Welcome to

Tomorrows Roads

Built on Today's Testing

Presented by

MAPA EMERGING LEADERS

Please make sure webcam is OFF & remember to MUTE your mic when not speaking. Thank You!

MAPA

EMERGING LEADERS

MAPA Emerging Leaders is comprised of professionals within our industry who strive to promote the proper use of asphalt, pavement selection, and collectively advance the asphalt market. Members of this group will have the opportunity to form new friendships, grow professionally and learn more about the industry through educational opportunities.

Presenter:

Andy LaPlante

Interstate Testing

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Tomorrows Roads Built on Today's Testing

MAPA Asphalt 101 Series

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Introduction

- Located in St. Louis, MO
- Highway construction materials testing and mix design services.
- HMA, RAP, RAS, PG asphalts, emulsions, cutback asphalts, and aggregates
- On-site HMA, aggregate, and concrete testing
- I-FIT, IDEAL CT, and Hamburg
- AASHTO R-18 Accredited

Introduction

- Started as an in-house QC laboratory for a heavy highway contractor during the inception of SHARP & Superpave in the late 1990's
- In 2016 we spun off to become our own private stand-alone laboratory
- This allowed us to provide testing, design and technical services to other heavy highway contractors as well as public and private entities.

Tomorrows Roads Built on Today's Testing

- Briefly discuss the makeup of a hot mix asphalt design
- What properties need to be tested during hot mix asphalt paving
- Preferred test methods to use for evaluation
- Appropriate testing frequencies
- Understanding test results

What's In Hot Mix Asphalt?

- Mineral Aggregate
  - HMA aggregate consists of crushed stone, crushed gravel, screenings, manufactured sands, and natural sands.
  - Coarse aggregate is the material retained on the #4 sieve and fine aggregate is the materials passing the #4 sieve.
  - Typically, 94% to 95% of the HMA mixture.

What's In Hot Mix Asphalt?

- Mineral aggregate
  - Coarse and Fine
- Liquid asphalt binder
  - Performance graded binder
- Recycled material
  - Recycled asphalt pavement (RAP)
  - Recycled asphalt shingles (RAS)
- Mineral filler
  - Baghouse fines
- Additives
  - Anti-strip agent
  - Warm mix additive
- Air Voids

What's In Hot Mix Asphalt?

- Liquid Asphalt
  - Performance graded asphalt
  - PG64-22, Based on 7-day average for high temperature (64) and single night low for low temperature (22)
  - Typically, 4.5% to 6.5% of your HMA mixture

What's In Hot Mix Asphalt?

- Recycled Material (RAP)
  - Recycled asphalt pavement
  - Typically, 10%-50% of your HMA mixture
- Recycled Material (RAS)
  - Recycled asphalt shingles
  - Manufacture rejects or post consumer tear offs
  - Typically, 1%-5% of your HMA mixture

What's In Hot Mix Asphalt?

- Mineral Filler
  - Baghouse fines or mineral filler
  - Typically, 0%-2%, as needed
- Additives
  - Anti-strip, as needed, 0.25% -0.5% of asphalt binder
  - Warm Mix additive, as needed, percentage varies

What's In Hot Mix Asphalt?

- Air Voids
  - Asphalt is designed with a certain amount of air voids in it.
  - The mineral aggregate acts as the framework of the mixture and the asphalt binder is the glue. Between these components is a designed amount of air.
  - This small amount of air is necessary for the durability of the asphalt mixture.
  - Typically designed with 3%-4% air voids

MAPA ASPHALT, LLC

Interstate Testing Services

AAP AASHTO R18

MIX TYPE BP-1

IDENT NO.	PRODUCER-LOCATION		PI	BULK SP. GR.	APP. SP. GR.	%ABS	FORMATION	LEDGES	% CHERT
	ROCK MINERALS	3/4" CLEAN		2.679	2.725	0.8	ROCK	1-100	0.1
	ROCK MINERALS	1/2" CLEAN		2.682	2.720	0.5	ROCK	1-100	0.1
	ROCK MINERALS	SCRN	NON	2.674	2.719	0.8	ROCK	1-100	0.1
	SAND & GRAVEL	FIELD SAND	NON	2.639	2.695	0.3	FIELD SAND		
	MISSISSIPPI LIME CO., STE GENEVIEVE, MO	MF		2.707			MIN FILLER		
	MAPA	RAP		2.634			RAP		

