

**CERTIFIED  
HOT MIX ASPHALT PRODUCER PROGRAM  
FULL AUDIT CHECKLIST (YEARLY)**

Date \_\_\_\_\_

Page 1 of \_\_\_\_

Plant No. \_\_\_\_\_

Producer \_\_\_\_\_

Plant Location \_\_\_\_\_

**INDOT Audit Team Members**

	<u>Name</u>	<u>Position</u>
1.	_____	District Testing Engineer
2.	_____	Area Supervisor
3.	_____	Technician
4.	_____	_____
5.	_____	_____
6.	_____	_____

**Producer Members**

	<u>Name</u>	<u>Position</u>
1.	_____	Management Representative
2.	_____	Level 1 or Certified Asphalt Technician
3.	_____	_____
4.	_____	_____

**1. GENERAL INSTRUCTIONS****Audit Team Members**

Tasks to be **completed before arriving** at the Producer's site:

- Review the QCP
- Review previous audits, especially the most recent one and note all corrective actions
- Coordinate with Independent Assurance Technician for comparison testing schedule
- Bring copies of the following:
  - Approved DMF and Contract Record worksheets for the current calendar year. These can be found at <https://itap.indot.in.gov/>
  - Qualified Products Lists and Qualified Source Lists
    - Performance-Graded Asphalt Binder Suppliers
    - Anti-Adhesive materials
  - Indiana Certified Asphalt Technicians (ICAT) List
  - Current copy of ITM 583

**Terminology:**

QC/QA HMA	Std. Spec. Section 401 (QC/QA Hot Mix Asphalt)
HMA	Std. Spec. Section 402 (Hot Mix Asphalt)
QCP	Quality Control Plan
DMF	Design Mix Formula
PGABS	Performance-Graded Asphalt Binder Suppliers
RAP	Reclaimed Asphalt Pavement
RAS	Reclaimed Asphalt Shingles
SMA	Std. Spec. Section 410 (Stone Matrix Asphalt)

Brackets must be filled in as follows:

- [ ✓ ] Satisfactory
- [ X ] Unsatisfactory or deficient; a **Corrective Action** Sheet must be prepared
- [NA] Not applicable to the audit or Producer

\* Item is only applicable in some cases; fill in 'NA' if not applicable

All unsatisfactory or deficient items resolved during the audit shall be noted on corrective action sheets with indication that item has been corrected.

**2. PRODUCER GENERAL INFORMATION**

ITM 583 Reference

5.0, 12.2

**Audit Team Member:** \_\_\_\_\_

- 2.1 [ ] Review the complete QCPs of INDOT and the Producer and verify they are identical and have the same authentication page:  
DTE signature date: \_\_\_\_\_
- 2.2 [ ] QCP is in accordance with ITM 583 (no updates needed)
- 2.3 [ ] Plant location and address in QCP is correct
- 2.4 [ ] Plant telephone numbers in QCP are correct
- 2.5 [ ] Management Representative \_\_\_\_\_
- 2.6 [ ] Management Representative e-mail address in QCP is correct
- 2.7 [ ] Level 1 or Certified Asphalt Technician at audit \_\_\_\_\_
- 2.8 [ ] Independent Assurance Qualifications completed on \_\_\_\_\_
- 2.9 [ ]\* All other Level 1 or Certified Technicians in QCP are current

For information only (ensure the QCP includes the following, if applicable):

- 2.10 [ ] Is this plant equipped with a water injection foaming device?  
=

**3. DOCUMENTS**

ITM 583 Reference

2.0

**Audit Team Member:** \_\_\_\_\_

Determine whether the following current documents are maintained at the Producer's lab or Plant, either by hard copies or electronically.

- 3.1 [ ] INDOT Standard Specifications (Including any applicable Supplemental Specifications and Special Provisions)

**Documents (continued)**

- 3.2 [ ] The ITM, AASHTO, and ASTM Test Methods ***referenced in QCP***. ITM revision dates are on the ITM webpage. The AASHTO and ASTM documents have the current revision date listed next to the test method. If the documents are accessible on the computer or internet, hard copies are not needed.

