MATERIALS

POLICY AND PROCEDURE

DIRECTIVES MANUAL

PREPARED BY:
ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
MATERIALS GROUP

REVISED TO CHANGE LETTER NO. 20
(May 21, 2021)

MATERIALS

POLICY AND PROCEDURE

DIRECTIVES MANUAL

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INTRODUCTION

The Materials Policy and Procedure Directives Manual has been prepared for the purpose of establishing uniform policies regarding materials for construction projects.

Each Policy and Procedure Directive is given a number designation. Subsequent changes to individual Policy and Procedure Directives will be identified with a letter suffix. For example, the first revision of Policy and Procedure Directive No. 4 would be identified as PPD No. 4a, the second revision would be PPD No. 4b, etc.

All revisions to the Materials Policy and Procedure Directives Manual shall officially originate from ADOT Materials Group.

Revisions will be issued under a Materials Policy and Procedure Directives Manual Change Letter. All change letters issued will be numbered consecutively, beginning with No. 1.

Change letters will be signed by the Assistant State Engineer, Materials Group.

Revisions issued under each Materials Policy and Procedure Directives Manual Change Letter will be effective for projects with a bid opening date on or after the effective date of the corresponding change letter.

Materials Group will welcome any suggestions for the improvement of the Materials Policy and Procedure Directives Manual, as it is hoped and intended that manual users will participate its formulation and revisions.

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP

1221 NORTH 21ST AVENUE PHOENIX, ARIZONA 85009-3740 PHONE (602) 712 - 7231

POLICY AND PROCEDURE DIRECTIVE

James P. Delton
Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 4
SUBJECT: ASPHALTIC CONCRETE MIX DESIGN PROPOSALS AND SUBMITTALS	EFFECTIVE DATE: February 27, 2009

1. GENERAL

1.1 This Policy and Procedure Directive supersedes P.P.D. No. 96-6.

1.2 The information provided herein is given to assist those involved in the preparation and submittal of asphaltic concrete mix design proposals in accordance with the requirements of the Specifications.

1.3 The use of previously used mix designs is addressed in Section 6 of this Policy and Procedure Directive.

2. MATERIALS GROUP RESPONSIBILITIES

2.1 The Regional Materials Engineer, the Materials Group Bituminous Engineer, or the Materials Group Pavement Materials Testing Engineer will be responsible for the approval/disapproval of all asphaltic concrete mix designs.

3. REQUIREMENTS FOR MIX DESIGN LABORATORIES

3.1 To ensure that testing laboratories are capable of performing all asphaltic concrete mix design testing in conformance with the appropriate test procedures, laboratories wishing to perform asphaltic concrete mix design testing must have had an equipment and procedural inspection by Department personnel to demonstrate mix design testing. Any deficiencies found shall be corrected before mix designs will be accepted. Arrangements for laboratory inspections are made by contacting the Materials Group Quality Assurance Engineer.

3.2 Mix design laboratories must satisfy the requirements of the Arizona Department of Transportation "System for the Evaluation of Testing Laboratories".

4. REQUIREMENTS FOR MIX DESIGN ENGINEER

4.1 The Specifications require that asphaltic concrete mix designs be prepared under the direct supervision of a professional engineer, registered in the state of Arizona, experienced in the development of asphaltic concrete mix designs and mix design testing. The following items should help clarify the Department's policy relative to this subject.

1) Mix designs shall be sealed, signed, and dated by the engineer responsible for the mix design.

2) The policy does not preclude the use of consultant engineers, provided the consulting engineer performs direct supervision of the testing and mix design development, has evaluated the test equipment and procedures used in the laboratory and found them in compliance with all test method requirements, and is thoroughly knowledgeable in asphaltic concrete mix design preparation.

3) The use of the term "direct supervision" is interpreted to include the requirement that the mix design engineer be physically present on a routine basis while the mix design testing is being done and is in responsible charge of that work.

4) The preparation of mix designs by or under the supervision of a professional engineer who is not experienced in the development of asphaltic concrete mix designs and mix design testing is clearly prohibited. While experience by the mix design engineer in preparation of asphaltic concrete mix designs in accordance with Arizona Test Methods is preferred, experience in mix design preparation under comparable procedures may be substituted if the mix design engineer demonstrates that he/she is fully aware of the Arizona procedures and is prepared to conform to them.

5) Submission of a mix design which does not comply with test method requirements will be considered cause for rejection of that mix design. Should such a failure be of a significant or reoccurring nature, the Department may refuse to accept mix design proposals from that mix design engineer.

6) All laboratories that wish to submit asphaltic concrete mix designs must submit information to the Materials Group Bituminous Engineer, which indicates that the requirements described above have been met. This information must be provided prior to submitting asphaltic concrete mix designs. Information provided should include evidence of registration and experience in asphaltic concrete mix designs and mix design testing. Also included should be information which outlines how the requirement for providing direct supervision is to be satisfied.

5. REQUIRED MIX DESIGN SUMMARY ITEMS

5.1 Asphaltic concrete mix designs shall be submitted in a summary format that clearly indicates the required mix design information shown below.

1) Project Number and "TRACS" Number.

2) Prime Contractor.

3) Type of Mix Design. If the same mix design is developed to satisfy the requirements for more than one type of mix, for example 1/2" AC and 3/4" AC, the mix design shall clearly state this, and also show the specifications governing each individual type of mix.

4) Name and address of testing laboratory which developed the mix design.

5) Name, signature, and seal of the professional engineer who is responsible for the mix design. Mix designs shall be sealed, signed, and dated in accordance with the requirements of the Arizona State Board of Technical Registration. The date the mix design is signed by the engineer, as shown on his registration seal, will be the mix design date. Revised mix designs shall be submitted containing all information for the design. Revised mix designs shall be identified as such, and shall be sealed, signed, and dated by the responsible engineer.

6) Specific location(s) of original source(s) of mineral aggregate.

7) The gradation of the mineral aggregate in each stockpile.

8) Mix design mineral aggregate composite percentages and gradation, along with the appropriate mix design grading bands. The mix design composite gradation of the mineral aggregate shall be a washed gradation in accordance with the requirements of Arizona Test Method 201.

9) Source, type, percentage, and specific gravity of mineral admixture. The mix design shall be developed by, and so state, laboratory mixing procedures which simulate the method of adding mineral admixture which will be used in the production of the asphaltic concrete.

10) The percent of mineral admixture, by specification, is by weight of the mineral aggregate. The composite gradation of the combined mineral aggregate and mineral admixture, determined in accordance with Arizona Test Method 815, and the appropriate mix design grading bands are to be shown in the mix design proposal.

11) Supplier, refinery, grade (including any modifiers), and specific gravity of asphalt cement. For asphalt-rubber mix designs: the asphalt-rubber design, including asphalt

cement type and source; crumb rubber type, gradation, and source; percent crumb rubber by weight of asphalt cement; asphalt cement binder properties; asphalt-rubber binder properties; blending procedures; and reaction time.

12) When required, viscosity-temperature curve along with the laboratory mixing and compaction temperature ranges. For PG asphalt binders that have a maximum laboratory mixing temperature exceeding 325 °F or a maximum laboratory compaction temperature exceeding 300 °F, the laboratory mixing and compaction temperature ranges shall be specified in writing by the asphalt binder supplier. The actual laboratory mixing and compaction temperatures used shall be reported on the mix design.

13) Abrasion for each source of mineral aggregate used.

14) Sand equivalent of the combined mineral aggregate.

15) Fractured coarse aggregate particles of the mineral aggregate.

16) When required, uncompacted void content of the mineral aggregate.

17) When required, percent carbonates in aggregate.

18) When required, flat and elongated particles of the mineral aggregate.

19) Coarse and fine aggregate specific gravities, coarse and fine aggregate water absorption, combined coarse and fine aggregate specific gravities, and combined water absorption. In some cases, the calculation of combined water absorption has been done incorrectly. The proper method of calculating the combined water absorption is given in Arizona Test Method 251.

20) Asphalt (or asphalt-rubber) absorption, as required.

21) Recommended mix design asphalt content.

22) The following mix design characteristics at the recommended asphalt content shall be given: percent air voids; percent voids in mineral aggregate (VMA); bulk density; Marshall stability and flow (when applicable); when required, Immersion Compression results (wet strength, dry strength, and index of retained strength); and the calculated maximum density of bituminous mixture. When determining the maximum theoretical specific gravity of the bituminous mixture (Arizona Test Method 806), it shall be assured that the requirement for no more than 18 grams difference between the total weight of aggregate, mineral admixture, and binder before mixing and the total "weight of the samples in air" is complied with.

23) When required, the dust to binder ratio, calculated by dividing the mix design composite gradation target for the No. 200 sieve (including mineral admixture) by the effective asphalt content.

24) Any stipulations upon which the use of the mix design is contingent. (For example, minmum or maximum percentage of special materials such as washed or imported aggregates.)

5.2 The mix design shall be submitted to the Engineer under a cover letter signed by an authorized representative of the contractor.

6. PREVIOUSLY USED MIX DESIGNS

6.1 The contractor may propose the use of a mix design that has been developed for a previous project. The proposed mix design shall meet the requirements of the current project. The contractor shall provide evidence that the type and source of bituminous material, the type of mineral admixture, and the source and methods of producing mineral aggregate have not changed since the formulation of the previous mix design. The contractor shall also provide current test results for all specified characteristics of the mineral aggregate proposed for use. The Engineer will determine if the previously used mix design is suitable for the intended use and if the previous use of the mix design was satisfactory to the Department. The Engineer will either approve or disapprove the proposed mix design. Should the Engineer disapprove the use of the previously used mix design, the contractor shall prepare and submit a new mix design proposal in accordance with the requirements of these specifications.

6.2 A previously used mix design older than two years from the date it was formulated, sealed, signed, and dated shall not be allowed for use. Once approved for use on a project, a mix design may be used for the duration of the project.

7. ADDITIONAL MIX DESIGN REQUIREMENTS

7.1 In addition to the mix design summary, worksheets showing laboratory data and test results are also to be included in the mix design. The loading used in the preparation of immersion compression specimens must be reported as part of the test data.

7.2 If any tests shown in the mix design were performed by another testing laboratory, the mix design must clearly state the tests, where they were performed, and the mix design engineer under whose direction the testing was accomplished. The laboratory performing this mix design testing and the mix design engineer must meet the requirements of this Policy and Procedure Directive.

7.3 For asphaltic concrete produced under ADOT Specifications 406, 409, 416, or 417, representative samples of the mineral aggregate, mineral admixture, and asphalt cement

used in the mix design are submitted to the Engineer for calibration of the ignition furnace, and the determination of sand equivalent and fractured coarse aggregate particles. If required, the uncompacted void content shall also be determined.

7.4 For asphaltic concrete produced under ADOT Specification 415, representative samples of the mineral aggregate, mineral admixture, and asphalt-rubber used in the mix design are submitted to the Engineer for calibration of the ignition furnace, and the determination of sand equivalent, fractured coarse aggregate particles, and uncompacted void content.

7.5 Mix design proposals for asphaltic concrete produced under ADOT Specifications 406, 409, 415, 416, or 417 are submitted to the Engineer. The Engineer shall send a copy of the mix design to the Regional Materials Engineer. The Regional Materials Engineer, the Materials Group Bituminous Engineer, or the Materials Group Pavement Materials Testing Engineer shall review the mix design proposal for completeness and accuracy, and shall approve or disapprove the mix design proposal. The mix design must be approved by the Regional Materials Engineer, the Materials Group Bituminous Engineer, or the Materials Group Pavement Materials Testing Engineer prior to the start of asphaltic concrete production.

James P. Delton, P.E.
Assistant State Engineer
Materials Group

09

POLICY AND PROCEDURE DIRECTIVE

James P. Delton
Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 6
SUBJECT: PROVISIONAL SEAL COAT	EFFECTIVE DATE: February 27, 2009

1. GENERAL

1.1 This Policy and Procedure Directive supersedes P.P.D. No. 96-9.

1.2 This Policy and Procedure Directive gives general guidelines for the use of a provisional seal coat. The Engineer has the option to apply a provisional seal coat to any new bituminous pavement surface at the locations and the times as he/she directs. The Engineer may use a provisional seal coat on any lift of new bituminous pavement that is likely to be subject to precipitation or exposed during winter shutdown prior to the placement of any subsequent lifts of bituminous material. Although provisional seal coats are not contract items, they should be considered for use under the conditions described herein.

2. REASONS FOR USE

2.1 In warm, sunny weather, the pneumatic action of traffic loads during and soon after construction will densify and seal the new pavement surface, reducing the air voids and making the pavement surface less permeable. However, if the pavement is subjected to moisture before the surface has a chance to densify and seal through pneumatic traffic action and warm dry weather, the pavement could strip and/or ravel. Application of a provisional seal coat to the new pavement surface before it is subjected to moisture will help alleviate this problem. Also, if a new asphaltic concrete pavement will go through a winter before receiving its final finishing course, a provisional seal coat may be needed to prevent water intrusion and damage to the pavement.

3. WHEN TO USE

3.1 In order for a provisional seal coat to be effective, the material should seal the surface. Good well-informed judgment should be exercised when deciding to direct the placement of a provisional seal. The following sources are valuable in obtaining the necessary information:

3.1.1 The percent asphalt content from acceptance tests on the new asphaltic concrete.

3.1.2 The percent air voids in the pavement (field voids), which can be obtained from field density and Rice tests.

3.1.3 If there is time, test strips approximately 3 feet by 30 feet can be placed using various application rates and types of bituminous material.

3.2 The following guidelines, based on field voids, can be utilized in forming a judgment as to when a provisional seal coat is needed for surfaces exposed for extended periods of inclement weather.

VOID LEVELS	ACTION
Field Voids < 6.0%.	Do not apply.
Field Voids 6.0% - 10.0%	Engineer's judgment
Field Voids > 10.0%	Apply

3.3 The Engineer should utilize a provisional seal when he/she deems it necessary to preserve the new asphaltic concrete from the adverse effects of moisture. It may be necessary to use a provisional seal frequently during rainy seasons; occasionally as required by weather conditions and traffic; once to protect the pavement during winter shutdown or to protect the final pavement surface; or, not at all. The Engineer should evaluate all conditions and information when deciding if a provisional seal is needed.

4. BITUMINOUS MATERIALS

4.1 The bituminous materials which may be used for a provisional seal are: emulsified asphalt, emulsified asphalt (special type), and emulsified recycling agent (ERA). Bituminous materials must meet the requirements of Section 1005 of the Specifications. If ERA is utilized, it shall be diluted one part water to one part ERA.

4.2 When selecting the type of bituminous material to use, the following may be helpful:

EMULSIFIED OR EMULSIFIED (SPECIAL) ASPHALTS

POSITIVE ASPECTS

1) Will not soften the new asphaltic concrete significantly.

2) Helps seal the surface of the new asphaltic concrete and prevent water intrusion.

3) In most cases, a tack coat will not be needed where an emulsified asphalt provisional seal coat was applied.

4) May be more available when needed on short notice due to weather or construction conditions, especially if it is being used for Tack Coat.

5) Can be effective in special cases or problems such as rocky or coarse pavement surface or very high air voids in the mix caused by low asphalt content and/or poor compaction when it is not desirable to take other corrective action.

NEGATIVE ASPECTS

1) Can be worn off by traffic in wet weather.

2) May not break and adhere to the asphaltic concrete surface well under cold and/or wet weather conditions.

3) Can cause a slick, shiny surface.

4) Can migrate and fill air voids in the lower portion of a lift of asphaltic concrete placed over it, especially if applied in excessive amount.

5) Can cause a water trap in the top portion of the new asphaltic concrete by making a very thin impervious seal on top which prevents any water that gets into the air voids below from escaping.

EMULSIFIED RECYCLING AGENTS

POSITIVE ASPECTS

1) Will penetrate, fill air voids, and soften the top portion of the new asphaltic concrete (from 1/8 to 1/4 inches) to produce a dense surface if pneumatic traffic is available before moisture is encountered, which will help prevent water intrusion.

2) Can be applied more successfully under cold and/or wet conditions and will penetrate the surface of the new asphaltic concrete better and will not be washed off by water and traffic as easily.

3) In some cases, a tack coat will not be needed where an emulsified recycling agent provisional seal coat was applied; however, this determination must be made on an individual basis.

4) ERA-25 can be effective in special cases or problems such as a rocky or coarse pavement surface or a very high air void content in the asphaltic concrete caused by low asphalt content and/or poor compaction when it is not desirable to take orher corrective action.

NEGATIVE ASPECTS

1) Can cause a slick, shiny surface and instability in the portion of the asphaltic concrete it penetrates.

2) Needs pneumatic compaction to perform well.

3) Will fill air voids in the top portion of the asphaltic concrete it is applied to.

4) Not available on short notice in some cases.

5) When used in excessive amounts or where conditions are wrong, it can increase or cause bleeding or instability.

4.3 The table below shows approximate application rates. The Engineer should direct the application rate he/she determines to be most beneficial to the new asphaltic concrete, according to type and dilution.

TYPE OF BITUMINOUS MATERIAL	APPROXIMATE APPLICATION RATE (gal./sq. yd.)
Emulsified Asphalt (Special Type)	0.08
Emulsified Asphalt (Other than Special Type)	0.06
Emulsified Recycling Agent (diluted with one part water to to one part ERA)	0.08

4.4 The Engineer may direct that a sand blotter be applied in one or more applications for a total application of approximately 2 pounds per square yard.