PG 64-22 MAPA REFINING, JEFF CITY MO 1.033 Mix Temp. 295-305 Mold Temp. 295-305

		3/4"	1/2"	#4	#8	MF	RAP			3/4"	1/2"	#4	#8	MF	RAP		BP-1
										22.0	28.0	19.0	10.0	1.0	20.0		
1 1/2"		100.0	100.0	100.0	100.0	100.0	100.0			22.0	28.0	19.0	10.0	1.0	20.0	100.0	100.0
1"		100.0	100.0	100.0	100.0	100.0	100.0			22.0	28.0	19.0	10.0	1.0	20.0	100.0	100.0
3/4"		100.0	100.0	100.0	100.0	100.0	100.0			22.0	28.0	19.0	10.0	1.0	20.0	100.0	100.0
1/2"		93.4	100.0	100.0	100.0	100.0	100.0			20.5	28.0	19.0	10.0	1.0	20.0	98.5	85-100
3/8"		80.0	98.5	97.5	100.0	100.0	94.0			17.6	27.6	18.5	10.0	1.0	18.8	93.5	
#4		26.0	51.0	72.0	96.0	100.0	66.0			5.7	14.3	13.7	9.6	1.0	13.2	58.1	50-70
#8		14.0	12.0	56.0	92.0	100.0	47.0			3.1	3.4	10.6	9.2	1.0	9.4	36.7	30-55
#16		8.5	5.0	45.5	76.0	100.0	33.0			1.4	1.4	8.6	7.6	1.0	6.6	26.9	
#30		6.0	4.4	40.0	51.0	100.0	26.0			1.3	1.2	7.6	5.1	1.0	5.2	21.5	10-30
#50		5.0	4.0	28.5	10.0	99.5	13.0			1.1	1.1	5.4	1.0	1.0	3.6	13.2	
#100		4.5	3.5	20.0	1.0	95.0	11.0			1.0	1.0	3.8	0.1	1.0	2.2	9.0	
#200		3.5	2.8	14.0	0.8	75.0	8.0			0.8	0.8	2.7	0.1	0.8	1.6	6.6	5-12

Gmm =	2.502	% VOIDS =	3.5	TSR =		TSR Weight =		Nini	na	MIX COMPOSITION	
Gmb =	2.414	V.M.A. =	13.6	DIB Ratio =	1.5			Ndes	35	MIN. AGG.	95.2%
Gsb =	2.696	% FILLED =	74.5	Gyro Weight =				Nmax	na	VIRGIN ASPHALT CONTENT	3.9%
Gse =	2.604									TOTAL AC	4.8%
Flat & Elongated		5:1 =		Clay Content =		Stability =				% AC RAP =	0.9
		3:1 =		Deleterious =	0.5					% AC Shingles =	
		CAA =		FAA =						Virgin Binder Ratio=	60.0

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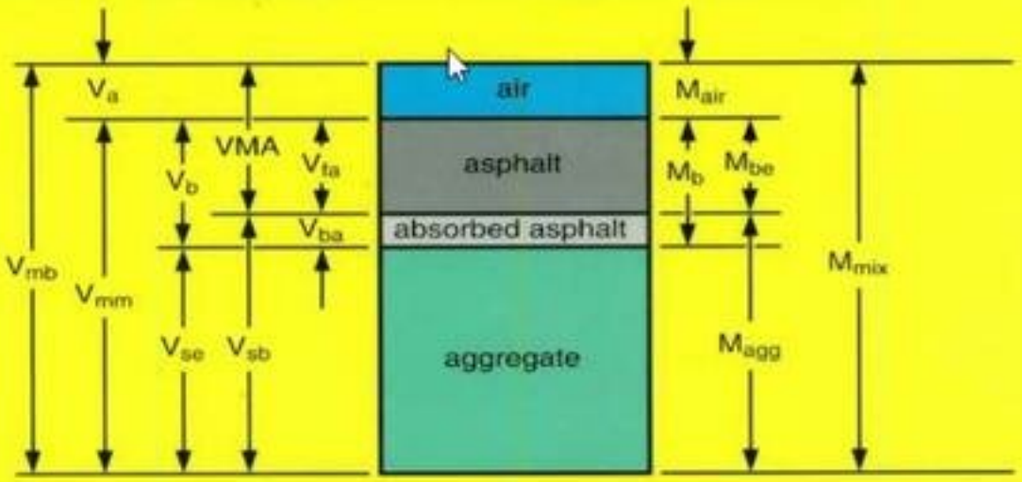
ASPHALT MIXTURE VOLUMETRICS

COMPONENT DIAGRAM



National Center for Asphalt Technology
NCAT
AUBURN UNIVERSITY

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Questions??????

