HOMEWORK

SUPERPAVE QC/QA COURSE

Revised 3-25-04
Revised 12-14-04
Revised 12-30-04
Revised 1-3-05
Revised 3-10-05
Revised 5-6-05
Revised 12-7-05
Revised 11-24-06
Revised 12-28-06
Revised 12-7-07
Revised 12-12-08
Revised 12-16-08
Revised 5-8-09
Revised 12-11-09
Revised 3-9-10
Revised 12-14-10
Revised 3-29-12
Revised 12-18-13
Revised 12-9-15
Revised 1-11-19
Revised 2-1-19

MODULE 1
INTRODUCTION TO SUPERPAVE
HOMEWORK

1. What 4 types of pavement distress are minimized when mixes are designed in accordance with Superpave criteria?

2. Where are ***guidelines*** for testing and inspection of MoDOT projects found?

3. What is the 403 target for air voids for an SP250 mix?

4. What is the 403 field tolerance for VMA?

Module 2A
Mix Design Overview
Mix Design/Pavement Structure Design

1. For an SP125B mix, what is the design traffic level in ESALS____________________________

2. What specifications cover Superpave mixes for hot mix and for aggregate?

Module 2B
Mix Design Overview
Aggregate Quality

1. For an SP 125B mix, during the design phase, what is the minimum (or maximum, or acceptable range) acceptance level for:

   a. Fractured face Count______
   b. Fine Aggregate Particle Shape_______
   c. Sand Equivalent_______
   d. Flat & Elongated________

Module 2C
Mix Design Overview
Binder, RAP, & Shingles

1. For a PG 70-28, what do the numbers signify?

   70 =

   -28 =

2. For the following M320 binder grades, what are the ~equivalent M332 grades?

M320	M332
PG 64-22	
PG 70-22	
PG 76-22	

3. What is the major extra test in M332 compared to M320?

4. For a mix containing RAP, what materials may be in the In-line binder grade compared to the Contract grade?

Module 2D
Mix Design Overview
Volumetrics

1. For an SP125B mix, during the design phase, what is the minimum (or maximum or acceptable range) for:

a. Air Voids_____
b. VMA___
c. VFA_____

2. Calculate the combined (weighted average) Gsb of the aggregate blend shown on the attached JMF.

3. What 2 things occupy the space in VMA?

4. Total binder content has 2 portions. What are they?

5. Describe what VFA represents.

6. In general, what 5 things can be done to increase VMA.

MISSOURI DEPARTMENT OF TRANSPORTATION - DIVISION OF MATERIALS

ASPHALTIC CONCRETE TYPE SP125HB

DATE = 01/05/04 | CONTRACTOR = MY BUSINESS | SP125 04-17

IDENT. NO.	PRODUCT CODE	/ PRODUCER, LOCATION	BULK SP. GR.	APPAR. SP. GR.	%ABS	FORMATION	LEDGES	% CHERT
35JSJ001	100207..LD1	/ Hard Rock Stone, Dig Deep, MO	2.515	2.713	2.9	Jet City Dolo.	5-8	25
35JSJ002	100204..LD1	/ Hard Rock Stone, Dig Deep, MO	2.476	2.725	3.7	Jet City Dolo.	5-8	25
35JSJ003	1002MS..MSLD	/ Hard Rock Stone, Dig Deep, MO	2.480	2.761		Jet City Dolo.	5-8	10
30CAJ016	1002HL..HL	/ Missy Lime Co. #2, Ste. General, MO	2.303	2.303		Hyd. Lime		
36DLJ016	1015ACPG..7022	/ Black Asphalt Products, Decoy, MO	1.023		PG70-22	Gyro Mold Temp. 300-310°F		

MATERIAL IDENT #	35JSJ001	35JSJ002	35JSJ003	30CAJ016	35JSJ001	35JSJ002	35JSJ003	30CAJ016	COMB.
4017	3/4"	3/8"	MAN SAND	Hyd. Lime	60.0	12.0	26.0	2.0	GRAD
1 1/2"	100.0	100.0	100.0	100.0	60.0	12.0	26.0	2.0	100.0
1"	100.0	100.0	100.0	100.0	60.0	12.0	26.0	2.0	100.0
3/4"	100.0	100.0	100.0	100.0	60.0	12.0	26.0	2.0	100.0
1/2"	97.6	100.0	100.0	100.0	58.6	12.0	26.0	2.0	98.6
3/8"	83.8	96.1	100.0	100.0	50.3	11.5	26.0	2.0	89.8
#4	31.8	35.0	99.9	100.0	19.1	4.2	26.0	2.0	51.3
#8	7.0	8.0	82.0	100.0	4.2	1.0	21.3	2.0	28.5
#16	2.6	3.5	40.7	100.0	1.6	0.4	10.6	2.0	14.6
#30	1.6	2.6	26.6	100.0	1.0	0.3	6.9	2.0	10.2
#50	1.6	2.1	13.5	100.0	1.0	0.3	3.5	2.0	6.7
#100	1.5	1.9	5.4	100.0	0.9	0.2	1.4	2.0	4.5
#200	1.5	1.8	4.2	99.0	0.9	0.2	1.1	2.0	4.2

