aggregate Field Samples to Test Samples
- IM 344 - Determining the Amount of Shale in Fine Aggregate
- IM 345 - Determining the Amount of Shale in Coarse Aggregate

### LEVEL I PCC

- IM 204 - Inspection of Construction Project Sampling & Testing
- IM 208 - Materials Laboratory Qualification Program
- IM 216 - Guidelines for Verifying Certified Testing Results
- IM 315 - Method of Protecting, Curing, Making & Testing Concrete Cylinders
- IM 316 - Flexural Strength of Concrete
- IM 317 - Slump of Hydraulic Cement Concrete
- IM 318 - Air Content of Freshly-Mixed Concrete by Pressure
- IM 327 - Sampling Freshly-Mixed Concrete
- IM 328 - Making, Protecting, and Curing Concrete Flexural Specimens
- IM 340 - Weight Per Cubic Foot, Yield, & Air Content (Gravimetric) of Concrete
- IM 383 - Testing the Strength of PCC Using the Maturity Method
- IM 385 - Temperature of Freshly-Mixed Concrete
- IM 525 - Designing Flowable Mortar
- Iowa 410-B - Method of Test for Flow of Grout Mixtures
- AASHTO T97 - Third Point Loading

## LEVEL II PCC

- IM 527 - Paving Plant Inspection
- IM 528 - Structural Concrete Plant Inspection
- IM 529 - PC Concrete Proportions

## LEVEL III PCC

- IM 530 - Quality Management & Acceptance of PC Concrete Pavement
- IM 531 - Test Method for Combining Aggregate Gradations
- IM 532 - Aggregate Proportioning Guide for Portland Cement Concrete Pavement

## HMA SAMPLER

- IM 322 - Method of Sampling Uncompacted Hot Mix Asphalt
- IM 323 - Method of Sampling Asphaltic Materials

## LEVEL I HMA

- IM 204 - Inspection of Construction Project Sampling & Testing
- IM 208 - Materials Laboratory Qualification Program
- IM 216 - Guidelines for Verifying Certified Testing Results
- IM 320 - Method of Sampling Compacted Asphalt Mixtures
- IM 321 - Method of Test for Compacted Density of Hot Mix Asphalt (HMA) (Displacement)
- IM 322 - Method of Sampling Uncompacted Hot Mix Asphalt
- IM 323 - Method of Sampling Asphaltic Materials
- IM 325 - Compacting Asphalt Concrete by the Marshall Method
- IM 325G - Method of Test for Determining the Density of Hot Mix Asphalt (HMA) Using the Superpave Gyratory Compactor (SGC)
- IM 337 - Determining Thickness of Completed Courses of Base, Subbase, & Hot Mix Asphalt
- IM 350 - Maximum Specific Gravity of Hot Mix Asphalt (HMA) Mixtures
- IM 357 - Preparation of Hot Mix Asphalt (HMA) Mix Samples for Test Specimens
- IM 501 - Asphaltic Terminology, Equations & Example Calculations
- IM 508 - Hot Mix Asphalt (HMA) Plant Inspection
- IM 509 - Tank Measurement & Asphalt Cement Content Determination
- IM 511 - Control of Hot Mix Asphalt (HMA) Mixtures
- IM 514 - Correlation of Field Density for Hot Mix Asphalt (HMA) Paving

## LEVEL II HMA

- IM 380 - Vacuum-Saturated Specific Gravity & Absorption of Combined or Individual Aggregate Sources
- IM 510 - Method of Design of Hot Mix Asphalt (HMA) Mixes
- AASHTO T176 - Plastic Fines in Graded Aggregate & Soils by use of Sand Equivalent Test
- AASHTO T304 - Uncompacted Void Content of Fine Aggregate
- ASTM D 4791 - Flat Particles, Elongated Particles, or Flat & Elongated Particles in Coarse Aggregate

## PROFILOGRAPH

- IM 341 - Determining Pavement & Bridge Ride Quality

## PRESTRESS

- IM 570 - Precast & Prestressed Concrete Bridge Units

## AGGREGATE TECHNICIAN DUTIES

Duties of the Aggregate Technician are detailed in IM 209 and the IM 300 Series and consist of, but are not limited to the following:

A. Sampling

1. Obtain representative samples by approved method(s).
2. Sample at required frequencies.
3. Identify samples with pertinent information such as:
    a. Type of material
    b. Intended use
    c. Production beds working depth
    d. Sampling method

B. Gradation Testing

1. Follow appropriate gradation testing methods.
2. Maintain current applicable specifications.
3. Post test results within 24 hours of sampling.

C. Other Testing as Required (specific gravity, moisture, deleterious material, etc.)

1. Follow appropriate testing methods.
2. Maintain current applicable specifications.
3. Complete required reports.

D. Sampling & Testing Equipment

1. Clean and check testing sieves for defects.
2. Assure scale accuracy.
3. Maintain sampling and testing equipment.

E. Communication

1. Notify the District Materials office for production start-up or changes.

2. Relay test results to appropriate production or supervisory personnel.

3. Report failing test results immediately to appropriate personnel (including District Materials office) and assure remedial actions are taken.

F. General

1. Monitor stockpiling procedures to avoid contamination and excess segregation.

2. Assure proper identification of stockpiles.

3. Assure specification requirements for intended use are met before shipment.

4. Assure sampling locations are safe.

5. Assure proper bedding planes or production depths are maintained.

G. Documentation

1. Report all production test results of certified aggregates on Form #821278 and distribute as required.

2. Assure "plant production log" is maintained.

## PORTLAND CEMENT CONCRETE (PCC) TECHNICIAN DUTIES
## PAVING & STRUCTURAL CONCRETE

The Quality Control Technician shall have no other duties while performing certified inspection duties. The District Materials Engineer may approve all quality control activities be performed by a single certified technician for low production situations.

Many of the duties of the PCC Level II Technician are detailed in IM 527 (Paving) and IM 528 (Structural) and consist of, but are not limited to the following:

A. Stockpiles

1. Assure proper stockpiling procedures.
2. Prevent intermingling of aggregates.
3. Prevent contamination.
4. Prevent segregation.

B. Plant Facilities

1. Assure safe sampling locations.
2. Check for equipment compliance.
3. Assure proper laboratory location and facilities.

C. Calibration

1. Be present during calibration (paving).
2. Check plant calibration (structural).
3. Assure proper batch weights.

D. Cement (Fly Ash) & Aggregate Delivery

1. Check for proper sources and certification.
2. Document quantities delivered.
3. Monitor condition of shipments.

E. Plant Sampling

1. Check aggregate gradations by obtaining, splitting, and testing samples.

2. Check aggregate moistures and specific gravity.

F. Proportion Control

1. Check scale weights and operation.

2. Check admixture dispensers.

3. Check mixing time and revolutions.

4. Check cement yield. (Paving plant only, unless over 10,000 cu. yds.)

G. Concrete Tests

1. Cure flexural test specimens.

2. Test flexural specimens (Contract agency will perform test in structural plant).

3. Conduct maturity testing.

H. Test Equipment

1. Clean and maintain scales, screens, pycnometers and beam molds, and laboratory facility.

I. Documentation

1. Prepare daily plant reports (paving), weekly plant reports (structures).

2. Document all checks and test results in the field book.

3. Maintain daily diary of work activity.

## HOT MIX ASPHALT (HMA) TECHNICIAN INSPECTION DUTIES

The following is a list of the duties that must be performed by the Certified Level I HMA Technicians doing quality control work for the Contractor on all projects where the Quality Management-Asphalt (QM-A) specification applies.

These duties consist of, but are not limited to, the following:

A. Aggregate Stockpiles.

1. Assure proper stockpiling of aggregate deliveries. (stockpile build & additions) (daily check list, IM 508)
   a. Prevent intermingling of aggregates.
   b. Check for and prevent contamination.
   c. Prevent segregation.
   d. Check for oversize material.

2. Document certified aggregate deliveries. (each delivery) (plant book, IM 508)
   a. Obtain truck tickets.
   b. Check for proper certification.
   c. Check for proper approved source.
   d. Enter deliveries in Plant Book Program, Aggregate Certification page.

3. Observe loader operation. (daily) (daily check list, IM 508)
   a. Check for proper stockpile to bin match-up.
   b. Check that loader does not get stockpile base material in load.
   c. Check that loader does not intermingle aggr. by overloading bins.

B. Asphalt Binder Delivery. (each delivery) (plant report & plant book, IM 508 & 509)

1. Check that material is pumped into correct tank.
2. Document Deliveries.
   a. Obtain truck tickets.
   b. Check for proper approved source.
   c. Check for proper certification.
   d. Check for proper grade.
   e. Check for addition of liquid anti-strip if required.
   f. Check if weight per gallon or specific gravity has changed.
   g. Enter deliveries into Plant Book Program, Asphalt Binder Shipment Log page.

C. Plant Operations. (daily)

1. Prepare Plant Report Program for daily entries. (plant report, IM 511)

    a. Enter Date.
    b. Enter Report Number.
    c. Enter expected tonnage for the day.
    d. Enter any proportion or target changes that apply.

2. Aggregate Delivery System. (daily check list, IM 508)

    a. Check for proper cold feed gate settings.
    b. Check for proper cold feed belt speed settings.
    c. Check for proper moisture setting (drum plants).
    d. Monitor RAP proportions

3. Mixing System. (daily check list, spec 2303.03, IM 508)

    a. Check for proper asphalt binder delivery setting.
    b. Check for proper interlock operation.
    c. Monitor coating of aggregates.
    d. Monitor mixing time (batch plants).

4. Loading System. (daily check list, spec 2303.03 & 2001.01, IM 508)

    a. Check hopper/silo gates for proper open/close
    b. Check trucks for proper loading and possible segregation.
    c. Check trucks for diesel fuel contamination in box and remove contaminated trucks from service (5 hrs with box raised).

5. Asphalt Binder Quantity Determination. (plant report, IM 508 & 509)

    a. Perform start-up tank stick measurement before mix production begins (if applicable).
    b. Perform final tank stick measurement after mix production is done (if applicable).
    c. Perform intermediate tank stick measurements as needed.
    d. If using meter for quantity, obtain totalizer printout readings and periodically check against tank stick readings.
    e. If using batch count for quantity, obtain printouts of each batch and add up the asphalt binder used for total quantity.

D. Plant Operations. (2 hour intervals) (plant report, IM 508)

1. Temperatures.

    a. Monitor and record mix temperature at discharge into truck box.
    b. Monitor and record asphalt binder temperature.

c. Monitor and record air temperature.

2. Observe plant operation for any irregularities.

E. Weighing Equipment.

1. Proportioning scales (batch plants). (min. 1/day) (spec 2001.07 & .20) (daily check list, IM 508)
   a. Perform sensitivity checks of scales.
   b. Check for interference at scale pivot points.

2. Pay Quantity Scales. (min. 1/day) (spec 2001.07 & .20, IM 508) (daily check list, plant book)
   a. Regularly perform check weighing comparisons with a certified scale as necessary. (min. 1st day and one additional if >5000 tons, and as directed by Engineer)
   b. Perform sensitivity checks of scales.
   c. Check for interference at scale pivot points.
   d. Perform verification weighing (truck platform scales).

3. Weigh Belts. (daily) (daily check list)

   a. Check weigh belt for excess clinging fines that effects speed reading.
   b. Check weigh belt for interference at bridge pivot points.
   c. Check for proper span setting.

4. Enter scale checks in Plant Book Program, Daily Check List or Plant Scale Checks page. (daily) (plant book)

F. Plant Sampling. (daily) (spec 2303.04, IM 204 & 511)

1. Obtain cold-feed gradation samples as directed by Contracting Authority personnel per IM 301and IM 204.

2. Obtain asphalt binder samples as directed by Contracting Authority personnel per IM 323 and IM 204.

3. Enter sample data into Plant Book Program, Sample Log page.

4. Obtain cold-feed moisture samples at a minimum of every ½ day (drum mix plants).

G. Field Sampling (if not performed by others). (daily) (spec 2303.04, IM 204 & 511)

1. Obtain uncompacted mix random samples as directed by Contracting Authority personnel, and identify time, station, lift and side.

3. Obtain compacted mix core random samples as directed by Contracting Authority personnel.

H. Testing. (daily) (spec 2303.04, IM 204 & 511)

1. Field cores.

   a. Provide properly calibrated equipment for Contracting Authority technician's use.
   b. Obtain and record core location station and offset information.
   c. Obtain copy of core thickness measurements from Contracting Authority Technician.
   d. Obtain copy of core weights from Contracting Authority technician.
   e. Record weights and thickness in Plant Report Program.
   f. Enter sample data into Plant Book Program Sample Log page.

2. Uncompacted mix.

   a. Properly store Contracting Authority secured portion of paired sample.
   b. Split Contractor half of paired sample into test portions as per IM 357.
   c. Perform gyratory compaction as per IM 325G.
   d. Perform bulk specific gravity test of laboratory-compacted specimen as per IM 321.
   e. Perform maximum specific gravity test as per IM 350.
   f. Enter test data into Plant Report Program.
   g. Submit secured samples to DOT District Lab.
   h. Enter sample data into Plant Book Program, Sample Log page.

3. Aggregate.

   a. Split one sample each day as directed by Contracting Authority personnel and provide half for testing by Contracting Authority.
   b. Perform gradation analysis as per IM 302 and enter weights into Plant Report Program.
   c. Perform moisture tests and enter weights into Plant Book Program, Plant Moistures page (drum mix plants).

4. Testing Lab Qualification. (as needed) (IM 208 & 511)

   a. Record all HMA sample validations with DOT on form 235.
   b. Document corrective actions taken when not correlating.
   c. Document all test equipment calibrations.
   d. Update IM's, test procedures and specs as required.

I. Documentation. (daily) (spec 2303.04, plant report, plant book, IM 204, 511 & 508)

1. Prepare computerized Daily Plant Report (form 241).

   a. Check that all data is correct.
   b. Check that all data is complete.
   c. Compute moving averages for gradation and lab voids.
   d. Compute tons of mix used to date.
   e. Enter mix adjustment data on report.
   f. Check for spec compliance.
   g. Immediately report non-complying results.
   h. Obtain and record mat temperatures and stationing.
   i. Provide daily Plant Report printout to DME.

2. Maintain a daily diary of work activity in Plant Report Program.

   a. Record weather conditions.
   b. Record daily high and low temperatures.
   c. Record sunrise and sunset times.
   d. Record any interruptions to plant production.
   e. Record any other significant events.

3. Copy and export daily data and paste into control charts program.

4. Enter all asphalt binder or aggregate proportion changes in Plant Book Program, Mix Adjustments page.

5. Enter tack shipment quantities in Plant Book Program, Tack Shipment Log page.

6. Total all truck tickets delivered to project and deduct any waste to determine HMA pay quantity.

J. Miscellaneous. (daily) (daily check list, IM 208 & 511)

1. Fill out Plant Book Program, Daily Check List page.

2. Clean lab.

3. Back-up computer files.

4. Dispose of samples as directed by District Lab.

5. Clean and maintain lab equipment.

K. Independent Assurance Duties. (Every 3 months) (IM 205 & 216)

1. Pick up HMA and aggregate proficiency sample from District Lab.
2. Test aggregate proficiency sample for gradation per IM 302.
3. Test HMA proficiency sample per IM 357, 325G, 321 & 350.
4. Report test results on proficiency samples to Central Materials Office per IM 205.

L. Project Duties. (1/project) (IM 508 & 511)

1. Be in possession of appropriate mix design.
2. Be present during plant calibration.
3. Observe scale calibrations.
4. Perform plant site and set-up inspection and fill out Plant Site Inspection List.
5. Set up Plant Report and Plant Book Programs and enter all project information to create Project Master files at beginning of project.
6. Check that release agents used in truck boxes are on the approved list in IM 491.15
7. Copy all computer files and provide to the Contracting Authority at completion of project.
8. Copy all paperwork and control charts and provide to the Contracting Authority at completion of project.

## PRESTRESS TECHNICIAN DUTIES

Duties of the Prestress Technician are detailed in IM 570 and consist of, but are not limited to the following:

A. Pre-pour

1. Identify and document materials requiring outside fabrication inspection.
2. Identify potential fabrication or production problems and notify Iowa DOT inspectors.
3. Verify that all materials incorporated meet the requirements of the contract documents.
4. Review concrete placement documents for strand locations.
5. Check tension calculations.
6. Measure elongation and gauge pressure during tensioning.
7. Check hold down and insert locations.
8. Check stress distributions.
9. Check steel reinforcement and placement.
10. Check strand position.
11. Check condition of pallet.
    a. Level
    b. Holes
    c. Gaps
    d. Other deformities
12. Determine moisture of aggregates.
13. Check form condition and placement.
    a. Oil
    b. Line alignment level
    c. Tightness

B. Concrete Placement

1. Check on use of an approved mix design and batching operations (sequence).
2. Assure appropriate placement and proper vibration techniques.
3. Measure and record concrete temperature.
4. Assure test cylinders are properly made.
5. Assure appropriate finish.
6. Assure appropriate curing operations.