ITM			AASHTO		ASTM	
[ ] ITMs on Computer			[ ] AASHTOs on Computer		[ ] ASTMs on Computer	
ITM	Date (if printed)	Current?	R30-24	Date	D5821-13	Date
207		Yes / No	R35-22	Date		
220		Yes / No	R46-22	Date		
571		Yes / No	R66-16	Date		
572		Yes / No	R76-23	Date		
580		Yes / No	R90-18	Date		
581		Yes / No	T11-25	Date		
583		Yes / No	T27-24	Date		
584		Yes / No	T30-25	Date		
586		Yes / No	T166-25	Date	<b>OTHER TEST METHODS</b>	
587		Yes / No	T209-25	Date	<b>REFERENCED IN QCP</b>	
588		Yes / No	T255-22	Date	Test Method	Date
590		Yes / No	T269-24	Date		
591		Yes / No	T275-22	Date		
597		Yes / No	T305-22	Date		
902		Yes / No	T312-22	Date		
903		Yes / No	T331-25	Date		
905		Yes / No	T344-22	Date		
906		Yes / No				
908		Yes / No				
909		Yes / No				
910		Yes / No				
916		Yes / No				

- 3.3 [ ]\* **Did the plant produce SMA?** If no skip to section 4
- [ ]\* Fibers certifications from manufacturer for SMA
- [ ]\* Instructions from manufacturer regarding storage and handling of fibers for SMA

**4. CONTROL LIMITS - QC/QA HMA and SMA**

ITM 583 Reference

10.0

**Audit Team Member:** \_\_\_\_\_

Select one QC/QA HMA PWL contract if applicable or one the larger contracts available. Otherwise select an SMA mixture from one current or recently completed contract for review of all test results for all stated properties. Verify the test results are within the control limits of the target value from the DMF or are within the control limits of the target value identified by Producer.

Target Values (see appendix to record any values outside of control limits)

Contract \_\_\_\_\_ Mixture Selected \_\_\_\_\_ DMF \_\_\_\_\_

4.1 Air Void Target Value from DMF \_\_\_\_\_

[ ] Air Void Test Results  $\pm 1.0$  from Target Value (Dense Graded)  
 -or-  
 $\pm 3.0$  from Target Value (Open Graded)

4.2 Mixture Binder Content Target Value from DMF \_\_\_\_\_

[ ] Mixture Binder Content Test Results  $\pm 0.7\%$  from DMF Target Value

4.3 VMA Target Value from DMF \_\_\_\_\_

[ ] VMA Test Results  $\pm 1.0\%$  from DMF Target Value  
 -or-  
 min. 16% (12.5 SMA) or min. 17% (9.5 SMA)

4.4 Dust/Calculated Effective Binder Ratio from DMF \_\_\_\_\_

[ ] Dust/Calculated Effective Binder Ratio between 0.6 to 1.4  
 (1.0 to 2.0 for 4.75mm)

4.5 Volume of Effective Binder \_\_\_\_\_

[ ] Vbe above spec design min. and less than + 2.0 from spec design min.

	4.75mm	9.5mm	12.5mm	19.0mm	25.0mm	9.5 SMA	12.5 SMA	19.0 SMA
Spec design min.	13.0	11.0	10.0	9.0	8.0	13.0	12.0	11.0

**Control Limits (continued)**

4.6 [ ]\* Aggregate Stockpile testing:  
 Aggregate Size \_\_\_\_\_ (select a stockpile)  
 Critical sieve identified is \_\_\_\_\_  
 Target Value identified by Producer is \_\_\_\_\_

Gradation Test Results for the critical sieve are within the following from Target Value:

3/4 in. -- ± 10.0	No. 8 -- ± 10.0	No. 50 -- ± 6.0
1/2 in. -- ± 10.0	No. 16 -- ± 8.0	No. 100 -- ± 6.0
No. 4 -- ± 10.0	No. 30 -- ± 6.0	No. 200 -- ± 2

4.7 Blended Aggregate – Mixture size \_\_\_\_\_

[ ]\* Belt sample -or- [ ]\* HMA sample used for gradation

[ ]\* Gradation Test Results are within the following from Target Value. (The Producer may establish values that are more restrictive).

