APPLICATION OF QUALITY ASSURANCE SPECIFICATIONS

FOR

ASPHALTIC CONCRETE MIXTURES

Jointly Developed by
Technology Transfer and Training
and
the Materials and Construction Sections
of the
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CREDITS

This manual was developed by Ms. Luanna Cambas, DOTD Materials Engineer Administrator, with the assistance of the technical review committee listed below. The manual was edited and prepared for publication by Ms. Cindy Twiner, Construction and Materials Training Program Manager.

The Construction and Materials Sections of the Louisiana Department of Transportation and Development and the DOTD Chief Engineer have approved this manual for publication.

Technical Advisory Committee
2006 Revised Edition

Mr. Chris Abadie
Materials Research Administrator

Mr. Danny Smith
DOTD Systems Engineer

Mr. William King
LTRC Asphalt Materials Research Engineer

Mr. Phil Arena
FHWA Pavement and Materials Engineer

Mr. Joe Bond
District 61 Training Coordinator

Mr. Todd Kidder
District Training Specialist

Mr. Michael Elliott
LTRC District Training Liaison

Mr. Steve Verbois
Engineering Technician 4

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PREFACE

The purpose of this manual is to supplement Part V of the 2006 LA Standard Specifications for Roads and Bridges, standardize policies and procedures, provide detail, explanation and examples, denote personnel requirements, and denote equipment and process requirements, all with the goal of facilitating Quality Assurance during the design, production and placement of asphaltic concrete and associated work.

Specifications - This manual is to be used in conjunction with the 2006 Edition of the *Louisiana Standard Specifications for Roads and Bridges, or "Blue Book".* Relevant specifications are referenced throughout this manual. Specifications may be repeated in order to further detail or demonstrate how they are applied. **All specifications, manuals, forms and spreadsheets are subject to change. Therefore, it is imperative that contract documents for each project be reviewed for any specific change, update and/or addition.**

Note that Section 501, Asphaltic Concrete which was based on the Marshall design system, has been eliminated. A complete summary of specification changes for Part V, which occurred with implementation of the 2006 Edition appears in the Appendix A1.

Manuals - Numerous manuals which are essential for performing DOTD asphaltic related work are listed below. The latest edition of each shall be available at the hot mix asphalt (HMA) production plant and at the district laboratory. Any required document can be obtained from the department at a published price through General Files at 225-379-1107. Many manuals are listed at ***www.dotd.louisiana.gov,*** hereafter referred to as "website". Following each manual description are instructions for locating the documents on the website.

Documents are:

- CONTRACT DOCUMENTS – the legally binding written agreement between the DOTD and the Contractor setting forth obligations for the performance of work for a specific project. *(not on website)*

- 2006 EDITION of the LOUISIANA STANDARD SPECIFICATIONS for ROADS and BRIDGES – (known as "Standard Specifications") the terms and stipulations for providing materials, services and the finished constructed product. (Go to ***Publications/Manuals***, to ***Standard Specifications***, to ***2006 Standard Spec…***)

- MATERIALS SAMPLING MANUAL – (known as "MSM") arranged by Contract Item #, this includes the purpose, method of sampling, minimum frequency of sampling, sample quantity (size), sampling procedures, certificate requirements, and distribution of documentation. (Go to ***Construction***, to ***Materials Lab,*** to ***Materials Sampling Manual***, to ***2006 Specs***…)

- SAMPLING PLAN – a project-specific document denoting the minimum number of samples and certificates required for each contract item to ensure adequate representation and quality of all materials incorporated into the project. This is prepared by the District Lab Engineer and/or the Project Engineer and is based upon the Materials Sampling Manual. *(Sampling Plan is not on web site)*

- MATT SYSTEM FIELD HANDBOOK – used for completing and submitting the required documentation to accompany samples. **This manual has been eliminated and replaced by individual links on the website, (**Go to ***Construction***, to ***Materials Lab***, to ***MATT System***, then select from ***General, Reports***, or ***Codes***.)

    - Sample Identification forms
    - Material Codes
    - QPL Source Codes
    - Plant Codes
    - Submitter Codes

- TEST PROCEDURES MANUAL – all standardized DOTD test procedures, which are denoted, "DOTD TR-xxx". (Go to ***Construction***, to ***Materials Lab***, to ***Testing Procedures Manual***)

- ENGINEERING DIRECTIVES AND STANDARDS MANUAL – (known as "EDSM") establishes policies and procedures for DOTD Design, Construction, and Maintenance. An example is "haul truck certification". (Go to ***Publications/Manuals***, to ***EDSMs (Engineering Directives and Standards***.)

- QUALIFIED PRODUCTS LIST, (known as "QPL") – a listing of materials which have been prequalified by DOTD. This does not necessarily eliminate the requirement for testing. (Go to ***Construction***, to ***Materials Lab***, to ***Qualified Products List***, then select from a number of options. To view the approved list of products, go to ***QPL Table of Contents***. There is even a list of ***Non-QPL Approved Source Codes*** – to be developed soon.)

- DOTD CONSTRUCTION MEMORANDA – The DOTD's internal office documentation to explain various construction issues. (Only available to DOTD Employees on the Intranet. Go to ***Construction Home Page***, to ***Construction Memos.***)

- CONSTRUCTION CONTRACT ADMINISTRATION MANUAL – Instructions for DOTD Project Engineers and their representatives which include procedures for change orders, estimates, diaries and field book entries. (Go to ***Construction***, to ***Construction Contract Administration Manual***.)

- AASHTO TEST PROCEDURES – a set of nationally recognized test procedures and specifications published by the American Association of State Highway Transportation Officials. (Available at **http://www.transportation.org/**, go to ***bookstore.*** DOTD personnel may contact the District Lab Engineer.)

- ASTM TEST PROCEDURES – a set of nationally recognized test procedures published by the American Standards for Testing and Materials. (Go to ***www.astm.org***, to ***Standards***, and then search. DOTD personnel may contact the District Lab Engineer.)

- ADMINISTRATIVE MANUAL for CONSTRUCTION TECHNICIAN TRAINING AND CERTIFICATION – certification and training requirements for performing construction inspection. (Go to ***www.ltrc.lsu.edu***, to ***Certification.***)

- LABORATORY EQUIPMENT MANUAL – a manual for asphalt plant contractors to keep records of plant laboratory equipment calibrations. (Go to ***Construction***, to ***Materials Lab***, to ***Laboratory Equipment Manual***.)

DOCUMENTATION

Forms and Spreadsheets - The examples of forms and spreadsheets shown in this manual are current as of the manual's publication date. Most are provided in the appendix and are on the website. Be sure to check with the district laboratory for the most recent form. At the time of this printing, the department is implementing Site Manager Materials to automate our quality assurance program. Once implemented, the forms and procedures for documentation will change. The use of approved computer-generated forms and spreadsheets will be allowed, with approval of the District Laboratory Engineer, if they are similar in design to standard DOTD forms and contain the data required by the department.

A DOTD spreadsheet may not be altered in any way that affects calculation or results. Violations may result in legal consequences or revocation of certification.

Rounding for Test Procedures - The preface of the DOTD *Testing Procedures Manual* outlines rules for numerical calculations and rounding. However, rounding determined from the use of approved computer based spreadsheets will be allowed, if the level of significance is not greater than that specified in the specific procedure. In the event that a difference in test results exists between values determined from computer spreadsheets and traditional DOTD rounding rules that influence payment factors, the DOTD method shall govern.

Rounding for Pay - Rounding for estimates and pay determination are to be in accordance with the Construction Contract Administration Manual or current Site Manager® construction policies. Asphalt mixture is paid to the whole percent. If the tenths position is less than 5, round downward; if greater than or equal to 5, round upward. For example 99.3 rounds to 99% and 99.5% rounds to 100% pay. Intermediate calculations are rounded to two more decimal places than the final answer.

Safety - Both DOTD and contractor personnel are to exercise caution while performing their duties at the plant/laboratory and in the field. They are to follow all safety procedures during sampling, testing and routine plant/roadway inspection in accordance with the Testing Procedures Safety Guidelines.

ENVIRONMENTAL PROTECTION -
Activities that negatively impact the environment potentially exist on every construction project, whether at construction sites, material producing plants, or equipment staging areas. Potential hazards can come from:

- Storm water runoff, because it carries residues from asphalts, oils, fuels, fertilizers, and chemicals that can be hazardous to the environment.
- Air, because vapors from materials such as fuel and oils can be carried away from the site.
- Noise, because vibrations that can cause soil subsidence resulting in structural damage to buildings and water table changes and high noise levels can impact hearing of individuals.

There are local, state, and federal guidelines that control these activities to minimize environmental harm. The contractor shall abide by these regulations and is to take every step necessary to prevent damage to the environment. Section 107.14 of the Standard Specifications covers Environmental Protection procedures.

Erosion control is critical on a project. Pursuant to the Clean Water Act and the Louisiana Environmental Quality Act, a Louisiana Pollution Discharge Elimination system (LPDES) General Permit is required from the Louisiana Department of Environmental Quality for any construction activity. Two different permits are required, one for any project that disturbs from one to five acres, and a separate one for any project that disturbs five or more acres. A Storm Water Pollution Prevention Plan (SWPPP) is required for these projects and normally consists of:

- Plan sheets indicating the location of erosion control items
- Standard Plan EC-01
- Standard Specifications Section 204

If there is no erosion control plan in the project plans, the project engineer is to contact the Headquarters Construction Section to find out if one should be added. The SWPPP shall be discussed at the pre-construction meeting.

CHAPTER 1 - QUALITY ASSURANCE

Quality Assurance

Quality Assurance is the combined efforts of quality control and acceptance processes to assure that a project will provide the public with a durable product exhibiting a high level of performance. A quality assurance system provides a level of confidence that our finished product will be of good value. To this end, the department has established a system of inspection by qualified personnel (both department and contractor/producer) and statistically based sampling and testing. To ensure that the quality assurance concept functions properly, it is critical that the contractor's quality control and the department's inspection and acceptance process be a cooperative coordinated effort. When any part of the process fails, the contractor's risk for payment adjustments and the department's risk of accepting substandard work increase.

It is not the intent of quality assurance specifications to allow the contractor to use construction practices or materials that may lead to a less than optimum product. If the contractor attempts to achieve only the minimum criteria for which the department will allow 100% payment, the risk of the discontinuance of operations an/or payment adjustments will be significantly increased due to the nature of statistically based acceptance parameters. The department will not allow continued operations when tests result in less than 100% payment or show less than minimum specification requirements when no payment adjustment is applicable.

This Quality Assurance system includes:

1. Quality Control
2. Inspection
3. Acceptance
4. Certification of Equipment and Processes
5. Certification or Qualification of Technicians
6. Documentation
7. Verification Sampling and Testing
8. Independent Assurance Program

This chapter defines and describes each element of Quality Assurance.

Quality Control

Quality Control is the process used by the contractor to monitor, assess, and adjust material selection, production, and project construction to control the level of quality so that the product continuously and uniformly conforms to specifications.

Minimum requirements for quality control sampling and testing are denoted in the specifications and the Materials Sampling Manual. However, the contractor must take as many samples and perform as many tests as necessary to ensure quality.

The department and the contractor use the same test methods and identical or equivalent equipment; however, the responsibilities of each entity are clearly separate and significantly different. For this reason, it is important for all parties to understand the concept and commit themselves to the process. The contractor's role is clearly to construct quality into each phase of a project. At the end of a construction phase, through statistical sampling and testing and the visual inspection program, the department can only identify the level of quality already constructed. The department has no part in the construction of quality, only quantifying the results. Because of these different responsibilities and the contractor trying to build quality and to avoid payment adjustments, it is obvious that the QC program will be more intense, at times necessitating many samples and/or tests beyond the normal situation. The department's program is rigid, based on historical data with specified inspection requirements. At the completion of a project, in most cases, the contractor will have taken more samples, conducted more tests, and made more inspections than the department.

Designing or producing material at the midpoint of a specification limit, instead of at the borderline, greatly increases the likelihood of receiving full or even incentive pay. Operations which result in continued pay cuts or when specification limits are repeatedly exceeded shall not be allowed. This will result in penalty, failure or mandatory shutdown.

The contractor is not to wait until a change in materials or a test result from DOTD indicates a deficiency, but must be continually aware of construction progress and activity. When the contractor identifies failing materials or processes, the contractor must take whatever measures necessary to correct the deficiency and prevent its recurrence. These measures shall include, but not be limited to the following:

- removal of personnel or equipment not performing in an acceptable manner
- removing and replacing materials or locating and selecting other material sources
- additional testing both to establish the total limits of the deficient area and to ensure that corrective action has been successful

Inspection

Inspection is the observation of materials, samples, tests, equipment, processes and the finished product to determine quality. Inspectors document test results and where the product is placed. Inspection may reveal areas of concern resulting in additional discussion, investigation, or further testing. The project engineer is the direct representative of the Chief Engineer for the administration of the contract and represents the department directly, as well as through the inspection staff.

Sampling and testing is a support for visual inspection. **Although the random, statistically based sampling and testing performed by the department represents the entire area or lot being tested, this methodology should be in addition to visual inspection.** When non-uniform materials or non-uniform processes result in areas which do not appear to be acceptable or which are obviously not in conformance with the quality of construction expected, the department will require the contractor to correct these deficient areas. **It has never been the intent of the department to accept a project solely on the basis of the sampling and testing program.** It is always necessary for the project engineer and inspector to be aware of the quality of construction and performance of the project during construction and acceptance phases before final acceptance.

When acceptance inspection or tests indicate that the contractor's QC program is not effective, the engineer will require modifications to the program. The project engineer has the right to require changes in personnel, equipment, construction methods, testing methods or frequency. **The contractor will not be allowed to proceed with construction operations without an effective QC program which complies with specifications.**

The project engineer will be certain that the contractor's representative on the project has the appropriate department documents as listed in the Preface.

A key element of inspection is the review of the contractor's QC results and program. Evaluations of the QC effort to ensure that additional failing acceptance tests do not occur may include, but not be limited to, the following:

- Observation of the contractor's sampling and testing procedures for conformance to department procedures and proper testing techniques
- Evaluation of the contractor's testing equipment for proper working condition and conformance to the requirements of the appropriate test procedure
- Observation of construction procedures for uniformity of effort and results
- Review of control charts

Acceptance

Acceptance is the process of sampling, testing and inspection to determine the degree of compliance with specifications for acceptance of materials and/or contractor's work. Acceptance testing is the responsibility of the DOTD. At the end of a construction phase, through sampling, testing, and visual inspection, the department will identify the level of quality already constructed as defined by the level of conformance to specifications.

Note: There are some types of samples that are taken by the contractor in the presence of the DOTD Inspector. The DOTD inspector determines sample location and takes immediate possession of the sample. Examples are asphalt cores and profiler data.

The department evaluates the contractor's construction process, materials, personnel, equipment, and quality control program to determine if specifications are being uniformly met. **The department's results which are used to determine the acceptability of the product will take precedence over any other test results.** The contractor shall correct any deficiency identified by the department through inspection, sampling or testing at no direct pay. **Consistent or repeated failures identified by test results or repeated deficiencies identified by inspection will result in the suspension of operations until the cause is identified and corrected and the QC program is reviewed and modified to eliminate such repeated or consistent failures.**

Project personnel will sample and test material for acceptance in accordance with the *Project Sampling Plan*, based on the schedule published in the *Materials Sampling Manual*. It is to be noted that the *Materials Sampling Manual* establishes the minimum required level of sampling and testing. The engineer has the authority to require additional tests to ensure uniformity, acceptability, and quality of the work. When samples or tests yield failing results, the department will require the contractor to correct the area represented by the sample or test, unless the specifications allow the application of payment adjustments. **Materials are to be sampled, tested and approved prior to incorporation into the project. Materials that do not meet specifications are not to be placed.**

Certification of Equipment

Certified equipment and processes ensure that the plant and paving equipment is in good working condition and capable of producing the required level of quality. The contractor shall provide plant, field and testing equipment that is in good condition and appropriate for the tasks for which it is used. A list of required plant laboratory equipment is included in Chapter 4.

Prior to construction, the project engineer’s representative will inspect the equipment to be used on the project to ensure that it is appropriately calibrated, in good condition and appropriate for the activity for which it is to be used. Equipment should have the proper Equipment Certification Sticker. The inspector will require that equipment that leaks or is damaged be repaired or replaced before it will be allowed to operate on the project.

Certified and/or Qualified Technicians

Certified and/or qualified technicians are required to ensure that the personnel are adequately trained and capable to perform design, sampling, testing, and inspections. Contractor’s technicians shall be certified to design, produce, control, and make adjustments to their operation. Requiring the use of certified technicians, equipment and processes further ensures the likelihood of acceptable quality. When producing asphaltic concrete mixtures, the contractor shall employ a Certified Asphaltic Concrete Plant Technician in accordance with specification requirements.

Documentation

Documentation provides a history of each project and a track record for contractors and/or technicians. Documentation will provide information such as:

- sample times and locations,
- test results,
- level of quality and conformance to specifications,
- percent pay,
- the location at which materials were placed,
- control charts,
- and who was responsible for each part of the operation.

The contractor shall document quality control testing. The department shall document acceptance, verification and Independent Assurance testing. In addition the department shall summarize the project-specific sampling and testing at the end of the project in the 2059, or Summary of Test Results, in accordance with EDSM III.5.1.2.

Verification and the Independent Assurance Program

Verification and the Independent Assurance Program are ways for the District Lab, or Materials Lab to check the quality assurance program. Verification testing is sampling and testing for the purpose of verifying that correct and accurate procedures and equipment are being used and to determine that materials used are of the same quality as previously tested materials. The Independent Assurance Program is sampling and testing for the purpose of making an independent random check on the reliability of results obtained in acceptance sampling and testing. Independent Assurance (IA) testing is required by the FHWA on National Highway System (NHS) projects which utilize Federal Aid funding.

The *Standard Specifications* and the *Materials Sampling Manual* stipulate the frequency of samples to be submitted to the district laboratory for verification and Independent Assurance. **Under no circumstances is the Department to use the results of the contractor's QC tests for independent assurance results.**

Validation is a specific type of verification testing, performed jointly by the contractor and DOTD, which is used to determine the viability of a laboratory-designed asphalt Job Mix Formula based upon test results of plant-produced mixtures. Validation is usually performed on the first day of asphalt plant production and determines if the plant-produced mixture conforms to the proposed job mix formula.

Sampling and testing requirements for materials or processes specified in Supplemental Specifications or Special Provisions are not usually included in the *Materials Sampling Manual.* If no sampling or testing requirements are published, the Project Engineer will determine sampling and testing.

CHAPTER 2 – SECTION 502 - SUPERPAVE ASPHALTIC CONCRETE MIXTURES

This chapter describes the procedures and documentation required for designing, validating, and producing an asphaltic concrete mixture for use on a DOTD project under Section 502 of the *Standard Specifications* (Superpave Asphaltic Concrete Mixtures). It also details Plant Quality Control and Acceptance, Roadway Quality Control and Acceptance and How to Pay for Asphaltic Mix.

This Chapter shall be used in conjunction with Section 502 (Superpave Asphaltic Concrete Mixtures) and Section 503 (Asphaltic Concrete Equipment and Processes) of the Standard Specifications. However, information in this chapter also applies to Section 508 (Stone Matrix Asphalt) and some subsections of Section 1002 (Asphalt Materials and Additives) and Section 1003 (Aggregates).

Applicable test procedures are listed in Table 1, in Appendix A2. A copy of each applicable test procedure shall be available at the plant for immediate reference. The Preface contains a listing of appropriate manuals.

CERTIFICATION

PERSONNEL

The contractor/producer shall employ a Certified Asphaltic Concrete Plant Technician. This technician must be present at the plant or the job site whenever plant operations are supplying materials to a DOTD project. Daily plant operations shall not commence unless the Certified Technician is present at the plant. Subsection 502.01 of the *Standard Specifications* states that the technician be “capable of designing asphaltic concrete mixes, conducting any test or analysis necessary to put the plant into operation and producing a mixture meeting specifications.”

The department awards certification upon satisfactory completion of the requirements, which include an examination and performance evaluation. Six months experience in plant operations and QC/QA is required before an applicant is considered eligible for certification testing. Arrangements for certification testing should be made through the District Training Section. All requirements for certification are outlined in the Department’s *Administrative Manual for Inspector/Technician Training and Certification*. This manual is available at http://www.ltrc.lsu.edu/certification.html.

The DOTD Materials Engineer Administrator is the certifying authority for the Department for certification of asphaltic concrete plant and paving inspectors and technicians. When a certified or authorized inspector or technician is performing substandard work, is not able to satisfactorily perform the duties routinely required of certified or authorized personnel, engages in unethical activities, **the certification or authorization may be revoked**. Revocation of a certification or authorization for failure to update by the established completion date will be automatic.

Proceedings to revoke a certification or authorization can be initiated by LA DOTD representatives or industry, including, but not limited to: department certified inspectors, district training specialists, laboratory engineers, area engineers, project engineers, construction engineers, or any member of the Certification Committee. The appropriate representative of the employing firm may also request revocation of certification or authorizations granted to non-department personnel.

Personnel must update certifications every five years. Failure to update by the established expiration date will result in the expiration of the certification. The certification will remain expired until the required steps are taken to reestablish certification credentials.

The Department's paving inspector must be certified in the area of Asphaltic Concrete Paving Inspection. Certification in this area also requires successful completion of an examination and following a minimum of six months experience, a performance examination in roadway paving.

All Department and nondepartment technicians and inspectors are expected to continually monitor the production process for conformity to specifications and consistency. It is expected that certified personnel conduct their duties of quality control and quality assurance in a cooperative, professional, and ethical manner.

Further, it is a requirement of asphaltic concrete technicians to complete all testing, documentation, and submittals in a neat, orderly, and timely fashion. A summary list of the required documentation is provided in the Documentation section of the Superpave and SMA Chapters of this manual.

EQUIPMENT

Asphalt plants and asphalt roadway equipment must be certified at least every 2 years in accordance with Section 503 of the Standard Specifications and Chapter 4 of this manual. A certified plant and certified roadway equipment will have a sticker issued showing the date certified. Asphalt plant lab testing equipment must be calibrated and verified in accordance with Section 503 of the Standard Specifications and Chapter 4 of this manual. All scales, meters, and measuring devices shall be officially calibrated by a private, licensed testing company, or the Weights and Standards Division of the Department of Agriculture and Forestry.

DESIGN OF ASPHALTIC MIXTURES, JOB MIX FORMULA (JMF).

Listed below are the general steps required to design, validate and approve an asphaltic mixture according to the Superpave method (Section 502).

1. Material procurement and approval (fine aggregate, coarse aggregate, asphalt cement, anti-strip, and other additives)
2. Gradation and Bulk Specific Gravity (G_{sb}) determination of aggregates
3. Consensus aggregate tests and evaluations (Coarse Aggregate Angularity, Fine Aggregate Angularity, Flat and Elongated Particles, and Sand Equivalency)
4. Blending of aggregates to meet specified gradation

5. Blending aggregates to meet friction rating requirements for travel lane wearing courses
6. Trial blends with varying asphalt cement contents
7. Selection of optimum asphalt cement content
8. Dust to Effective Asphalt Cement ratio evaluation
9. Moisture sensitivity analysis
10. Submittal process and documentation – (JMF Proposal Form)
11. Approval of JMF Proposal
12. Validation of JMF Proposal
13. Final Approval of JMF

1 - Material Procurement and Approval

The QC Technician selects and procures materials to utilize in the mix design process. Materials for an asphaltic mix design include, but are not limited to aggregates, asphalt cement and anti-strip.

Source Approval – Many materials, such as aggregates and asphalt cement, are assigned a Qualified Products List, (***QPL), Source Code or a non-QPL Source Code***. A vendor can pursue QPL approval by following procedures on the website. ***Initial QPL*** source approvals may take several months or longer to complete.

Materials that are ***not*** required to be on the QPL are still required to be approved and to have a non-QPL source code. Non-QPL approval is determined by the District Lab Engineer or by the Materials and Testing Section, “Matlab”. Examples are sand, RAP and Recycled Portland Cement Concrete. ***Initial non-QPL*** source approvals may take several weeks to complete.

All **source codes** for QPL and non-QPL sources are listed on the **web site.**

AGGREGATES

Project Samples- Upon notification by the contractor, DOTD project personnel will obtain a sample of aggregate materials from the stockpile at the plant and submit the samples to the district laboratory for testing in accordance with the Materials Sampling Manual, (MSM). An Superpave Asphaltic Concrete Aggregates form must be completed for each material to be used (Appendix B1). Samples should be submitted at **least three weeks prior to the submission of the job mix proposal (JMF). JMF submittals require 7 days for approval.** No proposed JMF will be accepted until all mix components have been sampled and approved.

Coarse Aggregate – Coarse aggregates shall be defined as all material retained on or above the No. 4 (4.75 mm) sieve. Gravel, stone and crushed slag shall be listed in QPL 2. The QPL lists all approved aggregates for use on DOTD projects along with their specific allowable use (hot-mix, concrete, etc.), friction rating, water absorption, Bulk Specific Gravity (G_{sb}), and Source Code. Coarse aggregates shall also comply with Section 1003 and shall meet the requirements for coarse aggregate angularity and flat and elongated per Table 502-5.

Reclaimed asphaltic pavement (RAP) is not listed on the QPL, but must be approved by the District Lab, receiving a non-QPL source code assignment. RAP shall be cold planed in accordance with Section 509 and shall meet the requirements of Section 1003.

Fine Aggregate - Fine aggregate shall be defined as all material passing the No. 4 (4.75 mm) sieve. Fine aggregate may be natural sand, or manufactured sand (screenings). Manufactured sand (screenings) are the finer particles generated as coarse aggregates are processed. Fine aggregates shall comply with Section 1003 and shall meet the requirements for fine aggregate angularity and sand equivalency per Table 502-5.

Friction Rating - For travel lane wearing courses, the total aggregate combination shall comply with Table 502-3 Aggregate Friction Rating. This table specifies allowable usage according to mixture type and Average Daily Traffic, (ADT). The mixture type will be shown on the pavement typical sections in the contract plans. The Materials and Testing Section (Matlab) assigns each aggregate friction rating in accordance with Table 1003-3.

Asphalt Cement

Asphalt cement shall also be from an approved source listed in QPL 41. Asphalt cement grade shall comply with Subsections 1002 and 502.02(a) and Table 502-2 – Superpave Asphalt Cement Usage. Substitutions are allowed in accordance with Subsections 502.02(a). A Certificate of Delivery for Asphaltic Materials (Appendix D1) shall accompany each load delivered to the plant.

Additives – Anti-strip shall be added to all mixtures and in an amount determined in accordance with Subsection 502.02(b)(2). Anti-strip used shall be listed in QPL 57. A Certificate of Delivery for Asphalt Anti-strip Additives shall accompany each load of anti-strip. (Appendix D2)

Silicone additives, when needed, shall be in accordance with Subsection 502.02(b)(1) and from a source listed in QPL 22. They shall be dispersed into the asphalt cement by methods and in concentrations given in the QPL. A Certificate of Delivery, matching a format similar to the CD for Asphaltic Materials, shall accompany each load of silicone additives.

Hydrated lime, if used, shall be in accordance with Subsection 502.02(b)(3) and Subsection 503.05(c) and from a source listed in QPL 34. The minimum rate shall not be less than 1.5 percent by weight of the total mixture. Further, hydrated lime shall be added to and thoroughly mixed with aggregates in accordance with Subsection 503.05.(c). Hydrated lime may be also added as mineral filler in accordance with Subsection 502.02(c)(3). A Certificate of Delivery shall accompany each load of hydrated lime. (Appendix D3)

Mineral filler, if used, shall be in accordance with Subsection 502.02(c)(3) and Subsection 1003.06(a)(6) and an approved product listed in QPL 10. It shall consist of limestone dust, pulverized hydrated lime (QPL 34), Portland cement (QPL 7), or cement stack dust. A Certificate of Delivery, matching a format similar to the CD for Asphaltic Materials, shall accompany each load of mineral filler.

2 – Aggregate Bulk Specific Gravity (G_{sb}) and Gradation

Bulk Specific Gravity (G_{sb}) – Once proposed aggregate materials have been stockpiled at the plant and are approved for use, the bulk specific gravity of each mineral aggregate material shall be determined by the QC Technician,. The QC technician and department inspector shall jointly obtain two samples for G_{sb} determination from each proposed aggregate stockpile. The QC technician shall test one sample. The DOTD inspector will submit the other sample, along with an Aggregate Test Report, to the district laboratory.

The QC technician shall use AASHTO Test Procedure T 84 to determine bulk specific gravity (G_{sb}) and absorption for each proposed fine aggregate source. Note that fine aggregate is defined in the *Standard Specifications* as all material passing the No. 4 sieve.

The QC technician shall use AASHTO Test Procedure T 85 to determine bulk specific gravity (G_{sb}) and absorption for each proposed coarse aggregate source. Note that coarse aggregate is defined in the *Standard Specifications* as all material retained on or above the No. 4 sieve.

For aggregate sources which are primarily coarse and contain ten percent or less material by weight passing the No. 4 sieve, a bulk specific gravity (G_{sb}) determination on that passing portion will not be required. However, should the proposed aggregate stockpile contain more than ten percent passing the No. 4 sieve, then the finer portion shall be separated and tested in accordance with AASHTO T 84. The results, for both coarse and fine portions, shall then be mathematically combined in proportion to the amounts retained on the No. 4 and passing the No. 4 to produce a single G_{sb} value for the source. The bulk specific gravity (G_{sb}) is used to calculate VMA and asphalt absorption. False high values for G_{sb} will lead to high VMA's and negative absorptions. If negative absorptions are calculated, the G_{sb} is in error. When this occurs, the DOTD inspector is to notify the District Laboratory Engineer.

The contractor may use the calculated values for bulk specific gravity (G_{sb}) on the proposed JMF provided that they are within the following range when compared to the district laboratory's values. These values were determined from multi-laboratory precision analysis.

Multi-Laboratory Precision for Bulk Specific Gravity (G_{sb})	
	G_{sb}
Fine Aggregate	±0.035
Coarse Aggregate	±0.020

Should the contractor's values be outside this range when compared to the district laboratory, then both parties shall jointly run a third test and these results shall be used for volumetric calculations on the proposed JMF submittal.

Bulk specific gravity values agreed upon by this procedure may be used on subsequent job mix formula submittals. However, the bulk specific gravity (G_{sb}) may be retested at either party's request. If bulk specific gravity (G_{sb}) results of the retest are within the tolerances shown above when compared to the previously determined values, the QC technician has the option of using the new values or the ones previously established and used on approved, validated JMF's.

At the option of the contractor/producer or DOTD, if the proposed composite aggregate blend is already known, the bulk specific gravity (G_{sb}) may be performed on a composite belt sample, separating the fine and coarse portions, in lieu of performing the G_{sb} procedure on each individual aggregate.

NOTE

The effective specific gravity, G_{se} of the RAP aggregate will be used in lieu of G_{sb}.

To determine G_{se}, first measure theoretical specific gravity (G_{mm}) in accordance with DOTD TR 327. Then perform an extraction in accordance DOTD TR 323 to measure AC content.

$$G_{se} = \frac{100 - P_b}{\frac{100}{G_{mm}} - \frac{P_b}{G_b}}$$

where:

P_b is the % AC

G_b is the specific gravity of the AC, assumed to be 1.03.

When determining the composite gradation for mixtures containing RAP, consider the RAP aggregate as an aggregate source, so that the total aggregate percentages, including RAP aggregate equal 100%.

Here is an example of how to determine a RAP JMF composite:

Determination of RAP JMF Composite

Given:
15% RAP in mixture
0.8% AC from RAP
3.4% New AC to be added.

Step 1: Calculate % AC in the reclaimed material.
Already completed in assumption
To determine total AC content that will be attributable by RAP:
(% RAP/100)(% AC Residual from RAP)

Step 2: Determine the percentage of RAP (by weight) in mixture.
Subtract %AC in RAP from % RAP in mixture
15% - 0.8% = 14.2% Total RAP aggregate in mixture

Steps 3 thru 5 on PG 58 is for determination of Total New aggregate .
For this example new aggregates has been given as follows for VCF%
35.0% - SST #78
33.0% - LS #78
17.0% - LS #11
15.0% - Coarse Sand

100% Total New Aggregate

Step 6: Calculate total material to be added to the new aggregate
A) Add: % RAP Aggregate (14.2%)
% Reclaimed Asphalt (0.8%)
% New Asphalt Cement (3.4%)

14.2% + 0.8% + 3.4% = 18.4%

B) Subtract this percentage of material to be added to the new aggregate

100% - 18.4% = 81.6%

C) Convert to Decimal
81.6% = 0.816

D) Multiply this decimal times the bin proportions to determine Mix percentages. (% Total of new aggregate for each material) determined in Steps 3 thru 5.

SST #78	35.0% x 0.816 = 28.6%
LS #78	33.0% x 0.816 = 26.9%
LS #11	17.0% x 0.816 = 13.9%
Coarse Sand	15.0% x 0.816 = 12.2%

Step 7: Mix Percentages

SST #78	28.6%
LS #78	26.9%
LS #11	13.9%
Coarse Sand	12.2%
RAP Aggregate	14.2%
%AC from RAP	0.8%
% New AC	3.4%
TOTAL:	**100.00%**

Step 8: Aggregate Percentages for Bulk Specific Gravity Computation

A.) Total aggregate = 28.6 + 26.9 + 13.9 + 12.2 + 14.2 = 95.8

B.) New % of each aggregate by % of total aggregate = (for example) 28.6/.958 = 29.9

SST #78	29.9
LS #78	28.1
LS #11	14.5
Coarse Sand	12.7
RAP Aggregate	14.8
TOTAL:	**100.00%**

Gradation

The QC technician shall obtain a second sample from each proposed stockpile for gradation determination. An accurate gradation analysis is required for blending analysis and to determine consistency of incoming material.

It is recommended that the QC technician secure samples of all bulk shipments of aggregates delivered to the plant site. The gradation results of these shipments should be determined prior to their addition to a working stockpile. Documentation of these continuous stockpile gradation and specific gravity results shall be kept on file so that varying trends of the aggregate source may be determined.

Aggregate Stockpiles

Aggregate material is stockpiled into either a dedicated stockpile or a non-dedicated, "working" stockpile.

A dedicated stockpile is a stockpile built for a specific project. It shall be sampled and tested during construction by the Project engineer's representative at the request of the contractor. It shall not be moved or disturbed. Material cannot be added, unless the material has been sampled and tested and the addition is approved by the Project

Engineer. Only dedicated stockpiles are eligible for advanced stockpile payment in accordance with Subsection 109.06 of the specifications.

Non-dedicated or working stockpiles, are usually utilized in asphalt construction. The contractor may add material or remove material as needed, provided the quality and gradation of the material is maintained. Aggregate from working stockpiles may be used on multiple projects. Advance payment will not be made for materials in non-dedicated stockpiles. Material from non-dedicated stockpiles is sampled and tested in accordance with the *Materials Sampling Manual*.

Aggregates must be handled in a manner that will not be detrimental to the final mixture. Stockpiles shall be built in a manner that will not cause segregation. Segregation can be minimized if stockpiles are built in successive layers, not in a conical shape. Constructing stockpiles in layers enables different aggregate fractions to remain evenly mixed and reduces the tendency of large aggregates to roll to the outside and bottom of the pile. Stockpiles shall be located on a clean, stable, well-drained surface to ensure uniform moisture content throughout the stockpile. The area in which the stockpiles are located shall be large enough for the stockpiles to be separated, so that no intermixing of materials will occur. Stockpiles shall not become contaminated with deleterious materials such as clay balls, leaves, sticks or nonspecification aggregates. The materials shall not become contaminated nor segregated when they are transported from stockpiles to cold feed bins. Aggregates are often moved from stockpile to cold feed bin with a front-end loader. The operator should proceed directly into the stockpile, load the bucket and move directly out. He should not scoop aggregate from only the outside edges of the stockpile.

3 – Consensus Aggregate Test Evaluations

The consensus aggregate tests determine properties of aggregates that are expected to contribute to the performance within HMA pavements. The consensus tests are listed below:

- Coarse Aggregate Angularity (DOTD TR 306 – Double Face)
- Fine Aggregate Angularity (DOTD TR 121)
- Flat and Elongated Count (ASTM D 4791)
- Sand Equivalency (DOTD TR 120)

There are required specifications for these aggregate properties. They are listed in Table 502-5 and Appendix A3. They are based on traffic level and position within the pavement structure. Materials near the pavement surface subjected to high traffic require more stringent consensus property specifications. They are intended for application to a proposed aggregate blend, not to individual components. However, they may be run on individual aggregate sources and mathematically combined. Individual components may be tested so that poor materials may be identified.

Coarse Aggregate Angularity - (CAA)

CAA is required for all aggregates having 10% or more retained on the No. 4 (4.75mm) sieve. Aggregates not meeting this criterion are ignored in the coarse aggregate angularity calculations for the blend.

CAA is determined in accordance with TR 306 (Double Faced) on the coarse material retained on the No. 4 sieve. This test ensures a high degree of aggregate internal friction and rutting resistance. [The minimum values for this test are given in Table 502-5 for each Level, type of mix and nominal maximum aggregate size (NMS).]

The district laboratory will verify the CAA value. Should the district laboratory's results be within ±3 percent of the result reported on the JMF and be within specification limits, then the QC Technician's result may be used. If not, the QC technician shall run a third sample jointly with the District Laboratory Engineer's representative. The QC technician shall use this jointly determined value for JMF submittal.

The QC Technician shall determine and report individual source CAA on the JMF. The CAA of the composite mixture shall be determined by calculating the weighted average based on aggregate proportions and the individual CAA values.

When mathematically combining CAA, use the following equation:

$$C = \left(\frac{P_1}{P_T} \times A_{p1}\right) + \left(\frac{P_2}{P_T} \times A_{p2}\right) + \left(\frac{P_3}{P_T} \times A_{p3}\right)$$

C	= Composite, CAA
P1, P2, P3,	= % Aggregate From Cold Feed Used for Consensus Properties
PT	= Total of % Aggregate Used for Consensus Properties
Ap	= Aggregate CAA Properties

EXAMPLE: CAA Composite

P1 = 39	Ap1 = 98
P2 = 13	Ap2 = 97
P3 = 15	Ap3 = 95
PT = 67	

$$C = \left(\frac{39}{67} \times 98\right) + \left(\frac{13}{67} \times 97\right) + \left(\frac{15}{67} \times 95\right)$$

$$C = 57.04 + 18.82 + 21.26 = 97.12$$

C = 97

Fine Aggregate Angularity - (FAA)

FAA is required for all aggregates having 10% or more passing the No. 4 (4.75mm) sieve. Aggregates not meeting this criterion are ignored in the fine aggregate angularity calculations for the blend. To calculate the fine aggregate angularity for a blend, use a weighted average based on the percentages of each aggregate in the blend that meets the above criteria.

Fine Aggregate Angularity is determined in accordance with DOTD TR 121 using the bulk specific gravity, (G_{sb}), of the aggregate, washed over the No. 100 (150 µm) sieve. This property ensures a high degree of fine aggregate internal friction and rutting resistance. Higher void content means more fractured faces. (The minimum values for this test are given in Table 502-5 for each level, type of mix and NMS size.)

The district laboratory will verify this value. Should the district laboratory's results be within ±2 percent of the result shown on the JMF and be within specification limits, then the QC technician's result may be used. If not, the contractor/producer shall then run a third sample jointly with the District Laboratory Engineer's representative. The QC technician shall use this jointly determined value for the proposed JMF.

Although the individual source (FAA) is reported on the JMF, the FAA of the composite mixture shall be determined by calculating the weighted average based on aggregate proportions and the individual FAA values reported on the JMF. The QC technician shall determine this FAA composite value (and for any individual source values) and report it on the proposed JMF.

When mathematically combining FAA use the following equation:

$$C = \frac{P_1(\%P_{1\#8} - \%P_{1\#100})Ap_1 + P_2(\%P_{2\#8} - \%P_{2\#100})Ap_2}{P_1(\%P_{1\#8} - \%P_{1\#100}) + P_2(\%P_{2\#8} - \%P_{2\#100})}$$

C	= Composite FAA
P1, P2,	= % Aggregate From Cold Feed Used for Consensus Properties
%P1 #8 & %P2 #8	= % Passing #8
%P1 #100 & %P2 #100	= % Passing # 100
Ap	= FAA Aggregate Properties

EXAMPLE: FAA Composite

P1 = 39%	%P1 #8 = 5.04	%P1 #100 = 3.54	Ap = 44.1
P2 = 13%	%P2 #8 = 60.40	%P2 #100 = 13.99	Ap = 47.4

$$C = \frac{39(5.04 - 3.54)44.1 + 13(60.4 - 13.99)47.4}{39(5.04 - 3.54) + 13(60.4 - 13.99)}$$

$$C = \frac{2579.85 + 28597.84}{58.5 + 603.33}$$

$$C = \frac{31177.69}{661.83}$$

C = 47

Flat and Elongated - (F&E)

The count of flat and elongated particles, (F&E), is required for all aggregates having 10% or more retained on the No. 4 (4.75mm) sieve. Aggregates not meeting this requirement are ignored in the F&E particles calculation for the blend.

Flat and elongated is determined in accordance with ASTM D 4791 using the coarse aggregate portion retained on the No. 4 sieve. This characteristic is the percentage by weight of coarse aggregates that have a maximum to minimum dimension greater than five. Elongated particles are undesirable because they have a tendency to break during construction and under traffic. The minimum values for this test are given in Table 502-5.

The district laboratory will verify this value. Should the district laboratory's results be within ±1 percent of the result shown on the JMF and be within specification limits, then the contractor/producer's result may be used. If not, the contractor/producer shall run a third sample jointly with the District Laboratory Engineer's representative. The QC technician shall use this jointly determined value for JMF submittal.

Although the individual source results for flat and elongated particles are reported on the JMF, the F&E of the composite mixture shall be determined by calculating the weighted average based on aggregate proportions and the individual F&E values. The QC technician shall determine this F&E composite value (and any individual source values) and report it on the proposed JMF.

When mathematically combining F&E, use the following equation:

$$C = \left(\frac{P_1}{P_T} \times A_{p1}\right) + \left(\frac{P_2}{P_T} \times A_{p2}\right) + \left(\frac{P_3}{P_T} \times A_{p3}\right)$$

C	= Composite, F&E
P1, P2, P3,	= % Aggregate From Cold Feed Used for Consensus Properties
PT	= Total of % Aggregate Used for Consensus Properties
Ap	= Aggregate F&E Properties

EXAMPLE: F&E Composite

P1 = 39	Ap1 = 7
P2 = 13	Ap2 = 3
PT = 52	

$$C = \left(\frac{39}{52} \times 7\right) + \left(\frac{13}{52} \times 3\right)$$

$$C = 5.25 + 0.75$$

C = 6

Sand Equivalent - (SE)

Sand Equivalent is required for all natural sands, having 10% or more passing the No. 4 (4.75 mm) sieve and less than 25% passing the No. 200 (0.075 mm) sieve. Aggregates not meeting these two criteria are ignored in the sand equivalent calculations. Sand equivalency requirements shall apply to individual natural sand sources only and do not apply to manufactured fines or fines produced from crushing operations (e.g., screenings, No. 10's and No. 11's). Subsection 1003.06(a)(3) provides additional specifications for natural sand. (The minimum values for this test are given in Table 502-5 for each level, type of mix, and NMS size.)

SE, sometimes referred to as clay content is determined in accordance with TR 120, using the fine aggregate portions of the composite blend (natural sands only) passing the No. 4 sieve. Clay content is the percentage of clay material contained in the aggregate fraction passing the No. 4 sieve.

The contractor/producer shall determine the SE value for each individual natural sand used, and the SE composite value, and report them on the proposed JMF. The district laboratory will verify this value. The district lab's results must meet specification limits. If not, the contractor/producer shall then run a third sample jointly with the District Laboratory Engineer's representative. The QC technician shall use this jointly determined value for JMF submittal.

When mathematically combining SE, use the following equation:

C	= Composite SE
P1, P2,	= % of individual natural sands from the cold feed
PT	= % of total natural sand from the cold feed
Ap_1, Ap_2	= SE Properties

EXAMPLE: SE Composite

P1 = 10 % C. Sand	Ap1 = 75
P2 = 5 % F. Sand	Ap2 = 50
PT = 15 %	

$$C = \frac{10x75}{15} + \frac{5x50}{15}$$

C = 50 + 17

C = 67

> **NOTE**
>
> The aggregate source properties, G_{sb}, CAA, FAA, F&E, and SE must be re-verified by the District Lab personnel at least every 6 months. If material properties change beyond the allowable verification limits, the district lab engineer will disapprove the existing JMF.

4 – Blending Aggregates to Meet Specified Gradation

Following bulk specific gravity (G_{sb}) determinations, gradation and aggregate consensus tests analysis, the technician must determine a master composite blend of the proposed, approved aggregates. Again, the mixture type shall be determined from the typical sections in the project plans. Tables 502-4 in the *Standard Specifications* lists a nominal maximum size aggregate for each type, a specification gradation limit for each mixture type, and tolerances (plus and minus) for the proposed JMF blend.

The following definitions are used by the DOTD to determine these sizes:

- **Nominal Maximum Size (NMS) – One sieve size larger than the first sieve to retain more than 10 percent by weight of the combined aggregates.**

- **Maximum Size (MS) – One sieve size larger than the nominal maximum size.**

With the mixture type known, the QC Technician can begin to mathematically blend the proposed aggregates to meet the requirement of Tables 502-4. An approved computer spreadsheet may be used for this task.

Table 502-5 – Superpave Design, Control and Acceptance specifies the maximum percent of natural sand and RAP that are allowed in Superpave. The maximum natural sand percent is determined by percent of new aggregate; the maximum percent of RAP is by percent of total mix.

Once the aggregates have been mathematically blended to meet requirements of Section 502, the composite gradation is plotted on the appropriate *Asphaltic Concrete Gradation – 0.45 Power Curve* for the corresponding nominal maximum aggregate size (Appendix C6). The 0.45 power curve uses a unique graphing technique to show the cumulative particle size distribution of an aggregate blend. The ordinate (vertical axis) of the chart is percent passing. The abscissa (horizontal axis) is an arithmetic scale of sieve size in mm of opening, raised to the 0.45 power. On these charts, the maximum density grading for a particular maximum size corresponds to a straight line drawn from the origin to the selected maximum aggregate size. It must be noted that this maximum density line is approximate, but can serve as a useful reference in proportioning aggregates. These power curves also depict other features. The **control points** function as specification limits through which the composite gradation must pass.