C. Post-pour

1. Check temperature and record during curing process.
2. Assure concrete strength has been met prior to releasing the line.
3. Assure proper detensioning procedure.
4. Check unit for defects and obtain approval for repairs.
5. Identify and store cylinders with the respective units.
6. Check beam ends for fabrication in accordance with the plans.
7. Assure exterior sides of facia beams are grouted.
8. Inspect after patching and desired surfacing.
9. Measure and record overall dimensions of beam.
10. Measure and record camber at release and compare to design camber.
11. Check and/or measure and record lateral sweep before shipping.
12. Assure proper cylinder cure.

## PROFILOGRAPH TECHNICIAN DUTIES

Duties of the Profilograph Technician are detailed in IM 341 and consist of, but are not limited to the following:

A. Test pavement for smoothness criteria.

B. Evaluate and certify test results.

   1. Certified person that reduces trace must sign certified test report.

   2. Profilograms become part of permanent project record.

C. Documentation

   1. Certified Profilograph Test report must include following statement:

      This is to certify that all testing and trace reduction herein described has been performed according to applicable contract specifications and requirements.

## FEDERAL CODE 1020 and IOWA CODE 714.8

I.M. 213 discusses the Unsatisfactory Notice that Certified Technicians are given when they are not performing their job duties satisfactorily. This can be given for a number of reasons including, improper sampling and/or testing, not performing their duties and reporting in the time frame required, reporting incorrect information, etc. The technician is given one written notice, the second notice is three-month certification suspension, and the third notice is decertification. According to I.M. 213 the Certified Technician can automatically be decertified for false statements without going through the Unsatisfactory Notice procedure. The Certified Technician also needs to be aware of the false statement clause that is applicable to all federal-aid projects and the fraudulent practice clause that applies to all non-federal aid projects. **Certified Technicians need to read and be aware of U.S.C. 1020 and Iowa Code 714.8 since these do apply to them.** They read as follows:

### FEDERAL AID PROJECTS

### IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

**NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS**
**18 U.S.C. 1020 reads as follows:**

**"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or**

**Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or**

**Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;**

**Shall be fined not more than $10,000 or imprisoned not more than 5 years or both"**

## NON-FEDERAL AID PROJECTS

**Iowa Code 714.8, subsection 3, defines fraudulent practices. "A person who does any of the following acts is guilty of a fraudulent practice. Subsection 3, Knowingly executes or tenders a false certification under penalty of perjury, false affidavit, or false certificate, if the certification, affidavit, or certificate is required by law or given in support of a claim for compensation, indemnification, restitution, or other payment." Depending on the amount of money claimed for payment, this could be a Class C or Class D felony, with potential fines and/or prison.**

The above codes refer to the individual making the false statement. **Standard Specification Article 1102.03, paragraph C. section 5 refers to the Contractor.**

**Article 1102.03, paragraph C, section 5 states, "A contractor may be disqualified from bidder qualification if or when: The contractor has falsified documents or certifications, or has knowingly provided false information to the Department or the Contracting Authority."**

# SAMPLING UNCOMPACTED HOT MIX ASPHALT

## SCOPE

Two methods of sampling hot mix asphalt (HMA) are used for sampling mix to be submitted for laboratory tests. The necessary containers for Agency samples are available for purchase by the Contractor from the Iowa Department of Transportation Warehouse in Ames, Iowa.

## REFERENCED DOCUMENTS

Standard Specification 2303 Hot Mix Asphalt Mixtures
Standard Specification 2309 Surface Recycling by Heater Scarification
IM 336 Reducing Aggregate Field Samples to Test Samples
IM 357 Preparation of Hot Mix Asphalt (HMA) Mix Samples for Test Specimens

## APPARATUS

- Metal Sampling Template, with a minimum area of 64 in.$^2$ (410 cm$^2$) & 4 in. (100 mm) deep.
- Laboratory Sampling Scoop (Square Pointed)
- Putty Knife
- 2-gallon (7.5-liter) capacity cardboard box (for Agency samples)
- Sampling Container
- Ruler
- Jabber Sampler (for thick lifts)
- Quartermaster (Optional)
- Square-pointed Shovel

Equipment used for sampling purposes must be clean and free of any materials, which may alter the material properties of the mixture. Extra care should be used when using petroleum distillates or other solvents to clean equipment. If petroleum distillates or other solvents are used to clean equipment, the equipment must be dry prior to use.

## PROCEDURE

### Sample Size

Samples submitted to both laboratories for testing shall be of sufficient size to run each of the required tests (approximately 30 pounds (14 kg) for each lab). Samples taken from thick layers will be proportionately larger.

### Sampling Methods

**NOTE:** Extreme care shall be taken to minimize segregation of coarse and fine particles while the sample is being taken. **NOTE:** Extreme care shall be taken so as not to contaminate the sample with any foreign matter (Fuel oil, dust, etc.).

## A. Pavement Sampling

This method of sampling hot mix asphalt is not to be used in situations involving Heater Scarification Work as stated in Standard Specification 2309.

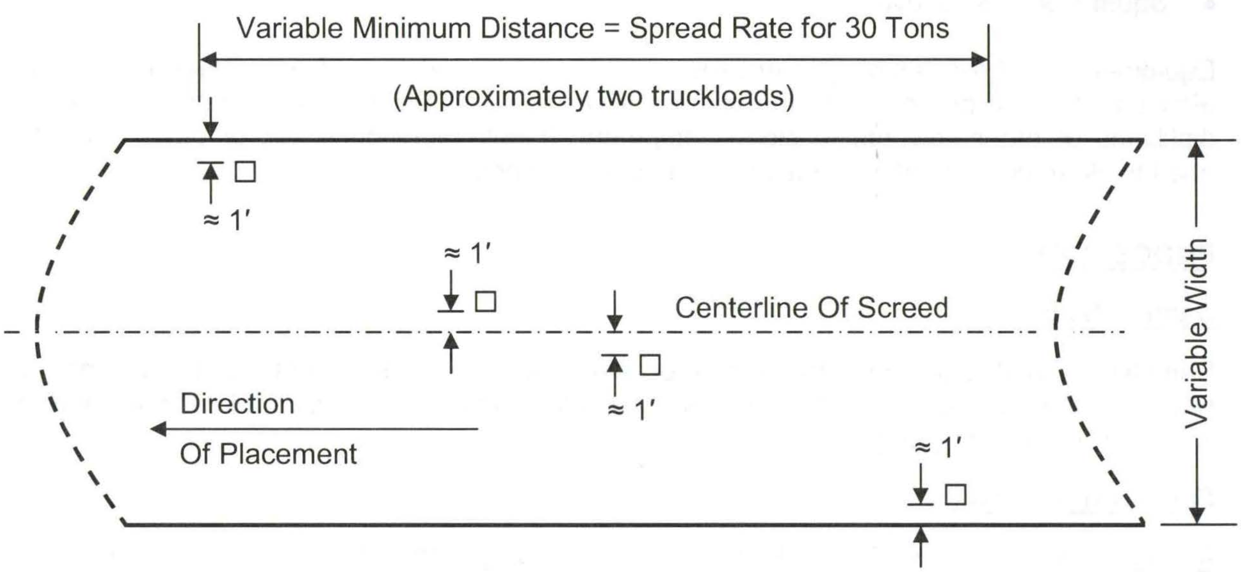
1. Samples shall always be taken behind the laydown machine before the material receives any compaction. Sampling shall be distributed over at least 30 tons (30 Mg) of mix placed (approximately two different truckloads).

2. The template shall be placed on the mat and forced straight down through the entire depth of the mat being laid. All material inside the template shall be scooped out and placed uniformly in the sample container(s). A square pointed shovel may be used to take the sample from the inside of the template. A scoop can be used to remove the remaining material from along the inside of the template. All the material, which has stuck to both the inside and outside of the scoop, shall be scraped off and added to the sample. The engineer may adjust the details of this procedure when samples are obtained from courses placed on earth subgrades, untreated subbases and bases to prevent contamination. **NOTE:** Any material adhering to the inside of the template shall be scraped off and added to each template sample.

3. Samples shall be taken to represent a cross-section of the mat as follows:

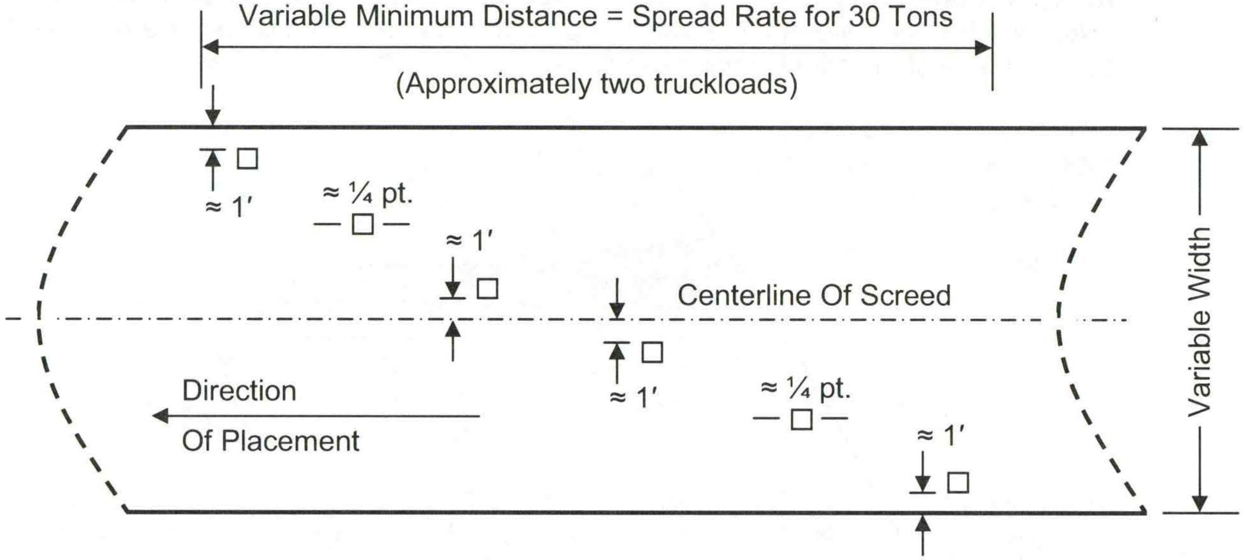
   a. A minimum of four template samples shall be taken. One approximately 1 foot (0.30 meters) in from the left edge of the mat, one approximately 1 foot (0.30 meters) left of the center of the screed, one approximately 1 foot (0.30 meters) right of the center of the screed, and one approximately 1 foot (0.30 meters) in from the right edge of the mat. (See Diagram 1.)

**DIAGRAM 1**



b. If six template samples are needed to yield a sample of sufficient size, an additional template sample shall be taken approximately on each quarter point. (See Diagram 2.) If eight or more template samples are needed to yield a sample of sufficient size, two or more repetitions of four or six template samples may be required.

**DIAGRAM 2**




4. When sampling from thick lifts [generally greater than 3 inches (80 mm) in thickness], obtain the sample in increments as outlined above except a metal straight edge or a square point shovel may be used to delineate the sample sites in lieu of the template. When using the shovel to sample thick lifts, the shovel is first used to delineate the sample area and remove the material that is not part of the sample by creating a vertical face and pulling the shovel and excess material away from the sample area. Then the shovel can be used to remove the sample. The scoop can be used to finish the sampling to be sure that all mix within the delineated area is included in the sample increment. If the four segments required by 3a result in excess mixture, the additional mixture shall be forwarded to the appropriate laboratory. Large samples shall be carefully combined and reduced at the laboratory prior to testing.

## A. Hopper Sampling

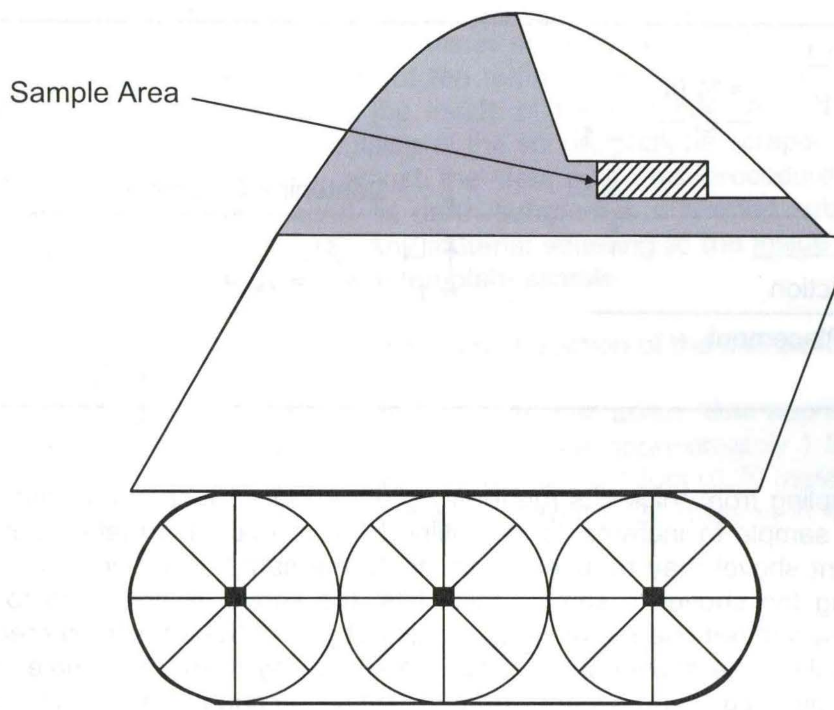
This method of sampling hot mix asphalt shall be limited to projects using the Heater Scarification Process as stated in Standard Specification 2309.

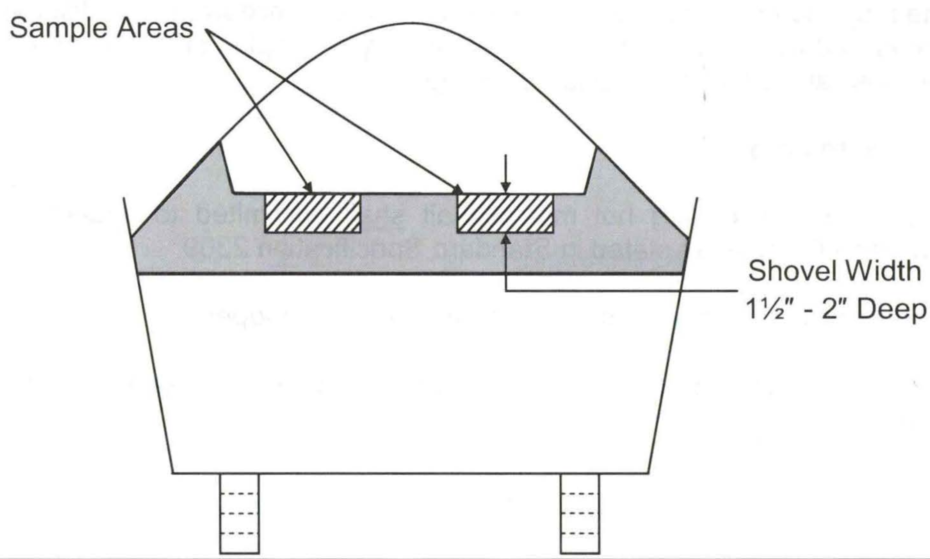
1. The sample shall always be taken from the paver hopper.

2. A square pointed shovel shall be used to prepare the sampling area and to take the sample.

3. The sample shall be built up from a minimum of 30 tons (30 Mg) of mixture placed (approximately two different truckloads).

4. The sample shall be taken from a location, which is as near the center of the mass of a nearly full hopper as practically possible. A flat surface shall be prepared by removing mix downward from the peak until the desired plateau is reached. Just prior to taking the sample, all foreign material shall be scraped from the shovel. The sample shall be removed from the plateau in a manner that will assure collection of material over an area, which is of uniform dimension. In placing material into the box, the material from the front face of the shovel shall be included.



## Paired Samples

Field Sampling (Side-by-Side Sampling) to obtain paired samples as required to provide Agency verification samples and Contractor quality control samples.

This method is only to be used when sampling directly from the pavement with a template.

1. The Contractor shall obtain HMA samples in accordance with the procedures outlined above, except that, two boxes of at least 30 pounds (14 kg) each shall be obtained from each samples site as directed and witnessed by the Engineer.