Testing HMA Properties

- First determine what type of mixture is being produced and paved
- Superpave (MoDot Section 403)
- Bit-Base or BP low type mixtures (MoDot Section 401)
- This will determine what properties to test for and what test methods to use

Testing HMA Properties

- Gradation
  - The gradations is the analysis of the combined aggregate going into the mixture
  - Testing the gradation of the mixtures is important because it can ensure the aggregate is being blended correctly at the asphalt plant and the JMF is being followed.
  - The gradation of the mixture can be obtained by a combined cold feed sample from a drum plant, hot bin pulls from a batch plant or from the residue of an ignition oven sample or chemical extraction
  - AASTHO T-27 and T-30 should be used for the analysis of the combined gradation

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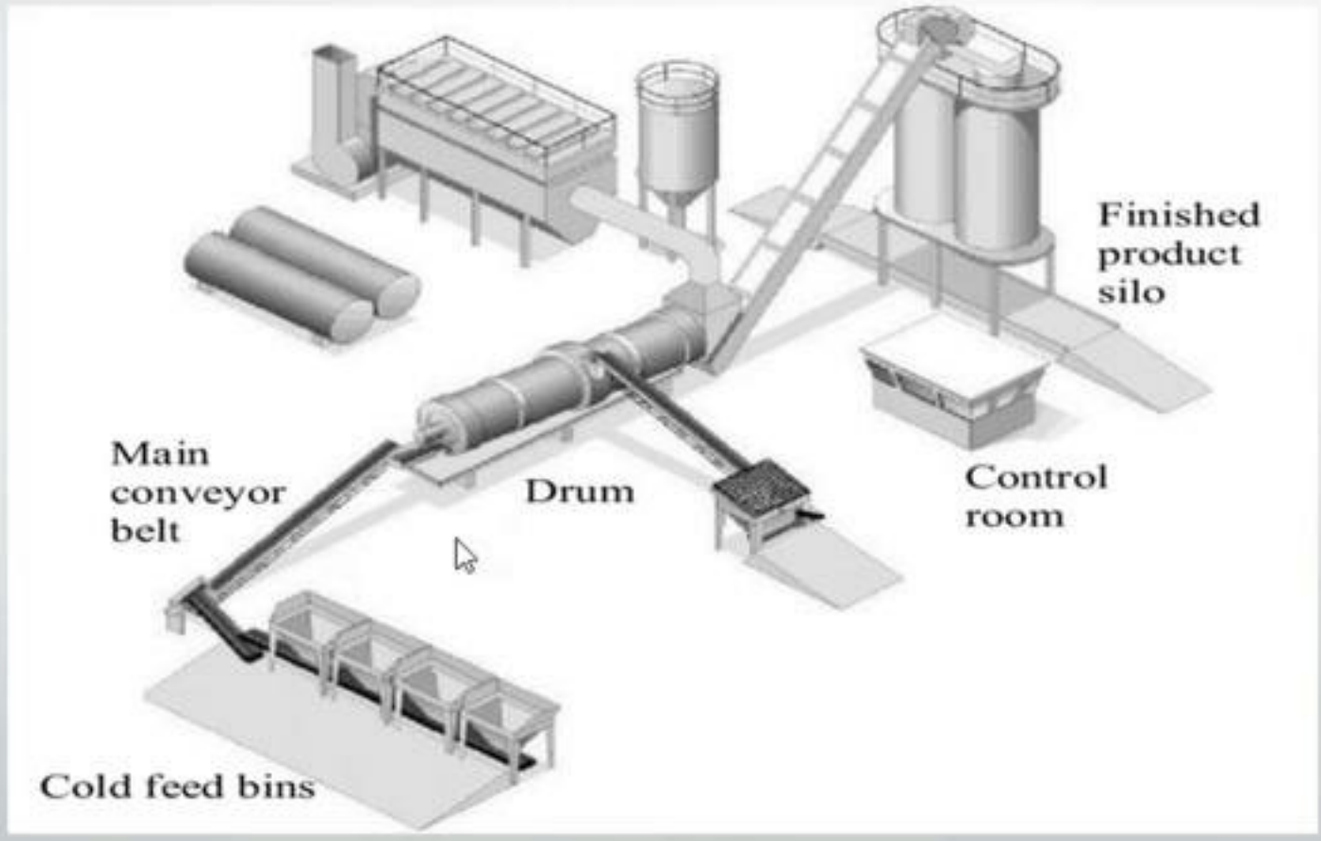
Testing HMA Properties