5. SUMMARY

5.1 The provisional seal coat is to be utilized only when and where it is needed. If used where it is not needed, the provisional seal coat can be harmful to the pavement. If used properly it can help prevent surface stripping and raveling in new pavement surfaces. A great deal of attention must be paid to the properties of the new asphaltic concrete pavement and the weather conditions in deciding if a provisional seal coat is needed, and if needed, what type and what application rate will do the best job. Good well-informed judgment must be used when working with provisional seal coats. The decisions necessary will need to be made at the project and district level for each project and its condition; however, Materials Group personnel will lend any assistance as requested.

5.2 Payment to contractors for provisional seal coat will be made by change order.

James P. Delton, P.E.
Assistant State Engineer
Materials Group

POLICY AND PROCEDURE DIRECTIVE

James P. Delton
Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 8
SUBJECT: SAMPLING, TESTING, AND ACCEPTANCE OF EMULSIFIED BITUMINOUS MATERIALS	EFFECTIVE DATE: February 27, 2009

1. GENERAL

1.1 This Policy and Procedure Directive supersedes P.P.D. No. 96-11.

1.2 This policy and procedure directive outlines the procedures to be followed for sampling, testing, and acceptance of emulsified asphalts and emulsified recycling agents. It establishes procedures to be used in the approval and shipment of all emulsions used on ADOT projects.

1.3 This Policy and Procedure Directive modifies the normal certification procedures. It shall be used in conjunction with the requirements of Subsection 106.05 of the Specifications.

2. PROCEDURES

2.1 Emulsions may be accepted for use on an ADOT project using either of two acceptance procedures. The first procedure involves testing and preapproval of individual tanks or batches of undiluted emulsion by ADOT. The second procedure involves acceptance on the basis of Certificate of Analysis for individual tanks or batches of undiluted emulsion by an approved testing laboratory. Both procedures include certain specified responsibilities and conditions that must be fulfilled by the supplier and ADOT personnel. Out-of-State suppliers shall conform to the provisions of this policy and procedure directive unless otherwise directed by the Materials Engineer or the Pavement Materials Testing Engineer.

Supplier Location	Responsible ADOT Lab
Phoenix Area	Central Laboratory
Tucson Area	Tucson Regional Laboratory
Flagstaff Area	Flagstaff Regional Laboratory
Fredonia Area	Flagstaff Regional Laboratory
Out-of-State	Central Laboratory

2.2 ACCEPTANCE THROUGH PREAPPROVAL

2.2.1 This is the most commonly used procedure for acceptance of emulsions. The supplier elects to have their tanks or batches of material preapproved by the responsible ADOT lab prior to shipment. Tank or batch samples shall be taken by the supplier and witnessed by ADOT personnel. Sampling shall conform to the requirements of Arizona Test Method 103. If an emulsion is not used promptly, it shall be resampled at 30 day intervals.

(a)) ADOT Testing Laboratory Responsibilities

(1) The responsible ADOT lab shall sample and test emulsions from suppliers.

(2) When the responsible ADOT lab receives a request for sampling and testing of an emulsion it shall respond in a timely manner. In general, testing of an emulsion shall be completed within 24 hours of receipt of a sample.

(3) After testing is completed, the supplier will be notified as to the acceptance or rejection of the emulsion. If the material is approved for use it shall be assigned an ADOT lab test number and the tank or batch number, quantity of material approved, and expiration date for this material shall be recorded.

(4) If an emulsion fails, the supplier may elect to have the material resampled and retested by ADOT personnel. If the material fails on retesting, it will not be tested further until the manufacturer submits test reports from a laboratory approved by the Materials Engineer which indicate the material is acceptable.

(5) The responsible ADOT testing laboratory will keep all necessary documentation in their offices on approved and disapproved tanks or batches of emulsion. They shall also keep copies of all Certificates of Compliance and maintain an accounting of the quantities of material shipped for each approved lab test number. Upon request from project personnel, the responsible lab will forward copies of test results of all materials incorporated on an ADOT project.

(b) Supplier's Responsibilities

(1) Upon notification of the approval of a tank or batch of emulsion and an assigned lab test number, the supplier shall submit to the responsible lab a Certificate of Compliance (a blank sample is shown in attachment #1) for the approved material which contains the following information:

a) Supplier's name and address.
b) Material type.
c) Tank or batch number.

d) Total quantity certified in tank or batch gallons.
e) Date certificate expires.
f) Statement that the material complies in all respects with the specific requirements of the cited specifications.
g) Responsible ADOT lab and the assigned ADOT lab test number.
h) Name, title, and signature/date of person(s) having legal authority to bind supplier of material.
i) This Certificate of Compliance shall be submitted to the responsible lab in a timely manner. If a certificate is not on file with the responsible lab, the Department may elect to disapprove the use of said material on an ADOT project.

(2) Each shipment (delivery unit) of an emulsion made to the project shall be accompanied by two copies of the Certificate of Compliance. In addition to the requirements listed above, these certificates shall include the following information:

a) ADOT project number.
b) Name of general (prime) contractor.
c) Quantity of material in shipment gallons.
d) Total quantity of material shipped from the certified tank or batch gallons.

(c)) ADOT Project Personnel Responsibilities

(1) Two copies of the Certificate of Compliance shall accompany each shipment (delivery unit) of emulsion supplied to the project. The ADOT inspector shall receive and inspect them for accuracy and completeness.

(2) The project shall call the responsible ADOT lab and receive verification of the lab test number and acceptability of material before use. The project may also request a copy of the test results from the responsible ADOT lab at this time.

(3) One copy of the Certificate of Compliance shall be sent to the responsible ADOT lab in a timely manner.

(4) Sampling on the project shall consist of a set of two nearly full half-gallon plastic containers per delivery unit. A minimum of one gallon of the material being sampled shall be drawn and discarded prior to taking the test sample. Samples shall be taken by the contractor and witnessed by ADOT personnel. If the emulsion has been diluted, the project should indicate the rate of dilution on the sample ticket. One sample shall be tested for percent residue by either the project or Regional Lab. The remaining sample shall be held at the project lab for backup testing.

2.3 ACCEPTANCE THROUGH CERTIFICATE OF ANALYSIS

2.3.1 An alternative procedure for acceptance of emulsions is through a Certificate of Analysis. With the approval of the Materials Group, the supplier may elect to sample and test their own material and submit a Certificate of Analysis to the project. The Mater ials Group's approval of this acceptance method is contingent upon the supplier fulfilling certain requirements as specified below. The Materials Group reserves the right to revoke its approval should the supplier fail to comply with these requirements.

(a)) Supplier's Responsibilities

(1) The supplier or its designated lab must be fully equipped and qualified to test emulsions for all specified properties. The testing laboratory must meet the requirements of the "ADOT System for the Evaluation of Testing Laboratories" for the testing of emulsified asphalts.

(2) The supplier must submit a written quality control and inventory control plan for approval to the Materials Group which outlines the procedure the supplier will follow to ensure that acceptable material is produced and supplied to the Department.

(3) All tanks or batches of material used on ADOT projects shall be fully tested by the supplier's designated testing lab and meet all properties specified for the material. The maximum amount of material which may be certified under any single Certificate of Analysis shall be 50,000 gallons. The material may not be used after 30 days from the date of test completion unless it has been retested and recertified.

(4) Upon completion of testing of a tank or batch of emulsion, the supplier shall submit to the responsible ADOT lab a Certificate of Analysis (a blank sample is shown in attachment #2) for the material which contains the following information:

a) Supplier's name and address.
b) Material type.
c) Tank or batch number.
d) Total quantity certified in tank or batch gallons.
e) Date certificate expires.
f) Statement that the material complies in all respects with the specific requirements of the cited specifications.
g) All required test information.
h) Name, title and signature/date of person(s) having legal authority to bind supplier of material.
i) This Certificate of Analysis shall be submitted to the responsible lab in a timely manner.

(5) Each shipment (delivery unit) of an emulsion made to the project shall be accompanied by two copies of the Certificate of Analysis. In addit ion to the requirements listed above, these certificates shall include the following information:

a) ADOT project number.
b) Name of general (prime) contractor.
c) Quantity of material in shipment gallons.
d) Total quantity of material shipped from the certified tank or batch gallons.

(b) ADOT Project Personnel Responsibilities

(1) Two copies of the Certificate of Analysis shall accompany each shipment (delivery unit) of emulsion supplied to the project. The ADOT inspector shall receive and inspect them for accuracy and completeness.

(2) The project shall call the responsible ADOT lab and receive verif ication that the supplier has been approved to use the "Certificate of Analysis Acceptance Program".

(3) One copy of the Certificate of Analysis shall be sent to the responsible ADOT lab in a timely manner.

(4) Sampling on the project shall consist of a set of three nearly full half-gallon plastic containers per delivery unit. A minimum of one gallon of the material being sampled shall be drawn and discarded prior to taking the test sample. Samples shall be taken by the contractor and witnessed by ADOT personnel. If the emulsion has been diluted, the project shall indicate the rate of dilution on the sample ticket. One sample shall be tested for percent residue by either the project or Regional Lab. One sample shall be sent to the responsible ADOT lab for quality assurance testing. The remaining sample shall be held at the project lab for backup testing.

(c)) ADOT Testing Lab Responsibilities

(1) The responsible ADOT lab shall test the quality assurance sample on a random basis. A minimum of 20% of all samples received will be tested for compliance to specifications.

(2) Should conditions warrant, the responsible lab may test undiluted samples from the supplier's tank or batch in lieu of testing samples from the project.

(3) The supplier, Materials Group Central Lab, and Regional Lab will be notified of out-of-specification test results or any significant variation from the supplier's test results on the same material. The intent of the quality assurance testing is to verify that the supplier's quality control program is adequate to ensure that the specified material is provided, not to

determine the acceptability of the material. The material is accepted by the Department on basis of the Certificate of Analysis. Should the responsible ADOT lab question the validity of the supplier's quality control program through quality assurance testing or reports from project offices of substandard material, the matter shall be referred to the Materials Engineer for his/her determination.

(4) The responsible ADOT lab will keep all necessary documentation on quality assurance testing of emulsions. They shall also keep copies of all Certificates of Analysis and maintain an accounting of the quantity of each shipment for comparison to the amount of emulsion certified.

3. SUMMARY

3.1 This Policy and Procedure Directive outlines the procedures to be followed for sampling, testing, and acceptance of emulsified bituminous materials. The important thing to remember is that no emulsified bituminous material shall be used until either a copy of the Certificate of Compliance with an approved lab test number, or a Certificate of Analysis is furnished. The initial certificate will be on file at the responsible ADOT lab. If any questions arise concerning these procedures, contact the Pavement Materials Testing Engineer.

James P. Delton, P.E.
Assistant State Engineer
Materials Group

Attachments (2)

CERTIFICATE OF COMPLIANCE

PROJECT #:_____ CONTRACTOR: _____

SUPPLIER NAME AND ADDRESS: _____

_____

_____

MATERIAL:_____ TANK OR BATCH NUMBER: _____

TOTAL QUANTITY CERTIFIED IN THIS TANK OR BATCH:_____ gallons

DATE CERTIFICATE EXPIRES: _____

QUANTITY IN THIS SHIPMENT:_____ gallons

TOTAL QUANTITY SHIPPED TO DATE
FROM CERTIFIED TANK OR BATCH:_____ gallons

I certify that the material indicated above conforms to all applicable requirements of Section 1005 of the Arizona Department of Transportation Standard Specifications, including requirements in the contract special provisions, and is from stock that has been sampled and approved by the responsible Arizona Department of Transportation laboratory (_____) under Laboratory Test Number (_____).

_____
Signature and Date

_____
Name

_____
Title

CERTIFICATE OF ANALYSIS

PROJECT #:_____ CONTRACTOR: _____

SUPPLIER NAME AND ADDRESS: _____

_____

_____

MATERIAL:_____ TANK OR BATCH NUMBER: _____

TOTAL QUANTITY CERTIFIED IN THIS TANK OR BATCH:_____ gallons

DATE CERTIFICATE EXPIRES: _____

QUANTITY IN THIS SHIPMENT:_____ gallons

TOTAL QUANTITY SHIPPED TO DATE
FROM CERTIFIED TANK OR BATCH:_____ gallons

I certify that the material indicated above conforms to all applicable requirements of Section 1005 of the Arizona Standard Specifications, including requirements in the contract special provisions, as represented by the attached test results.

_____
Signature and Date

_____
Name

_____
Title

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP

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POLICY AND PROCEDURE DIRECTIVE

James P. Delton
Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 10
SUBJECT: END PRODUCT ASPHALTIC CONCRETE ACCEPTANCE TESTING – PROCEDURE FOR DETERMINATION OF STATISTICAL OUTLIERS	EFFECTIVE DATE: February 27, 2009

1. GENERAL

1.1 This Policy and Procedure Directive supersedes P.P.D. No. 04-1.

1.2 This procedure deals with the problem of outlying observations in sample test results and how to test the statistical significance of them. This procedure is adopted from ASTM E 178 *Dealing with Outlying Observations.* This procedure is intended to be used with end product type asphaltic concrete specifications such as 406, 416, and 417. Either ADOT or the Contractor may raise the question of whether an observation is an outlier.

1.3 An outlying observation, or "outlier," is one that appears to differ significantly from other sample test result values in the same population from which it was taken. Two general alternatives are of interest when considering outliers:

a) The outlying observation may be an extreme value of the population caused by the random variability inherent in the data. If this is the case, the observation should be retained and used in the same manner as the other observations.

b) The outlying observation may be the result of gross deviation from the prescribed sampling and/or testing procedures or an error in calculating or recording the numerical value. If this is the case, the observation should be discarded.

1.4 The procedure below provides the steps to take to make the decision whether,

a) The observation is not an outlier and should not be discarded, or

b) The observation is an outlier and should be discarded.

2. PROCEDURE

2.1 Determine whether a testing related physical reason exists for the outlying test value. If a physical reason exists, the outlying test value is excluded from pay factor calculations. Normally, only the individual test value is excluded; the test results f or the entire sample are only excluded when the physical reason for the outlying test value applies to the entire sample.

2.1.1 Possible physical reasons for excluding a test value include:

a) *Damaging the sample prior to testing*.

b) *Gross deviation from prescribed test procedure*. If it is determined that a gross deviation from the prescribed test procedure has occurred, the resulting observation should be discarded, whether or not it agrees with the rest of the data.

c) *Test equipment malfunction*.

d) *Computational error was made*. If a computation error is found, it may be corrected and the corrected value used as the test result.

e) *The test result is outside the range of possible results.*

2.1.2 The following are examples of reasons that are **NOT** sufficient for excluding a test value:

a) *The sample was taken from a segregated area of the mat.*

b) *The acceptance test results do not agree with the quality control results.*

c) *The core had paint on it.*

d) *The test result is larger/smaller than all the rest.*

e) *The hot plant malfunctioned.* This is an assignable cause for the test result being different, because the material is different. It is not a reason for discarding a sample or a test result.

2.2 When a physical reason cannot be determined for an apparent outlying value the following calculation procedure should be used to determine whether the test result meets statistical criteria as an outlying value.

3. CALCULATION PROCEDURE FOR DETERMINATION OFSTATISTICAL OUTLIERS

3.1 This procedure is based on a two-tailed t-test with a level of significance of 2%, adopted from ASTM E 178 *Dealing with Outlying Observations*. The use of a two-tailed test means that the outlier may be either on the high or the low side of the average. The 2% level of significance means that if it is decided that the value is an outlier, there is only a 2% chance that it is not.

3.1.1 Determine whether there is an assignable cause for the apparent outlier. An assignable cause means that a reason exists for the material being different, forexample:

a) The sample was taken at the end of a truckload.

b) There is visible segregation at that location in the mat.

c) The paver wings were dumped at the sample location.

d) The plant was having problems.

e) The loader operator put the aggregate in the wrong bins.

3.1.1.1 If there is an assignable cause, the sample should not be excluded and the analysis should not proceed.

3.1.2 Identify the sample set to be used in the statistical analysis. The statistical procedure being used bases its criteria on the assumption that the samples are part of a normal population. This means that all samples used in the analysis must be part of the same population. Lots produced under different mix designs (or when there have been significant changes to the mix) are to be considered in different populations and should not be combined for the purpose of determination of statistical outliers. A target value change does not always indicate a significant change to the mix.

CASE 1: Compaction

For determination of statistical outliers in compaction lots, use all of the core results from the lot with the suspected outlier. Thus, n is normally 10 for the determination of compaction outliers.

CASE 2: Mix Properties

For determination of statistical outliers in mix properties, use all of the test results from the lot with the suspected outlier and the two previous lots. Thus, *n* is normally 12 for the determination of mix property outliers.

If there are not two previous lots with the same mix design (or it is the first or second lot in the project), following lots should be used. For example, if the lot containing the suspected outlier is the first lot of a new mix design, use the two following lots in the analysis. If the lot containing the suspected outlier is the second lot of a new mix design, use the previous lot and the following lot in the analysis. If there are not three consecutive lots with the same mix design, the analysis is conducted using only the samples in one or two lots (*n* will be less than12).

3.1.3 Calculate the sample average ($\bar{x}$) and standard deviation (*s*) of ALL of the samples in the sample set using the equations below. The suspected outlier is **NOT** excluded from these calculations.

$$\bar{x} = \frac{\sum x}{n} \qquad (1)$$

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} \qquad (2)$$

Where: $\bar{x}$ = average of sample test values
x = sample test value
n = number of samples
s = standard deviation

NOTE: Round *x* to one decimal place more than the data used to calculate it and *s* to two more decimal places more than the data used to calculate it.