2. After obtaining each template sample for the first box, the template shall be moved longitudinally so that the second template sample site shares a common edge (not more than 4 inches apart) with the first.

3. Perform the same procedures as stated above to remove all materials from the adjacent location and place this material in the second box.

4. Agency personnel will immediately take possession of one of the two boxes, secure it and fill out a sample identification (Form #193) before retuning the sample to the Contractor for transport to the Agency's testing lab.

When paired samples are required, but a template is not used to delineate the sample such as for base widening, thick lifts or heater scarification, the Engineer will provide direction on the sampling procedures to be used. Adjacent locations for paired samples will be used whenever practical.

## Sample Splitting

These splitting methods are to be used for reducing large field samples to lab sample size and to provide split samples for testing in multiple labs. To reduce samples to test sample size see IM 357.

The order of preference of sample splitting is as follows:

**A. Quartermaster (Or Similar Quartering Device)**

1. Place the entire sample (60-pound minimum) in the Quartermaster. **NOTE:** Take care to avoid segregation when placing material in the Quartermaster.

2. Release the gate to split the sample into four smaller samples.

3. Take the split material from opposite corners and recombine to obtain two boxes of material.

**B. Riffle Splitter**

Follow procedure I, Splitting Method, in IM 336 with the following exceptions:

1. Only one cycle of this process is performed to obtain the desired sample size for both labs.

**C. Manual Splitting**

Follow procedure IV, Quartering Method, in IM 336 with the following exceptions:

1. Only one cycle of this process is performed to obtain the desired sample size for both labs.

**Sample Delivery & Retention**

1. Each sample shall be carefully labeled.
2. The Contractor will transport the boxes to the Contractor's QMA laboratory.
3. The Contractor's certified technician will test the unsecured box of the paired sample at the Contractor's QMA laboratory for testing.
4. The secured box of each paired sample will be retained at the Contractor's QMA laboratory until delivered by the Contractor to the testing lab designated by the Engineer.
5. The Contractor shall retain all samples and test specimens for a lot until the Contracting Authority accepts the lot. **NOTE:** The Contractor should retain all samples until notified by the Contracting Authority that the material is no longer required.

April 15, 2003 Matls. IM 323
Supersedes April 28, 1998

---

# METHOD OF SAMPLING ASPHALTIC MATERIALS
(General Rewrite)

## SCOPE

This IM provides the procedure used in the sampling of asphaltic materials (asphalt binder, asphalt emulsions, and cutback asphalts) to be submitted for laboratory tests. The necessary sample containers are available for purchase by the contractor from the Iowa Department of Transportation, Ames warehouse.

## APPARATUS

- Disposable, unlined, one-quart (one-liter) capacity cardboard sample catching containers.
- 3 oz. (90 mL) ointment tin for asphalt binder.
- One-quart (one-liter) capacity wide-mouth cans with lids for cutback asphalts and complete analysis binder samples.
- One-quart (one-liter) and one gallon (four liter) plastic bottles for asphalt emulsion.
- Clean, dry cloth.
- 1 pair insulated gloves.

## PROCEDURE

1. Single samples as follows:

   a. Binder for DSR stiffness – 3 oz. (90 mL) tin

   b. Binder complete analysis – 1 quart (1 liter) metal can

   c. Cutback asphalts – 1 quart (1 liter) metal can

   d. Asphalt emulsion – partial analysis 1 quart (1 liter) – must be a plastic bottle
   – complete analysis – 1 gallon (4 liter) – must be a plastic bottle

## SAMPLING PROCEDURE

The various materials shall be drawn from plants, distributors, and storage tanks as required in a safe and reliable manner. Single samples shall be taken at the rate prescribed and by the following methods:

1. Sampling from Mixing Plants

   Samples shall be taken from sampling valves located in the pumping line, (line from tank to mixer). A minimum of one-gallon (four liters) of material must be drawn and wasted from the sampling valve before the actual sample is drawn. The plant should be operated a minimum of one hour before samples are taken.

Sample material shall be drawn into the appropriate containers provided for that purpose. DSR samples shall be prepared by pouring the material from the sample catching container into the ointment tins; the tins shall be filled to a depth 1/4" (6 mm) form the top. Material should not be spilled over the sides and edges of the tins. The tins should be covered and allowed to cool in air to handling temperature. The tins should then be capped and marked for shipment. When cutback asphalt or asphalt emulsion samples are obtained from mixing plants, the sample shall be one quart (one liter) or one gallon (four liters) size and may be placed directly in the shipping containers provided.

Prior to use, the "uncoated" sample-catching containers and sample storage containers should be inspected and wiped clean of dust and manufacturing residue with a clean, dry cloth. If the containers, which are to be used for shipment, are spattered during the pouring operation, they should be wiped clean with a clean, dry cloth. In case the tins are over filled or otherwise made unusable, they should be disposed of and new tins filled as required. Under no circumstances should any volatile material or contaminants of any kind be allowed to come in contact with the samples, containers, and cleaning cloths.

In the event that it is necessary to sample storage tanks by dipping through the dome or top opening of a tank, care should be taken so that the container is not filled entirely with the materials from the top portion of material in storage.

2. Samples from Distributors

Samples should be drawn from the spray bar after heating and recirculation has been completed. The spray bar should be opened and cleared of old or foreign material before the sample is taken. Asphalt emulsion samples should be taken from the spray bar after it has been adjusted to gravity feed. Samples may be drawn directly into sample containers furnished for this purpose.

> **NOTE**:: The test results of asphalt emulsion samples can be greatly affected when samples are obtained from the spray bar, under pressure.
>
> **NOTE**: When asphalt emulsions are diluted for tack coat material, the addition of the water changes the manufacturer's formula. Due to this, very rapid settlement occurs. To obtain a representative sample of the diluted asphalt emulsion, it is essential to obtain the sample immediately after circulating the material.

The precautions listed in the previous section should be observed in this procedure as well. Refer to Section No. 1 for size of samples.

3. Samples from Transports, Rail Cars, Terminal Storage

   When samples are to be obtained from hauling units or terminal facilities, sampling methods listed in Section No. 1 above are to apply. Samples shall be drawn from sampling valves located in tank walls or bulkhead, and/or transfer lines when possible. When sampling valves are not provided, samples are to be obtained by inverting sample containers substantially below the surface of the stored material.

# *ASPHALT BINDER SAMPLING AT THE PLANT*

The second basic material to flow through the plant is the asphalt binder.

The type and grade of binder to be used will be found in the contrast documents (see 2303.02 refer also to plan notes and special provisions). The acceptance for use on the project is the certified delivery ticket.

Sampling of binder is a basic inspection job. References for sampling include Materials IM 204 and 323.

Samples should be taken from sampling valves located in the pumping line, between the storage tank and the mixer. Remember that you must waste some material prior to getting the sample so the lines are cleaned of old binder.

This location is accessible, and could be a good sampling setup. A platform to stand on would get the inspectors high enough so the container isn't at eye level. The unsupported container can easily tip over, splashing hot asphalt around. A poor setup is an accident waiting to happen.

A slight difference in the position of the inspector makes a world of difference in the safety and convenience of getting the sample. Remember to use your safety apparel.

Sampling from the transport is <u>not</u> allowed by Specifications. The use of a metal can for binder is not proper, and insulated gloves are a must.

Sometimes changes can be made to make a very awkward location into one that is acceptable. Care must be used to be sure the sample is not contaminated by the fines lying around.

The sample, which will be sent in for test, is placed in tin. The tin is filled by pouring hot binder from the sampling cup. It would be advisable to put a piece of paper under the tin in case of spills.

It is advisable to write the sample number on the can lid before it is filled. The use of insulated gloves is recommended when handling the cardboard container even though it may feel cool enough to handle when you begin.

Form 820193
7-94

Central
Lab. No. ____________

**Iowa Department of Transportation**

**IDENTIFICATION OF SAMPLE FOR TEST**

(Read Instructions on back before taking sample and filling out form)

Material: Asphalt Binder PG 58-28 — Senders Sample No.: A5-16A

Intended Use: Surface 3M — Contract number: 77-0006-41

County: POLK — Group No.: ____ — Design No.: ABD5-1005

Project: NHS-6-3(41)--12-77

Contractor: Quality Asphalt Inc. (Name) ____ (Address)

Supplier: Bituminous Materials & Supply — Source: Des Moines, Iowa

Producer: Bituminous Materials & Supply — Brand: PG 58-28 — Lot No.: ____

Location of Producing Plant: Des Moines, Iowa

____ Sec. ____ Twp. ____ Range ____ Co. ____

Unit of Material Represented: one 4 oz. tin per Materials IM 204 witnessed by Bob Anderson

Quantity Represented: Approx. 80 tons each

Sampled by: John Rayson (name) — Quality Asphalt Inc. (address)

Date sampled: 05/16/05

Report to Tranportation Center(s) (Check appropriate box (es))

| DIST. #1 | DIST. #2 | DIST. #3 | DIST. #4 | DIST. #5 | DIST. #6 |
|---|---|---|---|---|---|
| X | | | | | |

Report to Residency (Write appropriate residency number): 11

Report to Counties (Write appropriate count number): ____

Report to Other: Quality Asphalt Inc. (Name) (Title) (Address) (Phone)

Report to Other: ____ (Name) (Title) (Address) (Phone)

Report to Other: ____ (Title) (Phone)

**Results need by: Date** ASAP

Additional Detailed Information: (For paint give analysis printed on container. For tile give grade specified, etc.)

| " X " | Sample Type |
|---|---|
| | Assurance |
| X | Project Information |
| | Mix Design |
| | Dept. Information |
| | Warehouse Stock |
| | Research Project |

## INSTRUCTIONS FOR SAMPLING AND IDENTIFICATION

In order to avoid erroneous conclusions, great care should be taken to select samples that are truly representative.

Make out an identification sheet for each sample submitted. If possible, enclose this sheet in an envelope tag (Form 194) and place inside the shipping container. Tag envelopes tied on the outside of shipments are often lost in transit, causing considerable delay in placing the samples in line for test. If tags must be tied on the outside of packages, mark your sender's number plainly on the package itself and mail a duplicate Form 820193 to the Testing Engineer. Give all information called for by this sheet that applies to the sample being submitted.

"Location of Producing Plant," shall in all cases be indicated by Section, Township, Range and County and location within the Section. Distance and direction from nearest town, and local names of the source in question, may also be indicated in addition to the above information.

"Unit of Material Represented," calls for such information as: Car numbers (where applicable), Station Numbers for tile from line of drain, Station Numbers and distance and direction from center-line, or coordinates for soil samples and samples from undeveloped material deposits. This data must be definite enough to insure that the test report can be accurately connected with the identical unit of material which the sample represents.

"Quantity Represented," calls for the total quantity of material represented by the sample. It is not necessary to indicate the weight of the sample itself.

**Asphalt or Road Oil** -- Ship in clean tin containers. Do not take samples from top of drum.

**Cement** -- Eight pounds for regular check samples and fifteen pounds for progress samples. Ship in plastic and canvas bags, obtainable at the warehouse in Ames, or in other tight containers.

**Culvert Metal** -- One strip of metal 4-1/2 to 5 in. wide cut from the edge or the end of one sheet from each 500 sheets or fraction thereof of each guage, heat and pot number. Heat numbers and Pot numbers, which are stenciled on each sheet, should be included in the identification of the sample.

**Gravel, Pit Run** -- Sample should consist of 40 lb. of the total material, plus an additional 40 lb. of material retained on the No. 4 screen in a separate container. Ship in clean bags or boxes sufficiently tight to prevent loss of fine material. Never pack samples in sugar sacks. Do not use burlap bags.

**Gravel, Screened** -- 60 lb. from each car load or other unit of material. Great care must be exercised in selecting samples of coarse material. Select 100 to 200 lbs. and reduce to proper size by quartering. *(See "Manual for Concrete Inspectors.")*

**Paint** -- One quart from each Lot Number. Stir paint thoroughly before selecting sample. Ship in tight container. Give manufacturer's analysis as printed on the container.

**Plastic Pipe**--Three five-foot samples. One sample should contain the date and plant code.

**Reinforcing Steel** -- One test sample from bundles or lots for each heat or 10 tons that can be identified, and two samples from each 10 tons when identification cannot be made. Cut all samples 42" long. Epoxy Coated Bar 60".

**Sand** -- 35 lb. from each car load or other unit of material. Ship in clean bag or box sufficiently tight to prevent loss of fine material. Never pack samples in sugar sacks. Do not use burlap bags.

**Soil** -- 25 lb. from each soil type. Show depth of layer for "Quantity Represented."

**Stone, Crushed (for Concrete)** -- 60 lb. from each carload or other unit of material. Observe instructions for sampling screened gravel.

**Stone, Ledge Samples** -- Two cement sacks full (about 140 lb.) from each ledge in the quarry face.

**Surfacing Material** -- For graduation test submit 40 lb. of total material, and for freeze and thaw test and abrasion. submit an additional 40 lb. of pebbles retained on the No. 4 screen in a separate container.

**Water** -- One quart shipped in a clean glass container.

**Wire Mesh** -- Submit 24x24 in. Sample from each size of mesh. Note width of sheet and length of overhangs, also indicate the size and grade of pipe in which wire is to be used.

**NOTE:** -- More complete information with regard to sampling of materials can be secured from District Materials Engineer or Ames Laboratory.

HIGHWAY DIVISION LABORATORY

| LOCATION | MATERIALS TESTED |
|---|---|
| Ames, Iowa | All Materials |

During the construction season a number of temporary laboratories at producing plant can test materials before it is shipped. Arrangments for this service can be made through the Central Office at Ames.

**Distribution:** White copy - Central Materials; Yellow copy - File

# HOT MIX SAMPLES

Hot mix sample locations are selected by the Agency's certified inspector at the job site. The Contractor performs the sampling and the Agency's inspector directs and witnesses the sampling. A certified technician must obtain the hot mix samples. The QM-A technician may take the samples or they may be obtained by a sampler at the lay down operation. There is a separate certification for individuals who only sample HMA but do not perform any testing. We want you to be familiar with the proper procedures for obtaining and handling the hot mix samples.

**Equipment needed for Sampling**

The equipment needed for sampling includes the template, scoop, the putty knife, sample box, and insulated gloves. Remember you are handling asphalt mix that is hotter than boiling water. Make sure you use proper safety precautions. The hot mix sample is a very important sample. It is used to determine the contractor's compliance for density and voids. You must be sure to get a representative sample of the mix being placed. Do not vary from the procedure shown in the I.M. unless necessary, and if you do vary, document why and how.

**Hot Mix Roadway Sampling**

The technique of template sampling is not difficult. It does require proper equipment, correct location, and attention to the details of doing the job right. Section A of I.M. 322 describes the proper location for each increment of the hot mix sample. Make sure that you don't sample the mix too soon. Wait until at least 100 tons (Mg) of mix have been laid out to give the plant time to even out. Also, get four increments from two separate truckloads of material.

The exception to the roadway sample is the heater scarification project. The asphalt mix on a heater scarification job would be contaminated by the scarified material. In this case, paver hopper samples must be taken as per Section B of I.M. 322.

For thicker lifts of HMA greater than 3 inches, such as HMA widening, the regular template will not go deep enough. In this case, you should use the deep template or the square pointed shovel. Most of the time, it will work better to use the square pointed shovel. When using the shovel to sample thick lifts, the shovel is first used to delineate the sample area and remove the material that is not part of the sample by creating a vertical face and pulling the shovel and excess material away from the sample area. Then the shovel can be used to remove the sample. The scoop can be used to finish the sampling to be sure that all mix within the delineated area is included in the sample increment.

A pair of samples is obtained from each sample location. The Agency's inspector takes possession of one of each pair, secures it and identifies it before returning it to the Contractor for transporting to the District Laboratory.

Each hot mix sample submitted to the District must have an identification form made out. Make sure you fill out the form with all the needed information. Included in this are:

1. The mix type and use
2. Mix Design number
3. The project number
4. The contractor
5. The date
6. The sublot represented
7. The security identification
8. The person who sampled the hot mix
9. Who to report the results to

Be sure to fill out the Form #193 completely.

# EXAMPLE QMA HOT MIX SAMPLE IDENTIFICATION SYSTEM

**LETTER #**

1. Two letters designating the intended use of the mix.

   BA = BASE     IN = INTERMEDIATE
   SU = SURFACE

2. The Date Using a month/date format

   May 16 = 5-16

3. A letter designating position of the box sample during the production day.

   "A" for first box,     "B" for second box, etc.