Further, LA DOTD allows for all mixtures produced under Section 502 to be either on the coarse or the fine side A coarse and fine side gradation plot on the 0.45 power curve is shown in Figure 2-1

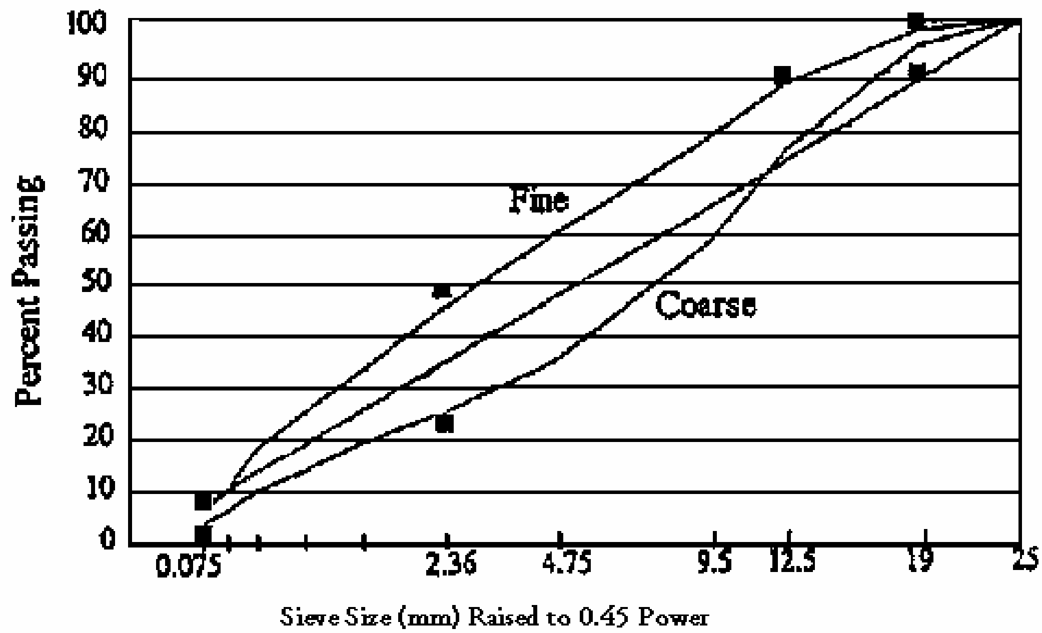


Figure 2-1 – 0.45 Power Curve with Coarse and Fine Sided Gradations

Care should be taken in the selection of the final composite aggregate blend. Many coarse graded blends may, if not properly designed and compacted, lead to pavements that are very porous and allow water to permeate the base and subbase.

Following is an example of the gradation requirements and a typical fine side proposed composite gradation Superpave 1/2 inch NMS (12.5mm

Sieve Size	Control Points	Mix Tolerance	Proposed JMF	JMF Limits
1.0 inch		± 4	100	100
¾ inch	100	± 4	100	100
½ inch	90-100	± 4	99	95-100
3/8 inch	89 max	± 4	89	85-93
No. 4		± 4	57	53-61
No. 8	34-58	± 3	34	31-37
No. 16		± 2	23	21-25
No. 30		± 2	17	15-19
No. 50		± 2	12	10-14
No. 100		± 2	7	5-9
No. 200	4.0-10.0	± 0.7	5.1	4.4-5.8

For gradation purposes, all values are reported to the nearest whole number with the exception of the No. 200 sieve size, which is rounded to the nearest tenth.

Note that the mix tolerances are applied to the proposed JMF to determine the allowable upper and lower limit. Tolerance limits may only exceed control points during production, but not on the JMF or during validation. For example, during validation, the JMF limits in the example above for the 3/8 inch sieve are 85 – 89.

5 – Blending Aggregates to Meet Friction Rating Requirements for Travel Lane Wearing Courses

Friction Rating – A friction rating is a relative indicator of the skid resistant properties of the aggregate. Friction ratings are assigned by the DOTD Materials and Testing Section to an aggregate source in accordance with Table 1003-3. These assigned friction ratings are listed for each aggregate on QPL 2.

Aggregates used in asphaltic mixtures which are used for the **final lift of the travel lane wearing course** have friction rating requirements in accordance with Table 502-3. The requirements are based upon current Average Daily Traffic (ADT) as shown on the plans and based on mix use and type. Generally frictional aggregates are not required in binder or base courses, shoulders, or in mixtures used for bike paths, curbs, driveways, guardrail widening, islands, joint repair, leveling, parking lots, patching, or widening. However, if the mixture type specified on the typical section of the plans is ***Level 1F or 2F***, then special friction rating requirements do apply. Level 1F or 2F asphalt mixtures have the same requirements as travel lane wearing course with current ADT > 7000. Table 502-3 is reprinted here from the Standard Specifications:

Table 502-3

Aggregate Friction Rating

Friction Rating	Allowable Usage
I	All mixtures
II	All mixtures
III	All mixtures, except travel lane wearing courses with plan ADT greater than 7000[1]
IV	All mixtures, except travel lane wearing courses[2]

[1] Blending of Friction Rating III aggregates and Friction Rating I and/or II aggregates will be allowed for travel lane wearing courses with plan current average daily traffic (ADT) greater than 7000 at the following percentages. At least 30 percent by weight (mass) of the total aggregates, including RAP aggregates, shall have a Friction Rating of I, or at least 50 percent by weight (mass) of the total aggregates, including RAP aggregates, shall have a Friction Rating of II. The frictional aggregates used to obtain the required percentages shall not have more than 10 percent passing the No. 8 (2.36mm) sieve.

[2] Blending of Friction Rating IV aggregates and Friction Rating I and/or II aggregates will be allowed for travel lane wearing courses with plan current average daily traffic (ADT) less than 2500 at the following percentages. At least 50 percent by weight (mass) of the total aggregates, including RAP aggregates, shall have a Friction Rating of I or II. The frictional aggregates used to obtain the required percentages shall not have more than 10 percent passing the No. 8 (2.36mm) sieve.

This chart is not in the Specifications, but may be helpful in determining the allowable usage of aggregates.

ALLOWABLE USE				
ADT	FR I	FR II	FR III	FR IV
> 7000	Allowed	Allowed	*Allowed only with 30% FR I or 50% FR II	Not Allowed
2500 to 7000	Allowed	Allowed	Allowed	Not Allowed
<2500	Allowed	Allowed	Allowed	*Allowed only with 50% FR I or 50% FR II

***In the two special "*Allowed only with…" cases above, the FR I or FR II aggregates must not have more than 10 percent passing the No. 8 sieve. Otherwise, they are too fine to be counted as a friction aggregate.**

EXAMPLE 1:
Consider this JMF submitted for a travel lane wearing of current ADT 21,000.

AGGREGATE NAME	% of Total Aggregate on JMF	FR from QPL	% passing No. 8
A - # 5 LS	22	III	0
B - #7 LS	20	III	2
C - # 11	14	I	29
D – Black # 11	20	I	16
E – RAP	18	N/A	50
F – Coarse Sand	6	N/A	86
	100 % total		

Looking at the Allowable Use Chart above, Aggregates C and D, with FR I, are allowed. However Aggregates A and B, with FR III, are allowed ***only if there are sufficient amounts of FR I or II in the blend.*** Combining the percentages of Aggregate's C and D, we get 14 + 20 = 34%, which is greater than the 30% required. However, these both have more than 10% passing the No. 8 sieve, and cannot be counted as frictional aggregate. Therefore, this is **not approved** as an appropriate blend. Note that RAP is not considered frictional aggregate.

EXAMPLE 2:
Consider this JMF submitted for a travel lane wearing of current ADT 8200.

AGGREGATE NAME	% of Total Aggregate on JMF	FR from QPL	% passing No. 8
A - # 5 SS	36	I	0
B - #7 LS	24	III	2
C - # 11 LS	25	III	29
D – Coarse Sand	15	N/A	86
	100 % total		

Looking at the Allowable Use Chart, Aggregate A is allowed. Aggregates B and C are allowed only if there is a sufficient % of FR I aggregate. The % of Aggregate A is 36% which is greater than the 30% required. Also, Aggregate A has less than 10% passing the No. 8, so it can be counted. This blend is **approved.**

6 - Trial Blends with Varying Asphalt Cement Contents

The QC technician, following determination of the composite aggregate blend, shall prepare trial blends of hot-mix asphalt with varying percentages of asphalt cement. These trial blends may be produced either in the design laboratory or the HMA plant.

The QC technician shall prepare three trial blends with the proposed composite aggregate blend. One of the blends shall be prepared at an asphalt cement content near optimum (as defined by a specified air void content, V_a). A second trial blend shall be prepared at an asphalt cement content approximately 0.5% less than optimum. A third trial blend shall be prepared at an asphalt cement content approximately 0.5% greater than optimum. A minimum of two specimens shall be prepared at each of the trial asphalt cement contents.

The mixing and compaction temperature used for preparing the trial mixes shall be determined by the asphalt cement supplier and will be printed on the Certificate of Delivery that accompanies each transport of asphalt cement delivered to the plant. (The traditional method of determining asphalt cement mixing and compaction temperatures, via a temperature/viscosity chart is not valid for many of the polymer-modified asphalts now in use.)

Unless procedures require otherwise, the laboratory produced mix shall be cured 2 hours in the mold and plant produced mix shall be cured 1 hour in the mold at the compaction temperature (±10°F). When the aggregate water absorption is >2%, the oven aging time for plant-produced mix shall be 2 hours.

Once the trial blends have been prepared, specimens (briquettes) shall be tested for the following:

1. Bulk Specific Gravity, G_{mb} at N_{design}
2. Air Voids, V_a at N_{design}

3. Voids in Mineral Aggregate, VMA at N_{design}
4. Voids Filled with Asphalt, VFA at N_{design}
5. Percent G_{mm} at $N_{initial}$
6. Percent G_{mm} at N_{design}
7. Percent G_{mm} at N_{max}

In addition, a loose mix sample from each trial blend asphalt cement content shall be prepared and tested for maximum theoretical specific gravity, G_{mm} (Rice Gravity) using DOTD TR 327. For laboratory produced trial blends, the mixture, when tested for G_{mm}, shall be cured at compaction temperature for approximately two hours prior to specimen preparation. Plant produced trial blends require one hour curing or aging period. The G_{mm} test values for the two specimens at each asphalt content shall be averaged to report a single value.

Mineral aggregate is porous and can absorb water and asphalt to a variable degree. Furthermore, the ratio of water to asphalt absorption varies with each aggregate. The three methods of measuring aggregate specific gravity take these variations into consideration. The methods are bulk, apparent, and effective specific gravities. The differences among the specific gravities come from different definitions of aggregate volume. The department, for use when analyzing and documenting Superpave hot-mix asphalt mixtures, adopts the following definitions and nomenclature.

- Bulk Specific Gravity, $G_{sb,}$ the ratio of the weight in air of a unit volume of a permeable material (including both permeable and impermeable voids normal for the material) at a stated temperature to the weight in air of equal density of an equal volume of gas-free distilled water at a stated temperature. See Figure 2-2

- Apparent Specific Gravity, G_{sa} – The ratio of the weight in air of a unit volume on an impermeable material at a stated temperature to the weight in air of equal density of an equal volume of gas-free distilled water at a stated temperature. See Figure 2-2.

- Effective Specific Gravity, G_{se} – The ratio of the weight in air of a unit volume of a permeable material (excluding voids permeable to asphalt) at a stated temperature to the weight in air of equal density of an equal volume of gas-free distilled water at a stated temperature. See Figure 2-2.

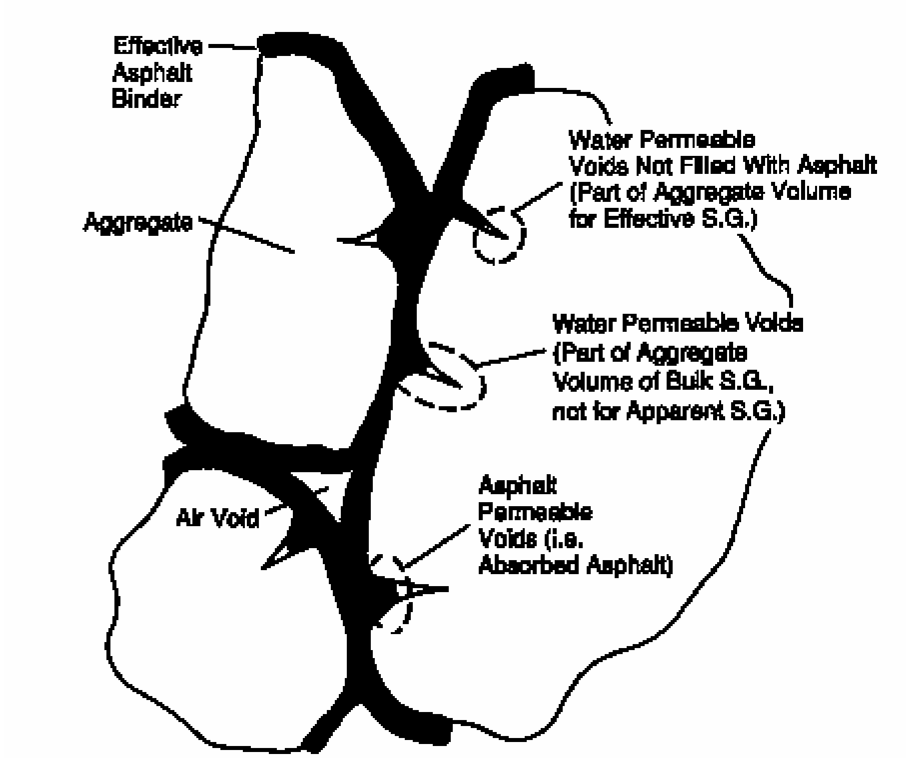


Figure 2-2 – Illustrating Bulk, Effective and Apparent Specific Gravities, Air Voids, and Effective Asphalt Content in Compacted Asphalt Paving Mixture

- Voids in Mineral Aggregate, VMA – The volume of intergranular void space between the aggregate particles of a compacted paving mixture that includes the air voids and the effective asphalt content, expressed as a percent of the total volume of the sample. See Figure 2-3.

- Air Voids, V_a – The total volume of the small pockets of air between the coated aggregate particles throughout a compacted paving mixture, expressed as a percent of the bulk volume of the compacted paving mixture. See Figure 2-3.

- Voids Filled with Asphalt, VFA – The portion of the volume of intergranular void space between the aggregate particles (VMA) that is occupied by the effective asphalt. See Figure 2-3.

- Effective Asphalt Content, P_{be} – The total asphalt content of a paving mixture minus the portion of asphalt that is lost by absorption into the aggregate particles. See Figure 2-3.

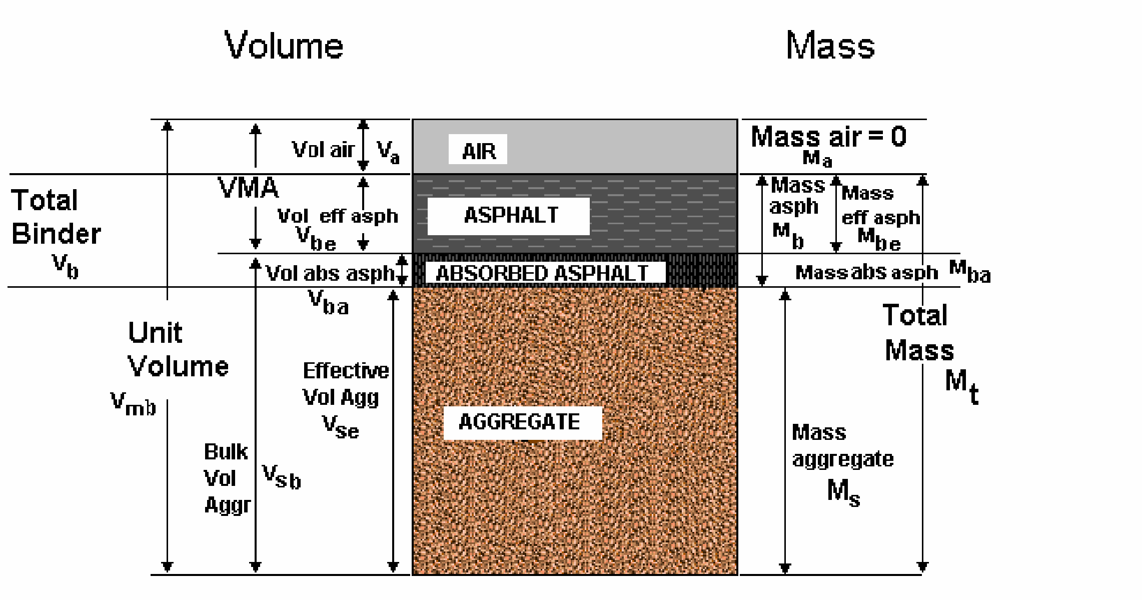


Figure 2-3 – Representation of Volumes in a Compacted Asphalt Specimen (Phase Diagram)

- Asphalt Cement Specific Gravity, G_b – The ratio of the mass in air of a given volume of asphalt binder to the mass of an equal volume of water, both at the same temperature.

- Mixture Bulk Specific Gravity, G_{mb} – The ratio of the mass in air of a given volume of compacted HMA to the mass of an equal volume of water, both at the same temperature.

- Theoretical Maximum Specific Gravity, G_{mm} (Rice Gravity) – The ratio of the mass of a given volume of HMA with no air voids to the mass of an equal volume of water, both at the same temperature.

- Initial Number of Gyrations, $N_{initial}$ - This is the number of gyrations (7 or 8 gyrations) that represents a measure of mixture compactability. Mixtures that compact too quickly are believed to be tender during construction and may be unstable when subjected to traffic.

- Design Number of Gyrations, N_{design} - This is the number of gyrations required to produce a density in the mix that is equivalent to the expected density in the field after traffic. In the mix design process, an asphalt content is selected that will provide 3.5 percent air voids when the mix is compacted to N_{design} gyrations.

- Maximum Number of Gyrations, N_{max} - This is the number of gyrations required to produce a density in the laboratory that would never be exceeded in the field. N_{design} provides an estimate of the ultimate field density. N_{max} provides a compacted density with some safety factor to ensure that the mixture does not densify too much, which would result in low in-place air voids, which can cause rutting. The air voids at N_{max} are required to be at least 2 percent. Mixtures that have less than 2 percent air voids at N_{max} are believed to be more susceptible to rutting than mixtures exceeding 2 percent air voids.

The following standard conventions are used to abbreviate asphalt cement (binder), aggregate and mixture characteristics:

Specific Gravity (G): G_{xy}

x - b = binder
s = aggregate (for example, stone)
m = mixture

y - b = bulk
e = effective
a = apparent
m = maximum theoretical

Mass (P) or Volume (V) Concentration: P_{xy} or V_{xy}

x - b = binder
s = aggregate (for example, stone)
a = air

y - e = effective
a = absorbed

Here is Superpave nomenclature related to volumetric calculations:

Superpave Nomenclature

G_{mb} = bulk specific gravity of the compacted HMA specimen.

G_{mm} = maximum specific gravity of the paving mixture (no air voids)

G_b = specific gravity of the asphalt

G_{se} = effective specific gravity of the aggregate

G_{sb} = bulk specific gravity of the aggregate

V_a = air voids in the compacted mixture, percent of total volume

VMA = voids in the mineral aggregate, percent of bulk volume.

VFA = voids filled with asphalt, percent of VMA

P_s = aggregate content, percent by total mass of the mixture

P_b = asphalt content, percent by total mass of the mixture

P_{ba} = absorbed asphalt, percent by mass of the aggregate

P_{be} = effective asphalt content, percent by total mass of the mixture

P_{200} /P_{be} = dust to asphalt ratio

P_{200} = aggregate content passing the N0. 200 sieve, percent by mass of aggregate

The VMA values for compacted asphalt paving mixtures are to be calculated in terms of the bulk specific gravity (G_{sb}) of the combined aggregate.

Voids in the mineral aggregate (VMA) and air voids (V_a) are expressed as percent by volume of the paving mixture. Voids filled with asphalt (VFA) is the percentage of VMA that is filled by the effective asphalt cement, (P_{be}). The effective asphalt cement content shall be expressed as a percent by weight of the total weight of the mixture.

The following equations are used to compute the volumetric properties of compacted hot-mix asphalt specimens:

Bulk Specific Gravity of HMA Specimen G_{mb}

$$G_{mb} = \frac{\text{Weight in Air}}{\text{SSD Weight} - \text{Weight in Water}}$$

Air Voids, V_a:

$$V_a = 100x\,\frac{G_{mm} - G_{mb}}{G_{mm}}$$

Voids in Mineral Aggregate, VMA:

$$VMA = 100 - \frac{G_{mb} \times P_s}{G_{sb}}$$

Voids Filled with Asphalt, VFA:

$$VFA = 100 \times \frac{VMA - V_a}{VMA}$$

Effective Specific Gravity, G_{se}:

$$G_{se} = \frac{100 - P_b}{\frac{100}{G_{mm}} - \frac{P_b}{G_b}}$$

Percent Absorbed Asphalt, P_{ba}:

$$P_{ba} = \frac{(100 \times G_b)(G_{se} - G_{sb})}{G_{sb} \times G_{se}}$$

Percent Effective Asphalt Cement, P_{be}:

$$P_{be} = P_b - \frac{P_{ba} \text{ x } P_s}{100}$$

Dust to Asphalt Ratio, D/P or P_{200}/P_{be}:

$$\text{Dust Ratio} = \frac{P_{200}}{P_{be}}$$

Slope of Gyratory Compaction Curve:

$$Slope = \frac{(\%G_{mm} @ N_{des} - \%G_{mm} @ N_{ini})}{(\log(N_{des}) - \log(N_{initial}))}$$

Note: The $\%G_{mm}$ is from the N_{max} briquette.

The Superpave volumetric analysis results for the trial blends shall be documented on an approved computer generated spreadsheet or a similar DOTD supplied form.

The following relationships, as determined from these equations, shall also be plotted on an approved graph or the form to show the Optimum Asphalt Cement Content - Summary of Test Properties. (Appendix C1)

1. Air Void (V_a) versus asphalt content
2. Voids in Mineral Aggregate (VMA) versus asphalt content
3. Voids Filled with Asphalt (VFA) versus asphalt content
4. Percent G_{mm} at $N_{initial}$
5. Percent G_{mm} at N_{design}.

7 – Selection of Optimum Asphalt Cement Content

Examining the test property curves plotted on the department's *Optimum Asphalt Cement Content Summary of Test Properties*, reveals information about the sensitivity of the mixture to asphalt content. Trends generally noted are:

- The percent air voids (V_a) steadily decreases with increasing asphalt cement content, ultimately approaching a minimum void content.

- The percent voids in the mineral aggregate (VMA) generally decreases to a minimum value then increases with increasing asphalt cement content.

- The percent voids filled with asphalt (VFA) steadily increase with increasing asphalt cement content because VMA is being filled with asphalt cement.

- The percent G_{mm} at $N_{initial}$ increases with increasing asphalt cement content.

- The percent G_{mm} at N_{design} consistently increases with increasing asphalt cement content.

The design asphalt cement content of the mixture is selected at that percentage yielding the median percentage of the range of air voids (which is 3.5 percent for all Superpave mixtures) and yielding the required target for VFA (which is 73% ± 1%). In addition, all of the calculated and measured mix properties at this asphalt cement content should then be evaluated and compared to the specified values in Table 502-5. If all of the design criteria are not met, then some adjustment is necessary or the mix may need to be redesigned.

8 – Dust to Effective Asphalt Cement Ratio Evaluation

Another mixture requirement, as per Table 502-5, is the dust ratio. This is computed as the ratio of the percentage by weight of aggregate finer than the No. 200 sieve to the effective asphalt content (P_{be}) expressed as a percent by weight of the total mixture. Effective asphalt content is the total asphalt used in the mixture less the percentage of absorbed asphalt.

Dust to Asphalt Ratio, D/P or P_{200}/P_{be}:

$$\text{Dust Ratio} = \frac{P_{200}}{P_{be}}$$

The dust ratio, P_{200}/P_{be}, tolerance for all Superpave mixtures is 0.6 to 1.6.

9 – Moisture Sensitivity Analysis – Tensile Strength Ratio, (TSR), (Lottman)

To complete the design process, the QC technician shall perform the moisture sensitivity test (DOTD TR 322) to evaluate the proposed hot-mix asphalt blend for stripping. This test identifies whether a combination of asphalt binder and aggregate is moisture susceptible.

Subsection 502.03 requires that mixtures yield a minimum TSR of 80 percent. In addition, the *Standard Specifications* require that the proposed JMF stipulate a single anti-strip rate, which is 0.1 percent greater than the percentage that will yield this TSR value up to a maximum of 1.2 percent. Tensile Strength Ratio (TSR) in Appendix C2 depicts typical Lottman results and the form on which they should be reported.

After validating the approved JMF proposal for mix properties in accordance with Subsection 502.04, the contractor, witnessed by the Department, shall sample the next day's production and perform validation testing at the plant for DOTD TR 322 and AASHTO T 312 specimens. Results will be reported on the TSR Form and forwarded to the District Laboratory Engineer with the JMF proposal. When the validation results are less than 80 percent, no further production for that job mix formula or any proposed job mix formula substituted for that mix type will be accepted on any DOTD project having DOTD TR 322 requirements until a passing plant-produced Tensile Strength Ratio (TSR) value is verified by the Department.

10 – Submittal Process and Documentation – (JMF Submittal Form)

Once the optimum asphalt cement content has been determined for the proposed aggregate blend and the consensus aggregate tests, dust proportion and the moisture sensitivity analysis (DOTD TR 322) have been completed, the certified QC technician is prepared to submit the proposed job mix formula (JMF) to the District Laboratory Engineer. The JMF shall be submitted on a properly completed JMF Superpave Asphaltic Concrete Mixtures Form (Appendix C3) or an approved computer generated form similar to the one furnished by DOTD. (Appendix C4).

The QC technician shall submit the following information to the District Laboratory Engineer with the JMF.

1. A proposed blend summary with individual source and composite gradations, volumetric analysis at optimum asphalt cement content, including two N_{design} and one N_{max} briquette. (Appendix C5).

2. Bulk specific gravity, G_{sb}, of each aggregate and the combined bulk specific gravity for the mineral aggregate blend. Friction ratings if applicable. Effective specific gravity (G_{se}) of RAP and % AC of RAP.

3. A graph on the Asphaltic Concrete Gradation – 0.45 Power Curve form, (Appendix C6), showing proposed composite gradation plotted to the 0.45 power curve

4. A quantitative summary of three (minimum) trial blends at optimum and ± 0.5 percent asphalt cement along with volumetric calculations (Appendix C7).

5. Optimum Asphalt Cement Content - Summary of Test Properties (Appendix C1) showing VMA, V_a, VFA, percent G_{mm} at $N_{initial}$ and percent G_{mm} at N_{design} versus asphalt cement content.

6. Coarse aggregate angularity (CAA) test results and calculations (Appendix B1).

7. Fine aggregate angularity (FAA) test results and calculations (Appendix B1).

8. Flat and Elongated Count (FE) test results and calculations (Appendix B1).

9. Sand equivalency (SE) test results and calculations (Appendix B2).

10. Gyratory compactor test results for two samples (laboratory or plant produced) prepared at optimum asphalt cement content for the proposed trial blend compacted to N_{design} and one sample compacted to N_{max} (Appendix C4).

11. Moisture Sensitivity results (from the laboratory or plant design) (Appendix C2).

The original signed JMF Proposal, along with the supporting documents, shall be submitted together to the District Laboratory Engineer for approval no less than 7 days before anticipated production is to begin.

11 – Approval of JMF Proposal

The District Laboratory Engineer must approve the proposed Job Mix Formula before any mixture can be produced for the department. Upon approval of the proposed JMF, the District Laboratory Engineer will give it a numerical identification (the JMF Sequence Number). This identifying code must be clearly written, typed, or printed on the JMF Proposal From and all supporting documentation.

Upon approval of the JMF, the District Laboratory Engineer will sign the original in the Proposal Approved section of the document and date it. The district laboratory will retain a copy; the original will be returned to the plant pending validation.

12 – Validation of JMF Proposal

Once the District Laboratory Engineer has approved the JMF for validation, the plant may begin producing mixtures for the department in accordance with the JMF.

However, before the validation process begins for the approved JMF Proposal, the project engineer in charge of the project must verify that the mix type and project specifications for the project(s) receiving the mix are the same as the proposed mix design and appropriate for the application.

It is the responsibility of the QC technician to always provide the project engineer with a copy of the approved JMF proposal and anticipated validation schedule prior to production for a particular project. (A scanned or facsimile copy will suffice.)

The JMF Proposal validation will be completed on the first production lot in accordance with Subsection 502.04 and Subsection 502.13. The evaluation is designed to ensure that the mixture produced in the plant meets the tolerances set forth in the JMF Proposal and to establish the approved Job Mix Formula.

Specifications state that, "Payment for validation lots will be in accordance with acceptance pay parameters, except that five cores shall be obtained to determine density pay." PWL analysis shall be used to determine pay for the validation lot. The validation lot will be paid separately, not combined with subsequent production lots.

Here is an illustrative example of how to pay for a validation lot.

Assume that the contractor runs 2000 tons for validation. The first 250 tons were used to make adjustments to the mix. The voids were 2.2 %, and the density of the first core was 94.3.

Using Table 502-8, Payment Adjustment Schedule for Small Quantities of Superpave:

Voids pay = 95%
Density pay = 100%.

Total pay for the first 250 tons is the average of voids and density pay.

95 + 100 = 195/2 = 97.5 pay = 98% pay.

The remaining 1750 tons were tested with results as follows:

Voids -	3.5	3.4	3.5	3.3	3.5
Density	94.3	94.5	94.4	95.4	94.3

The method for determining PWL calculations and percent pay will be explained later. However, for the purpose of illustration, these 5 voids results would produce:

PWL for voids = 100
Voids pay from Table 502-7A will be 103% pay.
The PWL for density = 100.

Therefore, from Table 502-7B, density pay is 105% pay.
Total pay for 1750 tons of validated mix is the average of voids and density pay = 104% pay.

The performance of the mixture on the roadway will also be evaluated to ensure that the JMF is not contributing to laydown deficiencies, such as segregation, tenderness, workability, compactibility, or surface texture problems. Mixtures that are identified as causing any laydown deficiency will not be validated. The project engineer in charge of the project or the District Laboratory Engineer may deem a proposed JMF invalid for roadway deficiencies. If deficiencies are discovered, the roadway inspector will inform the plant inspector, the project engineer, and the lab engineer.

Additionally, if the mixture exhibits uncoated aggregate or possible moisture problems, the QC technician and department inspector will perform **DOTD TR 328 (Ross Count) to ensure that the mixture meets the 95 percent coating requirement of the specifications (Subsection 503.08) and DOTD TR 319 to ensure that the moisture content of the mixture does not exceed the 0.3 percent specification requirement.**

If a mixture design fails to validate, a new proposal must be submitted and validation testing repeated or the producer may use a previously approved Job Mix Formula. No mixture shall be produced for a DOTD project until the District Laboratory Engineer has approved a new JMF proposal. If the JMF does not validate, the District Laboratory Engineer will indicate disapproved on the proposed JMF Proposal, enter the sequence number, date and sign it (Disapproved). Copies of the disapproved JMF Proposal will be distributed to each project engineer who received a portion of the lot.

Repeated validation failures indicate a serious problem with quality or quality control. If the first and second validation attempt fails, the contractor will be allowed to redesign and try another validation. However if the second mix design validation also fails, then the contractor will not be allowed to place mixture on this project. The contractor must redesign and validate off-site, not on state property and at no direct pay. The off-site validation plan must be pre-approved by the District Laboratory Engineer. Once completed, the validation data is promptly forwarded to the District Laboratory Engineer for review. The District Lab Engineer will determine if an additional validation is required on the state project.

13 – Final Approval of JMF

The District Laboratory Engineer, upon receipt of the validated JMF and supporting PWL (Percent Within Limits) calculations, will sign and date the document for a second time on the Approved Line. Copies of the approved mixture design will then be returned to the plant laboratory. Once a completed mixture design has been validated and approved, the same JMF may be used for all projects having the same specification requirements.

If a previously approved, validated JMF has not been produced within one year, the District Laboratory Engineer may require a check of gradation and aggregate properties or may require a full re-validation before allowing mixture production.

It is the responsibility of the QC technician to provide the project engineer (in charge of a project anticipating receiving mix from the plant) with a copy of the approved Job Mix Formula (cover sheet only) prior to production (a facsimile will suffice). The Project Engineer will send a copy to the roadway inspector.

The District Laboratory Engineer will provide the contractor, producer, department plant personnel, and the project engineer who is receiving the mixture with an approved copy of the mixture design for project records.

In summary:

1. Contractor submits proposed JMF to District Lab Engineer (DLE)
2. DLE approves JMF for Validation
3. Validation is performed, data send to DLE
4. DLE reviews and approves.
5. Validated proposal becomes new Approved JMF.

A summary of the asphaltic concrete mix design steps is shown on the following two pages.

Asphalt Concrete Mix Design Steps

Material Procurement

Coarse Aggregate

- QPL 2?
- Friction Rating OK?
- G_{sb} Determined?
- Gradation Determined?
- CAA Determined?
- FE Determined?

RAP

- Approved Stockpile?
- Gradation Determined?
- Percent AC Determined?
- G_{se} Determined?

Fine Aggregate

- District Lab Approved?
- G_{sb} Determined?
- Gradation Determined?
- FAA Determined?
- SE Determined?

Asphalt Cement

- QPL 41?
- Correct Grade?

Blending Aggregates

- Mixture Type Determined From Project Plans?
- Nominal Maximum Aggregate Size Determined?
- Aggregate Mathematically Blended to Meet Table 502-4?
- Composite Gradation Plotted on the 0.45 Power Curve?
- Blended Gradation Within Control Points?
- Blended Gradation Within FAA Specification?
- Blended Gradation Within CAA Specification?
- Blended Gradation Within SE Specification?
- Blended Friction Rating Within FR Specification?

Preparing Trial Blends Using Varying Asphalt Contents

- One Trial Blend Prepared At Optimum AC%?
- One Trial Blend Prepared 0.5% Above Optimum AC%?
- One Trial Blend Prepared 0.5% Below Optimum AC%?
- Two Specimens Prepared at Each Trial Blend?
- Loose Mix Specimens Prepared at Each Trial Blend?

Testing and Evaluating Trial Blends Using Varying Asphalt Contents

- G_{mm} Determined for Each Blend?
- G_{mb} @ N_{design} Determined for Each Blend?
- V_a @ N_{design} Determined for Each Blend? — V_a "vs" Asphalt Content Plotted on Graph?
- VMA @ N_{design} Determined for Each Blend? — VMA "vs" Asphalt Content Plotted on Graph?
- VFA @ N_{design} Determined for Each Blend? — VFA "vs" Asphalt Content Plotted on Graph?
- Percent G_{mm} @ $N_{initial}$ Determined for Each Blend? — Percent G_{mm} @ $N_{initial}$ "vs" Asphalt Content Plotted on Graph?
- Percent G_{mm} @ N_{design} Determined for Each Blend? — Percent G_{mm} @ N_{design} "vs" Asphalt Content Plotted on Graph?
- Percent G_{mm} @ N_{max} Determined for Each Blend?

Selection of Optimum Asphalt Cement Content

- Optimum Blend Yielding Design V_a Determined?
- Blend Prepared at Optimum Asphalt Content?
- VMA @ Design Blend Within Specifications?
- VFA @ Design Blend Within Specifications?
- $N_{initial}$ @ Design Blend Within Specifications?
- N_{design} @ Design Blend Within Specifications?
- N_{max} @ Design Blend Withing Specifications?
- Moisture Sensitivity, TSR Greater Than 80 Percent?
- Dust / Effective Asphalt Ratio Within Specification?
- Permeability Within Specification?

Job Mix Formula, JMF Submittal

Asphaltic Concrete Job Mix Release Form

- Proposed Blend Summary
- G_{sb} of Each Aggregate and Combined G_{sb}
- 0.45 Power Curve With Control Points
- Summary of Three Trial Blends
- Optimum Asphalt Cement Content Summary of Test Properties
- Coarse Aggregate Angularity, CAA Test Results
- Fine Aggregate Angularity, FAA Test Results
- Flat and Elongated Count, FE Test Results
- Sand Equivilancy, SE Test Results
- Gyratory Compactor Test Results For Two Samples Prepared At Optimum AC
- Tensile Strength Ratio, TSR Test Results

PLANT QUALITY CONTROL

The primary responsibilities of the QC technician are to design hot mix asphalt, (HMA) and control the production to ensure that it consistently meets departmental requirements.

The certified QC technician shall be at the plant for the beginning of daily operations. Whenever HMA mixtures are being produced for a DOTD project, the certified technician must be either at the plant or the paving site.

It is the QC technician's responsibility to perform all tasks necessary to begin plant operations. This includes, but is not limited to, checking asphalt cement working tanks, material stockpiles, aggregate bins, cold feed settings, meters and scales. The certified technician is responsible for recommending appropriate adjustments and ensuring that these adjustments have been made during continuing operations to ensure uniformity and conformance to specifications.

In addition, the certified technician shall oversee and monitor the complete production, transport, placement, and compaction phases to ensure compliance with DOTD specifications and to promote consistency.

The QC technician shall be knowledgeable of proper plant operations and be aware of moisture inconsistencies. When the plant is put into operation, the QC technician shall monitor stockpiles to ensure that they are constructed properly and that moisture contents entered into the plant controls are consistent with actual values for each material bin.

Plant operations are to be continuously inspected to ensure the following:

- Proper bag house operation (startup and shutdown loads will be impacted by improper sequence of fines return from the dust collection system, producing material with inconsistent amounts passing the No. 200 sieve.)

- Sufficient HMA is wasted at startup and shutdown to ensure adequate, sufficient, and consistent asphalt cement rates.

- Proper loading of trucks to minimize material segregation.

Gradation

Sampling and testing shall be in accordance with Subsection 502.05 and the Materials Sampling Manual. Proper sampling is crucial for accurate results that represent actual plant production.

The QC technician should also, at regular intervals, check to ensure that the aggregate proportioning system, as well as the RAP proportioning system, is in calibration. This may be a two-step process. First, the weighbridge is checked to ensure that it is in calibration. This may be determined by running a known mass of material over it and correcting the weighbridge factor to get it into calibration over the full span of expected weights. Secondly, each cold feed bin should be calibrated as needed to ensure that the proper mass of material/per unit time is being proportioned from the individual bin.

There are other methods for checking cold feed calibrations, such as that in DOTD's publication, *Cold Feed Adjustments for Asphaltic Concrete Plants*. In any method used, the measured weight of the aggregate includes moisture in the aggregate. Moisture content (M.C.) for each aggregate is calculated by the following equation:

$$\text{M.C.\%} = \frac{(\text{Wet Weight} - \text{Dry Weight})}{\text{Dry Weight}} \times 100$$

Therefore, to determine the *dry* mass, knowing moisture content, the following equation may be used:

$$\text{Total Dry Weight} = \frac{\text{Total Wet Weight} \times 100}{100 + \text{M.C.\%}}$$

Should the extracted gradation begin to vary erratically, the aggregate and RAP proportion systems should be immediately checked along with individual stockpile gradations.

Asphalt Cement Content

The asphalt cement content may be determined two ways. The ignition oven (DOTD TR 323) may be used along with a ***correction factor***. Also, the rate of asphalt cement delivery is continuously shown, in digital form, on all modern plant controls. If these two values differ significantly, then the correction factor for the ignition oven needs to be re-evaluated or the plant asphalt cement metering system needs to be recalibrated. The latter is done by metering a quantity of asphalt cement into a tanker or tank of known volume that can be readily weighed on a set of calibrated scales or load cells. Asphalt cement weight shall be corrected for temperature during calibration. Note that excess moisture in the mix may falsely appear as asphalt cement during the Ignition Oven test procedure; it may also artificially increase or decrease the G_{mm}. Higher asphalt content will also reduce G_{mm}.

The QC Technician should ensure that the Asphalt cement strainers and screens are clear and operational.

Laboratory Volumetrics

The QC technician shall conduct quality control tests to ensure that volumetrics are within specification range. Sampling and testing shall be in accordance with Subsection 502.05 and the Materials Sampling Manual These values shall be reported in a DOTD-approved format such as the Superpave Asphaltic Concrete Plant Report, to the Department's plant inspector (Appendix D4).

Additives

The QC technician shall check the rate of anti-strip at the beginning of each operational period, and when necessary thereafter, to ensure that the mixture is receiving the percent of anti-strip required by the JMF.

If additives are used, the QC technician shall also check the rate at the beginning of each operational period, and when necessary thereafter, to ensure that the mixture is receiving the percent of additive required by the JMF.

Temperature

The temperature of the asphalt cement and of HMA is very critical. It is also critical that the temperature of these two products be as specified and be consistent.

Specific attention shall be given to monitoring temperature in all asphalt cement working tanks and to ensure that all materials added, particularly from transports, are also at the correct elevated temperatures. Temperature is directly correlated with viscosity, which will affect the material's ability to adequately coat the aggregate.

Specifications require that a thermometer be provided to indicate mixture discharge temperature (typically at the discharge of the drum mixer). Mixture temperature consistency is essential in obtaining consistent roadway compaction. The technician may check this thermocouple temperature against either an infrared gun-type thermometer device or by using a standard, calibrated dial thermometer.

The JMF stipulates an optimum mixing temperature range of ±25° F of the optimum mixing temperature for the asphalt cement used (as supplied by the refinery). The discharge temperature shall always be within this range. **Mixing temperature must never exceed 350°F at the point of discharge, regardless of the supplier's recommendations.** Further, Subsection 502.08 of the *Standard Specifications* states that no mixtures shall be delivered to the paver cooler than 25° F below the lower limit of the compaction temperature as allowed by the JMF. **The temperature of the mix going through the paver shall not be cooler than 250° F.** The technician shall randomly select five portions of the lot for temperature checks.

Moisture

Stripping of asphalt courses will not occur in the absence of moisture or moisture vapor. To approach this ideal state, all hot-mix asphalt materials should be produced in a manner that minimizes internal moisture, because internal aggregate moisture can weaken the molecular bond between the asphalt cement and the mineral aggregate.

However, with the average annual rainfall and humidity present in Louisiana, it is difficult to remove all free and absorbed moisture from aggregate in the HMA production process. In a typical plant, when fuel is burned, a quantity of heat is produced. This heat is transferred to the aggregate to evaporate moisture and heat the aggregate. As moisture in the aggregate is evaporated, each pound of water expands to 33 cubic feet of steam. This enormous volume of steam must be removed by the plant's exhaust system. Hence, when aggregate moisture values increase (as in the presence of recent rainfall), the plant's production rate and burner settings must be adjusted to maintain and achieve consistent mixture temperatures and remove sufficient moisture. Excessively worn or missing flights will greatly affect the plant's ability to heat and dry aggregates. The drum mixer shall also be routinely inspected for excessive flight wear.

The presence of moisture also aggravates the process of accurately measuring mixture volumetrics. Excessive moisture in hot-mix asphalt may lead to an abrupt collapse in voids in mineral aggregate.

The certified technician shall continually monitor the moisture in the individual aggregate stockpiles (DOTD TR 403) and of the loose hot-mix asphalt (DOTD TR 319).

Documentation

The QC technician shall keep, as a minimum, the following records on file at the plant laboratory:

1. A QC copy of the Superpave Asphaltic Concrete Plant Report form (Appendix D4) for each lot showing a minimum of one extracted asphalt content, gradations for all sieves and percent crushed values for each sublot. Corrective action shall be taken if PWL for No. 8 sieve, No. 200 sieve, or G_{mm} falls below 90 or if the average of 5 VFA samples is outside the specification limits.

2. The QC Plant Report form shall also show a minimum of two results per sublot with appropriate control charts for the following:

   - Theoretical Specific Gravity (G_{mm})
   - Estimated Bulk Gravity (G_{mb}) at N_{max}
   - Percent G_{mm} at $N_{initial}$

3. Percent Moisture in loose mix once per lot (Appendix D5).

4. Asphaltic Concrete Control Charts (Appendix D6)

When the average of five extracted gradation tests per lot, one per sublot, on any sieve fall outside of the allowed tolerance of the approved JMF limit, the QC technician shall immediately make corrections to keep the mixture within specified limits. If the average VFA for 5 samples is outside the specifications limits, satisfactory adjustments must be made or production shall be discontinued. Failure to keep the mixture within specified limits shall result in the contractor's being prohibited from supplying this mixture to DOTD projects.

The QC technician shall document all corrections to control the mixture and prevent any effect of the mixture from moving outside specified limits or from varying erratically within those limits. This documentation shall include the action taken, date and time and be initialed by the QC technician. **Control charts shall be maintained per plant lot per job mix.**

The QC technician is to document all QC testing and keep these records on file at the plant laboratory. The certified technician shall stamp all QC documents "QC" with red ink, in minimum one-inch high letters.

LOTS and SUBLOTS

Definition of a Lot - Subsection 502.14 defines Superpave lots as a segment of continuous production of asphaltic concrete mixture from the same job mix formula produced for the Department at an individual plant. **A lot shall further be defined as being produced for and delivered to one DOTD project.** The standard lot is 5000 tons with five 1000 ton sublots. Although a standard sublot is 1000 tons, minor adjustments will be made in the 1000-ton sublot size to accommodate hauling unit capacity. When the total lot quantity is expended in the partial load of a truck, the full legal load of the truck will be included in the sublot. For example, if 988 tons of HMA are produced and sent to a project and the next truck hauls 24 tons, the actual sublot size will be 1022 tons (998 + 24).

Lot Documentation - The QC technician and DOTD inspector shall keep a running total of production to ensure that all sublots and lots are terminated at proper tonnage and that the succeeding lot number is placed on the next haul ticket. Lot numbers will be assigned based on total tons of plant production for a JMF ***for a project.***

Sublot numbers will be designated with letters (e.g., Lot 105-C would represent the third sublot in Lot 105).

