MDOT
Michigan Department of Transportation

OFFICE MEMORANDUM

DATE: April 6, 2000

TO: Region Engineers
Region Associate Delivery Engineers
Region Construction Engineers
Resident/Project Engineers/TSC Managers
Region Traffic Engineers

FROM: C. Thomas Maki
Chief Operations Officer

Gary D. Taylor
Chief Engineer/Deputy Director
Bureau of Highway Technical Services

SUBJECT: Bureau of Highway Instructional Memorandum 2000-08
Field Verification of Bituminous Mix Design - Pilot Study for 2000 Construction Season

The purpose of this memo is to notify department staff and contractors of the new procedure for the field verification of bituminous mix design (test strip) proposed for the year 2000 construction season. Attached is the procedure for the implementation of the Field Verification of Mix Design. This procedure was developed through partnering efforts by the MDOT/MAPA Mix Design Procedures Committee.

This is a pilot study and is voluntary for contractors for the 2000 construction season, with the approval of the project engineer. The procedure is applicable to all mixture types used on MDOT projects. The contractor and project engineer should discuss the possibility of using the test strip option at the pre-construction meeting to allow for adequate decision making and planning. For projects already under contract, the test strip option should be discussed at the pre-production meeting. Whenever the procedure is used, it should be properly authorized through a contract modification.

The following are potential benefits of this new procedure.

- Verification of plant produced mixture versus laboratory produced mixture.
- Reduce initial job mix formula changes during production.

- Minimize of delays in the start of paving.

The test strip should contain a maximum 250 tons and will be paid at the contract unit price for the mix type. Upon completion of the test strip, all paving shall be suspended until all verification testing is completed. Test strip material is subject to all QC/QA and project requirements. Unacceptable material shall be removed at the contractor's expense. The test strip should be located on the project site or as agreed upon by the engineer.

Two options exist for the contractor who elects to do field verification of mix design:

Option I - A paper review of the contractor's mix design with minimal central lab sample submission followed by full field verification of mix design by test strip. The contractor will not be allowed to proceed with paving until they are granted an approved mix design by the resident engineer.

Option II - Full sample submission to the central lab for mix design verification, then paving of a test strip for field production properties and job mix formula adjustment.

Contractors will still have the opportunity for traditional mix design verification, outlined in the *Procedures Manual for Submitted, Express, and Superpave Mix Design Processing*, if they so choose.

If you have any questions or comment regarding this information feel free to contact Mike Frankhouse at 517-322-5672, Gary Mayes at 517-322-5668, or Scott Greene at 517-322-1184.

C. Thomas Maki
Chief Operations Officer

Gary Taylor, Chief Engineer/Deputy Director
Bureau of Highway Technical Services

BOHTS:C/T:MF:kab
Subject Index: Bituminous
Attachments

cc: C&T Division Engineers
C&T Division Technicians
C & T, J. Culp
Real Estate, M. Frierson
Design Division, P. Miller
Maintenance, C. Roberts
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B. Jay
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MRBA
MAPA
MCPA
MCA
MAA
AUC
CRAM
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Attachment
BOH IM 2000-08

FIELD VERIFICATION OF BITUMINOUS MIX DESIGN
03-06-00

Description

This procedure provides Engineers in the Regions the guidelines for using the option of test strips for field verification of mix designs. This is a voluntary program for the contractors and MDOT regional personnel to gain experience with this method of mix design verification.

Objectives of this study are to determine and refine the quantities, tolerances, and logistics of implementing a test strip. Through the use of voluntary pilot projects, the process of mix design verification will be expedited for the construction project. This includes a paper review of mix designs with reduced central lab sample submission, leaving verification of mix designs to take place in the field by a qualified regional technician.

Verification Options

The test strip process for mix design submittal will have two options.

Option I: **Full Field Verification.** This option will provide for the full verification of the mix design in the field after a paper review by the central office. The Contractor will not be allowed to proceed with paving until they are granted an approved mix design by the resident engineer.

Option II: **Central Lab Verification with additional Test Strip.** This option allows the contractor to submit a mix design to the central lab for verification while also providing a test strip in the field.

In addition to these two options the contractor will still be allowed to submit a mix design following the existing process.

Test Strip Production

Notification to the Project Engineer and the Traveling Mix Inspector must be in writing within five working days prior to the paving of the test strip.

The test strip will consist of a minimum of 200 tons of plant produced mixture from the facility that will be providing mixture for the project. The location and tonnage of the test strip must be submitted to the Project Engineer for approval. Preferred locations for the test strip will be on the project or at a place with a properly compacted base (i.e. Contractors yard, temporary roadways, shoulders, etc.) The width of the test strip shall be representative of the project paving operation. Aggregate Wear Index (AWI) samples should be submitted to the central lab one week prior to mix design submittal.

Samples for the field verification will be taken by MDOT personnel in accordance with MTM 324 Michigan Test Method for Sampling Bituminous Paving Mixtures from Behind Lay Down Machine. Split samples will be provided to the contractor for information purposes. MDOT will have three days from the completion of sampling to perform all field mixture verification and density testing of the test strip.

Mixture adjustments, supported by trial runs and test data, will be allowed prior to paving of the test strip. However no adjustments will be made to the plant during the production of mixture for the test strip.

Submitted mix designs reviewed by MDOT will not be considered verified until the field verification process is complete.

Tolerance Limits for MDOT Field Verification of Superpave Mix Designs

1. Field Verified

- Theoretical Maximum Specific Gravity +/- 0.019
- Air Voids +/- 1.00 % @ N design
- Compacted Specimen Height 115mm +/- 3mm.
- VFA must meet specification requirements.
- VMA must be +/- 1.2 % of target value.
- Soft Particle must meet minimum specification. It will be picked when flagged by the paper review.