Example: Second Box of Day, Surface Mix, on October 10

Sample ID = SU10-10B

Also: Include the following:
Mix Type, Mix Design #, Contractor Name, Entire Project No., and intended % Binder on the side of the box along with senders ID. This prevents confusion at the District Lab and provides clear positive identification of the sample.

Form 820193
7-94

Central Lab. No. ______

Iowa Department of Transportation

# IDENTIFICATION OF SAMPLE FOR TEST

(Read Instructions on back before taking sample and filling out form)

Material: HMA 30M ESAL 3/4" @ 5.4% Asphalt Binder
Senders Sample No.: SU5-16A

Intended Use: Surface 30M
Contract number: 77-0006-41

County: POLK
Group No.: 
Design No.: ABD8-1007

Project: NHS-6-3(41)--12-77

Contractor: Quality Asphalt Inc.
(Name) (Address)

Supplier: 
Source: 

Producer: Quality Asphalt Inc.
Brand: 
Lot No.: 

Location of Producing Plant: US Highway 6 - Altoona

Sec. ______ Twp. ______ Range ______ Co. ______

Unit of Material Represented: 

Quantity Represented: Approx. 500 tons

Sampled by: John Rayson (name) Quality Asphalt Inc. (address)

Date sampled: 05/16/98

Report to Tranportation Center(s) (Check appropriate box (es))

| DIST. #1 | DIST. #2 | DIST. #3 | DIST. #4 | DIST. #5 | DIST. #6 |
|---|---|---|---|---|---|
| X | | | | | |

Report to Residency (Write appropriate residency number): 11

Report to Counties (Write appropriate count number): 

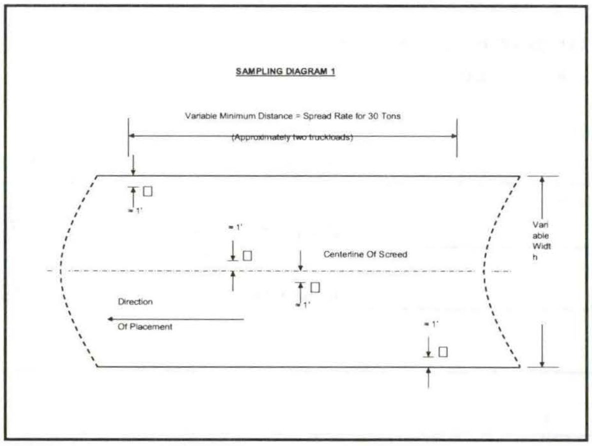
| | (Name) | (Title) | (Address) | (Phone) |
|---|---|---|---|---|
| Report to Other | Quality Asphalt Inc. | AMC | WATERLOO | 319-233-4689 |
| Report to Other | | | | |
| Report to Other | | | | |

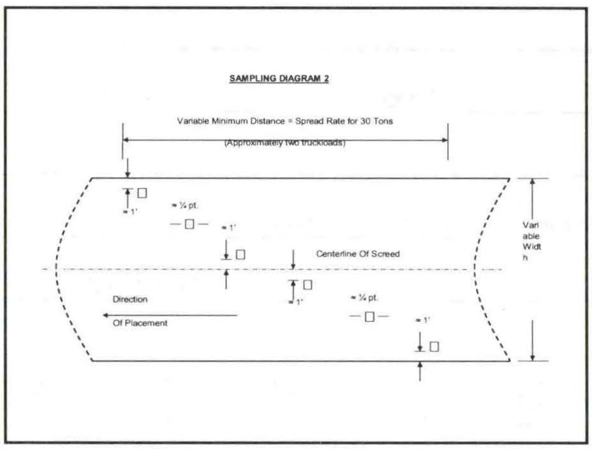
**Results need by: Date** ASAP

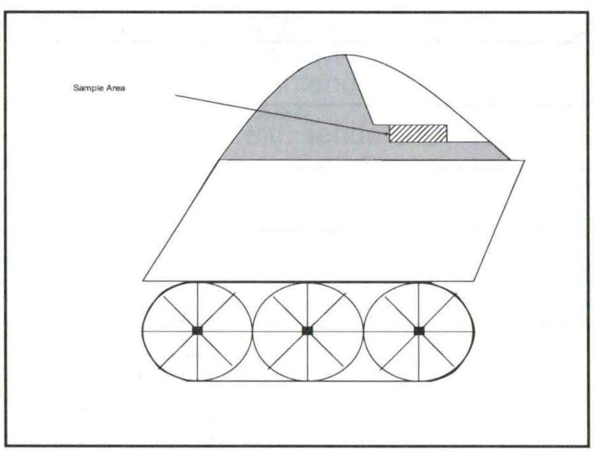
Additional Detailed Information: (For paint give analysis printed on container. For tile give grade specified, etc.)

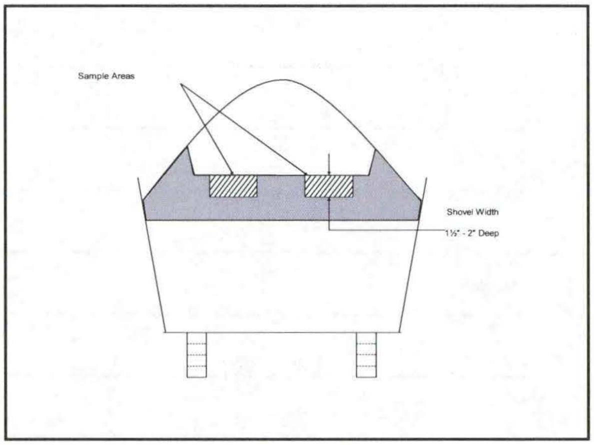
60 lb. Mix sample as per IM 204

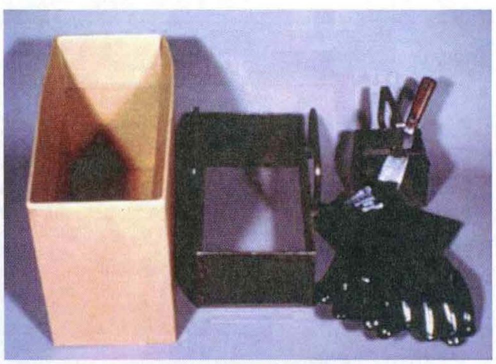
| "X" Sample Type | |
|---|---|
| | Assurance |
| X | Project Information |
| | Mix Design |
| | Dept. Information |
| | Warehouse Stock |
| | Research Project |

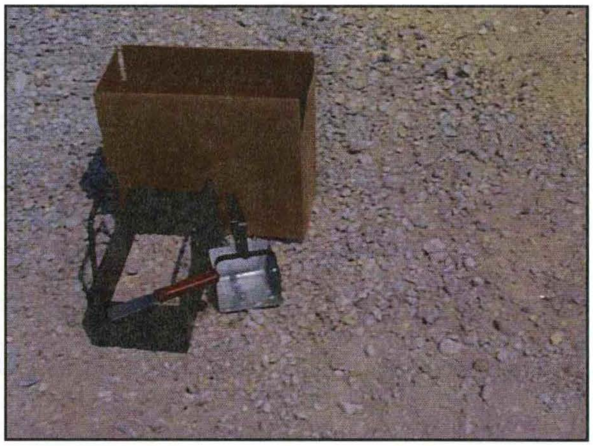

SAMPLING DIAGRAM 1
Variable Minimum Distance = Spread Rate for 30 Tons
(Approximately two truckloads)
≈ 1'
≈ 1'
Centerline Of Screed
≈ 1'
Direction
Of Placement
≈ 1'
Vari
able
Widt
h

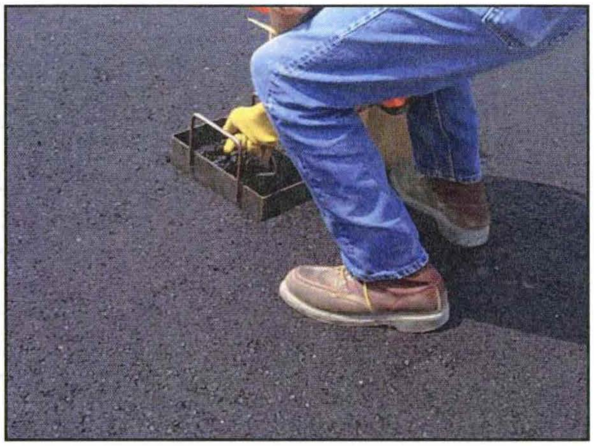

SAMPLING DIAGRAM 2
Variable Minimum Distance = Spread Rate for 30 Tons
(Approximately two truckloads)
≈ 1'
≈ ¼ pt.
≈ 1'
Centerline Of Screed
≈ 1'
Direction
Of Placement
≈ ¼ pt.
≈ 1'
Vari
able
Widt
h

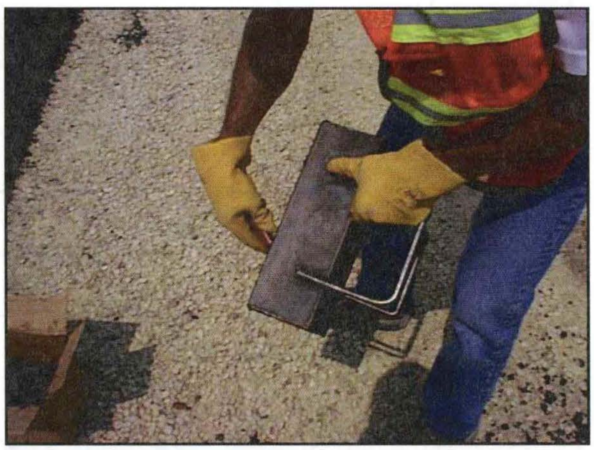

Sample Area

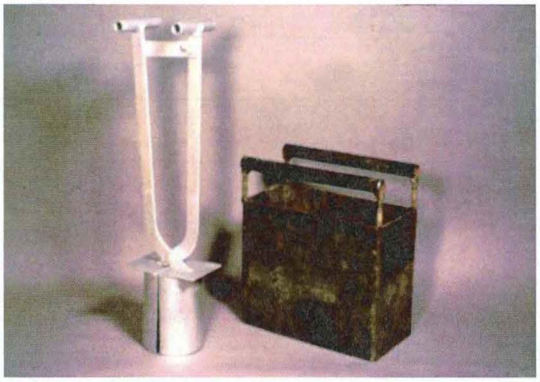

Sample Areas
Shovel Width
1½" - 2" Deep





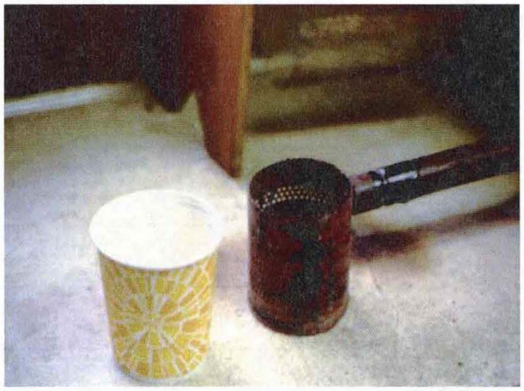


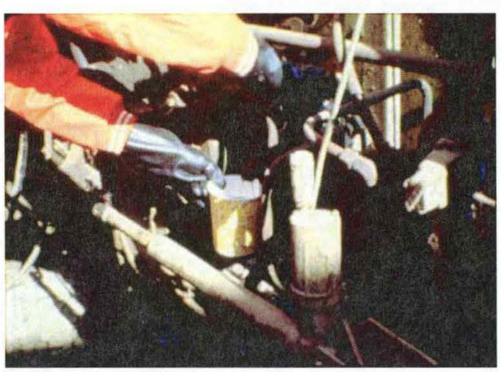


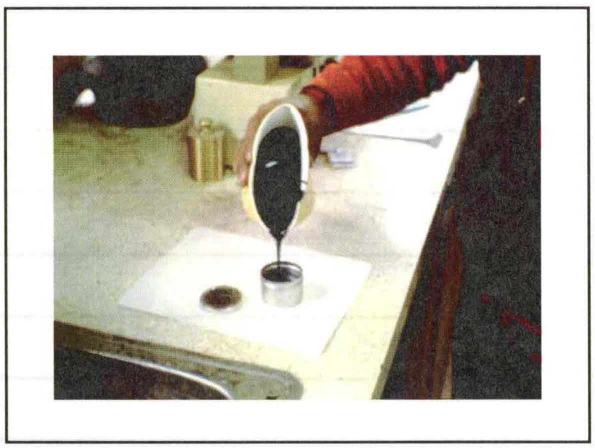


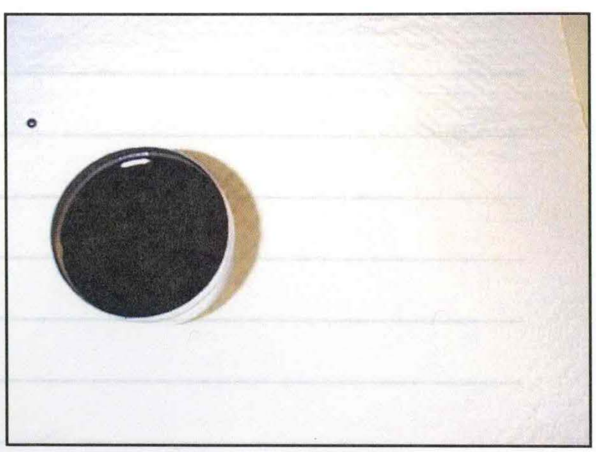
## SAMPLE IDENTIFICATION

- Date and Time the Sample was Obtained
- Station and Direction (NB, SB, EB, WB)
- Name of the Sampler
- Sublot and Tonnage (If Known)
- Lift (Surface, Intermediate, Base)

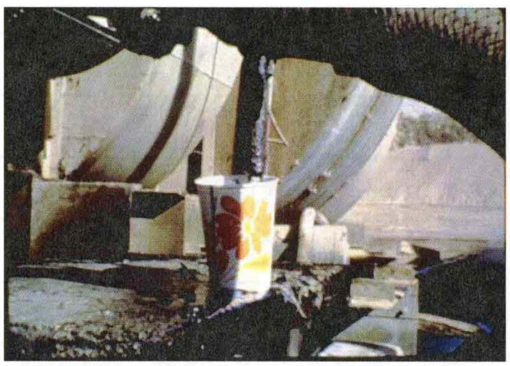


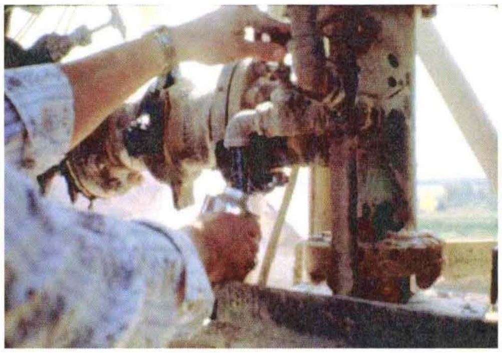







SUPPLY CO.
WEST DES MOINES, IOWA





# *SUBLOT DETERMINATION*

**If projected production is less than 2000 Tons:**

1. First Sublot is <u>ALWAYS</u> 500 Tons
2. One sublot next 750 Tons each

EXAMPLE:

Projected production: 1800 Tons

1. First sublot is ALWAYS 500 Tons
2. Next sublot is 750 Tons
3. Third sublot is 550 Tons

**If projected production is 2000 Tons or more:**

1. First sublot is <u>ALWAYS</u> 500 Tons
2. Next three sublots = (projected production - 500)/3

EXAMPLE:

Projected production: 4000 Tons

1. First sublot is ALWAYS 500 Tons
2. (4000 - 500)/3 = 1167 Tons for each remaining sublot

# *SUBLOT DETERMINATION & RANDOM SAMPLE SELECTION*

**Lot Size Procedure:**

First Day Production of a Mix: 4000 tons projected

First Sublot = 500 tons - 100 tons = 400 tons

Next 3 Sublots =

$$\frac{\text{projected output - 500 tons}}{3} = \frac{4000 - 500}{3} = 1167 \text{ tons}$$

**Random Ton Determination**

Three dice rolls are needed to determine the multiplier for using the random number chart to select a random ton in a lot.

One roll is for the vertical axis and one is for the horizontal axis to define one of the groupings of six random numbers. The third roll is used to select one of the six numbers in the grouping.

The randomly selected multiplier from the chart is multiplied by the mass of the sublot to determine which ton should be sampled.