The QC technician and DOTD inspector shall also maintain a written log of the distribution of hot-mix production for DOTD projects from a plant's operation. This log is to be kept in a numbered field book and shall contain, as a minimum, the following data:

Sublot No.	Date	Project Number	Tons	Total Tons	Mix Type/ Use	Project Engineer	Remarks	JMF	Initials
023-A	**14 Aug**	**123-44-5678**	**1006**	**1006**	**26/01**	**Bob Dover**	**Recalib cold feed**	**289**	**CJ**
023-B	**14 Aug**	**123-44-5678**	**500**		**26/01**	**Bob Dover**		**289**	**CJ**
023-B	**15 Aug**	**123-44-5678**	**510**	**1010**					
023-C	**15 Aug**	**123-44-5678**	**1006**	**1006**	**26/01**	**Bob Dover**	**Rain delay**	**289**	**CJ**
023-D	**17 Aug**	**123-44-5678**	**1003**	**1003**	**26/01**	**Bob Dover**	**Belt broke 10am**	**289**	**CJ**
023-E	**20 Aug**	**123-44-5678**	**995**	**995**	**26/01**	**Bob Dover**		**289**	**CJ**
			Lot Total:	**5020**					

This log is to remain at the plant as a continuing record of plant production and distribution. It is to be maintained separately from all other department documentation. Lot numbers shall not be repeated until the plant has produced 999 lots.

Lot Sizes - It is not the department's intent that this specification be used to artificially manipulate the size of lots that will be assessed payment adjustments.

Subsection 502.14 also gives criteria for adjusting lot sizes. Note that although the size of a sublot may be increased with mutual agreement of the Project Engineer and Contractor, the ***number of sublots*** may not be increased. The maximum number of sublots is five.

The greater consistency demanded by PWL specifications is reserved for roadway travel lanes, and is not required for a number of mix uses such as bike paths, driveways, or shoulders. The PWL specifications are not appropriate for these mix uses. Therefore, the appropriate payment methodology for asphaltic mixture is now related to the mix use, rather than the mix produced. Mixture for these uses will always be paid by Table 502-9, "Payment Adjustment Schedule for Small Quantities of Superpave"

Here is a summary of specifications by lot sizes:

≥ 3000 TONS: For payment purposes, take 1 sample for voids per sublot, take 3 cores per sublot and obtain surface tolerance results. Pay for lot in accordance with PWL calculations, Tables 502-6, 502-7 and 502-8. (Note: for unrepresented mix uses, take an additional core.)

250 – 2999 TONS: For payment purposes, take 1 sample for voids per sublot and take 3 cores per sublot. Obtain surface tolerance results for wearing courses. Pay for each 1000 ton, or less, sublot individually by table 502-8 and 502-9.

ALSO – all mixes used for incidental mix uses, such as bike paths, crossovers, curbs, driveways, guardrail widening, islands, joint repair, leveling, parking lots, shoulders, turnouts, patching, widening, and miscellaneous handwork, shall be paid in accordance with the requirements for 250-2999 tons, denoted above.

≤ 250 TONS: For projects, or separate locations within a project, requiring less than 250 tons (250 Mg), the job mix formula, materials, and plant and paving operations shall be satisfactory to the engineer. Sampling and testing requirements may be modified by the engineer and the payment adjustment for deviations waived. For example a 3200 ton project which has an additional 220 tons for a side-street bridge tie-in, would be considered a separate location within this project.

PLANT ACCEPTANCE

The DOTD certified inspector is the department's official representative at the plant. At the time of this printing, the DOTD certified inspector is responsible for the following:

1. Sampling and testing for acceptance.
    a. Asphalt Cement
        i. Transport Sample
        ii. CD's for each transport
        iii. Working Tank sample daily
    b. Mix temperature, 5 per lot
    c. Anti-strip quantity twice per day
    d. Volumetrics 1 G_{mm}/sublot and 1 N_{design} gyratory briquette/sublot
    e. Pavement Density 3cores/sublot

2. Review QC results and conformance to specifications.

3. Continually inspect plant and product to ensure conformance to specifications.

The DOTD inspector is also responsible for ensuring that material samples required for department testing are obtained in accordance with prescribed testing schedules and frequencies, that all samples are representative of the material and that the samples are submitted, along with appropriate forms and documentation, to the district laboratory in a timely manner. Additionally, the DOTD certified inspector is responsible for performing all acceptance sampling and testing on the product as delineated in this manual. During validation, the DOTD inspector and QC technician may work together to perform sampling and testing to minimize tester variation. **However, during production, the DOTD certified inspector must take and test all acceptance samples.**

Subsection 502.06 of the *Standard Specifications* outlines the required acceptance tests to be performed by the DOTD inspector. These tests are performed at the plant unless directed otherwise by the laboratory engineer. Sampling must follow a stratified sampling plan in accordance with the *Materials Sampling Manual* and specified test procedures. Random number tables were developed to ensure that sampling would occur at different times during production, and therefore, be representative of the mix. Since an inspector cannot always stop a test procedure to obtain a sample, some flexibility is allowed. The acceptance tests are listed below:

- Air Voids, V_a, and VFA (at N_{design})
- Asphalt Cement Properties
- Pavement Density

Asphalt Cement Properties

Asphalt cement shall be sampled, tested and accepted in accordance with Sections 502, 507 and 508 of the *Materials Sampling Manual.*

At a self-certified Asphalt Cement Refinery, refinery personnel sample and test the refinery tank. Test results shall be faxed and samples sent to the DOTD Materials Laboratory. The Materials Laboratory will issue a lab number which is placed on the Certificate of Delivery (CD) representing the refinery tank material. The material is then "accepted" and the refinery is authorized to ship with an accompanying CD.

At a non-self certified refiner, refinery personnel sample the refinery tank and send the sample to the Materials Laboratory. The Material Laboratory tests the material and issues a Lab number which is placed on the Certificate of Delivery. The refinery tank material is "accepted" and the refinery is authorized to ship the material in a transport to the plant with an accompanying CD.

The transport will arrive at the plant with a CD. **This Certificate of Delivery constitutes acceptance for asphalt cement for the project.** The project engineer's representative samples a minimum of one transport per project for each type of asphalt cement used. (Two samples are preferred. They should be taken at random, not always on the first day of production.) This sample is not tested by the District Laboratory but is sent to the Materials Laboratory. The transport sample is only used to spot-check our certification at the refinery and alert us to a potential problem.

Additionally**, the DOTD Plant Inspector will sample asphalt cement from the working tank for verification, once per day per grade, and submit for testing to the District Laboratory.**

Samples shall be clearly identified with the following:

- State Project #
- Plant Code, e.g., H312
- Asphalt Cement Grade
- JMF Sequence Number
- Lot Number
- Sample ID Number

Appendix B3 show copies of the required Performance Graded Asphalt Binder submittal forms that shall accompany each sample of asphalt cement when submitted to the district laboratory.

The working tank may be sampled from the top, from the tank spigot, or from an in-line spigot as determined by the DOTD Plant Inspector. If sampled from the top, the contractor shall sample the asphalt working tank in the presence of a DOTD inspector.

The district laboratory will test and report Dynamic Shear and phase angle. The Project Engineer should provide these test results to the contractor on a regular basis. If the sample meets all criteria, production continues.

Additionally, the District Laboratory Engineer will test one sample per week for rotational viscosity, keeping the records on file.

Should the working tank sample fail, the district laboratory will promptly notify the project engineer and the QC technician. The contractor shall notify the refinery. Additionally, the District Laboratory Engineer must investigate to determine the cause of failure. The following is general guidance for investigating failures:

- Compare working tank results to refinery results, transport results, and previous working tanks results. Does this material have a history of problems that would have resulted in similar problems?
- Send failed samples to the Materials Laboratory for complete analysis
- Check maintenance schedules or the working tank to find out what was done. When were the coils last cleaned? When was the tank last cleaned?
- Inspect facilities, checking the history of the refinery material, etc.
- Check the temperature on the working tank.
- Check whether or not a different brand or grade of material has been added to the tank. Was the tank drained sufficiently before adding new material?
- Test rotational viscosity

If it is determined that material in the working tank does not meet specification requirements, then plant production shall cease until corrections are made.

Asphalt cement in the plant's working tank shall meet the specifications of the asphalt cement required on the JMF.

The DOTD inspector will document the metered asphalt cement content on the Superpave Plant Report. It should be noted that if the asphalt cement content from the meter or scales does not fall within ± 0.2% of the optimum asphalt cement on the JMF, the DOTD inspector will take a second determination immediately. If these results indicate continued lack of conformance to % AC requirements, the contractor/'producer shall discontinue operations for DOTD until the process has been corrected to the satisfaction of the District Laboratory Engineer.

Temperature

The DOTD inspector will document the mix temperature in the truck at the time of sampling once per sublot and record it on the Superpave Asphaltic Concrete Plant Report form (Appendix D7).

Percent Anti-Strip

An anti-strip additive shall be added to all mixtures at no less than the minimum rate on the approved Job Mix Formula.

The DOTD inspector will test for the amount of anti-strip at a frequency of twice per lot. The lot will be divided into two approximately equal sublots. If the check performed indicates that the amount of anti-strip added is not in accordance with the JMF, the contractor must make adjustments so that the correct amount of anti-strip additive will be added to the mixture. If the second check indicates that the mixture is still not receiving the correct percentage of anti-strip, production for DOTD projects shall be terminated until adequate adjustments can be made to the system or the system can be recalibrated.

The results of the percent anti-strip are entered on the Superpave Asphaltic Concrete Plant Report Form (Appendix D7). These reading are to coincide as closely as possible to approximately each half of a plant lot.

The basic method of checking the percentage of anti-strip in the mixture is to monitor the flow of additive for a continuous time sufficient to represent approximately half a lot. In order to proceed with the calculations for the percentage of anti-strip, the certified technician must know the unit weight of the anti-strip additive at any given temperature. The anti-strip supplier must make the unit weight information available or a one-gallon sample may be weighed at the plant to determine this value.

An example of determining percentage of anti-strip added to HMA follows:

1. Temperature - Read and record the temperature of the anti-strip additive being added to the mixture from the thermometer on the anti-strip tank.

2. Readings - Take an initial reading of the amount of anti-strip additive from the anti-strip meter and take an initial reading from the asphalt cement totalizing meter. **It is required that the percent asphalt cement and the percent anti-strip be checked simultaneously during continuous production to evaluate the quality of the mixture in terms of both components.**

    a. For anti-strip, record the initial reading to the nearest readable increment (0.1 gallon, 0.25 gallon, or 0.034 gal). Allow the plant to run for a continuous period of time sufficient to represent approximately half a lot. Take a final reading to the nearest readable increment and record.

    b. For asphalt cement, record the reading to the nearest gallon. (Some plants will digitally display the mass of asphalt cement added on the computerized operational controls.) Allow the plant to run for the same period of time as used for AS determination. Take a final reading of AC used and record to the nearest gallon. Subtract the initial reading from the final reading to obtain gallons AC used. Subtract the initial reading from the final reading to obtain the actual amount of anti-strip used during the time period.

3. Calculations - Calculate the percent anti-strip in terms of the weight of asphalt cement in pounds.

   a. Anti-strip Quantity - Calculate pounds of anti-strip:

      Unit weight of anti-strip = 7.28 lb/gal (from curve)
      Gallons anti-strip used during check = 41.45 gal

      7.28 lb/gal x 41.45 gal = 301.8 lb

   b. Asphalt Cement Quantity – Calculate pounds of asphalt cement:

      Gallons AC used during check = 5820 gal
      Weight of 1 gallon of water = 8.34 lb/gal
      Specific Gravity of AC @ 60°F = 1.03

      5820 gal x 8.34 lb/gal x 1.03 = 49,994.964 lb

   c. % Anti-strip - Calculate the percent anti-strip:

$$\% \text{ AS} = \left(\frac{\text{pounds of anti} - \text{strip}}{\text{pounds of asphalt cement}} \right) \text{x} 100$$

$$\% \text{ AS} = \left(\frac{301.8}{49{,}994.964} \right) \text{x} 100$$

$$= 0.006 \text{ X } 100$$

$$= 0.6 \text{ \% anti-strip}$$

   Report the final percentage of anti-strip additive to the nearest 0.1 percent.

4. Alternate Method – An alternate method is to take a printout of anti-strip and asphalt cement quantities at a specific start and stop point in time from the control room. Divide the total anti-strip quantity for that period of time by the total asphalt cement for the same period of time. Results shall be within ±0.1 of the JMF. If not, production shall be discontinued until the proper rate can be added.

If lime or other additive types are being proportioned in the HMA mixture at the plant (and shown on the JMF) then this rate shall also be determined twice per lot, via the plants meters/scales, and shown on the QC copy of the Superpave Asphaltic Concrete Plant Report form (Appendix D7).

Volumetrics

The department's inspector will test for volumetrics (V_a and VFA) at a rate of one test per sublot from samples taken randomly after the mixture is placed in trucks.

The DOTD inspector will prepare the samples (gyratory briquettes) in accordance with AASHTO T 312, PP 19 and DOTD TR 304, using the contractor's equipment. The plant produced mixes will be cured one hour (at compaction temperature) in the mold prior to compaction. Aggregates with water absorption greater than 2% will require a 2-hour aging period as compared to those with low water absorption values.

After aging, the mix will be gyrated to N_{design} gyrations per Table 502-5 for the specified level and type of mix. The cooled briquettes will be tested for bulk specific gravity (G_{mb}) and the theoretical maximum specific gravity (G_{mm}). After G_{mm} and % G_{mm} @ N_{design} are determined for each sublot by DOTD, V_a and VFA will be calculated for acceptance. These test results will be reported by the DOTD certified technician on the approved Superpave plant report or approved computer spreadsheet.

The test results for volumetrics (V_a) shall be in accordance with the JMF and Table 502-7A, Payment Adjustment Schedules, for air voids. If test results indicate that payment adjustments are necessary for air voids, satisfactory adjustments shall be made or production shall be discontinued. If the average VFA for 5 samples is outside the specification limits, satisfactory adjustments must be made or production shall be discontinued.

Volumetrics for Pay – Once test results have been determined, use Quality Level Analysis in accordance with Subsection 502.13 to determine percent within limits (PWL) and Subsection 502.16 to determine pay. An example of determining PWL and percent pay for the plant acceptance parameter of air voids is as follows:

Assume a 5000 ton lot of continuous production of the same mix from a plant.

5000 TONS	¾" NMS Wearing	Category B Roadway

VOIDS – Spec Limits are 2.5% to 4.5%.

Test results are:

2.3%	2.2%	3.0%	2.9%	3.0%

VOIDS – Compute PWL for 5 voids results.
First compute the mean and the standard deviation. The formula used to determine the mean is:

$$\text{Mean} = \overline{X} = \frac{X_1 + X_2 + X_3 + \ldots + X_n}{n} = \frac{\sum_{i=1}^{n} X_i}{n}$$

Using our example,

$$\text{Mean} = \overline{X} = \frac{2.3 + 2.2 + 3.0 + 2.9 + 3.0}{5} = \frac{13.4}{5} = 2.68$$

Now compute standard deviation. The formula to determine standard deviation is:

$$\text{Standard Deviation} = s = \sqrt{\frac{(X_1 - \overline{X})^2 + (X_2 - \overline{X})^2 + \ldots. + (X_i - \overline{X})^2}{n - 1}}$$

$$= \sqrt{\frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n - 1}}$$

Using our example,

$$\text{Standard Deviation} = s = \sqrt{\frac{(2.3 - 2.68)^2 + (2.2 - 2.68)^2 + (3.0 - 2.68)^2 + (2.9 - 2.68)^2 + (3.0 - 2.68)^2}{5 - 1}}$$

$$= \sqrt{\frac{0.6280}{4}}$$

$$0.396232$$

$$= 0.3962$$

Note

When performing computations, please note that the significant digits for the average will be one more place than the significant digits for the value. Also, the significant digits for the standard deviation will be two more than the significant digits for the average. For example:

Voids is x.x	Density is xx.x
Voids Average is x.xx	Density Average is xx.xx
Voids Standard Deviation is x.xxxx	Density Standard Deviation is xx.xxxx

Then compute the Upper Quality Index, Q_u, and Lower Quality Index, $Q_{L,}$ using this formula:

$$\text{Upper Quality Index} = Q_U = \frac{USL - \overline{X}}{s} \qquad \text{Lower Quality Index} = Q_L = \frac{\overline{X} - LSL}{s}$$

If the Upper Spec Limit, USL, is 4.5 and the Lower Spec Limit, LSL, is 2.5, then:

$$\text{Upper Quality Index} = Q_U = \frac{4.5 - 2.68}{0.3962} = \frac{1.82}{0.3962} = 4.59$$

$$\text{Lower Quality Index} = Q_L = \frac{2.68 - 2.5}{0.3962} = \frac{0.18}{0.3962} = 0.45$$

Table 502-6 is used to convert the Quality Index into the PWL value. See Appendix A4. A PWL is calculated for each Quality Index (upper and lower) and combined for a total PWL calculated in accordance with the formula:

$PWL = PWL_L + PWL_U - 100$

where: PWL_L = lower percent within limits
PWL_U = upper percent within limits

The PWL for the five void results will be calculated as follows:

From Table 502-6, using n = 5, the PWL_U which corresponds to 4.59 is 100.

The PWL_L which corresponds to 0.45 is 66.

Applying the formula above, Total PWL = $PWL_U + PWL_L$ – 100 = 100 + 66 – 100 = 66.

From 502-7A, PLANT AIR **VOIDS %Pay = 90%.**

An example of determining pay ***total payment for a lot*** is on page 62 and an example of determining pay with ***different mix uses*** starts on page 62.

ROADWAY QUALITY CONTROL

The contractor shall perform roadway operations in accordance with Subsections 502.07, 502.08 and 502.09. Quality control shall be performed in accordance with Subsection 502.10. The contractor shall constantly monitor equipment, materials, and processes to ensure that density and surface tolerance requirements are met. Quality control testing and inspection shall be sufficient to ensure a smooth and homogenous pavement, free from segregation, truck ends, raveling, tearing, streaking, rutting, cracking, shoving, dragging of rocks, and rippling.

A nuclear density machine may be utilized to establish a rolling pattern and monitor density. Mixture temperature has a substantial effect on the density of the mat and shall be sufficiently monitored. The contractor shall coordinate the plant production rate with transportation and placement rates to ensure continuous placement of mix. The contractor shall monitor placement to ensure that cross-slope, grade, and transverse requirements are met as specified in Table 502-4, Subsection 502.10(b), and the Materials Sampling Manual.

When QC testing establishes that the surface tolerance is deficient, the contractor shall immediately suspend paving operations. Paving operations will not be allowed to resume until appropriate corrections have been made. The Project Engineer may require a 500 ton minimum test section successfully placed with acceptable density and surface tolerance before permitting full production.

Longitudinal quality control testing shall be in accordance with Subsection 502.10(b). The contractor shall furnish a DOTD Certified Inertial Profiler and measure both wheelpaths. A wheelpath is defined as 3±½' on either side of the longitudinal centerline of the lane being tested. Each segment of each wheelpath must meet the requirements of Table 502-8B. Categories are defined in Table 502-8A. If any 0.05-mile (0.08 km) segment does not meet these requirements, the contractor must correct the deficient area in accordance with Subsection 502.10(4).

Profiler Certification

The Materials & Testing Section (Matlab) certifies automated profilers annually, starting in May. Contractors shall call the Materials Section at 225-248-4151 to set up appointments for a certification inspection and to run the profiler on our test track. ProVAL software is now required to record and analyze data. ProVAL is available free of charge at **www.roadprofile.com.** Data collected during certification shall be transferred to the Materials Section in the raw data format and in the Texas.Pro format electronically by means of a USB port. Contractors are encouraged to have their equipment (lasers and accelerometer) calibrated by the profiler manufacturer prior to attending the certification.

ROADWAY ACCEPTANCE

Pavement Density and Surface Tolerance

Core Sampling

Upon completion of compaction procedures, cores shall be taken in accordance with Subsection 502.11(a). Specifications presently state," Sampling shall be performed using the random number tables shown in DOTD S605 in the Materials Sampling Manual. If there are different mix uses within the same sublot, i.e. shoulder and roadway, then an additional core may be taken to ensure that there is at least one core per mix use."

Here is an example of core sampling determination when there are different mix uses in the same sublot.

Assume lot has 5000 tons of continuous mixture production.

Sublot A	Sublot B	Sublot C	Sublot D	Sublot E
800 Tons Roadway Wearing	500 Tons Roadway Binder	200 Tons Rdwy Wear	600 Tons Roadway Wearing	1000 Tons Roadway Binder
200 Tons Shoulder	500 Tons Roadway Wearing	800 Tons Shoulder	400 Tons Shoulder	

Using random number tables, core locations may occur as follows:

800 Tons Roadway Wearing 3 cores	500 Tons Roadway Binder 1 core	200 Tons Rdwy Wearing 0 cores[2]	600 Tons Roadway Wearing 2 cores	1000 Tons Roadway Binder 3 cores
200 Tons Shoulder 0 cores[1]	500 Tons Roadway Wearing 2 cores	800 Tons Shoulder 3 cores	400 Tons Shoulder 1 core	

[1]Sublot A – Shoulder is a mix use that is not represented, so take an additional core from the shoulder
[2]Sublot C – Roadway wearing is a mix use that is not represented, so take an additional core from the roadway wearing.
Sublots B, D and E – All mix uses are represented.

Total number of roadway wearing and binder cores = 12 cores.
Total Shoulder cores = 5 cores

There is now a sufficient number of cores to compute PWL on roadway wearing and binder density, the **"roadway"** part of the lot, we will have a sufficient number of cores. For the **"non-roadway"** part, the average sublot core density will be used to determine pay. Every mix use per sublot is now represented by at least 1 core.

Since pavement density must be compared to the theoretical maximum specific gravity (G_{mm}) for the lot, the core samples must be clearly identified by sublot letter and lot number. The date the samples are taken will be recorded on the Superpave Asphaltic Concrete Roadway Report (Appendix D8).

If the sample obtained from a pavement sublot is less than 1 3/8 inches thick, the DOTD Certified Paving Inspector will reject the core and select another sampling location for that sublot by reapplication of the Random Number Tables. The DOTD inspector will package the core for transport in accordance with Subsection 502.11(a) and place the original and one copy of the Superpave Asphaltic Concrete Roadway Report (Appendix D8) and the Superpave Asphaltic Concrete Verification Report (Appendix D9) in the packaging. HMA mixtures placed in *design* layers less than 1 3/8 inches thick shall be compacted by approved methods to the satisfaction of the project engineer and shall not require coring.

The DOTD paving inspector, along with the contractor/producer coring representative, will inspect the cores for acceptability and label them for identification. The DOTD inspector and the QC technician at the plant, upon inspection and mutual agreement, also reserve the right to reject any core(s). It is intended that cores be delivered to the plant on the same day as they are taken, so that the results for acceptance and verification can be made available to the project engineer and field compaction personnel in a timely manner.

The core sample's official measurement will be obtained by taking three measurements spaced uniformly around the circumference of the core and then averaged. The measurements will be taken by a caliper and recorded by the DOTD plant technician to the nearest 0.01-inch on the Superpave Asphaltic Concrete Roadway Report (Appendix D8).

Should a specimen be damaged during operations, the core may be taken from a position longitudinally up or down the pavement within five feet.

The plant laboratory shall be equipped with a saw suitable for sawing HMA pavement cores. This saw may be used to remove base course material (e.g., soil cement and/or curing membrane), or to uniformly cut 4 or 6-inch diameter cylindrical samples. Care must be taken to minimize the amount of material cut and discarded, especially from the upper surface.

The DOTD inspector will evaluate the pavement cores for roadway % density which shall be computed by comparing bulk specific gravity (G_{mb}) to the theoretical maximum specific gravity (G_{mm},) reported for the sublot. The % density determined for each pavement sample will be used to calculate a PWL for the entire lot. To ensure that the cores are sufficiently free from moisture, they shall be placed in a force draft oven at 125° F until a constant mass is ensured in accordance with DOTD TR 304.

Notes on the determination of the bulk specific gravity (G_{mb}) of a pavement core:

Weighing an object (as we do with an HMA core) to determine its mass in air and its mass in a fluid (as we do in water) whose specific gravity is known yields sufficient data to determine its weight (mass), volume, and specific gravity. Specific gravity is defined *as the ratio of the weight of a unit volume of the sample to the weight of an equal volume of water at approximately 25° ±1° C, (77 ±1.8° F).*

LA DOTD now specifies that the G_{mb} *be determined by TR 304. The equation from the test method, for calculating* G_{mb} *is as follows:*

$$G_{mb} = \frac{\text{Weight in Air}}{(\text{SSD Weight} - \text{Weight in Water})}$$

As the size of the external voids in the specimen increase, it becomes difficult to determine an accurate SSD mass, because the diameter of the voids are of such size that the water will run out of them before an accurate SSD mass can be determined. If air pockets are observed on the core surface, there may be a problem with calculation of voids.

To account for this, alternate test procedures may be used with approval of the District Laboratory Engineer. One alternate test procedure is AASHTO T 275 – Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin, used for determining G_{mb} *when the percent water absorbed by the specimen exceeds 2.0 percent as determined by the following equation:*

$$\text{Percent } H_2O \text{ Absorbed (by Volume)} = \frac{(\text{SSD Weight} - \text{Weight in Air})}{(\text{SSD Weight} - \text{Weight in Water})}$$

In addition to DOTD TR 304 and AASHTO T 275, there exist two other methods to determine G_{mb} *of a cored pavement specimen. One method, the Pure Volume method, is performed by measuring the thickness and diameter of the cylindrical specimen in numerous locations to calculate average values and then using the following formula to determine its volume:*

$$\text{Volume} = \pi \text{ x} \left(\frac{\text{Diameter}}{2}\right)^2 \text{ x Height}$$

This volume is used in the denominator with dry weight in air in the numerator to determine the G_{mb}.

The second method, which uses proprietary equipment, involves weighing the submerged specimen in a vacuumed plastic bag to determine a true volume per AASHTO T 331-07

In summary, if the QC technician or the DOTD inspector suspects that G_{mb} *values determined via TR 304 in the field laboratory are yielding erroneous values, the District Laboratory Engineer is to be notified and may approve use of these alternate methods.*

Pavement Density Pay - Once test results have been determined, use Quality Level Analysis in accordance with Subsection 502.13 to determine percent within limits (PWL) and Subsection 502.16 to determine pay. An example of determining PWL and percent pay for the roadway density acceptance parameter is as follows:

Assume a 5000 ton lot of continuous production of the same mix from a plant.

5000 TONS	¾" NMS Wearing	Category B Roadway

Minimum density specified is 92% density. Taking 3 cores per sublot, here are the results:

1000 Tons Roadway Wearing	1000 Tons Roadway Wearing	1000 Tons Roadway Wearing	1000 Tons Roadway Wearing	1000 Tons Roadway Wearing
91.8	92.2	91.5	93.2	92.9
92.8	95.0	87.0	92.4	91.6
93.2	92.8	86.9	90.1	93.0

First compute the mean and the standard deviation. The formula used to determine the mean is:

$$\text{Mean} = \overline{X} = \frac{X_1 + X_2 + X_3 + \ldots + X_n}{n} = \frac{\sum_{i=1}^{n} X_i}{n}$$

Using our example, compute mean and standard deviation for all 15 cores in the lot.

$$\text{Mean} = \begin{aligned} \overline{X} &= \frac{91.8 + 92.8 + 93.2 + 92.2 + 95.0 + 92.8 + 91.5 + 87.0 + 86.9 + 93.2 + 92.4 + \ldots + 93.0}{15} \\ &= \frac{1376.4}{15} = 91.7600 = 91.76 \end{aligned}$$

Now compute standard deviation. The formula to determine standard deviation is:

$$\text{Standard Deviation} = s = \sqrt{\frac{(X_1 - \overline{X})^2 + (X_2 - \overline{X})^2 + ... + (X_i - \overline{X})^2}{n - 1}}$$

$$= \sqrt{\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{n - 1}}$$

Using our example, compute standard deviation.

Standard Deviation = s =

$$\sqrt{\frac{(91.8 - 91.76)^2 + (92.8 - 91.76)^2 + (93.2 - 91.76)^2 + (92.2 - 91.76)^2 + (95.0 - 91.76)^2 + ... + (93.0 - 91.76)^2}{15 - 1}}$$

$$= \sqrt{\frac{69.376}{14}} = \sqrt{4.955429}$$

$$= 2.226079 = 2.2261$$

The specification limit is a minimum of 92%. There is only a Lower Spec Limit, not an Upper Spec Limit. Determine the Lower Quality Index as follows:

$$\text{LowerQualityIndex} = Q_L = \frac{\overline{X} - LSL}{s}$$

Then compute the Lower Quality Index, Q_L using this formula:

$$\text{Lower Quality Index} = Q_L = \frac{91.76 - 92.0}{2.2261} = \frac{-0.24}{2.2261} = -0.1078 = -0.11$$

Now determine PWL. From Table 502-6, (see Appendix A4) using n=15, and Q_L of -0.11, the corresponding PWL_L = 100 – 55 = 45.

(The footnote in Table 502-6 explains how to handle a **negative** Quality Index. PWL is computed as 100 – the number in the table.)

Now compute % Pay.

From Table 502-7B, **ROADWAY DENSITY %Pay = 80%**

An example of determining ***total pay*** is on page 62 and an example of determining pay with ***different mix uses*** starts on page 62.

SURFACE TOLERANCE

The DOTD Roadway Inspector shall check cross slope, grade and transverse surface tolerance in accordance with Subsection 502.11(b).

Longitudinal Surface Tolerance Testing

Pre-op Tests and Observations

The DOTD Roadway Inspector shall ensure that the contractor is using a DOTD Certified Inertial Profiler for quality control and quality acceptance. Profilers must be certified and operated in accordance with DOTD TR 644 and Subsection 502.11. To verify that the profiler is certified to be used on a job, the DOTD roadway inspector will check the calibration sticker (Appendix E1) or certificate (*LA DOTD Profiler Inspection and Certification*). (Appendix E2) The Certification sticker will display the date of certification renewal for IRI and/or PI, high pass and low pass filter settings, the rated speed, the correct tire pressure, and the technician certifying the equipment.

The profiler settings shall match the certification settings during profiler operation on DOTD projects. Since the settings on the profilers *can* be changed by the operator, it is imperative that the certification settings be verified before accepting data from the contractor. The settings directly affect the data collected. By changing the settings, the data collected can be manipulated.

Before a profiler is used, the following pre-operation tests shall be performed by the contractor, witnessed by the DOTD inspector, each **day of testing:**

1. Tire Pressure Check - The distance measuring system of the profiler is based on revolutions of the wheel and the rolling radius of the tire. The rolling radius of a tire is dependent upon the air pressure. A tire that is fully inflated has a larger rolling radius than one that is not fully inflated. Tire pressure affects the number of revolutions made in a given distance. **The tire pressure shall be checked each morning on the cold tire and adjusted if necessary.** The correct tire pressure at which each profiler is to be run may be found on the *LA DOTD Profiler Inspection and Certification* form. It is also written in the field book for each profiler by the Materials Section on the day of certification. The tires must be inflated to the specified pressure used on the day of certification.

The profiler should then be driven for 15 minutes to warm the tires prior to testing.

2. Vertical Calibration - This test is performed on a stationary profiler **by placing various plates under the lasers and taking readings at each block height.** Blocks shall have a thickness of 0.25", 0.50" and 1.00". The vertical calibration check ensures that the height sensor is performing properly. The height sensor measures vertical distance from the sensor to the road way**. For a profiler to pass the vertical calibration check, the average difference must be 0.01 or less.** The operator should not be in the unit during this test.

3. Bounce Test - It is performed on **a stationary profiler while the operator bounces the unit (according to manufacturer's recommendation).** This test is performed in order to check that the accelerometers and height sensors are functioning properly. Accelerometers measure vertical acceleration and are mounted above the height sensor. If the sensors are working properly, the unit will filter out any bouncing or excess movement of the unit itself during the actual surface roughness testing. **The profiler will display "pass" or "fail".**

4. Horizontal Calibration - This procedure calibrates the horizontal measuring system of the profiler. This calibration is performed **by running the profiler over a measured 528 foot distance.** Whoever is going to be in the profiler during the testing process must be in the profiler during the horizontal calibration. The calibration adjusts for weight distribution. **The profiler will display, "calibration successful" or "calibration unsuccessful."**

5. Odometer Check - This check measures the distance traveled by the profiler and verifies the horizontal calibration. This test needs to be performed by **running the same measured path of 528 feet** that was used with the horizontal calibration. Distance is usually measured by a pulsar attached to the front wheels. Rotation of the wheel is measured by detection of pulses as the wheel rotates and the notches pass. Each pulse is directly associated with a fixed travel distance through the rolling radius of the tire.

NOTE: All results of the pre-ops shall be printed (or clearly displayed in data on the USB flash drive) and turned in to the DOTD inspector with the data. The date and time of the test will be indicated with the pre-op results.

Surface tolerance quality is determined by an International Roughness Index, (IRI) and is measured in units of inches per mile.

Surface Tolerance Pay

Once Pre-op Tests and setting verification are complete, the contractor shall measure and report the average IRI value for each wheelpath on every 0.05-mile (0.08 km) segment of highway. A wheelpath is defined as 3±½' on either side of the longitudinal centerline of the lane being tested. The IRI values for the inside and outside wheelpaths shall be averaged and reported as the segment average and the mean of each segment average shall be reported as the sublot average. Percent pay for each sublot is determined in accordance with Table 502-8A using the sublot average IRI.

Here is an example of how to compute surface tolerance pay.
Assuming:

5000 TONS	¾" NMS Wearing	Category B Roadway

Here are your IRI results and corresponding % pay from Table 502-8A.

1000 Tons Roadway Wearing IRI = 68 100%	1000 Tons Roadway Wearing IRI = 72 100%	1000 Tons Roadway Wearing IRI = 64 103%	1000 Tons Roadway Wearing IRI = 62 103%	1000 Tons Roadway Wearing IRI = 67 100%

Table 502-8A
Payment Adjustment Schedules for Longitudinal Surface Tolerance, Maximum International Roughness Index, inches per mile (mm per km)

Percent of Contract Unit Price (by Sublot)[1]	103%[2]	100%	90%	80%	50% or Remove[3]
Category A All Interstates, Multi-Lift New Construction and Overlays of More than two Lifts	<55 (<870)	<65 (<1030)	65-75 (1030-1180)	NA	>75 (>1180)
Category B One or Two Lift Overlays Over Cold Planed Surfaces, and Two-Lift Overlays Over Existing Surfaces[4]	<65 (<1030)	<75 (<1180)	75-89 (1180-1400)	NA	>89 (>1400)
Category C Single-Lift Overlays Over Existing Surfaces[4]	<75 (<1180)	<85 (<1340)	85-95 (1340-1500)	>95-110 (>1500-1740)	>110 (>1740)
Longitudinal Surface Tolerance Incentive Pay, Final Completion, Average of All Travel Lanes[5]	≤45 (≤710)				

[1]Or portion of sublot placed on the project.
[2]Maximum payment for sublots with exception areas, exclusions or grinding is 100 percent, unless the excluded area is a bridge end.
[3]At the option of the engineer.
[4] Existing surfaces include reconstructed bases without profile grade control.
[5]Only Category A projects are eligible for incentive. However, any grinding except within 300 feet (90 m) of a bridge end will cause the roadway to be ineligible for surface tolerance incentive pay.
.

Compute % pay for the lot by averaging % pay for the sublots.

$$\%\text{Pay} = \frac{100 + 100 + 103 + 103 + 100}{5} = 101\%\text{Pay}$$

Surface Tolerance Pay is 101% Pay.

Total Payment is determined in accordance with Subsection 502.16. If a wearing course mixture has the following payment parameters:

Plant Air Voids	= 95% Pay
Roadway Density	= 100% Pay
Surface Tolerance	= 103% Pay,

Then the total pay is the average of voids pay, density pay, and surface tolerance pay, rounded to the nearest whole number.

The rounding rules that normally apply to test procedures do not apply to payments. Rounding for estimates and payments should follow the Contract Administration Manual. Asphalt mixture is paid to the whole percent. **If the tenths position is less than 5, round downward; if greater than or equal to 5 round upward. For example 99.3 rounds to 99% and 99.5% rounds to 100% pay.** Intermediate calculations are rounded to two more decimal places than the final answer.

$$\%\text{Pay} = \frac{95 + 100 + 103}{3} = \frac{298}{3} = 99.33 = 99\% \text{ Pay}$$

The examples of how to pay for Superpave parameters have been for a 5000 ton lot with one mix use only. Many lots are less than 5000 tons and most have different mix uses. Following the discussion of lot sizes, is an example of paying for small quantities and an example of paying for a lot with different mix uses.

LOT SIZES FOR SMALL QUANTITIES OR DIFFERENT MIX USES

It is not the department's intent that this specification be used to artificially manipulate the size of lots that will be assessed payment adjustments.

Subsection 502.14 defines Superpave lots as a segment of continuous production of asphaltic concrete mixture from the same job mix formula produced for the Department at an individual plant. The standard lot is 5000 tons with five 1000 ton sublots. Although a standard sublot is 1000 tons, minor adjustments will be made in the 1000-ton sublot size to accommodate hauling unit capacity. When the total lot quantity is expended in the partial load of a truck, the full legal load of the truck will be included in the sublot. For example, if 988 tons of HMA are produced and sent to a project and the next truck hauls 24 tons, the actual sublot size will be 1022 tons (998 + 24).

Subsection 502.14 also gives criteria for adjusting lot sizes. Note that although the size of a sublot may be increased with mutual agreement of the Project Engineer and Contractor, the ***number of sublots*** may not be increased. The maximum number of sublots is five.

The greater consistency demanded by PWL specifications is reserved for roadway travel lanes, and should not be required for a number of mix uses such as bike paths, driveways, or shoulders. The PWL specifications are not appropriate for these mix uses. Therefore, the appropriate payment methodology for asphaltic mixture is now related to the mix use, rather than the mix produced. Mixture for these uses will always be paid by Table 502-9, "Payment Adjustment Schedule for Small Quantities of Superpave"

Here is a summary of specifications by lot sizes:

≥ 3000 TONS: For payment purposes, take 1 sample for voids per sublot, take 3 cores per sublot and obtain surface tolerance results. Pay for lot in accordance with PWL calculations, Tables 502-6, 502-7 and 502-8. (Note: for unrepresented mix uses, take an additional core.)

250 – 2999 TONS: For payment purposes, take 1 sample for voids per sublot and take 3 cores per sublot . Obtain surface tolerance results for wearing courses. Pay for each 1000 ton, or less, sublot individually by table 502-8 and 502-9.

ALSO – all mixes used for incidental mix uses, such as bike paths, crossovers, curbs, driveways, guardrail widening, islands, joint repair, leveling, parking lots, shoulders, turnouts, patching, widening, and miscellaneous handwork, shall be paid in accordance with the requirements for 250-2999 tons, denoted above.

≤ 250 TONS: For projects, or separate locations within a project, requiring less than 250 tons (250 Mg), the job mix formula, materials, and plant and paving operations shall be satisfactory to the engineer. Sampling and testing requirements may be modified by the engineer and the payment adjustment for deviations waived. For example a 3200 ton project which has an additional 220 tons for driveways. The driveways would be considered a separate location within this project. The separate location is defined as an area that is constructed in a stand alone phase.

HOW TO PAY – SMALL QUANTITIES

Here are examples of how to pay for small quantity lots.

EXAMPLE #1: If a project has 1700 tons.
Pay for the first 1000 ton sublot per Table 502-8 and 502-9, Payment for the first 1000 tons stands alone. Pay for the next 700 ton sublot separately per Table 502-8 and Table 502-9. Payment for the 700 tons also stands alone.

Now assume for this example that:

1700 TONS	¾" NMS Wearing	Category C Roadway

SMALL QUANTITY SUBLOT 1 1000 TONS	
Voids	3.4%
Voids Pay	100% Pay
Density (92% required)	92.5, 92.8, 92.9
Average Density	92.7
Density Pay	100% Pay
Surface Tolerance	84 IRI
Surface Tolerance Pay	100% Pay
Total Pay = Average of Voids, Density, Surf Tol.	$\frac{100+100+100}{3}$ = **100% Pay**

SMALL QUANTITY SUBLOT 2 700 TONS	
Voids	2.1%
Voids Pay	95% Pay
Density (92% required)	91.2, 92.0. 91.9
Average Density	91.7
Density Pay	95% Pay
Surface Tolerance	74 IRI
Surface Tolerance Pay	103% Pay
Total Pay = Average of Voids, Density, Surf Tol.	$\frac{95+95+103}{3}$ = **98% Pay**

EXAMPLE # 2: A project has 5300 tons. Compute pay for this lot in accordance with PWL methods previously given using 5 voids measurements and corresponding density and surface tolerance. The last 300 tons can be added to the fifth and final sublot, because specifications state, "The final sublot, at the end of a project lot, may be increased up to 150 percent to accommodate hauling unit capacity."

EXAMPLE # 3: A project has 5800 tons. Compute pay for the first 5000 tons in accordance with PWL methods previously given using 5 voids measurements and corresponding density and surface tolerance. The remaining 800 tons is considered a small quantity lot because it exceeds the 150% allowable increase. This 800 ton lot shall be paid separately using Tables 502-8 and 502-9.

EXAMPLE # 4: A project has 7900 tons. Compute pay for the first 5000 tons in accordance with PWL methods previously given using 5 voids measurements and corresponding density and surface tolerance. Compute pay for the next 2900 tons as in Example # 1 above.

HOW TO PAY - DIFFERENT MIX USES

Here is an example of how to pay for different mix uses within a lot.

There are three pay parameters for Superpave: voids, density, and surface tolerance. This section will give examples of how to take samples and calculate payment in each of these areas. After calculating payment for each parameter, the total payment is calculated.

The following example will be used to demonstrate:

Assume a 5000 ton lot of continuous production of the same mix from a plant.

5000 TONS	¾" NMS Wearing	Category B Roadway

Assume 1000 ton sublots.

1000 TONS	1000 TONS	1000 TONS	1000 TONS	1000 TONS

To complicate things, assume different mix uses for the sublots as follows:

800 Tons Roadway Wearing 200 Tons Shoulder	500 Tons Roadway Binder 500 Tons Roadway Wearing	200 Tons Roadway Wearing 800 Tons Shoulder	600 Tons Roadway Wearing 400 Tons Shoulder	1000 Tons Roadway Binder

Different Mix Uses – Voids

Using the 5000 ton lot previously shown, the following is an example of how to determine percent payment for V_a using Subsection 502.13 of the Standard Specifications.

V_a (specification limits are 2.5% to 4.5%) results:

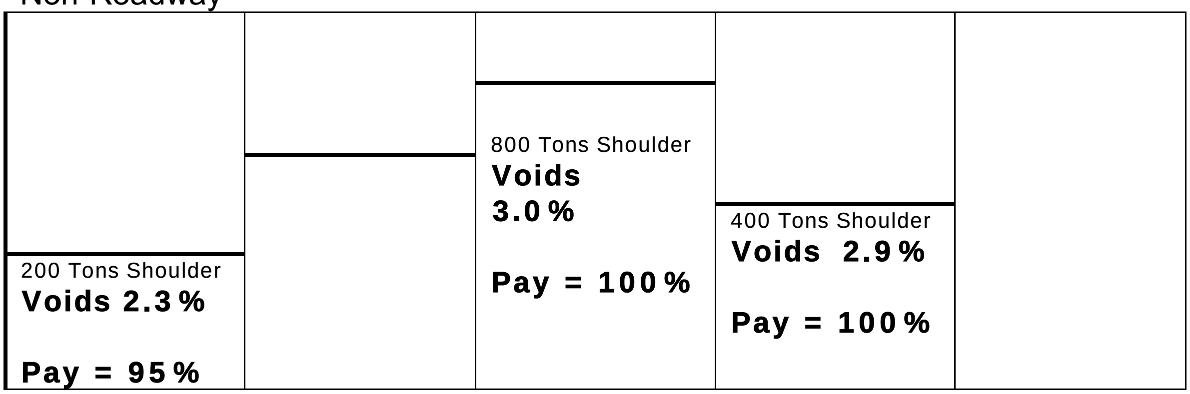
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
V_a	2.3%	2.2%	3.0%	2.9%	3.0%

From the example on page 52, Voids PWL = 66 and Voids % Pay = 90% Pay

Therefore percent payment for **V_a** shall be as per Table 502-7A = 90% for the ***roadway portion*** which represents 3600 tons.

Most of this lot, (the roadway portion), will receive 90% Pay for Voids. The exception is the quantity which is paid by the small quantity table, Table 502-9. Using the Small Quantity Table determine the % pay for the "non-roadway", or the shoulder portion of each sublot.

Non-Roadway



A table can be created to summarize total pay, as follows:

TOTAL PAY TABLE

	Tons	Voids	Density	Surface	Total (average)
Wearing	2100	90%	?	?	?
Binder	1500	90%	?	n/a	?
Shoulder-Sublot A	200	95%	?	n/a	?
Shoulder-Sublot C	800	100%	?	n/a	?
Shoulder-Sublot D	400	100%	?	n/a	?

Different Mix Uses – Pavement Density

An example of determining percent payment for Pavement Density is follows:

For density, take a minimum of three cores in each thousand ton sublot, 15 cores total. If there are different mix uses in a sublot, such as wearing and shoulder, take an extra core, if needed, to ensure that there is at least one core per mix use.

Below are some core locations and results for density. The specification minimum for roadway is 92.0. The specification minimum for shoulders is 89.0

800 Tons Roadway Wearing 91.8 92.8	500 Tons Roadway Binder 95.0	200 Tons Rdwy Wear 91.5	600 Tons Roadway Wearing 93.2 92.4	1000 Tons Roadway Binder 93.2 92.9 91.6
200 Tons Shoulder 89.4	500 Tons Roadway Wearing 92.8 92.2	800 Tons Shoulder 87.0 86.9	400 Tons Shoulder 90.1	

Compute PWL for all cores in the lot that represent the roadway travel lane.

800 Tons Roadway Wearing 91.8 92.8	500 Tons Roadway Binder 95.0	200 Tons Rdwy Wear 91.5	600 Tons Roadway Wearing 93.2 92.4	1000 Tons Roadway Binder 93.2 92.9 91.6
	500 Tons Roadway Wearing 92.8 92.2			

Total Tonnage is 3600 tons, the number of samples is 11, (n=11).