3.1.4 Determine the critical value for *T* from Table 1 using the total number of samples (*n*) in the sampleset.

Table 1
Critical Values for *T* at 2% significance level (two-tailed test)

n	*T*
3	1.155
4	1.492
5	1.749
6	1.944
7	2.097
8	2.221
9	2.323
10	2.410
11	2.485
12	2.550

3.1.5 Determine the lower outlier limit (*LO*) and the upper outlier limit (*UO*) using the equations below.

$$LO = \bar{x} - (T \times s) \qquad (3)$$

$$UO = \bar{x} + (T \times s) \qquad (4)$$

Where: *LO* = lower outlier limit
UO = upper outlier limit
$\bar{x}$ = average of sample test values
T = critical value from Table 1
s = standard deviation

NOTE: Round *LO* and *UO* to the same number of decimal places as the test values.

3.1.6 Provided there is no assignable cause for the occurrence of the test result in question, discard test data which falls outside of the lower and upper outlier limits calculated with equations 3 and 4. The entire sample is not discarded, only the outlying test result.

4. EXAMPLE CALCULATIONS

EXAMPLE 1: Suspected Compaction Outlier

The following 10 core densities were obtained. Is core number 4 an outlier for density? No physical reason or assignable cause could be identified for the low density.

Core	1	2	3	4	5	6	7	8	9	10
Density (pcf)	141.5	141.8	142.3	138.3	141.6	142.0	141.6	141.7	141.0	141.2

$n = 10$

$\bar{x} = 141.30$

$s = 1.117$

From Table 1, $T = 2.410$

$$LO = \bar{x} - (T \times s) = 141.30 - (2.410 \times 1.117) = 138.6$$

$$UO = \bar{x} + (T \times s) = 141.30 + (2.410 \times 1.117) = 144.0$$

Because the density for core number 4 is below the lower outlier limit (*LO*), core number 4 should be discarded and pay factor determinations should be made using the remaining 9 cores. Note that the calculated values for *LO* and *UO* are rounded to the same number of decimal places as the test data, in this case one decimal place.

EXAMPLE 2: Suspected air voids outlier.

The following test results were obtained for three consecutive lots on a project. Is Lot 3, Sample 1 an outlier for air voids? No physical reason or assignable cause could be identified for the high air voids.

Lot 1 Results:

SAMPLE NO.	Bulk Density (pcf)	VOIDS (%)	RICE (pcf)
1	151.8	4.2	158.5
2	152.1	5.8	161.4
3	152.1	4.0	158.5
4	153.2	4.7	160.8

Lot 2 Results:

SAMPLE NO.	Bulk Density (pcf)	VOIDS (%)	RICE (pcf)
1	152.4	4.8	160.0
2	152.7	4.3	159.6
3	152.6	4.3	159.5
4	152.7	3.5	158.3

Lot 3 Results:

SAMPLE NO.	Bulk Density (pcf)	VOIDS (%)	RICE (pcf)
1	149.5	7.3	161.3
2	151.7	5.0	159.7
3	151.9	4.5	159.1
4	151.5	4.9	159.3

$n = 12$

$\bar{x} = 4.78$

$s = 0.981$

From Table 1, $T = 2.550$

$$LO = \bar{x} - (T \times s) = 4.78 - (2.550 \times 0.981) = 2.3$$

$$UO = \bar{x} + (T \times s) = 4.78 + (2.550 \times 0.981) = 7.3$$

The air voids for Lot 3, Sample 1 are equal to the *UO*, thus this value is not an outlier and should be included in the pay factor determination. (The value in question must be outside the lower and upper outlier limits to be considered an outlier.) Note that the

calculated values for *LO* and *UO* are rounded to the same number of decimal places as the test data, in this case one decimal place.

IMPORTANT NOTE: The fact that the bulk density for Sample 1 of Lot 3 is an outlier (see Example 3 below) does not make the air voids an outlier.

EXAMPLE 3: Suspected outlier in bulk density, when it is used to calculate the compaction target value.

The data for this example is from a project where the compaction target is calculated as 98% of the bulk density. Using the data in Example 2 above, is the bulk density for Lot 3, sample 1 an outlier? No physical reason or assignable cause could be identified for the low bulk density.

$n = 12$

$\bar{x} = 152.02$

$s = 0.934$

From Table 1, $T = 2.550$

$$LO = \bar{x} - (T \times s) = 152.02 - (2.550 \times 0.934) = 149.6$$

$$UO = \bar{x} + (T \times s) = 152.02 + (2.550 \times 0.934) = 154.4$$

The bulk density for Lot 3, Sample 1 is below the lower outlier limit (*LO*), thus the bulk density for this sample should be discarded and the compaction target value for Lot 3 should be determined using the average of the remaining 3 bulk densities. Note that the calculated values for *LO* and *UO* are rounded to the same number of decimal places as the test data, in this case one decimal place.

James P. Delton, P.E.
Assistant State Engineer
Materials Group

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP

1221 NORTH 21ST AVENUE PHOENIX, ARIZONA 85009-3740 PHONE (602) 712 - 7231

POLICY AND PROCEDURE DIRECTIVE

James P. Delton
Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 11
SUBJECT: APPROVAL OF LABORATORIES TO PERFORM TESTING OF BEARING PADS FOR THE DEPARTMENT	EFFECTIVE DATE: February 27, 2009

1. GENERAL

1.1 This Policy and Procedure Directive supersedes P.P.D. No. 04-2.

1.2 This Policy and Procedure Directive outlines the procedure for approval of laboratories to perform testing of bearing pads for the Department.

1.3 Testing of bearing pads shall be accomplished in accordance with the requirements of Section 1013 of the ADOT Specifications.

2. REQUIREMENTS

2.1 Laboratories must be approved by the Quality Assurance Section and the Structural Materials Testing Section of the ADOT Materials Group prior to performing testing of bearing pads for the Department.

2.2 A laboratory desiring to perform bearing pad testing for the Department may gain approval for either Fabric Bearing Pads or Elastomeric Bearing Pads, or the laboratory may gain approval for both types of bearing pads.

3. PROCEDURE

3.1 Laboratories desiring to perform testing of bearing pads for the Arizona Department of Transportation shall submit a proposal to the Quality Assurance Engineer, Materials Group. The proposal shall contain the experience and qualifications of the laboratory and its technicians in performing bearing pad testing as required by Section 1013 of the ADOT Specifications. The proposal shall also contain a listing of any certifications that the laboratory has in such testing.

3.2 The Materials Quality Assurance Engineer will review the proposal and with the concurrence of the Materials Structural Testing Engineer shall accept or reject the proposal.

3.3 If the proposal is acceptable, an inspection of the laboratory desiring approval will be scheduled.

3.4. A joint team of members of the Materials Quality Assurance Section and the Materials Structural Testing Section will perform an inspection of the laboratory.

3.5 Approval or denial of the laboratory to perform bearing pad test ing for the Department will be based on the review of the submitted proposal and the results of the inspection. The Materials Quality Assurance Engineer and the Materials Structural Testing Engineer must concur on the approval or denial of the laboratory.

3.6 The Materials Quality Assurance Engineer notifies the laboratory in writing that they have either been granted or denied approval. A laboratory that is approved shall be listed in the ADOT Directory of Approved Testing Laboratories, which is issued by Materials Quality Assurance Section.

3.7 Following initial approval of a testing laboratory, reapproval must be obtained every 24 months. The Materials Quality Assurance Section will schedule inspections of an approved laboratory on a 24 month cycle. The laboratory will not need to submit a new proposal for reapproval unless there have been changes that will affect their approval status.

3.8 Any laboratory which has been approved must notify the Materials Quality Assurance Engineer of any changes in laboratory ownership, location, or managerial personnel within 60 days of when the change occurs. The Materials Quality Assurance Engineer shall also be notified within 30 days of any changes in supervisory and key technical personnel involved in the testing of bearing pads.

James P. Delton, P.E.
Assistant State Engineer
Materials Group

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POLICY AND PROCEDURE DIRECTIVE

James P. Delton
Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 12
SUBJECT: REVIEW OF TEST RESULTS AND ISSUANCE OF TEST REPORTS	EFFECTIVE DATE: February 27, 2009

1. GENERAL

1.1 This Policy and Procedure Directive supersedes P.P.D. No. 04-3.

1.2 This Policy and Procedure Directive provides guidelines for the review of laboratory test results and the issuance of the appropriate test report.

1.3 The *"ADOT System for the Evaluation of Testing Laboratories"* outlines the qualification requirements for individuals responsible for supervising sampling and testing, and for individuals who perform actual sampling and testing.

2. RESPONSIBILITIES

2.1 The test operator shall date, and sign or initial, the test report adjacent to the report of test results for the testing they have completed. Some test reports have a location for the signature of the test operator. Some test reports are designed such that specified standard test methods are indicated. If the test report does not state the test method used, the test method shall be noted on the test report. Any modifications or deviations from the standard test procedure shall also be noted on the test report. Areas are provided for reporting both the test results and the corresponding specification requirements for the required tests. The appropriate test specifications shall be written on the test report to provide the test operator and the lab supervisor with a convenient reference for determining the acceptability of the test results.

2.2 The laboratory supervisor (person accepting technical responsibility for the test report) shall review test results of all testing performed by laboratory personnel under their supervision. In their review, they must ensure that the proper test methods were used, the required tests have been performed, the correct specifications were used, and the test results are recorded correctly. After review and approval of the test results, the lab supervisor shall date and sign the test report, along with noting their title. Test reports that do not have a provision for the signature of the lab supervisor shall be signed, dated, and the notation of their title made in any convenient location on the test report. Any necessary comments shall be recorded on the test report. If an area for comments is not provided, the comments shall be placed in any convenient place on the test report.

2.3 Test reports have boxes labeled as "White", "Yellow", and "Blue" which are used to indicate the acceptance status of the material. The appropriate box shall be marked, as described in Section 3 below.

2.4 Test results shall be promptly reported to the appropriate individual. The person contacted and the date shall be recorded on the test report.

3. ISSUANCE OF TEST REPORTS

3.1 When tests have been completed and the results reviewed, copies of the test report shall be promptly made and distributed to the appropriate individuals. The copies shall be made utilizing the appropriate paper color to indicate the acceptance status of the material. The significance of each of the different colors is as described below:

3.1.1 White test reports are used when the sample complies with all the requirements of the specifications and the material is approved for use.

3.1.2 Yellow test reports are issued when the sample deviates from the specifications and there is provision in the specifications for acceptance of the material with a price reduction. For example, asphalt cement that does not meet the specified requirements for 100 percent of contract unit price may be accepted at a lower percentage.

3.1.3 Blue test reports indicate non-compliance with the specifications. Material with test results reported on a blue sheet is only to be used if specification compliance is obtained through corrective action or through the issuance of a supplemental agreement. If a blue test report is issued on a material already in place, the Engineer will evaluate whether the material will be allowed to remain in place in accordance with Subsection 105.04 of the Specifications.

James P. Delton, P.E.
Assistant State Engineer
Materials Group

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POLICY AND PROCEDURE DIRECTIVE

James P. Delton
Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 13a
SUBJECT: CERTIFICATION AND ACCEPTANCE OF HYDRAULIC CEMENTS, FLY ASH, NATURAL POZZOLAN, SILICA FUME, AND LIME	EFFECTIVE DATE: April 14, 2010

1. GENERAL

1.1 This Policy and Procedure Directive outlines the procedures to be followed for certification and acceptance of hydraulic cements, fly ash, natural pozzolan, silica fume, and lime.

1.2 This Policy and Procedure Directive modifies the certification procedures for hydraulic cements, fly ash, natural pozzolan, and lime. It shall be used in conjunction with the requirements of Subsection 106.05 of the Specifications.

1.3 The certification and acceptance of hydraulic cements, fly ash, natural pozzolan, or lime for use in Portland cement concrete or asphaltic concrete is performed as specified in Section 2.

1.4 The certification and acceptance of silica fume for use in Portland cement concrete is performed as specified in Section 3.

1.5 The certification and acceptance of lime or hydraulic cement for use in soil stabilization (Lime Treated Subgrade, Cement Treated Subgrade, or Cement Treated Base) is performed as specified in Section 4.

1.6 The acceptance of Portland cement and hydrated lime for use in mortar or grout is performed as specified in Section 5.

2. CERTIFICATION AND ACCEPTANCE OF HYDRAULIC CEMENTS, FLY ASH, NATURAL POZZOLAN, OR LIME FOR USE IN PORTLAND CEMENT CONCRETE OR ASPHALTIC CONCRETE

2.1 Hydraulic cement, fly ash, and natural pozzolan used in Portland cement concrete shall conform to the requirements of Section 1006 of the Specifications.

2.2 Portland cement, blended hydraulic cement, and hydrated lime used as a mineral admixture in asphaltic concrete shall conform to the following:

Material	Requirement
Portland Cement, Type I or II	ASTM C 150
Blended Hydraulic Cement, Type IP	ASTM C 595
Hydrated Lime	ASTM C 1097

2.3 The certification and acceptance of hydraulic cements, fly ash, natural pozzolan, or lime for use in Portland cement concrete or asphaltic concrete will be on the basis of the material originating from an Approved Materials Source.

2.4 Approved Materials Source Lists for "Hydraulic Cements", "Fly Ash and Natural Pozzolan", and "Lime (mineral admixture for asphaltic concrete)" are maintained by Materials Group, Structural Materials Testing Section. Current lists are available on the Materials Group, Structural Materials Testing Section homepage through the ADOT intranet (ADOTNet) and the ADOT internet website.

2.5 Project personnel shall verify that materials being used on their project are on the current Approved Materials Source List.

2.6 Certificates of Compliance and Certificates of Analysis are not required to be submitted with deliveries of material.

2.7 No samples of hydraulic cement, fly ash, natural pozzolan, or lime are required.

2.7.1 The Department reserves the right to sample and test material for acceptance from any source without notification.

2.8 Source approval of hydraulic cement, fly ash, natural pozzolan, or lime producers/suppliers will be based on the satisfactory submittal to the Materials Group, Structural Materials Testing Engineer, on a monthly and timely basis, of the following:

2.8.1 A Certificate of Compliance which lists the lots produced during that month.

2.8.2 A separate Certificate of Analysis for each lot shown on the corresponding Certificate of Compliance for that month.

2.8.3 Certificates of Compliance and Certificates of Analysis shall be submitted in electronic format (pdf) to the Structural Materials Testing Engineer at "cert@azdot.gov".

2.9 Examples of typical Certificates of Compliance and Certificates of Analysis are given in the attachments to this Policy and Procedure Directive.

2.9.1 Attachment #1 gives an example of a Certificate of Compliance for cement.

2.9.2 Attachment #2 gives an example of a Certificate of Analysis for cement.

2.9.3 Attachment #3 gives an example of a Certificate of Compliance for fly ash.

2.9.4 Attachment #4 gives an example of a Certificate of Analysis for fly ash.

2.9.5 Certificates of Compliance and Certificates of Analysis for natural pozzolan would be similar to Certificates of Compliance and Certificates of Analysis for fly ash.

2.9.6 Attachment #5 gives an example of a Certificate of Compliance for lime.

2.9.7 Attachment #6 gives an example of a Certificate of Analysis for lime.

2.10 To maintain an active status on the Approved Materials Source List, the producer/supplier shall, on a monthly and timely basis, provide either the required Certificates specified above, or other documentation described below.

2.10.1 If no materials are produced during any given monthly reporting period, the producer/supplier shall so notify the Structural Materials Testing Engineer by email at "cert@azdot.gov".

2.10.2 If no materials are produced during any given monthly reporting period, but materials are shipped from a previously certified lot of material, the producer/supplier shall so notify the Structural Materials Testing Engineer by email at "cert@azdot.gov".

2.10.3 If there is a temporary (more than one month) stop in production of materials from a specific source, the producer/supplier shall so notify the Structural Materials Testing Engineer by email at "cert@azdot.gov".

2.11 If there is a permanent stop in production of materials from a specific source, the producer/supplier shall so notify the Structural Materials Testing Engineer by email at "cert@azdot.gov".

2.12 The suspension of source approval shall be instituted for any of the following reasons. The Structural Materials Testing Engineer will notify the producer/supplier in writing (by letter or email) of such suspension.

(a) The producer/supplier provides materials from an approved source which fail to meet specification requirements to an ADOT project.

(b) The producer/supplier fails to provide the required documents to the Department as specified for the source approval on a monthly and timely basis.

2.12.1 Any suspension shall be in effect until such time that the hydraulic cement, fly ash, natural pozzolan, or lime producer/supplier can demonstrate that the deficiency in the material has been corrected and the product meets specification requirements, and/or the requirements for submittal of the required documents have been met. The Structural Materials Testing Engineer will notify the producer/supplier in writing (by letter or email) of the removal of such suspension.

3. CERTIFICATION AND ACCEPTANCE OF SILICA FUME FOR USE IN PORTLAND CEMENT CONCRETE

3.1 Silica fume used in Portland cement concrete shall conform to the requirements of ASTM C 1240.

3.2 A Certificate of Compliance conforming to the requirements of Subsection 106.05 shall be submitted for each delivery of silica fume.

3.3 No samples of silica fume are required.

3.3.1 The Department reserves the right to sample and test material which has been accepted on the basis of a Certificate of Compliance.

4. CERTIFICATION AND ACCEPTANCE OF LIME OR HYDRAULIC CEMENT FOR USE IN SOIL STABILIZATION (LIME TREATED SUBGRADE, CEMENT TREATED SUBGRADE, OR CEMENT TREATED BASE)

4.1 Lime used in soil stabilization shall conform to the requirements of ASTM C 977 and Section 301 of the Specifications.