Example: horizontal = 4

vertical = 3

grouping = 4

From the chart the multiplier = 0.817

Using the sublot size shown above:

Random ton = 0.817 x 1167 = 953 ton

## RANDOM NUMBERS TABLE

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 0.116 | 0.665 | 0.249 | 0.167 | 0.096 | 0.348 |
| | 0.747 | 0.182 | 0.909 | 0.654 | 0.592 | 0.631 |
| | 0.876 | 0.290 | 0.247 | 0.041 | 0.010 | 0.131 |
| | 0.848 | 0.625 | 0.396 | 0.920 | 0.629 | 0.737 |
| | 0.614 | 0.421 | 0.729 | 0.711 | 0.454 | 0.707 |
| | 0.234 | 0.886 | 0.390 | 0.498 | 0.586 | 0.863 |
| 2 | 0.558 | 0.721 | 0.690 | 0.287 | 0.219 | 0.716 |
| | 0.348 | 0.710 | 0.941 | 0.761 | 0.877 | 0.317 |
| | 0.987 | 0.839 | 0.013 | 0.585 | 0.637 | 0.804 |
| | 0.461 | 0.141 | 0.441 | 0.396 | 0.715 | 0.395 |
| | 0.619 | 0.752 | 0.981 | 0.730 | 0.112 | 0.341 |
| | 0.343 | 0.294 | 0.001 | 0.508 | 0.503 | 0.699 |
| 3 | 0.294 | 0.027 | 0.728 | 0.174 | 0.301 | 0.355 |
| | 0.842 | 0.952 | 0.092 | 0.495 | 0.393 | 0.970 |
| | 0.768 | 0.647 | 0.336 | 0.140 | 0.528 | 0.070 |
| | 0.859 | 0.774 | 0.770 | 0.817 | 0.191 | 0.934 |
| | 0.710 | 0.279 | 0.522 | 0.764 | 0.246 | 0.695 |
| | 0.381 | 0.108 | 0.066 | 0.068 | 0.086 | 0.941 |
| 4 | 0.217 | 0.138 | 0.122 | 0.435 | 0.638 | 0.348 |
| | 0.563 | 0.684 | 0.368 | 0.975 | 0.894 | 0.399 |
| | 0.440 | 0.836 | 0.834 | 0.116 | 0.678 | 0.260 |
| | 0.037 | 0.713 | 0.879 | 0.223 | 0.768 | 0.281 |
| | 0.130 | 0.845 | 0.906 | 0.654 | 0.233 | 0.646 |
| | 0.912 | 0.132 | 0.469 | 0.255 | 0.584 | 0.209 |
| 5 | 0.201 | 0.475 | 0.738 | 0.337 | 0.031 | 0.888 |
| | 0.162 | 0.037 | 0.509 | 0.415 | 0.451 | 0.894 |
| | 0.628 | 0.514 | 0.586 | 0.237 | 0.578 | 0.915 |
| | 0.366 | 0.554 | 0.506 | 0.098 | 0.054 | 0.932 |
| | 0.259 | 0.895 | 0.840 | 0.070 | 0.350 | 0.930 |
| | 0.988 | 0.670 | 0.625 | 0.781 | 0.772 | 0.241 |
| 6 | 0.368 | 0.067 | 0.562 | 0.625 | 0.831 | 0.857 |
| | 0.664 | 0.781 | 0.423 | 0.090 | 0.790 | 0.628 |
| | 0.034 | 0.924 | 0.242 | 0.998 | 0.241 | 0.173 |
| | 0.189 | 0.992 | 0.373 | 0.279 | 0.643 | 0.283 |
| | 0.669 | 0.462 | 0.986 | 0.166 | 0.017 | 0.998 |
| | 0.163 | 0.410 | 0.004 | 0.770 | 0.902 | 0.188 |

| | | | | |
|---|---|---|---|---|
| Expected Tonnage for the Lot: | 3800 | | 6/18/05 | :Date |
| First Hot Box Sample Tons: | 373.00 | -- | 500.00 | First Sublot = (tons) |
| Second Hot Box Sample Tons: | 563.00 | -- | 1,100.00 | Second Sublot = (tons) |
| Third Hot Box Sample Tons: | 2,127.00 | -- | 1,100.00 | Third Sublot = (tons) |
| Fourth Hot Box Sample Tons: | 3,656.00 | -- | 1,100.00 | Fourth Sublot = (tons) |

| | |
|---|---|
| Plant Production Tons per Hour: | 375 |
| Laydown Start Time: | 7:30 AM |
| Approximate First Sample Time: | 8:29 AM |
| Approximate Second Sample Time: | 9:00 AM |
| Approximate Third Sample Time: | 1:10 PM |
| Approximate Fouth Sample Time: | 5:14 PM |

**Press F9 to Calculate**

To use this spreadsheet to select random samples of uncompacted HMA you must provide the tonnage the contractor expects to lay.
If only the expected tonnage is provided the program will provide sample locations based on the running total of tonnage delivered when you press F9.
If you want the sample locations expressed as time you must also provide the tons per hour at which the plant is operating and the time when the laydown operation started then press F9.

**Any changes in expected tonnage or plant production such as breakdowns, weather interruptions or other delays may require recalculation of sample locations if the interrruption causes the sample time to fall during a period when no mix is being laid or fall in the same sublot as a previous sample.**

Every attempt should be made to keep the sampling random, however if, for example, rain-out is eminent or plant production ceases prematurely and the sample for the sublot has not been obtained a sample should be taken immediately if possible.

Sample locations must not be provided to the contractor in advance except for the time needed to prepare for sampling.
The contractor should be prepared to sample as directed at any time.

This program works best if it is the only file loaded in Excel. Automatic recalculation has been turned off in this file so that the program will only calculate once when you press F9.
If other files have been loaded into Excel that allow automatic recalculation this file may change sample locations whenever any data is changed.
If this occurs, exit Excel then reload it and open this file and complete the sample locations before loading any other Excel files.

## RANDOM CORE SAMPLES

PROJECT ____________ MAT THICKNESS ________ IN.

COURSE LAID ____________ MAT (LANE) WIDTH ________ FT.

DATE LAID ________ DATE CUT ________

**Enter Number of Cores Desired for Each Section Below**

| | | | | | | | Direction /Lane | |
|---|---|---|---|---|---|---|---|---|
| STATION | ______ | TO | STATION | ______ | = | ______ | L.F. ______ | ______ |
| STATION | ______ | TO | STATION | ______ | = | ______ | L.F. ______ | ______ |
| STATION | ______ | TO | STATION | ______ | = | ______ | L.F. ______ | ______ |
| STATION | ______ | TO | STATION | ______ | = | ______ | L.F. ______ | ______ |
| | | | TOTAL | | = | ______ | L.F. (DAY'S LOT) | |

______ L.F. DIVIDED BY 7 SAMPLES = ______ L.F. (PER SUBLOT)

---

**CORE # 1:** ______ X ______ = ______ + STA. ______ = **STATION** ______
______ X ______ + 1.0 = ______ **FT.** (Offset)

**CORE # 2:** ______ X ______ = ______ + STA. ______ = **STATION** ______
______ X ______ + 1.0 = ______ **FT.** (Offset)

**CORE # 3:** ______ X ______ = ______ + STA. ______ = **STATION** ______
______ X ______ + 1.0 = ______ **FT.** (Offset)

**CORE # 4:** ______ X ______ = ______ + STA. ______ = **STATION** ______
______ X ______ + 1.0 = ______ **FT.** (Offset)

**CORE # 5:** ______ X ______ = ______ + STA. ______ = **STATION** ______
______ X ______ + 1.0 = ______ **FT.** (Offset)

**CORE # 6:** ______ X ______ = ______ + STA. ______ = **STATION** ______
______ X ______ + 1.0 = ______ **FT.** (Offset)

**CORE # 7:** ______ X ______ = ______ + STA. ______ = **STATION** ______
______ X ______ + 1.0 = ______ **FT.** (Offset)

---

MAT TEMPERATURES

| | | | |
|---|---|---|---|
| 7:00am | ______ | 1:00pm | ______ |
| 9:00am | ______ | 3:00pm | ______ |
| 11:00am | ______ | 5:00pm | ______ |

HMA (MIX) REPORT

| | |
|---|---|
| TOTAL TONS | ______ |
| - TONS WASTED | ______ |
| = TONS USED | ______ |
| + PREVIOUS TONS | ______ |
| = TONS USED TO-DATE | ______ |

## RANDOM CORE SAMPLES

| | | | | | |
|---|---|---|---|---|---|
| PROJECT | NHS-6-3(41)--12-77 | MAT THICKNESS | 2.00 | IN. | Enter Number of Cores Desired for Each Section Below |
| COURSE LAID | Surface | MAT (LANE) WIDTH | 12.0 | FT. | |
| DATE LAID | 6/18/2005 | DATE CUT | 6/19/2005 | | |

| STATION | | TO STATION | | = | | | Direction /Lane | | ↓ |
|---|---|---|---|---|---|---|---|---|---|
| STATION | 100.00 | TO STATION | 267.45 | = | 16745 | L.F. | WB/OL | 7.0 | 7 |
| STATION | | TO STATION | | = | | L.F. | | | |
| STATION | | TO STATION | | = | | L.F. | | | |
| STATION | | TO STATION | | = | | L.F. | | | |
| | | TOTAL | | = | 16745 | L.F. (DAY'S LOT) | | | |

16745 L.F. DIVIDED BY 7 SAMPLES = 2392 L.F. (PER SUBLOT)

---

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CORE # 1:** | 2392 | X | 0.451 | = | 1079 | + STA. | 100.00 | = | **STATION** **110.79** |
| | 10.0 | X | 0.330 | + 1.0 = | **4.3** | **FT.** | (Offset) | | |
| **CORE # 2:** | 2392 | X | 0.309 | = | 739 | + STA. | 123.92 | = | **STATION** **131.31** |
| | 10.0 | X | 0.834 | + 1.0 = | **9.3** | **FT.** | (Offset) | | |
| **CORE # 3:** | 2392 | X | 0.886 | = | 2120 | + STA. | 147.84 | = | **STATION** **169.04** |
| | 10.0 | X | 0.177 | + 1.0 = | **2.8** | **FT.** | (Offset) | | |
| **CORE # 4:** | 2392 | X | 0.520 | = | 1244 | + STA. | 171.76 | = | **STATION** **184.20** |
| | 10.0 | X | 0.179 | + 1.0 = | **2.8** | **FT.** | (Offset) | | |
| **CORE # 5:** | 2392 | X | 0.062 | = | 147 | + STA. | 195.69 | = | **STATION** **197.16** |
| | 10.0 | X | 0.338 | + 1.0 = | **4.4** | **FT.** | (Offset) | | |
| **CORE # 6:** | 2392 | X | 0.584 | = | 1397 | + STA. | 219.61 | = | **STATION** **233.57** |
| | 10.0 | X | 0.929 | + 1.0 = | **10.3** | **FT.** | (Offset) | | |
| **CORE # 7:** | 2392 | X | 0.231 | = | 552 | + STA. | 243.53 | = | **STATION** **249.05** |
| | 10.0 | X | 0.059 | + 1.0 = | **1.6** | **FT.** | (Offset) | | |

---

MAT TEMPERATURES

| | | | |
|---|---|---|---|
| 7:00am | 280 | 1:00pm | 285 |
| 9:00am | 275 | 3:00pm | 285 |
| 11:00am | 270 | 5:00pm | 275 |

HMA (MIX) REPORT

| | |
|---|---|
| TOTAL TONS | |
| - TONS WASTED | |
| = TONS USED | |
| + PREVIOUS TONS | |
| = TONS USED TO-DATE | |

# HOT MIX ASPHALT

Section 2303, 2213, & 2114

| MATERIAL OR CONSTRUCTION ITEM | TESTS | METHOD OF ACCEPTANCE & RELATED IMs | QUALITY CONTROL | | | | | INDEPENDENT ASSURANCE, & VERIFICATION S&T | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SAMPLE BY | FREQ. | SAMPLE SIZE | TEST BY | REPORT | S&T TYPE | SAMPLE BY | FREQ. | SAMPLE SIZE | TEST BY | REPORT | |
| **SOURCE INSPECTION** | | | | | | | | | | | | | | |
| Aggregates-Coarse (4127) | | AS 209 | | | | | | | | | | | | |
| Aggregates-Fine (4127) | | AS 209 | | | | | | | | | | | | |
| Hydrated Lime (4126/4127) | | AS 491.04 | | | | | | | | | | | | |
| Asphalt Binder | | AS 437 | | | | | | | | | | | | |
| Emulsions & Cutbacks | | AS 437 | | | | | | | | | | | | |
| Release Agent | | AB 491.15 | | | | | | | | | | | | |
| **PLANT INSPECTION** | | | | | | | | | | | | | | |
| Aggregates (2303) | Quality | | | | | | | V | DME | 1/20,000 Ton | 50 lb. | CTRL | | |
| Combined Aggregate (4126, 4127) | Gradation | | RCE/ CONTR | 1/lot | IM 301 | CONTR | | V<br>IA | RCE/ CONTR | Sample 1/day, Test 1st day + 20%<br>Systems Approach* | IM 301 | DME/ RCE | IM 216<br>IM 216 | |
| | Moisture | | CONTR | 1 / half day | 1000 gm | CONTR | | | | | | | | Dryer Drum Plants Only |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

AS-Approved Source
ASD-Approved Shop Drawing
S&T-Sampling & Testing

Cert A-Type A Certification
Cert C-Type C Certification
Cert D-Type D Certification

RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Materials Office
CONTR-Contractor

IA-Independent Assurance
V-Verification

*A project approach may be applied at the discretion of the DME at the frequency 1/project.

**NOTE:** RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.

Sampling & Testing Guide-Minimum Frequency

April 17, 2007
Supersedes October 17, 2006

# HOT MIX ASPHALT
Section 2303, 2213, & 2114

Matls. IM 204
Appendix F (US) Units

| MATERIAL OR CONSTRUCTION ITEM | TESTS | METHOD OF ACCEPTANCE & RELATED IMs | QUALITY CONTROL | | | | | INDEPENDENT ASSURANCE, & VERIFICATION S&T | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SAMPLE BY | FREQ. | SAMPLE SIZE | TEST BY | REPORT | S&T TYPE | SAMPLE BY | FREQ. | SAMPLE SIZE | TEST BY | REPORT | |
| **PLANT INSPECTION** | | | | | | | | | | | | | | |
| Mineral Filler | | | | | | | | V | DME | 1/project | 5 kg | DME | 821278 | |
| Asphalt Binder | DSR | AS Cert D | | | | | | V | RCE/ CONTR | Sample 1/day<br>Test 1st 3days + 1/week | 4 oz tin | DME | | Log all shipments |
| | Quality | | | | | | | V<br>IA | DME | 1/20,000 T of Mix<br>Systems Approach | 1 qt | CTRL | | |
| Cutback | | AS 329 | | | | | | | | | | | | Log all shipments |
| Emulsion | Residue | AS 360 | | | | | | V | RCE | 1/project | 1 qt | DME | | Plastic bottle required |
| **GRADE INSPECTION** | | | | | | | | | | | | | | |
| Uncompacted Mixture: | Lab Density & Lab Voids | 321, 350<br>325G | RCE/ CONTR | As per 2303 | 30 lb | CONTR | | V<br>IA | RCE/ CONTR | As per 2303<br>Test 1/day<br>Systems Approach | 30 lb | DME | | May be adjusted by DME as per 2303 |
| | | | | | | | | | | | | | | |
| Compacted Mixture | Density, Thickness & Voids | 320, 321<br>337 | RCE/ CONTR | Lot | 7/lot | RCE | | IA | DME | 1 lot/project* | | DME | | |
| | Smoothness | 341 | CONTR | 100% | 100% | CONTR | | V | DME | 10% | | DME | | |

AS-Approved Source
ASD-Approved Shop Drawing
S&T-Sampling & Testing

Cert A-Type A Certification
Cert C-Type C Certification
Cert D-Type D Certification

RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Materials Office
CONTR-Contractor

IA-Independent Assurance
V-Verification

* A system approach may be applied at the discretion of the DME.
<u>NOTE</u>: Verification not required under 2000 tons of mix.
<u>NOTE</u>: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.