LABORATORY	Gmm =	2.405	% VOIDS =	4	TSR =	95	TSR Wt.	Nini =	9	MIX COMPOSITION	
CHARACTERISTICS	Gmb =	2.308	V.M.A. =	14.4	-200/AC =	1.1	3855	Ndes =	125	MIN. AGG.	93.8%
AASHTO T312	Gsb =		% FILLED =	72	Gyro Wt. =	4610		Nmax =	205	ASPHALT CONTENT	6.2%

CALIBRATION NUMBER	40002	MASTER GAUGE BACK CNT. =	2196	A1 =	-5.234741
MASTER GAUGE SER. NO. =	2502	SAMPLE WEIGHT =	7200	A2 =	3.436895

Aggregate & Mixture Properties Based on Contractors Mix Design

7. What 2 tests are used determine bulk specific gravity of aggregate?

8. What test is used to determine effective specific gravity of aggregate?

Module 2E & 2F
Mix Design Overview
Mix Design Phase 1 &2

1. During the design phase, for an SP125B mix, what are the required number of gyrations for Nini, Ndes, and Nmax? ______, ______, ______

2. During the design phase, for an SP125B mix, what are the required compaction levels (%Gmm) for Nini, Ndes, and Nmax? ______, ______, ______

3. Phase 1 is to determine design (gradation final binder content)

4. Phase 2 is to determine (gradation final binder content)

Module 2G
Mix Design Overview
TSR, JMF, Misc

1. What 9 pieces of information on the JMF can be useful to the QC or QA inspector on a daily basis?

MODULE 3

HOMEWORK

Performance Specification Contracts

GRADATION

1. For *QC*: What is the minimum sampling frequency for *gradation* samples at the HMA plant?

   Should they retain a split?_______

2. For an SP250B mix, given the following *QC* sample's gradation off the cold feed at a drum mix plant, what specifications (with tolerances applied) should the sample meet? Did the gradation pass?

Sieve	%Passing	Allowable	Pass/Fail?
1 1/2"	100		
1"	95.8		
3/4"	84.3		
1/2"	71.2		
3/8"	63.3		
#4	54.2		
#8	46.0		
#16	33.2		
#30	16.5		
#50	10.1		
#100	8.9		
#200	8.1		

3. For *QA*: What is the minimum sampling frequency for the *independent gradation* samples at the HMA plant?

4. What is *QA's* minimum testing frequency for the *QC retained splits* for *gradation* samples at the HMA plant?

5. When comparing QA to QC *gradations* from retained splits, what is considered "favorable comparison"?

Sieve	Favorable Comparison Spec
1 ½"	
1"	
¾"	
½"	
3/8"	
#4	
#8	
#16	
#30	
#50	
#100	
#200	

CONSENSUS TESTS

6. *For QC*: What is the minimum sampling frequency for ***consensus test*** samples at the HMA plant for QC?

   Should they retain a split?_______

7. **For QC**: For an SP250B mix, what are the allowable limits (specification with field tolerances applied) for ***consensus test*** values? Given the following QC consensus test results, did the sample pass?

Test	Result	Allowable	Pass/Fail?
FAA	43		
CAA	100/100		
T&E	11		
SE	44		

8. **For QA**: What is the minimum sampling frequency for independent QA consensus test samples at the HMA plant?

9. **For QA**: What is QA's minimum testing frequency for the QC retained splits for ***consensus test*** samples at the HMA plant?

10. When comparing QA to QC ***consensus test*** results from retained splits, what is considered "favorable comparison"? Given the following, is there a "favorable comparison"?