Sieve Sizes		Base and Intermediate Mixtures	Surface Mixture	Target from DMF	Test Result	Test Results within target value? (✓ or x)
19.0 mm	3/4 in.	± 10.0	---			<input type="checkbox"/>
12.5 mm	1/2 in.	± 10.0	± 10.0			<input type="checkbox"/>
4.75 mm	No. 4	± 10.0	± 10.0			<input type="checkbox"/>
2.36 mm	No. 8	± 10.0	± 8.0			<input type="checkbox"/>
1.18 mm	No. 16	± 8.0	± 8.0			<input type="checkbox"/>
600 µm	No. 30	± 6.0	± 4.0			<input type="checkbox"/>
300 µm	No. 50	± 6.0	± 4.0			<input type="checkbox"/>
150 µm	No. 100	± 6.0	± 3.0			<input type="checkbox"/>
75 µm	No. 200	± 2.0	± 2.0			<input type="checkbox"/>

4.8 Recycled Materials – RAP Size/Name \_\_\_\_\_

Binder Content Target Value from DMF for RAP \_\_\_\_\_ and RAS \_\_\_\_\_

[ ]\* RAP coarse aggregate gradation is 100% passing the mixture maximum particle size sieve

[ ]\* Fine RAP gradation is 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve when used in ESAL Category 3 and 4 surface mixtures

[ ]\* RAS gradation is 100% passing the 3/8 in. (9.5 mm) sieve

[ ]\* RAP Binder Content Test Results ± 0.7% from DMF Target Value

[ ]\* RAS Binder Content Test Results ± 3.0% from DMF Target Value

[ ]\* RAP Bulk Specific Gravity Results between 2.620 and 2.660

**5. DIARY**ITM 583 Reference

8.0, 11.0

**Audit Team Member:** \_\_\_\_\_

Select at random one production month for review of the diary. The month chosen can be any month within the current year or past three complete calendar years. The diary should be in accordance with the following requirements and information.

Month/Year \_\_\_\_\_

- 5.1 [ ] Diary on file for 3 years
- 5.2 [ ] Open book format or readily accessible electronic format
- 5.3 [ ] One or more pages for each day of production
- 5.4 [ ] Type of Mixture (QC/QA HMA, HMA, SMA) produced and quantity
- 5.5 [ ] DMF number
- 5.6 [ ] Contract or purchase order number the mixture was sent to
- 5.7 [ ] Time sample obtained and tests completed (samples are required to be tested within two working days of the time the sample was taken. If all samples are tested the same day, a statement indicating that this occurred is acceptable)
- 5.8 [ ]\* Significant events or problems
- 5.9 [ ] Signature of Level 1 or Certified Technician or Management Representative

Review the month of test data for nonconforming tests. If some are found, review the diary on the date of each test for notations regarding action taken.

- 5.10 [ ] Nonconforming test(s) are noted in diary
- Control limits are exceeded for Binder Content, Vbe, VMA, Air Voids, aggregate gradation.
  - Control limits are exceeded for 2.36mm sieve (9.5mm surface only)
  - 2.36 mm sieve %passing greater than 47% for 9.5 mm surface mix
  - Aggregate degradation value for SMA mix is greater than 3.0%
  - Dust/Pbe ratio is less than 0.6 or greater than 1.4 (or 1.0 to 2.0 for 4.75 mm mixtures)
  - Vbe is determined to be less than design minimum or more than design maximum
  - Moisture content of surface mixture exceeds 0.30% at the plant or 0.10% behind paver
- 5.11 [ ] Corrective action was taken or documented.

**6. SAMPLING AND TESTING**

ITM 583 Reference

9.1, 9.2

**Audit Team Member:** \_\_\_\_\_

Obtain the diary for one **QC/QA HMA or SMA** mixture produced for a selected contract within the current year or past three complete calendar years. Perform calculations as needed and compare the quantities produced from the diary against the number of tests, thereby determining the frequency of testing.