# HOT MIX ASPHALT

## Section 2303, 2113, & 2114

| MATERIAL OR CONSTRUCTION ITEM | TESTS | METHOD OF ACCEPTANCE & RELATED IMs | QUALITY CONTROL | | | | | INDEPENDENT ASSURANCE, & VERIFICATION S&T | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SAMPLE BY | FREQ. | SAMPLE SIZE | TEST BY | REPORT | S&T TYPE | SAMPLE BY | FREQ. Note 1 | SAMPLE SIZE | TEST BY | REPORT | |
| **SOURCE INSPECTION** | | | | | | | | | | | | | | |
| Aggregates-Coarse (4127) | | AS 209 | | | | | | | | | | | | |
| Aggregates-Fine (4127) | | AS 209 | | | | | | | | | | | | |
| Hydrated Lime (4126/4127) | | AS 491.04 | | | | | | | | | | | | |
| Asphalt Binder | | AS 437 | | | | | | | | | | | | |
| Emulsions & Cutbacks | | AS 437 | | | | | | | | | | | | |
| Release Agent | | AS 491.15 | | | | | | | | | | | | |
| **PLANT INSPECTION** | | | | | | | | | | | | | | |
| Aggregates (2303) | Quality | | | | | | | V | DME | 1/20,000 Mg | 22 kg | CTRL | | |
| Combined Aggregate (4126, 4127) | Gradation | | RCE/ CONTR | 1/lot | IM 301 | CONTR | | V<br><br>IA | RCE/ CONTR | Sample 1/day, Test 1st day + 20% Systems Approach* | IM 301 | DME/RCE<br>DME | IM 216<br><br>IM 216 | |
| | Moisture | | CONTR | 1/halfday | 1000 gm | CONTR | | | | | | | | Dryer Drum Plants Only |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

AS-Approved Source
ASD-Approved Shop Drawing
S&T-Sampling & Testing

Cert A-Type A Certification
Cert C-Type C Certification
Cert D-Type D Certification

RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Materials Office
CONTR-Contractor

IA-Independent Assurance
V-Verification

*A project approach may be applied at the discretion of the DME at the frequency 1/project.

**NOTE:** RCE/CONTR indicates that the contractor shall assist in the sampling at the direction of and witnessed by the project engineer.

# HOT MIX ASPHALT

## Section 2303, 2113, & 2114

| MATERIAL OR CONSTRUCTION ITEM | TESTS | METHOD OF ACCEPTANCE & RELATED IMs | QUALITY CONTROL | | | | | INDEPENDENT ASSURANCE, & VERIFICATION S&T | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SAMPLE BY | FREQ. | SAMPLE SIZE | TEST BY | REPORT | S&T TYPE | SAMPLE BY | FREQ. | SAMPLE SIZE | TEST BY | REPORT | |
| **PLANT INSPECTION** | | | | | | | | | | | | | | |
| Mineral Filler | | | | | | | | V | DME | 1/project | 5 kg | DME | 821278 | |
| Asphalt Binder | DSR<br><br>Quality | AS Cert D | | | | | | V<br><br>V<br>IA | RCE/ CONTR<br><br>DME | Sample 1/day, Test 1st day + 20%<br>Systems Approach | 120 ml<br><br>1 L | DME<br><br>CTRL | | Log all shipments |
| Cutback | Quality Viscosity | AS 329 | | | | | | | | | | | | Log all shipments |
| Emulsion | Residue | AS 360 | | | | | | V | RCE | 1/project | 1 L | DME | | Plastic bottle required |
| | | | | | | | | | | | | | | |
| **GRADE INSPECTION** | | | | | | | | | | | | | | |
| Uncompacted Mixture: | Lab Density & Lab Voids | 321, 350<br>325G | RCE/ CONTR | As per 2303 | 14 kg | CONTR | | V<br>IA | RCE/ CONTR | As per 2303, Test 1/day Systems Approach | 14 kg | DME | | May be adjusted by DME as per 2303 |
| | | | | | | | | | | | | | | |
| Compacted Mixture | Density Thickness Voids | 320, 321 337 | RCE/ CONTR | Lot | 7/lot | RCE | | IA | DME | 1/lot/project | | DME | | |
| | Smoothness | 341 | CONTR | 100% | 100% | CONTR | | V | DME | 10% | | DME | | |

AS-Approved Source
ASD-Approved Shop Drawing
S&T-Sampling & Testing
Cert A-Type A Certification
Cert C-Type C Certification
Cert D-Type D Certification
RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Materials Office
CONTR-Contractor
IA-Independent Assurance
V-Verification

* A system approach may be applied at the discretion of the DME.
**NOTE**: Verification not required under 2000 Mg of mix.
**NOTE**: RCE/CONTR indicates that the contractor shall assist in the sampling at the direction of and witnessed by the project engineer.

# METHOD OF SAMPLING COMPACTED ASPHALT MIXTURES

## SCOPE

This IM provides the procedures used for sampling compacted asphalt mixtures.

## REFERENCED DOCUMENTS

IM 204, Inspection of Construction Project Sampling & Testing

## APPARATUS

- Core drill suitable for cutting a sample from the mat
- Core tongs if a core drill is used to cut the sample
- Hammer
- Steel plate 4 in. (100 mm) wide, 4 in. (100 mm) long, 1/8 in. (3.175 mm) thick and curved to fit firmly around the core being taken. A piece of core bit will serve this purpose.
- Wedge – A small cold chisel makes a suitable wedge.

## PROCEDURE

1. Unless otherwise specified, sampling frequency shall comply with IM 204 and sample sites shall be randomly located by the Engineer.

   > **NOTE:** Exercise care during sampling, handling, transporting and testing to minimize possibility of damaging the specimens.

2. Drill completely through the layer being sampled.

   > **NOTE:** If samples are to be cut from compacted mixtures that are still warm, it may be necessary to subject the sample site to artificial cooling equivalent to surface contact with ice for approximately 20 minutes.

3. Use the curved steel plate for protection of sample. Then place the wedge behind the plate and strike it with a sharp blow from the hammer. This will snap the sample loose.

4. If a layer being sampled adheres to a lower layer such that it is necessary to remove two or more layers during the sampling process, cool the composite sample and remove the extraneous material before testing by sawing or other suitable methods.

   > **NOTE:** Under no circumstances shall the cores be submerged in water before testing.

5. All samples shall be carefully inspected for damage before testing. Samples that are damaged shall be replaced by additional samples obtained as outlined above.

6. Mark the core for later identification.

## DOCUMENTATION

Assign a number to each core and record the core number, date sampled, station, and transverse position on the appropriate form.

# HMA PAVEMENT CORES

A certified technician will be involved in the roadway density, thickness, and voids determination. These are found by testing cores cut from the completed pavement. Your job can be any of several functions, including locating, witnessing coring, and testing cores. The Agency's inspector will locate and witness the core cutting. Core locations must be selected at random to represent the pavement selections. Casting a die or using a random number table may be used to select locations, but the most commonly used method of random location is to use a computer spreadsheet designed for that purpose. The location of the core is marked out on the pavement. After drilling the core, it is carefully removed from the location. Pavement cores are another instance where the answers are only as good as the sample. Three areas of compliance are determined by these cores. The contractor and inspector must both use care in processing them. If you see an obvious problem, take care of it before a wrong answer makes the problem bigger. Check for a damaged core after it is removed. Also, check for thickness. The core being tested must represent the pavement layer as placed. Damaged cores or cores not of proper thickness must be replaced before density is determined. If extra material cannot be readily removed, it may be necessary for the contractor to trim the core to get an accurate test sample. When two layers are together, check for thickness before trimming. Once acceptable cores have been cut from the pavement, the Agency's inspector will take possession of the cores and transport them to the Contractor's lab, or secure the core samples so the Contractor can transport them to the lab, for testing by an Agency technician certified to perform density tests.

# CORES AND DENSITY GUIDE INFORMATION

1. Cores and Density (items covered)
   A. Location
   B. Cutting and Transportation
   C. Damaged Cores (inspect each BEFORE testing)
   D. Field book set up and computer worksheet
   E. Weighing procedures Article 2001
   F. Calculations, Density, and Air Voids
   G. Quality Index, Density, and Thickness
   H. Correlation with the District labs.

2. Location
   A. Reference
      1. Construction manual, Chapter 8,13
      2. I.M. 204 frequency
      3. I.M. 337 thickness
      4. I.M. 321 density and voids
      5. Article 2303
      6. Current Supplemental Specifications
      7. I.M. 501
   B. Specifications designate the number of cores for a lot when payment is based on:
      1. Tonnage, Sq. Yd., and Thickness (7 density samples will be taken for each lot).
      2. For a core to be used for density determination, thickness <u>cannot</u> be less than 70% and no more than 150% of intended thickness.
      3. Test strips for mixes which have a plan quantity of at least 3000 ton (3000 Mg) may be required. Check Requirements.
         NOTE: 1 extra core is needed when doing a test strip. The lowest density core is thrown out.

C. Definition of a "LOT"
    1. One layer of one mixture placed during one day's operation
D. Random Sampling
    1. Roll a die
    2. Random Numbers
    3. Computer programs for random locations

3. Cutting, Care, and Transportation of Density Cores
    A. Specifications require the cores to be cut as promptly as practical. The grade inspector will mark and lay cores out. Grade Inspector or Monitor will witness the cutting of cores.
        1. Monitor will witness the cutting of cores
        2. Monitor will determine if core is damaged or not of proper thickness for testing
        3. Monitor will transport the cores to the lab or secure the cores for delivery to the lab
        4. Monitor tests the cores
        5. Contractor records results in plant book & daily Form 800241
    B. Cores should be sampled no later than the following workday. The contractor is given a 16" circle to cut in, only because he cannot stop in exactly one spot. Most of the coring machines are built on two wheel trailers. NO DENSITY GAUGE is to be used to find the best place to core!!!!!!
    C. If the contractor cannot meet these guidelines, he should be shut down. First, consult with Tech 3, Assistant RCE, or RCE before taking any action against contractor.
    D. Keep core bits sharp.
    E. **DO NOT** pry on the cores with a screwdriver; use a set of tongs. If they cannot be removed with a hard knock, then drill full depth and remove the underlying layers with a masonry saw.

F. Transportation: Cores should be transported on a **hard**, **flat surface**, not in a pail of water, not in a cardboard box. Cores should **NEVER** be kept in the freezer. Cores should never be placed on their sides, they should be laid flat. If it is a long trip to the lab, cores should be put in plastic bags and placed in a cooler with some ice. This is to prevent the cores from getting too hot and falling apart.

4. Damaged Cores

   A. Typical Damage to Cores

      1. Cracks
      2. A piece might fall off
      3. Dented or distorted by prying out of hole

   **B. EACH INDIVIDUAL CORE HAS TO BE INSPECTED PRIOR TO TESTING.**

   Be sure to remove the tack coat. Do not saw if not necessary. Sawing seals the surface of the core approximately 60%.

      1. If the core has obvious damage, and another core must be drilled, there is one more thing you need to check, check the thickness. Cores must be at least 70%, but not more than 150% of intended thickness. If the core is short, a new location must be selected prior to re-drilling for the new core.

   C. Density Cores

      1. Be absolutely positive that the cores you are running represent the finished product.

   D. Masonry Saw

      1. If cores have part of the old road or have the lower lift still attached, this should be sawed off.
      2. The contractor on the road or at the plant site will do the sawing of the cores.

5. Density:

The quantity per unit volume or the mass of a substance per unit volume. If the specific gravity of a material is known, it can be multiplied by the density of water to determine the material's density. Fort example: 2.350 x 62.4 = 146.64 lb./cu. ft. (2.350 x 1000 = 2350 kg/m$^3$). Design quantity is based on lb./cu. ft. (kg/m$^3$). It is usually 145 lb/cu. ft. (2320 kg/m$^3$).

Specific Gravity:

The ratio of the density of a substance to the density of water.

Compaction:

The process of increasing the density of a material by applying forces that reduce the unit volume.

Density is nothing more than a determination of how much compactive effort the contractor has taken when rolling an HMA mixture. The specifications require a minimum amount of density in relation to lab density. The lab density comes from the average of the QC tests run by the contractor each day and has been determined to be 100% of density of that particular mix.

1. Class 1A compaction is 96% of density and 8.0% voids max.
2. Class 1B compaction is 95% of density and 8.0% voids max.
3. Class 1C compaction is 94% of density and 8.0% voids max.

# METHOD TO DETERMINE THE THICKNESS OF COMPLETED COURSES OF BASE, SUBBASE & HOT MIX ASPHALT (General Rewrite)

## SCOPE

This method covers the sampling and measurement procedures for determining the thickness of completed courses of pavement.

## REFERENCED DOCUMENTS:

IM 320, Method of Sampling Compacted Asphalt Mixtures

## APPARATUS

1. Complete core drilling apparatus as required in IM 320 or as furnished by the contractor.
2. Straightedge at least 18 in. (500 mm) long
3. Ruler with graduations of 1/16 in. (1 mm)
4. Tape measure

## PROCEDURES

Specifications and instructions require that the thickness of the completed pavement courses be measured to the nearest 1/8 in. (3 mm) by means of cores, measurement of hole depth or measurement of the side of the trench, as directed by the engineer. Sample sites shall be randomly located.

### A – THICKNESS DETERMINATION BY CORE MEASUREMENT

A-1 If the compacted material has sufficient cohesion and strength to permit the drilling and handling required to obtain an undisturbed core, this method should be used.

A-2 Drill through the course and remove the core. Refer to IM 320 for drilling and removal procedures.

A-3 Measure with a ruler, to the nearest 1/8 in. (3 mm), the thickness of the pavement course. Make four measurements, along the edge of the core at 90° intervals.

A-4 Assign a number to the core and record the core number, date drilled, station, transverse position (distance from centerline) and core measurements.

A-5 Retain all samples obtained from lots of construction that are determined to be deficient until final disposition of the lot is made as provided for by the specifications.

**B – THICKNESS MEASUREMENTS BY HOLE MEASUREMENT**

B-1 If the core breaks, while drilling or handling, or if it crumbles or disintegrates in the hole while drilling, the hole may be measured.

B-2 Place a straightedge at least 18 in. (500 mm) long, flat on the surface so as to establish the plane of the surface surrounding the hole.

B-3 Measure with a ruler, to the nearest 1/8 in. (3 mm), the distance perpendicular from the straightedge, laid across the center of the hole, to the bottom of the hole.

B-4 Take two measurements along the edges on opposite sides of the hole with the straightedge parallel to the centerline of the road, and two with it perpendicular to the centerline.

B-5 If the core breaks, but the portion in contact with the subgrade remains intact, remove it and measure to the nearest 1/8 in. (3 mm) the amount of the subgrade material adhering to it at four points on the edge of the core at 90° intervals. Subtract the average depth of subgrade material for the average depth measurement of the entire depth of the hole as made in B-1 to arrive at the average thickness.

B-6 Record the station, lateral position, date measured, and the depth of hole measurements.

**C – THICKNESS DETERMINATION BY SIDE OF TRENCH MEASUREMENT**

C-1 If accurate measurements cannot be obtained as outlined in Section A or B, the engineer, at his/her discretion may require the course to be dug open with any hand or mechanical means which will produce an opening large enough, and of sufficient depth, to permit viewing of the pavement course profile and the subgrade immediately under it. Obtain at least four measurements from the surface to the bottom of the course as viewed in the trench as described in Section B.

## CALCULATIONS

Average the individual measurements for each core or hole to the nearest 1/8 in. (3 mm), and record in the appropriate field book and report form.

## EXAMPLE DETERMINATION OF QUALITY INDEX (QI)

Design thickness 4 in. (101.6 mm)

Individual core averages as determined and recorded per this IM.

4.50 in. (114 mm)
3.75 in. ( 95 mm)
4.00 in. (102 mm)
4.12 in. (105 mm)
3.50 in. ( 89 mm)
3.88 in. ( 99 mm)
4.12 in. (105 mm)

Average = 3.982 in. (101.3 mm)

Range = (high value - low value) = 1 in. (25.4 mm)

$$QI = \frac{\text{Average - (Design - 0.5*)}}{\text{Range}}$$

*0.5 is used with English units, 12.7 is used with S.I. units.

$$QI = \frac{3.982 - (4.00 - 0.5)}{1.00}$$

$$QI = 0.48$$

Report QI upon completion of each lot. Refer to applicable specifications for specific details and disposition for each type of construction.

Iowa Department of Transportation

Office of Materials

October 17, 2006 Matls. IM 511
Supersedes April 18, 2006

## CONTROL OF HOT MIX ASPHALT MIXTURES

### SCOPE

This IM describes the Quality Control/Quality Assurance (QC/QA) procedures for monitoring and controlling plant-produced Hot Mix Asphalt (HMA) on Quality Management of Asphalt (QMA) projects. Because the plant-produced mixtures may not develop test characteristics that meet design criteria, each mixture shall be evaluated during plant production. The evaluation procedures outlined herein are to be carefully followed so that all mix characteristics will conform to the appropriate requirements.