Test	QC Result	QA Result	Favorable Comparison Spec	Yes/No?
FAA	43	44		
CAA	98/92	99/94		
T&E	11	10		
SE	44	49		

11. Where should the consensus sample be taken?

DELETERIOUS MATERIAL:

12. **For QC**: What is the minimum sampling frequency for QC ***deleterious material*** samples at the HMA plant?

13. **For QA**: What is the minimum sampling frequency for independent QA ***deleterious material*** test samples at the HMA plant?

14. Where should the deleterious sample for aggregate be taken?

GENERAL:

~~13~~. What does MoDOT do on an annual basis at the quarry?
15.

MODULE 4
HMA QC PLAN
HOMEWORK

1. In the QC plan short form, what information is required about lots and sublots?

2. In the QC plan short form, what information is required about binder content testing?

3. In the QC plan short form, what information is required about coring?

4. What is a very critical item in the agreement between the HMA producer and the aggregate producer?

5. In the QC plan short form, what information is required about the gradation sample?

MODULE 5
HOTMIX SAMPLING/ CORING
HOMEWORK

1. For routine lots, are there requirements for lot size under the section 403 specification contracts?

2. What are the minimum number of sublots per lot?

3. What is the maximum sublot size ?

4. Are non-integral shoulders included in the traveled way lot routine?

For volumetrics/binder content loose mix samples:

1. **For QC**: What is the frequency of sampling for **QLA analysis?**____________

Is a retained sample required?_____

Should the location be random?______

2. **For QA**: Who should obtain the independent QA QLA loose mix sample, QA or QC?

At what minimum frequency? __________

Is a retained sample required?____

Should the location be random?_____

3. List the steps in the sample quartering process.

4. **For QA**: What is the minimum testing frequency of the QC retained sample?

5. What is the maximum time allowed for reheating samples at the field lab?_______

6. What are check samples used for?

7. In order for a check sample to be used for defining removal limits, what information must be tied to it?

8. Do check samples need to be random?_____

9. Can check samples be used for QLA?______

For TSR loose mix samples:

1. What is the frequency of sampling for QC?

2. **For QA**: Who should obtain the independent QA loose mix sample, QC or QA?

At what minimum frequency should the sample be taken?

3. List the steps in the TSR sample quartering process.

4. What locations are allowable for TSR samples?

5. Should QA get their sample at the same location?

Cores from the traveled way:

1. Does QA obtain an independent core? _______

2. What is the minimum QA ***witnessing/testing*** frequency for cores?

3. What is the minimum QC ***sampling and testing*** frequency for core samples?

4. What is meant by a core "sample"?

Cores from unconfined longitudinal joints:

1. What is the sampling frequency?

Cores from non-integral shoulders:

1. What is the sampling frequency?

MODULE 5
SAMPLING POINTS
HOMEWORK

1. For a 3000 ton lot, divide into 4 sublots and determine at what tonnage the loose mix samples should be taken, and at what roadway offset. The roadway is 12 ft wide, with no unconfined joints. For random numbers, use the table in Module 5: column 3, starting with number set 11 (from the top). Choose 4 pairs (A and B) of numbers moving down the column.

2. For the same lot, determine the sampling points for all QC cores in the lot. The beginning station is 1000+00. The sublot ending stations are1050+50, 1100+50, 1149+00, and 1199+10. The roadway width is 12 ft. For random numbers, use column 4, starting with number set 6 (from the top). Choose 4 pairs (A and B) of numbers moving down the column.