Now compute PWL and % Pay.

$$\text{Mean} = \overline{X} = \frac{91.8 + 92.8 + 95.0 + 92.8 + 92.2 + 91.5 + 93.2 + 92.4 + 93.2 + 92.9 + 91.6}{11}$$

$$= \frac{1019.4}{11} = 92.67273 = 92.67$$

$$\text{Standard Deviation} = s =$$

$$\sqrt{\frac{(91.8 - 92.67)^2 + (92.8 - 92.67)^2 + (95.0 - 92.67)^2 + (92.8 - 92.67)^2 + (91.5 - 92.67)^2 + \ldots + (91.6 - 92.67)^2}{11 - 1}}$$

$$= \sqrt{\frac{9.6419}{10}} = \sqrt{0.96419}$$

$$= 0.981932 = 0.9819$$

$$\text{Lower Quality Index} = Q_L = \frac{92.67 - 92.0}{0.9819} = \frac{0.67}{0.9819} = 0.682351 = 0.68$$

From Table 502-6, using n=11, and Q_L of 0.74, the corresponding PWL_L = 75.

From Table 502-7B, DENSITY %Pay = 90% for 3600 tons of roadway mix.

Now look at the “non-roadway” part, the 1400 tons of shoulder.

Using Table 502-9 for Density:

200 Tons Shoulder **Density 89.4** **Pay = 100%**		800 Tons Shoulder **87.0 86.9** **Average = 87.0** **Pay = 50%**	400 Tons Shoulder **90.1** **Pay = 100%**	

Note that in Sublot C, there are two cores. Use the average of these density values, with Table 502-9 to determine density sublot pay.

The same table, created previously can now be used to show Voids and Density.

TOTAL PAY TABLE

	Tons	Voids	Density	Surface	Total Pay
Wearing	2100	90%	90%	?	?
Binder	1500	90%	90%	n/a	?
Shoulder	200	95%	100%	n/a	?
Shoulder	800	100%	50%	n/a	?
Shoulder	400	100%	100%	n/a	?

Different Mix Uses - Surface Tolerance

Payment is calculated using the IRI for each sublot. Percent pay is determined for each sublot using Table 520-8A. Percent pay is calculated for the lot by averaging percent pay for the sublots. If there are different mix uses, use a weighted average by tonnage and percent pay to get percent pay for the lot.

Use Table 502-7A to determine % pay with the information below.

<table>
<tr>
<td>800 Tons
Roadway Wearing
IRI = 68
100% Pay</td>
<td>500 Tons
Roadway Binder</td>
<td>200 Tons Rdwy
Wearing
IRI = 64
103% Pay</td>
<td>600 Tons
Roadway Wearing
IRI = 67
100% Pay</td>
<td rowspan="2">1000 Tons
Roadway Binder</td>
</tr>
<tr>
<td>200 Tons
4’ Shoulder</td>
<td>500 Tons
Roadway Wearing
IRI = 77
90% Pay</td>
<td>800 Tons
10’ Shoulder</td>
<td>400 Tons
4’ Shoulder</td>
</tr>
</table>

Note that surface tolerance only affects the pay for 2100 tons of roadway wearing.

Use a weighted average to determine Surface Tolerance Pay for the wearing course portions of the lot.

$$\frac{(800)(100)+(500)(90)+(200)(103)+(600)(100)}{2100}=97.9$$

Surface Tolerance Pay for Roadway Wearing, 2100 tons, is 97.9% Pay.

The Total Pay Table is now completed.

	Tons	Voids	Density	Surface	Total (ave)
Wearing	2100	90%	90%	97.9	92.6%
Binder	1500	90%	90%	n/a	90%
Shoulder	200	95%	100%	n/a	97.5%
Shoulder	800	100%	50%	n/a	75%
Shoulder	400	100%	100%	n/a	100%

The total payment for the lot shall be determined in accordance with Subsection 502.16.

Total Payment for Roadway Wearing is the average of voids, density and surface tolerance, as follows:

$$\frac{90+90+97.9}{3}=92.6=93\%$$

Total Pay for Roadway Binder is the average of voids and density, as follows:

$$\frac{90+90}{2}=90\%$$

Total Pay for the Entire Lot is a weighted average determined by tonnage and % pay.

$$\frac{(2100)(92.6)+(1500)(90)+(200)(97.5)+(800)(75)+(400)(100)}{5000}=8\underline{9}.79=90\%\mathrm{PAY}$$

VERIFICATION and INDEPENDENT ASSURANCE

The district laboratory performs verification testing to ensure that the QC technician and DOTD personnel are using correct and accurate procedures, as well as proper equipment.

For HMA materials, the following verification tests are performed:

Sample	Tests	Frequency
Briquettes	Volumetrics	1 per lot
Pavement Cores	Density	1 per sublot
Loose Mix*	Rice Gravity	1 per lot

* G_{mm} material that was previously tested for acceptance.

Verification samples must be delivered to the district laboratory in a timely manner so that the Department inspector and the QC technician may study the total quality control process and be assured that the results of sampling and testing used for acceptance and control are valid and representative of the material.

The results of verification testing for HMA materials should be within the tolerances provided in the following table:

Test	Tolerance
Pavement Core	± 0.7 % of pavement density
V_a	± 1.0 % plant test results
G_{mm}	± 0.015 % plant test results

If the results of verification tests are outside of these tolerances or the limits of the specifications, then the District Laboratory Engineer will notify the project engineer and plant inspector immediately. It will be the joint responsibility of the project engineer and the District Laboratory Engineer to investigate the problem and, if necessary, to inspect the process, testing equipment, and testing procedures in use at the plant, followed by a notice of discrepancy when necessary.

In addition, the district laboratory will perform verification analysis on asphalt cement.

Independent Assurance, (IA) testing is required on National Highway System (NHS) projects which have federal funding. The federally mandated Independent Assurance program requires that the district laboratory cut additional cores near the acceptance cores. It is necessary that station numbers appear on the project in accordance with Section 740, Construction Layout, and that the core holes are clearly identified on the pavement. For more information on Independent Assurance, refer to the *Materials Sampling Manual*, S-701.

SUMMARY OF DOCUMENTATION

Many forms are available on the website.

Asphaltic Concrete Plant Certification Report – The Asphaltic Concrete Plant Certification Report (Appendix E4) is used to inspect the HMA plant for certification. In addition, a copy of the completed form may be used to reinspect plants for conformance to certification. The District Laboratory Engineer, or his/her authorized representative will provide one copy for the HMA plant to be kept in the Plant Certification File and will retain the original.

Certification Report for Scales and Meters – This form (Appendix E5) will be provided by the Department and can be obtained, along with all other DOTD documents, from the District Laboratory Engineer. This form is to be completed by an authorized representative of an independent qualified licensed scale calibration company hired by the contractor, or the Weights and Standards Division of the Department of Agriculture and Forestry, and submitted to the District Laboratory Engineer. This form, whether completed for initial plant certification or for subsequent 90-day checks, shall be prepared in duplicate. One copy shall be retained in the Plant Certification File at the plant and the other is to be forwarded to the District Laboratory Engineer.

Asphaltic Concrete Paving Equipment Certification – District laboratory representatives use the Asphaltic Concrete Paving Equipment Certification forms (Appendix E7 – E12) to document the certification of asphalt distributors, pavers, and rollers. This form is designed to be used as a complete package to certify the entire paving train or in parts for the certification of individual pieces of equipment. Copies of the certification forms for each piece of equipment certified in the district will be furnished upon request to each project engineer in the district by the District Laboratory Engineer. Copies of equipment certification documentation will be supplied across district lines upon request to the certifying District Laboratory Engineer.

Asphaltic Concrete Paving Equipment Checklist – This form (Appendix E6) is to be used by project personnel at the beginning of each project to document that all paving equipment used on the project is certified and is operating in accordance with the standards under which certification was granted. Copies of these checklists will be placed in the 2059 Review for the project on which the equipment was in operation. Copies will also be made available across district lines upon request to the certifying District Laboratory Engineer. This form also includes a checklist for miscellaneous equipment.

Job Mix Formula Proposal – The QC Technician submits the JMF Proposal to the District Laboratory with all back up material. See Appendix C3. An approved computer generated form can also be used.

Asphaltic Concrete Gradation – 0.45 Power Curve(s) – The QC technician shall plot the proposed design gradation on the appropriate 0.45 Power Curve according to the mixture's nominal maximum aggregate size (Appendix C6). The appropriate form corresponds to the Nominal Maximum Aggregate Size used in the HMA.

Optimum Asphalt Cement Content – Summary of Test Properties – The QC technician shall submit the Summary of Test Properties form (Appendix C1) along with the JMF Proposal form and supporting design data, to the District Laboratory Engineer. A computer generated set of curves may be used in lieu of the DOTD supplied form. Plots of Va, VMA, VFA, percent G_{mm} at $N_{initial}$, and percent G_{mm} at N_{design} shall be graphed versus percent asphalt cement as determined from the trial blends. % G_{mm} @ N_{max} must be shown to meet specification requirements.

Tensile Strength Ratio (TSR) - The QC technician shall submit the Tensile Strength Ratio (TSR) form (Appendix C2), along with the JMF Proposal form and supporting design data to the District Laboratory Engineer.

Superpave Asphaltic Concrete Plant Report – The Superpave Asphaltic Concrete Plant Report (Appendix D7) is presently a MATT System form which may be used in lieu of approved computer-generated spreadsheets to document test results associated to a lot of Superpave asphalt. It is the joint responsibility of the QC technician, the DOTD inspector, and the district laboratory to complete and sign this report.

The completed plant report is to be sent to the District Laboratory Engineer with the Asphaltic Concrete Verification Report (Appendix D9), the gyratory briquettes (one per sublot) and roadway pavement cores (two per sublot) for verification testing. The Plant Report, when filed with the Superpave Asphaltic Concrete Roadway Report (Appendix D8), will complete documentation for acceptance of the HMA lot.

An original and one copy of each plant report must be completed for acceptance. The signed original shall be sent to the district laboratory. The copy shall be kept in the plant files. The District Laboratory Engineer's representative will review the information for completeness and accuracy and sign the form on the line labeled District Laboratory. The District Laboratory Engineer will then review the information and approve the form by signing in the line labeled "Approved By" before the information is entered into the MATT System, if available. The district laboratory will keep the original of the Plant Report. Copies will be sent to each project engineer receiving mixture from the lot.

Asphaltic Concrete Control Charts – Control charts may be requested by the engineer if mixture problems develop. These charts shall be completed by the QC technician and kept on file at the plant. . They are to be maintained on a lot or running average basis. Control Charts shall be plotted for maximum theoretical specific gravity of the HMA mixture (G_{mm}), %G_{mm} @ $N_{initial}$, and G_{mb} @ N_{max}. Any corrective action taken for deficiencies (or to bring the production process closer to median values) shall be documented, dated and initialed on the back of the Control Chart by the QC technician A copy of the Asphaltic Concrete Control Chart form is shown in Appendix D6.

Superpave Asphaltic Concrete Roadway Report – This form (Appendix D8) **will be completed for each mix use for each type mix for each project**. This will result in only one pay item being recorded on each form. The DOTD Certified Paving Inspector is responsible for the completion of this form, with the exception of roadway density data and corresponding percent pay information that is determined at the plant. The DOTD Certified Plant Technician will complete these sections. The DOTD Certified Paving Inspector will sign and date the form in the space labeled "Roadway Inspector." The Pavement Report, when filed in conjunction with the Asphaltic Concrete Plant Report, will complete documentation for acceptance of the pavement lot.

An original plus two copies of this form must be generated. The DOTD paving inspector will retain one copy for project records. The original and one copy are to be sent to the DOTD plant technician with each set of pavement cores. The DOTD plant technician will complete both copies of the form with pavement density information and percent pay, then sign and date the form on the line labeled "Plant Inspector." The original will then be sent to the district laboratory with the other completed copy retained for the plant files. A district laboratory or his/her authorized representative will review the form upon receipt for completeness and accuracy, initial and date it in the upper right corner, enter the information into the MATT System, if available, and copy the form for use during verification testing. The original will then be sent to the project engineer receiving mixture for the lot for project records, and 2059 submittal.

Any disposition of failing results or payment adjustments must be noted in the "Remarks Field" by the project engineer and returned to the District Laboratory Engineer for MATT System update, if available. The district laboratory will then update the MATT System, copy the updated Asphaltic Concrete Pavement Report for laboratory files, and then return the original to the project engineer. The district laboratory will keep a copy of the updated report in the Disposition of Failing Test Reports file.

Superpave Asphaltic Concrete Verification Report – The district laboratory uses this form (Appendix D9) to report the results of Independent Assurance tests and verification tests on samples submitted by project personnel.

The DOTD plant inspector will complete an original and one copy of the Verification Report. The original will accompany the gyratory briquettes that are submitted to the district laboratory for verification testing. Before sending the form to the district laboratory with the briquettes, the technician will enter the "Header" information and sample ID for the volumetric tests along with the G_{mm} determined for the corresponding sublot. All samples ID's will consist of the lot (and sublot) number plus sample number as identified by the plant and paving inspectors. The Verification Report and briquettes are to be sent to the district laboratory along with Asphaltic Concrete Plant Report.

The DOTD paving inspector will complete an original and two copies of the Verification Report for each set of pavement samples sent to the plant for acceptance and testing. The original and one copy of the report must accompany the samples. The paving inspector will retain the second copy for project records. The paving inspector shall complete the header information, Roadway Tests and Sample ID.

After completing plant tests on the pavement samples, the DOTD plant inspector will forward one of three samples to the district laboratory for verification testing. All sample ID's shall consist of the lot (and sublot) number plus sample number. The inspector will then attach the original Verification Report to the original Pavement Report which accompanies the pavement samples to the district laboratory.

The district laboratory will use these forms (Plant and Roadway information) to enter complete verification information into the MATT System, if available. If problems are encountered during the verification process the district laboratory will send copies of the Verification Report to the project engineer.

Ticket for Hot-Mix Asphalt "Haul Tickets" – Each load of HMA delivered to a DOTD project shall be recorded on a printer ticket, which is stamped on the back with the departmental stamp.

This stamped printer ticket shall be given to the driver of the certified haul truck at the plant. The driver, upon arriving at the paving site, shall give this ticket to the DOTD paving inspector. The paving inspector is responsible for completing and signing the lower portion of the stamp.

At a minimum, the HMA ticket shall show the following information:

- Quantity of mix in tons
- Project Number
- Date
- Lot Number and Sublot Letter
- Ticket Number
- Truck Number (DOTD Certification Number for truck)
- Mix Type

CHAPTER 3 – SECTION 508 -STONE MATRIX ASPHALT

This chapter outlines the required procedures and necessary documentation for designing stone matrix asphalt (SMA) for use on a DOTD project in accordance with Section 508, Stone Matrix Asphalt, of the *Standard Specifications* (Stone Matrix Asphalt). It also details the responsibilities of the Certified Asphaltic Concrete Plant Technician (Quality Control), the DOTD Certified Asphaltic Concrete Plant Inspector (Quality Assurance), and the district laboratory. In addition, several miscellaneous items are discussed pertaining to definition of lot size, SMA compaction/MTV requirements, and documentation/forms. All requirements of Section 502 apply to Stone Matrix Asphalt, except as modified within Section 508 and in this chapter. All plant and paving equipment and processes must meet the requirements of Section 503.

SMA is hot-mix asphalt consisting of two parts: a coarse aggregate skeleton and binder-rich mastic. The rationale used in the SMA mix design is to first develop an aggregate skeleton with coarse aggregate-on-coarse-aggregate contact that is generally referred to as stone-on-stone contact. The second part of the mix design rationale is to provide sufficient mastic of the desired consistency. Satisfactory mastic consistency requires a relatively high percentage of fines passing the No. 200 sieve (0.0075mm), and relatively high asphalt cement content. For this reason, the voids in mineral aggregate (VMA), must exceed a minimum requirement (16.0 VMA). One potential construction problem with SMA is draindown of the asphalt cement from the aggregate matrix. Using a stiff asphalt cement binder along with the required amount of mineral fillers and/or fibers will help to minimize any potential draindown problem. The five steps for SMA mixture design are:

1. Select proper aggregate materials.
2. Determine an aggregate gradation yielding stone-on-stone contact.
3. Ensure the chosen gradation meets or exceeds minimum VMA requirements.
4. Choose an asphalt content that provides the desired air void level.
5. Evaluate the moisture susceptibility and asphalt cement draindown.

SMA shall be designed according to the Superpave method.

MIX DESIGN STEPS AND APPROVAL

Mix design steps and approval process are the same as for Superpave, except that the mixture must meet draindown requirements.

1 - Material Procurement and Approval

Material procurement and approval ***procedures*** are the same as for Superpave, except that JMF submittals require 10 days for approval.

Coarse Aggregate - Coarse aggregates for use in stone matrix asphalt shall be listed in QPL 2 and meet the requirements 0f Subsections 1003.01 and 1003.06(b). Coarse aggregate used in SMA shall be composed of clean and durable crushed stone. The combined aggregates shall be in accordance with the design gradation requirements in Table 508-1.

Section 1003.06(b) of the *Standard Specifications* requires that **50 percent of the coarse aggregates meet Class I friction requirements and the remainder shall meet Class I, II or III friction requirements. Alternately, 100 percent of the coarse aggregate shall meet Class II friction requirements**. At a 3 to 1 ratio in accordance with ASTM D 4791, the flat and elongated particle limit shall be 25 percent maximum by mass. In addition, at a 5 to 1 ratio, the flat and elongated particle limit shall be 5 percent maximum by mass.

Fine Aggregate - Fine aggregates for use in SMA, shall be from stone aggregate sources listed in QPL 2. Section 1003.06(b) of the *Standard Specifications* requires that the fine aggregate be comprised of 100 percent-crushed manufactured sand (i.e., screenings).

The Fine Aggregate Angularity (FAA) of each fine aggregate source shall be measured and the calculated fine aggregate blend (weighted average) shall be 45 percent minimum when tested in accordance with DOTD TR 121 (mineral filler excluded).

Asphalt Cement - Asphalt cement shall be from an approved source listed in QPL 41. Asphalt cement grade shall be PG 76-22m. No substitutions are allowed for asphalt cement for SMA.

Asphalt cement is accepted at the plant, by a Certificate of Delivery (CD) (Appendix D1). A Certificate of Delivery shall accompany each load delivered to the plant. Asphalt cement testing shall be in accordance with Section 502 and as previously discussed.

Additives – Anti-strip, silicone, (when needed), hydrated lime, (if used), and mineral filler, (if used), shall meet the requirements for Superpave.

Cellulose or mineral fibers, pre-approved by the Department, shall be used to prevent draindown or to serve as a filler. The specific requirements for fibers are listed in Subsections 503.05, 508.02 and 1002.02.

2 – Aggregate Bulk Specific Gravity (G_{sb}) and Gradation

Procedures used to determine bulk specific gravity (G_{sb}) and gradation are the same as for Superpave, except that the gradation shall be as specified in Table 508.1.

NOTE:
RAP is not allowed in SMA.

3 – Blending Aggregates to Meet Specified Gradation

This procedure is the same as for Superpave.

4 – Trial Blends with Varying Asphalt Cement Contents

This procedure is the same as for Superpave, except that N_{design}, which equals $N_{max,}$ shall be at seventy-five revolutions of the Superpave Gyratory Compactor. Percent G_{mm} at N_{design} shall not be more than 89 percent at 9 revolutions and not more than 96.5 percent at 75 revolutions. The Job Mix Formula shall show a minimum of 16.0 percent VMA at N_{design} and the SMA shall maintain a minimum average of 16.0 percent VMA for each lot during production.

A maximum 0.3 percent draindown of asphalt cement by weight (mass) will be allowed and shall be calculated in accordance with ASTM D6390. Moisture susceptibility shall be determined in accordance with DOTD TR 322.

Each specimen (briquette) prepared for each trial blend shall be tested for the following:

Superpave Gyratory Compactor Design (AASHTO M 323):

Bulk Specific Gravity, G_{mb}
Air Voids, V_a
Voids in Mineral Aggregate, VMA
Voids Filled with Asphalt, VFA
Percent G_{mm} at $N_{initial}$
Percent G_{mm} at N_{design}

In addition, a loose mix sample at each trial blend asphalt cement content shall be prepared and tested for maximum theoretical specific gravity, G_{mm} (Rice Gravity), using DOTD TR 327. For laboratory produced trial blends the mixture, when tested for G_{mm}, should be cured at compaction temperature for approximately two hours prior to specimen preparation. Plant produced trial blends require one hour curing or aging period. The average of the test values of two specimens at each asphalt content shall be averaged to report a single value.

5 – Asphalt Cement Draindown Evaluation

A maximum 0.3 percent draindown of asphalt cement by mass is required as denoted in Subsection 508.03 and shall be tested in accordance with ASTM D 6390.

6 – Moisture Sensitivity Analysis – Lottman Test (Tensile Strength Ratio)

Moisture sensitivity analysis is the same as for Superpave

7,8 – Submittal Process and Documentation – JMF Proposal Form and Approval of JMF Proposal

The process for submittal and approval of JMF Proposal are the same as for Superpave.

9 – Validation of JMF Proposal

Validation procedures shall be in accordance with Subsection 508.04.

Validation testing for each third of the validation sublot shall include:

- 1 – aggregate gradation and percent asphalt cement
- 1 – briquettes tested for volumetrics (V_a and VMA), with corresponding Maximum Theoretical Specific Gravity (G_{mm}).

In addition, for the validation lot, take

- 1 – asphalt cement draindown
- 1 – percent anti-strip additive

Pending acceptable validation results, moisture sensitivity testing (Lottman testing) shall be performed the next day in accordance with Superpave procedures.

- 1 – moisture sensitivity (Lottman) (Tensile Strength Ratio)

Once completed, the validation data is promptly forwarded to the District Laboratory Engineer.

The average of test results shall meet specification requirements for job mix validation and final job mix formula approval. If the mix fails to validate, one additional attempt may be allowed by the District Laboratory Engineer before requiring redesign of the mixture.

Upon validation of the JMF, the validation results shall be used for acceptance.

The department will also evaluate the performance of the mixture on the roadway to ensure that the JMF is not contributing to laydown deficiencies, such as segregation, tenderness, workability, compactability, or surface texture problems. Mixtures that are identified as causing any laydown deficiency will not be approved. The project engineer, in charge of the project, or the District Laboratory Engineer may reject a proposed JMF due to roadway deficiencies.

If a mixture design fails to validate, a new proposal must be submitted and validation testing repeated. No mixture shall be produced for a DOTD project until the District Laboratory Engineer has approved a new JMF Proposal.

If the JMF does not validate, the District Laboratory Engineer will indicate disapproved on the proposed JMF, enter the sequence number, date, and sign it (Disapproved). Copies of the disapproved JMF Proposal will be distributed to each project engineer who received a portion of the lot.

10 – Final Approval of JMF

Procedures for final approval are the same as for Superpave.

DEFINITION OF A LOT

Lots shall be determined the same as for Superpave, except that that all travel lane SMA, regardless of the quantity produced, will be paid in accordance with Section 508, not as a Small Quantity Lot.

PLANT QUALITY CONTROL

General requirements are the same as for Superpave, except that draindown must be performed sufficiently to ensure that the mixture is within specification limits. Percent asphalt cement, gradation, G_{mm}, and volumetrics shall be measured in accordance with Section 502. Sampling and testing requirements are as specified in the Materials Sampling Manual.

The sample of mixture taken from each sublot shall be evaluated for volumetrics. A minimum of two briquettes @ N_{design} shall be prepared per sublot and evaluated for V_a and VMA. Also, the samples shall be evaluated for percent G_{mm} @ $N_{initial.}$ If the average quality control tests for the lot for gradation, percent air voids, and VMA are not within specification requirements, corrections shall be made or operations ceased. These values are shown along with other contractor/producer data on the QC copy of the Plant Worksheet (Appendix D4).

This specified Quality Control Program is only a minimum requirement and should not prevent the technician from performing any test(s) to ensure consistent SMA, meeting specifications.

The asphalt cement content is based on the Ignition Oven (TR 323) results along with a correction factor. The correction accounts for moisture, fibers, and loss of aggregate during ignition. For additional information, the rate of asphalt cement delivery is continuously shown, in digital form, on all modern plant controls. If these two values differ significantly then the correction factor for the Ignition Oven needs to be reevaluated or the plant asphalt cement metering systems needs to be recalibrated.

The QC technician shall also check the rate of anti-strip, mineral filler, lime, or fibers at the beginning of each operational period, and when necessary thereafter, to ensure that the mixture is receiving the JMF percent.

Documentation

The QC technician is to document all quality control (QC) testing and keep these records on file at the plant laboratory. The QC Technician shall stamp all QC documents “QC” with red ink, in minimum one-inch high letters. The QC technician shall keep, as a minimum, the following records on file at the plant laboratory:

1. An approved Superpave Asphaltic Concrete *Plant Report* form (Appendix D4) for each lot showing one (minimum) extracted asphalt content and gradation results for each sublot.

2. The Plant Report form shall also show a single test value for the following for each sublot:

   - Theoretical Maximum Specific Gravity (G_{mm})
   - Air Voids (V_a)
   - Voids in Mineral Aggregate (VMA)
   - Percent G_{mm} @ $N_{initial}$
   - Percent G_{mm} @ N_{design}

Asphaltic Concrete Control Charts (Appendix D6). For control purposes, the QC technician shall plot, per sublot, individual results for percent asphalt cement (TR 323), extracted gradation (TR 309), air voids (V_a), and theoretical maximum specific gravity (DOTD TR 327) on Asphalt Concrete Control Charts. The percent passing for each screen as indicated on the Job Mix Formula shall be on the control chart, with the upper and lower limits. When the control charts show a trend in the mix toward the JMF limits, or continuous readings above or below the limits, the QC technician shall immediately take steps to prevent the mix from moving outside the JMF limits.

All corrections made by the QC technician shall be documented on the back of the control chart. This documentation shall include the action taken, date and time, and be initialed by the QC technician. **The control charts shall be maintained per plant lot per job mix.**

PLANT ACCEPTANCE

Plant acceptance tests and DOTD Certified Inspector responsibilities are the same as for Superpave, except that tests will include the following:

Plant acceptance tests will include:
- Percent anti-strip
- Percent asphalt cement
- Air voids
- VMA
- % Retained on the No. 4 sieve
- % Retained on the No. 200 sieve

Roadway acceptance tests will include:
- Pavement density
- Surface tolerance

In addition, the Plant Inspector will perform draindown tests in accordance with ASTM D 6390 once per lot (minimum). The DOTD inspector will determine the theoretical maximum specific gravity, G_{mm} in accordance with DOTD TR 327 to utilize in volumetric and roadway density calculations.

Asphalt Cement Properties and Anti-Strip

Asphalt cement,and anti-strip shall be accepted by the same methods and procedures as for Superpave.

Additives

Any material rates, including silicone, hydrated lime, mineral filler, cellulose or mineral fibers shall be checked at least twice per lot and as needed to ensure conformance to JMF and specification limits.

Air Voids (V_a) and Voids in Mineral Aggregate (VMA) – Payment Factor Applied

Sampling and testing for Volumetrics (V_a and VMA) shall be conducted the same as for Superpave. Pay, however, is determined differently.

The test results for volumetrics (V_a and VMF) for each sublot shall be compared to the JMF limits. If any results are out of the JMF limits, immediate corrections shall be made or operations for DOTD projects shall be discontinued.

Deviations from the JMF limits are then determined for each sublot in accordance with Table 508-1 – Stone Matrix Asphalt (SMA) Mix Properties. The average of the % deviation's for each sublot are then used to compute % pay for V_a and for VMA in accordance with Table 508-2 – Payment Adjustment Schedules.

An example of determining percent payment for V_a and VMA is as follows:

Lot 105 – 5010 tons of SMA (12.5 mm NMS)

V_a and VMA results as shown for Lot 105:

	Sublot A	**Sublot B**	**Sublot C**	**Sublot D**	**Sublot E**
V_a	3.9	3.5	3.6	3.5	3.5
VMA	15.6	15.7	15.2	16.2	15.6

From Table 508-2 it can be seen that the V_a for each of the five sublots is within the specified range of 2.5 to 4.5 percent (from Table 508-1). There were no deviations from JMF limits.

However, the VMA for the sublot A is 0.4 percent below the 16.0 minimum shown in Table 508-1. Additional deviations are as follows:

	Sublot A	**Sublot B**	**Sublot C**	**Sublot D**	**Sublot E**	Average
VMA	15.6	15.7	15.2	16.2	15.6	
Deviations	0.4	0.3	0.8	0.0	0.4	0.4

Therefore, from the Payment Adjustment Schedules (Table 508-2), for an average deviation of 0.3 – 0.5, a payment of 95.0 percent would be applicable to Lot 105 for VMA results.

Although % pay has now been determined for V_a, and VMA, the gradation must still be considered to determine total plant acceptance pay. **In addition, for roadway acceptance, the percent payment for pavement density and surface tolerance must be considered.**

Gradation – Payment Factor Applied

Gradation sampling and testing procedures shall be conducted the same as for Superpave except that different gradation requirements apply. The percent passing the No. 4 and No. 200 will be used to determine pay.

This adjustment in unit price is determined by percent deviation from JMF control limits for the No. 4 and No. 200 sieve sizes.

An example of applying payment adjustment factors for extracted aggregate gradation is as follows:

Use the following validated JMF target for gradation, along with tolerances from Table 508-1 to get the specification limits.

Sieve	JMF	Tolerance	Specification Limits
No. 4	30	± 4	26 - 34
No. 200	8.6	± 1	7.6 – 9.6

Lot 105 – 5010 tons of SMA (12.5 mm NMS)

Gradation results (No. 4 and No. 200 sieves) for Lot 105:

	Sublot A	**Sublot B**	**Sublot C**	**Sublot D**	**Sublot E**
No. 4	27	28	26	30	34
No. 200	8.3	7.9	8.6	8.6	8.9

For payment determination for gradation, the percent deviation for each sieve for each sublot from the JMF tolerances is calculated. The average of the sublot deviations is used to determine the percent payment for each sieve size.

From Table 508-2 it can be seen that each value is within specification limits. Therefore, the average deviations for the No. 4 and No. 200 sieves for the five sublots are within the specified ranges in Table 508-1 for full payment.

Plant Pay

To determine total plant acceptance pay, first average the % pay for these four items (V_a, VMA, Percent Passing the No. 4, and Percent Passing the No. 200).
For example:

V_a:	100%
VMA:	95%
No. 4 Sieve:	100%
No. 200 Sieve:	100%

$$\text{Average} = \left(\frac{100 + 95 + 100 + 100}{4} \right)$$

$$\text{Average} = 98.8\,\text{percent} \ = 99\%\ \text{pay}$$

Pavement Density

Obtaining cores for measurement and calculations of pavement density shall be the same as for Superpave.

To determine pay for roadway density, first determine for each core the bulk specific gravity (G_{mb}) (DOTD TR 304), and compare, as a percentage, to the theoretical maximum specific gravity (G_{mm},).

Then determine the average $\%G_{mm}$ for the sublot.

Compare this value to Table 508-2 requirements to determine % Density Pay for sublot to determine the deviation.

For example:

Sublot	Core 1	Core 2	Core 3	Core Average	Deviation	% Sublot Pay
A	94.1	93.8	94.3	94.1	0.0	100
B	94.2	94.2	93.9	94.1	0.0	100
C	93.8	93.9	94.0	93.9	0.1	95
D	92.9.	92.6	92.3	92.6	1.4	80
E	94.1	94.4	94.3	94.3	0.0	100

Now average the % Sublot Pay = $\frac{100 + 100 + 95 + 80 + 100}{5}$ = 95% Pay

Roadway Density Pay for the lot is 95%.

Surface Tolerance Requirements

Surface tolerance requirements are the same as for Superpave.

For example, assume that surface tolerance pay is 100%.

Percent pay for roadway acceptance is the average of percent payment for roadway density and surface tolerance, or:

$$\frac{95+100}{2} = 97.5\% = 98\%\ \text{Pay}$$

Now determine total pay.

TOTAL LOT PAY

The percent pay for the SMA Lot will be the lowest value of the percent payments for plant and roadway acceptance as illustrated below from previous calculations.

Plant Acceptance

• V_a	100.0	percent
• VMA	95.0	percent
• No. 4 sieve	100.0	percent
• No. 200 sieve	100.0	percent
Average	99%	

Roadway Acceptance

- Pavement Density

Sublot 105-A	100.0	percent
Sublot 105-B	100.0	percent
Sublot 105-C	95.0	percent
Sublot 105-D	80.0	percent
Sublot 105-E	100.0	percent
Average	95.0	percent

- Surface Tolerance 100.0 percent

The percent payment for roadway acceptance is the average of the percent payments for pavement density and surface tolerance:

Percent Roadway Payment = (95 + 100)/2 = 97.5 percent = 98%

Total Payment

For roadway acceptance, the percent payment for pavement density and surface tolerance are averaged. Finally, the percent payment for the SMA lot will be the lowest value of the percent payments for plant acceptance and roadway acceptance.

> The percent payment for the Lot 105 is the lowest value of the percent payments for plant acceptance (99) and roadway acceptance (98). Therefore, the total payment for Lot 105 is 98 percent.
>
> All calculations for percent payment shall be rounded to the nearest whole percent.

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DOTD DISTRICT LABORATORY – VERIFICATION AND INDEPENDENT ASSURANCE

Verification and Independent Assurance shall be the same as for Superpave and the Materials Sampling Manual.

SMA PLACEMENT AND COMPACTION

The SMA mixture shall be placed and compacted in accordance with Sections 502 and 508.08.

SUMMARY OF DOCUMENTATION

All documentation shall be the same as for Superpave, except for the determination of % payment. In addition draindown results shall be shown on the JMF and the Plant Report.

CHAPTER 4 – SUPERPAVE ASPHALT EQUIPMENT AND PROCESSES

This chapter describes the equipment and processes used in producing a Superpave Asphaltic concrete mixture for a DOTD project under Standard Specifications Section 502, Superpave Asphaltic Concrete Mixtures, and in conjunction with Section 503, Asphaltic Concrete Equipment and Processes. Section 508 provides details of specific equipment and construction requirements, describes inspection of equipment and processes, explains yield and discusses the coordination of production rates.

This chapter shall be used along with Section 502 (Superpave Asphaltic Concrete Mixtures) and Section 503 (Asphaltic Concrete Equipment and Processes) of the Standard Specifications. This chapter also applies to Section 508 (Stone Matrix Asphalt) and some subsections of Section 1002 (Asphalt Materials and Additives) and Section 1003 (Aggregates).

PLANT CERTIFICATION

INITIAL PLANT CERTIFICATION

Plants furnishing asphaltic concrete mixtures in accordance with Sections 502 and 508 shall be certified at least every two years pending inspection and approval by the District Laboratory Engineer. The district laboratory in the district in which the plant is located will certify the plant. Material shall not be produced or accepted on any DOTD project from an asphalt plant that does not possess a valid certification. Certified plants will have a Plant Inspection Certification sticker placed in an obvious location in the plant control house (Appendix E3).

Following is a list of steps required to certify a plant and on-site laboratory:

1. The plant shall be operational with approved materials on-site and be capable of producing mixtures that are correctly proportioned and mixed. The plant shall consistently produce specified materials in accordance with Sections 502 or 508.

2. In accordance with Subsection 503.02(b), the plant and laboratory equipment, meters, scales and measuring devices, and plant mixture-weighing device shall be tested, inspected and certified by the Weights and Measures Division of the LA Department of Agriculture and Forestry or by a independent scale service, licensed by Louisiana and approved by the certifying District Laboratory Engineer. These certifications shall be maintained in the Plant Certification File for access by district laboratory personnel. The service/technician will place a signed sticker in an obvious location in the plant control house. Scales shall be checked in a conventional manner using known weights of sufficient size to check the scale system in its upper ranges with a minimum number of loadings, to the satisfaction of the department.

> **NOTE:**
>
> When a calibration service/technician located outside of Louisiana must be used to calibrate a scale or metering device, the service/technician shall be licensed by the state where the service/technician is located under standards similar to those required by Louisiana and approved by the DOTD Materials Engineer Administrator.

3. The producer shall notify the district laboratory that the plant is ready for certification.

4. The District Laboratory Engineer will send qualified personnel to certify the plant using the *DOTD Asphaltic Concrete Plant Certification Report* (Appendix E4). This form documents the inspection of materials, crushing apparatus, individual plant components, storage/surge silos, testing and laboratory. Construction personnel may also use this form as a guide for routine plant inspection. The District Laboratory Engineer must sign and date the form.

5. Upon satisfactory completion of the Asphaltic Concrete Plant Certification Report, plant certification will be granted for a two-year period, provided the plant is maintained in accordance with the conditions under which certification was issued.

Every 90 days (or more frequently, if directed by the District Laboratory Engineer) the plant *may* be inspected for conformance to certification requirements by the District Laboratory Engineer's representative.

RE-CERTIFICATION

Before the two-year certification period expires, the producer shall notify the district laboratory that the plant is ready for re-certification.

The producer shall also notify the District Laboratory Engineer of any major change in the manufacturing process at the plant because a new certification inspection will be required. This would include the installation of a new dryer/drum, RAP system, baghouse, storage/surge system, or proportioning system.

REVOKED CERTIFICATION

If a plant fails to conform to DOTD standards under which certification was issued, the District Laboratory Engineer will revoke the plant certification. The certifying District Laboratory Engineer may also revoke plant certification when the mixture demonstrates continued non-conformance to specifications.

Once certification has been revoked the plant will be prohibited from supplying mix for any department project until all deficiencies have been corrected and certification is reinstated by the District Laboratory Engineer.

PLANT LABORATORY EQUIPMENT AND DOCUMENTATION

The plant shall be equipped with a quality control laboratory that, as a minimum, shall comply with Subsection 722.02. The plant laboratory shall contain equipment to meet the requirements of the specifications and as referenced in applicable test procedures.

At the time of this printing, the following equipment is required:

- Constant Temperature Oven (100°F to 400°F) A 350°F capability oven is for heating loose mix and gyratory briquettes. It should be of adequate size to hold 3 gyratory molds. An oven of 125°F capability is required for moisture content determination and for drying cores.
- Fume hoods
- Specimen Ejector
- Shakers, splitters, scales
- Approved SHRP Gyratory Compactor, and extra molds (4 recommended).
- Maximum Specific Gravity (G_{mm}) apparatus, including vibrating table, pycnometer, vacuum pump and drier apparatus, and residual pressure manometer
- Saw, suitable for cutting pavement cores
- Automated Ignition Furnace
- Freezer for TR 322, Tensile Strength Ratio
- Breaking heads for Lottman test
- Water baths, at 77°F and at 140°F.
- Draindown test apparatus for SMA Mixes
- Land-based telephone
- Computer and adequate connection for internet connectivity
- Other laboratory equipment used to perform Quality Control/Acceptance Testing
- Laboratory Equipment Manual which documents equipment calibrations
- If mix design is performed at the plant lab, then a Void content apparatus (FAA) and a Flat & Elongated (F&E) Gauge are required.

The contractor shall supply all of this equipment. Also, the contractor shall provide sufficient six-inch diameter molds and auxiliary equipment necessary for the gyratory compactor and its calibration. DOTD will provide Marshall compactors, devices and molds, but not breaking heads. A loading scoop (chute) for transferring material to gyratory molds is recommended to minimize segregation and temperature loss and help in attaining consistency.

All equipment supplied by the contractor/producer (including electronic scales) shall be maintained, serviced and calibrated in accordance with the manufacturers' recommendations and Subsection 503.02.

The District Laboratory Eengineer will inspect and approve all laboratory equipment supplied by the contractor/producer at the time of initial plant certification and during all subsequent inspections.

All laboratory equipment shall be calibrated and verified by the procedures in AASHTO R18, the appropriate test methods, and by the frequency directed in AASHTO R18.

Traceable standards and accreditation are not required. The contractor shall maintain a Laboratory Equipment Manual containing all records for calibration of plant equipment. See the Preface and website for information and worksheets.

SCALES AND METERS CERTIFICATION

In accordance with Subsection 503.02(b), every 90 days (or more frequently, if directed by the District Laboratory Engineer), the plant shall have its meters, scales and measuring devices tested, inspected and recertified by the Weights and Measures Division of the LA Department of Agriculture and Forestry or by an independent scale service approved by the certifying District Laboratory Engineer. The required *DOTD Certification Report for Scales and Meters* (Appendix E5) shall be completed and sent to the District Laboratory Engineer each 90 days. One copy shall be sent to the project engineer and one shall be retained at the plant in the Certification File.

There must be a calibration sticker on each scale and meter. If the DOTD Certified Inspector has reason to question the calibration of any scale or meter, the inspector will contact the District Laboratory Engineer. The District Laboratory Engineer has the authority to require the recalibration of scales or meters even though the ninety-day calibration sticker has not expired. Meters must properly display flow rate and total amount of material and liquid dispensed.

EQUIPMENT CERTIFICATION

Primary roadway equipment shall be certified. This equipment includes asphalt distributors, pavers, rollers and hauling equipment. The District Laboratory Engineer, in the district in which the equipment is operating, will arrange inspection and will issue certification. Certification signifies that the equipment is in satisfactory condition and is capable of performing its function as related to proper paving practices and in accordance with department standards. Certification will be granted following an evaluation of the equipment's performance on the project. These evaluations shall be documented on the following department forms:

- Asphalt Distributor – *DOTD Asphaltic Concrete Paving Equipment Certification* (Appendix E7).
- Paver - *DOTD Asphaltic Concrete Paving Equipment Certification* (Appendix E8).
- Roller - *DOTD Asphaltic Concrete Paving Equipment Certification* (Appendix E9).
- Haul Trucks - *DOTD Asphaltic Concrete Haul Truck Certification* (Appendix E10).

For haul trucks, separate tractor/trailer trucks require certification together as a unit so that an accurate total tare weight may be determined. The DOTD number on separate tractor/trailers must match, showing that they were originally certified together. A new trailer shall require a new certification. Prior to certification, a truck or tractor/trailer shall have its tare weight determined on a truck scale certified by the Weights and Measures Division of the Louisiana Department of Agriculture and Forestry. This tare weight shall be determined with a minimum fuel tank capacity of three quarters. The tare weight is used to calculate the maximum payload the truck or tractor/trailer is permitted to legally haul according to its axle size. DOTD Engineering Directives and Standards (EDSM) Number III.1.1.12 outlines the *Enforcement of Legal Load Requirements on Construction and Maintenance Construction Projects* (See website.). A copy of the DOTD truck (and trailer, if applicable) Weight Certification Tag is shown in Appendix E11.

Certification of all equipment is valid for two years provided the equipment is maintained in accordance with the conditions under which certification was issued. Expired equipment shall not be used for more than 2 days before renewing certification. The project engineer's representatives, at the beginning of each project, will inspect equipment. They will complete the *DOTD Asphaltic Concrete Paving Equipment Checklist* (Appendix E6 and web site) during this inspection and place it in the 2059 Review for inspection documentation. A copy of the Equipment Inspection Certification sticker is shown in Appendix E3.

Official certification and performance reviews/evaluations do not release the DOTD or QC technician from the responsibility of monitoring the performance of plant, transport, and roadway equipment on a daily basis. If equipment fails to perform satisfactorily or is not maintained in acceptable condition the inspector is to notify the project engineer and District Laboratory Engineer. If an equipment malfunction is detrimental to the project, the certified technician or inspector has the authority to require the removal of the equipment.

Section 503.10 of the *Standard Specifications* requires the use of a material transfer vehicle (MTV) when placing the final two lifts of HMA on roadway travel lanes. There is not yet a certification for the MTV, but the project engineer's representative shall inspect it for conformance to Subsection 503.10. The form in Appendix E12 may be used during the inspection.

PLANT AND ROADWAY INSPECTION

The Certified Plant Inspector and the Certified Paving Inspector are the official representatives of the department through the authority of the project engineer. Hence, the project or plant becomes the inspector's responsibility. Other department representatives must coordinate their efforts to improve operations within the realm of their responsibility with the Certified Inspector at the plant or project site. The inspection of the HMA product must be a coordinated effort between the plant and paving inspectors. Because problems in the laydown phase of the operation may be directly related to mix characteristics, the paving inspector is to confer with the plant inspector regarding problems that may originate in the manufacturing process.

The concept of applying a payment adjustment to certain acceptance tests does not imply that the role of DOTD's Certified Plant Inspector is limited to performing or monitoring these tests. Increased dependence on contractor/producer quality control programs has extended the need for DOTD inspector's to be vigilant and knowledgeable concerning the production, transport, placement and compaction of the hot-mix asphalt materials. It is intended that all requirements of the specifications shall be adhered to, not merely those to which payment adjustments are applied.

If problems arise in the production, transport or paving operations, it is the Certified Inspector's responsibility to notify the contractor/producer's representatives that the product is not meeting department standards. The DOTD Certified Inspector will tell the contractor/producer what is wrong, but under no circumstances is the inspector to order a solution to the problem by word or action. Correcting the problem so that the product meets all requirements of the specifications is the responsibility of the contractor/producer. If corrective actions are not made, the inspector is to notify the project engineer and district lab engineer and make a subsequent investigation to ensure that corrective action has been taken. The inspector will document all actions, discussions with other department personnel and contractor/producer personnel, any other information relevant to the situation and will take measurements or samples, as necessary, to identify the problem.

When repeated deficiencies occur in any area of the production, transport or paving processes, the contractor/producer must take immediate action to correct the problem. Failure to do so can result in the discontinuance of operations for DOTD projects. Quality control shall be accomplished by a program independent of, but correlated with, the department's acceptance testing and shall verify that all requirements of the JMF are being achieved, and that necessary adjustments provide specification compliance. **It is the intent of the specifications that mixtures provided meet 100 percent for all production. Whenever the mixture produced falls into areas under which payment adjustment schedules must be applied, the contractor/producer shall make immediate adjustments or the DOTD Certified Inspector will require the discontinuance of operations for DOTD projects.**

Plant Inspection

The Certified Inspector at the plant must continually observe the entire manufacturing process. The inspector is to make a daily general inspection of the plant to ensure that it is in conformance with the standards under which certification was granted. The inspector must be familiar with Section 503 of the *Standard Specifications*, Asphaltic Concrete Equipment and Processes, and the certification standards for plants. It is also the inspector's responsibility to observe the contractor/producer's testing, monitor the results, and perform any sampling and testing operations assigned to department personnel. The plant equipment and operations are to be inspected continually during production to ensure that no malfunctions have occurred which will have a detrimental effect on the mixture.

The following headings indicate areas of the plant in which routine inspection is considered essential. These lists are not intended to be comprehensive or to exclude other areas from regular inspection. They are merely intended to serve as a guide to the inspector in the performance of this responsibility.