Contract \_\_\_\_\_ DMF \_\_\_\_\_ Mixture \_\_\_\_\_ Quantity \_\_\_\_\_

**Recycled Materials**

6.1 [ ]\* Sampling and testing of Recycled Materials for actual binder content, moisture content, gradation, coarse aggregate angularity, and bulk specific gravity is in accordance with QCP

*Note: For assistance, see example calculation page in appendix*

Percent by mass from DMF \_\_\_\_\_ Total RAP and/or RAS used \_\_\_\_\_

-- or --

Total RAP and/or RAS processed \_\_\_\_\_

	<b>QCP Frequency</b>	<b>Tests Required</b>	<b>Tests Completed</b>
Actual Binder Content	_____	_____	_____
Moisture	_____	_____	_____
Gradation	_____	_____	_____
CAA	_____	_____	_____
Bulk Spec. Gravity of Agg	_____	_____	_____

**Aggregates**

6.2 [ ] Sampling and testing of Blended Aggregate is in accordance with QCP

**QCP Frequency      Tests Required      Tests Completed**

\_\_\_\_\_

6.3 [ ] Sampling and testing of Aggregate Stockpiles is in accordance with QCP

**PG Binder**

6.4 [ ] Sampling of PG Binder is in accordance with QCP

Plant # \_\_\_\_\_

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**Mixture**

<b>Plant/Truck Samples</b>	<b>QCP Frequency</b>	<b>Tests Required</b>	<b>Tests Completed</b>
Actual Binder Content	_____	_____	_____
Gradation	_____	_____	_____
Moisture	_____	_____	_____
Temperature	_____	<u>N/A</u>	( Y or N )
Draindown (OG & SMA)	_____	_____	_____
Agg. Degredation (SMA, 1 per lot)	_____	_____	_____

6.5 [ ] Sampling and testing of Mixture at the Plant for actual binder content, gradation, draindown (open graded and SMA mixtures only), moisture content, and temperature is in accordance with QCP

<b>Pavement/Plate Samples</b>	<b>QCP Frequency</b>	<b>Tests Required</b>	<b>Tests Completed</b>
Air Voids	_____	_____	_____
VMA	_____	_____	_____
Actual Binder Content	_____	_____	_____
Gradation	_____	_____	_____
Dust/Pbe ratio	_____	_____	_____
Volume Eff. Binder (Vbe)	_____	_____	_____
Moisture (surface only)	_____	_____	_____

6.6 [ ] Sampling and testing of Mixture from the pavement for properties listed above is in accordance with QCP

**SAMPLING AND TESTING (continued)**

ITM 583 Reference

9.1, 9.2

Obtain the diary for one **HMA** (402) mixture produced for a selected DMF within the current year or past three complete calendar years. Perform calculations as needed and compare the quantities produced from the diary against the number of tests, thereby determining the frequency of testing. The frequency of sampling and testing shall be in accordance with the QCP, but not less than:

1. The first 250 t and each subsequent 1000 t of each DMF for base and intermediate mixtures. If a DMF does not reach 250 t, a minimum of one sample is required for certification.
2. The first 250 t and each subsequent 600 t of each DMF for surface mixtures. If a DMF does not reach 250 t, a minimum of one sample is required for certification.

Mixture \_\_\_\_\_ QCP Frequency \_\_\_\_\_ Quantity \_\_\_\_\_

Tests Required \_\_\_\_\_ Tests Completed \_\_\_\_\_

Certifications Required \_\_\_\_\_ Certifications sent to Jobsite \_\_\_\_\_

- 6.7 [ ] Sampling and Testing of Mixture for binder content, coarse aggregate angularity, gradation, and air voids is in accordance with QCP.
- 6.8 [ ] Test results are within requirements as follows:  
Air Voids --  $\pm 2\%$  from DMF  
Binder Content --  $\pm 0.7\%$  from DMF
- 6.9 [ ] Type D certifications were sent to jobsite as required and are on file
- 6.10 [ ] Test results shown on Type D certifications match test reports

**SAMPLING AND TESTING (continued)**ITM 583 Reference

9.1, 9.2

Select at random one test report for any one **QC/QA HMA or SMA** mixture and check the calculations performed for the Blended Aggregate, RAP, and Mixture. If only **HMA** mixture is produced, check the calculations for that mixture only.