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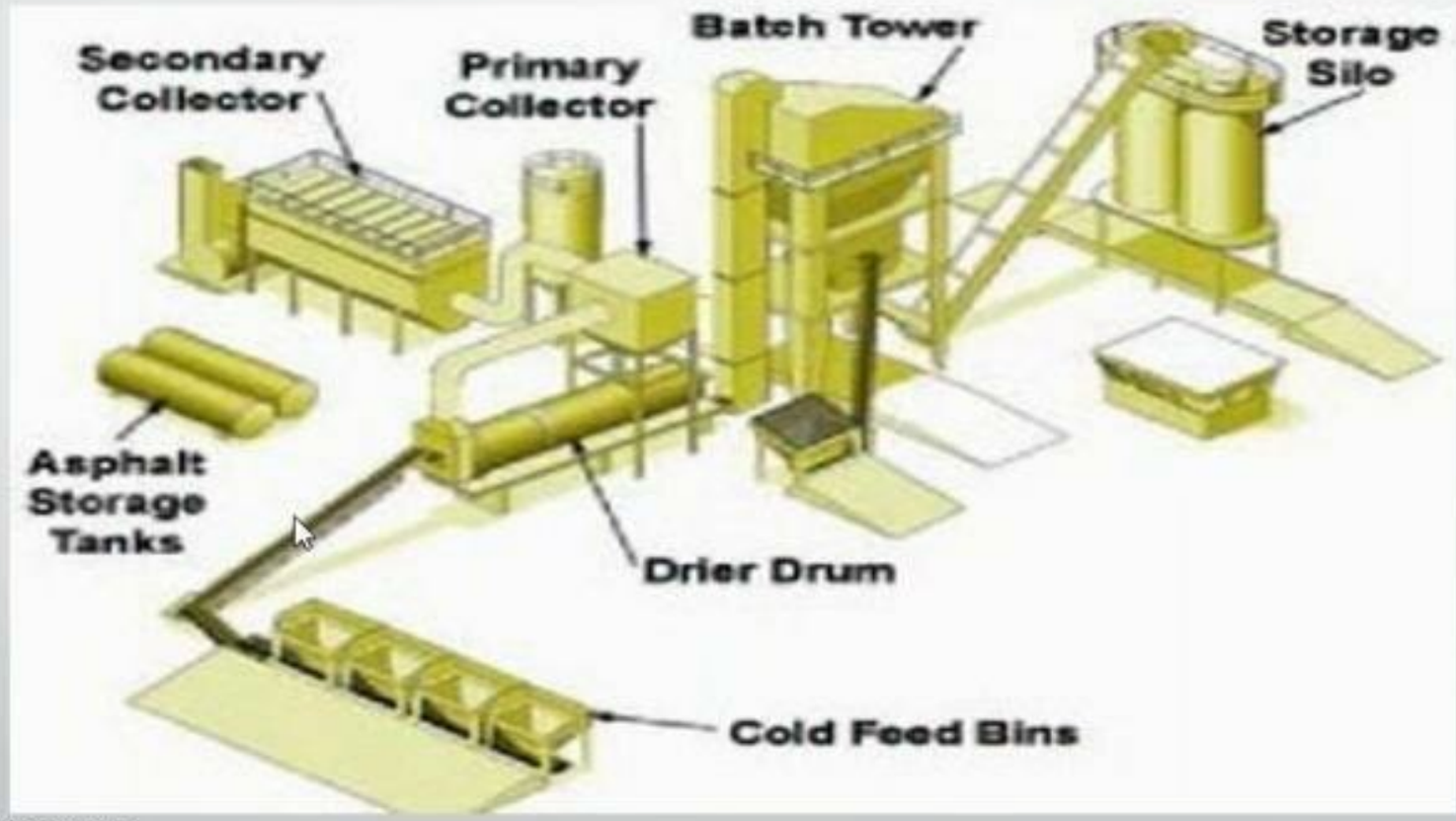
Testing HMA Properties



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Testing HMA Properties

- Asphalt Content
  - The asphalt content is the measurement of the percentage of liquid asphalt going into the mixture
  - Testing the asphalt content is extremely important. This ensures that the correct amount of liquid asphalt is being mixed with the aggregate at the asphalt plant.
  - There are several ways to test the Asphalt content. Some test methods need additional information to obtain accurate results.

Testing HMA Properties

- AASHTO T-308 (Ignition Oven Method)
  - Loose mix sample can be obtained from the hot mix plant or from the behind the paver on the road.
  - To run this test method correctly you will need the aggregate correction factor and the oven temperature in which the correction factor was obtained
  - Residue from this method can be used to preform a gradation


STEP 3
TERESTING FACT:

Testing HMA Properties

- AASHTO T-164 (Chemical Extraction)
  - Loose mix sample can be obtained from the hot mix plant or from the behind the paver on the road.
  - No information about the mixture is needed to perform this method
  - Residue from this method can be used to preform a gradation