LOOSE MIX

JOB ______ ROUTE ______ MIX NO ______ LOT NO ______

SUBLOT ______

TECHNICIAN ______

TONS IN SUBLOT "T" ______
BEGINNING TONS "BT" ______
ENDING TONS "ET" ______
WIDTH ______

RANDOM NO

A	B

T	A	X=T x A	TONS = BT + X

WIDTH	B	W = WIDTH - 2'	W x B	OFFSET = 1+W x B

SUBLOT ______

TECHNICIAN ______

TONS IN SUBLOT "T" ______
BEGINNING TONS "BT" ______
ENDING TONS "ET" ______
WIDTH ______

RANDOM NO

A	B

T	A	X=T x A	TONS = BT + X

WIDTH	B	W = WIDTH - 2'	W x B	OFFSET = 1+W x B

SUBLOT ______

TECHNICIAN ______

TONS IN SUBLOT "T" ______
BEGINNING TONS "BT" ______
ENDING TONS "ET" ______
WIDTH ______

RANDOM NO

A	B

T	A	X=T x A	TONS = BT + X

WIDTH	B	W = WIDTH - 2'	W x B	OFFSET = 1+W x B

SUBLOT ______

TECHNICIAN ______

TONS IN SUBLOT "T" ______
BEGINNING TONS "BT" ______
ENDING TONS "ET" ______
WIDTH ______

RANDOM NO

A	B

T	A	X=T x A	TONS = BT + X

WIDTH	B	W = WIDTH - 2'	W x B	OFFSET = 1+W x B

SUBLOT ______

TECHNICIAN ______

TONS IN SUBLOT "T" ______
BEGINNING TONS "BT" ______
ENDING TONS "ET" ______
WIDTH ______

RANDOM NO

A	B

T	A	X=T x A	TONS = BT + X
0	0.0000	0	0

WIDTH	B	W = WIDTH - 2'	W x B	OFFSET = 1+W x B
0	0.0000	-2	0	1

MAT COMPACTION

JOB 0 ROUTE 0 MIX NO 0 LOT NO 0

SUBLOT
TONS IN SUBLOT
BEGIN STATION "STA"
ENDING STATION
LENGTH "L"
WIDTH "W"

	A	B
RANDOM NO		

L	A	X=L x A	STA + X
W	B	OFFSET = W x B	

SUBLOT
TONS IN SUBLOT
BEGIN STATION "STA"
ENDING STATION
LENGTH "L"
WIDTH "W"

	A	B
RANDOM NO		

L	A	X=L x A	STA + X
W	B	OFFSET = W x B	

SUBLOT
TONS IN SUBLOT
BEGIN STATION "STA"
ENDING STATION
LENGTH "L"
WIDTH "W"

	A	B
RANDOM NO		

L	A	X=L x A	STA + X
W	B	OFFSET = W x B	

SUBLOT
TONS IN SUBLOT
BEGIN STATION "STA"
ENDING STATION
LENGTH "L"
WIDTH "W"

	A	B
RANDOM NO		

L	A	X=L x A	STA + X
W	B	OFFSET = W x B	

SUBLOT
TONS IN SUBLOT 0
BEGIN STATION "STA"
ENDING STATION
LENGTH "L" 0
WIDTH "W" 0.0

	A	B
RANDOM NO		

L	A	X=L x A	STA + X
0	0.0000	0	0
W	B	OFFSET = W x B	
0	0.0000	0	

ALWAYS MEASURE OFFSET FROM SAME EDGE

SUBLOT
TECHNICIAN
A = Weight of sample in air
B = Weight in water:
C = Weight of surface dry sample
Gmc = CORE SPECIFIC GRAVITY = A / (C - B)
Gmm = MAX. SPECIFIC GRAVITY (T209)
% COMPACTION OF CORE = 100 x (Gmc / Gmm)

	0.000	0.000	0.000	0.000
	0.0	0.0	0.0	0.0

MODULE 6
GYRO OPERATION
HOMEWORK

1. What height should the volumetrics gyro pucks be compacted to at the end of the prescribed number of gyrations?____________

   How about the TSR pucks?___________

2. What is the difference between gyro verification and calibration?

3. How often should gyro verification be performed and in what condition should the gyro be in?

4. How often should calibration be performed?

5. What five things do you check during gyro verification?

6. During field verification of mix volumetric properties, specimens should be compacted to which number of gyrations: N_{ini}, N_{des}, or N_{max}?

7. During field verification of mix volumetric properties, what do you use the gyro-compacted puck data (G_{mb}) for?

8. Where do you obtain the specimen weight for volumetric gyro pucks?

9. Is the required TSR puck weight different from the volumetric gyro puck weight?

10. Calibration is to be of which angle, internal or external?

11. The internal calibration angle should be:

12. How is angle verification handled?

13. How often should the critical mold dimensions be checked?

MODULE 7
MAXIMUM SPECIFIC GRAVITY OF VOIDLESS MIX
HOMEWORK

1. On the accompanying data sheets, calculate G_{mm} of the loose mix, G_{mb} of the compacted gyro puck, and the volumetrics: air voids (V_a), VMA and VFA.