\* Producer reports results to a third party application? If yes skip to section 7.

Blended Aggregate                      Mixture \_\_\_\_\_                      Date \_\_\_\_\_

- 6.11 \* Gradation of aggregate from mixture sample is calculated correctly  
 6.12 \* Gradation of aggregate from cold feed belt or belt discharge is calculated correctly (Drum Plants)  
 6.13 \* Gradation of aggregate from each hot bin is calculated correctly and blend calculations are correct (Batch Plants)  
 6.14 \* Moisture content of aggregate is calculated correctly

\* Recycled Materials                      RAP size/Name \_\_\_\_\_                      Date \_\_\_\_\_

- 6.15  Actual binder content calculated correctly (fines correction, if required, is used in calculation)  
 6.16  Gradation of aggregate calculated correctly  
 6.17 \* Moisture content calculated correctly  
 6.18 \* Coarse Aggregate Angularity for RAP calculated correctly  
 6.19  Gsb of recycled aggregate calculated correctly

Hot Mix Asphalt                      Mixture \_\_\_\_\_                      Date \_\_\_\_\_

- 6.20  Determination of Air Voids and VMA calculated correctly  
 6.21  Actual binder content calculated correctly (fines correction, if required, is used in calculation)  
 6.22  Gradation from mixture sample calculated correctly  
 6.23  Dust/calculated effective binder ratio calculated correctly  
 6.24 \* Moisture content calculated correctly  
 6.25  Bulk Specific Gravity calculated correctly  
 6.26 \* Aggregate degradation value (SMA only)  
 6.27  Maximum Specific Gravity calculated correctly  
 6.28  Volume of Effective Binder calculated correctly  
 6.29 \* If ignition oven is utilized, correct calibration factors are used

**7. HMA PLANT**ITM 583 Reference

2.5, 12.2

**Audit Team Member:** \_\_\_\_\_

Determine if the following documents are on file. Typically, the documents will be on file at the HMA Plant rather than the Laboratory.

- 7.1 [ ] Bill of ladings for most current day's production indicating material from ASC Supplier
- 7.2 [ ] Plant calibrations/blend sheets for each DMF (Calibrations on Plant computer are acceptable)
- 7.3 [ ] Annual calibrations for plant scales and verification of meters
- 7.4 [ ]\* Legitimate Use Approval letter from IDEM for post-consumer shingles
- 7.5 [ ] Weigh tickets adhere to requirements of section 109.01(b) of INDOT Standard Specifications  
Net weight, ticket serial #, date, contract number, source of material, material designation (size or type), DMF #, truck #, time weighed, gross weight/tare weight (if applicable)
- 7.6 [ ] Type A Certifications for all binders

Inspect the site and observe the operation of the Plant to verify that the production process is in accordance with the QCP and the Plant site layout diagram is correct.

Plant Site Layout

- 7.7 [ ] Binder tanks are located correctly
- 7.8 [ ] Fuel tank is located correctly
- 7.9 [ ]\* Fibers supply is located correctly
- 7.10 [ ] Anti-adhesive supply is located correctly
- 7.11 [ ]\* Field laboratory is located correctly
- 7.12 [ ] Visitor parking area is located correctly
- 7.13 [ ] Mixing Plant major components are located correctly

Aggregates (material stockpiles)

- 7.14 [ ] Stockpile map is current and located as indicated in QCP
- 7.15 [ ]\* All stockpiles have signs as indicated in QCP
- 7.16 [ ]\* Stockpiling procedure is in accordance with QCP
- 7.17 [ ] Stockpiles are adequately spaced and not contaminated
- 7.18 [ ]\* Cold bin loading procedure is in accordance with QCP

Plant # \_\_\_\_\_

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**HMA PLANT (continued)**

ITM 583 Reference  
2.5, 12.2

Binder Tanks

- 7.19 [ ] Binder tanks are labeled
- 7.20 [ ] Two binder samples per grade obtained this calendar year? If yes skip to 7.22
- 7.21 [ ] Binder samples obtained during audit