4.2 Hydraulic cement used in soil stabilization shall conform to the requirements of Section 302 or Section 304 of the Specifications.

4.3 If desired by the producer/supplier, the acceptance and certification of hydraulic cement used in soil stabilization may be performed as specified in Section 2. Otherwise, a Certificate of Compliance conforming to the requirements of Subsection 106.05 shall be submitted for each delivery of hydraulic cement.

4.4 A Certificate of Compliance conforming to the requirements of Subsection 106.05 shall be submitted for each delivery of lime.

4.5 No samples of lime or hydraulic cement are required.

4.5.1 The Department reserves the right to sample and test material as deemed necessary by the Engineer.

5. ACCEPTANCE OF PORTLAND CEMENT AND HYDRATED LIME FOR USE IN MORTAR OR GROUT

5.1 Portland cement used in mortar or grout shall conform to the requirements of Section 1006 of the ADOT Specifications.

5.2 Hydrated lime used in mortar or grout shall conform to the requirements of ASTM C 207, Type N.

5.3 Certificates of Compliance or Certificates of Analysis are not required.

5.4 Portland cement and hydrated lime used in mortar or grout shall be approved by the Engineer.

5.4.1 If desired by the producer/supplier, the acceptance and certification of Portland cement used in mortar and grout may be performed as specified in Section 2.

5.5 No samples of Portland cement or hydrated lime are required.

5.5.1 The Department reserves the right to sample and test material as deemed necessary by the Engineer.

James P. Delton, P.E.
Assistant State Engineer
Materials Group

Attachments (6)

ACME CEMENT COMPANY
9876 N. Notled Drive
Bigtown, AZ 85555
Phone No. 602-555-4321

CERTIFICATE OF COMPLIANCE

Date: April 29, 2010
Material: Type II/V Portland Cement
Source: Newton Plant

The following lots of Type II/V Portland Cement have been produced during the month of **March 2010** at the Newton Plant in Bigtown, Arizona.

Lot Number
0011562
0011563
0011564
0011565
0011566
0011567
0011568
0011569
0011570

I hereby certify that the Type II/V Portland Cement produced in the lots listed above meets or exceeds the requirements specified in ASTM C 150 and Subsection 1006-2.01 of the Arizona Department of Transportation Specifications.

Respectfully,

(Signature)
Billy B. Bop
General Manager

ACME CEMENT COMPANY
9876 N. Notled Drive
Bigtown, AZ 85555
Phone No. 602-555-4321

CERTIFICATE OF ANALYSIS

Date: April 29, 2010
Material: Type II/V Portland Cement
Source: Newton Plant

The following are the test results for **Lot Number 0011566** of Type II/V Portland Cement produced during the month of **March 2010** at the Newton Plant in Bigtown, Arizona.

TESTS	RESULTS	SPECIFICATIONS	
		TYPE II	TYPE V
Silicon Dioxide (SiO_2), %	20.9		
Aluminum Oxide (Al_2O_3), %	4.0	6.0 max.	
Iron Oxide (Fe_2O_3), %	3.7	6.0 max.	
Calcium Oxide (CaO), %	63.5		
Magnesium Oxide (MgO), %	2.8	6.0 max.	6.0 max.
Sulfur Trioxide (SO_3), %	2.9	3.0 max.	2.3 max.*
Loss on Ignition, %	2.6	3.0 max.	3.0 max.
Insoluble Residue, %	0.52	0.75 max.	0.75 max.
Equivalent Alkalies, %	0.56	0.60 max.	0.60 max.
Carbon Dioxide, (CO_2), %	1.7		
Limestone, %	4.5	5.0 max.	5.0 max
Calcium Carbonate, ($CaCO_3$ in Limestone), %	88	70 min.	70 min.
Potential Composition:			
C_3S, %	51		
C_2S, %	21		
C_3A, %	4	8 max.	5 max
C_4AF, %	11		
$C_3S + 4.75(C_3A)$, %	70	100 max.	
$C_4AF + 2(C_3A)$, %	19		25 max.
Physical Analysis:			
Blaine Fineness, m^2/kg	406	280 min.	280 min.
Air Content, %	7	12 max.	12 max.
Autoclave Expansion, %	0.03	0.80 max.	0.80 max.
3-Day Compressive Strength, psi	3980	1450 min.	1160 min.
7-Day Compressive Strength, psi	5060	2470 min.	2180 min.
28-Day Compressive Strength, psi	6350		3050 min.
Autoclave Expansion, %	0.03	0.80 max.	0.80 max
Initial Vicat, minutes	120	45 min.	45 min.
Mortar Bar Expansion, %	0.010	0.020 max.	0.020 max.

*Must conform to ASTM C 1038 mortar bar expansion limit of 0.020% if the maximum percent specified for SO_3 is exceeded.

I certify that **Lot Number 0011566** of Type II/V Portland Cement, produced during the month of **March 2010** at the Newton Plant, meets or exceeds the requirements specified in ASTM C 150 and Subsection 1006-2.01 of the Arizona Department of Transportation Specifications.

Respectfully,

(Signature)
Billy B. Bop
General Manager

FLYASH R' US
1234 N. Gwegowy Way
Littletown, AZ 85111
Phone No. 602-555-6789

CERTIFICATE OF COMPLIANCE

Date: May 13, 2010
Material: Class F Fly Ash
Source: Ashley Plant

The following lots of Class F Fly Ash have been produced during the month of **March 2010** at the Ashley Plant in Littletown, Arizona.

Lot Number
041562
041563
041564
041565
041566
041567
041568
041569
041570

I hereby certify that the Class F Fly Ash produced in the lots listed above meets or exceeds the requirements specified in ASTM C 618 and Subsection 1006-2.04 of the Arizona Department of Transportation Specifications.

Respectfully,

(Signature)
Mat Erial
President

FLYASH R' US
1234 N. Gwegowy Way
Littletown, AZ 85111
Phone No. 602-555-6789

CERTIFICATE OF ANALYSIS

Date: May 13, 2010
Material: Class F Fly Ash
Source: Ashley Plant

The following are the test results for **Lot Number 041567** of Class F Fly Ash produced during the month of **March 2010** at the Ashley Plant in Littletown, Arizona.

TESTS	RESULTS	SPECIFICATIONS
Silicon Dioxide (SiO_2), %	61.12	
Aluminum Oxide (Al_2O_3), %	22.09	
Iron Oxide (Fe_2O_3), %	5.78	
Sum of SiO_2, Al_2O_3, Fe_2O_3, %	89.99	70 min.
Calcium Oxide (CaO), %	4.79	
Magnesium Oxide (MgO), %	0.98	
Sulfur Trioxide (SO_3), %	0.42	5.0 max.
Sodium Oxide (Na_2O), %	0.87	
Potassium Oxide (K_2O), %	1.30	
Total Alkalies (as Na_2O), %	1.73	
Available Alkalies (as Na_2O), %	0.50	
Moisture Content, %	0.03	3.0 max.
Loss on Ignition, %	0.21	3.0 max.
Amount Retained on No. 325 Sieve, %	26.14	34 max.
Specific Gravity	2.25	
Autoclave Soundness, %	-0.01	0.8 max.
SAI, 7 Days, % of Control	76.5	75 min.*
SAI, 28 Days, % of Control	95.5	75 min.*
Water Required, % of Control	96.3	105 max.

*Meeting the 7 day or 28 day Strength Activity Index will indicate specification compliance.

I certify that **Lot Number 041567** of Class F fly Ash, produced during the month of **March 2010** at the Ashley Plant, meets or exceeds the requirements specified in ASTM C 618 and Subsection 1006-2.04 of the Arizona Department of Transportation Specifications.

Respectfully,

(Signature)
Mat Erial
President

LIME INCORPORATED
4321 South Seger Drive
Middletown, AZ 85999
Phone No. 602-555-9876

CERTIFICATE OF COMPLIANCE

Date: April 2, 2010
Material: Hydrated Lime (ASTM C 1097)
Source: Seger Plant

The following lots of Hydrated Lime (ASTM C 1097) have been produced during the month of **March 2010** at the Seger Plant in Middletown, Arizona.

Lot Number
030110
030810
031510
032210
032910

I hereby certify that the Hydrated Lime produced in the lots listed above meets or exceeds the requirements specified in ASTM C 1097.

Respectfully,

(Signature)
Barbie Que
Vice President, Quality Control

LIME INCORPORATED
4321 South Seger Drive
Middletown, AZ 85999
Phone No. 602-555-9876

CERTIFICATE OF ANALYSIS

Date: April 2, 2010
Material: Hydrated Lime (ASTM C 1097)
Source: Seger Plant

The following are the test results for **Lot Number 030810** of Hydrated Lime (ASTM C 1097) produced during the month of **March 2010** at the Seger Plant in Middletown, Arizona.

TESTS	RESULTS	SPECIFICATIONS
Total Calcium Oxide (CaO) and Magnesium Oxide (MgO), %	97.37	90.0 min.
Carbon Dioxide, %	0.69	5.0 max.
Unhydrated CaO and MgO (Insolubles), %	0.90	5.0 max.
Free Moisture of Dry Hydrates, %	0.40	2.0 max
Retained on No. 30 Sieve, %	0.19	3.0 max.
Retained on No. 200 Sieve, %	5.65	30 max.

I certify that **Lot Number 030810** of Hydrated Lime produced during the month of **March 2010** at the Seger Plant, meets or exceeds the requirements specified in ASTM C 1097.

Respectfully,

(Signature)
Barbie Que
Vice President, Quality Control

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP

1221 NORTH 21ST AVENUE PHOENIX, ARIZONA 85009-3740 PHONE (602) 712- 7231

POLICY AND PROCEDURE DIRECTIVE

TO: ALL MANUAL HOLDERS	PPD NO. 14a
SUBJECT: TESTING AND CERTIFICATION OF BITUMINOUS DISTRIBUTOR TRUCKS	EFFECTIVE DATE: November 5, 2014

1. GENERAL

1.1 Prior to the spreading of bituminous material on any ADOT project, bituminous distributor trucks shall have been tested in accordance with Arizona Test Method 411, "Determination of Bituminous Distributor Truck Transverse Spread Rate", and shall have been certified within 12 months prior to the date of spreading in accordance with the requirements of Subsection 404-3.02(A) of the ADOT Specifications.

1.2 ADOT Regional Materials Engineers are responsible for the certification of bituminous distributor trucks.

1.3 All testing, including the preparation of test pads and test plates, shall be performed by an independent testing laboratory which has been approved by the respective ADOT Regional Materials Engineer. A professional engineer, registered in the State of Arizona and employed by the independent testing laboratory, shall be responsible for all testing and test results.

1.4 The distributor truck owner shall be responsible for all costs associated with the testing performed by the independent testing laboratory.

1.5 Upon completion of testing, the independent testing laboratory shall issue a letter to the owner of the distributor truck. The letter shall include the following:

1.5.1 A statement that the testing was performed in accordance with the requirements of Arizona Test Method 411.

1.5.2 The name and location of the facility where the testing was performed.

1.5.3 The date that the testing was performed.

1.5.4 Identification of the truck for which testing was performed. Such identification shall consist of:

1.5.4.1 Name of the owner of the distributor truck.

1.5.4.2 Truck Number.

1.5.4.3 Truck License Plate Number.

1.5.4.4 Truck Make and VIN Number.

1.5.5 Name of person performing the testing.

1.5.6 Name, signature, and seal of the registered professional engineer responsible for the testing and test results. The date shall be recorded as part of the seal.

1.5.6.1 An example of a typical letter from the independent testing laboratory to the owner of the distributor truck is shown in **Attachment #1**.

1.5.7 A copy of the test results shall be attached to the letter from the independent testing laboratory. The test results shall be sealed, signed, and dated by the engineer responsible for the testing.

1.5.7.1 An example of the test results is shown in **Attachment #2**.

1.6 The owner of the distributor truck shall submit the letter from the independent testing laboratory, along with the accompanying test results, to the respective ADOT Regional Materials Engineer.

1.6.1 The Regional Materials Engineer shall review the submittal from the owner of the distributor truck for accuracy and completeness. If the submittal is satisfactory, the Regional Materials Engineer will approve the test results.

1.6.2 Upon approval of the bituminous distributor truck transverse spread rate test results, the respective ADOT Regional Materials Engineer will issue a completed "Certificate of Test" and a completed "ADOT Bituminous Distributor Truck Certification" sticker to the owner of the distributor truck. Illustrations of a blank Certificate of Test and a blank certification sticker are shown in **Attachment #3** and **Attachment #4**,respectively.

1.7 The owner of the distributor truck shall apply the completed certification sticker to the inside of the driver's side door of the truck in a clearly visible location. The Certificate of Test shall be kept in the distributor truck and shall be readily available for review by the Engineer.

1.8 Bituminous distributor trucks that do not have a valid and current Certificate of Test and ADOT certification sticker will not be allowed to supply bituminous materials on ADOT projects.

1.9 Regardless of certification, the Engineer may at any time require that distributor trucks be tested to determine their acceptability.

Paul T. Burch

Paul T. Burch, P.E.
Assistant State Engineer (Acting)
Materials Group

Attachments (4)

Letterhead of Approved Independent Laboratory
(Name of Laboratory is shown as "ABC" below)

Month, Day, Year

First Name, Last Name
Title of Position Held
Owner of Distributor Truck *(Company Name is shown as "XYZ" below)*
Address
City, State Zip

RE: Bituminous Distributor Truck Certification

Dear *(* _____ *)*,

As requested and authorized by XYZ Company, ABC laboratory has completed testing on the following bituminous distributor truck which is owned and operated by XYZ.

Truck Make: _____ VIN Number: _____

Truck Number: _____ License Plate Number:_____

Testing was performed in accordance with the requirements of Arizona Test Method 411, "Determination of Transverse Distributor Spread Rate".

Testing was conducted by the undersigned at *(name of testing facility)* on (*Date*). Prior to performing the testing, the pads were prepared, weighed, and assembled in accordance with Arizona Test Method 411. Spray bar application of the bituminous material was observed. The pads were removed from the metal sheets and weighed to determine the application rate of the bituminous material. The data was analyzed per Arizona Test Method 411 and Subsection 404-3.02(A) of the ADOT Specifications.

A summary of the test results is attached to this report for your information and review. Please submit this letter, along with the accompanying test results, to the respective ADOT Regional Materials Engineer for their approval and certification of the referenced bituminous distributor truck.

If you have any questions regarding this information, or if we may be of further assistance in any way, please do not hesitate to contact us.

Sincerely,

_____*(Name)*_____

_____*(Title of Position Held)*_____

_____*(Signature)*_____

Reviewed By: _____*(Name)*_____

_____*(Title of Position Held)*____

(Sealed, Signed, and Dated)

Attachment

EXAMPLE OF LETTER FROM THE INDEPENDENT TESTING LABORATORY TO THE OWNER OF THE DISTRIBUTOR TRUCK

(Name of Approved Independent Laboratory)

TRANSVERSE DISTRIBUTOR TRUCK SPREAD RATE

Arizona Test Method 411

DISTRIBUTOR TRUCK OWNER: _____ **TESTED BY:** _____ **DATE:** _____

TRUCK #: _____ **LICENSE PLATE #:** _____ **VIN #:** _____ **SPRAY WIDTH:** _____ **FT.**

TEST FACILITY: _____ **JOB #:** _____

TYPE OF BITUMINOUS MATERIAL USED: _____ **TEMP.:** _____ **TEST RESULT:** **PASS:** X **FAIL:** _____

PAD #	WT. PAD + BIT. MATL	PAD TARE	WT. BIT. MATL	* SPREAD RATE	PAD OUT	REMARKS	PAD #	WT. PAD + BIT. MATL	PAD TARE	WT. BIT. MATL	* SPREAD RATE	PAD OUT	REMARKS
1		8.9	0.0	0.000		OMIT	26	21.0	8.8	12.3	0.132		
2	21.7	8.8	12.8	0.137			27	20.8	8.9	12.0	0.128		
3	21.9	8.9	13.0	0.139			28	20.6	8.8	11.8	0.126		
4	22.0	8.7	13.3	0.142			29	20.9	8.9	12.1	0.129		
5	22.2	8.8	13.3	0.142			30	21.0	8.8	12.3	0.132		
6	21.9	8.8	13.1	0.140			31	20.3	8.9	11.4	0.122		
7	21.5	8.9	12.7	0.136			32	21.2	8.8	12.4	0.133		
8	21.6	8.8	12.8	0.137			33	21.9	8.8	13.2	0.141		
9	21.0	8.8	12.1	0.129			34	21.6	8.8	12.8	0.137		
10	21.7	8.8	12.9	0.138			35	21.8	8.8	13.0	0.139		
11	22.3	8.9	13.4	0.143			36	21.2	8.8	12.4	0.133		
12	20.5	8.9	11.6	0.124			37	21.1	8.8	12.3	0.132		
13	22.0	8.9	13.1	0.140			38	20.0	8.8	11.2	0.120		
14	21.7	8.9	12.8	0.137			39	20.2	8.9	11.3	0.121		
15	21.1	8.9	12.2	0.131			40	21.9	8.8	13.1	0.140		
16	19.6	8.8	10.9	0.117	X		41	21.5	8.8	12.7	0.136		
17	20.9	8.9	12.1	0.129			42	21.8	8.8	13.0	0.139		
18	20.8	8.9	11.9	0.127			43	21.0	8.8	12.2	0.131		
19	20.3	8.9	11.4	0.122			44	21.1	8.8	12.2	0.131		
20	20.9	8.8	12.1	0.129			45	21.7	8.9	12.8	0.137		
21	21.0	8.9	12.2	0.131			46	21.6	8.8	12.8	0.137		
22	20.9	8.8	12.1	0.129			47	22.3	8.8	13.5	0.144		
23	21.2	8.8	12.4	0.133			48	23.0	8.8	14.2	0.152	X	
24	20.7	8.8	11.9	0.127			49	21.5	8.8	12.6	0.135		
25	20.7	8.8	11.9	0.127			50	19.9	8.9	11.0	0.118	X	
				* SPREAD RATE = GALLONS PER SQ. YD.			51		8.8	0.0	0.000		OMIT

TOTAL NUMBER OF PADS OUTSIDE ACCEPTABLE RANGE: 3

AVG. PAD TARE: 8.8

AVG. SPREAD RATE: 0.133 GALS./SQ. YD.