Plant Equipment

Stockpiles and Handling - Any new materials delivered to the plant are to be inspected, sampled, and tested in a timely manner so that production is not disrupted.

Aggregates must be handled in a manner that will not be detrimental to the final mixture.

Stockpiles shall be built without causing segregation. Segregation can be minimized if stockpiles are constructed in successive layers, not in a conical shape. Constructing stockpiles in layers enables the tendency of large aggregates to roll to the outside and bottom of the pile. Stockpiles shall be located on a clean, stable, well-drained surface to ensure uniform moisture content throughout the stockpile. The area in which the stockpiles are located shall be large enough for the stockpiles to be separated, so that no intermixing of materials will occur. Stockpiles shall not become contaminated with deleterious materials such as clay balls, leaves, sticks or non-specification aggregates. For information on dedicated and non-dedicated stockpiles, see Chapter 1.

Material Proportioning - All materials used, such as aggregates, asphalt cement, mineral filler, hydrated lime, fibers and RAP shall be proportioned by fully integrated measuring systems that maintain the required proportions in conformance with the approved mix design.

Cold Bins – Cold feed apparatus shall conform to Subsection 503.03(b) and shall be inspected routinely. Bins shall be of the proper size to accommodate loader bucket size and plant production. They shall also be of a configuration that will not contribute to segregation and be in good condition. There shall be no holes in any bin. The bin separating partitions shall not be worn or broken. If a partition is damaged to the point that this specification is not met, the contractor/producer shall replace the damaged part. Cold feed bins shall be loaded in a manner that will not contribute to segregation. Aggregates shall be dumped into the center of each bin. Bins shall be kept adequately filled with a relatively constant level of material with uniform moisture content.

Belt feeders shall be in good condition, not worn or broken. Gate openings and belt speeds shall be set to distribute the appropriate gradation for the job mix formula being produced. The gate openings and belt speeds shall be periodically inspected to ensure that they remain properly set. Aggregates shall flow uniformly onto the belt. Clogged gates, bridging or excessive moisture can cause non-uniform flow. If the material is not flowing uniformly, the inspector will require the contractor/producer to locate and correct the problem.

Truck Loading - The loading of trucks will be observed to ensure that loading techniques or discharge equipment is not contributing to mixture segregation. Equipment that drops a large amount of mixture at a time into the truck will tend to generate less segregation than compared to equipment that discharges a small flow/stream. Discharging material into the front, back, then middle of the truck bed is a sequence that may be utilized at the plant to load trucks. The material dropped into the front and back should be placed as close as possible to the front and back of the bed to minimize segregation caused by the rolling of large aggregates. The intent of this truck loading procedure is to minimize the roll down of coarse aggregate at the front and back of the truck and to concentrate any roll down in the center of the load, where it will be more readily mixed with the mass of material during discharge into the paver or MTV. When equipment necessitates deviating from this procedure, the producer may modify this procedure as long as segregation does not occur.

Drum mix plants will be checked for satisfactory performance by inspecting the material exiting the drum mixer. It will be checked for temperature, coating [Ross Count, (DOTD TR 328), if questionable], moisture and segregation. If segregation is occurring during the mixing process, one side of the material coming out of the dryer/drum will usually be fine and the other coarse. Such segregation is often caused by improper drum operation.

Batch plants will be checked during production for such things as proper sequence of bin use, screens, uniform asphalt cement distribution, proper mixing temperature, leaking valves or gates, JMF mixing time, excessive override, overflow chutes not blocked and no dry material falling into truck beds during loading.

Material produced at the beginning or termination of production periods shall be diverted from DOTD projects. During startup, the QC technician shall observe the mixture coming out of the diversion chute during these periods to determine that proper mixing and coating are being achieved before allowing the HMA materials to enter the surge or storage silos.

The surge or storage silos in use at all plants are components that must be carefully and routinely inspected. The batcher or slug feeder on the top of the silo must operate properly and at all times. The gates must close tightly so that material cannot dribble through. The required indicator lights in the control room must accurately reflect how long the "slug" feeder is open. The storage silo or surge silo must be kept at least one-third full at all times to maintain the proper cone shape of the material in storage and to reduce the height of mix drop, thereby helping to prevent segregation.

On a daily basis, when the plant is in production, the resident DOTD inspector will, as a part of continuous quality assurance efforts, inspect the plant and its individual components. Section 503 (Asphaltic Concrete Equipment and Process) outlines requirements for the inspection of the following items:

- Asphalt cement tanks (storage and working)
- Anti-strip additive equipment
- Cold aggregate feeders (bins)
- Hydrated Lime/Mineral Filler equipment (if used)
- Screening systems
- Dryer/drums
- Thermometers (including thermocouples)
- Dust collection systems (baghouses)
- Asphalt Measuring Equipment
- Weigh hoppers (if used)
- Scales and printer systems
- Storage and Surge silos
- Mix Release agent dispenser systems
- Hot-Bins (if a batch plant is used)
- Pugmills (if a batch plant is used)

Not only shall proper functioning of these individual components be inspected, but their combined operation is to be continually monitored for proper quality assurance.

Inspection of Mixture at Plant

Temperature of the HMA Mixture – The temperature is to be checked a minimum of 5 trucks per lot by the QC technician and recorded on the QA copy of the Asphaltic Concrete Plant Report. For each temperature determination, the temperature shall be checked in more than one location per truck.

Segregation – HMA mixtures that exhibit obvious segregation when loaded at the plant shall not be issued a haul ticket. The material shall not be transported to a DOTD project. If there is plant segregation the loading procedure, stockpile construction, cold feed bin operation, mixing process and surge/storage bin operations should immediately be inspected for proper function.

Uniformity – The HMA material should be uniform in appearance in all aspects from batch to batch and from one area of the truckload to another. There should be no lumps, areas of differing color, segregation or wet/dry areas. Inconsistent color throughout a truckload may also be the result of excessive dryer/drum flight wear, low or excessive asphalt cement content or inadequate drying/heating. If the mixture does not exhibit acceptable uniform color, the Certified Inspector will require the QC technician to identify and correct the problem.

Odor – Burned or unusual odor may be indicative of oxidized asphalt cement.

Asphalt Coating – HMA material which exhibits obvious coating deficiencies shall not be transported to a DOTD project. If the Certified Inspector suspects that the mixture is improperly coated, he/she will sample the deficient material and perform a Ross Count to determine if the material meets the DOTD requirements of 95 percent coating.

Moisture – Excess moisture in HMA materials may cause the mixture to appear to have excessive asphalt cement. Hence, the material will appear to be wet and shiny and slump in the truck. This is because, prior to moisture evaporation,, the saturated steam is acting like excess asphalt cement. If the Certified Inspector(s) suspects moisture problems, then the HMA material shall be analyzed for moisture content (DOTD TR 319). **The maximum moisture content allowed by specifications is 0.3 percent.**

Haul Ticket

All truckloads of HMA materials shall be accompanied by a properly completed haul ticket. Haul tickets show the exact quantity, by weight, of material in the haul truck. This quantity, in tons, is used to determine pay. No material shall be placed from a truck without a properly completed haul ticket.

The sublot and lot number shall be indicated on each haul ticket. The sublot and lot number may be either printed on the ticket via the printer system or written on the DOTD stamped form on the back of the ticket.

The QC technician and DOTD inspector shall keep a running total of production to ensure that all sublots and lots are terminated at proper tonnage and that the succeeding lot number is placed on the next haul ticket. Lot numbers will be assigned based on total tons of plant production for a JMF. Lot numbers will be sequential to plant production for DOTD without regard to delivery points, individual projects or mix types. Therefore, lot numbers for an individual project could start at lot number 001 or at any lot number thereafter and will not necessarily be sequential on a project.

Sublots will be designated with letters (e.g., Lot 105-C would represent the third sublot in lot 105).

The QC technician and DOTD inspector shall also maintain a written log of the distribution of hot-mix production for DOTD projects from a plant's operation. This log is to be kept in a numbered field book and shall contain, as a minimum, the following data:

Sublot No.	Date	Project Number	Tons	Total Tons	Mix Type/ Use	Project Engineer	Remarks	JMF	Initials
023-A	**14 Aug**	**123-44-5678**	**1006**	**1006**	**26/01**	**Bill Dover**	**Recalib cold feed**	**289**	**CJ**
023-B	**14 Aug**	**123-44-5678**	**500**		**26/01**	**Bill Dover**		**289**	**CJ**
023-B	**15 Aug**	**123-44-5678**	**510**	**1010**					
023-C	**15 Aug**	**123-44-5678**	**1006**	**1006**	**26/01**	**Bill Dover**	**Rain delay**	**289**	**CJ**
023-D	**17 Aug**	**123-44-5678**	**1003**	**1003**	**26/01**	**Bill Dover**	**Belt broke 10am**	**289**	**CJ**
023-E	**20 Aug**	**123-44-5678**	**995**	**995**	**26/01**	**Bill Dover**		**289**	**CJ**
			Lot Total:	**5020**					

This log is to remain at the plant as a continuing record of plant production and distribution. It is to be maintained separately from all other department documentation. Lot numbers shall not be repeated until the plant has produced 999 lots.

Roadway Equipment

Haul Trucks – Trucks are to be routinely inspected to ensure they are clean and that there are no holes in the trailer beds. Materials shall not be allowed to build up in truck beds. Truck beds must be coated with an approved mix release agent, as needed. Neither diesel nor any other petroleum based product shall be used as a mix release agent. Each truck shall have an adequate cover and tie downs. The cover must be in good condition with no holes or tears and must cover the complete bed. Covers shall be used to protect the material from rain and excessive temperature loss. **All haul trucks shall have silver weight certification stickers attached to the cab and the trailer unit (Appendix E11). These two stickers must match to be valid. If the weight certification stickers are not valid, the haul truck shall be removed from the project.**

PAVERS - The paver shall be operated at a consistent speed that will produce a smooth, uniformly textured pavement surface and create a continuous operation in conjunction with plant production and hauling capacity. The hopper is to be kept reasonably full at all times; the slat conveyors should never be uncovered. Cold, segregated material in the hopper wings shall not be dumped into the paver. The paving inspector will check the sensitivity of the paver's electronic controls to ensure they are working properly.

If screed extensions are used, they must be heated and meet all screed requirements and produce the same quality surface as the screed. When auger extensions are required, they must extend to within one foot of the end of the screed. With approval, the use of an auger extension with screed extensions in excess of one foot on one side may be waived for transitions, taper sections and similar short sections or when hydraulically extended screeds, which trail the main screed assembly, are used, provided required density and surface texture are obtained.

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ROLLERS - It is critical to the life of an HMA pavement that it be properly compacted to develop the strength and proper aggregate interlock intended for the mixture. Sufficient compactive energy should be applied as necessary for adequate design density. A properly compacted pavement will provide a smooth, sealed riding surface.

It is the contractor's responsibility to establish a rolling pattern that will ensure optimum and consistent density. Almost every project or mixture type requires a varied rolling pattern. The ability of a mixture to be compacted will be affected by variables such as mixture temperature, aggregate gradation, type of aggregate and asphalt, ambient temperature, moisture content, and condition of the foundation on which the HMA is being placed and compacted.

Section 503.17 of the *Standard Specifications* states that all compaction equipment must be self-propelled and be capable of reversing without backlash. It is the contractor's responsibility to provide the number, type and size of rollers sufficient to compact the mixture to the specified density and surface smoothness. The contractor shall establish the number, type, size and rolling pattern on the first day of production for a particular mix design. Once established, the same protocol shall be maintained throughout production. If the pavement or mixture characteristics are changed during the project, the project engineer may require a revised protocol deemed appropriate for those changes. Compaction equipment shall be certified in accordance with Subsection 503.12.

Steel wheel rollers may be either vibratory or nonvibratory. The wheels shall be true to round and equipped with suitable scraper and watering devices. If used, **vibratory rollers shall be designed for HMA compaction and shall have separate controls for frequency, amplitude and forward speed.** Non-vibrating steel wheel rollers shall be operated with drive wheels toward the paver. Vibratory rollers shall not be used on the first lift of HMA placed over asphalt treated drainage blanket. When HMA is placed on newly constructed cement or lime stabilized or treated layers, vibratory rollers shall not be used for at least 7 days after such stabilization or treatment. Steel wheels shall be checked for flat spots.

Drawbar pull is defined as the horizontal force required to move the roller forward. The most efficient roller is that with the smallest drawbar pull. Rollers with large diameter drums have lower drawbar pull (rolling resistance), because they do not tend to penetrate as far into the mix to develop a contact area as a roller with smaller diameter drums.

All tires for pneumatic tire rollers shall have smooth tread, shall be the same size and ply rating, and shall be inflated to a uniform pressure not varying more than ±5 psi between tires. Wheels shall not wobble and shall be aligned so that tires of the other axle cover gaps between tires on one axle. Tires shall be equipped with scrapers to prevent adhesion to the HMA material. The pneumatic tire roller shall be kept 6 inches from unsupported edges of the paving strip; however, when an adjacent paving strip is down, the roller shall overlap the adjacent paving strip approximately 6 inches. All scrapers and watering systems shall be in good condition and functioning properly.

Rollers shall be operated at uniform speeds that will coordinate with paver speed and within the frequency setting so as to allow for proper drum impacts per linear foot. The more quickly a roller passes over a particular point in the new HMA surface, the less time the weight of the roller rests on that point. This in turn means that less compactive effort is applied to the mixture. As roller speed increases, the amount of density gain achieved with each roller pass decreases. The roller speed selected is dependent on a combination of the following factors:

- Paver speed
- Layer thickness
- Position of the roller in the roller train.

Typically static steel wheel rollers can operate at speeds of 2 to 5 miles per hour; pneumatic tire rollers typically run 2 to 7 miles per hour; a vibratory roller can operate at speeds of 2 to 3 ½ miles per hour. Roller speed is also governed by the lateral displacement or tenderness of the HMA mix. If the mixture moves excessively under the roller, the speed of the compaction equipment should be reduced. As discussed earlier, roller speed affects the impact spacing for vibratory rollers. This spacing is important for controlling the amount of dynamic compaction energy applied to the pavement, as well as for obtaining the proper surface smoothness. In general, at least 10 to 12 impacts per foot are needed to obtain adequate density and layer smoothness.

Rollers are not to reverse in the same location on subsequent passes. Reversal points of continuous passes should be skewed at an angle of approximately 45 degrees across the mat. Rollers should cross their reversal points when moving across the mat surface in order to smooth any dips or bumps caused by changing direction. When a vibratory roller is used for breakdown rolling, the vibrators must be turned off to compact joints or whenever the roller stops or changes direction.

The paving inspector will inspect the mat during compaction after the rollers have passed. If the mat tears, blisters, shoves, leaves indelible marks or displaces in any way beneath the roller, the paving inspector will require the contractor to adjust the operation so that the mat is not damaged. Deficiencies shall be corrected.

Tender Zone - A mid-temperature *tender zone* has been identified for some Superpave mixes. The tender zone has been identified in temperature ranges of approximately 200° F to 240° F. The mixture can be satisfactorily compacted above this range or below this range, but the mixture is tender within the temperature range and cannot be adequately compacted. This is not true for all mixtures, but it has been observed for some Superpave designed mixtures.

When a mixture is tender within the mid-temperature range, the preferred compaction method is to obtain density prior to cooling to the point of the tender zone. This may require an additional breakdown roller or other changes in rolling techniques, but obtaining density prior to reaching the tender zone is preferable. In some cases, the mixture temperature may be increased slightly to provide more compaction time. However, excessive temperatures will magnify the problem. Another alternative is to use a vibratory steel wheel breakdown roller above the tender zone, followed by a rubber tire roller, which can be operated in the tender zone. The finish roller should be used after the mixture has cooled below the tender zone. This second method may not be satisfactory if the rubber tire roller picks up excessively.

Another possibility is to breakdown with a steel wheel roller above the tender zone, then complete the rolling process after the HMA has cooled to below the tender zone. This has been used on a number of projects, but problems may occur due to differential cooling of the mixture and due to excessive aggregate breakdown when rolling in the vibratory mode after the mixture has cooled to below 200° F. Therefore, vibratory rolling should not be used below 200° F.

If the tenderness problem yields a pavement with poor in-place density, or if the paving train length is excessively long due to the time required for the mixture to cool, adjustments to the mixture design must be made to eliminate, or at least reduce, the temperature tenderness zone. It is important that the paving crew working at the laydown site communicate with the plant personnel.

Surface Preparation – The requirement to use tack coat, prime coat or curing membrane depends on the type of surface material upon which it is being placed. The different types of asphaltic materials, along with their applicable sections in the *Standard Specifications,* are as follows:

1. Tack Coat - (Section 504) is applied to existing hot-mix asphalt between lifts, asphaltic surface treatment, or Portland cement concrete pavement surface. The distributor used to apply the tack coat shall be certified.

2. Prime Coat – (Section 505), is applied to untreated base course such as crushed aggregate, stone and concrete base courses. The distributor that is used to apply the prime coat shall be certified.

3. Curing Membrane – (Section 506), is applied to treated base courses such as on the surface of cement or lime-treated/stabilized materials. The distributor used to apply the curing membrane does not have to be certified, but shall be approved by the Engineer.

ROADWAY INSPECTION

Inspection of Mixture on Roadway

Department personnel shall visually inspect the HMA product. The Certified Inspectors are to evaluate the mixture both at the plant and at the jobsite. Mixtures exhibiting the following deficiencies shall not be placed:

- segregation,
- contamination,
- lumps,
- non-uniform coating,
- excessive temperature variations
- other deficiencies

Mixture contamination, alignment deviations, variations in surface texture and appearance or other deficiencies apparent on visual inspection will not be accepted. Poor construction practices such as inadequate handwork, improper joint construction or other deficiencies apparent on visual inspection will also not be accepted. Deficiencies revealed by visual inspection both after placement and before final acceptance shall be corrected at the contractor's expense.

If a load of HMA material is suspected of deficiencies, but is allowed to be placed, the paving inspector will also sample the HMA for testing. The paving inspector will document the exact location where the suspect material was placed. Materials identified as being deficient may require subsequent removal and replacement.

The DOTD Certified Paving Inspector at the laydown site is responsible for observing the performance of surface tolerance testing, checking lane widths and other grade and alignment checks and equipment suitability. In addition, the Certified Paving Inspector is responsible for maintaining a running total of tonnage delivered to the project from each plant production lot. The inspector must also mark the beginning and ending limits of each lot as it is placed on the roadway. Continuous records of lot placement should be maintained in a field book. The Certified Paving Inspector will check yield on a continuing basis during the project and calculate the yield for each portion of a lot delivered to the roadway. Beyond these duties, the Certified Paving Inspector must observe the appearance of the mat behind the paver and the rollers, the uniformity and acceptability of joint construction and the performance of the paving train equipment. If material related problems occur at the jobsite, then the Certified Paving Inspector shall make immediate contact with the Certified Plant Inspector so that adjustments can be made in the manufacturing and transport processes.

Discarding Material - It may be necessary when dumping HMA into the MTV, to discard approximately 200 to 300 pounds of material. This material shall be disposed of by the contractor/producer outside the limits of the right-of-way upon completion of the project. No deduction in lot tonnage totals shall be made for this material waste. However, the paving inspector is to continually monitor the truck dumping operation to assure minimal waste.

The following headings address essential inspection points. This list is not intended to be comprehensive or to exclude any other area from regular inspection. It is merely intended to serve as a guide to the field inspector in the performance of his/her responsibility.

Ensure that the contractor must have adequate incidental equipment such as rakes, tamps, lutes and shovels for the work being performed available at the project. This equipment must be clean and in satisfactory condition.

Lumps, Contamination, Coating - Any material that is not properly coated, has lumps, or is contaminated will be rejected prior to placement. Lumps may be indicative of moisture problems or a dryer/drum that needs to be cleaned out. If the paving inspector observes this deficiency, the inspector is to notify the Certified Plant Inspector. Operations shall be discontinued and the dryer/drum cleaned. A mix that is not properly coated will be sampled and a Ross Count performed (DOTD TR 328). Contaminated material will also be sampled. When sampling a material for future Department investigation, the inspector must be certain to obtain a sample that is representative of the questionable material.

Temperature - The paving inspector is also responsible for verifying that the temperature of the material at the roadway is within specification tolerance. The temperature of the material in the truck shall be within 25° F of the bottom limit of the job mix formula (JMF). If the temperature is outside this tolerance or exceeds the upper JMF temperature limit, it is out of specifications and shall not be placed. The paving inspector will record the job site temperature and tonnage rejected on the haul ticket and void the ticket. The paving inspector will immediately notify the Certified Plant Inspector and check each subsequent truck until the material temperature is again within acceptable limits. The material temperature will be recorded on the haul ticket. The temperature of the mix going through the paver shall not be cooler than 250° F. In such cases, the temperature of the material and the tonnage discarded will be documented on the haul ticket and the payment quantity adjusted.

Yield

Theoretical Yield – The estimated quantity of HMA shown on the plans is the amount that should be used on the project based on a mixture that weighs 110 pounds per square yard per inch of thickness. If the project is constructed in accordance with the dimension and mat thickness shown on the plans, this plan quantity should be accurate. If less HMA is used than called for by the plans, the mat will probably, on the average, be too thin.

If more HMA is used than called for by the plans, the mat will probably, on the average, be too thick. Additionally, a cost overrun will result. Failure to keep the actual quantity of HMA used fairly close to plan quantity may require a plan change. If extra material is needed for minor adjustments due to field conditions, it is imperative that current departmental policy for overruns be strictly followed.

The plan quantity is always calculated on HMA material weighing 110 lb/sq yd/inch thickness. However, some aggregates such as sandstone or slag will cause the unit weight of the mixture to differ from the standard 110 lb/sq yd/inch value.

To take this weight difference into account, the department has established weight-volume adjustment factors to determine the theoretical yield of an HMA material with a theoretical maximum specific gravity (G_{mm}) outside the range of 2.400 – 2.540. These factors (from the *Standard Specifications)* are shown in the following table.

Theoretical Maximum Specific Gravity, (G_{mm}) (AASHTO T 209)	**Adjustment Factor (F)**
2.340 – 2.360	1.02
2.361 – 2.399	1.01
2.400 – 2.540	1.00
2.541 – 2.570	0.99
2.571 – 2.590	0.98

The adjustment factor (F) for mixtures with theoretical maximum specific gravities (G_{mm}) less than 2.340 or more than 2.590 will be determined by the following formulas:

Theoretical Maximum Specific Gravity (G_{mm}) less than 2.340:

$$F = \frac{2.400}{S}$$

Theoretical Maximum Specific Gravity (G_{mm}) more than 2.590:

$$F = \frac{2.540}{S}$$

Where:

F = quantity adjustment factor
S = theoretical maximum specific gravity (G_{mm}) on JMF

Example,

Theoretical maximum specific gravity is 2.320.

$$F = \frac{2.400}{2.320}$$

$$F = 1.0345 = 1.03$$

The theoretical maximum specific gravity (G_{mm}) can be found on the approved job mix formula.

For HMA materials with an adjustment factor other than 1.00, the theoretical yield of the mixture may be determined by dividing the theoretical yield based on 110 lb/sq yd/inch thickness by the applicable adjustment factor.

For example:

> If the material being placed has a theoretical maximum specific gravity (G_{mm}) of 2.390, the factor of 1.01 will apply. Assume the material is being placed in a 2.0-inch lift.
>
> T = Thickness in inches
>
> Theoretical Yield = 110 x T
>
> Theoretical Yield = 110 x 2.0 = 220 lb/sq yd
>
> $$\text{Adjustment Theoretical Yield} = \frac{\text{Theoretical Yield}}{\text{Adjustment Factor}}$$
>
> $$\text{Adjustment Theoretical Yield} = \frac{\text{220 lb/sq yd/inch}}{1.01}$$
>
> Adjusted Theoretical Yield = 217.8 lb/sq yd
>
> Therefore, a mixture with a theoretical maximum specific gravity (G_{mm}) of 2.390 would require 2.2 less pounds (220 – 217.8 = 2.2) of HMA material per square yard for the same volume (2.0 inches thick) as a mixture with a theoretical maximum specific gravity (G_{mm}) between 2.400 and 2.540, inclusive.

These factors are used to adjust pay quantities, which are based on actual tonnage used, documented on haul tickets. If plan quantity for a project is 11,620 tons and the material placed has a theoretical gravity of 2.390 (factor 1.01), 11504.950tons of this material would be needed to occupy the same volume as a mixture with a theoretical maximum gravity (G_{mm}) of 2.400-2.540 (factor 1.00). therefore, the target tonnage for this project would be 11,504.950 tons. Assuming that this target tonnage is the tonnage used on the project as documented on the haul tickets to calculate payment tonnage, multiply the tons used by the factor 1.01.

1,504.950 x 1.01 = 11,620.000 tons

The contractor will be paid for 11,620 tons of material, which equals plan quantity. If the contractor were to place plan quantity (11,620 tons), the mat would be too thin. Therefore, the factors must be applied when doing yield calculations, to be certain that the correct amount of material is being placed.

Theoretical Yield is also calculated for paving operations expressed as lbs/sq yd/inch. This value can be used in a variety of applications such as:

- Establishing distances that one truck or multiple trucks should cover
- Establishing sub lot and lot limits for travel lanes and shoulders
- Determining the amount of HMA needed for irregular areas, driveways, turnouts, crossovers, etc.

Theoretical Yield is documented in field books and is also a required entry on the *Superpave Asphaltic Concrete Pavement Report.*

Below are examples of the different applications. An Adjustment Factor of 1.00 is assumed for all examples:

Establishing distances that one truck or multiple trucks should cover:

$$\frac{\text{Weight of Asphaltic Concrete in Truck in Tons x 2000}}{\text{(Width of Paving Strip/9) (110 x Plan Thickness in Inches)}}$$

$$\frac{\text{23.60 tons x 2000}}{\text{(11.5 width of paving strip/9) (110lbs x 2” plan thickness)}}$$

$$\frac{\text{47200.00 lbs)}}{\text{(1.27 sq yds per linear foot) (220 lbs.)}}$$

$$\frac{\text{47200.00 lbs}}{\text{279.40 lbs per linear foot}}$$

168.93 = 169 linear feet that this truck *should* cover

An alternate method of tracking and monitoring yield for trucks is to convert the pounds per linear foot value to tons per linear foot.

279.40 lbs. per linear foot/2000 = 0.139~~7~~ = 0.139 tons per linear foot

This converted value can be easily applied and used as a constant by dividing this value into the tonnage of HMA delivered as reflected on a haul ticket, provided that the width of the paving strip and the plan thickness do not change. Note that there will be a slight difference in distances because of the conversion from pounds per linear foot to tons per linear foot.

$$\frac{\text{23.60 Tons of Asphaltic Concrete in Truck}}{\text{0.139 tons per linear foot}}$$

169.78 = 170 linear feet that this truck *should* cover

Establishing sub lot and lot limits for travel lanes and shoulders:

Assume that the typical section of a roadway is 24 feet wide and 2 inches thick. The sequence of construction will utilize an 11.5' wide paving strip for a standard 1000 ton sub lot. The full width of the roadway would be accomplished by laying an adjacent paving strip of 12.5'. Adjacent paving strips may not always be included in the same sub lot.

$$\frac{\text{Sub Lot or Lot Size in Tons x 2000}}{\text{(Width of Paving Strip/9) (110 x Plan Thickness in Inches)}}$$

$$\frac{\text{1000 Tons x 2000}}{\text{(11.5 width of paving strip/9) (110 lbs. x 2" plan thickness)}}$$

$$\frac{\text{2000000.00 lbs.}}{\text{(1.27 sq yds per linear foot) (220.00 lbs)}}$$

$$\frac{\text{2000000.00 lbs.}}{\text{279.40 lbs per linear foot}}$$

$$715\underline{8}.19 = \text{7158 linear feet for the sub lot}$$

Determining the amount of HMA needed for irregular areas, driveways, turnouts, crossovers, etc.:

Assume that an overlay project has 25 residential driveways, with each driveway having an area of 15 square yards and a plan thickness of 4".

$$\frac{\text{(Total Area in Square Yards) (110 lbs. x Plan Thickness in Inches)}}{2000}$$

$$\frac{\text{(25 driveways x 15 Square Yards) (110 lbs. x 4" plan thickness)}}{2000}$$

$$\frac{\text{(375.0000 sq yds) (440.0000 lbs)}}{2000}$$

$$\frac{\text{165000.0000 lbs}}{2000}$$

$$82.5\underline{0}00 = \text{82.50 tons needed}$$

Actual Yield – Actual yield is the actual amount of HMA material placed in terms of pounds per square yard. It is the responsibility of the Certified Paving Inspector to maintain a constant check on actual yield during paving operations to ensure that at the end of the project, actual yield and theoretical yield will match closely. Actual yield should be checked and compared to the theoretical yield several times during a paving day, at the end of a lot, and at the end of the project. Since mat thickness is averaged and not exact, actual yield may vary slightly from theoretical yield on an individual truck or even for several truckloads. However, it should never run consistently over or under theoretical yield. If actual yield is consistently over or under theoretical yield, something may not be correct with the paving operation. The contractor will then be required to identify and correct the problem, or the project will not conform to the plans.

The formula for computing actual yield is:

$$\text{Actual Yield} = \frac{\text{Tons Used x 2000}}{\text{Square Yards of Pavement}}$$

Utilizing the example of establishing sub lot limits in the previous section on Theoretical Yield, a comparison against the Actual Yield shall be made and documented on the *Superpave Asphaltic Concrete Pavement Report.*

1040 Tons of HMA were used for the sub lot that was 7158 linear feet and 11.5' wide and 2 inches thick.

Square Yards = (7158 x 11.5)/9 = (82317.00)/9 = 914<u>6</u>.33 = 9146 square yards

Actual Yield:

$$\frac{\text{1040 tons Used x 2000}}{\text{9146 square yards}}$$

$$\frac{\text{2080000.000 lbs.}}{\text{9146 square yards}}$$

227.<u>4</u>21 = 227.4 lbs/sq yd

Therefore, the difference between the Theoretical Yield of 220.0 lbs/sq yd/plan thickness in inches and the Actual Yield of 227.4 lbs/sq yd used is 7.4 lbs/ sq yd over. This indicates that the mat may be too thick and an overrun for this sub lot has occurred.

One method for determining percent overruns an under runs can be calculated from the tonnage.1000 tons were needed for the area to be paved based on Theoretical Yield for the sub lot. 1040 tons were actually used for the area.

$$\frac{\textbf{40 Tons Over}}{\textbf{1000 Tons Needed Based on Theoretical Yield}} \textbf{ x 100}$$

.0400 *x* 100 = 4.0 % Overrun

As stated earlier, Actual Yield should never run *consistently* over or under theoretical yield. Overruns or under runs that exceed 5% for the Contract Item may require a Change Order in accordance with the *DOTD Construction Contract Administration Manual*.

JOINT CONSTRUCTION

All pavement joints shall be constructed according to the requirements of the specifications. They shall be inspected by the department's inspectors for satisfactory compliance to the department standards in accordance with the procedures described in this manual and the standard specifications.

Longitudinal Joints – Department specifications stipulate that, during the construction of a longitudinal joint, no material will be scattered loosely over the uncompacted mat. The overlapped material shall be pushed back to form a vertical edge above the joint. The vertical edge shall then be compacted by rolling to form a smooth, sealed joint.

Coarse aggregate shall not be raked from the HMA mixture at the joint. Excess material or spillage shall not be pushed onto the uncompacted mat. If workers cast the overlap onto the uncompacted mat, this material will be segregated and not visually appealing. Such material will ravel under traffic. If this occurs, the inspector must require that the material be removed from the fresh mat before the roller approaches the area.

After compaction, a properly constructed longitudinal joint should not be high or low when compared to the adjacent mat. There should be no rough material at the joint location. The joint must be properly sealed. There can be no opening allowed between the mats. The joint should not overlap onto the previously compacted mat. After compaction, the inspector must check the joint for all points applicable to the transverse joints. The inspector should also place a 10-foot static straightedge across the joint, transverse to the centerline. If there is any deviation greater than the transverse surface tolerance applicable to that course listed in Table 502-4 of the *Standard Specifications*, corrective action will be required. Checking the joint with a 10-foot static straightedge is effective on a tangent slope, but will not work on a two-lane roadway with center crown. For a roadway with center crown, the inspector will place a ten-foot static straightedge across the joint with approximately one foot resting on the new mat. If the fluff was not adequate, there will be a dip at the joint and the paver shall be adjusted.

Transverse Joints – A transverse joint must be formed whenever paving operations are discontinued long enough for the temperature of the HMA material being placed to fall below 250°F. This includes the interruption of paving operations at the end of the day. Equipment malfunctions, plant problems, or weather conditions can also cause an interruption of the paving operations, which will require construction of a transverse joint.

The inspector will visually inspect the joint longitudinally and transversely to determine if there are any apparent deviations in the area. The inspector will then place a ten-foot metal static straightedge at several locations across the joint location and attempt to push a shim the thickness of the applicable specification deviation beneath the straightedge. The joint shall comply with Subsection 502.07(c)(2). Specifications further require that the inspector check the joint with a long stringline (40 to 50 feet) to determine its rideability.

If the transverse joint does not meet specification requirements, the contractor shall correct it before the paving operation can proceed. Only the minimum amount of handwork required to correct the deficiency will be allowed and only the affected area shall be worked. This handwork must also be completed so that the area can be recompacted before the mat surface has cooled beyond the point where compaction cannot be achieved. If the deviation at the joint is excessive (i.e., beyond that which can be satisfactorily repaired with a minimum amount of handwork) the contactor will be required to completely remove the material placed and reconstruct the joint with the paver.

After any required corrections have been completed and the area recompacted, the inspector must recheck the joint to ensure that the corrective action has met all Department surface finish requirements and that the surface texture of the corrected area is acceptable. If the inspector is still unable to approve the joint, the contractor must take additional corrective measures.

SEGREGATION

If the material appears to be segregated in the truck, the inspector shall determine if the degree of segregation is severe enough to warrant rejection. If the load is placed, the inspector is to sample the material for subsequent testing. If the material appears segregated in the truck, the inspector must check the mat carefully behind the paver. If segregation is apparent, the inspector shall notify the Project Engineer and the Certified Plant Technician. Future trucks showing segregation will be rejected until the problem is corrected. If material does not appear segregated in trucks, but the mat exhibits segregation, the inspector shall require the contractor to identify and correct the problem immediately. If the problem cannot be corrected, operations shall be discontinued. Segregated areas of compacted HMA mat will be subject to Department investigation for acceptability and may have to be removed and replaced at the contractor's expense.

As previously stated, Section 503.15 of the *Standard Specifications* requires the use of a material transfer vehicle (MTV) when placing the final two lifts of HMA on the roadway travel lanes. The three main objectives in requiring the MTV are to reduce HMA segregation, improve surface smoothness, and promote continuous, non-stop paving. However, HMA materials may be placed without the use of the MTV when placing base course mixtures, leveling, and shoulders or as allowed by Subsection 503.15. In any case, the Certified Paving Inspector should continually monitor the finished mat for any segregated area.

When paving without an MTV (dumping HMA directly into the paver hopper from the haul truck), proper truck exchange is critical to the production of a smooth, uniform mat. The truck should never bump the paver and should not rest on the paver hopper. Material should not be dumped or spilled in front of the paver. The material should be dumped into the paver in a large mass to prevent segregation.

Segregation on Mat - Segregated areas of the mat will have a different look than the rest of the roadway surface. These areas will be more open-textured. The size of these areas will vary depending on the severity of the cause. It is not uncommon for such open-textured area to be 30 feet long and the full width of the paver, although many of these areas are confined to 15-foot lengths and just the center two-thirds of the paver's width. These areas have a tendency to become more noticeable after being exposed to traffic and can best be observed when the angle of reflective light is low (i.e., early morning or late evening) or just after a rainfall. Under these conditions, these open-textured areas remain wet and dark looking when compared to the drier surrounding areas.

Truck Ends - Truck end segregation is caused by the coarse aggregate fractions separating from the fine aggregate fractions either in the production, transport or laydown processes. In severe cases, this separation can be observed at the plant when noticeable roll-down of the coarse aggregate occurs toward the sides, the tailgate and the cab area of the haul unit. Such roll-down segregation results in a truck end in one or more of the following ways.

- The segregated roll-down material at the tailgate is fed onto an empty slat conveyor and fed back to the paver augers as segregated material, causing a truck end.

- The segregated roll-down material on the sides of the haul truck is fed into the wings of the paver hopper. When these wings are dumped (i.e., the material in the wings is fed to the slat feeder), this segregated roll-down material will cause a truck end.

- The segregated roll-down material at the cab end of the truck (which is the last to be fed from the truck) will roll down the entire length of the bed, and if fed by itself to the augers, will cause a truck end.

Numerous investigations have identified the material at truck end locations to be inferior in quality, possessing low asphalt content, with an extremely coarse gradation and a low roadway density. **The net result of these poor mix qualities is an area of roadway that will crack and/or ravel if used as a wearing course or be structurally deficient and subject to moisture damage if used as a binder or base course.** Beyond the poor mixture characteristics associated with these truck end segregations, a poor ride is most often the result. This poor ride is identified by dips at the same intervals previously described. These dips are due to either a paver's screed settling on the coarse mix during construction (i.e., a mixture with high air voids offers less resistance to the screed) or the dips develop later under traffic, when these high-void areas which have low initial density are compacted more than the well-compacted areas immediately adjacent.

Regardless of where the segregation is first observed, truck end segregation areas on the roadway are to be eliminated or minimized to the best degree possible.

It is an important point to remember that the material is segregating through whatever handling processes it is being subjected to (e.g., coated in a dryer/drum, conveyed into a surge/storage silo, emptied into a large trailer truck and dumped onto a paver's empty slat feeder). It is an equally important point to know that some well-graded and well-coated mixes do not segregate given an identical handling process. Consequently, all attempts to eliminate or effectively minimize truck end segregation have not been taken until one or more mixture, process, and handling changes have been tried and implemented.

The following steps should be taken whenever segregation is observed:

- Paver wings should not be dumped until the end of the paving day. HMA materials dumped from paver wings shall be discarded and not incorporated into the roadway.

- Haul trucks should be loaded with the minimum of three drops, the last of which shall be in the middle of the bed. It is the intent of this loading procedure to first load as close to the tailgate and cab areas as possible to minimize roll-down and then complete the load in the middle of the bed.

- During the exchange of trucks at the paver (when no MTV is required), the level of material remaining in the paver hopper should not drop so low as to expose the hopper feed slats. Keeping the slat feeders covered with material will aid the mixing of whatever roll-down material exists with nonsegregated material before it is fed to the paver augers.

- The paver augers should be run at minimum revolution to reduce segregation. Further, the level of material should be maintained to at least that of the auger shaft. Augers should run at least 95% of the time.

Any segregated areas on the roadway which occur at regular intervals must be eliminated or effectively minimized. The paving inspector must be aware of the potential problem and maintain constant communication with the production and paving personnel when a problem exists. The project engineer will instruct the contractor/producer to correct problems associated with segregation.

COORDINATION OF PAVING OPERATIONS

Coordination of Paving Operations with Production and Transport - One of the most important elements of successful HMA paving operations is the coordination of paving speed to plant production and hauling capacity. A start and stop operation will not produce a uniform mat and smooth riding surface. A start and stop paving operation is specifically prohibited by the specifications. The *Standard Specifications* require the contractor/producer to coordinate and manage plant production, transportation of HMA, and laydown operations to ensure reasonably continuous plant and paving operations with minimum idle time between loads. Delivery of the material to the paver must be at a uniform rate. There should be no waiting time between truckloads; nor should a large number of trucks be waiting to discharge into the paver or MTV. The correct speed for the paver is such that as one truck empties and pulls away, one truck is waiting to move into discharge position immediately. If sufficient hauling vehicles are not available to maintain a smooth, coordinated paving operation, the specifications authorize the discontinuance of operations or requirement of additional trucks. Paver speed and plant production should also be tied to time required for rollers to achieve compaction in the paving train.

APPENDIX

Appendix A - Reference

A-1 Summary of Specification Changes
A-2 Summary of Test Procedures
A-3 Table 502-5, Superpave General Criteria
A-4 Table 502-6, Quality Index Values for Estimating Percent Within Limits

Appendix A

A-1 Summary of Specification Changes

APPENDIX A1

SPECIFICATION CHANGES - Specification changes have occurred quite frequently in recent years. Most changes were due to the implementation of Superpave asphalt mix design method and the removal of the Marshall mix design method. Here is a summary of recent changes to the specifications for Section V, Asphaltic Pavements, of the 2006 LA Standard Specifications for Roads and Bridges, and for Section1002, Asphalt Materials and Additives, and Section 1003, Aggregates.

PART V – ASPHALTIC PAVEMENTS

Part V of the specifications covers the application of Superpave asphaltic concrete mixtures. Significant changes have been made to Part V with the removal of Section 501 – Asphaltic Concrete Mixtures. Section 508, formerly, Asphalt Treated Drainage Blanket, now covers Stone Matrix Asphalt. Stone Matrix Asphalt is a plant mixed asphalt concrete wearing course for high traffic applications.

SECTION 502 - SUPERPAVE ASPHALTIC CONCRETE MIXTURES

502.01 Description (a) General – Completely reorganized to create a more logical flow of information. Also, changes to references due to relocated information within the section are not listed here.

502.01(c) Mixture substitutions – The first paragraph has been reworded for clarification.

502.02 Materials – The test procedures for Superpave asphaltic concrete are now listed in new Table 502-1.

502.02(a) Asphalt Cement – In the fourth paragraph, leveling was added to the list of items for which a PG 64-22 asphalt cement may be used in lieu of the modified asphalts. Previously, leveling (except blade leveling) required the same grade of asphalt cement as the layer immediately above.

502.02(c)(1) Friction Ratings – For all usages, except final lift of roadway travel lane wearing courses, any combination of Friction Ratings I, II, III, and IV aggregates may be used in combination with the allowable RAP percentages of Table 502-3.

Table 502-3 Aggregate Friction Ratings – The footnote language reorganized and revised to clarify that the percentages of total weight of aggregates allowed for each friction rating includes the RAP aggregates. The footnote, however, was inadvertently omitted from the 2006 LA Standard Specifications for Roads and Bridges. Please check the Supplemental Specifications for the addition of this footnote.

502.03 Design of Asphaltic Mixtures, Job Mix Formula (JMF) – The third paragraph has been deleted. Permeability will not be required as part of the job mix formula.

502.04 Job Mix Formula Validation – The validation lot shall be divided into five equal sublots, with one validation sample required per validation sublot. In the sixth paragraph, it was clarified that the "average" of all validation tests for the parameters not listed in items (1) through (10) shall be within specification limits. The list of mix uses for which validation is not required has been expanded to include parking lots and all shoulders.

502.05 Plant Quality Control – Amended to require the moisture content of the final mixture be minimized and uniformly controlled to ensure that placement and density requirements are met. Also, the percent moisture in loose mix shall not exceed 0.3 percent by weight. This is changed from 0.5 percent and moved from Section 503.

502.08 (b) Paving Operations – Paragraph seven added to specify procedures for when a screed control device malfunctions during binder or wearing course operations. Paving operations shall be immediately discontinued; however, material in transit can be placed. The contractor will bear any cost overrun resulting from placing material without the automatic screed control device.

The 30-foot traveling reference plane method of construction shall be used for roadway travel lanes, unless the erected stringline is required or directed. The erected stringline method shall be used when directed, and on the first lift of the asphaltic pavement when underlying new or reconstructed bases do not have grade control requirements.

502.09 Compaction – A profilograph trace may be required to define unacceptable areas due to excessive rippling.

502.10 Roadway Quality Control – Requires the contractor to constantly monitor equipment, materials, and processes to ensure that density and surface tolerance requirements are met.

502.10 (b) (1) Equipment – The inertial profiler, furnished by the contractor for quality control and acceptance, shall be DOTD certified.

502.10(b)(2) Transverse, Cross Slope and Grade – Areas with surface deviations in excess of "specification limits" shall be isolated and corrected by the contractor. Previously, deviations in excess of 1/2 inch had to be corrected. This change resolves a conflict in the specifications.

502.11 Roadway Acceptance – Hot mix exhibiting deficiencies shall be satisfactorily corrected and/or replaced at no direct pay.
502.11(a) Density – Added a requirement that the contractor shall provide approved transport containers for cores at no direct pay.

502.11(b)(3)(a) Acceptance – Deleted the requirement that longitudinal surface tolerance measurement of "short" segments, less than 264 feet in length, be included in adjacent sublots. Also, deleted the requirement for department review of each IRI sublot report provided by the contractor.

502.14 Lot Sizes – In the first sentence of the second paragraph, added, "...lot size may be increased up to 10,000 tons with corresponding [sublot size] up to 2,000 tons."

PWL calculations will be required for lots with 3,000 tons or greater of mix.

A Small Quantity Lot has been defined as a lot with less than 3,000 tons of mix.

Any mixtures used for bike paths, crossovers, curbs, driveways, guardrail widening, islands, joint repair, leveling, parking lots, shoulders, turnouts, patching, widening, and miscellaneous handwork will be paid as Small Quantity Lots, and separately in 1,000 ton sublots or portions thereof.

Pavement density and surface tolerance requirements will not be applied for short irregular sections; such as curbs, driveways, guardrail widening, islands, joint repair, leveling, and turnouts.

502.16(e) Longitudinal Surface Tolerance Incentive Pay – First paragraph amended to state that incentive pay only applies to Category A projects, with no areas of grinding, unless grinding is within 300 feet of a bridge end.

Table 502-4 Superpave Requirements – A density requirement of 89 percent of the theoretical maximum specific gravity is specified for bike paths and parking lots, and 91 percent for patching, widening, and crossovers.

Table 502-5 Superpave General Criteria – Table has been reformatted due to the deletion of 0.5 inch wearing courses (Level 3), 0.75 inch wearing courses (Levels 1 and 3), 1 inch and 0.75 inch binder courses (Level 3), and 1 inch and 1.5 inch base courses (Levels 2 and 3). Other changes to various design criteria and footnotes are as follows:

- Clarified percent of sand to be percent of new aggregates.
- Clarified percent of RAP to be percent of mix.
- Allowed Level A to be used where Marshall Type 3 is specified.
- Changed maximum percent G_{mm} @ $N_{initial}$ to be the following:

  Level 2 90%

  Level 1 91%

  Level A 92%

  Specified target VFA = 73%

Footnote 2 clarified to remove Levels 3 and 3F to be consistent with the removal of these levels from other areas of Section 502.