2. Informational Tests

Note: The following tests will be used for informational purposes only for the year 2000 construction season. They will also be used to set statistically based tolerances for the future.

- % Crushed and Angularity Index samples.
- Asphalt content by an approved method.
- Aggregate gradation within control points and outside of the restricted zone, plotted on a 0.45 power chart.
- Belt samples during production of **fine and coarse aggregate for bulk - SSD -** apparent specific gravity samples will be provided for random testing by the central lab.
- 75 % of cores from the Test Strip should satisfy the 92% compaction requirement. Contractor will be allowed to chose the segment for coring with MDOT choosing the random locations of each core within this area. The segment for coring shall be no less than 25 feet in length. There shall be a minimum of four cores taken in each segment

Superpave Test Strip Paper Review Requirements

Mix designs submitted to the Central Lab for review must be prepared per procedures manual except as noted below, and meet all mixture specifications.

Note: All Mixture Samples are submitted at Optimum Asphalt Content.
Note: This is for the full field verification option.

1. Materials Required

1 - 2300 Gram sample of mixture. For Theoretical Maximum specific Gravity.
2 - (*) Gram samples of mixture. For Compacted Bulk Specific Gravity.
1 – (5000) Gram Samples of combined aggregates.

* The weight of the mix to compact to 115 mm height.

2. Documentation Required:

Note: Computer duplication of forms must follow MDOT formats.

- Form 1855 - Superpave Bituminous Mix Design Communication.
- Form 1923 - Sample Identification. Note: must be included in each sample package.
- Form 1858 - Superpave Mix Design Summary Sheet.
- Form 1806 - Theoretical Maximum Specific Gravity Worksheet.
- Form 1851 - Gyratory Compacted Bulk Specific Gravity Worksheet.
- Form 1862 - Superpave Mix Design Checklist.
- Documentation of Quality Control Testing of RAP Stockpiles when RAP is used in the mixture. This includes a minimum of 10 theoretical Maximum Specific Gravity Tests.
- Combined gradation plotted on the 0.45 power gradation chart.
- Mix Design Regression Analysis.
- Complete Superpave Worksheet from gyratory.
- Full set of height data.

<u>Superpave Mix Design Guidelines</u>

For all projects containing the Superpave Bituminous Mixture Special Provision and choosing the Test Strip Mix Design option. A private testing lab, either contractor or consultant, will supply the Michigan Department of Transportation's Superpave Mix Design. All guidelines set forth in Section five, page 15, of the Procedures Manual for Submitted, Express, and Superpave Mix Design Processing shall apply except for the following. Paragraph 5 shall read

- Acceptance for evaluation requires a person from the Bituminous Mix Design Unit to review the paperwork. Upon acceptance, of a completed submittal, MDOT will have four working days to complete paper review of the Superpave Mix Design. Superpave Mix Designs received after 11:45 a.m. will start the four workday clock on the next scheduled workday.

Tolerance Limits for MDOT Field Verification of Marshall Mix Designs

1. Verified

- Theoretical Maximum Specific Gravity +/- 0.019 from target.
- Air Voids +/- 1.00 % of target.
- Compacted Specimen volume 515cm^3 +/- 8cm^3.
- VMA must be +/- 1.2 % of target value.
-
- Soft Particle must meet minimum specification. It will be picked when flagged by the paper review.

2. Informational Tests

Note: *The following tests will be used for informational purposes only for the year 2000 construction season. They will also be used to set statistically based tolerances for the future.*

- % Crushed samples.
- Asphalt content by an approved method.
- Aggregate gradation within design master gradation and be plotted on a 0.45 power chart.
- 75 % of cores from the Test Strip should satisfy the 92% compaction requirement. Contractor will be allowed to chose the segment for coring with MDOT choosing the random locations of each core within this area. The segment chosen for coring shall be no smaller than 25 feet in length. There shall be a minimum of four cores taken in each segment.

Marshall Test Strip Paper Review Requirements

Mix designs submitted to the Central Lab for review must be prepared per procedures manual except as noted below, and meet all mixture specifications.

Note: *All Mixture Samples to be submitted at Optimum Asphalt Content or a point closest to.*

1 - 5000 Gram Sample of mixture.

Documentation Required

Note: *Computer duplication of forms must follow MDOT formats.*

- Form 1820 - Contractor Bituminous Mix Design Communication.
- From 1923 - Submitted Mix Design Summary Sheet.
- Form 1822 - Marshall Mix Design Worksheet.
- Form 1806 - Theoretical Maximum Specific Gravity.
- Form 1813 - Submitted Mix Design Summary Sheet.
- Form 1849 - Bituminous Mix Design Checklist.
- Documentation of Quality Control Testing of RAP Stockpiles when RAP is used in the mixture. This includes a minimum of 10 theoretical Maximum Specific Gravity Tests.
- Combined gradation plotted on the 0.45 power gradation chart.
- Mix Design Regression Analysis.

Marshall Mix Design Guidelines

For all projects to be constructed using Marshall Bituminous Mixtures and choosing the Test Strip Mix Design option. A private testing lab, either contractor or consultant, will supply the Michigan Department of Transportation's Marshall Mix Design..

All guidelines set forth in Section four page 11 of the Procedures Manual for Submitted, Express and Superpave Mix Design Processing shall apply except for the following.

- Any reference to the 80 percent or greater passing rate on Marshall Mix Designs either regular or express.