GILSON
CENTRIFUGE EXTRACTOR

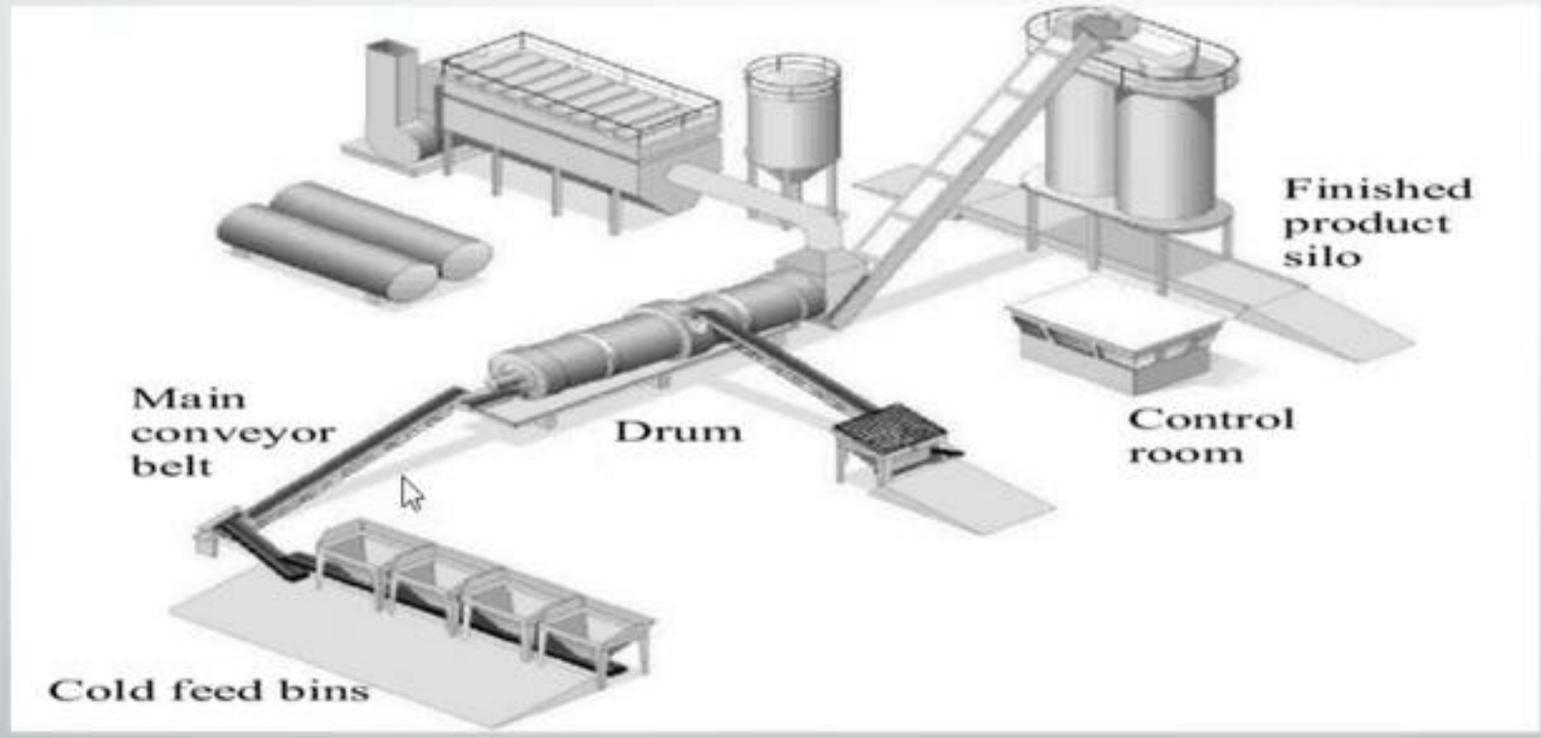
Testing HMA Properties

- AASTHO T-287 (Nuclear Method)
  - Loose mix sample can be obtained from the hot mix plant or from the behind the paver on the road.
  - To run this test method correctly you will need a gauge calibrated to the mixture you are testing, and the sample weight obtained from that calibration
  - This is a non-destructive test method so there is no residue left over to test the gradation

Testing HMA Properties

- Deleterious Content
  - Deleterious content tests the coarse aggregate for shale or shaley rock, extremely soft rock, mud balls, and other foreign material
  - The deleterious content is import because it ensures that the coarse aggregate going into the asphalt mixture is a hard, sound durable aggregate.
  - The deleterious sample can be obtained from the combined cold feed at the asphalt plant.