TOTAL SPREAD: 6.5 GALS.

ACCEPTABLE RANGE: UPPER: 0.146 **LOWER:** 0.120

SPECIFICATION LIMITS: Average Spread Rate ±10% or ±0.02 Gallons per Sq. Yd., whichever is less, per Subsection 404-3.02(A)

REMARKS: _____

Tested By: _____ *(Name)*

_____ *(Title of Position Held)*

_____ *(Phone Number)*

_____ *(Signature)*

Reviewed By: _____ *(Name)*

_____ *(Title of Position Held)*

Testing Facility: _____ *(Name)*

_____ *(Address)*

_____ *(City, State, Zip)*

(Sealed, Signed, Dated)

EXAMPLE TEST RESULTS

ADOT
Intermodal Transportation

Certificate of Test

RE: Bituminous Distributor Truck Transverse Spread Rate (Arizona Test Method 411)

Name of Approved Independent
Laboratory Performing Testing: _____

Test Date: _____ Distributor Truck Owner: _____

Truck Make: _____ VIN Number: _____

Truck Number: _____ License Plate Number: _____

Date of Certificate Issuance: _____

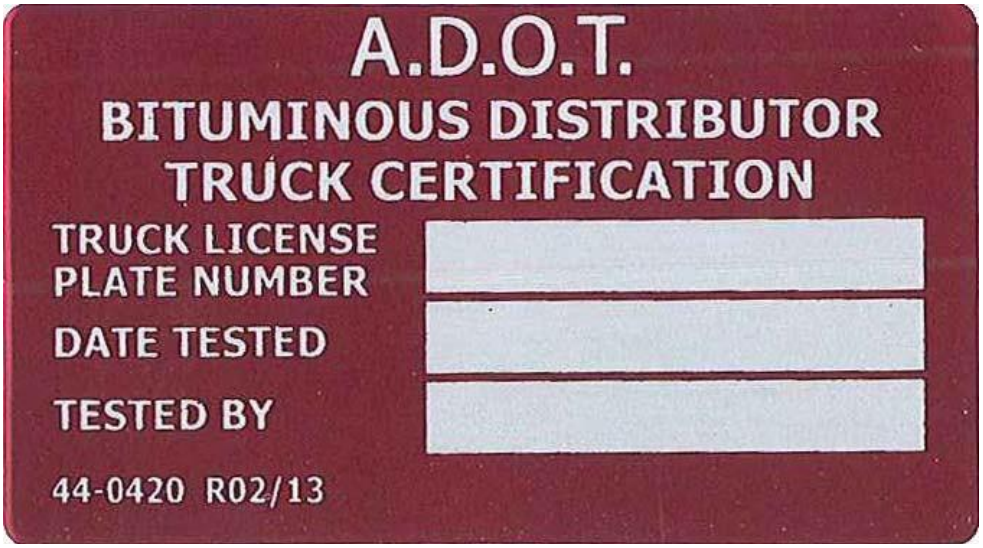
Date of Certificate Expiration: _____

This is to certify that the distributor truck identified above complies with the requirements of Arizona Test Method 411 and Subsection 404-3.02(A) of the ADOT Specifications.

(Region Name) Regional Materials Engineer: _____*(Name)*_____

_____*(Signature)*_____

BLANK CERTIFICATE OF TEST



(Sticker shown above is larger than actual size.)

(Sticker has silver lettering on a red background.)

BLANK ADOT BITUMINOUS DISTRIBUTOR TRUCK CERTIFICATION STICKER

)9 1221 NORTH 21ST AVENUE PHOENIX, ARIZONA 85009-3740 PHONE (602) 712-7231

James P. Delton
Assistant State Engineer

POLICY AND PROCEDURE DIRECTIVE

TO: ALL MANUAL HOLDERS	PPD NO. No. 17
SUBJECT: ACQUISITION, DISPOSAL, AND USE OF ADOT-LICENSED MATERIAL SOURCES AND STOCKPILE SITES	EFFECTIVE DATE: February 27, 2009

1. GENERAL

1.1 This Policy and Procedure Directive (PPD) describes the procedures, roles, and responsibilities for ADOT Districts and Materials Group to acquire, dispose of, and use ADOT-licensed material sources and stockpile sites. The PPD also advises District and contractor personnel in how to obtain approval to use ADOT-licensed material sources for construction projects. This PPD requires involvement by the Materials Group and the Districts in locating and identifying proposed sites, as well as disposing of sites that are no longer needed. Input from each construction and maintenance Org is imperative to locating new sites and making recommendations to expand or dispose of existing sites.

2. ACQUISITION AND DISPOSAL PROCEDURES

2.1 The ADOT Materials Group, Material Source Supervisor (MSS) will arrange for material sources and stockpile sites, statewide. Stockpile sites that Materials Group will secure for District use include the following:

- sites that have stockpiles only
- sites that have no equipment storage (temporary storage activities are acceptable)
- sites that have no facilities (buildings, restrooms, fueling stations)

2.2 The District personnel and the MSS will continually seek opportunities for developing new material sources and stockpile sites. Input from the Resident Engineer, Maintenance Engineer, State Geotechnical Design Engineer, and land manager or owner will be critical in locating sources/sites suitable for project needs. However, in most cases, the State Materials Engineer and the District Engineer must be agreeable to obtaining or disposing of any material source or stockpile site.

2.3 The MSS will submit an application (SF-299) to the federal land managing agency to identify the need for a new, or renewal of the, license. The term "license" applies to Special Use Permits, Letters of Consent (Title 23 Appropriation), Operational Agreements, Haul Road Easements, and other documents for which the State Materials Engineer has delegated authority. The MSS, or designated representative, will be the sole point of contact with the land

manager. If the source/site is located on private land, the same protocol exists, except a letter or phone call (rather than submitting the SF-299) to the private land owner will be initiated by the MSS.

2.4 Materials Group will coordinate with the District to delineate the material source or stockpile site boundaries. Materials Group will obtain title reports, obtain aerials, sketch the boundary, provide legal descriptions, initiate geotechnical investigations, and request environmental clearance from the ADOT Office of Environmental Services (OES), or in some cases, from the land manager.

2.5 The MSS will coordinate all licensing activities with the District Engineer, or designated representative. The State Materials Engineer, or designated representative, will coordinate with ADOT Risk Management regarding the terms of the license. All permits and licenses shall be reviewed by a representative of the Attorney General's office. The State Materials Engineer will sign the license issued.

2.6 Prior to disposal of a material source or stockpile site, the District Engineer must approve that the disposal process may commence. Reclamation/restoration of the source/site will be completed prior to any action taking place.

2.7 The MSS will work with the ADOT Materials Right-of-Way Agent to facilitate the disposal process.

3. USE OF ADOT-LICENSED SOURCES BY CONTRACTORS

3.1 The Resident Engineer (RE) will ensure that the contractor supplies a new environmental assessment anytime an ADOT-licensed source is proposed for a project. The environmental assessment form will need to have the following attachments:

- copy of the license or permit from the land manager or owner,
- copy of the most current environmental determination or analysis,
- project-specific plan of operations,
- project-specific reclamation/restoration plan, and
- Erosion and Pollution Control Plan (EPCP), or Stormwater Pollution Prevention Plan (SWPPP), as required in Section 3.4.

3.2 The RE will review and submit the documents listed in Section 3.1 to the MSS, who will review and forward the items to the land manager or owner, as appropriate. Review and approval of these documents must be completed by the RE, MSS, and land manager or owner, prior to the contractor bringing any equipment on site.

3.3 The RE will ensure that the contractor adheres to the approved project-specific plan of operation and the approved reclamation/restoration plan. Following these approved plans will ensure that the contractor continues to work toward the goal of remediation while conducting activities such as mining, blasting, and stockpiling. To the extent practicable, any

changes to these plans shall be approved by the MSS, the land manager or owner, and the District prior to any additional work being conducted on-site.

3.4 The RE will ensure that the source/site is included in the SWPPP or EPCP for the construction project. If the construction project does not require a SWPPP or an EPCP, the contractor shall prepare and implement a SWPPP or an EPCP for ancillary facilities; for example, the haul road and the entire pit boundary (as depicted on the plat map and pit sketch). Implementation, inspection, and maintenance of the Best Management Practices (BMPs) will be the responsibility of the District or contractor.

3.5 The RE will provide Materials Group with any revisions to all required documents and all inspection reports upon completion of the project, unless changes are as specified in Section 3.3.

3.6 Representatives from Materials Group and the District, the land manager or owner, and the contractor shall meet on-site no sooner than one week prior to project completion to ensure that restoration activities are being completed as proposed.

4. SUMMARY

4.1 The MSS will facilitate licensing by coordinating efforts between Materials Group, the District, the Right-of-Way agent, the OES, and the land managing agency or owner. All questions or concerns regarding new or existing material sources/sites will be directed to the MSS. Implementing this policy will require cooperation and involvement between Materials Group, Districts, and the OES. This policy is visualized as an opportunity to distribute responsibility, streamline license processing and contractor submittals, maintain our commitment to effective partnering while building teamwork, and most importantly to allow consistent operations statewide.

James P. Delton, P.E.
Assistant State Engineer
Materials Group

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP

1221 NORTH 21ST AVENUE PHOENIX, ARIZONA 85009-3740 PHONE (602) 712- 7231

POLICY AND PROCEDURE DIRECTIVE

James P. Delton
Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 18
SUBJECT: DETERMINING SAMPLE TIMES AND LOCATIONS FOR END PRODUCT ASPHALTIC CONCRETE	EFFECTIVE DATE: February 27, 2009

1. GENERAL

1.1 This procedure outlines the requirements for determining sample times and locations for end product asphaltic concrete.

1.2 The acceptance of end product asphaltic concrete is based on statistical methods, making it critical that random samples be obtained. If random samples are not obtained, the test results may not reflect the true characteristics of the material being evaluated.

1.3 Material should not be excluded from the random sampling process just because it appears to be segregated or non-uniform. With the exception of those areas outlined in the Specifications to be excluded from testing, all material that is placed on the project must be considered. The only way that the test results will give a true picture of all the material included in the project is if samples are taken randomly from all the material placed. It is the nature of random sampling that some of the samples will represent below average material, while others will represent above average material.

1.4 The sample times and locations determined by this procedure should not be shared with the contractor until just prior to the sample being obtained, or in the case of core locations, until compaction of the lot is completed.

1.5 On rare occasion, it may be necessary to modify the requirements of this procedure due to plant breakdowns, weather, or other unexpected circumstances. In those cases, the Engineer and contractor must work together to identify the best solution which most closely adheres to the intent of this procedure. That may involve a split lot, obtaining fewer samples than required by specification, or obtaining a sample prior to the time required in cases where the operation is unexpectedly shut down.

2. STRATIFIED RANDOM SAMPLING

2.1 In order to ensure that samples represent the true characteristics of the entire lot being tested, a stratified random sampling procedure shall be incorporated into the sampling process. This is accomplished by dividing the lot into sublots. The quantity associated with each sublot is determined by dividing the lot by the number of samples required. Sample times and locations for each sublot are then determined on a random basis. Specific procedures to be followed for selecting sample times for a mixture properties lot and locations for a compaction lot are described below.

3. SAMPLE TIMES FOR MIXTURE PROPERTIES LOT

3.1 Sampling for mixture properties will be based on time or tonnage. When paving is expected to be sporadic during a given shift, it may be more appropriate to sample for mix properties based on tonnage rather than time.

3.2 In order to determine sample times, the expected duration of the paving shift is first divided by the number of samples to determine the duration of each sublot. The sample time within each sublot is then determined on a random basis. This is accomplished by multiplying a random number by the duration of the sublot, and adding that value to the beginning time of the sublot to be sampled. If the duration of the shift changes after production begins, sample times for the remaining samples should be determined using the expected time left in the shift as well as the number of remaining samples.

3.3 The contractor should be expected to obtain an acceptance sample as soon as possible after being notified that a sample is required. Typically the sample should be obtained within 5 minutes of the request.

3.4 Example 1 and Example 2 below illustrate how sample times are determined.

EXAMPLE 1:

The contractor plans to pave from 7:00 am to 5:00 pm. Four plate samples are required based on the specifications for end product asphaltic concrete paving. Determine stratified random sample time for this scenario.

First, divide the lot into four sublots;

10 hour shift / 4 samples per shift = 2.5 hours per sublot

Sublot 1 is from 7:00 am to 9:30 am
Sublot 2 is from 9:30 am to 12:00 pm
Sublot 3 is from 12:00 pm to 2:30 pm
Sublot 4 is from 2:30 pm to 5:00 pm

Then, determine the specific time to sample each sublot;

Random numbers are generated in accordance with Attachment #1. For the sake of this example, assume the four random numbers generated are 0.502, 0.452, 0.841 and 0.046.

Multiply each random number by the duration of the sublot;

0.502 x (2.5 hours) = 1.255 hours
0.452 x (2.5 hours) = 1.130 hours
0.841 x (2.5 hours) = 2.103 hours
0.046 x (2.5 hours) = 0.115 hours

Add the interval determined above to the start time of the sublot to determine actual sample time;

Sample 1 to be taken at 7:00 am plus 1.255 hours = 8:15 am
Sample 2 to be taken at 9:30 am plus 1.130 hours = 10:38 am
Sample 3 to be taken at 12:00 pm plus 2.103 hours = 2:06 pm
Sample 4 to be taken at 2:30 pm plus 0.115 hours = 2:37 pm

EXAMPLE 2:

Assume sample times are determined as shown above in Example 1. However, at 12:45 pm the contractor informs you that they will quit paving at 3:00 pm.

Sample 1 and Sample 2 have already been taken at the times determined in Example 1. At 12:45 pm there are 2 hours and 15 minutes (2.250 hours) remaining in the shift. The stratified random sample times for the two remaining samples are determined as follows.

First, divide the remaining time in the shift into two sublots;

2.250 hour shift / 2 samples per shift = 1.125 hours per sublot

Sublot 3 is from 12:45 pm to 1:53 pm
Sublot 4 is from 1:53 pm to 3:00 pm

Then, determine the specific time to sample each remaining sublot;

Two new random numbers are generated in accordance with Attachment #1. For the sake of this example, assume the two random numbers generated are 0.208 and 0.745.

Multiply each random number by the duration of the sublot;

0.208 x (1.125 hours) = 0.234 hours
0.745 x (1.125 hours) = 0.838 hours

Add the interval determined above to the start time of the sublot to determine actual sample time;

Sample 3 to be taken at 12:45pm plus 0.234 hours = 12:59 pm
Sample 4 to be taken at 1:53pm plus 0.838 hours = 2:43 pm

3.5 When sampling for mixture properties is based on tonnage, the total tonnage expected for the lot is divided by the number of required samples to determine the quantity of material in each sublot. A random sample is obtained from each sublot using random numbers generated in accordance with Attachment #1.

3.6 Example 3 below illustrates how to determine sampling based on tonnage.

EXAMPLE 3:

The contractor plans to place 1800 tons of mix during a given shift. Four plate samples are required based on the specifications for end product asphaltic concrete paving. Determine stratified random sample tonnages for this scenario.

First, divide the lot into four sublots;

1800 tons / 4 samples per shift = 450 tons per sublot

Sublot 1 is material between 0 and 450 tons
Sublot 2 is material between 450 and 900 tons
Sublot 3 is material between 900 and 1350 tons
Sublot 4 is material between 1350 and 1800 tons

Then, determine the specific tonnage when each sample should be taken;

Random numbers are generated in accordance with Attachment #1. For the sake of this example, assume the four random numbers generated are 0.731, 0.344, 0.502 and 0.245.

Multiply each random number by the tonnage in each sublot;

0.731 x (450 tons) = 329 tons
0.344 x (450 tons) = 155 tons
0.502 x (450 tons) = 226 tons
0.245 x (450 tons) = 110 tons

Add the tonnage determined above to the tonnage at the beginning of the sublot to determine the sample tonnage;

Sample 1 to be taken at 0 plus 329 tons = 329 tons
Sample 2 to be taken at 450 plus 155 tons = 605 tons
Sample 3 to be taken at 900 plus 226 tons = 1126 tons
Sample 4 to be taken at 1350 plus 110 tons = 1460 tons

4. SAMPLE LOCATIONS FOR COMPACTION LOT

4.1 Sampling for compaction will be based on the area paved, and requires determining a random station and offset for each sample location. When possible, areas to be excluded from testing, as allowed by the specifications and the Engineer, should be eliminated prior to determining the sample locations. It is not acceptable to arbitrarily move a sample a short distance from its determined location because it falls in an area excluded from testing. Rather, when a sample location falls within an area that is not subject to testing a new random location shall be determined for that sample.