Table 502-8A Payment Adjustment Schedules for Longitudinal Surface Tolerance, Maximum International Roughness Index – Table further revised to clarify the surface tolerance incentive pay regarding grinding.

Table 502-8B Individual Wheel Path Deficient Area Limits, Maximum International Roughness Index, inches per mile (mm per km) – IRI requirements for Binder Courses for Category A and B projects have been changed from 105 and 110 inches per mile to 130 and 150 inches per mile, respectively.

SECTION 503 - ASPHALTIC CONCRETE EQUIPMENT AND PROCESSES

503.01 Description - This section specifies requirements for certification of plant and paving equipment. It includes methods and equipment for handling and storing materials, producing asphaltic concrete, and transporting and placing asphaltic concrete at the jobsite. The department's publication entitled "Application of Quality Assurance Specifications for Asphaltic Concrete Mixtures" is hereby made a part of the specification by reference.

Deleted the Marshall Design method. No longer need to reference either method for distinction.

503.02(a) General – Section completely reorganized in the interest of creating a more logical flow of information.

503.02(b) Certification and Calibrations – Revised the heading and removed wording regarding permits since permits are addressed in Part 1, General Provisions.

Plants shall have air, water, and other environmental permits available during the plant certification. Plant certification shall occur at least every two years. The plant and plant laboratory certification procedures have been completely revised.

503.03(b) Cold Feed – Subsection revised to allow a predetermined gate setting to match the calibration curves and revises the calibration requirements for the cold feed system/gate.

503.03(e) Reclaimed Asphaltic Pavement – The requirements for a RAP cold feed system have been added.

503.04(a) Working Tank – The asphalt cement working tank shall be capable of uniformly heating the material to the temperature recommended by the supplier. Also, only new tanks are required to be equipped with the paddle-type mixers or agitators which keep the material in motion and minimize prolonged exposure to the heating source. Strainers and screens must be placed between the working tank and mixing unit to filter undesirable material.

503.05 Additives – In addition to anti-strip, when mineral filler and/or fibers are used they shall be digitally displayed and the quantity used totalized.
503.05(d) Fibers – New paragraph. A separate feeder system is required for mineral fibers. Proportioning requirements are also specified. Flow indicators or sensing devices are required to interrupt mixture production if the fibers are not added.

503.09(b)(2) Unheated Surge Bins – Storage time for surge bins depends on the temperature of the stored mix. The mix temperature, when discharged from the storage bin, must not be lower than 25° F below the optimum mixing temperature in the job mix formula. Previously, the maximum allowable storage time was 2 hours, unless otherwise approved.

503.10(a) Scales – Calibrations are required in accordance with Subsection 503.02 (b). All asphaltic concrete mixtures shall be measured by weigh hoppers or truck platform scales to determine weight for pay.

503.12 Paving Equipment – New paragraph. All primary roadway equipment, including asphalt distributors, pavers, rollers, and hauling equipment, must be certified at least every two years.

503.13 Haul Trucks – The paragraph addressing excessive deviations or other surface defects caused by the hauler unit or paver has been replaced by the following statement, "If the hauling unit or paver is causing surface tolerance penalties or excessive bumps, its use shall be discontinued."

Bottom dump equipment producing windrows will no longer be allowed.

503.15 Material Transfer Vehicle (MTV) – If the weight of the MTV is determined by the engineer to cause settlement or movement in the base or sub-base, the use of the MTV shall be discontinued for this section of roadway.

The following has been added to the list of MTV restrictions that apply at bridge crossings:
"(a) The MTV shall abide by posted weight limits."

503.17(a) General – The statement requiring compaction equipment to be certified prior to use has been removed.

503.17(c) Pneumatic Tire Rollers – The requirements for minimum tire roller weight and tire contact pressure range have been deleted along with the requirement for the contractor to supply the calibration charts for wheel loads and contact pressure.

SECTION 507 - ASPHALTIC SURFACE TREATMENT

507.02 Materials – Limestone and interlayer aggregates for hot application will not require precoat with asphalt cement or emulsion.

Gelled asphalts are no longer allowed for asphaltic surface treatment applications.

Last paragraph revised to read, "Samples of asphalt material will be taken by the contractor in the presence of the engineer's representative. The engineer's representative will immediately take possession of the samples." Reference to the supplier has been removed.

507.04 Weather Limitations – Interlayers may be placed during any month of year.

507.05 Preparation of Existing Surface – Potholes and surface depressions will be repaired by the Department prior to the AST work. Previously, repair was required prior to issuance of the work order.

Raised pavement markers may be left in place when specified in the plans.

Specifications for determining when the surface is too wet for AST application have been included.

507.06 Application – The subsection includes clarifications that the application rates of asphalt materials and aggregates shall be recommended by the contractor and approved by the engineer.

507.06(a) Asphalt Material – General guidance has been provided for adjustments in the application rate of asphalt materials.

507.06(d) Interlayers – Interlayers shall be Type E and may be placed on raw or stabilized base, on a milled surface, between lifts of asphalt, or over existing Portland cement concrete pavement that will be overlaid with asphalt. The aggregate size and application rate of asphalt materials will no longer be specified on the plans.

Table 507-2 Asphaltic Surface Treatment (AST) Requirements (Hot Applications) – Gelled asphalt is no longer allowed in AST applications.

507.09 Measurement – Asphalt material and aggregates will now be measured for pay separately; each aggregate by the square yard per application and the asphalt material in the distributor by the gallon.

507.10 Payment – Separate pay items have been established for aggregate and for asphalt material.

SECTION 508 - STONE MATRIX ASPHALT

508.01 Description – All requirements of Section 502 apply to Stone Matrix Asphalt, except as modified herein.

For SMA projects, mixtures used for shoulders may be SMA or any mixture type shown in Table 502-5, Superpave General Criteria.

508.02(c)(3) Fibers – The material specifications for fibers have been moved to Subsection 1002.02 (d). In addition, fibers shall be added at a minimum rate of 0.1 percent by weight of mixture and at a rate sufficient to prevent draindown.

Deleted the requirement for cellulose and mineral fiber to be pre-approved by the Department.

508.03 Job Mix Formula (JMF) – The contractor is now required to utilize a Superpave gyratory compactor in design of SMA. Previously, it was optional. Revised the third sentence of the second paragraph to specify limits for percent G_{mm} at N_{design}, not $N_{initial}$

508.04 Validation – One random sample from each third of the validation sublot shall be taken. The "average of" tests results shall meet specification requirements for final job mix formula approval. Previously, all tests had to meet specifications. If the mix fails to validate, one additional attempt may be allowed by the Laboratory Engineer before requiring redesign of the mixture.

508.05 Quality Control – Lot sizes for both QC and acceptance will be determined in accordance with Subsection 502.14, Lot Sizes, except that all travel lane SMA, regardless of the quantity produced, will be paid in accordance with these specifications, not as Small Quantity Lot.

508.06(a) Theoretical Maximum Specific Gravity – Theoretical maximum specific gravities (G_{mm}) shall be determined in accordance with DOTD TR 327, not AASHTO T 209.

508.06(b) Plant Volumetrics – For acceptance testing, volumetrics will be determined on the compacted briquette with 2.5 – 4.5 percent air voids. Previously, it was with 3 – 5 percent air voids.

508.06(d) Roadway Density – Three (3) cores per sublot, instead of five (5), will be taken for roadway density acceptance. Also, the "average" percent G_{mm} for the sublot will be determined.

508.07(a) Plant Acceptance Tests – Percent anti-strip is no longer a pay factor for plant acceptance.

508.07(b)(1) Roadway Density – For roadway density, the average sublot percent density will be used to determine the sublot percent deviation from the JMF. The sublot deviation will be used to determine percent payment for the sublot.

508.08 Construction Requirements – Existing pavement markings shall be removed before placing SMA.

The paragraph addressing excessive rippling has been deleted. SMA is to comply with the surface tolerance requirements of section 502 regarding correction of deficiencies.

Table 508-1 Stone Matrix Asphalt (SMA) Mix Properties – Table revised to add a requirement for extracted percent asphalt cement, to change some volumetric requirements, and to change the density for shoulders to 89.0 percent, from 92.0 percent.

Table 508-2 Payment Adjustment Schedules – Deleted reference to the profilograph since IRI is now required.

SECTION 509 - COLD PLANING ASPHALTIC PAVEMENT

509.03(a) General – Reinstated the original language of the second sentence, which includes provisions for increasing the forward speed of the cold planing operation.

The requirement for transverse faces to be beveled at the end of a work period has been deleted. Instead, the contractor shall place smooth transitions, a minimum of 1 foot per 1/4 inch of cold planed depth, at transverse joints prior to restoring traffic by milling or by using asphaltic concrete mix. RAP shall not be used.

Drainage of planed areas, when needed, shall be cut through the shoulder to the ditch the same day that the adjacent cold planing is performed.

For single lift overlays requiring shoulder stabilization, 15 calendar days will be allowed between the cold planing operation and subsequent paving operations, which may be extended further by the engineer if extensive joint repair, patching, or shoulder stabilization is required. Previously, 30 days were allowed between cold planing and subsequent paving operations.

Millings containing lightweight aggregate shall not be used as RAP in asphaltic concrete mixtures.

As required for pavement patching, joint repair shall also be in accordance with Section 510 (The old Section 724).

509.04 Measurement – Measurement has been clarified to state that no additional measurement will be made for multiple passes required to achieve total cold planing depth indicated in the plans.

509.05 Payment – Clarified the second paragraph to require drainage cuts placed through the shoulders and transitions at transverse joints be made at no "additional" pay. Previously, it was at no direct pay.

SECTION 510 – ASPHALTIC CONCRETE PAVEMENT PATCHING, WIDENING AND JOINT REPAIR

The old section 724, Pavement Patching, Widening and Joint Repair, has been modified to only address asphaltic pavements for inclusion in Part V. The requirements applicable to Portland cement concrete pavements are presented in the appropriate subsections in Section 602.

Section 510.02 Materials – Asphaltic concrete for joint repair shall be Superpave asphaltic concrete (Level A). Previously, the specifications referred to incidental paving wearing courses.

Section 510.06(a) Patching – Deleted the last sentence of Heading (a). The Materials and Testing Section will not provide the payment adjustment percentages for properties of asphalt materials for pavement patching, widening and joint repair. Payment adjustments for asphaltic concrete will be made in accordance with Section 502.

Section 510.06(b) Widening – Revised the second sentence to allow overwidths to be accepted at no "additional" pay. Also, underwidths shall be corrected by furnishing and placing additional asphaltic concrete to a minimum width of 1 foot (0.3 m) and plan thickness at no direct pay.

SECTION 1002 – ASPHALT MATERIALS AND ADDITIVES

1002.01 Asphalt – Added statement that payment adjustment shall apply to the quantity of the material represented by the sample. Also, if no specific pay adjustments exist, the invoice price of the material shall be used.

1002.02 (d) Fibers – Added requirement for cellulose and mineral fibers.

Table 1002-1 Performance Graded Asphalt Cements – Deleted the footnote regarding usage of the different grades of asphalt cement shown in the table. Added a clarifying footnote for force ductility testing. Also, revised the footnote/requirements for elastic recovery testing.

Table 1002-2 PG 70-22m Alternate – Deleted the footnote requirements that limited its use to Superpave Asphaltic concrete Level 1 or Level A mixes with less than 2500 ADT.

Tables 1002-3, 1002-4, 1002-5, 1002-9 and 1002-10 – Eliminated the pay penalty for viscosity for Types SS-1, SS1h, CRS-2, CMS-2, CSS-1, CSS-1h, CRS-2P, SS-1P and SS-1L emulsified asphalts. Retained payment penalty for MC Cutback, EPR-1 and AEP asphalt.

Where applicable, removed the language regarding payment by percent of contract unit price, "...per liter or shipment." Now refer to payment by percent of contract unit price.

Also, where applicable in the tables, removed redundant information in the footnote regarding test method AASHTO T 301 for elastic recovery.

SECTION 1003 – AGGREGATES

1003.01 General – Deleted shell, sand-shell, and sand-gravel from the specifications as in accordance with the direction of the Chief Engineer to remove all shell items from Part III Base Course.

Added test method AASHTO T 279 for polish value.

1003.01(a) Source Approval – The soundness test may be waived for recycled Portland cement concrete from raw materials stockpiles obtained exclusively from DOTD pavements or structures.

Clarified the requirement that recycled Portland cement concrete shall be produced by approved concrete crushing operations.

Revised the requirements for use and testing of aggregate regarding alkali reactivity properties.

1003.06 (a)(1)Gravel, Stone, and Crushed Slag – Friction ratings for aggregates will also be indicated in the QPL 2.

1003.06(a)(2) a – Fine Aggregate Angularity will now be determined in accordance with DOTD TR 121, with weighted averages based on the aggregate portions passing the No. 4 sieve.

Appendix A

A-2 Summary of Test Procedures

APPENDIX A2

Table 1

Test Methods and Procedures for Hot-Mix Asphalt Design, Control and Acceptance

TEST PROCEDURE	DOTD TR	AASHTO	ASTM
Asphalt Cement (Table 1002.1 and 1002.2)			
Rotational Viscosity		TP 48	
Dynamic Shear		TP 5	
Flash Point		T 48	
Solubility		T 44	
Separation of Polymer	TR 326		
Force Ductility Ratio		T 300	
Rolling Thin Film Oven		T 240	
Elastic Recovery		T 301	
Ductility		T 51	
Test on Pressure Aging Vessel Residue		PP 1	
Bending Beam Creep Stiffness		TP 1	
Specific Gravity, G_b		T 228	
Aggregate			
Sampling of Aggregates	S 301		
Deleterious Material	TR 119		
Foreign Matter in Shell	TR 109		
Unit Weight (for Source Approval)	TR 109		
Polish Value (for Source Approval		T 278	
Liquid Limit and PI (for Source Approval)	TR 428		
Los Angeles Abrasion (for Source Approval)		T 96	
Sulfate Soundness (for Source Approval)		T 104	
Determination of Moisture Content	TR 403		
Sieve Analysis of Fine and Coarse Aggregate	TR 113	(T 30)	
Sieve Analysis P_{200} by Wash	TR 112	(T 30)	
Sieve Analysis of Mineral Filler	TR 102		
Specific Gravity of Coarse Aggregate, G_{sb}		T 85	
Specific Gravity of Fine Aggregate, G_{sb}		T 84	
Specific Gravity of Mineral Filler, G_{sb}		T 100	
Coarse Aggregate Angularity, (% crushed)	TR 306		
Flat and Elongated Count			D 4791
Fine Aggregate Angularity (Method A)	TR 121		
Sand Equivalency	TR 120		

Hot-Mix Asphalt			
Bulk Specific Gravity, G_{mb}	TR 304		
Maximum Specific Gravity, G_{mm}	TR 327		
Asphalt Cement Content, P_b	TR 323		
Mechanical Analysis of Extracted Aggregate	TR 309		
Moisture Content of Loose HMA	TR 319		
Degree of Particle Coating (plant requirement)	TR 328		
Moisture Sensitivity (Lottman)	TR 322		
Preparing Gyratory Samples		T 312	
Mixture Conditioning of HMA Mixtures		R 30	
Superpave Volumetric Design		M 323	
Density of HMA Gyratory Specimens		T312	
Volumetric Analysis of Compacted HMA		PP 19	
Asphalt Cement Draindown			D 6390
Longitudinal Profile Using Automated Profilers	TR 644		
Thickness and Width of Base and Subbase	TR 602		

Notes: The *Standard Specifications* defines coarse aggregate as all material retained on or above the No. 4 (4.75mm) sieve. Fine aggregate is defined as all material passing the No. 4 (4.75mm) sieve.

Appendix A

A-3 Table 502-5, Superpave General Criteria

APPENDIX A3
Table 502-5
Superpave General Criteria

Nominal Max., Size Agg.	0.5 inch (12.5 mm)			0.75 inch (19 mm)			1.0 inch (25 mm)			1.5 inch (37.5 mm)
Type of Mix	Incidental Paving[1]	Wearing Course		Wearing Course	Binder Course		Binder Course		Base Course	Base Course
Level[2]	A	1	2	2	1	2	1	2	1	1
Asphalt Binder	Table 502-2									
Friction Rating[2]	Table 502-3									
Coarse Agg. Angularity, + No. 4 (4.75 mm)	55	75	95	95	75	95	75	95	75	75
Fine Agg. Angularity, Min. % - No. 4 (4.75 mm)	40	40	45	45	40	45	40	45	40	40
Flat and Elongated Particles, % Max. (5:1) + No. 4 (4.75 mm)	10									
Sand Equivalent, Min. % (Fine Agg.), - No. 4 (4.75 mm)	40	40	45	45	40	45	40	45	40	40
Natural Sand Max. % of New Agg.	N/A	15	15	15	15	15	15	15	15	25
RAP, Max. % of Mix[3]	20	15	15	15	20	20	20	20	30	30
	Compacted Mix Volumetrics [4]									
VMA, Min. %	13	13	13	12	12	12	11	11	11	10
Air Voids, %[5]	2.5-4.5									
VFA, %[5]	68-78									
$N_{initial}$ 90% max.[6] (Gyrations)	7	7	8	8	7	8	7	8	7	7
N_{design} 96.5±1 % (Gyrations)	75	75	100	100	75	100	75	100	75	75
N_{max} 98 % max. (Gyrations)	115	115	160	160	115	160	115	160	115	115
Moisture Sensitivity, TSR Min.	80									
Dust/Effective Asphalt Ratio, %	0.6 – 1.6									
Lift Thickness, inch (mm)	2.0- (50-)	1.5–2.0 (45-50)		2.0–3.0 (50-75)			2.5–4.0 (65-100)		2.5+ (65+)	4.0+ (100+)

Appendix A

A-4 Table 502-6, Quality Index Values for Estimating Percent Within Limits

APPENDIX A4
Table 502-6
Quality Index Values for Estimating Percent Within Limits

PWL	n = 3	n = 4	n = 5 - 6	n = 7 - 9	n = 10 - 12	n = 13 - 15
99	1.16	1.47	1.68	1.89	2.04	2.14
98	1.15	1.44	1.61	1.77	1.86	1.93
97	1.15	1.41	1.55	1.67	1.74	1.80
96	1.15	1.38	1.49	1.59	1.64	1.69
95	1.14	1.35	1.45	1.52	1.56	1.59
94	1.13	1.32	1.40	1.46	1.49	1.51
93	1.12	1.29	1.36	1.40	1.43	1.44
92	1.11	1.26	1.31	1.35	1.37	1.38
91	1.10	1.23	1.27	1.30	1.32	1.32
90	1.09	1.20	1.23	1.25	1.26	1.27
89	1.08	1.17	1.20	1.21	1.21	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17
87	1.06	1.11	1.12	1.12	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.04	1.04
84	1.02	1.02	1.02	1.01	1.00	1.00
83	1.00	0.99	0.98	0.97	0.96	0.96
82	0.98	0.96	0.95	0.94	0.93	0.92
81	0.96	0.93	0.92	0.90	0.89	0.89
80	0.94	0.90	0.88	0.87	0.85	0.85
79	0.92	0.87	0.85	0.83	0.82	0.82
78	0.89	0.84	0.82	0.80	0.79	0.78
77	0.87	0.81	0.79	0.77	0.76	0.75
76	0.84	0.78	0.76	0.74	0.72	0.72
75	0.82	0.75	0.73	0.71	0.69	0.69
74	0.79	0.72	0.70	0.67	0.66	0.66
73	0.77	0.69	0.67	0.64	0.63	0.62
72	0.74	0.66	0.64	0.61	0.60	0.59
71	0.71	0.63	0.60	0.58	0.57	0.56
70	0.68	0.60	0.58	0.55	0.54	0.54
69	0.65	0.57	0.55	0.53	0.51	0.51
68	0.62	0.54	0.52	0.50	0.48	0.48
67	0.59	0.51	0.49	0.47	0.46	0.45
66	0.56	0.48	0.46	0.44	0.43	0.42
65	0.53	0.45	0.43	0.41	0.40	0.40
64	0.49	0.42	0.40	0.38	0.37	0.37
63	0.46	0.39	0.37	0.35	0.35	0.34
62	0.43	0.36	0.34	0.33	0.32	0.31
61	0.39	0.33	0.31	0.30	0.30	0.29
60	0.36	0.30	0.28	0.27	0.26	0.26
59	0.32	0.27	0.25	0.24	0.24	0.23
58	0.29	0.24	0.23	0.21	0.21	0.21
57	0.25	0.21	0.20	0.19	0.18	0.18
56	0.22	0.18	0.17	0.16	0.16	0.15
55	0.18	0.15	0.14	0.13	0.13	0.13
54	0.14	0.12	0.11	0.11	0.10	0.10
53	0.11	0.09	0.08	0.08	0.08	0.08
52	0.07	0.06	0.06	0.05	0.05	0.05
51	0.03	0.03	0.03	0.03	0.03	0.03
50	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: For negative values of Q_u or Q_L. PWL_U or PWL_L is equal to 100 minus the tabular PWL_U or PWL_L.
Note 2: If the value of Q_U or Q_L does not correspond exactly to a value in the table, use the next higher value.

Appendix B – Materials

B-1 Superpave Asphaltic Concrete Aggregates
B-2 Sand Equivalent for Asphaltic Concrete Sands
B-3 Performance Graded Asphalt Binder

Appendix B

B-1 Superpave Asphaltic Concrete Aggregates

MATT MENU SELECTION - 09

DOTD 03-22-0748
Rev. 10/07

Louisiana Department of Transportation and Development

SUPERPAVE ASPHALTIC CONCRETE AGGREGATES

Project No.........

Material Code ...

Lab No...............

Sampled By ......

Date Sampled ...

Submitted By ....

Quantity .... X X X X X X **Unit** X X X

Purpose Code ...

Source Code ·· **Spec Code**

P. O. Number ....

Independ. Testing Lab Code....... L

Date Tested ....

Sample Ident ....

Material Sampled From..

Date Transport to Dist/Matls Lab - -

Date Rec'd @ Dist Lab... - -

Date Rec'd @ Matls Lab .... - -

Remarks 1

Remarks 2

Item No....

Sampling / Testing Comments

	Test Results	P/F
PLANT CODE	H	XXXX
DESIGN LEVEL *(A, 1, 1F, 2, 2F, 3, 3F)*		XXXX
MIX TYPE *(WC, BC, BIND, INCID)*........		XXXX
(INACTIVE FIELD 10/07)	XXXXXXXXXXXXXXXXXXXXXXX	XXXX
JMF SEQ NO.		XXXX
ASPHALTIC CONCRETE AGGREGATE MATERIAL CODE		XXXX
BULK SPECIFIC GRAVITY - DRY (G_{sb})	•	XXXX
APPARENT SPECIFIC GRAVITY (G_{sa})	•	XXXX
ABSORPTION % *(AASHTO T84 or T85)*	•	XXXX
COARSE AGGREGAGTE ANGULARITY (+2 Faces) *(DOTD TR 306)*		
FLAT AND ELONGAGTED (5:1) *(ASTM D4791)*		
FINE AGGREGATE ANGULARITY (FAA) *(DOTD TR 121)*	•	
SAND EQUIVALENT (-NO. 4) *(DOTD TR 120)*		
RECLAIMED ASPHALT PAVEMENT (RAP)	XXXXXXXXXXXXXXXXXXXXXXX	XXXX
% AC IN RAP	•	XXXX
% AGGREGATE IN RAP	•	XXXX
THEO. MAX. SPEC GRAV OF RAP (G_{mm}) *(DOTD TR 327)*	•	XXXX
EFFECTIVE SPECIFIC GRAV OF RAP IN AGGREGATE (G_{se})	•	XXXX
SPECIFIC GRAVITY OF MINERAL FILLER (G_{sb}) *(DOTD TR 300)*	•	XXXX
FRICTION RATING, COARSE AGGREGATE		
% CRUSHED *(DOTD TR 306)*		

Tested By: ____________________ Checked By: ____________________

Date: ____________________ Date: ____________________

Approved By ____________________ **Date:** ____________________

(Over)

(CAA) Coarse Aggregate Angularity (+No.4) *(DOTD TR 306)*

Wt of doubled faced crushed	A		
Wt of No.4 aggregate	B		
% Crushed *(Doubled Faced)*		A / B x 100	

Effective Specific Gravity of Aggregate in RAP

Wt of aggregate *(DOTD TR 323)*	A		
Wt of RAP	B		
% Asphalt in RAP	C	(B - A) / B x 100	
Wt of jar + water	D		
Wt of jar + water + RAP	E		
Theo. max sp.gr of RAP *(TR 327)* G_{mm}	F	(B / (D + B - E)	
% Aggregate in RAP	X	100 - C	
Spec grav of asphalt cement	H		
Effective spec grav of aggregate	G_{se}	X / (100 / F) - (C / H)	

Flat & Elongated Particles *(ASTM 4791)*

Sieve Size	% Ret in Grad (A)	Wt of Flat & Elong Part (B)	Wt of Test Sample (C)	Actual % (D) B ÷ C x 100	Weighted Avg % (E) A x D
1.5 in *(37.5 mm)*					
1 in *(25.0 mm)*					
3/4 in *(19.0 mm)*					
1/2 in *(12.5 mm)*					
3/8 in *(9.5 mm)*					
No.4 *(4.75 mm)*					
	Total Wt Avg, %				
	5 to 1		3 to 1		

Gradation of Extracted Aggr

Sieve Size	% Passing
2 in *(50 mm)*	
1.5 in *(37.5 mm)*	
1 in *(25.0 mm)*	
3/4 in *(19.0 mm)*	
1/2 in *(12.5 mm)*	
3/8 in *(9.5 mm)*	
No.4 *(4.75 mm)*	
No.8 *(2.36 mm)*	
No.16 *(1.18 mm)*	
No.30 *(600 µm)*	
No.50 *(300 µm)*	
No.100 *(150 µm)*	
No.200 *(75 µm)*	
Passing No.200	

< 25% Passing No. 200	Yes	
	No	

Notes:

Tested By: ____________________

Date: ____________________

Checked By: ____________________

Date: ____________________

(FAA) Fine Aggregate Angularity (-No. 8) *(DOTD TR 121)*

			TEST 1	TEST 2
Wt of empty measure	D			
Wt of measure & fine aggr	E			
Net Wt of fine agg in measure	F	E - D		
Volume of cylindrical measure	V			
Bulk dry spec grav of fine aggr	G			
Uncompacted voids % in matl	U	V - (F/G) / V x 100		
Average uncompacted voids	U_s	$U_1 + U_2 / 2$		

Bulk Specific Gravity, Apparent & Absorption

Fine Aggregate *(AASHTO T 84)*

Wt of oven dry sample in air	A		
Wt of volumetric flask with water	B		
Wt of flask, sample & water	C		
Wt of SSD test sample	S		
Bulk spec grav (Dry)		A / (B + S - C)	
Apparent specific gravity		A / (B + A - C)	
% Absorption		(S - A) / A x 100	

*Coarse Aggregate *(AASHTO T 85)*

Wt of oven dry sample in air	A		
Wt of SSD in air	B		
Wt of SSD in water	C		
Bulk spec grav (Dry)		A / (B - C)	
Apparent spec grav		A / (A - C)	
% Absorption		(B - A) / A x 100	

*Combined Specific Gravity & Absorption

% Passing No. 4		M		
% Retained No. 4		N	100 - M	
Bulk Spec Grav (Dry)	Fine	f		
	Coarse	c		
	Combined		(f x M / 100) + (c x N / 100)	
Apparent Spec Grav	Fine	f		
	Coarse	c		
	Combined		(f x M / 100) + (c x N / 100)	
% Absorption	Fine	f		
	Coarse	c		
	Combined		(f x M / 100) + (c x N / 100)	

** If > 10% passing No. 4, split material on No. 4, run separately and combine.*

Appendix B

B-2 Sand Equivalent for Asphaltic Concrete Sands

Louisiana Department of Transportation and Development

SAND EQUIVALENT FOR ASPHALTIC CONCRETE SANDS
(DOTD TR 120)

Project No .... **Material Code** ... 2 7 5

Sampled By *(signature)*

Lab No ....

Date Sampled .....

Submitted By ....

Quantity .... **Unit** ....

Purpose Code ....

Source Code ...... **Spec Code** .....

P. O. No. ....

Independ. Testing Lab Code L

Date Tested ....

Sample Ident ....

Material Sampled From ....

Date Transport to Dist/Matls Lab ...

Date Rec'd @ Dist Lab ......

Date Rec'd @ Matls Lab ....

Remarks 1

Remarks 2

Item No. .....

Sampling / Testing Comments

	Test Results	**Pass or Fail (P / F)**
JOB MIX FORMULA SEQUENCE NO.		XXXX
MIX CODE		XXXX
PLANT TYPE 1 - Batch Screenless 3 - Drum Mixer 2 - Batch Hot Bin 4 - Continous		XXXX
COARSE SAND SOURCE .... ________		XXXX
FINE SAND SOURCE .... ________		XXXX
COARSE SAND, % OF COMPOSITE		
FINE SAND, % OF COMPOSITE		
SAND EQUIVALENT, AVERAGE		

Cylinder No.	Time Soaking Period Started	Time Sedimentation Period Started	Time Sample is Read
1			
2			
3			

Cylinder No.	Sand Reading (A)	Clay Reading (B)	Sand Equivalent (A / B) x 100	
1				
2				
3				
			Total (C)	
			Sand Equivalent, Avg. (C / 3)	

Tested By: ________________ Date: ________________

Checked By: ________________ Date: ________________

APPROVED BY: **DATE:**

Appendix B

B-3 Performance Graded Asphalt Binder

MATT MENU SELECTION - 09

DOTD 03-22-0707
Rev. 06/03

Louisiana Department of Transportation and Development

PERFORMANCE GRADED ASPHALT BINDER

(Use with Material Codes 656, 657, 658, 659 and 660)

Project No.........

Material Code ... *(code descriptions on back)*

Lab No...............

Sec 22 Lab No. .. 2 2 -

Date Sampled ...

Submitted By ....

Quantity .... **Unit**

Purpose Code ...

Source Code ·· **Spec Code**

P. O. Number ....

Independ. Testing Lab Code....... L

Date Tested ....

Sample Ident ....

Section 22 Date Test 2 2 -

Material Sampled From.. x x x x x *1 = Working Tank* *2 = Transport*

Date Transport to Dist/Matls Lab - -

Date Rec'd @ Dist Lab... - -

Date Rec'd @ Matls Lab .... - -

Remarks 1

Remarks 2

Item No....

Sampling / Testing Comments

Materials & Testing Laboratory Results:

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxx

District Laboratory Results: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxx

DISTRICT LABORATORY NUMBER .... - xxxxxx

CERTIFICATE OF DELIVERY LAB NUMBER .... 2 2 - xxxxxx

Tank Penetration .... ____________ % Difference .... ____________

Tank Viscosity .... ____________ % Difference .... ____________

* PENETRATION, 25 °C, 100g, 5 Sec., dmm (AASHTO TP49) xxxxxx

1 ____________ 2 ____________ 3 ____________

* VISCOSITY, ROTATIONAL, SPINDLE #SC4 - ____________ , ____________ .... • xxxxxx

RPM, 135°C, Pa.s (__________ m Pa.s x 0.001) (AASHTO TP48-96)

* ***Note:*** *Enter 'P' for passing results. An entry of 'F' is not allowed. If material fails, submit to the Materials Lab.*

DYNAMIC SHEAR, 10 RAD/s, G*/SIN(δ), kPa (AASHTO TP5) .... •

PHASE ANGLE, DEGREES .... •

TEST TEMPERATURE, °C (58, 64, 70, or 76) ....

Tested By: ____________________ Date: ____________

Checked By: ____________________ Date: ____________

Approved By: ____________________ **Date:** ____________

MATERIAL CODES

Code	Description
656	Asphalt Binder 58 - 28
657	Asphalt Binder 64 - 22
658	Asphalt Binder 70 - 22M
659	Asphalt Binder 70 - 22M ALTERNATE
660	Asphalt Binder 76 - 22M

Appendix C - JMF

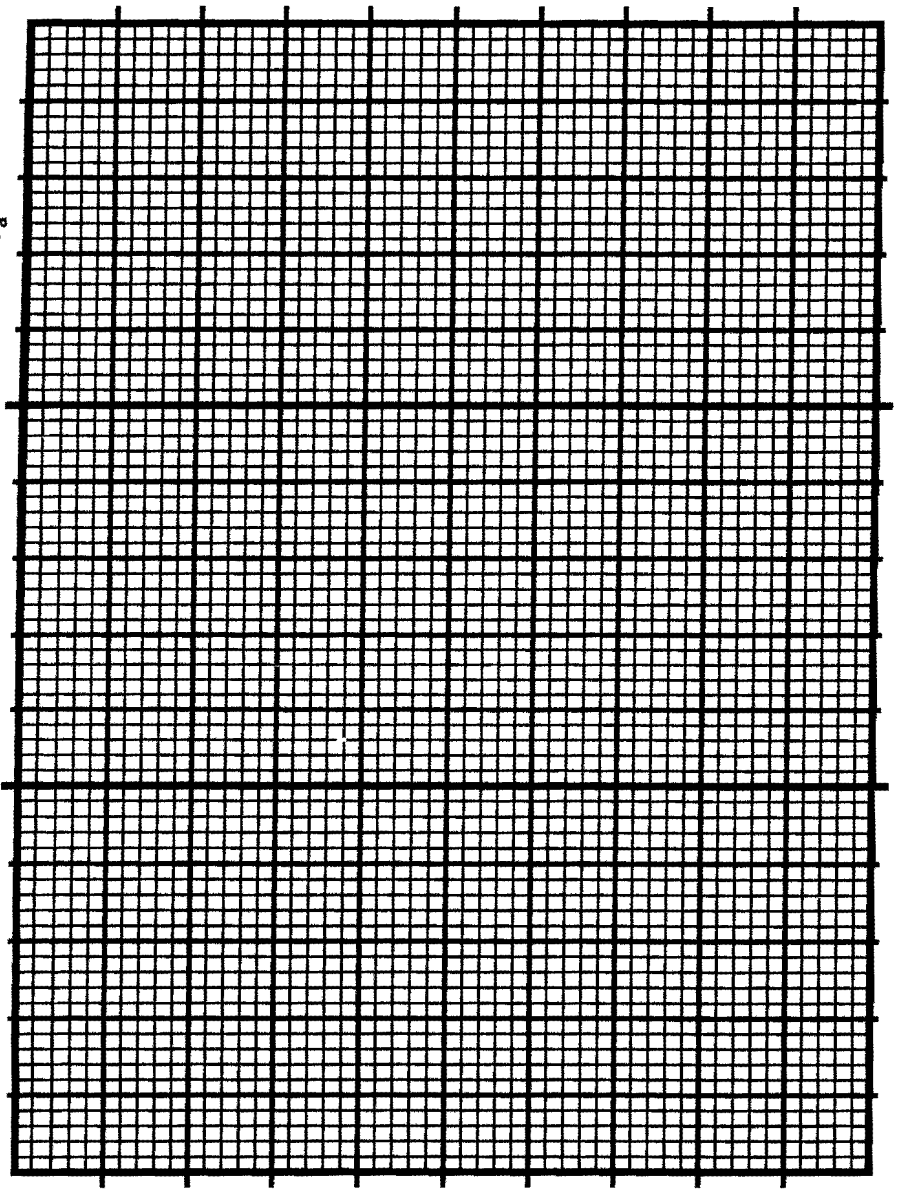
Appendix C

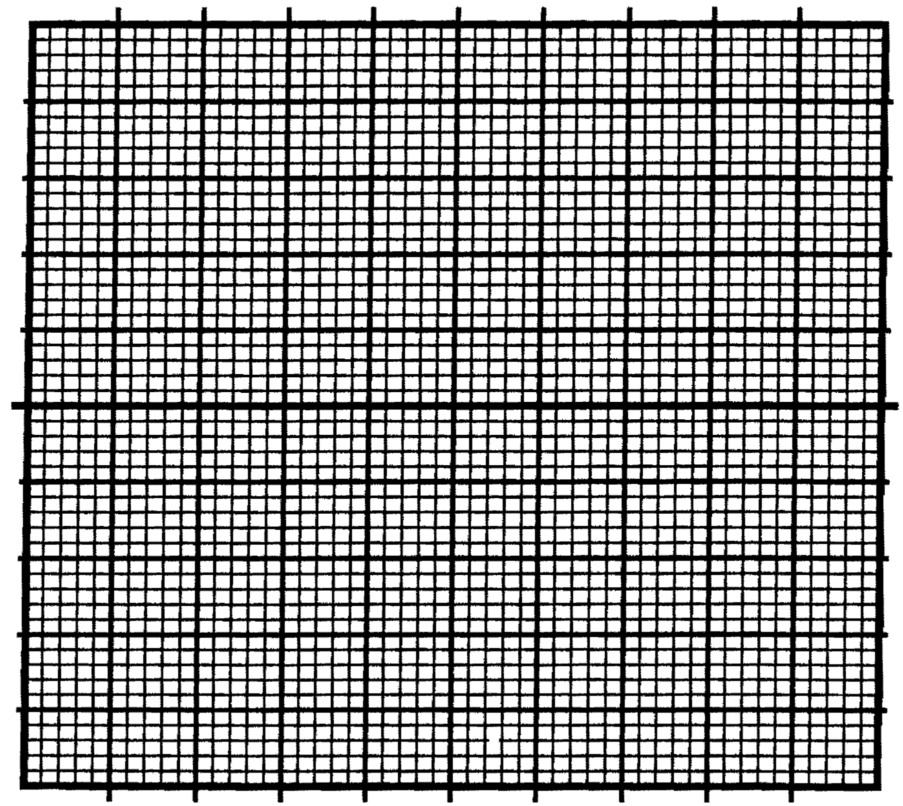
C-1 Optimum Asphalt Cement Content – Summary of Test Properties

Louisiana Department of Transportation and Development

SUPERPAVE ASPHALTIC CONCRETE

Optimum Asphalt Cement Content - Summary of Test Properties
(DOTD TR 303)





Mix Type Code: ____________ Design Level: ____________

Mix Description: ____________ Plant Code: ____________

% Voids, V_a ____________ % VMA (Min): ____________

Limits For % VFA: ____________ Opt. AC Content,%: ____________

% G_{mm} @ N_{ini} ____________

Tested By: ____________ Date: ____________

Appendix C

C-2 Tensile Strength Ratio (TSR)

MATT MENU SELECTION - 09

DOTD 03-22-0732
Rev. 07/05

Louisiana Department of Transportation and Development

TENSILE STRENGTH RATIO (TSR)
AASHTO T 283 / DOTD TR 322

Project No ....

Material Code ... 6 6 1

Sampled By *(signature)*

Lab No ....

Date Sampled .....

Submitted By ....

Quantity ....

Unit ....

Purpose Code ....

Source Code ......

Spec Code .....

P. O. No. ....

Independ. Testing Lab Code L

Date Tested ....

Sample Ident ....

Material Sampled From .....

Date Transport to Dist/Matls Lab ...

Date Rec'd @ Dist Lab ......

Date Rec'd @ Matls Lab ....

Remarks 1

Remarks 2

Item No. .....

Sampling / Testing Comments

	Test Results	**Pass or Fail** P / F
	XXXXXXXXXXXXXXXXXXXX	XXXX
	XXXXXXXXXXXXXXXXXXXX	XXXX
JOB MIX FORMULA SEQUENCE NO.		XXXX
LOT NO.		XXXX
MIX TYPE CODE		XXXX
NUMBER OF BLOWS PER SIDE		XXXX
AVERAGE NUMBER OF GYRATIONS		XXXX
PLANT TYPE 1 *- Batch Screenless* 3 *- Drum Mixer*		XXXX
2 *- Batch Hot Bin* 4 *- Continous*	XXXXXXXXXXXXXXXXXXXX	XXXX
	XXXXXXXXXXXXXXXXXXXX	XXXX
JMF MAX. THEORETICAL SPECIFIC GRAVITY (G_{mm})	.	
AVERAGE AIR VOIDS (MOISTURE-CONDITIONED SET),%	.	XXXX
AVERAGE AIR VOIDS (CONTROL SET), %	.	XXXX
AVG. TENSILE STRENGTH (MOISTURE-CONDITIONED SET), PSI (kPa)		XXXX
AVG. TENSILE STRENGTH (CONTROL SET), PSI (kPa)		XXXX
TENSILE STRENGHT RATIO (TSR), %		

Tested By: ____________________ Date: ____________

Checked By: ____________________ Date: ____________

(Over)

APPROVED BY: ____________________ **DATE:** ____________

TENSILE STRENGTH RATIO (TSR) -- AASHTO T 283

Project No.: ______________________ Date Sampled: __________________ Date Tested: __________________

E. Max. Theo. Gr:(T 209) ____________ Sample Set ID: __________ JMF Seq.No: ______ Mix Type: ________

SAMPLE ID										
A	Wt. (Mass) in Air - Dry									
B	Wt. (Mass) in Water									
C	SSD Wt. (Mass)									
v	Volume	(C - B)								
D	Bulk Sp Grav	(A / v)								
F	% Max Theo Grav *(T 209)*	(D / E x 100)								
H	% Air Voids	(100 - F)								

Avg %Voids (Cond) = _______ Av g % Voids (Ctrl) = ________ Hg = ________ T ime =________ # Blows = ________

AFTER VACUUM CONDITIONING										
G	Weight in Air (SSD)									
I	Weight in Water									
V	Volume	(G-I)								
W	Vol. Abs. Water,cc	(G-A)								
Vv	Vol. Air Voids	(Hv/100)								
N	% Sat	(100W/Vv)								

INDIRECT TENSILE TESTING										
Specimen Thickness		T_1								
		T_2								
		T_3								
		T								
Specimen Diameter		D_1								
		D_2								
		D								
	Dial Reading									
P	Maximum Load									
S	Strength									
	Strength (Control)									
	Strength (Conditioned)									
	Avg. Strength (Ctrl.)									
	Avg. Strength (Cond.)									
	TSR									

Tested By: ______________________ Date: ____________

Checked By: ______________________ Date: ____________

Remarks: ____

____

Approved By: **Date:**

Appendix C

C-3 JMF Superpave Asphaltic Concrete Mixtures

JMF SUPERPAVE ASPHALTIC CONCRETE MIXTURES

Metric / English ___ *(M or E)* **Spec Year** ____

Proj. No. ___ **Plant Code** H___ **Mix Type** ___ Mix Use ___ **Des. Level** ___ **Seq No.** ___

10^6 ESAL ___ Plant Type ___ *1 = Batch Screenless 2 = Batch Hot Bin 3 = Drum Mixer 4 = Continuous* Prod. Rate ___ Mixing Time: Dry ___ Wet ___

Adj.Factor ___ ADT/Lane ___ Nom. Agg.Size ___ AC Corr.Factor ___ Perm.,fpd ___

Report Pos (+) or Neg (–) for AC Corr Fac

F.A.P. No. ___ Project Contr. ___ Project Engr ___

AGGREGATES

Material	Source Code	Source Name	Aggr Type	Material Code	Aggr. Percent	Bulk Sp Gr, G_{sb}	Abs	FAA	Sand Eq.	Flat & Elong	CAA	FR (1-4)	% Ret No.8
Cr Aggr													
Cr Aggr													
Cr Aggr													
Cr Aggr													
Co Sand													
Fine Sand													
RAP Aggr			RAP Aggr			*						3	
Other													
Composite					100%								

ASPHALT CEMENT and ADDITIVES *(AC G_b assumed to be 1.03)*

* *Report Effective Specific Gravity of RAP Aggregate, G_{se}*

Material	Source Code	Product Name	Matl. Code	Source Name	% of Mix
Asphalt Cement					
Asphalt from RAP					
Anti Strip					
Other					
Mineral Filler					
Fibers					

TENSILE STRENGTH RATIO

Design: Control, PSI (MP_a) ___
% TSR ___

[1] Validation: Control, PSI (MP_a) ___
% TSR ___

DESIGN DATA		VALIDATION DATA			JMF Limits
Parameter	Submittal	Average	Std. Dev.	PWL	(per validation avg)
G_{mm}				[2]	
% G_{mm} @ NI				[2]	
% G_{mm} @ ND					
% G_{mm} @ NM				[2]	
VMA				[2]	
VFA		[3]			
% Voids				[2]	
% AC Design					
Slope					
Comp Temp					
G_{mb} (Max)					
% DF Crushed					
1 ½ in (37.5 mm)		[3]			
1 in (25.0 mm)		[3]			
3/4 in (19.0 mm)		[3]			
½ in (12.5 mm)		[3]			
3/8 in (9.5 mm)		[3]			
No. 4 (4.75 mm)		[3]			
No. 8 (2.36 mm)		[3]		[2]	
No. 16 (1.18 mm)		[3]			
No. 30 (600 µm)		[3]			
No. 50 (300 µm)		[3]			
No. 100 (150 µm)		[3]			
No. 200 (75 µm)		[3]		[2]	
% AC Extracted		[3]			
Dust/P_{eff}		[3]			0.6 - 1.6
G_{se}		[3]			
P_{ba}	±	± [3]			≥ 0.0
P_{be}					

Submitted for Contractor By: ___
Date Submitted ___

Technician

Proposal Approved: *Y=Yes N=No* ..... ___
By: ___
Date ___

Signature

Validation Approved: *Y=Yes N=No* ... ___
By: ___ *(lab engr sub code)*
Date ___
Number of Validation Attempts .. ___

(Y/ N)

[1] TSR ≥ 80 .... ___
[2] Each PWL Parameter ≥ 90 .... ___
[3] Avg. within JMF spec. limits .... ___

Approved By

Date First Used: ___

[1] To validate, TSR must be ≥ 80
[2] To validate, PWL must be ≥ 90 for each parameter.
[3] To validate, validation average must be within JMF specification limits.