Testing HMA Properties



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Testing HMA Properties

- Asphalt Mixture Volumetrics
  - Air voids and Vma
  - Typically associated with superpave
  - To determine the air voids and Vma two test methods need to be preformed
  - These test methods should only be preformed by a well-trained accredited laboratory who runs these test methods routinely

Testing HMA Properties

- AASHTO T-209 (Maximum Theoretical Specific Gravity)
  - Loose mix sample can be obtained from the hot mix plant or from the behind the paver on the road.
- AASHTO T-166 (Bulk Specific Gravity)
  - Loose mix sample can be obtained from the hot mix plant or from the behind the paver on the road.
  - Loose mix must be compacted to the specified number of blows or gyrations according to the mix design

Testing HMA Properties

- In-Place Mat Density
  - In-place mat density measures how well compacted the mixture is in the field.
  - Testing the in-place mat density ensures the mixture is not being over or under compacted during the paving and rolling process.
  - There are two main test methods used to measure in-place mat density

Testing HMA Properties

- Density Gauges
  - Nuclear and Non-Nuclear gauges
  - Will need the Gmm from the JMF or field testing for proper use
  - Nondestructive testing
  - Test results are obtained very quicky


Do Not Touch
PQI During Reading
GPS
Trans Tech
Continuous Reading
Push Stop Button to stop reading
Stop
Compaction: 94.6%
Density: 145 lb/ft³
Temperature: 176 F°
Mix: BPZ NORTH
Project: WHITEHALL
7.7 V
09:38
09/03/20

Testing HMA Properties

- Density Cores
  - 4" and 6" cores
  - Will need the Gmm from the JMF or field testing to calculate the density
  - Use T-166 to determine the bulk specific gravity of density cores

Questions????

Testing Frequency

- The testing frequency of hot mix asphalt should be evaluated based on:
  - Type of Mixture
  - Scope of work i.e. county road or interstate
  - Tonnage produced

Testing Frequency

- Low Type Mixtures
  - Asphalt content & gradations: Once per day or every 1000 tons
  - Deleterious: Once per project or every 5000 tons

Testing Frequency

- Superpave Mixtures
  - Air voids, Vma, asphalt content: Once per day or every 750 tons
  - Gradation & deleterious: Once per project or every 1500 tons

Scope of Work

- Low type mixture on county road <1000 tons
  - One asphalt content and gradation per day
  - Deleterious one per road
  - In-place mat density monitored with density gauge

Scope of Work

- Superpave mixture, high traffic area
  - Air voids, Vma, asphalt content once per day or every 750 tons
  - Gradation and deleterious once per day or every 1500 tons
  - Monitor in-place mat density with gauge
  - In-place mat density cores

Scope of Work

- Low type mixture lettered Rt. >1000 tons
  - One asphalt content and gradation per 1000 tons
  - Deleterious once per project or 5000 tons
  - In-Place density cores cut per 500 tons

The Result

- Understanding the test results
- Tolerances
- How will it effect the performance
- Timely test results

```
-----------------------
Elapsed Time:  39:08
Sample Weight: 1270g
Weight Loss:   79.0g
Percent Loss:  6.28%
Temp Comp:     0.17%
Calib. Factor: 0.26%
Bitumen Ratio: 6.27%
=======================
Calibrated Asphalt Ctnt
        5.85%
=======================
 39  495   79.8   6.28*
 38  494   79.8   6.28
 37  495   79.7   6.27
 36  495   79.5   6.25
 35  497   79.3   6.24
 34  499   79.1   6.22
 33  503   78.7   6.19
 32  506   78.2   6.15
 31  509   77.7   6.11
 30  513   77.1   6.07
 29  516   76.2   6.00
 28  519   75.4   5.93
 27  521   74.5   5.86
 26  524   73.5   5.78
 25  526   72.2   5.68
 24  528   70.8   5.57
 23  529   69.5   5.47
 22  530   68.0   5.35
 21  531   66.4   5.22
 20  531   64.8   5.10
 19  532   63.2   4.97
 18  536   59.6   4.69
 17  536   59.2   4.66
 16  536   59.0   4.64
 15  537   58.2   4.58
 14  539   56.9   4.48
 13  546   54.8   4.31
 12  563   50.9   4.00
 11  612   43.9   3.45
 10  648   24.1   2.68
  9  526   22.1   1.74
  8  459   11.7   0.92
  7  439    5.5   0.43
  6  433    4.0   0.31
  5  427    2.8   0.22
  4  420    2.0   0.15
  3  414    1.4   0.11
  2  409    0.9   0.07
  1  411    0.5   0.03
---|----|-------|------
  T|TEMP|WT.LOSS|%LOSS
-----------------------
Filter Set Pt:  750°C
Chamber Set Pt:  500°C

Tested By:_____

Mix Type:_____

Sample ID:_____
Time: 15:41:21
Date:  2-11-15
```

The Result

Interstate Testing Services

10440 Liberty Avenue • St. Louis, MO 63132
Tel. 3149944641

AAP AASHTO R18

Date of Test	11/24/2020	**Client**	MAPA
Sample Date	11/20/2020	**Date**	11/25/2020
Date Completed	11/24/2020	**Technician**	GB
Material Type	BP-1	**Sample ID**	P0429
Material Source	MAPA	**Test Tonage**	275