Fibers

- 7.22 [ ]\* Procedure for addition of fibers is in accordance with QCP

Anti-Adhesive Agent

- 7.23 [ ]\* Procedure for application of anti-adhesive agent is in accordance with QCP
- 7.24 [ ] Anti-adhesive agent supply is labeled with original manufactures label  
Name: \_\_\_\_\_
- 7.25 [ ] Anti-Adhesive is on approved list. Approval # : \_\_\_\_\_

Truck Loading

- 7.26 [ ]\* Procedure for loading trucks is in accordance with QCP

Other Process Control Techniques

- 7.27 [ ]\* Procedures are in accordance with QCP

Plant # \_\_\_\_\_

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## 8. LABORATORY

ITM 583 Reference

6.0, 7.0

Audit Team Member: \_\_\_\_\_

The laboratory will be inspected for compliance with the QCP.

- 8.1 Lab location:  Plant -or-  Offsite
- 8.2  Facility acceptable for testing materials
- 8.3  All equipment listed in QCP at laboratory
- 8.4  All equipment apparently in good working order
- 8.5 \* Procedure for transportation of mixture to laboratory not located at plant is in accordance with QCP
- 8.6  Calibration or verification documentation on file for minimum of 3 years

Check the calibration or verification records to verify that the frequency meets the minimum requirements and the documentation includes the following:

- Description of equipment including Model or Serial Number
- Name of person performing calibration or verification
- Identification of calibration equipment
- Date of calibration or verification and next due date
- Reference of procedure used
- Calibration or verification results

**LABORATORY (continued)**ITM 583 Reference

6.0, 7.0

	<b>Equipment</b>	<b>Requirement</b>	<b>Minimum Frequency</b>	<b>Procedure</b>	<b>Date Calibrated/ Verified</b>
8.7	Balances	Standardize	12 mo.	ITM 910	
8.8	Gyratory Compactor	Verify Ram Pressure, Angle of Gyration, Frequency of Gyration, LVDT	1 mo.	ITM 908	
8.9	Gyratory Compactor Internal Angle	Verification	12 mo.	AASHTO T 344	
8.10	Gyratory Mold and Plate Dimensions	Verification	12 mo.	AASHTO T 312	
8.11	Ignition Oven	Conduct Lift Test	Weekly	Operators Manual	
8.12	Ignition Oven Balance	Standardize	12 mo.	ITM 910	
8.13	Mechanical Shakers	Verify Sieving Thoroughness	12 mo.	ITM 906	
8.14	Ovens	Verify Temperature Settings	12 mo.	ITM 903	
8.15	Sieves	Verify Physical Condition	12 mo.	ITM 902	
8.16	Thermometers	Verification	12 mo.	ITM 909	
8.17	Corelok	Verification	3 mo.	ITM 905	
8.18	CoreDry	Verification	3 mo.	ITM 905	
8.19	T209 <sup>1</sup>	Verification	3 mo.	ITM 905	
8.20	Calipers	Verification	12 mo.	ITM 916	

NOTE 1: Auto rice has a frequency of 12 months

	<b>Calibration Equipment</b>	<b>Testing Equipment</b>	<b>Minimum Frequency</b>	<b>Date Calibrated/ Verified</b>
8.21	Master ring used with the Bore Gauge	Gyratory Compactor Molds – AASHTO T 312	36 mo.	
8.22	Dynamometer Load Cell with Height Billet <sup>2</sup>	Gyratory Compactor – AASHTO T 312	24 mo.	
8.23	Proving Ring with Height Gage Blocks	Gyratory Compactor – AASHTO T 312	24 mo.	
8.24	Vacuum Gage	Vacuum Systems – ITM 905	12 mo.	
8.25	Weights, Min. Class 3	Balances – ITM 910	12 mo.	

NOTE 2: Troxler equipment only

**9. AUDIT CLOSE-OUT**

**DTE or Area Supervisor**

A meeting with the Producer will be conducted at the completion of the audit. The results of the audit will be discussed, and all outstanding matters will be completely resolved or solutions with deadlines will be established. An Audit Close-Out meeting with the Producer will be scheduled for two weeks after the Audit, or if circumstances require, at a time deemed appropriate by the DTE. Any addenda required by items listed on the Addenda Summary Sheet, QCP Annex, or Corrective Action Sheets shall be submitted at this time.