   Re-calculate G_{mm} if the dry-back procedure is used and the new surface dry weight (A2) is 1574.4g

2. Of what use is Rice gravity (Gmm) data?

3. What should be the air void content of a Rice specific gravity specimen?

4. Where do you obtain the Rice sample?

5. What are the 2 ways of verifying that the moisture content in the Rice specimen is below the maximum allowed?

6. Under what condition do you employ the "dry-back" procedure?

7. What are the minimum required sample sizes for:

   a. SP125
   b. SP190
   c. SP250

8. Why do you crumble the Rice gravity specimen?

9. Why do you shake the Rice gravity specimen?

10. Why do you pull a vacuum on Rice gravity specimen?

11. What is the official name of the Rice gravity?

SUPERPAVE MIXTURE PROPERTIES

JOB 0 ROUTE 0 MIX NO #VALUE! LOT NO 0

SUBLOT							
DATE							

A2 required when T85 absorption ≥ 2.0% on any aggregate fraction

AASHTO T 209							
TECHNICIAN							
A = Wt. of sample	1571.4						
A2=Wt. of sample (dry-back)							
D = Wt. of flask filled with water	7471.8						
X = A + D		0.0	0.0	0.0	0.0	0.0	0.0
E = Wt. of flask filled with water and sample	8348.4						
Y = X - E		0.0	0.0	0.0	0.0	0.0	0.0
Gmm = MAX. SPECIFIC GRAVITY = A / Y							

AASHTO T 166								
TECHNICIAN								
MOLDING TEMPERATURE								
A = Weight of sample in air:		1174.4						
B = Weight of sample in water:	SPEC. 1	632.6						
C = Weight of surface dry sample		1178.0						
Gmb = BULK SP. G. = A / (C-B)			0.000	0.000	0.000	0.000	0.000	0.000
A = Weight of sample in air:		1176.4						
B = Weight of sample in water:	SPEC. 2	634.6						
C = Weight of surface dry sample		1180.0						
Gmb = BULK SP. G. = A / (C-B)			0.000	0.000	0.000	0.000	0.000	0.000
AVG. Gmb			0.000	0.000	0.000	0.000	0.000	0.000

TECHNICIAN							
MoDOT TM54 (NUCLEAR)							
SAMPLE WEIGHT							
BACKGROUND							
COUNTS							
UNCORRECTED % AC							
AASHTO TP53 (IGNITION)							
UNCORRECTED %AC	9.01						
CORRECTION FACTOR	0.98						
NUCLEAR OR IGNITION							
% MOISTURE	0.13						
% AC BY IGNITION OR NUCLEAR							

AASHTO PP28							
A = Gmm (FIELD)							
B = Gmb (FIELD)		0.000	0.000	0.000	0.000	0.000	0.000
C = Gsb (Job Mix)	2.410	2.410	2.410	2.410	2.410	2.410	2.410
D = Ps = Percent Agg. in mix		100.0	100.0	100.0	100.0	100.0	100.0
VMA = 100 - (B X D / C)		100.0	100.0	100.0	100.0	100.0	100.0
Va = 100 X ((A - B) / A)		100.0	100.0	100.0	100.0	100.0	100.0
VFA = [(VMA-Va) / VMA] x100		0	0	0	0	0	0

AASHTO T 166							
TECHNICIAN							
A = Weight of sample in air							
B = Weight in water							
C = Weight of surface dry sample							
Gmc = CORE SPECIFIC GRAVITY = A / (C - B)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gmm = MAX. SPECIFIC GRAVITY (T209)							
% COMPACTION OF CORE = 100 x (Gmc / Gmm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THICKNESS							
SUBLOT							

SUPERPAVE MIXTURE PROPERTIES

JOB 0 ROUTE 0 MIX NO #VALUE! LOT NO 0

SUBLOT							
DATE							

A2 required when T85 absorption ≥ 2.0% on any aggregate fraction

AASHTO T 209							
TECHNICIAN							
A = Wt. of sample							
A2=Wt. of sample (dry-back)	1574.4						
D = Wt. of flask filled with water	7471.8						
X = ~~A + B~~ A2 + D		0.0	0.0	0.0	0.0	0.0	0.0
E = Wt. of flask filled with water and sample	8348.4						
Y = X - E		0.0	0.0	0.0	0.0	0.0	0.0
Gmm = MAX. SPECIFIC GRAVITY = A / Y							

AASHTO T 166								
TECHNICIAN								
MOLDING TEMPERATURE								
A = Weight of sample in air	SPEC. 1	1174.4						
B = Weight of sample in water	SPEC. 1	632.6						
C = Weight of surface dry sample	SPEC. 1	1178.0						
Gmb = BULK SP. G. = A / (C-B)	SPEC. 1	2.153	0.000	0.000	0.000	0.000	0.000	0.000
A = Weight of sample in air	SPEC. 2	1176.4						
B = Weight of sample in water	SPEC. 2	634.6						
C = Weight of surface dry sample	SPEC. 2	1180.0						
Gmb = BULK SP. G. = A / (C-B)	SPEC. 2	2.157	0.000	0.000	0.000	0.000	0.000	0.000
AVG. Gmb		2.155	0.000	0.000	0.000	0.000	0.000	0.000