### REFERENCE DOCUMENTS

Standard Specification 2303 Hot Mix Asphalt
Supplemental Specification 01014 Hot Mix Asphalt (Gyratory Mix Design for Local Systems)
AASHTO R 9-90 Acceptance Sampling Plans for Highway Construction
IM 204 Inspection of Construction Project Sampling & Testing
IM 208 Materials Laboratory Qualification Program
IM 216 Guidelines for Validating Test Results
IM 301 Aggregate Sampling & Minimum Size of Samples for Sieve Analysis
IM 302 Sieve Analysis of Aggregates
IM 320 Method of Sampling Compacted Asphalt Mixtures
IM 321 Method of Test for Compacted Density of Hot Mix Asphalt (HMA)(Displacement)
IM 322 Sampling Uncompacted Hot Mix Asphalt
IM 323 Method of Sampling Asphaltic Materials
IM 325 Compacting Asphalt Concrete by the Marshall Method
IM 325G Method of Test for Determining the Density of Hot Mix Asphalt (HMA) Using the Superpave Gyratory Compactor (SGC)
IM 336 Reducing Aggregate Field Samples to Test Samples
IM 337 Method to Determine Thickness of Completed Courses of Base, Subbase & Hot Mix Asphalt
IM 338 Method of Test to Determine Asphalt Binder Content & Gradation of Hot Mix Asphalt (HMA) by the Ignition Method
IM 350 Method of Test for Determining the Maximum Specific Gravity of Hot Mix Asphalt (HMA) Mixtures
IM 357 Hot Mix Asphalt (HMA) Mix Sample for Test Specimens
IM 510 Method of Design of Hot Mix Asphalt Mixes

## RESPONSIBILITIES

Appendix A contains an outline of the responsibilities required for all parties.

The Table of Responsibility, in Appendix A, is broken up into two main categories, Quality Action and Type of Project. The Type of Project is further broken down into two sub-categories, Certified Plant Inspection (CPI) and QMA, and projects with small quantities. The Quality Action is subdivided into the types of work needing to be performed. These areas are General, Asphalt Binder, Aggregate, Loose Hot Mix, Compacted Hot Mix and Revisions. The table is organized in a way to represent how the work would progress during a Hot Mix Asphalt paving operation.

Each Quality Action identifies the group responsible for ensuring the desired action is performed. The groups are the Contractor (CONTR), Resident Construction Office/Project Engineer (RCE), District Materials Office (DME), and the Central Materials Office (CTRL).

In addition, there are certain levels of certification required to perform specific activities. Depending on the Quality Action, an individual might be required to be a HMA Sampler, Level I HMA, Level II HMA, Level I AGG, or a Level II AGG Certified Technician.

## SAMPLING & TESTING

Samples of the combined aggregate, asphalt binder, and plant-produced mixture are obtained in accordance with IM 204 and analyzed as soon as the operations of the plant stabilize.

Only the information obtained from random samples as directed and witnessed by the Engineer and validated by comparison to one or more of the paired samples tested by the Contracting Authority will be used for specification compliance and included in the moving averages. Additional samples of aggregate and loose hot mix asphalt may be taken to provide better quality control. The results of testing done on additional samples will be for informational purposes only. Any proposed changes in the quality control and verification sampling/testing frequencies require the approval of the District Materials Engineer.

All testing done by the Contractor that is used as part of the acceptance decision shall be performed in qualified labs by certified technicians. On all QMA projects, the Level I HMA-Certified Technician is responsible for making sure that all samples are obtained according to the applicable IMs. Samples of loose HMA and asphalt binder must be taken by someone with a minimum of a HMA Sampler Certification.

Samples taken for acceptance purposes shall be retained until the lot has been accepted.

## A. ASPHALT BINDER

The procedure used in the sampling of asphalt binder is found in IM 323. AASHTO procedures are used in the testing of asphalt binder. The frequencies for taking asphalt binder samples are found in IM 204.

## B. AGGREGATE

The procedure used in the sampling of aggregate is found in IM 301. The procedures used in the testing of aggregate are found in IM 336 and IM 302. The frequencies for taking aggregate samples are found in IM 204.

When results from one or more sieves of the specified gradation sample are outside the allowable gradation tolerances, the Engineer may direct and witness one additional aggregate sample or process one loose mix sample to include in the gradation acceptance decision.

## C. LOOSE HOT MIX

The procedure used in the sampling of loose hot mix asphalt is found in IM 322. The procedures used in the testing of loose hot mix asphalt are found in IM 357, IM 350, IM 325, IM 325G, and IM 338. The frequencies for taking loose hot mix asphalt samples are found in IM 204.

The first production sample each day shall be obtained within the first 500 tons (500 Mg) of mix produced. Subsequent daily samples will be obtained from the remaining daily production by dividing the anticipated production beyond the first 500 tons (500 Mg) into three sublots and randomly selecting a sampling point within each sub lot. When less than 2000 tons (2000 Mg) of mix is anticipated to be produced in a day, samples shall be obtained at a minimum rate of one per 750 tons (750 Mg), after the first 500 tons (500 Mg) is sampled. In both cases, samples shall not be taken within the first 100 tons (100 Mg) of production. The specific ton or truckload to begin sampling shall be determined by the Engineer using a random number system. The production samples shall be obtained as directed and witnessed by the Engineer.

The laboratory density, $G_{mb}$, of each production sample will be determined by averaging the densities of the compacted specimens. Two Gyratory specimens are compacted to the specified number of gyrations. The number of gyrations or blows is specified in the project documents.

Laboratory voids, $P_a$, for each production sample will be determined from the results of laboratory density and the corresponding individual Rice, $G_{mm}$, results. The moving average of lab voids will be determined by averaging the last four individual lab void values. A separate moving average will be established for each Job Mix Formula (JMF).

The calibration of the Rice pycnometer shall be checked at the beginning of a project and anytime that a correlation problem occurs.

## D. COMPACTED HOT MIX

The procedure used in the sampling of compacted hot mix asphalt is found in IM 320. The procedures used in the testing of compacted hot mix asphalt are found in IM 321 and IM 337. The frequencies for taking compacted hot mix asphalt samples are found in IM 204.

The Engineer will provide inspection staff to direct and witness the sampling and perform density measurement during time agreed between the Engineer and the Contractor. The Engineer should make every effort to meet the Contractor's schedule. Results must be determined and reported within the period of time specified in this IM.

The Engineer will transport the cores in accordance with IM 320. The Engineer and Contractor will determine that cores are not damaged. The Engineer will decide if a core is damaged prior to testing.

Field density will be based on the average of the seven density cores taken for each lot. The Quality Index (QI) for density will be determined using the field density compared to the average lab density obtained from samples, which correspond to the pavement from which the cores were taken. Field voids will be determined using the field density and the average of the Rice test results of production samples.

The Quality Index is a statistical measure of the difference between the field density and the minimum required density. The index identifies and compensates for values falling outside the statistical norm (outliers). The Quality Index is based on AASHTO R 9-90. The equations used in the determination of the Quality Index are located in the Specifications. Examples on how to calculate the QI as well as outliers are located in IM 501.

## VALIDATION

Validation is defined as the ability of two labs to achieve similar (statistically equivalent) test values on split or paired samples (split for aggregate samples and paired for HMA samples). To achieve or reestablish validation, a minimum of two consecutive test results must meet IM 216 tolerances.

When any of the following events occur, validation has not been achieved or maintained.

- The difference between test results on each of two consecutive split/paired samples exceeds the IM 216 tolerance.
- The difference between test results on any two of three consecutive split/paired samples exceeds the IM 216 tolerance.
- The test results in a series of split/paired samples (minimum of 3 samples, normally no more than 5) are not variable and random (results are consistently higher or results are consistently lower) and the difference between each split/paired test result is greater than half of the IM 216 tolerance.

## DISPUTE RESOLUTION

When validation is not achieved or maintained, the District Materials Engineer may apply the following actions as appropriate to resolve split/paired test result differences.

- Retest the same sample
- The District labs will test additional verification samples.
- The District Materials Engineer will review the sampling and testing procedures of both labs
- The District Materials Engineer will immediately test samples sent in by the Contractor without allowing cool down and reheating (hot-to-hot testing).
- Both labs will test samples using comparable reheat periods.
- The District Materials Engineer will establish a correction factor based on the reheat evaluation outlined in Appendix B.
- Both labs will test a sample that was taken and split by the Engineer.
- Both labs and a third laboratory designated by the Contracting Authority will test a sample split three ways. The 3rd lab for state projects will normally be the Central Materials Lab.
- The District Materials Engineer will establish a correction factor for the Contractor's gyratory compactor based on the procedure described in Appendix C. The correction factor for $G_{mb}$ should not exceed 0.030.

Resolution decisions by the Iowa DOT Central Materials Laboratory will be final. During the period of production when validation cannot be achieved, the Engineer's test results will be used for acceptance of the lot. The use of the Engineer's test values for acceptance will be retroactive to the time when the first sample exceeded the validation tolerance. Similarly, when validation is regained, the use of the Contractor's test results for acceptance is retroactive to the first test used to reestablish validation.

- If validation cannot be achieved for aggregate gradation, the Engineer's test results will be used for the entire gradation and applied to any calculations involving the gradation for the entire lot.
- If validation cannot be achieved on loose hot mix tests for $G_{mm}$ or $G_{mb}$, the Engineer's test results will be used for any calculations involving that particular test value for the entire lot.

## PRODUCTION TOLERANCES

Production tolerances are listed in the specifications.

Variations between two consecutive test results in $G_{mb}$ or $G_{mm}$ of more than 0.030 shall be investigated promptly since these tests reflect significant changes in binder content, aggregate properties and/or gradation. In some cases variations may be attributed to segregation, thoroughness of mixing, sampling procedure, and changes in aggregate production. On non-QMA designed mixtures, the investigation should include the testing of back-up samples obtained during the production of the lot.

## REPORTING

For each production sample of loose HMA the Contractor will determine, report, and plot (per QMA specification), $G_{mb}$, $G_{mm}$ and $P_a$. Binder content measurement by an approved method will be determined, reported, and plotted daily. Gradation will be determined, reported and plotted daily. The inter lab correlation reports shall be made available. **NOTE:** Under no circumstances can changes in the target gradation be set outside of the control points.

Test results are to be recorded and plotted in the computer programs provided by the Iowa DOT. A copy of the completed Daily HMA Plant Report (Form #800241) summarizing all test results including the field density QI shall be faxed to the District Materials Engineer within four hours of beginning operations on the next working day. Copies of computer files containing the project information shall be furnished to the Engineer upon project completion.

## ADJUSTING (TROUBLESHOOTING)

As stated in Standard Specification 2303, "The Contractor shall be responsible for all aspects of the project, provide Quality Control management and testing, and maintain the quality characteristics specified".

The Contractor is responsible for making changes, as necessary, to achieve target values specified on the JMF. These changes can include adjusting the proportions of aggregate and asphalt binder necessary to meet the JMF. If a change in the target gradation is desired, the Contractor must obtain approval of a new JMF from the District Materials Engineer. The Contractor may change the target binder content to maintain the required mixture characteristics, provided the appropriate documentation and reporting is performed. All changes in proportions must be reported on the Daily ACC Plant Report (Form #800241).

The addition of new materials to the JMF may be approved by the District Materials Engineer without laboratory tests if the materials are produced from geologically comparable sources, do not constitute more than 15 percent of the total aggregate, meet quality requirements, and produce mixes that meet design criteria. When aggregates are introduced from sources that are not geologically comparable or otherwise differ significantly, complete laboratory mix design testing and approval is required.

Any time the moving average for laboratory voids falls outside the specification tolerance limit, the Contractor must cease operations. The Contractor assumes the responsibility to cease operations, including not incorporating produced material, which has not been placed. Production shall not be started again until the Contractor notifies the Engineer of the corrective action proposed.

Moving averages and the gyratory compaction slope assist in identifying potential problems before they arise. Watch the trends in the moving averages (approaching a specification limit) and the slope of the compaction curve. The slope of the compaction curve of plant-produced material shall be monitored and variations in excess of ± 0.40 of the mixture design gyratory compaction curve slope may indicate potential problems with uniformity of the mixture.

## GUIDANCE TABLES

The tables below are intended to provide guidance on dealing with the most common problems, which arise during the production of HMA. The first table deals with problems, which can show up in the laboratory setting and the second table deals with problems, which can appear in the field.

The following example explains how to read the tables. Both tables are read downward. The shaded regions are the items to be considered for adjusting purposes.

### Lab Problem Table

The first step is to identify which lab problem is occurring. If "Low Voids" is the identified problem, move down the column to the "Step 1 Check". Assuming the first check is to be made on the "Binder Content", move down the column to "Step 2 If". If the Binder Content is high proceed to "Step 3 Verify". Each of the shaded items identified in the "Step 3 Verify" should be looked at before proceeding further. Assuming that the items in "Step 3 Verify" are on target, go to "Step 4 Do". In this case, the action to be taken in "Step 4 Do" is to "Lower Binder" in the mix.

In all cases, the items in the "Step 3 Verify" are assumed to be within the allowable tolerances and won't fall outside of allowable tolerances if the action in "Step 4 Do" is taken.

| LAB PROBLEM | | Low Voids | | | High Voids | | | Low Film Thickness | | | High Film Thickness | | | Low VMA | | | High VMA | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Step 1-Check | Binder Content | ■ | | | ■ | | | ■ | | | ■ | | | | | | | | |
| | Gradation | | ■ | | | ■ | | | ■ | | | ■ | | ■ | ■ | | ■ | ■ | |
| | Aggr. SG (Gsb) | | | ■ | | | ■ | | | | | | | | | ■ | | | ■ |
| | Aggr. Absorption | | | | | | | | | ■ | | | ■ | | | | | | |
| Step 2-If | Low Binder | | | | ■ | | | ■ | | | | | | | | | | | |
| | High Binder | ■ | | | | | | | | | ■ | | | | | | | | |
| | Low -200 | | | | | ■ | | | | | | ■ | | | | | ■ | | |
| | High -200 | | ■ | | | | | | ■ | | | | | ■ | | | | | |
| | Off JMF Target | | | ■ | | | ■ | | | ■ | | | ■ | | ■ | ■ | | ■ | ■ |
| Step 3-Verify | Filler Bitumen Ratio | ■ | ■ | | ■ | ■ | | ■ | ■ | | ■ | ■ | | ■ | ■ | | ■ | ■ | |
| | Film Thickness | ■ | ■ | | ■ | ■ | | | | | | | | ■ | ■ | | ■ | ■ | |
| | VMA | ■ | ■ | | ■ | ■ | | | | | | | | | | | | | |
| | Field Compaction | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | Voids | | | | | | | ■ | ■ | | ■ | ■ | | ■ | ■ | | ■ | ■ | |
| | Individual Aggr. Sources | | | ■ | | | ■ | | | ■ | | | ■ | | | ■ | | | ■ |
| Step 4-Do | Lower Binder | ■ | | | | | | | | | ■ | | | | | | | | |
| | Increase Binder | | | | ■ | | | ■ | | | | | | | | | | | |
| | Lower -200 | | ■ | | | | | | ■ | | | | | ■ | | | | | |
| | Increase -200 | | | | | ■ | | | | | | ■ | | | | | ■ | | |
| | Adjust Aggr. Proportions | | ■ | ■ | | ■ | ■ | | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Recompute Volumetrics | | | ■ | | | ■ | | | ■ | | | ■ | | | ■ | | | ■ |

Field Problem Table

The first step is to identify which field problem is occurring. If "High Field Voids" is the identified problem, move down the column to the "Step 1 Check". Assuming the first check is to be made on the "Lab Voids", move down the column to "Step 2 If". If the Lab Voids are high proceed to "Step 3 Verify". Each of the shaded items identified in the "Step 3 Verify" should be looked at before proceeding further. Assuming that the items in "Step 3 Verify" are on target, go to "Step 4 Do". In this case the process of looking at the "Step 3 Verify" would lead to the Lab Problem Table and cause one of the actions for High Lab Voids to be used.