4.2 In order to determine sample locations, the total length paved is first divided by the number of samples to determine the length of each sublot. The station limits for each sublot are then calculated followed by the random sample location within each sublot. The sample station is calculated by multiplying a random number by the length of the sublot , and adding that length to the beginning station of the sublot to be sampled. The offset distance is calculated by multiplying a separate random number by the width of the pavement subject to testing, at the station calculated above.

NOTE: In many cases the width subject to testing will be less than the total width that was paved. The width used in calculating the random offset should be determined based on the top surface of the mat, excluding any slope or other area excluded by specification from testing requirements.

4.3 Figure 1 illustrates typical locations to be excluded from testing on a multiple pass paving operation.

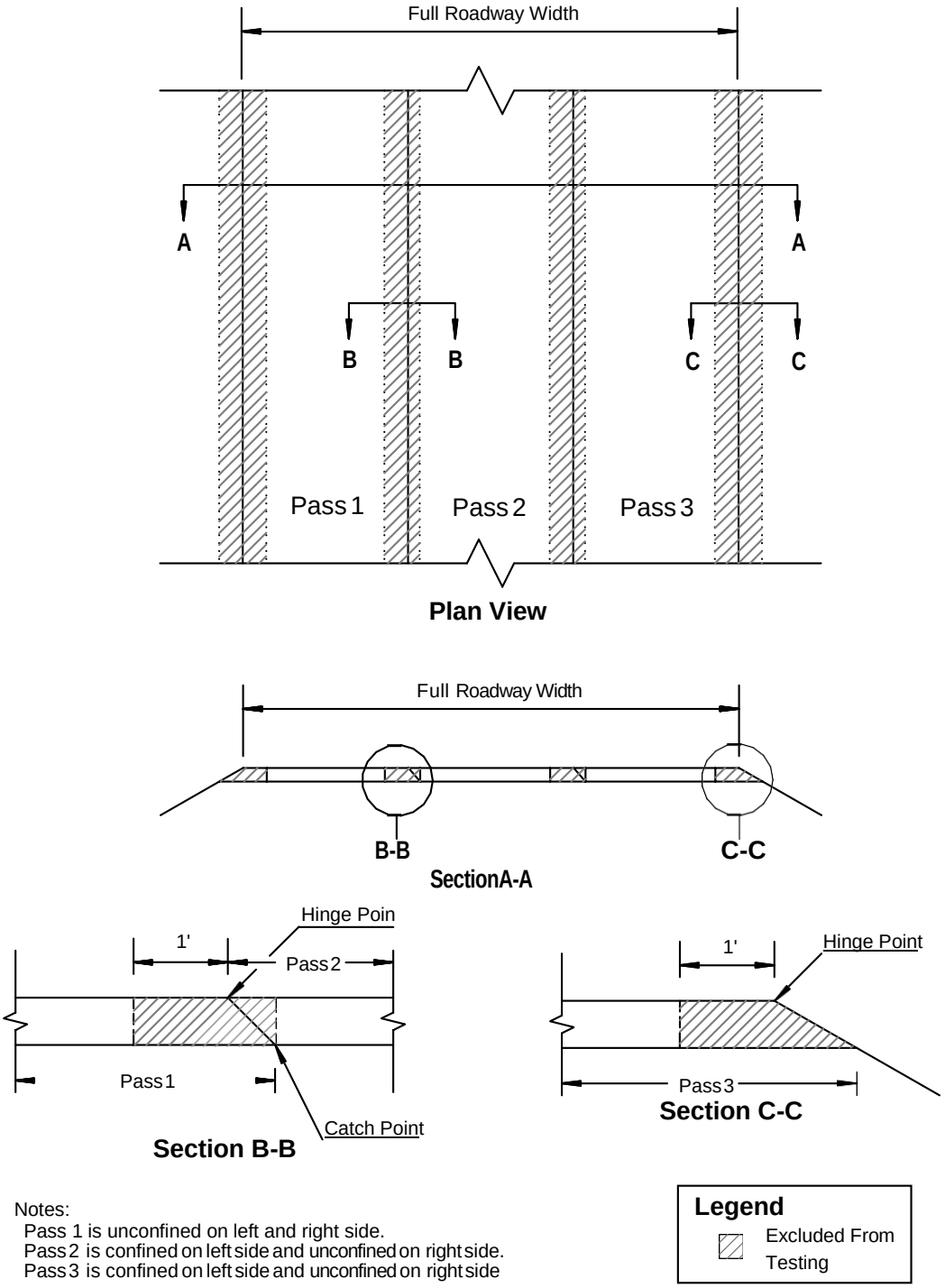


Figure 1
(Not to Scale)

4.4 Example 4 and Example 5 below illustrate how sample locations are determined.

EXAMPLE 4:

The contractor has paved an area as illustrated in Figure 2. The area paved is 6000 feet long and the width varies between 12 and 16 feet, not including the 3:1 slope along the unconfined edge of pavement. The left side of the mat is confined between Sta 10+00 and Sta 46+00 by a previous lot. The left side of the mat between Sta 46+00 and Sta 70+00, as well as the entire right side of the mat, is unconfined. The specifications exclude from testing the outside 1 foot of the unconfined edge. Ten core samples are required based on the specifications for end product asphaltic concrete paving. Determine the stratified random sample locations for this scenario.

First, divide the lot into ten sublots;

Length of Sublot = 6000 feet / 10 cores per lot = 600 feet

Sublot 1 is from Sta 10+00 to 16+00
Sublot 2 is from Sta 16+00 to 22+00
Sublot 3 is from Sta 22+00 to 28+00
Sublot 4 is from Sta 28+00 to 34+00
Sublot 5 is from Sta 34+00 to 40+00
Sublot 6 is from Sta 40+00 to 46+00
Sublot 7 is from Sta 46+00 to 52+00
Sublot 8 is from Sta 52+00 to 58+00
Sublot 9 is from Sta 58+00 to 64+00
Sublot 10 is from Sta 64+00 to 70+00

Then, determine the specific location to be sampled from each sublot;

Random numbers are generated in accordance with Attachment #1. Two random numbers are required for each sample location; one for the station, and one for the offset. For the sake of this example, assume the random numbers generated are as follows:

Random Numbers for Stationing:

0.475, 0.721, 0.496, 0.272, 0.458, 0.694, 0.410, 0.150, 0.055, 0.455

Random Number for Offsets:

0.056, 0.939, 0.839, 0.800, 0.705, 0.047, 0.236, 0.991, 0.170, 0.699

Multiply the first random number (Stationing) by the length of the sublot, and add that to the beginning station of the sublot. Multiply the first random number (Offsets) by the width subject to testing. Round the station to the nearest 1 foot and the offset to the nearest 0.5 foot. The resulting station and offset determines the location for the sample. The process is continued for each sublot;

Sample 1: Station = (0.475 x 600) + Sta 10+00 = Sta 12+85
Offset = (0.056 x 11) = 0.5 ft

Sample 2: Station = (0.721 x 600) + Sta 16+00 = Sta 20+33
Offset = (0.939 x 11) = 10.5 ft

Sample 3: Station = (0.496 x 600) + Sta 22+00 = Sta 24+98
Offset = (0.839 x 11) = 9.0 ft

Sample 4: Station = (0.272 x 600) + Sta 28+00 = Sta 29+63
Offset = (0.800 x 12.45) = 10.0 ft

NOTE: The pavement width at this location varies. The actual width of pavement at each station must be calculated in order to determine the sample offset.

Sample 5: Station = (0.458 x 600) + Sta 34+00 = Sta 36+75
Offset = (0.705 x 15) = 10.5 ft

Sample 6: Station = (0.694 x 600) + Sta 40+00 = Sta 44+16
Offset = (0.047 x 15) = 0.5 ft

Sample 7: Station = (0.410 x 600) + Sta 46+00 = Sta 48+46
Offset = (0.236 x 14) = 3.5 ft

Sample 8: Station = (0.150 x 600) + Sta 52+00 = Sta 52+90
Offset = (0.991 x 14) = 14.0 ft

Sample 9: Station = (0.055 x 600) + Sta 58+00 = Sta 58+33
Offset = (0.170 x 14) = 2.5 ft

Sample 10: Station = (0.455 x 600) + Sta 64+00 = Sta 66+73
Offset = (0.699 x 14) = 10.0 ft

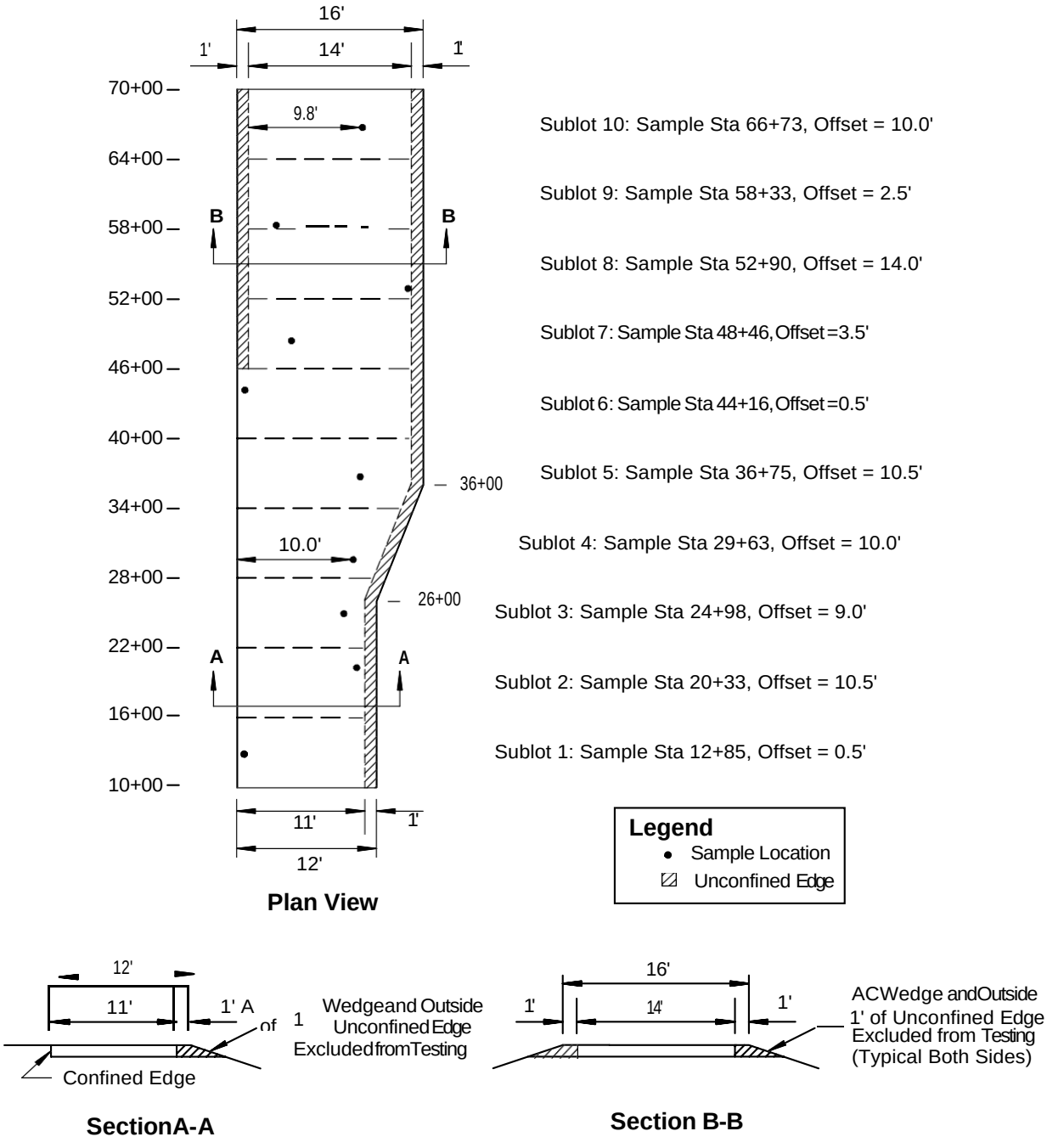


Figure 2
(Not to Scale)

EXAMPLE 5:

Assume the same conditions as outlined in Example 4. However, when laying out Sample 9 it is discovered that a manhole exists at the sample location.

When a sample location falls within an area not subject to testing, a new random location must be determined. It is not acceptable to arbitrarily move a sample location.

Determine a new sample location for Sample 9;

For the sake of this example, assume the new random numbers generated are as follows:

Random number for new station: 0.730

Random number for new offset: 0.412

Sample 9: Station = (0.730 x 600) + Sta 58+00 = Sta 62+38
Offset = (0.412 x 14) = 6.0 ft

James P. Delton, P.E.
Assistant State Engineer
Materials Group

Attachment (1)

METHODS FOR SELECTING RANDOM NUMBERS

There are several acceptable methods for selecting random numbers including the use of a calculator, computer spreadsheet, or a random number table.

1) Many calculators have a random number function that can be used to determine random numbers. Each calculator is different and the user should review the manual for a given calculator to determine how to use this function. Sets of random numbers may be generated directly from the calculator by repeated use of this function.

2) Most computer spreadsheets also have a function to generate random numbers. A procedure similar to that described above for calculators can be used to generate a set of random numbers using a computer spreadsheet.

3) In order to properly use a random number table, two "seed" numbers must first be selected to determine a starting row and column within the table. Seed numbers may be determined using a calculator or computer spreadsheet as described above, or they can be determined by "pointing". To select seed numbers by pointing, place the random number table in front of you and with your eyes closed place a pointer on the table to select the seed number. Suitable pointers would be any devise with a small tip including a pen or mechanical pencil.

   Once two seed numbers are selected, they can be used to determine the starting point for selecting random numbers within the random number table. The first seed number should be multiplied by the number of rows in the table. That product is rounded to the nearest whole number and determines the row for the starting point. The second seed number should be multiplied by the number of columns in the table. That product is rounded to the nearest whole number and determines the column for the starting point. The random number at the intersection of the starting row and column is the first random number used in determining the random sample location. Additional random numbers are selected by moving to the right along the row, or down along the column, until the required number of random numbers are generated. Once the end of a row or column is reached, simply start at the beginning of the next row or column to continue recording random numbers.

4) As an alternate to the methods given above for determining random numbers, the standard practice described in ASTM D3665, "Practice for Random Sampling of Construction Materials", can be used if desired.

	1	2	3	4	5	6	7	8	9	10
1	0.566	0.282	0.133	0.355	0.016	0.915	0.813	0.695	0.524	0.309
2	0.706	0.702	0.539	0.107	0.557	0.981	0.959	0.393	0.069	0.746
3	0.113	0.924	0.855	0.781	0.755	0.326	0.071	0.642	0.153	0.646
4	0.129	0.688	0.575	0.584	0.073	0.615	0.384	0.058	0.053	0.992
5	0.031	0.224	0.400	0.324	0.886	0.171	0.768	0.164	0.036	0.921
6	0.944	0.986	0.295	0.664	0.226	0.963	0.546	0.151	0.881	0.586
7	0.484	0.377	0.246	0.852	0.444	0.004	0.335	0.198	0.222	0.078
8	0.193	0.824	0.184	0.828	0.442	0.859	0.890	0.797	0.104	0.571
9	0.872	0.042	0.191	0.650	0.630	0.941	0.091	0.826	0.491	0.519
10	0.213	0.795	0.464	0.773	0.648	0.622	0.024	0.870	0.604	0.056
11	0.606	0.522	0.511	0.408	0.480	0.386	0.460	0.297	0.666	0.344
12	0.446	0.155	0.788	0.595	0.178	0.488	0.961	0.684	0.448	0.639
13	0.500	0.804	0.990	0.999	0.917	0.375	0.426	0.761	0.839	0.770
14	0.879	0.841	0.293	0.697	0.497	0.202	0.120	0.932	0.082	0.559
15	0.240	0.486	0.422	0.679	0.064	0.553	0.440	0.366	0.357	0.850
16	0.764	0.466	0.904	0.884	0.579	0.662	0.238	0.051	0.373	0.562
17	0.753	0.719	0.262	0.200	0.699	0.997	0.515	0.127	0.806	0.713
18	0.109	0.682	0.289	0.637	0.628	0.741	0.910	0.830	0.027	0.431
19	0.060	0.395	0.369	0.206	0.313	0.244	0.304	0.009	0.710	0.817
20	0.131	0.147	0.864	0.528	0.140	0.937	0.597	0.790	0.801	0.451
21	0.766	0.810	0.608	0.799	0.218	0.471	0.435	0.919	0.173	0.617
22	0.095	0.204	0.673	0.535	0.300	0.599	0.286	0.093	0.482	0.100
23	0.397	0.693	0.952	0.229	0.302	0.089	0.613	0.317	0.868	0.759
24	0.284	0.593	0.737	0.135	0.269	0.258	0.544	0.946	0.717	0.266
25	0.002	0.195	0.411	0.551	0.124	0.311	0.906	0.044	0.271	0.437
26	0.728	0.329	0.473	0.337	0.175	0.404	0.273	0.977	0.675	0.331
27	0.815	0.115	0.577	0.633	0.939	0.315	0.098	0.306	0.102	0.138
28	0.591	0.362	0.186	0.644	0.568	0.901	0.624	0.948	0.690	0.162
29	0.029	0.757	0.793	0.291	0.049	0.837	0.537	0.655	0.526	0.322
30	0.013	0.433	0.382	0.346	0.349	0.892	0.144	0.602	0.508	0.808
31	0.908	0.351	0.928	0.080	0.158	0.180	0.555	0.075	0.744	0.364
32	0.708	0.160	0.209	0.231	0.122	0.517	0.775	0.417	0.424	0.320
33	0.189	0.877	0.453	0.233	0.844	0.406	0.777	0.260	0.735	0.220
34	0.930	0.748	0.988	0.242	0.950	0.857	0.380	0.504	0.730	0.875
35	0.333	0.888	0.897	0.513	0.653	0.087	0.912	0.167	0.249	0.255
36	0.895	0.468	0.786	0.169	0.704	0.668	0.018	0.972	0.111	0.280
37	0.784	0.833	0.391	0.142	0.118	0.278	0.819	0.067	0.686	0.402
38	0.955	0.415	0.420	0.040	0.821	0.033	0.211	0.935	0.475	0.251
39	0.619	0.493	0.084	0.235	0.462	0.353	0.506	0.899	0.722	0.011
40	0.340	0.020	0.750	0.564	0.724	0.975	0.626	0.957	0.253	0.670
41	0.371	0.926	0.360	0.038	0.428	0.455	0.966	0.007	0.548	0.531
42	0.495	0.477	0.611	0.182	0.657	0.149	0.848	0.588	0.342	0.726
43	0.635	0.835	0.022	0.779	0.979	0.062	0.275	0.995	0.533	0.866
44	0.582	0.457	0.739	0.264	0.677	0.542	0.983	0.413	0.968	0.389
45	0.861	0.659	0.970	0.715	0.502	0.846	0.047	0.573	0.733	0.215

Random Number Table

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP

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POLICY AND PROCEDURE DIRECTIVE

TO: ALL MANUAL HOLDERS	PPD NO. 20a
SUBJECT: GUIDANCE ON THE USE OF RECLAIMED ASPHALT PAVEMENT (RAP) IN ASPHALTIC CONCRETE	EFFECTIVE DATE: April 19, 2013

1. GENERAL

1.1 Reclaimed asphalt pavement (RAP) may be used in asphaltic concrete provided it is allowed per Specification.

1.2 This Policy and Procedure Directive was developed to provide guidance to those involved in the production of asphaltic concrete containing RAP. It assumes the reader has a general understanding of the requirements for mixtures which do not contain RAP.