TECHNICIAN							
MoDOT TM54 (NUCLEAR)							
SAMPLE WEIGHT							
BACKGROUND							
COUNTS							
UNCORRECTED % AC							
AASHTO TP53 (IGNITION)							
UNCORRECTED %AC	9.01						
CORRECTION FACTOR	0.98						
NUCLEAR OR IGNITION							
% MOISTURE	0.13						
% AC BY IGNITION OR NUCLEAR	7.9						

AASHTO PP28							
A = Gmm (FIELD)							
B = Gmb (FIELD)	2.155	0.000	0.000	0.000	0.000	0.000	0.000
C = Gsb (Job Mix)	2.410	2.410	2.410	2.410	2.410	2.410	2.410
D = Ps = Percent Agg. in mix	92.1	100.0	100.0	100.0	100.0	100.0	100.0
VMA = 100 - (B X D / C)	17.6	100.0	100.0	100.0	100.0	100.0	100.0
Va = 100 X ((A - B) / A)		100.0	100.0	100.0	100.0	100.0	100.0
VFA = [(VMA-Va) / VMA] X 100		0	0	0	0	0	0

AASHTO T 166							
TECHNICIAN							
A = Weight of sample in air							
B = Weight in water							
C = Weight of surface dry sample							
Gmc = CORE SPECIFIC GRAVITY = A / (C - B)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gmm = MAX. SPECIFIC GRAVITY (T209)							
% COMPACTION OF CORE = 100 X (Gmc / Gmm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THICKNESS							
SUBLOT							

MODULE 8
ASPHALT CONTENT
HOMEWORK

1. What is the "Aggregate Calibration (or, Correction) Factor" [now called the "Asphalt Binder Correction Factor"]? How is it applied? Who determines it?

   What:

   How applied:

   Who determines (QC or QA):

2. For the Thermolyne brand oven, what is the "Temperature Compensation"? How is it applied?
   What:

   How applied:

3. What is the "Chamber Set Point"? Who decides which of the standard values should be used?
   What:

   Who decides (QC or QA):

4. On the accompanying "Calibration" data sheet, calculate the Asphalt Binder Correction Factor [Aggregate Correction Factor] (C_F). Assume that the moisture content of the lab-produced mix is zero. All weighing steps will be performed on an exterior scale.

5. On the accompanying "HMA Moisture Correction" data sheet, calculate moisture content of a plant-produced HMA sample.

6. On the accompanying HMA Asphalt Content (NCAT oven method) data sheet ("Reproducing Oven Ticket Values"), record the appropriate information from the oven ticket and calculate the moisture-corrected asphalt content of the plant-produced HMA sample (use the moisture determined in question 5).

7. Something happens during an ignition oven test, and you must finish the test manually. You obtain the [final mass of basket + burned specimen] by weighing on your bench balance. Previous information about this specimen is that there was 0.1% moisture in it, and the aggregate correction factor for the mix is 0.98%. On the accompanying form ("Manual Weighing Method"), calculate the binder content.

8. At what point is the moisture content determined, during mix design or during field sampling? Who determines the moisture content, QC or QA? How is the moisture correction applied?

   When determined:

   Who (QC or QA):

   How used:

8. If the Aggregate Correction Factor exceeds 1.0 % at 538 C, MoDOT specs dictate that the Chamber Set Point (ignition temperature) should be____________?

9. If the Aggregate Correction Factor exceeds 1.0% at 482 C, MoDOT specs dictate that the Chamber Set Point (ignition temperature)should be______?