Remarks ___

Appendix C

C-4 Computer Generated JMF

JMF SUPERPAVE FORM

Project No.	100-10-1000	Mix Code	26	JMF No.	100	Plant Code	H100	Traffic (ADT)	1000
Project No.				Design Level	1	Plant Type	3-dryer drum	Prod. Rate	250
Project Eng.	Ben Pavin	Mix Type	2-Wearing			Nom Agg Size	0.5"	Mix Temp	340
Submitted	Quality Contractors	Mix Use	1-Wearing			Specs	2006	Date	1/1/2006
						AC Corr Factor	0.3		

Source Code	Source	Aggregate Type	Mat'l Code	%	Bulk Gravity	Abs.	FAA Method A	Sand Eq. -4.75 mm	Flat & Elong %5:1	CAA	FR	%Ret No.	
AAXX	Vulcetta	#5 LS	634	18.0	2.620	0.6			7	100	2	97	COARSE
AAXP	Martcan	5/8" Gravel	631	37.0	2.596	0.9			3	95	3	87	
RP10	Scraper's	RAP	640	15.0	2.682	0.6							
AA10	Rivers Stone	Screenings	643	15.0	2.705	2.1	47	100					FINE
AA20	Morgan	C.Sand	630	8.0	2.648	0.7	45	60					
AA30	Rocky S&G	F. Sand	636	7.0	2.652	0.6	45	60					
Combined Aggregates Properties				100.00	2.603	0.85	46	81	4	97			

	Code/Grade	Source	Mat'l Code	Source Name	%	Sp. Gravity
Asphalt	41AA	PG70-22m	658	Exron	4.3	1.03
Asp. fm. RAP	RP10	RAP		Scraper's	0.7	1.03
Anti-strip	5710	Stic-2		Stripnot	0.6	

Design Submitted by Contractor

Average Volumetrics		Average Oven Extracted Sieve		%Passing
Gmm	2.438	2"	50	100
%Gmm,NI	89.6	1.5"	37.5	100
%Gmm,Nd	96.5	1"	25	100
%Gmm,Nmax	96.7	3/4"	19	100
Gmb@Des,est	2.335	1/2"	12.5	92
Gmb@Des,cor	2.353	3/8"	9.5	82
VMA	14	#4	4.75	53
VFA	75	#8	2.36	37
%Voids	3.5	#16	1.18	27
%DesignAC	5.0	#30	0.6	24
Gsb agg	2.603	#50	0.3	17
Slope	6.75	#100	0.15	9
Comp Temp	300	#200	0.075	5.0
Gmb(N_{des})	2.353	% Extracted AC		5.0
%Crushed	96	dust/Peff		1.06
		Gse		2.627
		Pabsorb		0.36
		Pbe		4.7

Average Gyratory Data at Optimum AC

% Design AC = 5.0

Specimen No. 1

	Gyrations	Ht, mm	Gmb(est)	Gmb(corr)	%Gmm
N initial	7	124.0	2.165	2.184	89.6
N design	75	115.2	2.331	2.352	96.5

Gmm	2.438	VMA	14	Air Wt.	4745.0
Cor. Fact.	1.009	VFA	75	Water Wt.	2739.0
Gmb	2.351	%Voids	3.5	SSD Wt.	4757.0
		slope	6.70		

Specimen No. 2

	Gyrations	Ht, mm	Gmb(est)	Gmb(corr)	%Gmm
N initial	7	124.2	2.170	2.183	89.5
N design	75	115.2	2.339	2.353	96.5

Gmm	2.438	VMA	14	Air Wt.	4762.0
Cor. Fact.	1.006	VFA	75	Water Wt.	2754.0
Gmb	2.354	%Voids	3.5	SSD Wt.	4777.0
		slope	6.80		

Specimen No. 3

	Gyrations	Ht, mm	Gmb(est)	Gmb(corr)	%Gmm
N initial	7	124.3	2.171	2.164	88.8
N design	75	115.3	2.340	2.333	95.7
N max	115	114.1	2.365	2.358	96.7

Gmm	2.438	VMA	15	Air Wt.	4768.0
Cor. Fact.	0.997	VFA	71	Water Wt.	2754.0
Gmb	2.359	%Voids	4.3	SSD Wt.	4775.0
		slope	6.70		

AASHTO T283 as modified by PP28

Control PSI 111
Validation TSR% 93

Proposal approved by:________________________
Date: __________

Validation approved by:________________________
Date: __________

Submitted for contractor by:________________________
Date: __________

Remarks: ____

Appendix C

C-5 Blend Summary

Blend Summary

Sieve Size	Fine Sand Withrow Bin #1 7.0	Total %	CDA Sand Hanson Bin #2 8.0	Total %	Screens M/M Bin #3 15.0	Total %	1/2" Gravel Hanson Little River Bin #4 37.0	Total %	5/8" Stone MM Haton Bin #5 18.0	Total %	RAP Bin #6 15.0	Total %	Total % 100.0 Pass	LA Spec min	max
2"	100		100	8	100	15	100	37	100	18	100	15	100		100
1 1/2"	100		100	8	100	15	100	37	100	18	100	15	100		100
1"	100		100	8	100	15	100	37	100	18	100	15	100		100
3/4"	100		100	8	100	15	100	37	100	18	100	15	100	90	100
1/2"	100		100	8	100	15	98	36.3	66	11.9	92	13.8	92		89
3/8"	100		100	8	99	14.9	90	33.3	35	6.3	85	12.8	82		
#4	100		100	8	80	12	42	15.5	6	1.1	65	9.8	53.4		
#8	100		98	7.8	58	8.7	14	3.2	5	0.9	47	7.1	36.7	34	58
#16	100		95	7.6	35	5.3	6	2.2	4	0.7	34	5.1	27		
#30	100		90	6.2	28	4.2	4	1.5	3	0.5	27	4.1	24.5		
#50	80		50	4	20	3	3.5	1.3	2.5	0.5	20	3	17.4		
#100	28		12	1	15	2.3	3	1.1	2	0.4	12	1.8	8.6		
#200	12		2	0.2	11	1.7	2	0.7	1.5	0.3	10	1.5	5.2	4	10

Appendix C

C-6 Asphaltic Concrete Gradation – 0.45 Power Curve

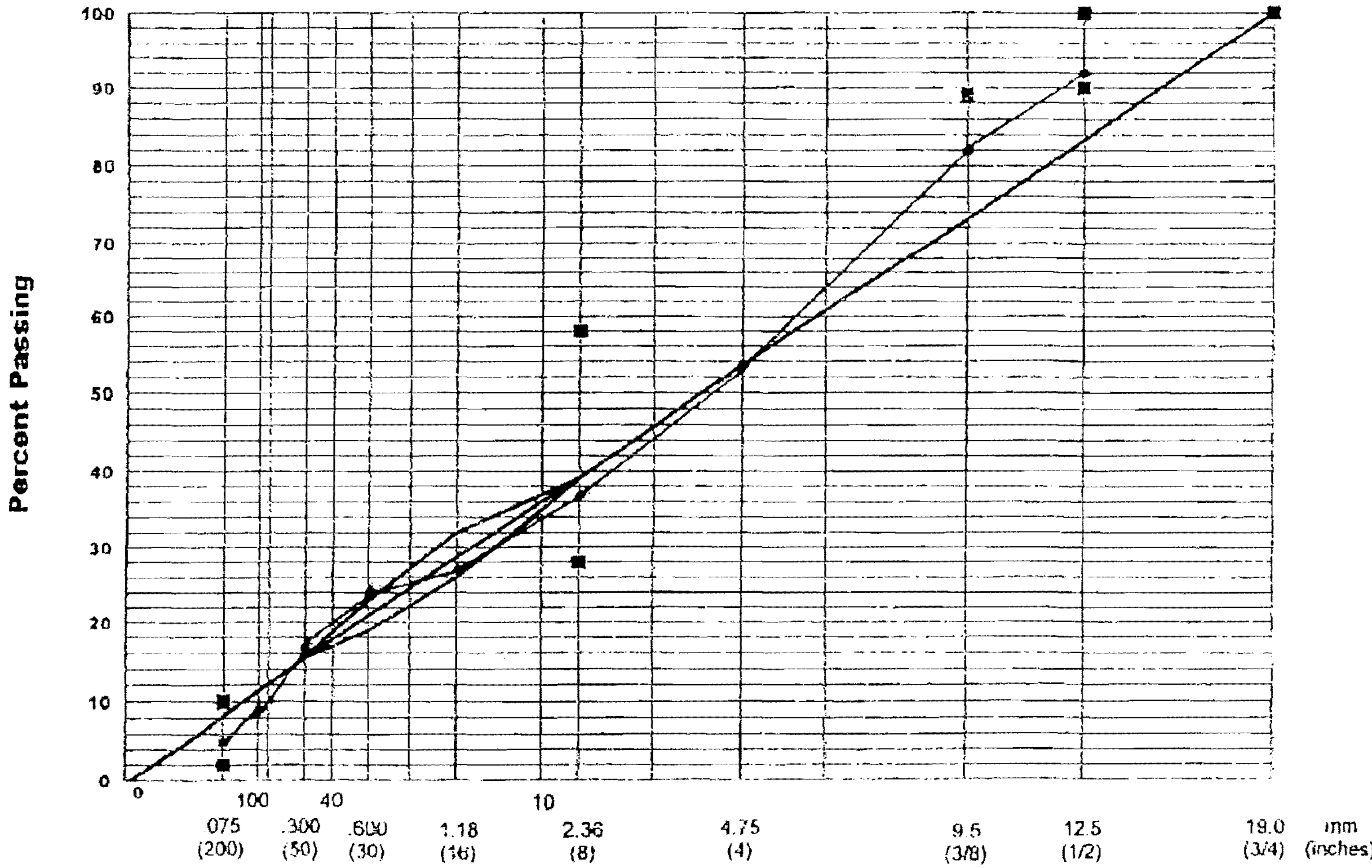
DOTD 03-22-
Rev. 06/02

Louisiana Department of Transportation and Development

ASPHALTIC CONCRETE GRADATION - 0.45 POWER CURVE WITH RESTRICTED ZONE AND CONTROL POINTS

1 / 2 inch (12.5mm) Nominal Maximum Size

Plant Code: H 402 **Level:** 1 **Mix Type:** W.C. **Job Mix Sequence No:** 239



Sieve Sizes

Steve Milam
Certified Asphaltic Concrete Technician

3-29-07
Date

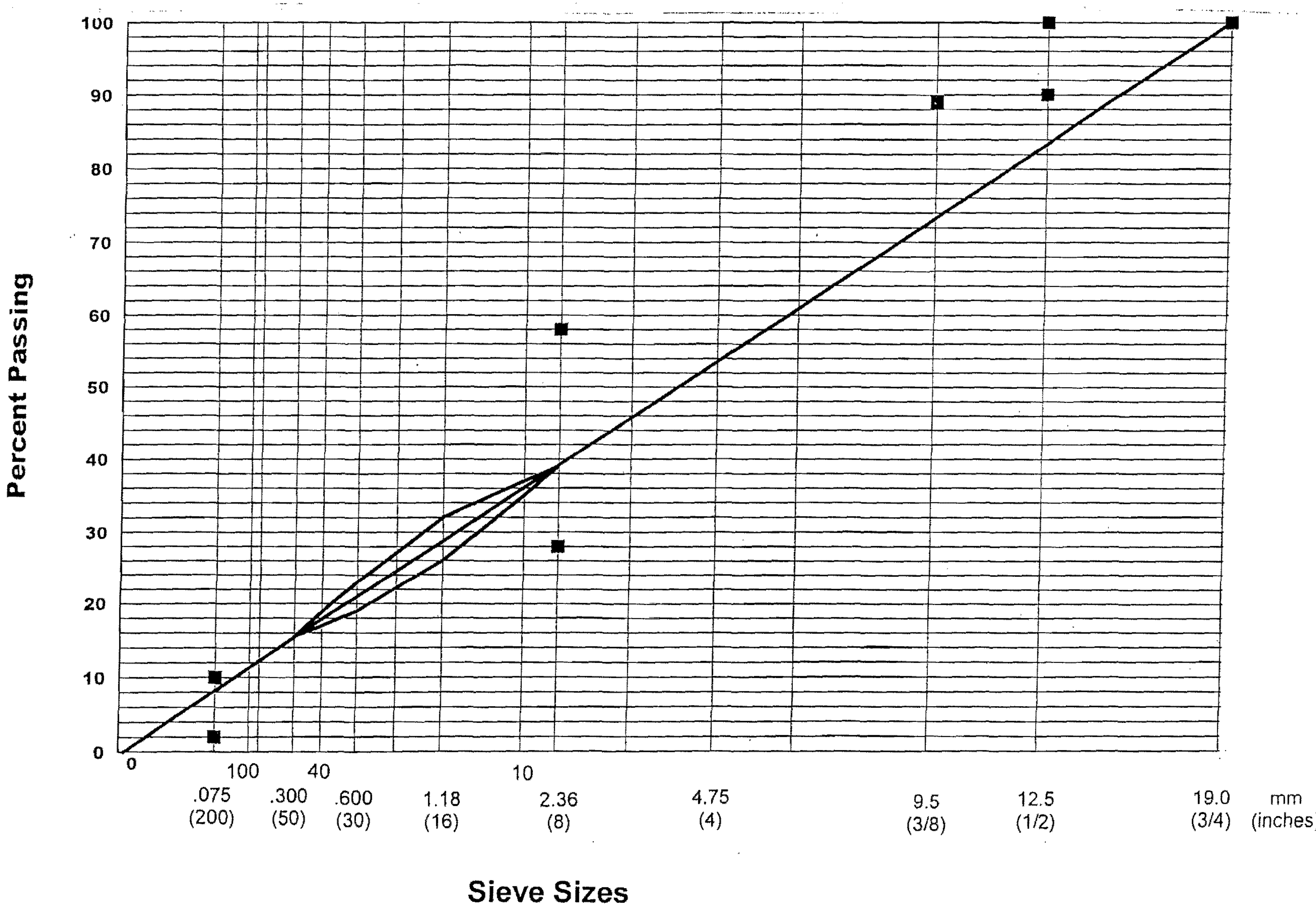
DOTD 03-22-3030
Rev. 06/02

Louisiana Department of Transportation and Development

ASPHALTIC CONCRETE GRADATION - 0.45 POWER CURVE WITH RESTRICTED ZONE AND CONTROL POINTS

1 / 2 inch (12.5mm) Nominal Maximum Size

Plant Code: H **Level:** ______ **Mix Type:** ______ **Job Mix Sequence No:** ______



Certified Asphaltic Concrete Technician

Date

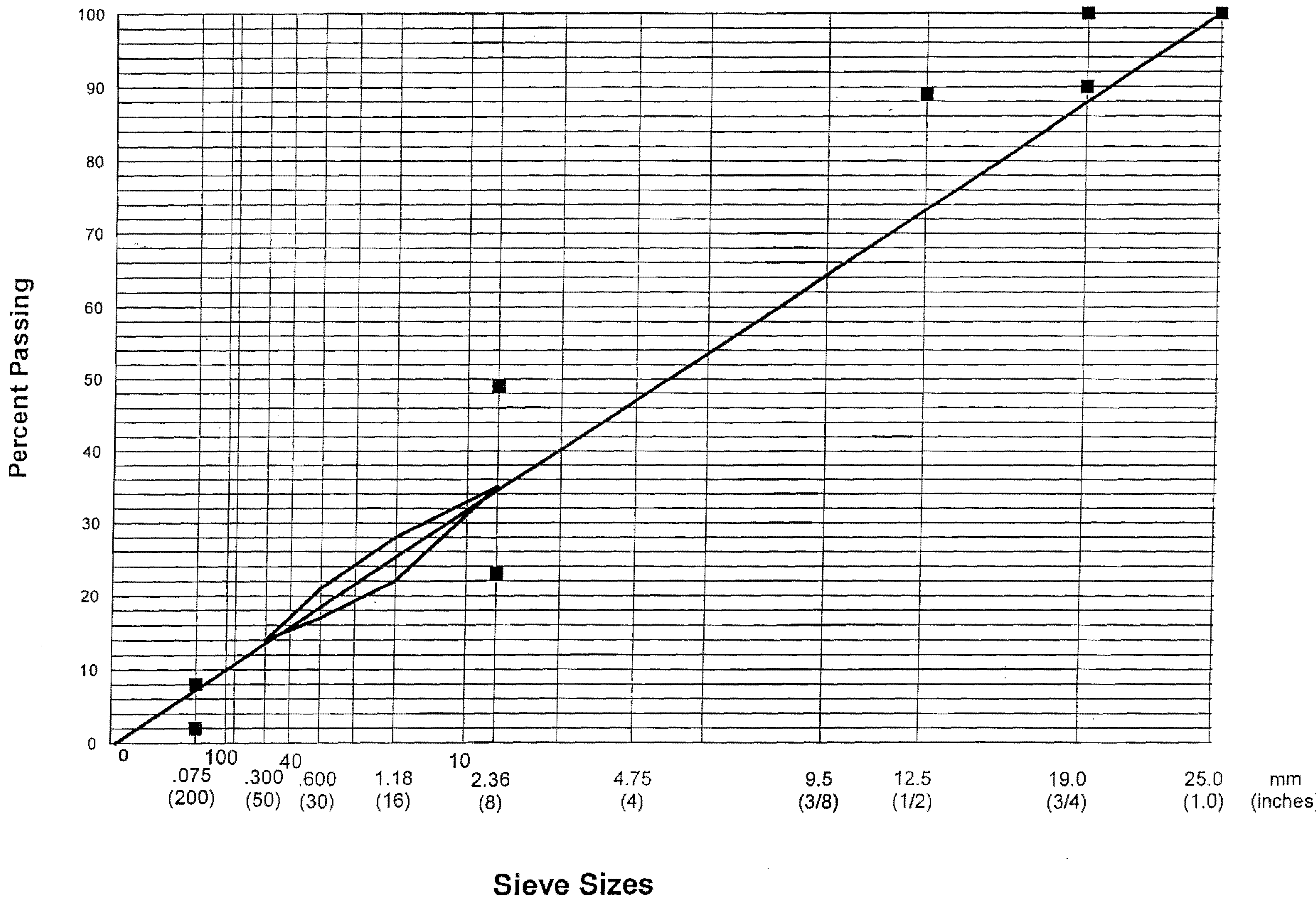
DOTD 03-22-3031
Rev. 06/02

Louisiana Department of Transportation and Development

ASPHALTIC CONCRETE GRADATION - 0.45 POWER CURVE WITH RESTRICTED ZONE AND CONTROL POINTS

3/4 inch (19.0mm) Nominal Maximum Size

Plant Code: ____________ **Mix Type:** ______________ **Job Mix Sequence No:** ____________



______________________________ ______________

Certified Asphaltic Concrete Technician Date

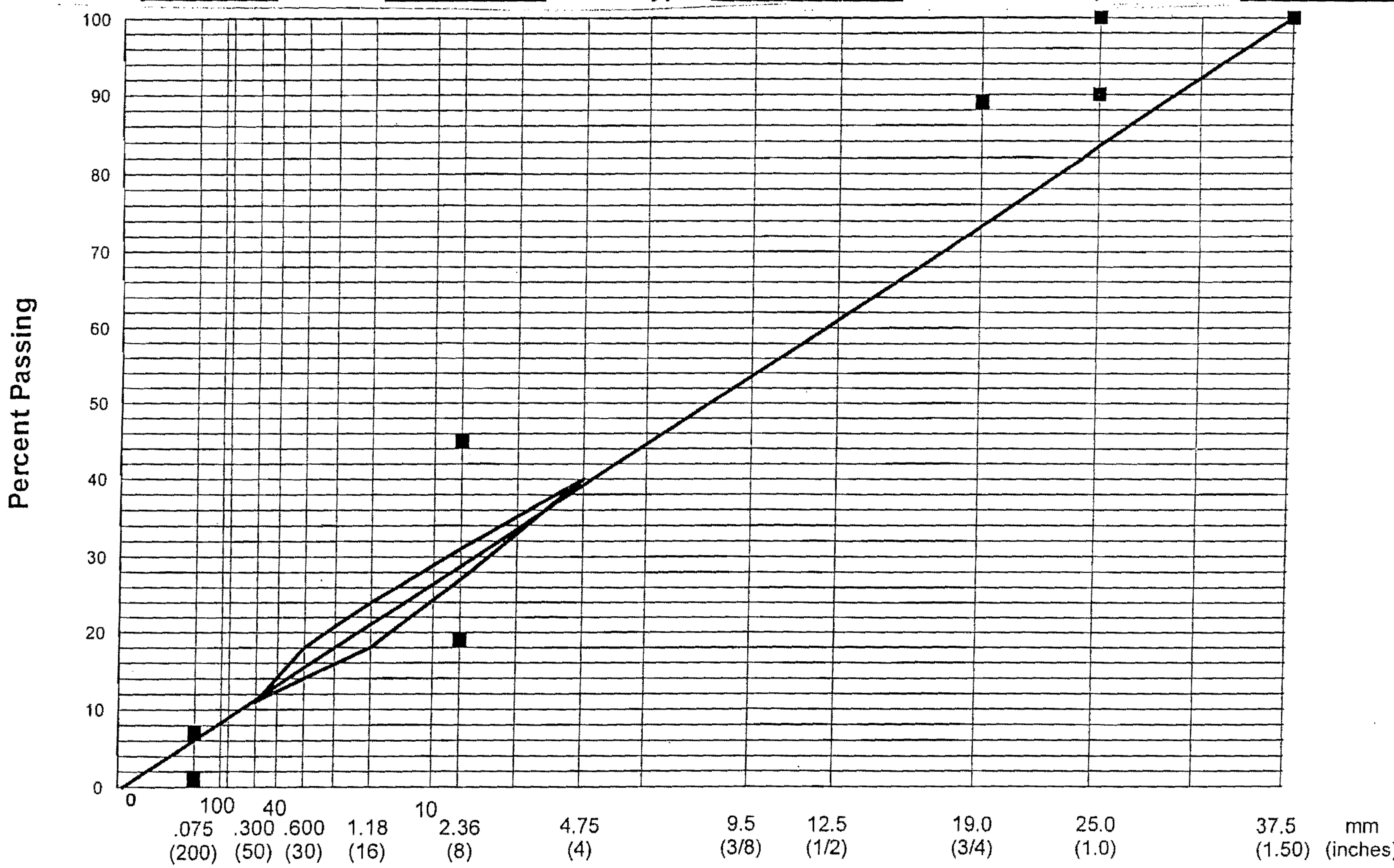
DOTD 03-22-3032
Rev. 06/02

Louisiana Department of Transportation and Development

ASPHALTIC CONCRETE GRADATION - 0.45 POWER CURVE WITH RESTRICTED ZONE AND CONTROL POINTS

1 inch (25.0mm) Nominal Maximum Size

Plant Code: H **Level:** ____________ **Mix Type:** ______________ **Job Mix Sequence No:** ____________



Sieve Sizes

______________________________ Certified Asphaltic Concrete Technician

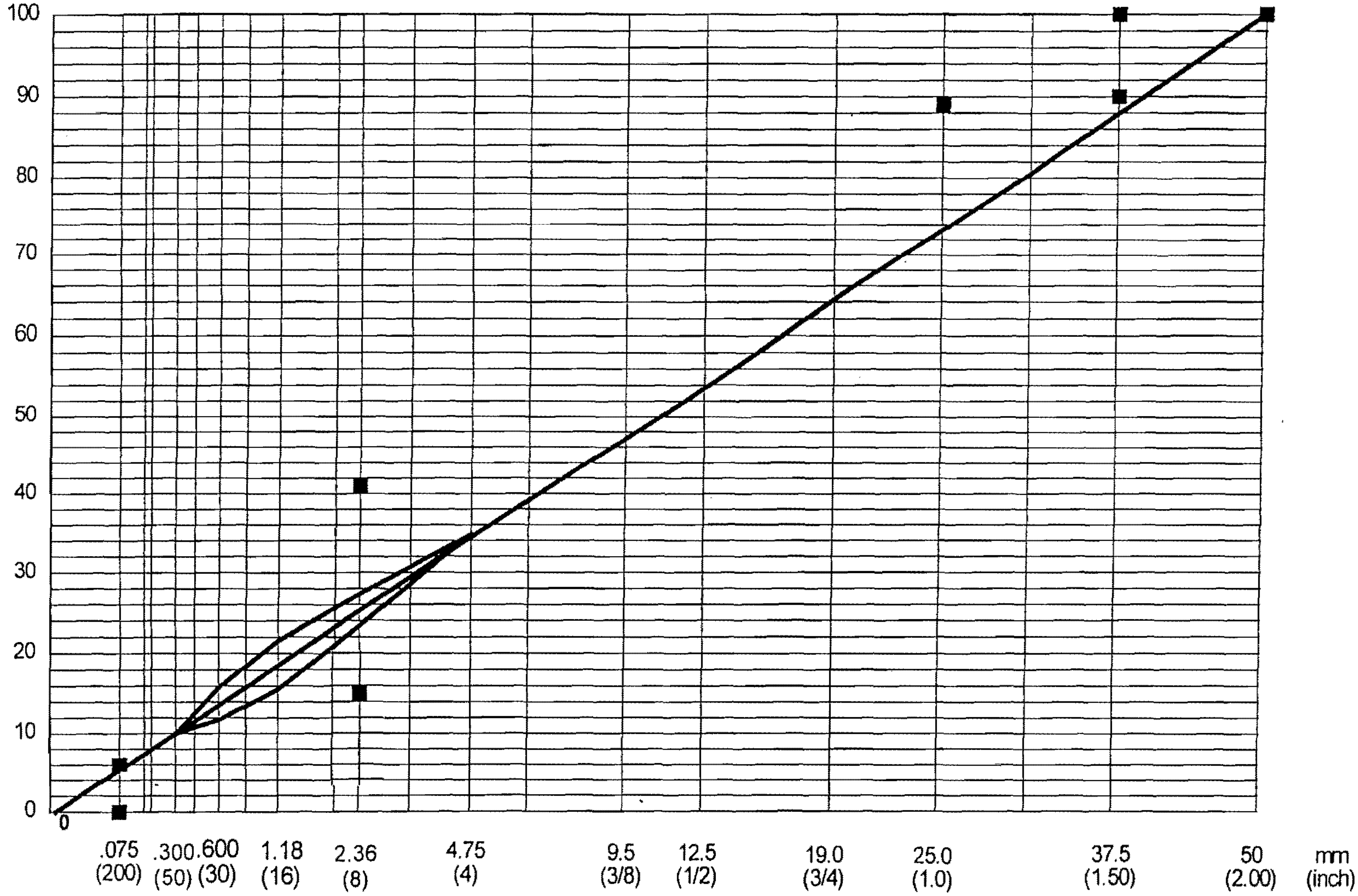
______________ Date

Louisiana Department of Transportation and Development

ASPHALTIC CONCRETE GRADATION - 0.45 POWER CURVE WITH RESTRICTED ZONE AND CONTROL POINTS

1.500 inch (37.5 mm) Nominal Maximum Size

Plant Code: H **Level:** ______ **Mix Type:** ______ **Job Mix Sequence No:** ______



Sieve Sizes

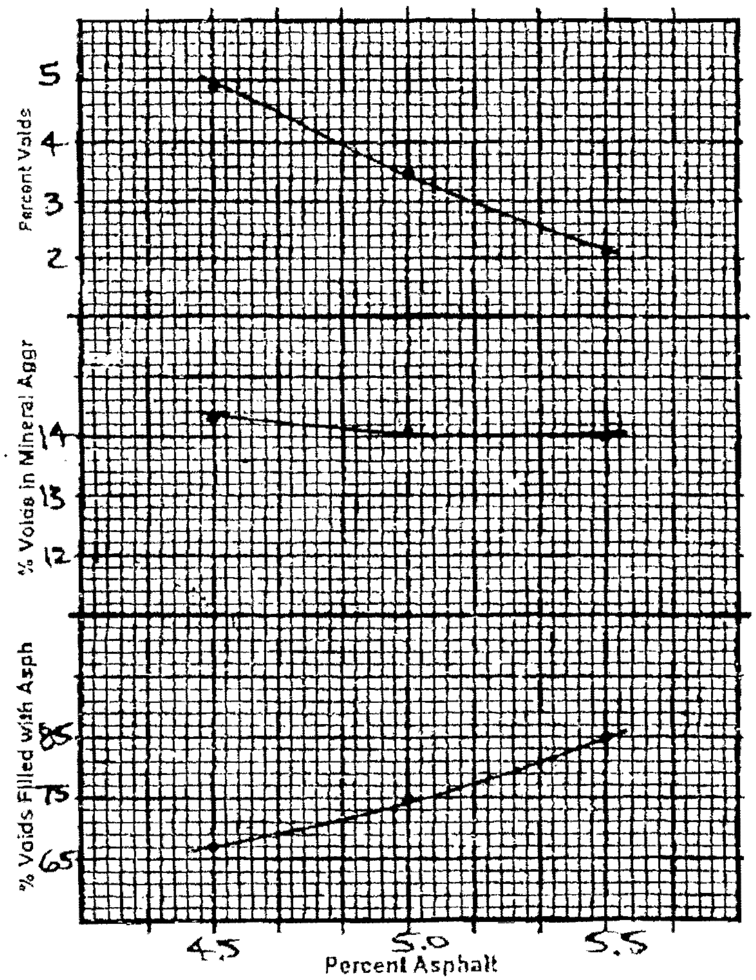
Certified Asphaltic Concrete Technician ______ **Date** ______

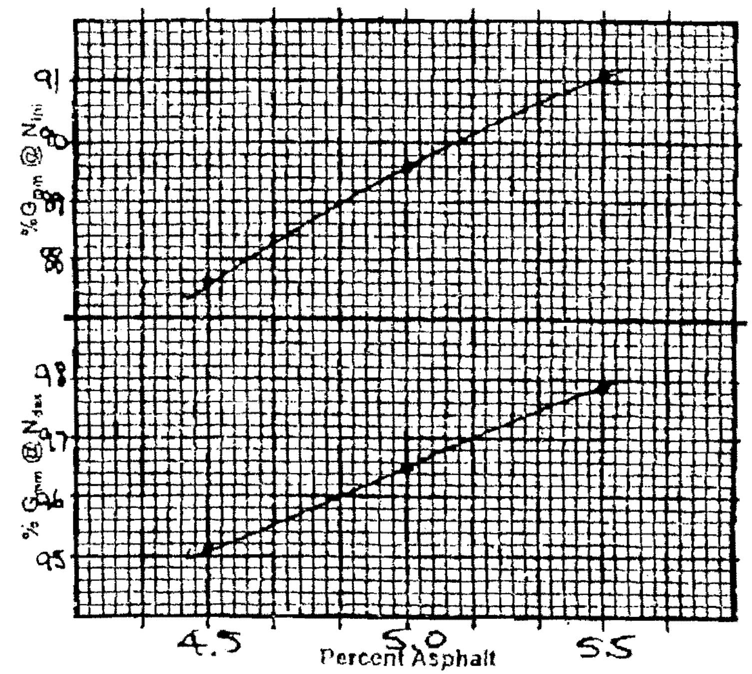
Appendix C

C-7 Summary of Three Trial Blends

SUPERPAVE ASPHALTIC CONCRETE - 2000 SPECIFICATIONS

Optimum Asphalt Cement Content - Summary of Test Properties





Mix Type Code: 2 Mix Level: 1

Mix Description: 1/2" W.C. Plant Code: H402

% Voids, V_a: 2.5 - 4.5 % VMA (Min): 14

Limits For % VFA: 68-78 Opt AC Content,%: 5.0

% G_{mm} @ N_{ini}: 89.6 % G_{mm} @ N_{des}: 96.5

Tested By: Steve Milam Date: 3-29-07

Summary of Volumetrics @ Initial Binder Content							
	% Binder	% Gmm @ Nini	% Gmm @ Ndes	% Gmm @ Nmax	% Air Voids	% VMA	% VFA
Blend 1 Gmm 2.455	4.5	87.6	95.1	96.4	4.9	14.3	66
Blend 2 Gmm 2.438	5.0	89.6	96.5	97.7	3.5	14.1	75
Blend 3 Gmm 2.420	5.5	91.1	97.9	99.1	2.1	14.0	85
Blend 4							
Design Criteria from Specs.		90% Max	96.50%	98% Max	3.50%	> 14	68-78

Appendix D – QC/QA

D-1 Certificate of Delivery for Asphaltic Materials
D-2 Certificate of Delivery for Asphalt Anti-Strip Additives
D-3 Certificate of Delivery for Lime
D-4 QC Superpave Asphaltic Concrete Plant Report w/Gradation
D-5 Moisture Content of Asphaltic Concrete
D-6 Asphaltic Concrete Control Charts
D-7 Superpave Asphaltic Concrete Plant Report
D-8 Superpave Asphaltic Concrete Roadway Report
D-9 Superpave Asphaltic Concrete Verification Report

Appendix D

D-1 Certificate of Delivery for Asphaltic Materials

DOTD 03-22-0004
Rev. 10/07

DOTD LAB NO: ____________________

DATE SHIPPED: ____________________

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

MATERIALS & TESTING SECTION
5080 FLORIDA BLVD.
BATON ROUGE, LA 70806

CERTIFICATE OF DELIVERY FOR ASPHALTIC MATERIALS

PROJECT NAME ____________________ P. O. NUMBER ____________________

PROJECT NUMBER ____________________ CONTRACTOR ____________________

TYPE ASPHALT	PRODUCT SOURCE CODE	QUANTITY (GALLONS)	REFINERY	REFINERY LOCATION

DESTINATION	REFINERY TANK NUMBER

CHECK ONE: Distributed to: ☐ Distributor ☐ Truck (License No. ____________________)

NOTE TO SUPPLIER: *The supplier is required to enter the following results for the above referenced DOTD Lab No.*

ROTATIONAL VISCOSITY @135^{O}C, Pa .... ____________

RECOMMENDED MIXING TEMPERATURE .... MINIMUM ________ ^{O}F, MAXIMUM ________ ^{O}F

(Mixing Temperature shall not exceed 350^{o})

RECOMMENDED COMPACTION TEMPERATURE .... MINIMUM ________ ^{O}F, MAXIMUM ________ ^{O}F

NOTE TO CONTRACTOR: *Binders with rotational viscosity values higher than 3.0 Pa should be used with caution only after consulting with the supplier as to any special handling procedures and guarantees of mixability and pumpability.*

The undersigned certifies that the asphalt in this shipment is the same asphalt as indicated above and that preliminary source testing has been conducted in accordance with policies of the Materials and Testing Laboratory and that this material meets all specification requirements for the intended use of the designated project.

This certificate is invalid unless signed by an authorized representative of the company.

COMPANY: ______________________________

BY: ______________________________
(Authorized Company Representative Signature)

Copies: Two copies shall accompany all shipments:

- One copy for the Project or Maintenance Engineer and one copy to the District Laboratory Engineer.
- One copy shall be mailed to the Materials Engineer Administrator, LA DOTD, 5080 Florida Blvd., Baton Rouge, LA 70806.

For DOTD Use:

Approved: ______________________________ Date: ____________________

Remarks: ______________________________

____

____

Shipments will be accepted only when accompanied by this official DOTD certificate form.

Appendix D

D-2 Certificate of Delivery for Asphalt Anti-Strip Additives

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
MATERIALS & TESTING SECTION
5080 FLORIDA BLVD., BATON ROUGE, LA 70806

CERTIFICATE OF DELIVERY FOR ASPHALT ANTI-STRIP ADDITIVES

PROJECT NAME ______________________ P. O. NUMBER ______________________

PROJECT NUMBER ______________________ CONTRACTOR ______________________

ASPHALTIC PLANT ______________________ PLANT LOCATION ______________________

MATERIAL ABBREV. (SEE BELOW)	MANUFACTURER	QUANTITY	MANUFACTURER LOT NUMBER	PROD. SOURCE CODE	DOTD LOT NUMBER *(EX:61-AS-0001)*	REPRESENTED BY DOTD LAB. NUMBER

List of Materials with Material Abbreviation:

(AS) Anti-Strip Additive (QPL 57)

This is to certify that the materials listed above have been shipped to the referenced project. We certify that these materials have been previously tested by the Materials & Testing Section under the above referenced lab numbers and have met all specification requirements for the designated project. ***This certificate is invalid unless signed by an authorized representative of the company.***

COMPANY: ______________________

Date Shipped to Plant: ______________ BY: ______________________
(Authorized Company Representative Signature)

Copies:
One copy shall accompany all shipments of the above listed materials for each project.
One copy shall be mailed to the Materials Engineer Administrator, Louisiana Department of Transportation and Development, 5080 Florida Blvd, Baton Rouge, LA 70806.

For DOTD Use:

Approved: ______________________ Date: ______________

Remarks: ______________________

____

Shipments will be accepted only when accompanied by this official DOTD certificate form.

Appendix D

D-3 Certificate of Delivery for Lime

DOTD 03-22-0031
06/95

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
MATERIALS & TESTING SECTION
5080 FLORIDA BLVD., BATON ROUGE, LA 70806

CERTIFICATE OF DELIVERY FOR LIME

PROJECT NAME ______________________ P. O. NUMBER ______________________

PROJECT NUMBER ______________________ CONTRACTOR ______________________

MANUFACTURER	MFG. LOCATION	PROD. SOURCE CODE	SUPPLIER	SUPPLIER LOCATION

TYPE	INTENDED USE	MODE OF SHIPPING	VEHICLE NO.	DATE SHIPPED	QUANTITY (TONS)

CHECK ONE: To be used for Slurry: ☐ Yes ☐ No

The undersigned certifies that the lime in this shipment has been manufactured under strict quality control and complies with the Louisiana Department of Transportation and Development specifications for the intended use and type of lime indicated above. ***This certificate is invalid unless signed by an authorized representative of the company.***

COMPANY: ______________________

BY: ______________________
(Authorized Company Representative Signature)

Copies:
One copy shall accompany all shipments (rail, truck, or barge) of the above listed materials for each project.
One copy shall be mailed to the Materials Engineer Administrator, Louisiana Department of Transportation and Development, 5080 Florida Blvd., Baton Rouge, LA 70806.

For DOTD Use:

Approved: ______________________ Date: ______________________

Remarks: ______________________

____

Shipments will be accepted only when accompanied by this official DOTD certificate form.

Appendix D

D-4 QC Superpave Asphaltic Concrete Plant Report w/Gradation

QA Data for Production

Proj. No.	100-10-1000	Plant	H100	Design level		Mix Type	2-Wearing
Proj. No.		JMF No.	100	Lot No.		Mix use	
Lot Size		Start Date		End Date		DATE	
No. Sublots							

%AC	0.0	G_{sb}	4.734	P_s	100	Roadway Category	B

Gyr. Rev
0
0
0

Theoretical Maximum Specific Gravity, Gmm "Rice"

	Sublot A		Sublot B		Sublot C		Sublot D		Sublot E	
	1	2	1	2	1	2	1	2	1	2
Wt of Mix										
Wt of Pyc & Water										
Wt of Pyc, Water & Mix										

Sublot #A

QC Gradation

2"	50	
1.5"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
#4	4.75	
#8	2.36	
#16	1.18	
#30	0.6	
#50	0.3	
#100	0.15	
#200	0.075	
%AC		

Volumetrics

Rice 1	#DIV/0!		
Rice 2	#DIV/0!		
	QA	QC1	QC2
Air			
Water			
SSD			
Ht@Ni			
Ht@Nd			
Ht@Nmax			
Comp Temp			
Meter AC	0.0		
Sample Taken-Tons			
Mix Temp			
%Crushed			
AntiStrip	0.0		

	Asph	Aggr	RAP	AntiStrip
1st Meter Reading, AM				
1st Meter Reading, PM				
2nd Meter Reading, AM				
2nd Meter Reading, PM				

Sublot #B

QC Gradation

2"	50	
1.5"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
#4	4.75	
#8	2.36	
#16	1.18	
#30	0.6	
#50	0.3	
#100	0.15	
#200	0.075	
%AC		

Volumetrics

Rice 1	#DIV/0!		
Rice 2	#DIV/0!		
	QA	QC1	QC2
Air			
Water			
SSD			
Ht@Ni			
Ht@Nd			
Ht@Nmax			
Comp Temp			
Meter AC	0.0		
Sample Taken-Tons			
Mix Temp			
%Crushed			
AntiStrip	0.0		

	Asph	Aggr	RAP	AntiStrip
1st Meter Reading, AM				
1st Meter Reading, PM				
2nd Meter Reading, AM				
2nd Meter Reading, PM				

Sublot #C

QC Gradation

2"	50	
1.5"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
#4	4.75	
#8	2.36	
#16	1.18	
#30	0.6	
#50	0.3	
#100	0.15	
#200	0.075	
%AC		

Volumetrics

Rice 1	#DIV/0!		
Rice 2	#DIV/0!		
	QA	QC1	QC2
Air			
Water			
SSD			
Ht@Ni			
Ht@Nd			
Ht@Nmax			
Comp Temp			
Meter AC	0.0		
Sample Taken-Tons			
Mix Temp			
%Crushed			

	Asph	Aggr	RAP	AntiStrip
1st Meter Reading, AM				
1st Meter Reading, PM				
2nd Meter Reading, AM				
2nd Meter Reading, PM				

Sublot #D

QC Gradation

2"	50	
1.5"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
#4	4.75	
#8	2.36	
#16	1.18	
#30	0.6	
#50	0.3	
#100	0.15	
#200	0.075	
%AC		

Volumetrics

Rice 1	#DIV/0!		
Rice 2	#DIV/0!		
	QA	QC1	QC2
Air			
Water			
SSD			
Ht@Ni			
Ht@Nd			
Ht@Nmax			
Comp Temp			
Meter AC	0.0		
Sample Taken-Tons			
Mix Temp			
%Crushed			

	Asph	Aggr	RAP	AntiStrip
1st Meter Reading, AM				
1st Meter Reading, PM				
2nd Meter Reading, AM				
2nd Meter Reading, PM				

Sublot #E

QC Gradation

2"	50	
1.5"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
#4	4.75	
#8	2.36	
#16	1.18	
#30	0.6	
#50	0.3	
#100	0.15	
#200	0.075	
%AC		

Volumetrics

Rice 1	#DIV/0!		
Rice 2	#DIV/0!		
	QA	QC1	QC2
Air			
Water			
SSD			
Ht@Ni			
Ht@Nd			
Ht@Nmax			
Comp Temp			
Meter AC	0.0		
Sample Taken-Tons			
Mix Temp			
%Crushed			

	Asph	Aggr	RAP	AntiStrip
1st Meter Reading, AM				
1st Meter Reading, PM				
2nd Meter Reading, AM				
2nd Meter Reading, PM				

Appendix D

D-5 Moisture Content of Asphaltic Concrete

MATT MENU SELECTION - 09

DOTD 03-22-0734
5/97 (Met)

Louisiana Department of Transportation and Development
Materials and Testing Section

MOISTURE CONTENT OF ASPHALTIC CONCRETE
(LOOSE MIX - DOTD TR 319)

Project No .... ___-___-___ **Material Code** ... 5 5 1 *(Eng = 238)*
Lab No.............. ___-___
Date Sampled ... ___-___-___ **Submitted By** ....
Quantity .... **Unit** Mg Purpose Code ...
Source .... H **Spec Code** **P. O. Number** ....
Independ. Testing Lab Code... **Date Tested** .... ___-___-___
Sample Ident ....
Material Sampled From: Date Transport to Dist/Matls Lab ... ___-___-___
Date Rec'd @ Dist Lab... ___-___-___ **Date Rec'd @ Matls Lab** .... ___-___-___
Remarks 1
Remarks 2
Item No.... ( ) ( )
Sampling / Testing Comments
Sampled By .... Date .....

		Test Results	P/F
JOB MIX FORMULA SEQUENCE NO.			XXX
LOT NUMBER			XXX
PLANT TYPE 1 = Batch Screenless 2 = Batch Hot Bin 3 = Drum Mixer 4 = Continous			XXX
MIX CODE			XXX
MIX TEMPERATURE, ^{O}C			XXX
WEIGHT OF SAMPLE, BUCKET, LID & BAIL, g	(A)		XXX
TARE WEIGHT OF BUCKET, LID & BAIL, g	(B)		XXX
WET WEITHT OF LOOSE MIX, g (A - B)	(C)		XXX
WEIGHT OF DRIED SAMPLE, BUCKET, LID, BAIL & PAN, g	(D)		XXX
TARE WEIGHT OF PAN, g	(E)		XXX
TOTAL WEIGHT OF PAN, g (E + B)	(F)		XXX
DRY WEIGHT OF LOSSE MIX, g (D - F)	(G)		XXX
WEIGHT OF WATER, g (C - G)	(H)		XXX
MOISTURE CONTENT, % $(\frac{H}{G} \times 100)$		.	