1.3 References contained herein to "ARIZ 428" are defined as "Arizona Test Method 428".

2. TERMS

2.1 Asphaltic concrete with RAP consists of a mixture of virgin aggregate, virgin binder, RAP, and mineral admixture.

2.1.1 Virgin aggregate consists of mineral aggregate not previously used.

2.1.2 Virgin binder consists of asphalt cement not previously used.

2.1.3 RAP consists of salvaged, milled, pulverized, broken, or crushed asphalt pavement. For purposes of the Specification, RAP is made up of two main components: RAP aggregate and RAP binder.

2.1.3.1 RAP aggregate consists of the aggregate portion of the reclaimed asphalt pavement.

2.1.3.2 RAP binder consists of the binder, or asphalt cement, portion of the reclaimed asphalt pavement.

2.2 When the term "aggregate" is used without being further described as "RAP" or "Virgin", the intended meaning is the total aggregate used in the mixture. Also note that the term "aggregate" is used interchangeably with "mineral aggregate".

2.3 When the term "binder" is used without being further described as "RAP" or "Virgin", the intended meaning is the total binder used in the mixture. Also note that the term "binder" is use interchangeably with "bituminous material", "asphalt cement", and "asphalt".

2.4 The specifications are very deliberate in their use of the terms "RAP" and "Virgin" when describing aggregate or binder. Therefore, it is important that the user be familiar with these definitions and read the specifications carefully.

3. LIMITS ON RAP USAGE

3.1 The amount of RAP material allowed in asphaltic concrete is limited by both a maximum RAP aggregate contribution and a maximum RAP binder contribution to the mixture. In addition, production and testing requirements vary depending on the amount of RAP aggregate and RAP binder in the mixture.

3.1.1 A maximum of 25% RAP aggregate, by weight of total aggregate in the mix, may be used in mixes placed in a lower lift (minimum 2" below finished surface). A maximum of 20% RAP aggregate, by weight of total aggregate in the mix, may be used at all other locations.

3.1.2 A maximum of 25% RAP binder, by weight of total binder in the mix, may be used in mixes placed in a lower lift (minimum 2" below finished surface). A maximum of 20% RAP binder, by weight of total binder in the mix, may be used at all other locations.

3.2 When less than or equal to 15% RAP aggregate is used, by weight of the total aggregate in the mix, all RAP material must pass the 1¼ inch sieve.

3.3 When more than 15% RAP aggregate is used, by weight of the total aggregate in the mix, the RAP must be processed into uniform coarse and fine stockpiles meeting the gradation requirements of the specifications, and such that there will be a minimum amount of fines.

3.4 When less than or equal to 15% RAP binder is used, by weight of the total binder in the mix, no testing is required on the RAP binder properties during the mix design process.

3.5 When more than 15% RAP binder is used, by weight of the tota l binder in the mix, the RAP binder must be extracted, recovered, and tested during the mix design process. Depending on the results of these tests, the grade of virgin binder supplied to the project may need to be different than the grade specified in the bid documents. A different virgin binder

grade may be required to ensure the blend of virgin and RAP binder meets the grade specified in the bid documents. The virgin binder grade delivered to the project shall be as specified in the approved mix design.

3.6 There are no specific restrictions on the source of RAP material for a project. However, the contractor is responsible to determine the suitability of the RAP proposed for use regardless of its source.

4. SAMPLING AND TESTING

4.1 The sampling and testing of asphaltic concrete containing RAP is similar to non-RAP mixtures, with some important differences. These differences deal primarily with aggregate properties and asphalt cement content. For mixtures containing RAP, the RAP binder must be tracked separately from the virgin binder. This requires additional sampling, testing, data collection, and calculations.

4.2 During production of asphaltic concrete, sampling and testing is required on the following materials:

4.2.1 Mineral Aggregates (See Section 5 for details.)

4.2.2 Virgin Binder (See Section 6 for details.)

4.2.3 RAP Material (See Sections 7 and 8 for details.)

4.2.4 Asphaltic Concrete (See Section 9 for details.)

4.3 Additional contractor quality control is required for an asphaltic concrete mixture containing RAP. See the project specifications for specific requirements.

5. SAMPLING AND TESTING OF MINERAL AGGREGATES

5.1 Virgin mineral aggregate will be sampled in accordance with Arizona Test Method 105.

5.2 Requirements for the sand equivalent and uncompacted void content are on the composite of the virgin aggregates only. Samples will be obtained from the cold feed belt prior to the addition of admixture, or from the stockpiles when sampling from the cold feed belt is not possible.

5.3 The requirement for fractured coarse aggregate particles is on the composite of the virgin aggregate and RAP aggregate material. The aggregate material for determining fractured coarse aggregate particles will normally come from an asphaltic concrete sample taken and tested for binder content and gradation in accordance with ARIZ 428. However, if the

engineer determines that excessive breakdown of the aggregate has occurred due to the use of the ignition furnace, the fractured coarse aggregate particles testing will be performed on a composite of RAP aggregate obtained in accordance with ARIZ 428, and virgin mineral aggregate. The virgin mineral aggregate will be obtained from the cold feed belt prior to the addition of admixture, or from the stockpiles when sampling from the cold feed belt is not possible. The virgin aggregate and RAP aggregate shall be batched per Composite #1 in the mix design.

6. SAMPLING AND TESTING OF VIRGIN BINDER

6.1 Virgin binder will be sampled and tested in the same way as it is done for non-RAP mixtures. However, as mentioned in Subsection 3.5, the virgin binder grade required may be different than what is specified in the bid documents to ensure the blend of virgin and RAP binder meet the grade specified. This will be determined during the mix design process. Sample labels shall indicate the actual grade of virgin binder provided to the project.

7. SAMPLING AND TESTING OF RAP MATERIAL FOR GRADATION, MOISTURE CONTENT, AND BINDER CONTENT

7.1 RAP material must be sampled and tested to ensure it meets the gradation requirements in the specifications. The intent of the RAP material gradation requirements is to prohibit the use of oversized (+ 1¼ inch) material, improve consistency, and minimize segregation. RAP material must also be sampled and tested for moisture content and RAP binder content. Virgin binder and RAP binder contents must be tracked separately in order to determine correction factors, validate and/or determine payments for asphalt cement, and to properly apply asphalt price adjustments.

7.2 RAP material will be sampled in accordance with Arizona Test Method 105. The sample shall be split to provide a sufficient amount of material for gradation testing, moisture content testing, and binder content testing. When multiple RAP stockpiles are used, RAP material shall be sampled separately from each stockpile.

7.3 Each RAP stockpile will be sampled and tested for gradation, moisture content, and binder content at a minimum frequency of one sample per lot of asphaltic concrete production. When more than one RAP sample is tested for moisture content and binder content, for a given lot and stockpile, the average of the results will be used.

7.4 Prior to testing the RAP material for gradation and binder content, the weight of the RAP material is recorded and the material is then dried at 140 °F to a constant weight. A higher temperature is not appropriate because it will soften the binder causing the RAP material to break into smaller particles and adhere to the pan. Drying to a constant weight at 140 °F will typically take overnight. The percent moisture content by drying at 140 °F shall be determined and recorded. After drying and determining the moisture content at 140 °F, the material shall be allowed to cool and then be tested for gradation and binder content.

7.5 The gradation of the RAP material will be determined by first dry sieving the material in accordance with Arizona Test Method 240, but utilizing the No. 8 sieve as the smallest sieve. To control breakdown of the particles of salvaged material into smaller size fractions, Arizona Test Method 240 limits the time for shaking the sample to 5 minutes ± 15 seconds. The gradation of the RAP material is then determined in accordance with Arizona Test Method 248 (Alternate #2).

7.6 The RAP binder content, including the determination of moisture content at 290 °F, of each RAP stockpile will be determined in accordance with ARIZ 428.

7.7 The total percent moisture content of the RAP material from each stockpile is determined by adding the percent moisture content by drying at 140 °F (Subsection 7.4) to the percent moisture content by drying at 290 °F (Subsection 7.6).

7.8 The total moisture content and RAP binder content results will be used to determine the total quantity of RAP binder used in each lot, as well as in the calculation of a tank stab correction (See Subsection 9.2.2).

8. RAP BINDER CONTENT CORRECTION FACTOR

8.1 A RAP binder content correction factor will be applied to each RAP binder content result determined in accordance with Subsection 7.6. A correction factor is required for each RAP stockpile and is determined as follows:

8.1.1 At the start of asphaltic concrete production, the first two samples of RAP material from each stockpile will be split and tested for binder content; one split is tested in accordance with ARIZ 428 (Ignition Furnace) and the other split is tested in accordance with AASHTO T 164 (Solvent Extraction). A RAP binder content correction factor will be determined by subtracting the average ignition furnace result from the average solvent extraction result. The appropriate correction factor shall be added to each RAP binder content test result determined on the material from each RAP stockpile in accordance with ARIZ 428 to determine the RAP binder content. At the discretion of the Engineer, the correction factor may be determined prior to the start of asphaltic concrete production provided representative RAP samples are available. A new correction factor may be determined at any time the Engineer believes it is necessary due to a change in material or other circumstances. See Attachment #1 for an example calculation for determining the RAP binder content correction factor.

8.1.2 When splitting RAP material to determine the RAP binder content correction factor for the respective stockpile, it is extremely important that a representative split be obtained because the correction factor will be applied to all RAP binder content test results for that RAP stockpile. To help ensure a good split is obtained the sample should first be reduced to the approximate size required to perform both procedures (ARIZ 428 and AASHTO T 164). Generally, 9000 grams of RAP material from each stockpile will be adequate to obtain the split samples for determining the RAP binder content correction factor. The sample shall be split and each half visually observed to verify that both halves appear similar in composition. One half of the split is then tested by the acceptance laboratory in accordance with ARIZ 428. The other half is sent to the Central Laboratory to have tested accordance with AASHTO T 164. Split samples must be sent to the Central Laboratory as quickly as possible to ensure that the RAP binder correction factor for each RAP stockpile and a subsequent ignition furnace correction (tank stab correction) can be calculated in a timely manner.

Note: ADOT does not currently perform AASHTO T 164. Therefore, the Central Laboratory will send their split of the RAP material to an on-call independent laboratory for the required testing.

9. SAMPLING AND TESTING OF ASPHALTIC CONCRETE

9.1 Asphaltic concrete containing RAP is sampled in the same manner as asphaltic concrete without RAP.

9.2 Testing for gradation, total asphalt content by ignition furnace, effective voids, stability, and compaction for asphaltic concrete containing RAP is done in the same manner as asphaltic concrete without RAP with the following exceptions:

9.2.1 The ignition furnace calibration is performed in accordance with ARIZ 428.

9.2.2 An ignition furnace correction (tank stab correction) must be determined by the Engineer for all mixtures containing RAP. If the correction is greater than 0.1%, it shall be applied to the ignition furnace results. Applying the correction is not optional as is the case for mixtures that do not contain RAP. The tank stab correction is defined as the average difference between the asphalt cement content as measured by the ignition furnace testing and the actual asphalt cement content for the first five lots of production. The "actual" asphalt cement content is determined by adding the virgin asphalt cement content to the RAP binder content, both expressed as a percent of the total mix. See Attachment #2 for an example calculation for determining the tank stab correction when one RAP stockpile is used. See Attachment #3 for an example calculation for determining the tank stab correction when two RAP stockpiles are used.

9.2.3 Asphalt content results for mixtures containing RAP are not subject to referee testing because a tank stab correction cannot be established for referee results.

10. MEASUREMENT AND PAYMENT FOR ASPHALT CEMENT

10.1 Asphaltic cement will be measured by the ton, for each lot of asphaltic concrete accepted, in one of the following ways:

10.1.1 Asphalt cement may be measured by multiplying the average asphalt cement content (from the Mix/Compaction Report) by the total tons of asphaltic concrete in that lot.

10.1.2 Asphalt cement may be measured by adding invoice quantities for virgin binder to the RAP binder used, adjusted as necessary for waste. The invoice quantities should be shown on the hot plant reports and substantiated by certified weights. RAP binder used shall be determined by multiplying the RAP binder content determined in Subsection 7.6 by the number of tons of dry RAP materials used in that lot. The tons of RAP material shall be a measured value (i.e., from a belt scale) rather than a calculated value. The measured tons of RAP material shall be shown on the hot plant report. When multiple RAP stockpiles are used, the RAP quantities and RAP binder contents must be determined separately for each stockpile.

10.2 In no case shall the measured amount of asphalt cement for payment be greater than the quantity determined in Subsection 10.1.2 above, adjusted for waste.

11. OTHER CONSIDERATIONS

11.1 Asphalt cement penalties and price adjustments only apply to the virgin binder in the mixture.

11.2 During production, the percent RAP aggregate shall be maintained to within plus 2 percent and minus 5 percent of the mix design values, not to exceed the maximum allowed by specification. When more than one RAP stockpile is used, this tolerance shall apply to the total percent RAP aggregate in the mixture, as well as the percent RAP aggregate from each stockpile.

11.3 For mixes containing RAP, an asphalt cement tank shall be dedicated to the project for each shift of asphalt concrete production. This is necessary in order to accurately track virgin binder usage for the project and to establish an accurate tank stab correction.

11.4 At least five days prior to the start of asphaltic concrete production, a copy of the mix design and representative samples of the virgin mineral aggregate, RAP aggregate, mineral admixture, and asphalt cement used in the mix design must be submitted by the contractor for calibration of the ignition furnace, and determination of aggregate properties. A minimum of 40 pounds of representative RAP material and a minimum of 10 pounds of solvent extracted RAP aggregate shall be submitted. If the RAP is fractionated, the RAP material and RAP aggregate from each stockpile shall be kept separate. All materials must be submitted in sufficient quantity to perform an ignition furnace calibration by both the acceptance lab and a referee lab if

necessary. If referee testing is performed, the referee testing laboratory will only be required to perform the ignition furnace calibration to determine a minus No. 200 correction factor.

11.5 The contractor shall provide daily documentation of the weight, determined by a belt scale, and proportion of material from each individual RAP stockpile incorporated into the mix. The percent moisture content of the RAP material from each stockpile shall also be determined and provided daily by the contractor.

11.6 A pre-activity meeting shall be held approximately two weeks prior to the start of paving. The agenda should include discussion items dealing with the production of asphaltic concrete containing RAP.

Bill Hurguy, P.E.
Assistant State Engineer
Materials Group

Attachments (3)

Project Number: F-011-1(11)

TRACS Number: H011101C

RAP Material Type: Fine

Sample # 1 Sampled By: Barb B. Que Sampled From: Stockpile
Date Sampled: 04/22/13 Time Sampled: 9:25

Sample # 2 Sampled By: Jack Frost Sampled From: Stockpile
Date Sampled: 04/23/13 Time Sampled: 14:50

RAP BINDER CONTENT CORRECTION FACTOR
(Ignition Furnace vs. Solvent Extraction)

Sample #	RAP Binder Content (%)		RAP Binder Content Correction Factor
	Ignition Furnace (ARIZ 428)	Solvent Extraction (AASHTO T164)	(Average Solvent Extraction Value) Minus (Average Ignition Furnace Value)
1	7.73	6.51	
2	8.31	7.28	
Average	**8.020**	**6.895**	**- 1.13**

Notes:
1) Shaded fields contain data input by the user. All other numerical fields are calculatedvalues.
2) The RAP binder contents and RAP binder content correction factor in this example are high due to the recycling of ARAC.