10. What test method is specified for moisture determination of hot mix samples?

11. Is it allowable to use the residue of an ignition oven test for gradation analysis?

12. What may be necessary to determine if you were going to use an ignition oven sample for gradation purposes?

13. **What is the QC testing frequency of RAP binder content?**

14. **What is the QA testing frequency of RAP binder content?**

15. **What testing method for RAP binder is specified?**

16. **Under what conditions can a different RAP binder content test method be substituted?**

17. **What is the frequency of oven verification?**

ASPHALT CONTENT IGNITION METHOD
(AASHTO T 308-10)
METHOD A

Aggregate Correction Factor
[Asphalt Binder Correction Factor] Determination

Sample______________________Lab No.________Date______Initials______

Replicate	1	2	3	4
Test Temperature	538	538		
Tare (basket, etc.) Mass (g)	3000	3000		
Total Dry Mass (g)	4500	4480		
Initial Dry Specimen Mass (g)				
Loss in Weight (g)	81.0	79.2		
%AC, measured = M				
%AC, actual = A	5.01	5.02		
$\%AC_{diff}$ ($M_1 - M_2$)		> 0.15%? If so, 2 more replicates		
$C_F = M - A$				
C_F, average				

MOISTURE CONTENT OF HOT MIX ASPHALT (HMA) by OVEN METHOD AASHTO T 329-15 (for ignition oven correction purposes)			
Project No.	Job No.	Route	County
Technician	Date	Sublot No.	Mix No.
Oven Temp.	Time in	Time out	Interval
		Sample:	Sample:
Pan wt. (g)		340	
Mix + pan wt., moist (g) = (W_{wet})		1840	
Mix + pan wt., dry (g) [Trial 1]		1839	
Mix + pan wt., dry (g) [Trial 2]		1838	
Mix + pan wt., dry (g) [Trial 3] = (W_{dry})		1838	
$\%Moisture = \frac{W_{wet} - W_{dry}}{W_{dry} - pan} \times 100$			

NOTE: All weights to nearest 0.1 gram and % moisture to nearest 0.01%

Elapsed Time: 82:00
Sample Weight: 1486g
Weight Loss: 135.6g
Percent Loss: 9.13%
Temp Comp: 0.12%
Calib. Factor: 0.98%
Bitumen Ratio: 8.94%

=======================

Calibrated Asphalt Ctnt
8.02%

=======================

82	490	135.6	9.13*
81	490	135.6	9.13
80	490	135.5	9.12
79	490	135.4	9.11
78	490	135.3	9.10
77	490	135.2	9.10
76	490	135.1	9.09
75	490	135.0	9.08
74	490	134.8	9.07
73	490	134.7	9.06
72	490	134.5	9.05
71	490	134.3	9.04
70	489	134.1	9.02
69	489	134.0	9.02
68	489	133.8	9.00
67	490	133.5	8.98
66	490	133.3	8.97
65	490	133.1	8.96
64	490	132.8	8.94
63	490	132.6	8.92
62	489	132.3	8.90
61	489	132.1	8.89
60	489	131.8	8.87
59	489	131.6	8.86
58	490	131.2	8.83
57	490	130.9	8.81
56	490	130.6	8.79
55	489	130.2	8.76
54	489	129.9	8.74
53	488	129.6	8.72
52	487	129.2	8.69
51	487	128.8	8.67
50	486	128.4	8.64
49	486	128.1	8.62
48	485	127.7	8.59
47	484	127.2	8.56
46	484	126.7	8.53
45	484	126.2	8.49
44	484	125.7	8.46
43	483	125.1	8.42
42	483	124.6	8.38
41	483	123.9	8.34
40	483	123.3	8.30
39	483	122.7	8.26
38	483	121.8	8.20
37	483	120.7	8.12
36	484	120.0	8.08
35	486	119.2	8.02
34	488	118.4	7.97
33	491	117.4	7.90
32	495	116.3	7.83
31	498	115.2	7.75
30	[illegible]	[illegible]	[illegible]

ASPHALT CONTENT IGNITION METHOD
(AASHTO T 308-10)
METHOD A
Reproducing Oven Ticket Values

Revised 12-9-15

Project No.	Job No.	Route	County
Technician	Date	Sublot No.	Mix No.

Empty Basket Assembly Weight (g), [T_e]	3000
Basket Assembly + Wet (or dry) Sample Weight (g), [T_i]	4486
Wet (or dry) Sample Weight (g), [$W_i = (T_i - T_e)$]	
Loss in Weight (g), [L] (from tape)	
Total % Loss, [$P_L = (L / W_i)$ x100]	
Temperature Compensation (%), [C_{tc}] (from tape)	
% AC, uncorrected, [$P_{bu} = P_L - C_{tc}$]	
Aggregate Correction (Calibration) Factor (%), [C_f] (from tape)	
Calibrated %AC (from ignition oven tape), [$P_{bcal} = P_{bu} – C_f$]	
% Moisture Content, [MC] (previous test)*	-0.13
% AC, corrected (by weight of mix), [$P_b = P_{bcal} – MC$]*	

*If w_i = wet

ASPHALT CONTENT IGNITION METHOD
(AASHTO T 308-10)
METHOD A
Manual Weighing Method

Revised 12-18-15

Project No.	Job No.	Route	County
Technician	Date	Sublot No.	Mix No.