T-30 GRADATION

	WEIGHT	Percent Passing
1 1/2"	0.0	**100.0**
1"	0.0	**100.0**
3/4"	0.0	**100.0**
1/2"	141.1	**92.5**
3/8"	320.0	**86.1**
4	408.4	**64.4**
8	298.8	**48.4**
16	170.0	**39.4**
30	147.4	**31.5**
50	144.1	**23.9**
100	126.6	**17.1**
200	114.2	**11.1**
PAN	55.2	
WET WT		
DRY WT	1078.1	
WASHED WT	1725.4	
P-200	152.7	

AASHTO T-308 BINDER IGNITION @427°C

SAMPLE + BASKET WT.	4906.2
BASKET WEIGHT	2906.2
SAMPLE WEIGHT	2000.0
LOSS	123.10
% LOSS	6.16
TEMP. COMP. FACTOR	0.10
AGGREGATE COR. FACTOR	0.70
ASPHALT CONTENT	**5.4**

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Interstate Testing Services

10440 Liberty Avenue • St. Louis, MO 63132
Tel. 314-994-0641

Client: MAPA COUNTY Project: Prairie Rd East bound Technician: Tim T

Date	Station/ Tonnage	Gmm	Nuke Gauge Reading #1	Nuke Gauge Reading #2	Nuke Gauge Reading #3	Nuke Gauge Reading #4	Nuke Gauge Reading #5	Avg. Density
6/17/2020	4.672 LM	2.447	92.5	93.4	93	93.5	93.1	93.1
6/17/2020	4.760 LM		95.4	93.9	96.2	95.8	94.9	95.2
6/17/2020	4.927 LM		94.0	95.0	95.6	96.3	95.6	95.3
6/17/2020	5.100 LM		95.4	95.6	94.9	95.2	94.8	95.2
6/17/2020	5.207 LM		95.4	95.9	95.4	95.7	95	95.5

Interstate Testing Services

[illegible] Liberty Avenue • St. Louis, MO [illegible]
Tel. [illegible]

SAMPLE DATE	10/6/20	LOT #	SQ	SUBLOT #	SQ	TEST TONNAGE	550
ROUTE	NA	ITS JOB #	NA			TEST TIME	10:00 AM
PLANT	MAPA	ITS SAMPLE #	P[illegible]			MIX TEMPERATURE	295 °F
MIX TYPE	SP125CLP	ASPHALT: PG	64H-22			QC CONTACT	ANDY L

AASHTO T-166	GYRO PUCKS	
SPECIMEN #	1	2
HEIGHT	115.9	115.4
DRY WT	4699.6	4696.0
SSD WT	4704.5	4699.9
WT IN WATER	2711.1	2712.4
VOLUME	1993.2	1995.5
Gmb =	2.357	2.365

AASHTO T-209	RICE
DRY WT	1957.7
FLASK FILLED W/ WATER	1323.6
SUM	3321.3
WT OF SAMPLE W/ WATER	2504.2
DRY BACK WT	
VOLUME	817.1
Gmm =	2.445

AASHTO T-166	CORES	
IDENT	1A1	1A2
STAITON	100+15	100+15
DRY	527.3	563.5
SSD	527.5	565.2
WATER	295.6	325.6
VOL	231.7	239.6
SP.GR	2.267	2.352
DENSITY	92.7	96.2
AVERAGE	94.5	

TARGET

Gmm	2.445
Gmb	2.361
AIR VOIDS	**3.4**
VMA=	**14.1**
VFA=	75.8
A.C. CONTENT=	**5.2**
Gsb=	**2.607**

AASHTO T-308	BINDER IGNITION
SAMPLE + BASKET WT	4867.0
BASKET WEIGHT	2867.0
SAMPLE WEIGHT	2000.0
LOSS	112.50
% LOSS	5.63
TEMP. COMP. FACTOR	0.12
AGGREGATE COR. FACTOR	0.30
ASPHALT CONTENT	**5.2**

UNCONFINED AASHTO T-166 JOINT CORE		
IDENT		
STAITON		
DRY		
SSD		
WATER		
VOL		
SP.GR		
DENSITY	0.0	

TM-71 DELETERIOUS		AASHTO T-329 HMA MOISTURE CONTENT	
SHALE	1.0	Wet Wt	2000.0
OTHER DEL	0.0	Dry Wt	2000.0
ORIG. WT	550.0		
		% Moisture	**0.0**
TOTAL %	0.182		

GRADATION

	BIN 1	BIN 2	BIN 3	BIN 4	M.F.		BAGHOUSE SILO M.F.	A.C.	TOTAL
BIN PULLS	100.0	0.0	0.0	0.0	0.0		0.0	2000.0	100.0
MIX %	5.0	0.0	0.00	0.00	0.0		0.0	5.0	
AGG. %	**100.0**	**0.0**	**0.0**	**0.0**	**0.0**			100.0	