When all items indicated on Corrective Action Sheets have been addressed, and all testing results (if applicable) have been reviewed, the DTE and/or Area Supervisor will verify the audit package is prepared properly and completely. Upon completion of the Audit Close-Out meeting, all documents will be sent to the Asphalt Engineer, Office of Materials Management.

Corrective Action Sheets requiring longer than two weeks must be addressed by the DTE.

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\_\_\_\_\_  
DTE/Area Supervisor

\_\_\_\_\_  
Date

**CORRECTIVE ACTION SHEET**

**PLANT #** \_\_\_\_\_

**DATE** \_\_\_\_\_

**ITEM** \_\_\_\_\_

**Problem Explanation:** \_\_\_\_\_

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**Corrective Action To Be Taken Is:**

- Not Applicable; Observation.** This item occurred in the past and cannot be corrected.
- Not Applicable; Corrected.** This item was resolved at the audit.

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**Deadline Date Is:** \_\_\_\_\_

**Follow-up**                      **Date** \_\_\_\_\_

**Finding:** \_\_\_\_\_

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Corrective Action Sheets requiring longer than two weeks must be addressed by the DTE.

## CALCULATIONS

### BINDER CONTENT (ITM 571)

$$\% \text{ Binder} = \frac{\text{Wt. of Sample} - (\text{Wt. of Extracted Aggregate} + \text{Wt. of Fines})}{\text{Wt. of Sample}} \times 100$$

### HMA or RAP MOISTURE CONTENT (ITM 572)

$$\% \text{ Moisture} = \frac{\text{Wt. of Original Sample} - \text{Wt. of Dried Sample}}{\text{Wt. of Dried Sample}} \times 100$$

### VOIDS in the MINERAL AGGREGATE (AASHTO R 35)

$G_{sb}$  = Bulk Specific Gravity of Aggregate (obtained from DMF)

$P_s$  = Aggregate, percent by total weight of HMA

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

### AGGREGATE GRADATION (AASHTO T 27)

$$\% \text{ Passing} = \frac{\text{Wt. Passing Each Sieve}}{\text{Original Dry Sample Wt.}} \times 100$$

### HMA or RAP EXTRACTED AGGREGATE GRADATION (AASHTO T 30)

$$\% \text{ Passing} = \frac{\text{Wt. Passing Each Sieve}}{\text{Original Dry Wt. of Aggregate} + \text{Wt. of Fines}^*} \times 100$$

\*Not required for ignition oven

### BULK SPECIFIC GRAVITY (Dense Graded and SMA) -- $G_{mb}$ (AASHTO T 166)

$$G_{mb} = \frac{\text{Wt. of Specimen in Air}}{(\text{Wt. of Surface-Dry Specimen in Air}) - (\text{Wt. of Specimen in Water})}$$

$$\% \text{ Absorption} = \frac{(\text{Wt. of Surface-Dry Specimen in Air}) - (\text{Wt. of Specimen in Air})}{(\text{Wt. of Surface-Dry Specimen in Air}) - (\text{Wt. of Specimen in Water})}$$

## CALCULATIONS (continued)

### MAXIMUM SPECIFIC GRAVITY -- $G_{mm}$ (AASHTO T 209)

A = weight of oven dry sample in air

$A_1$  = weight of surface dry sample

B = weight of container in water, g

C = weight of container and sample in water, g

D = weight of container filled with water at 77°F

E = weight of container filled with sample and water at 77°F

#### Weighing in Air

$$G_{mm} = \frac{A}{A + D - E}$$

#### Weighing in Water

$$G_{mm} = \frac{A}{A - (C - B)}$$

#### Supplemental Procedure

$$G_{mm} = \frac{A}{A_1 + D - E}$$

### AGGREGATE MOISTURE CONTENT (AASHTO T 255)

$$\% \text{ Moisture} = \frac{\text{Wt. of Original Sample} - \text{Wt. of Dried Sample}}{\text{Wt. of Dried Sample}} \times 100$$