Empty Basket Assembly Weight (g), [T_e]	3000
Initial Basket Assembly + Wet (or dry) Sample Weight (g), [T_i]	4400
Initial Wet (or dry) Sample Weight (g), [$W_i = (T_i - T_e)$]	
Final Basket Assembly + Sample Weight (g), [T_f]	4310
Loss in Weight (g), [$L = T_i - T_f$]	
% Loss, [$P_L = (L / W_i)$ x100]	
Aggregate Correction (Calibration) Factor (%), [C_f]	
Calibrated %AC, [$P_{bcal} = P_L - C_f$]	
% Moisture Content, [MC]*	-0.10
% AC, corrected (by weight of mix), [$P_b = P_{bcal} - MC$]*	

*If w_i = wet

Ignition Ovens Forms.doc (11-24-06;12-28-06;12-12-08;3-9-10;12-14-10;4-14-11; 12-18-13; 12-9-15)

MODULE 9
TSR HOMEWORK

1. What should be the finished height of the TSR puck?

2. What should be the finished air void content of the TSR puck?

3. What should be the finished % saturation of the TSR puck?

What should you do if it is low on saturation?

What should you do if it is high on saturation?

4. If the TSR (during production) is 72, what is the pay adjustment factor?

5. Under what conditions is TSR required for BP and BB mixes?

6. List some things that might happen which would cause the lab running the TSR to call for more sample?

MODULE 10A
PAY FACTORS
HOMEWORK

1. The Pay Factors for a 4000 ton lot of material placed on the traveled way are as follows. Compute the overall pay factor for this lot:

Pay Factor	%
Density	96.2
Binder content	100.4
VMA	102.2
Air Voids	99.4
PF_{Total}	

If the contract unit price per ton of hotmix is $65.00, calculate the bonus or deduct for this lot.

2. The total Pay Factor for ***non-integral shoulders*** includes the following pay factors:

____

____

____

3. During HMA production, what are the specification limits (with field tolerances applied) for:

Factor	Spec Limit with Field Tolerances
Air voids	
VMA	
Binder content	
Density	

MODULE 10B
FAVORABLE & UNFAVORABLE COMPARISON
HOMEWORK

1. How close must the QA results be to the mean of the QC results in order for the data from QC be considered valid so that the QC results can be used to compute pay factors?

Rule# 1:

Rule #2:

2. If QC's mean binder content is 5.80% with a standard deviation of 0.20 % and QA's binder content is 5.67%, is there favorable comparison?

3. If QC's mean binder content is 5.80% with a standard deviation of 0.05 % and QA's binder content is 5.67%, is there favorable comparison?

4. If there is unfavorable comparison between QC and QA, to resolve the issue, what is the first step?

5. If all data appears to be correct, what 2 alternate courses of action could be taken?

6. If a retained sample is tested, what tests must be run?

7. What constitutes favorable comparison between the 2 original and retained sample test results?

8. If there is favorable comparison between the original and retained sample test results, what should be done?

9. If there is un-favorable comparison between the original and retained sample test results, what should be done?

10. If the retained sample test results are substituted for the original results and the lot comparison still shows unfavorable comparison between QC and QA, what should be done?

MODULE 10C
Miscellaneous
HOMEWORK

1. Under what circumstances would material be considered for removal & replacement?

2. The payment for non-integral shoulder lots can also adjusted for________________by use of the
____.

MODULE 10D
Performance Testing
HOMEWORK

1. What are the two performance tests currently being explored through JSP's?

MODULE 11
RECORDKEEPING
HOMEWORK

1. What lab equipment calibration records must be kept?

2. A record of certain information must be kept 3 years. List the types of required info.

3. In regard to test data and results, when should QC make it available to QA and what info is required?

4. In regard to test data and results, when should QA make it available to QC and what info is required?

5. List some things that a process review team may ask for.

MODULE 12
CONTRACT ADMINISTRATION

1. Are MoDOT inspectors limited to taking only random HMA samples off the roadway?

2. Under what conditions can self-test results be used for determining removal limits?

3. According to the Section 403 Q&A document, when should loose mix random numbers be given to QC?