AASHTO T-27/30

	BIN 1 WEIGHT	BIN 2 WEIGHT	BIN 3 WEIGHT	BIN 4 WEIGHT	BIN 1 GRAD	BIN 2 GRAD	BIN 3 GRAD	BIN 4 GRAD	M.F. GRAD	BIN 1 %	BIN 2 %	BIN 3 %	BIN 4 %	M.F. %	COMB GRAD	JOB MIX	DIFF	MASTER RANGE
										100.0	**0.0**	**0.0**	**0.0**	**0.0**	100.0			
1 1/2"					100.0				100.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0	100.0
1"					100.0				100.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0	100.0
3/4"					100.0				100.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0	100.0
1/2"	[illegible]				98.6				100.0	98.6	0.0	0.0	0.0	0.0	98.6	0.0	98.6	90-100
3/8"	[illegible]				95.0				100.0	95.0	0.0	0.0	0.0	0.0	95.0	0.0	95.0	90MAX
4	[illegible]				66.1				100.0	66.1	0.0	0.0	0.0	0.0	66.1	0.0	66.1	
8	[illegible]				42.9				100.0	42.9	0.0	0.0	0.0	0.0	42.9	0.0	42.9	28-58
16	[illegible]				33.4				100.0	33.4	0.0	0.0	0.0	0.0	33.4	0.0	33.4	
30	[illegible]				23.1				100.0	23.1	0.0	0.0	0.0	0.0	23.1	0.0	23.1	
50	[illegible]				14.3				100.0	14.3	0.0	0.0	0.0	0.0	14.3	0.0	14.3	
100	[illegible]				10.7				96.0	10.7	0.0	0.0	0.0	0.0	10.7	0.0	10.7	
200	[illegible]				9.3				75.0	9.3	0.0	0.0	0.0	0.0	9.3	0.0	9.3	2-10
PAN	[illegible]																	
DRY WT	[illegible]																	
WASHED WT	[illegible]																	
P-200	[illegible]	0.0	0.0	0.0														
	1625.2	0.0	0.0	0.0														

Tolerances

- Appropriate tolerance should always be used when analyzing HMA test results
- Local DOTs (MoDot) and or associations such as MAPA should always be the go-to for establishing testing tolerances
- If the mix design, testing frequency, and testing tolerance are good enough to haul the material to your project they are most likely good enough for your project.

Tolerances

- Gradation
  - +/- 2.0% on the #200, +/- 5.0% on the #8 of the JMF
  - Combined gradation must stay within the master range
- Asphalt Content
  - +/- 0.3% of the JMF
  - Or -0.3% and +0.5% of the JMF on low type mixtures

Tolerances

- In-Place Mat Density
  - 94.5% +/- 2.5%
  - Or >91.5% on low type mixtures
- Air Voids & Vma
  - VA = +/- 1.0% of the JMF
  - Vma = -0.5% and + 2.0% of the target Vma

How Will it Effect the Performance

- Gradation
  - A gradation out of tolerance and or the master range can lead to high or low air voids, raveling and the potential for poor density
  - On-site QC or the QC manager should be made aware of the failing results so changes to the aggregate blend can be made

How Will it Effect the Performance

- Asphalt Content
  - Low asphalt contents can lead to raveling, cracking, high air voids and poor density
  - High asphalt contents can lead to low air voids and a mixture that has the potential to rut
  - On-site QC or the QC manager should be made aware of the failing results so changes to the plant operations can be made

How Will it Effect the Performance

- In-Place Mat Density
  - Low density can lead to higher permeability, premature cracking, raveling and permeant deformation due to rutting
  - High density, although not as large a performance issue as low density, can lead to flushing and permanent deformation
  - On-site QC, superintendent or the QC manager should be made aware of the failing results so changes to the rolling pattern can be made

How Will it Effect the Performance

- Air Voids and Vma
  - Typically failing Va or Vma is due to a failure from one of the previous tests and will cause the same performance issues
  - Out of tolerance Va and Vma can seriously affect the performance and longevity of an asphalt mixture
  - On-site QC or the QC manager should be made aware of the failing results so changes to the mixture can be made

Timely Test Results

- Test results are only as good as the hands they are in
  - Results do very little on a desk or in an in-box
  - Communicate results, good or bad, to all the appropriate individuals as quickly as possible

Timely Test Results

- Sampling is not testing
  - Although test results are only as good as the sample, pulling a sample and letting it sit in the truck or lab for days does very little good
  - Asphalt is not concrete, results 28 days later are unacceptable
  - All the test methods discussed can be completed in a workday.

Questions????

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