EXAMPLE RAP BINDER CONTENT CORRECTION FACTOR DETERMINATION

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
							Only if two RAP stockpiles are used								
Lot #	Tons of Asphaltic Concrete in the Lot (including waste)	Tons of Virgin Binder in the Lot	Tons of Fine RAP Material in the Lot	Total Percent Moisture Content of Fine RAP Material	Tons of Dry Fine RAP Material used in the Lot	Fine RAP percent binder content from lab (corrected)	Tons of Coarse RAP Material in the Lot	Total Percent Moisture Content of Coarse RAP Material	Tons of Dry Coarse RAP Material used in the Lot	Coarse RAP percent binder content from lab (corrected)	Percent Binder Content from Ignition Furnace (Lot average from Pay Factor report)	Tons of RAP Binder used in the Lot	Actual Tons of Total Binder used in the Lot (RAP plus Virgin)	Calculated Total Actual Percent RAP Binder and Virgin Binder used in the Lot	Difference between the Percent Binder Content from the Ignition Furnace Pay Factor Report and the Calculated Total Actual Percent Binder
1	1370.78	59.76	205.47	3.14	199.02	6.60					5.20	13.14	72.90	5.32	-0.12
2	2483.52	114.10	371.27	2.98	360.21	7.18					5.43	25.86	139.96	5.64	-0.21
3	1679.76	78.11	252.96	3.57	243.93	7.27					5.05	17.73	95.84	5.71	-0.66
4	1349.10	54.94	202.40	3.42	195.48	6.89					4.91	13.47	68.41	5.07	-0.16
5	3280.36	135.20	489.01	3.86	470.13	6.87					4.95	32.30	167.50	5.11	-0.16
													Tank Stab Correction =		**-0.26**

Notes:

1) Shaded columns contain data input by the user. All other columns are calculated values.
2) Column B is the tons of asphaltic concrete produced for the given lot.
3) Column C is the tons of virgin binder in the lot (per the hot plant report, verified by certified weights).
4) Column D is the tons of fine RAP material used in the lot (if only one RAP stockpile is used, the tons of RAP used is entered in Column D).
5) Colunm E is the total percent moisture content of the fine RAP material (the sum of percent moisture contents from drying at 140 °F and 290 °F).
6) Column F is the tons of dry fine RAP material used in the given lot. F = D x [(100-E) / 100]
7) Column G is the percent binder content of the fine RAP material, as determined by ARIZ 428 and corrected by the RAP binder content correction factor (see Attachment #1).
8) Columns H, I, J and K are used in the same way as columns D, E, F and G when a second RAP stockpile is used (See Attachment #3).
9) Column L is the average percent binder content in the lot as measured by the ignition furnace (ARIZ 428).
10) Column M is the tons of RAP binder used in the lot. M = [{(G x F) / 100} + {(K x J) / 100}]
11) Column N is the actual tons of total binder (tons of RAP binder plus tons of virgin binder) used in the lot. N = C + M
12) Column O is the calculated total actual percent binder content used in the lot. O = (N / B) X 100
13) Column P is the difference between the percent binder content measured by the ignition furnace and the calculated total actual percent binder content. P = L - O
14) The tank stab correction is the average of the five values in Column P.
15) The above values include waste at the plant and grade. Waste must be deducted prior to payment for binder and mix.
16) This example is for a mixture with one RAP stockpile. An example of a tank stab correction when two RAP stockpiles are used is given in Attachment #3.

EXAMPLE IGNITION FURNACE CORRECTION (TANK STAB CORRECTION) DETERMINATION

(WHEN ONE RAP STOCKPILE IS USED)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
							Only if two RAP stockpiles are used								
Lot #	Tons of Asphaltic Concrete in the Lot (including waste)	Tons of Virgin Binder in the Lot	Tons of Fine RAP Material in the Lot	Total Percent Moisture Content of Fine RAP Material	Tons of Dry Fine RAP Material used in the Lot	Fine RAP percent binder content from lab (corrected)	Tons of Coarse RAP Material in the Lot	Total Percent Moisture Content of Coarse RAP Material	Tons of Dry Coarse RAP Material used in the Lot	Coarse RAP binder content from lab (corrected)	Percent Binder Content from Ignition Furnace (Lot average from Pay Factor report)	Tons of RAP Binder used in the Lot	Actual Tons of Total Binder used in the Lot (RAP plus Virgin)	Calculated Total Actual Percent RAP Binder and Virgin Binder used in the Lot	Difference between the Percent Binder Content from the Ignition Furnace Pay Factor Report and the Calculated Total Actual Percent Binder
1	1390.19	62.31	145.53	2.07	142.52	4.65	144.90	0.57	144.07	3.57	5.12	11.77	74.08	5.33	-0.21
2	1896.32	86.12	191.88	3.34	185.47	4.51	191.89	1.26	189.47	3.58	5.24	15.15	101.27	5.34	-0.10
3	1099.05	48.30	109.68	3.37	105.98	4.53	111.61	1.58	109.85	3.49	5.04	8.63	56.93	5.18	-0.14
4	2195.36	98.48	218.50	2.83	212.32	4.47	220.03	1.39	216.97	3.85	5.21	17.84	116.32	5.30	-0.09
5	2248.38	102.02	217.15	2.99	210.66	4.73	228.20	1.60	224.55	4.01	5.19	18.97	120.99	5.38	-0.19
													Tank Stab Correction =		-0.15

Notes:

1) Shaded columns contain data input by the user. All other columns are calculated values.
2) Column B is the tons of asphaltic concrete produced for the given lot.
3) Column C is the tons of virgin binder in the lot (per the hot plant report, verified by certified weights).
4) Column D is the tons of fine RAP material used in the lot (if only one RAP stockpile is used, the tons of RAP used is entered in Column D).
5) Column E is the total percent moisture content of the fine RAP material (the sum of percent moisture contents from drying at 140 °F and 290 °F).
6) Column F is the tons of dry fine RAP material used in the given lot. F = D x [(100-E) / 100]
7) Column G is the percent binder content of the fine RAP material, as determined by ARIZ 428 and corrected by the RAP binder content correction factor (see Attachment #1).
8) Columns H, I, J and K are used in the same way as columns D, E, F and G when a second RAP stockpile is used.
9) Column L is the average percent binder content in the lot as measured by the ignition furnace (ARIZ 428).
10) Column M is the tons of RAP binder used in the lot. M = [{(G x F) / 100} + {(K x J) / 100}]
11) Column N is the actual tons of total binder (tons of RAP binder plus tons of virgin binder) used in the lot. N = C + M
12) Column O is the calculated total actual percent binder content used in the lot. O = (N / B) X 100
13) Column P is the difference between the percent binder content measured by the ignition furnace and the calculated total actual percent binder content. P = L - O
14) The tank stab correction is the average of the five values in Column P.
15) The above values include waste at the plant and grade. Waste must be deducted prior to payment for binder and mix.
16) This example is for a mixture with two RAP stockpiles. An example of a tank stab correction when one RAP stockpile is used is given in Attachment #2.

EXAMPLE IGNITION FURNACE CORRECTION (TANK STAB CORRECTION) DETERMINATION

(WHEN TWO RAP STOCKPILES ARE USED)

1221 NORTH 21ST AVENUE PHOENIX, ARIZONA 85009-3740 PHONE (602) 712 - 7231

POLICY AND PROCEDURE DIRECTIVE

Bill Hurguy
Assistant State Engineer

TO: ALL MANUAL HOLDERS	P.P.D. NO. 23
SUBJECT: REQUIREMENTS FOR THE USE OF WARM MIX ASPHALT (WMA) TECHNOLOGIES IN ASPHALTIC CONCRETE	EFFECTIVE DATE: September 28, 2012

1. GENERAL

1.1 This Policy and Procedure Directive outlines the requirements for the addition of Warm Mix Asphalt (WMA) technologies in dense-graded asphaltic concrete mixes (ADOT specifications Section 416 and Section 417). These requirements are used in conjunction with, and in addition to, ADOT specifications.

1.2 Warm Mix Asphalt (WMA) is the generic term used to describe the reduction in production, placement, and compaction temperatures, achieved through the application of one, or a combination of several WMA technologies. For purposes of the ADOT specifications, WMA is defined as asphaltic concrete that is produced within the temperature range of 215 to 275 °F. WMA can be produced by one or a combination of several ADOT approved WMA technologies including plant water foaming processes, mineral additives, and chemical additives.

1.3 WMA technologies may be used at the contractor's option provided all requirements of the specifications are met and the WMA technology is approved by ADOT for use in asphaltic concrete. WMA technologies may be used to produce WMA as described above, or may be used in standard asphaltic concrete mixes as a compaction aid or as a component to allow workability in long haul applications.

2. WARM MIX ASPHALT TECHNOLOGY APPROVAL PROCESS

2.1 WMA technologies must be approved by ADOT Materials Group for use in production of asphaltic concrete.

2.2 The "Approved Warm Mix Asphalt (WMA) Technologies List" is maintained by ADOT Materials Group, Pavement Materials Testing Section. The current approved list is available on the Materials Group homepage through the ADOT intranet (ADOTNet) and the ADOT internet website.

2.3 The following requirements must be met before a WMA technology will be added to the "Approved Warm Mix Asphalt (WMA) Technologies List":

2.3.1 The WMA technology must be a recognized WMA technology with successful projects constructed nationally, with production of at least 100,000 tons of WMA produced and placed on State DOT highways.

2.3.2 The WMA technology manufacturer must submit documentation from a minimum of three construction projects using the WMA technology on State DOT highways. The documentation must include a mix design with mechanical property test results and the Quality Control/Quality Assurance test results measured during production for each project. The documentation must include DOT contacts and phone numbers, product name and supplier, dates of construction, and the location and highway for each project submitted.

2.3.3 The WMA technology manufacturer must provide documentation and test results showing the effect that the WMA technology has on the rheological properties of virgin asphalt binders beyond such time needed to produce, place, compact, and allow the WMA mixture to cool. Documentation must include asphalt binder performance grade test data over the range of WMA technology percentages recommended by the WMA technology manufacturer and used on past projects.

2.3.4 On a project where WMA is allowed by specification, the WMA technology manufacturer must partner with a contractor and an ADOT Construction District/Project to construct a test section, using the WMA technology. The WMA technology representative must be present for the construction of the test section. The WMA test section must be a separate Lot and the tonnage must be at least 1000 tons, but less than 2000 tons. The Engineer must approve the location of the test section. During construction of the test section, the WMA must meet all ADOT construction acceptance specifications and the test section must show successful performance after construction.

2.3.5 Requests to be included on the "Approved Warm Mix Asphalt (WMA) Technologies List" must be accompanied with the required documentation, and shall be submitted in electronic format (pdf) to the Pavement Materials Testing Engineer at "WMA@azdot.gov".

2.3.6 ADOT Materials Group will make the final decision on the approval of WMA technologies.

3. MIX DESIGN REQUIREMENTS FOR WMA MIX DESIGNS

3.1 When a WMA technology is used in the mixture, all specified mix design requirements shall apply to the development of the asphaltic concrete mix design. With the exception of Immersion Compression Testing (Arizona Test Method 802), the mix design may be developed without the WMA technology for all mix design requirements.

3.2 If the contractor, supplier, or WMA technology representative recommends that a full mix design be performed to include the WMA technology, the mix design shall be performed in accordance with the WMA manufacturer's recommended laboratory mixing and laboratory compaction temperatures.

3.3 When a full mix design, including Immersion Compression testing, is performed with the WMA technology, the WMA technology must be added to the mix before testing. The WMA technology must be added to the mix in accordance with the specific type of technology and the recommendations in the National Cooperative Highway Research Program (NCHRP) Report 691 "Mix Design Practices for Warm Mix Asphalt", Appendix A, Section 7. The WMA technology shall be added at the rate anticipated to be used in production of asphaltic concrete.

3.4 Immersion Compression testing shall be performed in accordance with ARIZ 802 (as modified below) with and without the WMA technology in the mix design testing. The test results, both with and without the WMA technology, shall meet the minimum requirements of the specifications and shall be reported in the mix design.

3.4.1 Subsection 3(c) of ARIZ 802 is revised to read:

3.4.1.1 The temperature of the asphalt, aggregate, and mineral admixture at the time mixing begins shall be in accordance with the following:

3.4.1.1.1 For testing with WMA technologies, the mixing temperature for the laboratory prepared samples shall be per the WMA technology manufacturer's recommendations, but shall not exceed the maximum anticipated mixing temperature during field production. In making laboratory mixing temperature recommendations, the WMA technology manufacturer should consider the mixing temperature based on the viscosity-temperature curve for the asphalt which has been modified with the WMA technology as well as the minimum mixing temperature required for adequate coating.

3.4.1.1.2 For mix design testing without the WMA technology, the temperature of the asphalt, aggregate, and mineral admixture at the time mixing begins shall be the mix design laboratory mixing temperature, which is normally based on the viscosity - temperature curve for the asphalt which has not been modified with the WMA additive.

3.4.2 Subsection 5(a) of ARIZ 802 is revised to read:

3.4.2.1 Place the samples in an oven maintained at 255 ± 5 °F.

3.4.2.2 A mold and bottom plunger for each sample shall be heated to the compaction temperature specified below:

3.4.2.2.1 For mixtures with WMA technology, the samples shall be at a compaction temperature of 255 ± 5 °F, unless an alternative compaction temperature is recommended by the WMA technology manufacturer and approved by the Engineer.

3.4.2.2.2 For mixtures without the WMA technology, the compaction temperature shall be 255 ± 5 °F.

3.5 For WMA water foaming processes, if laboratory water foaming equipment is not available, the specimens for Immersion Compression testing may be fabricated from plant produced mix. The specimens shall be tested as described above except the specimens shall be compacted without allowing the mixture to cool after the sample is obtained. Reheating, aging, or curing will not be allowed. This process must be explained, and the results reported, in the mix design.

3.6 When a WMA technology is used in the mixture, the following additional information shall be included in the mix design:

1) WMA technology information and/or WMA additive information.
2) Recommended temperature range for mixing during production.
3) Recommended temperature range for compaction during production.
4) WMA technology manufacturer's established target rate for water and additives, and the acceptable variation during production.
5) Actual laboratory mixing and compaction temperatures used during mix design testing.
6) Immersion Compression test results as specified in Section 3.4 above.

4. CONSTRUCTION AND HOT PLANT REQUIREMENTS

4.1 For asphaltic concrete with WMA technologies, the contractor shall use equipment and WMA technologies capable of producing an asphaltic concrete mixture that meets specification requirements and is workable at the minimum placement and compaction temperature desired, regardless of storage or haul distances.

4.2 The contractor must modify the hot plant as required by the WMA technology manufacturer to introduce the WMA technology. Plant modifications may include additional plant instrumentation, the installation of asphalt binder foaming systems and/or WMA additive delivery systems, adjusting the plant burner and/or the mixing drum flights in order to operate at lower production temperatures, and/or reducing the production rate of WMA.

4.3 ADOT specifications require that the moisture content of the asphaltic concrete immediately behind the paver does not exceed 0.5 percent. To ensure that this requirement is met, the contractor shall implement best management practices in the control of aggregate moisture prior to the introduction of aggregate into the drying or mixing drum, as well as during WMA production.

4.4 It may be beneficial to produce the asphaltic concrete mixture at conventional temperatures immediately before WMA production at the lower temperatures in order to bring the plant up to temperature and ensure proper baghouse operation.

4.5 The WMA mix shall be inspected at the hot plant and on the grade to ensure that aggregate is fully coated during WMA production. If complete aggregate coating is not achieved, modifications to current production shall be made to produce an asphaltic concrete mixture with fully coated aggregate.

5. ACCEPTANCE TESTING

5.1 When a WMA technology is used in the mixture, all specified acceptance testing requirements in the specifications shall apply to the asphaltic concrete mix. Acceptance testing for the WMA mix will be performed at the same frequency and with the same requirements in the specifications for asphaltic concrete.

5.2 When producing asphaltic concrete with WMA technologies, samples for mixture properties acceptance testing shall be allowed to cool and then be reheated prior to testing. Acceptance samples shall be prepared and split in accordance with Arizona Test Method 416. Unless the WMA technology remains active in the mix, the compaction temperature for preparing Marshall or Gyratory specimens in accordance with ARIZ 410 or AASHTO T 312, respectively, shall be based on the laboratory compaction temperature of the original binder. If the WMA technology remains active in the mix after the time needed to cool and reheat the sample, the mix designer shall specify alternative laboratory compaction temperatures for ARIZ 410 and AASHTO T 312. Additional heating or aging of samples beyond that required in Arizona Test Methods 416, 410, 417, and AASHTO T 312 shall not be allowed.

5.3 Additional moisture content testing shall be performed when WMA technologies are used in asphaltic concrete. There is additional concern of moisture in the mix during WMA production due to the lower hot plant temperatures, especially with highly absorptive aggregates. To ensure that the moisture content of the asphaltic concrete behind the paver does not exceed the specified maximum of 0.5 percent, separate moisture content samples shall be taken at a frequency determined by the Engineer.

5.4 If the WMA technology alters the asphalt binder rheological properties beyond such time needed to produce, place, compact, and allow the mixture to cool, sampling for acceptance testing of the binder shall occur after the WMA additive is added to the binder. In such case, the mixing of the binder and the WMA technology shall be performed at the asphalt terminal, and sampling will be accomplished after delivery of the binder to the hot plant.

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Materials Group