Tested By: ______ Checked By: ______ Date: ______

APPROVED BY: ______ **DATE:** ______

Appendix D

D-6 Asphaltic Concrete Control Charts

Louisiana Department of Transportation and Development

ASPHALTIC CONCRETE CONTROL CHARTS

Plant Code: H Mix Type: ______ JMF Seq. No: ______

Plant Locaton: ______________ Design Level: ____

Lot No.															
Date															

% Asphalt Cement	JMF ________%	
	JMF Limits ________	

% Crushed	JMF ________%	
	JMF Limits ________	

Max.Theo. Sp Gr (G_{mm}) $\bar{X}$	JMF ________%	
	JMF Limits ________	

Max. Theo. Sp Gr (G_{mm}) $\bar{R}$	JMF ________%	
	JMF Limits ________	

G_{mb} @ N_{max} $\bar{X}$	JMF ________%	
	JMF Limits ________	

G_{mb} @ N_{max} $\bar{R}$	JMF ________%	
	JMF Limits ________	

% G_{mm} @ $N_{initial}$ $\bar{X}$	JMF ________%	
	JMF Limits ________	

% G_{mm} @ $N_{initial}$ $\bar{R}$	JMF ________%	
	JMF Limits ________	

____
Certified Asphaltic Concrete Technician

Extracted Gradations

2 in. (50 mm)	JMF ______%	JMF Limits ______
1 1/2 in. (37.5 mm)	JMF ______%	JMF Limits ______
1 in. (25.0 mm)	JMF ______%	JMF Limits ______
3/4 in. (19.0 mm)	JMF ______%	JMF Limits ______
1/2 in (12.5 mm)	JMF ______%	JMF Limits ______
3/8 in. (9.5 mm)	JMF ______%	JMF Limits ______
No. 4 (4.75 mm)	JMF ______%	JMF Limits ______
No. 8 (2.36 mm)	JMF ______%	JMF Limits ______
No. 16 (1.18 mm)	JMF ______%	JMF Limits ______
No. 30 (600 µm)	JMF ______%	JMF Limits ______
No 50 (300 µm)	JMF ______%	JMF Limits ______
No. 100 (150 µm)	JMF ______%	JMF Limits ______
No. 200 (75 µm)	JMF ______%	JMF Limits ______

Appendix D

D-7 Superpave Asphaltic Concrete Plant Report

Louisiana Department of Transportation and Development

DOTD 03-22-3092
Rev. 10/07

SUPERPAVE ASPHALTIC CONCRETE PLANT REPORT

English/Metric ___ *(M / E)* **Spec Year** ______

Proj.No. ____-____-______ **Plant Code** H____ **Design Level** ___ **Mix Type** ___ **Use** ____

Proj.No. ____-____-______ **Seq. No.** ____ **Lot No.** ______ **Purp Code** ___

Proj.No. ____-____-______ **% AC** ___•___ **G_{sb}** ______ **P_s** ______

Lot Size ______ **Start Date** __________ **End Date** __________

Weather: ____________ Temp: High ______ °F(°C) Low ______ °F (°C)

Theoretical Maximum Specific Gravity, G_{mm} "RICE" *(AASHTO T 209 or DOTD TR 327)*

		$G_{mm}1$		$G_{mm}2$		$G_{mm}3$		$G_{mm}4$		$G_{mm}5$	
		Sample a	Sample b	Sample a	Sample b	Sample a	Sample b	Sample a	Sample b	Sample a	Sample b
Wt of Mix	A										
Wt of Pyc. & Water	D										
Wt of Pyc. Water & Mix	E										
Difference	A + D - E										
Sample G_{mm}	A / (A + D - E)	G_{mm} 1a	G_{mm} 1b	G_{mm} 2a	G_{mm} 2b	G_{mm} 3a	G_{mm} 3b	G_{mm} 4a	G_{mm} 4b	G_{mm} 5a	G_{mm} 5b
Average G_{mm}		$G_{mm}1$ =		$G_{mm}2$ =		$G_{mm}3$ =		$G_{mm}4$ =		$G_{mm}5$ =	

Plant Test Properties *(AASHTO T 166,T209,T245/DOTD TR's 304, 305 & 327)*

		Sublot No.	1	2	3	4	5
G_{mm}	A						
Wt (Mass) in Air	B						
Wt (Mass) in Water	C						
SSD Wt (Mass)	D						
Difference	E	D - C					
G_{mb}, ND	F	B / E					
Density	G	F x 62.4					
% G_{mm},ND	H	100 x F / A					
Ht. @ NI (mm)							
Ht. @ ND(mm)							
% G_{mm},NI							
% Voids, V_a	I	100 - H					
% VMA	J	100 - (F x Ps) / Gsb					
% VFA		100 x (J - I) / J					

			Asph	Aggr	RAP	Asph	Aggr	RAP	Asph	Aggr	RAP	Asph	Aggr	RAP	Asph	Aggr	RAP
% Asphalt Content	2nd Meter Reading	AM															
	2nd Meter Reading	PM															
	1st Meter Reading	AM															
	1st Meter Reading	PM															

		1	2	3	4	5
% AC Meter						
Comp. Temp. °F (°C)						
Dust/P_{eff}						
G_{se}						
P_{ba}		+				
P_{be}						
Total Sublot Tons (Mg)						
Sample Taken - Tons Accum.						
Mix Temperature °F (°C)						

	TEST 1	TEST 2
% Anti Strip		
% Lime		

PERCENT PAY:

% Air Voids: ____•__

% Anti Strip: ____•__

% VMA: ____•__ **Final Plant % Pay** ______

Remarks: ________________________________

DOTD Cert. Asphaltic Concrete Plant Tech. **QC Cert. Aspahaltic Concrete Plant Tech.** **APPROVEDBY: District Lab. Engr.**

Superpave Asphaltic Concrete Codes

Design Level Codes

Code	Des Level
1	1
1F	1F
2	2
2F	2F
3	3
3F	3F
A	A

Mix Type Codes

Code	Description
1	Incidental Paving
2	Wearing Course
3	Binder Course
4	Base Course

Mix Use Codes

Code	Description
01	WC Roadway
02	Patching Roadway
03	Leveling
04	Widening
05	WC Shoulder
06	Turnouts Roadway *(Full Thickness)*
07	Airport (*Surface Tol. Required)*
08	Misc. *(Including Driveways)*
09	Binder Roadway
10	Base Roadway
11	Binder Shoulder
12	Base Shoulder
13	Patching Shoulder
14	Joint Repair
15	Airport *(No Surface Tol.)*

Pavement Codes

Code	Description
01	All Interstates, multi-lift new construction and overlays more than two lifts
02	One or two lift overlays over cold planed surfaces and two lift overlays over existing surface
03	Single lift overlays over existing surfaces
04	Binder courses
05	Turnouts, crossovers, detour roads, parking areas, and roadway or shoulder sections less than 500 feet (150 mm) in length
06	Secondary areas

Appendix D

D-8 Superpave Asphaltic Concrete Roadway Report

SUPERPAVE ASPHALTIC CONCRETE ROADWAY REPORT

Adopted 10/07

Proj. No. ________ **Design Level** ___ **Mix Type** ___ **Plant Code** ___ **JMF No.** ___

Previous Sublot *(Circle)*: A B C D E **Lot No.** ___ **Sublot** ___ ***Primary* Mix Use Code** ___ **Spec Code** ___

Pavement Code ___ **Submitter Code** ___ **Purp Code** ___ Nom. Max Aggr Size, in (mm) ___

From Station ___ + ___ To Station ___ + ___ Location ___ Adjust. Factor ___

From Station ___ + ___ To Station ___ + ___ Location ___ Proj Engr ___

From Station ___ + ___ To Station ___ + ___ Location ___ Start Date ___

From Station ___ + ___ To Station ___ + ___ Location ___ End Date ___

**** Yield ****

SqYds (W) (sq m)	Theo. Yield, lb/yd^2 (kg/m^2) ___ • ___ 110 $lb/yd^2/in$ x Plan Thick., in ÷ Adj. Factor 2.35 $kg/m^2/mm$ x Plan Thick., mm ÷ Adj. Factor	Actual Yield, lb/yd^2 (kg/m^2) ___ • ___ Portion of Lot Used (U) U x 2000 ÷ W (U x 1000 ÷ W)	Density, %G_{mm} Required ___ Avg Plant Max Grav (G_{mm}) ___

**** Pavement Density ****

Sample No.	Date	Mix Use	Station	Thickness in. (mm)	Wt. (Mass) In Air (A)	Wt. (Mass) In Water (B)	Wt. (Mass) SSD (C)	Bulk Sp Gr (P) A / (C – B)	% Pav. Density (P/G_{mm} x 100)
				•					•
				•					•
				•					•
				•					•
				•					•

**** Project Quantity (tons) Mg ****	**** Surface Tolerance ****
Previous ___ + Portion of Lot Used (U) ___	Profile Index, in/mile (mm/km) ___ • ___
Total to Date ___	IRI, in/mile (mm/km) ___ **% Pay** ___

Sublot Remarks ___

Lot Remarks ___

Pay Item ___ **APPROVED BY:** ___

CERT PLANT INSP: ___ **CERT RDWY INSP:** ___ **DATE:** ___

Superpave Asphaltic Concrete Codes

Design Level Codes

Code	Design Level
1	1
1F	1F
2	2
2F	2F
3	3
3F	3F
A	A

Mix Type Codes

Code	Description
1	Incidental Paving
2	Wearing Course
3	Binder Course
4	Base Course

Mix Use Codes

Code	Description
01	WC Roadway
02	Patching Roadway
03	Leveling
04	Widening
05	WC Shoulder
06	Turnouts Roadway *(Full Thickness)*
07	Airport (*Surface Tol. Required)*
08	Misc. *(Including Driveways)*
09	Binder Roadway
10	Base Roadway
11	Binder Shoulder
12	Base Shoulder
13	Patching Shoulder
14	Joint Repair
15	Airport *(No Surface Tol.)*

Pavement Codes

Code	Description
01	All Interstates, multi-lift new construction and overlays more than two lifts
02	One or two lift overlays over cold planed surfaces and two lift overlays over existing surface
03	Single lift overlays over existing surfaces
04	Binder courses
05	Turnouts, crossovers, detour roads, parking areas, and roadway or shoulder sections less than 500 feet (150 mm) in length
06	Secondary areas

Appendix D

D-9 Superpave Asphaltic Concrete Verification Report

Louisiana Department of Transportation and Development

DOTD 03-22-3093
Rev. 10/07

SUPERPAVE ASPHALTIC CONCRETE VERIFICATION REPORT

English/Metric : (E or M)

Spec Year :		Spec Rev :		Plant Code :	H	Lab Nos :	
Project No :		Des Level :		Mix Type Code :		As :	
Start Date :		Lot No :		Mix Use Code :			
End Date :		Purp Code :		Spec Code :		Submit Code :	
Aggr Cont (P_s) :		Bulk Sp Gr Aggr (G_{sb}) :		% Asph Cont :		Spec Grav AC :	

Roadway Tests for Cores *(DOTD TR 304)*

Laboratory No.	Sublot	G_{mm}	Wt in Air (A)	Wt in Water (B)	SSD Wt (C)	Difference (C - B)	Bulk Sp Gr (D) (A / (C - B))	Thickness in (mm)	% G_{mm} (D / G_{mm} x 100)

Tested By: Date: Checked By: Date:

Theo Max Sp Gr, G_{mm} "RICE" *(TR 327)*

** Sample b req'd only when designated by TR 327*		Sublot: Sample a	Sample b*
Wt of Mix	A		
Wt of Pyc & Water	D		
Wt of Pyc, Water & Mix	E		
Difference	A + D - E		
G_{mm}	A / (A + D - E)	$G_{mm}a$	$G_{mm}b$
$G_{mm} = (G_{mm}a + G_{mm}b) / 2$			

Plant Tests *(DOTD TR 304 & 305)*

Sublot			
Sample ID		Theo Max Sp Gr (G_{mm})	
Laboratory No.		% G_{mm} ND	
Wt in Air		% G_{mm} NI	
Wt in Water		% Voids (V_a)	
SSD Wt		% VMA	
Difference		% VFA	
Bulk Sp Gr (G_{mb})		% AC Meter	
Density		Control Temperature	

Tested By: ____________ Date: ____________

Checked By: ____________ Date: ____________

Roadway Pay Item :

% AC, Gradation & % Crushed

Laboratory No :		Sieve Size	Wt Retained	% Retained	% Coarser	% Pass
Total Wt of Mix		2 1/2				
Correct Factor of Mix		2				
% AC Content		1 1/2				
% AC *(from JMF)*		1				
Dry Total Wt of Aggr		3/4				
Dry Wt After Wash		1/ 2				
Wt of Crushed Aggr		3/8				
Wt of +No 4 Aggr		No 4				
% Crushed		No 8				
		No 16				
Tested By :		No 30				
		No 50				
Date :		No 100				
		No 200				
Checked By :		Pass No 200				
		Decant Loss				
Date :		Acc Total				
		% Difference				

Remarks *(Limit - 54 characters)*

____________ Certified Inspector ____________ Date

____________ Approved By : ____________ Date

Superpave Asphaltic Concrete Codes

Design Level Codes

Code	Design Level
1	1
1F	1F
2	2
2F	2F
3	3
3F	3F
A	A

Mix Type Codes

Code	Description
1	Incidental Paving
2	Wearing Course
3	Binder Course
4	Base Course

Mix Use Codes

Code	Description
01	WC Roadway
02	Patching Roadway
03	Leveling
04	Widening
05	WC Shoulder
06	Turnouts Roadway *(Full Thickness)*
07	Airport (*Surface Tol. Required)*
08	Misc. *(Including Driveways)*
09	Binder Roadway
10	Base Roadway
11	Binder Shoulder
12	Base Shoulder
13	Patching Shoulder
14	Joint Repair
15	Airport *(No Surface Tol.)*

Pavement Codes

Code	Description
01	All Interstates, multi-lift new construction and overlays more than two lifts
02	One or two lift overlays over cold planed surfaces and two lift overlays over existing surface
03	Single lift overlays over existing surfaces
04	Binder courses
05	Turnouts, crossovers, detour roads, parking areas, and roadway or shoulder sections less than 500 feet (150 mm) in length
06	Secondary areas

APPENDIX E – EQUIPMENT

APPENDIX E

E-1 LA DOTD Profiler Inspection Certification Sticker

NO. 0100

LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

LOW PASS FILTER: __________

HIGH PASS FILTER: __________

COLLECTION FILTER: __________

IRI CERTIFICATION: __________

PI CERTIFICATION: __________

CALIBRATION DATE: __________

EXPIRATION DATE: __________

TECHNICIAN: __________

APPENDIX E

E-2 LA DOTD Profiler Inspection Certification

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
PROFILER INSPECTION AND CERTIFICATION

GENERAL INFORMATION

Owner: ____________ Telephone: ____________
Address: ____________ Prior Inspection: ____________
City / State / Zip: ____________ Test Date: ____________

Laptop S/N: ____________ Mfg/Model: ____________
Vin Number: ____________ Process. Computer S/N: ____________
Laser S/N (#1): ____________ Laser S/N (#2): ____________

Tire Pressure (psi)
RF: ________ RR: ________ LF: ________ LR: ________

INSPECTION AND TESTING

1. Miscellaneous Apparatus (must be available at the time of inspection) Windows Op. Sys: ________
   - A. ✓ Tire pressure gauge
   - B. ✓ Air pump
   - C. ✓ 3 ft alignment bar, adjustable
   - D. ✓ 100 ft minimum measuring tape or measuring wheel
   - E. ✓ Owner's manual
   - F. ✓ ProVal
     Version: ________

2. Field Book
   - A. ✓ Available
   - B. ✓ Up-to-Date (including record of upgrades)

3. Optical Digital Sensors (ODS) ✓ Clean

4. Calibration Blocks
   - A. 0.25 inch, other ✓ inch, Thickness ________ (± 0.01)
   - B. 0.50 inch, other ✓ inch, Thickness ________ (± 0.01)
   - C. 1.00 inch, other ✓ inch, Thickness ________ (± 0.01)

5. Data Acquisition and Reporting System
   - A. ✓ USB Port
   - B. ✓ Thermal Printer
   - C. ✓ Omit, event key or method
   - D. ✓ Bump detection feature
   - E. ✓ Calculates IRI, 0.05 mile segment
   - F. ✓ Calculates PI, 0.10 mile segment

STATIC TESTS

6. Vertical Calibration Check

EXTENSIVE TESTS					
ODS # 1			ODS # 2		
Block Size	Avg. Diff.	Tolerance	Block Size	Avg. Diff.	Tolerance
0.25 (other)	0.0000	Less than 0.01	0.25 (other)	0.0000	Less than 0.01
0.50 (other)	0.0000	Less than 0.01	0.50 (other)	0.0000	Less than 0.01
1.00 (other)	0.0000	Less than 0.01	1.00 (other)	0.0000	Less than 0.01

✓ Pass ________ Fail

7. Bounce Test

✓ Pass ____ Fail ✓ Report Printed

8. Horizontal / DMI Calibration

A. ✓ 1140 ft (calibration distance)
B. ✓ Calibration Successful
C. ✓ Report Printed

9. Odometer Mode Analysis

A. ✓ Distance Traveled (1140ft ± 1.14ft) ✓ Report Printed

10. Set-up information

California Profilograph Settings:		**Bump Settings:**	
Band Width(in.) =	0.20	Bump Height (in.) =	0.3
Min. Scallop Width (in.) =	2.00	Bump Width (ft) =	25.00
Min. Scallop Height (in.) =	0.03	Bump Detection =	On
Scallop Rounding =	0.05	Dip Detection =	Off
Count Scallops Once =	True		

Filter Settings:

Low Pass Filter(ft) =	0.00
High Pass Filter(ft) =	300.00
Reduction Length =	IRI: 264' PI: 528' (100m)
Horizontal Scale =	300 to 1
Vertical Calibration =	1.000 ± 0.01
Horizontal Calibration =	80 ± 5

11. Do the results generated by the alternate profilograph correlate to the results generated by the California Type Ames Profilograph to within 1.0 inch/mile for pavement surfaces which are up to 15 inches/mile in roughness?

Yes ✓ No ____

Were ten (10) runs performed for the determination?

Yes ✓ No ____

12. Does the alternate model demonstrate repeatability to within 1.0 inch/mile when testing pavements up to 15 inches/mile in roughness?

Yes ✓ No ____

Were ten (10) runs performed for the determination?

Yes ✓ No ____

13. Precision: Is the standard deviation within the accepted tolerance of the IRI?

Yes ✓ No ____

14. Bias: Is the mean IRI value within the acceptable tolerance of the reference IRI value?

Yes ✓ No ____

15. Speed: Range: ____ mph to ____ mph Calibration Speed: ____ mph

Remarks: All results are on file at the Materials & Testing Unit. Profiler meets state specifications for IRI and PI.

Certification Sticker Number: ____

Certification Expiration Date: ____

Inspected By: ____ Date: ____

Approved By: ____ Date: ____

APPENDIX E

E-3 Inspection Certificate Sticker

LOUISIANA DEPARTEMENT
OF
TRANSPORTATON & DEVELOPMENT

INSPECTION CERTIFICATE

Plant: ______________________________

Location: ______________________________

Type: ______________________________

Date Certified: ______________________________

Truck or Unit No.: ______________________________

Inspected by: ______________________________

This Certificate Will be Valid for a period of two years if not Revoked for non compliance

Stock No. 16-20-6500

Plant or Equipment Inspection Certificate Sticker
(03-22-6500)

LOUISIANA
DEPARTMENT OF
TRANSPORTATION & DEVELOPMENT

Calib. By

90-Day Inspection Sticker for Equipment

APPENDIX E –

E-4 Asphaltic Concrete Plant Certification Report

State of Louisiana
Department of Transportation and Development

ASPHALTIC CONCRETE PLANT CERTIFICATION REPORT

GENERAL INFORMATION

Last Certification Date on Sticker:_______________ **Date:** _______________

Plant Name: _______________ **Dist. Name:** _______________

Plant Owner: _______________ **Location:** _______________

Plant Code: _______ **Make:** _______________ **Model/Serial No:**_______________

Mailing Address:_______________

Plant Type: ☐ Batch ☐ Screenless Batch ☐ Drum Mixer Recycle Capability ☐ Yes ☐ No

Type of Fuel :_______________ Dryer

Remarks: _______________

____

MATERIAL STORAGE AND HANDLING

AGGREGATES: Handling and Equipment

Stockpiles

Building Method: ☐ Dozer ☐ Loader ☐ Dragline ☐ Other _______________

Remarks: _______________

____

Material	Approved Source		Satisfactory Drainage		Separation						Contamination		Segregation	
					Adequate		Spacing		Partition					
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No

Crusher: Type: ☐ Cone ☐ Roller ☐ Sling ☐ Other _______________

Oversize Re-crush System: ☐ Yes ☐ No

Remarks: _______________

____

____

Cold Aggregate Feeder

	New Material	Recycled Material
Type of Loading:	☐ Loader ☐ Dragline ☐ Other: ______	☐ Loader ☐ Dragline ☐ Other: ______
No. of Cold Feed Systems Used:	______	______
If more than one system used, are controls integrated?	☐ Yes ☐ No	☐ Yes ☐ No
No. of Cold Bins Used:	______	______
Number of bins sufficient for operations:	☐ Yes ☐ No	☐ Yes ☐ No
Bins are large enough for continuous peration at rated capacity:	☐ Yes ☐ No	☐ Yes ☐ No
Condition of bins satisfactory:	☐ Yes ☐ No	☐ Yes ☐ No
Partitions extend a minimum one foot above top between bins:	☐ Yes ☐ No	☐ Yes ☐ No
Bins equipped with vibrators:	☐ Yes ☐ No	☐ Yes ☐ No
Individual Bin Gates:		
Gate rectangular:	☐ Yes ☐ No	☐ Yes ☐ No
Gate has positive mechanized adjustment:	☐ Yes ☐ No	☐ Yes ☐ No
Gate locks in Position:	☐ Yes ☐ No	☐ Yes ☐ No
Aggr. Proportioning by cold feed:	☐ Applicable ☐ N/A	☐ Applicable ☐ N/A
Proportions determined by:	☐ Belt Speed	☐ Gate Opening
Calib Curve / each bin per material type used:	☐ Yes ☐ No	☐ Yes ☐ No
Automatic shut off on each bin:	☐ Yes ☐ No	☐ Yes ☐ No
Adjusted and operating correctly:	☐ Yes ☐ No	☐ Yes ☐ No

Remarks ______________________________
____
____

Hydrated Lime Additive Equipment

Interlocked and synchronized with cold feed control: ☐ Yes ☐ No
Positive Signal Auto Shut-down: ☐ Yes ☐ No
Separate Bulk Storage: ☐ Yes ☐ No
With approved feed: ☐ Yes ☐ No
Can be readily calibrated: ☐ Yes ☐ No
Can be easily sampled: ☐ Yes ☐ No
Can be easily be verified: ☐ Yes ☐ No
Has totalizer: ☐ Yes ☐ No
Approved spray system:
Consistently maintains aggregate in uniform surface wet condition: ☐ Yes ☐ No
Moist. content can be introduced into automatic moisture controls: ☐ Yes ☐ No
Approved mixing device: ☐ Yes ☐ No
Coats uniformly: ☐ Yes ☐ No
Located between additive point & dryer: ☐ Yes ☐ No
Dispensed directly into aggregate: ☐ Yes ☐ No
Between cold feed and dryer: ☐ Yes ☐ No
Minimum required amount added: ☐ Yes ☐ No
Included in belt scale weight: ☐ Yes ☐ No

Remarks ______________________________
____
____

Mineral Filler Equipment

Capacity ____________(tons)
Adequate: ☐ Yes ☐ No
Weatherproof: ☐ Yes ☐ No
Leakage: ☐ Yes ☐ No
Proportioned separately: ☐ Yes ☐ No
From hopper with adjustable feed: ☐ Yes ☐ No
Can be accurately and conveniently calibrated: ☐ Yes ☐ No
Interlocks with aggr & asphalt feeds: ☐ Yes ☐ No
Proportions accurately: ☐ Yes ☐ No
Constant flow of materials: ☐ Yes ☐ No

For Batch Plants:
Batched into mix with aggregates: ☐ Yes ☐ No

For Drum and Continuous Plants:
Introduced into mix at approved location in advance of asphalt for proper drying time: ☐ Yes ☐ No

Remarks ______________________________
____
____

Screens and Scalpers

Over hot bins: ☐ Yes ☐ No
Size: __________ ☐ N/A
Over fine sand bins: ☐ Yes ☐ No
Size: __________ ☐ N/A
Between cold feed discharge & belt scale: ☐ Yes ☐ No
Size: __________ ☐ N/A
Vibrating: ☐ Yes ☐ No
Over reclaimed bin: ☐ Yes ☐ No
Size: __________ ☐ N/A
Hot Bin Screens: ☐ Applicable ☐ N/A
Number and size sufficient for operation: ☐ Yes ☐ No

Remarks: ____________________

Dust Collector

Dust Collector: ☐ Applicable ☐ N/A
Type: ☐ Cyclone ☐ Wet Scrubber ☐ Baghouse ☐ Other __________
If Baghouse type, type of control device:
☐ Collector Box ☐ Surge Bin ☐ Filler Silo
Collected fines returned to the mix: ☐ Yes ☐ No
Material returned to approved location: ☐ Yes ☐ No
Location: __________
Uniform rate of return: ☐ Yes ☐ No
Method of Return: ☐ Screw ☐ Bucket ☐ Conveyor Belt ☐ Other __________
Condition of System Acceptable: ☐ Yes ☐ No
For drum mixer, fines added near asphalt discharge?
____

Remarks: ____________________

STORAGE AND EQUIPMENT

Asphalt Cement Storage & Equipment

Tanks: Recirculating system ☐ Yes ☐ No
Storage: No. __________ Tot.Capacity: __________ Gals (L)
Working: No. __________ Tot.Capacity: __________ Gals (L)
Uniform Heating: ☐ Yes ☐ No
Required temperature: ☐ Yes ☐ No
Under positive control: ☐ Yes ☐ No
Method of Heating: ☐ Hot Oil ☐ Other: __________
Calib.Chart & Measuring Stick Provided: ☐ Yes ☐ No
Method of Sampling: ☐ Spigot ☐ DOTD Samp. Device
Any Leakage ☐ Yes ☐ No
Plant equip. with automatic shut-off controls: ☐ Yes ☐ No
If yes, are controls operable? ☐ Yes ☐ No
Pipelines & fittings: Heated: ☐ Yes ☐ No
Insulated: ☐ Yes ☐ No
Thermometers
Graduated in 5°F increments: ☐ Yes ☐ No
Accurate within ± 5°F: ☐ Yes ☐ No
Affixed in feed line near discharge valve to indicate storage temperature: ☐ Yes ☐ No
If A/C measured by volume:
Positive displacement pump: ☐ Yes ☐ No
Recorded in digital form to nearest gal. ☐ Yes ☐ No
Corrects to 60° ☐ Yes ☐ No
Quantity totalized ☐ Yes ☐ No
Accurate to 1.0% of req. measurement ☐ Yes ☐ No

Remarks ____________________

Anti Striping Additive Storage & Equip.

Tanks: Recirculating system ☐ Yes ☐ No
Total Capacity: __________ Gals (L)
Uniform Heat: ☐ Yes ☐ No
Method of Heating: ☐ Hot Oil ☐ Electric ☐ Other: __________
Calib. Chart & measuring stick provided: ☐ Yes ☐ No
Dispensed directly into asphalt feed line: ☐ Yes ☐ No
Between asph. ctrl. valve & end of asphalt discharge line ☐ Yes ☐ No
Required quantity of anti-stripping additive uniformly proportioned: ☐ Yes ☐ No
How is proportioning verified? __________
____
Is proportioning easily and quickly verifiable? ☐ Yes ☐ No
Include positive displacement accumulating meter: ☐ Yes ☐ No
Accumulates & displays materials used: ☐ Yes ☐ No
Reads to nearest 0.25 gals: ☐ Yes ☐ No
Thermometers
Graduated in 5° increments ☐ Yes ☐ No
Accurate within ± 5° F increments: ☐ Yes ☐ No
Affixed near discharge point to indicate temperature in storage: ☐ Yes ☐ No

Remarks ____________________

SCALES & METERS						
	[1] Asphalt Met/Scale	[2] Aggr Scale	Min. Filler Feed	Anti -Strip Meter	[3] Platform Scales	[4] Silo/Bin Scales
Make						
Capacity						
Graduation						
Date Calib						
Max.Error %						
Type Panel Indicator						
Accurate to within 1.0% of req'd measurement						
Accurate to within 0.5% of req'd measurement						

[1] **Asphalt Met/Scale**

Material delivery diverted for checking accuracy: . . . . ☐ Yes ☐ No
AC meter self-correcting to 60°F: . . . . ☐ Yes ☐ No
Are all pertinent readouts & indicators readily visible to the plant operator at all tim es: ☐ Yes ☐ No

[2] **Aggregate Scales**

Scale interlocked with asphalt and mineral filler measuring equipment: . . . . . . ☐ N/A ☐ Yes ☐ No
Scale wet weight corrected to dry weight: . . . . ☐ Yes ☐ No
Material delivery diverted for checking accuracy: . . . . ☐ Yes ☐ No

[3] **Platform Scales** ☐ Applicable ☐ Not Applicable

Sufficient length to weigh entire unit at one tim e:
Prints zero tare weight: . . . . ☐ Yes ☐ No
Prints total batch weight of mixture: . . . . ☐ Yes ☐ No
Prints total weight of mixture and unit: . . . . ☐ Yes ☐ No

[4] **Silo/Bin Scales** ☐ Applicable ☐ Not Applicable

Type:________________ ☐ Weight Hopper ☐ Suspended Bin
Type Scale: ________________ ☐ Springless ☐ Load Cell

Remarks: ____

Teleprinter

1. _______**Batch plant not using surge or storage bins**:
   Prints separately weight of aggregate and asphalt: . . . . ☐ Yes ☐ No
   Prints zero weight for each batch: . . . . ☐ Yes ☐ No
   Prints total weight of mixture in truck . . . . ☐ Yes ☐ No
2. _______**Plants using surge or storage bins**:
   Prints zero weight: . . . . ☐ Yes ☐ No
   Prints tare weight: . . . . ☐ Yes ☐ No
   Prints batch weight: . . . . ☐ Yes ☐ No
   Prints mix weight: . . . . ☐ Yes ☐ No
   Print total weight of unit & mixture loaded in truck: . . . . ☐ Yes ☐ No
   Automatically returns to zero after tare is weights: . . . . ☐ Yes ☐ No
   Does printing mechanism print weights in combination as req'd by 503.02(3) of the Standard Specification . . . . ☐ Yes ☐ No

Remarks: ____

PRODUCTION AND STORAGE OF MIX

DRUM MIXER: ☐ Applicable ☐ Not Applicable

Type Fuel: ______________________

Materials fed into drum mixer in a manner that:

- Aggregates are dry: ☐ Yes ☐ No
- Mixture is uniform: ☐ Yes ☐ No
- Coating is adequate: ☐ Yes ☐ No
- Moisture content level is uniform & acceptable: ☐ Yes ☐ No
- Oxidation is acceptable: ☐ Yes ☐ No
- Mixing unit is continuously supplied with sufficient materials to operate at capacity: ☐ Yes ☐ No
- Temperature is uniform: ☐ Yes ☐ No
- Mixture is within specified temperature limits: ☐ Yes ☐ No

Equipped with automatic burners: ☐ Yes ☐ No

Slope of dryer as recommended by manufacturer: ☐ Yes ☐ No

Flights are recommended by manufacturer: ☐ Yes ☐ No

Mixer flights in acceptable condition: ☐ Yes ☐ No

BATCH PLANT DRYER: ☐ Applicable ☐ Not Applicable

Type fuel: ______________________

Supplies mixing unit continuously with hot, dry aggregate at operating capacity: ☐ Yes ☐ No

Temperature uniform: ☐ Yes ☐ No

Held at specified temperature: ☐ Yes ☐ No

Acceptable moisture content: ☐ Yes ☐ No

Equipped with automatic burners: ☐ Yes ☐ No

Slope of dryer as recommended by manufacturer: ☐ Yes ☐ No

Dryer and flights in acceptable condition: ☐ Yes ☐ No

HOT BINS: ☐ Applicable ☐ Not Applicable

Adequate size and number for continuous operation at rated capacity: ☐ Yes ☐ No

Adequate storage for individual components: ☐ Yes ☐ No

Provided with overflow to prevent contamination: ☐ Yes ☐ No

Free flowing: ☐ Yes ☐ No

Condition: ______________________

BATCH PLANT PUGMILL: ☐ Applicable ☐ Not Applicable

Rated capacity: DOTD:__________Tons Manuf.:__________Tons

Twin Shafts: ☐ Yes ☐ No

All paddles acceptable for wear: ☐ Yes ☐ No

Liner in good condition: ☐ Yes ☐ No

Weigh box leaking: ☐ Yes ☐ No

Pugmill gate leaking: ☐ Yes ☐ No

Clogged spray bars: ☐ Yes ☐ No

Timing device operating properly: ☐ Yes ☐ No

Discharge gates lock during timing cycle: ☐ Yes ☐ No

Additional material interlock working: ☐ Yes ☐ No

Asphalt bucket locked out during drying mixing: ☐ Yes ☐ No

Signal operational: ☐ Yes ☐ No

Mixing Time: Drying time:__________ Sec. Wet time:__________ Sec.

Material properly coated: ☐ Yes ☐ No

Evidence of segregation: ☐ Yes ☐ No

Remarks ____

____

____

THERMOMETERS

Heated Aggregates or Asphaltic Mixture

Graduated in 10° F (Maximum) increments: ☐ Yes ☐ No
Accurate within ± 5°F change: ☐ Yes ☐ No
Approved recording thermometer: ☐ Yes ☐ No
Sensitive to 1°F change: ☐ Yes ☐ No
Registers automatically: ☐ Yes ☐ No
Accurately records discharge temperature: ☐ Yes ☐ No
Describe Location: ______________________

STORAGE SILOS AND SURGE BINS: ☐ Applicable ☐ Not Applicable

General

Bin indicator installed at top of slope portion: ☐ Yes ☐ No
Signal: ______Light _______ Audible
Obvious to operator and working: ☐ Yes ☐ No
Any segregation: ☐ Yes ☐ No
Mixture drawn from bins meets same requirements as mix being loaded: ☐ Yes ☐ No
Method of loading: ☐ Bucket ☐ Drag Slat ☐ Other ______________
Conveyor system works continuously: ☐ Yes ☐ No
Uniform temperature: ☐ Yes ☐ No
Mix conveyed to storage remains with ± 15F of plant discharge temperature: ☐ Yes ☐ No
Automatic warning system for gate malfunction: ☐ Yes ☐ No
Type of unloading gate: ☐ Clam ☐ Other ______________

Storage Silo: ☐ Applicable ☐ Not Applicable
☐ Heated ☐ Unheated
Capacity: __________________Tons Maximum storage time: _______ Hrs.
Type of heating: ☐ Hot Oil ☐ Other ______________
Type of Atmosphere: ☐ Air ☐ Inert gas
When inert gas is used, can silo be purged: ☐ Yes ☐ No
Type of anti-segregation system: ______________

Surge Bin: ☐ Applicable ☐ Not Applicable
☐ Heated ☐ Unheated
Capacity: __________________Tons Maximum storage time: _______Hrs.
Type of heating: ☐ Hot Oil ☐ Other ______________
Type of anti-segregation system: ______________

Remarks ______________________

MIX RELEASE AGENT

Method of applicable: ☐ Spray ☐ Other ______________
Platform for application: ☐ Yes ☐ No
From approved source: ☐ Yes ☐ No

SAMPLING AND TESTING

SAMPLING PLATFORM

Sturdy: ☐ Yes ☐ No
Acceptable location: ☐ Yes ☐ No
Satisfactory: ☐ Yes ☐ No

Remarks: ______________________

PLANT LABORATORY

Size: Length _________ Width _________ Square Feet _________

Acceptable (min. 160 sq. ft.)	☐ Yes	☐ No
Acceptable location:	☐ Yes	☐ No
Weatherproofed:	☐ Yes	☐ No
Heated:	☐ Yes	☐ No
Air Conditioned:	☐ Yes	☐ No
Fumed Hood:	☐ Yes	☐ No
Acceptable Exhaust Fan:	☐ Yes	☐ No
Running water:	☐ Yes	☐ No
Electricity:	☐ Yes	☐ No
Bench along at least one wall:	☐ Yes	☐ No
Chairs, desks, and tables adequate:	☐ Yes	☐ No
File storage facilities adequate:	☐ Yes	☐ No
Sanitation facilities adequate:	☐ Yes	☐ No
Suitable locks and catches:	☐ Yes	☐ No
Required testing equipment:	☐ Yes	☐ No
Constant temperature oven (100 - 400 F)($\pm$ 5 ^{0}F):	☐ Yes	☐ No
Specimen ejector:	☐ Yes	☐ No

Remarks ______________________________

____

____

ABSON TEST RESULTS (ABSOLUTE VISCOSITY)

Sample location: ☐ Drum Discharge ☐ Silo Discharge ☐ Pugmill Discharge

Original AC: ____________________ Poises

Recovered AC: ____________________

Recovered differs from original AC more than 2000: ☐ Yes ☐ No

ABSON test results from roadway

Recovered AC: ____________________ Poises

Remarks ______________________________

____

____

______________________________ PROJECT ENGINEER'S REPRESENTATIVE

______________________________ DISTRICT LABORATORY REPRESENTATIVE

______________________________ PROJECT ENGINEER

______________________________ APPROVED BY DISTRICT LAB ENGINEER

______________________________ DATE

APPENDIX E

E-5 Certification Report for Scales and Meters

DOTD 03-22-3065
Rev. 10/93

State of Louisiana
Department of Transportation and Development

CERTIFICATION REPORT FOR SCALES AND METERS

Plant Name: ______________________ Location: ________________ Date: ______________

Plant Type: ☐ Portland Cement Concrete ☐ Asphaltic Concrete ☐ Other ______________

Type Measurement Device: ☐ Springless Dial ☐ Load Cell ☐ Beam ☐ Platform
☐ Belt ☐ Meter ☐ Other ______________________

Material Measured: ☐ Asphalt ☐ Anti-Strip ☐ Water ☐ Aggregate: ☐ Coarse ☐ Fine
☐ Cement ☐ Filler ☐ Admix ☐ Other ______________________

Make of Device: ________________ Capacity: ______________ Minimum Gradations: ____________

Serial No. (Identification): ______________________________ Electronic Readout: ☐ Yes ☐ No

Actual Amount	Reading Amount	Percent Error	Actual Amount	Reading Amount	Percent Error	Actual Amount	Reading Amount	Percent Error

Maximum Error ____________________%

I certify that this measuring device meets the certification requirements of the Louisiana DOTD.

Certifying Company: ________________________ ______________________________
Technician and LA License No.

LA State License No: ________________________

*Expiration Date: ________________________

All scales and other measuring devices utilized at plants supplying materials to DOTD are to be certified by an independent company every 90 days or as required by the engineer. This report is to be completed by the certifying company's representative for each measuring device for each material.

Copies:
One copy is to be filed in plant records readily available to department personnel.
One copy is to be sent to the DOTD District Laboratory Engineer.

APPENDIX E

E-6 Asphaltic Concrete Paving Equipment Checklist

ASPHALTIC CONCRETE PAVING EQUIPMENT CHECKLIST

Review Inspection Date: ____________________

Project Number: ___________________________

☐ Equipment Conforms to Certification Standards
☐ Equipment Fails to meet Certification Standards in the following areas
(list check points from certification form)

____
____
____
____
____

Modifications: _______________________________________
____
____

Remarks: _______________________________________
____
____

______________________________	______________________________	____________________
Project Engineer Representative	**Title**	**Date**
______________________________	______________________________	____________________
District Laboratory	**Title**	**Date**

Miscellaneous Equipment Checklist

The following equipment is available in sufficient quantity at the jobsite and is in acceptable condition:

☐ Rakes
☐ Shovels
☐ Lutes
☐ Static Straightedge
☐ Hand Brooms
☐ Hand Tampers
☐ Apparatus for checking slope control
☐ Joint painting tools
☐ Stringlines for joint construction
☐ Means of cleaning equipment
☐ Joint cutting tools
☐ Mechanical Sweeper
☐ Paper for joint construction
☐ String for paver control line
☐ Blocks & Shims for supporting the screed of the paver at the beginning of operations

Remarks: _______________________________________
____
____

______________________________	____________________
Project Engineer's Representative	**Date**

APPENDIX E

E-7 Asphaltic Concrete Paving Equipment Certification – Distributor

State of Louisiana
Department of Transportation and Development

ASPHALTIC CONCRETE PAVING EQUIPMENT CERTIFICATION

Asphalt Distributor

Make: ______________________ Serial No: ______________________
Certification Tag: ______________________ Date: ______________________
Expiration Date: ______________________

General ☐ condition acceptable ☐ no fluid or fuel leaks that could contaminate mat
Heating System ☐ burners working properly ☐ tack kept at proper temperature
Thermometer *Type:* ☐ armored ☐ dial ☐ other ______________________
☐ acceptable accuracy ☐ current location ______________________
Measuring System *Type:* ☐ gauge ☐ graduated measuring stick
☐ other ______________________
Metering System ☐ Tachometer - acceptable (ft/min) ☐ Flow Control Device (gal/min)
☐ Calibration Charts available

Distribution System *Pump:* ☐ working properly ☐ uniform pressure & flow of material
Screens: ☐ not clogged
Spray Bar: ☐ nozzles not clogged ☐ uniform application rate of material

WEIGHT CERTIFICATION TAGS ☐ condition acceptable
number: ______________ tare weight: ______________ allowable load ______________

Remarks ____
____
____
____

______________________ ______________
District Laboratory Representative **Date**

______________________ ______________
Project Engineer Representative **Date**

APPROVED BY: ______________________ ______________
District Laboratory Engineer **Date**

APPENDIX E

E-8 Asphaltic Concrete Paving Equipment Certification – Paver

ASPHALTIC CONCRETE PAVING EQUIPMENT CERTIFICATION
Paver Equipment

Make: ______________________ Serial No: ______________________
Certification Tag: ______________________ Date: ______________________
Expiration Date: ______________________

General
☐ entire paver is in good mechanical working order
☐ lays mixtures within specification tolerances
☐ positive connection available between paver & truck
☐ no fluid or fuel leaks that could contaminate mat
☐ clean
☐ walk platform in acceptable condition

Type Paver ☐ tracked ☐ acceptable condition ☐ rubber tired ☐ uniform & proper pressure

Hopper
☐ roller bars in good working condition
☐ adjustable wings
☐ no holes
☐ conveyor belts feed properly
☐ designed to prevent spillage
☐ clean
☐ adequate size
☐ flow control gates allow adequate flow to the screed

Auger Assembly ☐ in good condition ☐ extends complete width of screed & extension, if attached
☐ automatic paddle switches adjusted & operating properly

Screed Assembly
Strike Off Type: ☐ tampers ☐ other ______________________
Tamping Bar: ☐ applicable ☐ non-applicable
☐ timing of stroke is properly synchronized
☐ beveled face is not excessively worn
☐ clearance between bars & screed is in accordance with manufacturer's recommendations
Other: ☐ strike off assembly is not excessively worn
☐ strike off assembly is adjusted in accordance with manufacturer's recommendations
Heaters: ☐ working properly

Screed *Type:* ☐ oscillating ☐ vibrating ☐ static
☐ width extends across paving lane
☐ smooth, free from holes & cracks
☐ crown adjusted properly
☐ designed to incorporate extensions
☐ true to line
☐ lays smooth, uniform mat without screed marks or segregation
Extensions: ☐ applicable ☐ non-applicable
Type: ☐ solid ☐ hydraulic width ______________ ft/m
☐ attached properly
☐ adjusted to lay mix in true line with screed
☐ meet all screed check points

Automatic Control ☐ equipped with automatic screed controls
☐ slope ☐ grade
☐ equipped to work from stringline
Traveling stringline: ☐ applicable ☐ non-applicable
Type: ☐ ski ☐ short ski ☐ rigid ☐ articulated ☐ properly attached
☐ footed frame ☐ wheeled ☐ joint matcher ☐ clean ☐ in satisfactory condition

Remarks ____
____

______________________ ______________
District Laboratory Representative **Date**

______________________ ______________
Project Engineer Representative **Date**

APPROVED BY: ______________________ ______________
District Laboratory Engineer **Date**

APPENDIX E

E-9 Asphaltic Concrete Paving Equipment Certification – Compaction Equipment

State of Louisiana
Department of Transportation and Development

ASPHALTIC CONCRETE PAVING EQUIPMENT CERTIFICATION

Compaction Equipment

Make: ______________________ Serial No: ______________________
Certification Tag: ______________________ Date: ______________________
Expiration Date: ______________________

Roller Type: ☐ vibratory ☐ pneumatic ☐ 3-wheel steel Cert. Wt. ______________
☐ tandem wheel steel ☐ combination ______________

General ☐ watering devices ☐ scrapers ☐ ballast system
☐ self-propelled ☐ reversible ☐ changes direction without backlash
☐ clean ☐ devices in good working condition

Steel Wheeled Rollers ☐ smooth surfaced wheels ☐ wheels - true round without flat spots
wheel width ______________ wheel diameter ______________

Vibratory Rollers ☐ smooth surfaced wheels ☐ wheels - true round without flat spots
wheel width ______________ wheel diameter ______________

☐ amplitude & frequency independently & easily adjustable
☐ amplitude & frequency easily readable on control panel

Pneumatic Roller No. of tires: ________ wt. per tire: ________ ply: ________ side: ________

☐ tire replacement as per manufacturer's specifications
☐ all tires of same size, ply, inflation & diameter
☐ manufacturer's calibration charts for contact pressure available
☐ air pressure sufficient for proper contact pressure

Remarks ____
____
____
____

______________________________ ______________
District Laboratory Representative **Date**

______________________________ ______________
Project Engineer Representative **Date**

APPROVED BY: ______________________________ ______________
District Laboratory Engineer **Date**

APPENDIX E

E-10 Asphaltic Concrete Haul Truck

DOTD 03-22-3060
Rev. 06/02

State of Louisiana
Department of Transportation and Development

ASPHALTIC CONCRETE HAUL TRUCK

Make: ______________________ Serial No: ______________________

Certification Tag: ______________ Date: ______________________

Expiration Date: ______________ Project No: ______________________

☐ GENERAL CONDITION ACCEPTABLE
☐ no fluid or fuel leaks that could contaminate mat

BED

☐ clean ☐ metal ☐ smooth ☐ no holes
☐ tailgate ☐ apron adequate to prevent spillage

Sideboards

☐ applicable ☐ not applicable ☐ meet department requirements

Remarks: ____

COVER ☐ acceptable material ☐ adequate size ☐ sufficient tie-downs

Remarks: ____

DISCHARGE

☐ bed does not rest on spreader apron
☐ smooth, continuous operation
☐ pushed easily by paver

Remarks: ____

WEIGHT CERTIFICATION TAGS

☐ acceptable condition Number: ______________________

Tare Weight: ______________ Allowable Load: ______________

Remarks: ____
____
____
____

______________________________ ______________________
District Laboratory Representative Date

______________________________ ______________________
Project Engineer's Representative Date

Approved: ______________________________ ______________________
Project Engineer Date

APPENDIX E

E-11 Weight Certification Tag

STATE OF LOUISIANA

Department of Transportation & Development

Weight Certification Tag

Truck & Trailer No. ______________________________

Tare Weight ______________________________ lbs.

Legal Payload ______________________________ lbs.

Date Certified ______________________________

Stock No. 16-20-5866

Weight Certification Tag
(03-22-5866)

APPENDIX E

E-12 Asphaltic Concrete Material Transfer Vehicle Equipment Certification

Louisiana Department of Transportation and Development

ASPHALTIC CONCRETE MATERIAL TRANSFER VEHICLE EQUIPMENT CERTIFICATION

Make: ____________________ Serial No.: ____________________

Certification Tag: ____________________ ____________________
Number Date

Expiration Date: ____________________

____ GENERAL CONDITION ACCEPTABLE

____ no fluid or fuel leaks that could contaminate material

____ GENERAL OPERATION ACCEPTABLE

____ delivers mix from hauling equipment to paver

____ performs additional continuous mixing of asphalt concrete mixture using augers prior to delivery to paver

____ require storage bin (minimum capacity of 25 tons)

____ require a discharge conveyor to paver, with ability to swivel(for operating from an adjacent lane)

____ require a paver insert hopper (minimum capacity of 18 tons), which can be inserted into conventional paving hoppers.

Remarks: ____

____

____

____________________ ____________
District Laboratory Date

____________________ ____________
Project Engineer's Representative Date

Approved: ____________________ ____________
District Laboratory Engineer Date