### AIR VOIDS (AASHTO T 269)

$$\% \text{ Air Voids} = \frac{G_{mm} - G_{mb}}{G_{mm}} \times 100$$

### DRAINDOWN (Open Graded and SMA) -- (AASHTO T 305)

$$\% \text{ Draindown} = \frac{A - B}{C} \times 100$$

A = final weight of plate or container, g

B = initial weight of plate or container, g

C = initial total sample weight, g

### AGGREGATE DEGRADATION LOSS VALUE (SMA only) -- (ITM 220)

Aggregate Degradation Loss, % = A - B

A = average % passing the No. 8 sieve from the gyratory specimens

B = % passing the No. 8 sieve from the uncompacted mixture sample

## CALCULATIONS (continued)

### BULK SPECIFIC GRAVITY (Open Graded) -- $G_{mb}$ (AASHTO T331)

A = weight of dry specimen in air, g

B = weight of dry, sealed specimen, g

E = weight of sealed specimen in water, g

$F_t$  = apparent specific gravity of plastic sealing material at 77°F

$$G_{mb} = \frac{A}{B - E - \frac{B - A}{F_t}}$$

### COARSE AGGREGATE ANGULARITY (ASTM D 5821)

$$\% \text{CAA} = \frac{\text{Wt. of Crushed Particles}}{\text{Wt. of Crushed Particles} + \text{Wt. of Uncrushed Particles}} \times 100$$

### VOLUME OF EFFECTIVE BINDER

$$V_{be} = VMA - AV$$

VMA = VMA of the mixture

AV = Air voids of the mixture

### DUST TO CALCULATED EFFECTIVE BINDER RATIO

$$\text{Dust/Pbe} = \left( \frac{P_{200}}{P_{be}} \right)$$

P200 = aggregate passing the No. 200 sieve

Pbe = Percent of effective binder

$$P_{be} = \left( \frac{V_{be}}{G_{mb}/1.03} \right)$$

## CALCULATIONS (continued)

### Example Calculation for Recycled Materials Sampling and Testing

Contract R-38721 DMF 120460J Mixture 19.0 mm Int. Quantity 17,500 tons

#### Recycled Materials

$$\text{Total RAP used} = \text{Total mix quantity} \times \frac{\text{Percent RAP by Mass}}{100}$$

	Binder % RAS	Binder Replacement %	Virgin Binder %
	0.0%	24.7%	2.9%
			%

10.0% + 9.0%  
= 19.0% RAP  
by mass

Fine RAP/ Coarse RAP/ RAS in mixture, %	10.0%	9.0%	
Fine RAP/ Coarse RAP/ RAS binder, extracted, %	5.7%	4.1%	
Ignition oven test temp ( °F )	1000		

$$\text{Total RAP used} = 17,500 \text{ tons mix} \times \frac{19.0\%}{100}$$

$$\text{Total RAP used} = 3,325 \text{ tons RAP}$$

Percent by mass from DMF 19.0 Total used (in tons) 3,325 tons  
-- or --

Total Processed 3,325 tons

	QCP Frequency	Tests Required	Tests Completed
Actual Binder Content	<u>1/1000 t RAP</u>	<u>3</u>	<u>5</u>
Moisture	<u>1/1000 t RAP</u>	<u>3</u>	<u>5</u>
Gradation	<u>1/1000 t RAP</u>	<u>3</u>	<u>5</u>
CAA	<u>1/1000 t RAP</u>	<u>3</u>	<u>5</u>

6.4 [✓]\* Sampling and testing of Recycled Materials for actual binder content, moisture content, gradation and coarse aggregate angularity is in accordance with QCP

**APPENDIX**  
**Testing Results Outside of Control Limits**

Record the date and the result for any value outside of the control limit for the following properties

<i><b>Air Voids</b></i>	Target Value:
Date/Air Voids Value:	

<i><b>Binder Content</b></i>	Target Value:
Date/Binder Content Value:	

<i><b>VMA</b></i>	Target Value:
Date/VMA Value:	

<i><b>Dust/Effective Binder Ratio</b></i>	Target Value:
Date/Dust/Pbe Value:	

<i><b>Vbe</b></i>	Target Value:
Date/Vbe Value:	