In all cases, the items in the "Step 3 Verify" are assumed to be within allowable tolerances and won't fall outside of allowable tolerances if the action in "Step 4 Do" is taken.

| | FIELD PROBLEM | Low Field Voids | High Field Voids | Tender Mix | Low Density Q.I. | Agglomerates | Uncoated Aggr. | Brown Rock | Stripping |
|---|---|---|---|---|---|---|---|---|---|
| Step 1-Check | Stockpiles | | | | | | | | |
| | Aggr. Absorption | | | | | | | | |
| | Binder Content | | | | | | | | |
| | Lab Voids | | | | | | | | |
| | Film Thickness | | | | | | | | |
| | Mixing Time | | | | | | | | |
| | Moisture in Mix | | | | | | | | |
| | Mix Temp at Plant | | | | | | | | |
| | Mat Temp | | | | | | | | |
| Step 2-If | Low | | | | | | | | |
| | High | | | | | | | | |
| | Yes | | | | | | | | |
| Step 3-Verify | Filler/Bitumen Ratio | | | | | | | | |
| | Film Thickness | | | | | | | | |
| | Voids | | | | | | | | |
| | Field Compaction | | | | | | | | |
| | Aggr. Breakdown | | | | | | | | |
| | Individual Aggr. Sources | | | | | | | | |
| | Moisture | | | | | | | | |
| | Amount of Clay Binder | | | | | | | | |
| | Go To Lab Problem Table | | | | | | | | |
| Step 4-Do | Increase Binder | | | | | | | | |
| | Lower Temp | | | | | | | | |
| | Increase Temp | | | | | | | | |
| | Cover Loads | | | | | | | | |
| | Increase Aggr. Dryer Time | | | | | | | | |
| | Screen | | | | | | | | |
| | Adjust Aggr. Proportions | | | | | | | | |
| | Increase Wet Mixing Time | | | | | | | | |

*****GENERAL REWRITE – PLEASE READ CAREFULLY.*****

### TABLE OF RESPONSIBILITY

| QUALITY ACTION | CPI & QMA | SMALL QTY. |
|---|---|---|
| **General** | | |
| Use of Qualified Labs & Certified Technicians | CONTR/RCE | CONTR |
| Use of Certified Labs & Qualified Technicians | DME/CTRL | DME/CTRL |
| Preparation of the Job Mix Formula (JMF) | CONTR(2) | CONTR(2) |
| Approval of the JMF | DME | DME |
| Calibration of the Plant | CONTR | CONTR |
| Monitoring of Plant Operations | DME/RCE(1) | DME/RCE(1) |
| Inspection of Plant Operations | CONTR(1) | CONTR(1) |
| **Asphalt Binder** | | |
| Direct & Witness Verification Sample of Asphalt Binder | RCE/DME(3) | NA |
| Sample Asphalt Binder | CONTR(3) | NA |
| Secure Verification Sample of Asphalt Binder | RCE/DME | NA |
| Transport Verification Sample of Asphalt Binder | CONTR/RCE | NA |
| Run & Report Verification Sample of Asphalt Binder | DME/CTRL | NA |
| **Aggregate** | | |
| Direct & Witness Verification Sample of Combined Aggregate | RCE(4) | NA |
| Sample Combined Aggregate | CONTR(4) | CONTR(4) |
| Direct & Witness Splitting of Combined Aggregate Sample | RCE(5) | NA |
| Secure Verification Sample of Combined Aggregate | RCE | NA |
| Transport Verification Sample of Combined Aggregate | CONTR/RCE | NA |
| Run & Report QC Tests on Combined Aggregate Gradation | CONTR(5) | CONTR(5) |
| Run & Report Verification Tests on Combined Aggregate Gradation | DME/RCE(5) | NA |
| Report Validation per IM 216 on Combined Aggregate Gradation | DME/RCE | NA |
| Obtain & Transport Verification Samples of Coarse Aggregate Quality | DME(4) | NA |
| Run & Report Verification Tests on Coarse Aggregate Quality | CTRL | NA |
| **Loose Hot Mix** | | |
| Determine Loose Hot Mix Paired Sample Frequency/Location | RCE(3) | CONTR |
| Direct & Witness Verification Sample of Loose Hot Mix | RCE(3) | NA |
| Sample Loose Hot Mix Paired Samples | CONTR(3) | CONTR(3) |
| Secure Verification Sample of Loose Hot Mix | RCE | NA |
| Transport Verification Sample of Loose Hot Mix | CONTR/RCE | NA |
| Run & Report QC Tests on Loose Hot Mix Samples | CONTR(1) | CONTR(1) |
| Run & Report Verification Tests on Loose Hot Mix Samples | DME(1) | NA |
| Report Validation of Hot Mix Tests | CONTR(1) | NA |
| Evaluate Test Results/Take Action when Validation Fails | DME | NA |
| **Compacted Hot Mix** | | |
| Determine Density Coring Frequency/Location | RCE(3) | RCE(3) |
| Direct & Witness Coring & Transport to QC Lab | RCE(3) | RCE(3) |
| Obtain Core Samples & Prepare Samples at the QC Lab | CONTR | CONTR |
| Run Density Testing on Cores | RCE(3) | RCE(3) |
| Record Density Testing Measurements on Cores | RCE(3) | RCE(3) |
| Report Density Testing Results on Cores | CONTR(1) | CONTR(1) |
| **Revisions** | | |
| Adjust Production to Maintain JMF Targets | CONTR | CONTR |
| Report Plant Adjustments | CONTR(1) | CONTR(1) |
| Approve Revisions to JMF Targets | DME | DME |
| Shut Down Production when Required | CONTR | CONTR |

NOTES:
(1) Must be done by Certified Level I HMA Technician
(2) Must be done by Certified Level II HMA Technician
(3) Must be done by Certified HMA Sampler
(4) Must be done by Certified Level I Aggr. Technician
(5) Must be done by Certified Level II Aggr. Technician

ABBREVIATIONS:
CPI = Certified Plant Inspection
QMA = Quality Mgmt. of Asphalt
RCE = Project Engineer
CONTR = Contractor
DME = District Materials
CTRL = Central Materials

## REHEAT EVALUATION

The contractor's QMA laboratory technician shall split the sample selected for correlation. The split will provide material for 3 individual maximum specific gravity, $G_{mm}$, test samples and material for 3 sets of laboratory density, $G_{mb}$, specimens.

The contractor's technician will split and retain sufficient material for 2 $G_{mm}$ test samples and 2 sets of laboratory density specimens. The remainder of the field sample will be submitted to the DOT laboratory. From this portion the DOT laboratory will split and test an additional $G_{mm}$ sample and an additional set of laboratory density specimens, after reheating.

Immediately after splitting, the contractor's technician will return one set of laboratory density samples to the oven and heat to compaction temperature. Once compaction temperature is reached, this set is removed from the oven, compacted as per IM 325 or IM 325G, cooled to ambient temperature and $G_{mb}$ determined. The second set of samples is cooled to ambient temperature, reheated to compaction temperature then compacted as per IM 325 or IM 325G, cooled to ambient temperature and $G_{mb}$ determined. This dual testing is intended to indicate the differences in test results, which can be expected, between samples tested on the original heat of the mixture and those tested at a later time (hot-to-cold testing).

The contractor's technician will cool and separate both $G_{mm}$ samples. The contractor's technician will test one $G_{mm}$ sample. The second $G_{mm}$ sample will be sealed in a plastic bag and submitted to the appropriate DOT laboratory for testing. The DOT laboratory will test the sample without any significant reheating (not more than 5 minutes oven reheating to facilitate breaking up sample).

Interlaboratory correlation, as specified in IM 208, will be determined by comparing $G_{mm}$ results obtained by the contractor to those obtained by the DOT laboratory on the $G_{mm}$ samples split by the contractor. The laboratory density obtained by the contractor on the $G_{mb}$ specimens prepared from the reheated portion will be compared to the $G_{mb}$ determined by the DOT laboratory on $G_{mb}$ specimens prepared from the reheated portion of the original split sample. If the test results compared are within the tolerances specified in IM 208, then the reheat procedure shall be performed when required by the District Materials Engineer. If the test results are not within the tolerances specified in IM 208, additional testing on the same or subsequent samples will be required.

The District Materials Engineer may waive the reheat testing if the test results indicate no significant difference caused by reheating of samples. Additional correlation testing may be performed at any time at the request of the contractor or the District Materials Engineer. The information obtained by the dual testing described above may be used when monitoring the daily comparison of contractor's test results to DOT laboratory test results when reheating of samples is involved. All samples shall be retained until permission to discard them is obtained from the DOT laboratory.

This outline is to serve only as a guide to the steps in the correlation procedure. All tests noted in this outline must be performed in accordance with the applicable IM.

1. Contractor Testing Responsibilities

   A. Obtain field sample and split to obtain 2 sets of laboratory density, $G_{mb}$, specimens and 2 Maximum specific gravity, $G_{mm}$, specimens and submit the remainder of field sample to DOT laboratory for testing.

   B. Bulk Density Testing

      1) Set #1 – Immediately after splitting, return specimens to the oven, reheat to compaction temperature, compact specimens as per IM 325 or IM 325G, cool to ambient temperature and test for density.

      2) Set #2 – Cool to ambient temperature, return to oven, reheat to compaction temperature, compact as per IM 325 or IM 325G, cool to ambient temperature and test for density.

      3) Compare values obtained in #1 and #2 to determine possible reheat factor.

   C. Maximum Density Testing

      1) Sample #1 – Cool sample and perform Rice Test.

      2) Sample #2 – Cool sample, place in plastic bag and submit to the DOT laboratory for testing.

   D. Submit remainder of field sample to DOT laboratory for testing.

2. DOT Laboratory Testing Responsibilities

   A. Bulk Density Testing

      1) From the field sample supplied by the contractor, split one set of $G_{mb}$ specimens, place in oven, heat to compaction temperature, compact as per IM 325 or IM 325G, cool to ambient temperature and test for density.

   B. Maximum Density Testing

      1) From the field sample supplied by the contractor, split one $G_{mm}$ specimen and perform Rice Test.

      2) Test the $G_{mm}$ sample supplied by the contractor.

      3) Compare values obtained in #1 and #2 to determine possible deviation in $G_{mm}$ results that might occur between the Contractor's split $G_{mm}$ sample and the DOT $G_{mm}$ sample split from a field sample.

## PROCEDURE FOR ESTABLISHING A CORRECTION FACTOR

The procedure used for establishing a correction factor is as follows:

### PROCEDURE A

1. Obtain one sample of sufficient plant produced material for 12 $G_{mb}$ specimens and split per IM 357 into 6 specimens each between the contractor and engineer. This should provide enough material that 6 gyratory specimens may be compacted at both labs. The sample should be representative, but sampling procedure IM 322 is not required.

2. The material must be handled and compacted in the same manner by the contractor and engineer (hot-to-hot or cold-to-cold).

3. Compact the specimens per IM 325G.

4. Perform density testing on the compacted specimens per IM 321.

5. Average the 6 $G_{mb}$ results for each lab.

The difference between the average $G_{mb}$ results from the two labs will be considered the correction factor. **NOTE:** Unless otherwise decided on by the Engineer, only 1 correction factor will be established for a given mix design.

### PROCEDURE B

The engineer may use the results of 3 consecutive QC/QA split tests in lieu of a single 12 split sample. There can be no significant change to the mix between the 3 tests and no adjustments to the gyratory compactors. The material must be handled and compacted in the same manner by the contractor and engineer (hot-to-hot or cold-to-cold). The contractor's QC results will be averaged and the engineer's QA results will be averaged with the difference being the correction factor to be applied.

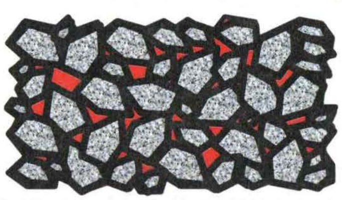
## Bulk Specific Gravity of Compacted Bituminous Mixtures (I.M. 321)

- **Purpose**
  - Determine Gmb and density of compacted specimens
  - Used in volumetric analysis
- Apparatus
  - Balance
  - Oven
  - Sample Basket
  - Water Bath

## BSG of Compacted HMA

- **Binder mixed with agg. and compacted into sample**

$$G_{mb} = \frac{\text{Mass agg. and Binder}}{\text{Vol. agg., Binder, air voids}}$$



## Testing

- **Mass of dry sample**
- **Mass under water**
- **Mass saturated surface dry (SSD)**

## Apparatus Preparation (I.M. 321)

- Hang the basket from the bottom of the scale
- Fill the container with 77°F water
- Check that the scale balances to zero
- Maintain the water level above the basket. (If it falls below, it will change the scale balance and your final answer.)
- Check that the basket does not touch the side or the bottom of the bucket

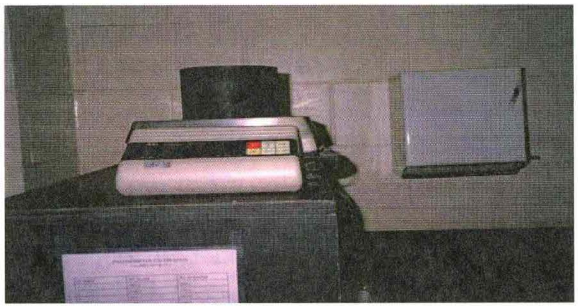
## **Sample Preparation** (I.M. 321)

- Compacted specimens (SGC) or field cores
- Field cores must be surface dried

## **Test Procedure** (I.M. 321)

- Cool to room temp and record mass in air to 0.1g ($W_1$)
- Place in basket, immerse in water at 77±5°C until balance stabilizes, record mass in water to 0.1g ($W_2$)
- Remove and damp dry (SSD) by blotting with damp towel, record SSD mass to 0.1g ($W_3$)

## Testing



**Obtain mass of dry compacted sample**

## Testing

**Obtain mass of specimen at SSD**

## Calculations

- $G_{mb} = W_1 / ( W_3 - W_2 )$

  Where:

  $W_1$ = mass of dry sample

  $W_2$ = mass of sample under water

  $W_3$ = mass of SSD sample

## Calculations (I.M. 321)

- Bulk Specific Gravity, Gmb = $W_1/(W_3 - W_2)$
- Density = Gmb×density$_{water}$
- Report all gravities to 0.001

# METHOD OF TEST FOR COMPACTED DENSITY OF HOT MIX ASPHALT (HMA) (DISPLACEMENT METHOD)
(General Rewrite)

## SCOPE

This IM provides the method of test used in determining the bulk specific gravity ($G_{mb}$), bulk density, of laboratory-compacted specimens of HMA or cores takes from compacted HMA pavements.

## APPARATUS

- A balance having a capacity of 5000 grams or more and accurate to 0.5 gram.
- Water container of sufficient size to allow a submerged sample to not touch the sides or bottom.
- Suspension apparatus (sample holder) – "wire suspending the container shall be the smallest practical size to minimize any possible effects of a variable immersed length. The suspension apparatus shall be constructed to enable the container to be immersed to a depth sufficient to cover it and the test sample during weighing. Care should be taken to ensure no trapped air bubbles exist under the specimen" (AASHTO T166-00).
- Spatula or putty knife
- Clean cloth


Balance, Sample Holder, and Water Container

## PROCEDURE

### SAMPLE PREPARATION

#### Field Cores

1. Allow the core to attain laboratory room temperature prior to testing. Cores stored in refrigerated units must be removed and allowed to stand at least 2 hours at room temperature prior to testing. Under no circumstances shall the cores be submerged in water prior to testing.

2. Clean off all loose particles, base materials, and prime oils that are stuck to the sample. The portion of the sample that needs to be cleaned may be lightly warmed and scraped with a putty knife.

3. If water was used in cutting the sample, the specimen shall be surface-dried before testing.

#### Laboratory Compacted Specimens

1. Cool lab-compacted specimens to laboratory room temperature before testing.

2. Clean off all loose particles that are stuck to the specimen.

### TEST PROCEDURE FOR DENSITY

1. Fill the water container with water at approximately 77°F (25°C) to a depth sufficient to ensure that the sample holder and sample are completely submerged during testing.

2. Connect the wire to the balance at the point provided on the balance.

3. Connect the holder to the wire and place in the water bath filled with water and tare the balance.

4. Weigh the sample in air ($W_1$).

5. Weigh the suspended sample completely submerged in water targeted at 77° ± 5°F (25° ± 3°C) ($W_2$). The reading must be taken when the balance stabilizes.

> **NOTE:** The balance will normally be considered to have stabilized when the weight reading doesn't change by more than 0.1 gram over a 10 to 30 second time span.

6. Remove the sample from the water, and with a damp cloth; blot the free water from the surface of the sample. Weigh the sample again in air ($W_3$).

> **NOTE:** Care should be taken not to rub any particles from the edges or corners when blotting the free water.

7. Calculate the $G_{mb}$ bulk density, and report the result to three decimal places.

## CALCULATIONS

The calculation for determining $G_{mb}$ is as follows:

$$G_{mb} = \frac{W_1}{W_3 - W_2}$$

**Iowa Department of Transportation**
**Technical Training and Certification Program**

COURSE EVALUATION SHEET

In an effort to improve the Iowa DOT Technical Training and Certification Program, we ask that you fill out this evaluation form after you have taken the exam. Thank you for your cooperation.

Course: ________________________ Location: ______________________

Instructor: ______________________

1. What type of agency are you employed by?

   ____________________________

2. Please rate the following portion of the course on a scale of 1-5. 1 = Poor, 5 = Excellent

   Facility: _________________

   Material: ________________

   Instructors: ______________

   Course Activities: _________
   (lectures, videos, demonstrations, etc.)

3. Are there any changes you would like to see made in the course?

   ___________________________________________________________

   ___________________________________________________________

REMARKS: