ASPHALT TECHNICIAN REVIEW

(8:00 to 2:30)

Intro

- ATTI
- Safety
- Rounding Procedure

Thursday

ARIZ 427	Asphalt Content by Ignition Furnace
ARIZ 406	Moisture Content of Bituminous Mixtures
ARIZ 417	Rice Test
ARIZ 410	Marshalls
ARIZ 415	Bulk Specific Gravity of Compacted Bituminous Mixtures
ARIZ 424	Voids Calculations
ARIZ 421	Asphalt Content by Nuclear Method
Lunch 11:30 — 12:30	
AASHTO T312	Gyratory
ARIZ 247	Uncompacted Voids
Hand Out Practice Calculations & Questions	

Friday

Check Practice Calculations	
ARIZ 103	Sampling Bituminous Materials
ARIZ 104	Sampling Bituminous Mixtures
ARIZ 416	Splitting Field Samples of Bituminous Mixtures for Testing
Review Practice Questions	
Lunch 11:30 — 12:30	
Hands On Practice	12:30 — 2:30

ADOT Materials Testing Manual
http://www.azdot.gov/business/engineering-and-construction/MaterialsGroup

ADOT
Intermodal Transportation

Asphalt Technician Review Class

Practice Calculations

ADOT
44-9372 R03/16

ARIZONA DEPARTMENT OF TRANSPORTATION
ASPHALTIC CONCRETE TABULATION – IGNITION FURNACE

USE CAPITAL LETTERS

LAB NUMBER | UNIT NUMBER | MATL | TYPE | PUR-POSE | TEST LAB | SIZE | SIZE %

TEST NO. | LOT OR SUFFIX | SAMPLED BY | MO | DAY | YEAR | TIME (MILITARY TIME)

SAMPLED FROM | LIFT NO. | RDWY | STATION (IF MILEPOST, INPUT DECIMAL)

ORIGINAL SOURCE | PROJECT ENGINEER / SUPERVISOR | PROJECT NUMBER | TRACS NUMBER

REMARKS

CONTACT NUMBER

COARSE FACTOR = 100 / COARSE SIEVE TOTAL

WEIGHTS RETAINED		% RET	% PASS	SPECS
3″				
2 1/2″				
2″				
1 1/2″				
1″				
3/4″				
1/2″	157			
3/8″	334			
1/4″	389			
#4	183			
#8	352			
- #8	810			
Total				

= i (Rounded)

Weight of Pass # 8 Split: 710 = p

FINE FACTOR = % Pass #8 / Wt. of Pass #8 Split

WEIGHTS RETAINED		% RET	% PASS	SPECS
#10	71			
#16	179			
#30	159			
#40	60			
#50	47			
#100	66			
#200	43			
-#200	2			
Total	625			
Elutri-ation				

r

q = Dry Weight

= p - q

r - s = Corrected % Pass No. 200

% Pass No. 200 Correction Factor (±) ____ s

IGNITION FURNACE

ARIZ. 427 ☑ ARIZ. 428 ☐

a. Wet Mass of Moisture Sample: 1002.8 g

b. Dry Mass of Moisture Sample: 1002.5 g

c. Moisture Content (ARIZ 406) [(a - b) / a] x 100: ____ %

d. Mass of Basket Assembly: 3109.0 g

e. Mass of Sample and Basket Assembly: 5460.6 g

f. Initial Mass of Sample (e - d): ____ g

g. Ignition Furnace Set Temperature: 538 °C

h. Mass of Sample and Basket Assembly After Ignition: 5332.2 g

i. Mass of Sample After Ignition (h - d): ____ g

j. Uncorrected Asphalt Binder Content [(f - i) /f] x 100: ____ %

k. Asphalt Binder Content Calibration Factor (±): 0.10 %

l. Ignition Furnace Correction (Tank Slab Correction) (±): 0.00 %

m. Corrected Asphalt Binder Content (j - k - c - l): ____ %

n. Design Asphalt Binder Content: 5.30 %

o. Elapsed Time of Test (minutes): 69

COMPACTION

Marshall = M Gyratory = G Core = C ☐

RICE

Sample Max. Sp. Gr. (Gmm): ____

Sample Max. Density [(Gmm) x (62.3)]: ____ pcf

MARSHALL

Average Bulk O.D. Sp. Gr. (Gmb): ____

Average Bulk Density [(Gmb) x (62.3)]: ____ pcf

Air Voids = ____ %

$\left[1 - \frac{\text{Average Bulk Density}}{\text{Max Density From Rice Test}}\right] \times 100$

Stability: ____ lbs

Flow: ____ 0.01 in

GYRATORY

Average Relative Density (% Gmm) at Ndesign: ____ pcf

Air Voids = ____ %

$100 - \left[\text{Average Relative Density \% (Gmm) at Ndesign}\right]$

WHITE ☐

YELLOW ☐

BLUE ☐

RECEIVED DATE | TEST OPERATOR AND DATE | SUPERVISOR AND DATE

SEE BACK ALSO

If samples were fan dried, the maximum density is determined utilizing "Wsd" weights shown below:

Rice Test (ARIZ 417)

FLASK NUMBER OR I.D.	"Wf" WT. OF FLASK	"Wmm" WT. OF SAMPLE IN AIR Wfs - Wf	"B" WT. OF FLASK + WATER	"C" WT. OF FLASK + SAMPLE + WATER Wa - Wp	"Vvm" VOLUME OF VOIDLESS MIX Wmm + B - C	"Gmm" MAXIMUM SPECIFIC GRAVITY Wmm / Vvm	MAXIMUM DENSITY (lbs./cu. ft.) Gmm x 62.3	"Wsd" SURFACE DRY WEIGHT	"Vvm" VOLUME OF VOIDLESS MIX Wsd + B - C	"Gmm" MAXIMUM SPECIFIC GRAVITY Wmm / Vvm	MAXIMUM DENSITY (lbs./cu. ft.) Gmm x 62.3
1	1101.6		3215.7								
2	1139.0		3178.7								
3	1151.9		3194.1								
AVERAGE											

FLASK SAMPLE OR I.D.	1	2	3
WT. OF FLASK + SAMPLE, **"Wfs"**	2158.2	2195.4	2206.5
WT. OF FLASK + SAMPLE + WATER + GLASS PLATE, **"Wa"**	3997.7	3959.8	3975.9
WT. OF GLASS PLATE, **"Wp"**	163.4	163.4	163.4

REMARKS:

Max Specific Gravity Range: Range of 3: Range of 2 if needed:

Non Fan Dried:

Fan Dried:

Marshall Compaction (ARIZ 410 or 422) or Cores

Specimens compacted by: Hand ☐ Mechanical ■ 4" ■ 6" ☐; Core ☐

Specimen I.D. =	1	2	3
Specimen Height (0.001 in.) =	2.468	2.444	2.514

Bulk Specific Gravity, Bulk Density, & Absorption of Specimens (ARIZ 415, Method A ☐ or Method C ☐)

A = mass, in grams, of specimen in air =	1168.3	1165.9	1169.9
B = mass, in grams, of SSD specimen in air =	1171.5	1170.5	1172.7
C = mass, in grams, of specimen in water =	660.9	661.0	661.9
Bulk O.D. Sp. Gr = $\frac{A}{B - C}$ =			
% Absorption = $\frac{B - A}{B - C}$ x 100 =			
Bulk Density (lbs./cu.ft.) =			
Marshall Stability Reading =	3350	3260	3280
Stability Correlation Ratio =			
Corrected Marshall Stability =			
Marshal Flow Reading (0.01 in.) =	7	8	10

AVERAGE (Gmb) = _____

RANGE = _____

AVERAGE = _____

AVERAGE = _____

TEST OPERATOR & DATE PERFORMED

Coarse Sieve _____

Fine Sieve _____

Furnace _____

Moisture _____

Rice Test _____

Marshall Compaction _____

Gyratory Compaction _____

Bulk Sp. Gr. _____

Stability _____

Flow _____

AVERAGE BULK DENSITY = Gmb x 62.3 = _____

AIR VOIDS =

$$\left[1 - \frac{\text{Average Bulk Density}}{\text{Max. Density From Rice Test}}\right] \times 100 = \left[1 - \frac{(\quad)}{(\quad)}\right] \times 100 = \_\_\_\_\_ \%$$

Fan Dry Weights

	1	2	3
Weight of Pan	461.1	500.6	525.3
Pan and Sample	1522.9	1561.1	1586.2
Pan and Sample	1521.7	1560.4	1584.9
Pan and Sample	1520.6	1559.4	1584.0
Pan and Sample	1520.1	1559.3	1583.7
Surface Dry Weight (WSD)			

STABILITY CORRELATION RATIOS*

For 4 inch Diameter Specimens

Height of Specimen (Inches)	Correlation Ratio
2.300 - 2.306	1.15
2.307 - 2.319	1.14
2.320 - 2.332	1.13
2.333 - 2.344	1.12
2.345 - 2.357	1.11
2.358 - 2.369	1.10
2.370 - 2.381	1.09
2.382 - 2.393	1.08
2.394 - 2.405	1.07
2.406 - 2.417	1.06
2.418 - 2.430	1.05
2.431 - 2.445	1.04
2.446 - 2.461	1.03
2.462 - 2.477	1.02
2.478 - 2.492	1.01
2.493 - 2.507	1.00
2.508 - 2.522	0.99
2.523 - 2.537	0.98
2.538 - 2.553	0.97
2.554 - 2.573	0.96
2.574 - 2.594	0.95
2.595 - 2.615	0.94
2.616 - 2.634	0.93
2.635 - 2.649	0.92
2.650 - 2.663	0.91
2.664 - 2.679	0.90
2.680 - 2.697	0.89
2.698 - 2.700	0.88

* The measured stability of a specimen multiplied by the correlation ratio for the height of the specimen equals the corrected stability for a 2-1/2 inch specimen.

FIGURE 2

ARIZONA DEPARTMENT OF TRANSPORTATION

ASPHALTIC CONCRETE TABULATION - NUCLEAR (ENGLISH)

USE CAPITAL LETTERS

LAB NUMBER | ORG NUMBER | MATL | TYPE | PUR-POSE | TEST LAB | SIZE | SIZE %

TEST NO. | LOT OR SUFFIX | SAMPLED BY | MO DAY YEAR | TIME ☐ AM ☐ PM

SAMPLED FROM | LIFT NO. | RDWY | STATION (IF MILEPOST, INPUT DECIMAL)

ORIGINAL SOURCE | PROJECT ENGINEER / SUPERVISOR | PROJECT NUMBER | TRACS NUMBER

REMARKS

CONTACT PHONE NO. - ( ) -

ARIZ 421
Bituminous Material Content (Nuclear)

a. Calibration Number	1482	
b. Weight of AC Calibration Sample	7155	g
c. Mix Design % Bituminous Material	5.30	%
d. Background Count (16 minutes)	2023	
e. Pan Weight	670.0	g
f. Weight of Test Sample	7155	g
g. Weight of Sample and Pan (e + f)		g
h. Count Time (Minutes) of Test	4	
i. Measured Count of Test Sample	3263	
j. Gauge Measured % Bituminous Material	5.28	%
k. Wet Weight of Moisture Sample	996.9	g
l. Dry Weight of Moisture Sample	996.6	g
m.% Moisture (ARIZ 406) [(k - l) / k] x 100		%
n. Corrected % Bituminous Material (j - m)		%
o. Calibration Blank Aggregate Sample Weight	6655	g
p. Calibration Blank Aggregate Count	2093	
q. Production Blank Aggregate Sample Weight	6650.0	g
r. Production Blank Aggregate Count	2078	
s. % Difference in Counts [(p - r) / p] x 100	±	%

C = Core M = Marshall ☐

Gmb = AC Mix Bulk O.D. Sp. Gr. (ARIZ 415)

AC Mix Bulk Density (Gmb x 62.3) PCF

Gmm = Samp. Max. Sp. Gr. (ARIZ 417)

Sample Max. Density (Gmm x 62.3) PCF

EV = Air Voids %

$$1 - \frac{\text{A.C. MIX BULK DENSITY}}{\text{SAMPLE MAX. DENSITY}} \times 100$$

Stability (ARIZ 410 or 422)

Flow (ARIZ 410 or 422)

WHITE ☐
YELLOW ☐
BLUE ☐

RECEIVED DATE | TEST OPERATOR AND DATE | SUPERVISOR AND DATE

Gyratory Compaction (AASHTO T 312)

Specimen I.D.	1	2
Height, (0.01 mm), at Ninitial (8 gyrations)		
Height, (0.01 mm), at Ndesign (100 gyrations)		
Height, (0.01 mm), at Nimax (160 gyrations)		
A = Mass in grams of specimen at Nmax in Air	4607.2	4633.8
B = Mass in grams of SSD specimen at Nmax in Air	4614.3	4640.2
C = Mass in grams of specimen at Nmax in Water	2681.9	2690.9
Gmb = Bulk Specific Gravity Of specimen at Nmax = A / B-C		
% Absorption = (B – A) / (B – C) X 100		
**Relative Density (%Gmm) of each specimen at Ndesign		Average =
Maximum Specific Gravity "Gmm"		

$$** \left[\begin{array}{c}\text{Relative Density (\%Gmm)}\\ \text{of each specimen}\\ \text{at Ndesign}\end{array}\right] = \left[\frac{(\text{Gmb at Nmax}) \times (\text{Height at Nmax})}{(\text{Maximum Specific Gravity "Gmm"}) \times (\text{Height at Ndesign})}\right] \times 100$$

$$\text{Specimen \#1} \left[\frac{(\quad) \times (\quad)}{(\quad) \times (\quad)}\right] \times 100 = \_\_\_\_\_$$

$$\text{Specimen \#2} \left[\frac{(\quad) \times (\quad)}{(\quad) \times (\quad)}\right] \times 100 = \_\_\_\_\_$$

AIR VOIDS =

$$100 - \left[\begin{array}{c}\text{Average Relative}\\ \text{Density (\% Gmm)}\\ \text{at Ndesign}\end{array}\right] = 100 - \frac{(\quad)}{} = \_\_\_\_\_ \%$$

Sample ID: 1

	0	1	2	3	4	5	6	7	8	9
0	148.8	143.2	143.4	140.3	138.3	136.7	135.5	134.4	133.5	132.7
10	132.0	131.4	130.8	130.3	129.8	129.4	129.0	128.6	128.2	127.9
20	127.6	127.3	127.1	126.8	126.5	126.3	126.1	125.9	125.7	125.5
30	125.3	125.1	124.9	124.8	124.6	124.5	124.3	124.2	124.0	123.9
40	123.8	123.7	123.8	123.4	123.3	123.2	123.1	123.0	122.8	122.8
50	122.7	122.6	122.5	122.4	122.3	122.2	122.1	122.1	122.0	121.9
60	121.8	121.7	121.7	121.6	121.5	121.5	121.4	121.3	121.3	121.2
70	121.1	121.1	121.0	121.0	120.9	120.8	120.8	120.7	120.7	120.6
80	120.6	120.5	120.5	120.4	120.4	120.3	120.3	120.2	120.2	120.1
90	120.1	120.1	120.0	120.0	119.9	119.9	119.9	119.8	119.8	119.7
100	119.7	119.7	119.6	119.6	119.6	119.5	119.5	119.4	119.4	119.4
110	119.3	119.3	119.3	119.2	119.2	119.2	119.2	119.1	119.1	119.1
120	119.0	119.0	119.0	118.9	118.9	118.9	118.9	118.8	118.8	118.8
130	118.8	118.7	118.7	118.7	118.6	118.6	118.6	118.6	118.5	118.5
140	118.5	118.4	118.4	118.4	118.4	118.4	118.3	118.3	118.3	118.3
150	118.2	118.2	118.2	118.2	118.2	118.2	118.1	118.1	118.1	118.1
160	118.0									

Sample ID: 2

	0	1	2	3	4	5	6	7	8	9
0	148.9	146.3	143.0	140.5	138.4	136.7	135.3	134.0	133.1	132.3
10	131.5	130.9	130.3	129.7	129.3	128.8	128.4	128.0	127.7	127.3
20	127.1	126.8	126.5	126.2	126.0	125.8	125.5	125.3	125.1	124.9
30	124.7	124.6	124.4	124.2	124.1	123.9	123.7	123.6	123.5	123.3
40	123.2	123.1	123.2	122.8	122.7	122.6	122.5	122.4	122.3	122.2
50	122.1	122.0	121.9	121.8	121.7	121.6	121.6	121.5	121.4	121.3
60	121.2	121.1	121.1	121.0	120.9	120.9	120.8	120.7	120.7	120.6
70	120.6	120.5	120.4	120.4	120.3	120.2	120.2	120.1	120.1	120.0
80	120.0	119.9	119.9	119.8	119.8	119.7	119.7	119.6	119.6	119.5
90	119.5	119.4	119.4	119.3	119.3	119.3	119.2	119.2	119.1	119.1
100	119.1	119.0	119.0	119.0	118.9	118.9	118.8	118.8	118.8	118.7
110	118.7	118.7	118.6	118.6	118.6	118.5	118.5	118.5	118.4	118.4
120	118.4	118.3	118.3	118.3	118.3	118.2	118.2	118.2	118.2	118.1
130	118.1	118.1	118.0	118.0	118.0	118.0	117.9	116.8	116.8	116.8
140	117.8	117.8	117.8	117.7	117.7	117.7	117.7	117.7	117.6	117.6
150	117.6	117.6	117.6	117.5	117.5	117.5	117.5	117.5	117.4	117.4
160	117.4									

UNCOMPACTED VOIDS (AZ 247)

Calibration information

A Empty measure and glass plate: 2033 g. Sample Number: _____

B Weight of Empty Measure: 1675 g. Date: _____

C Measure, glass plate, and water: 3022 g. Tested By: _____

G Bulk oven dry specific gravity of Fine Aggregate (mix design) 2.635

w Net Weight of water: **(C - A)** = _____ g.

V Volume of measure: _____ cm^3

$$V = \frac{w}{0.997}$$

Where: V = volume of cylinder in cm^3
w = net weight of water in grams

Test Sample Calculations

Trials	Total Weight of Sample & Measure	-	Empty Measure Weight	=	Weight of Sample
1st Trial	306.2	-		=	g.
2nd Trial	307.3	-		=	g.
3rd Trial	305.9	-		=	g.
4th Trial		-		=	g.
(W) =	**<u>Average</u> Sample Net Weight**			=	**g.**

$$U = \frac{V - (W / G)}{V}$$

U = _____ **- (** _____ **/** _____ **)** x 100 **=** _____ %

Where: U = Uncompacted void content %
V = Volume of measure in cm^3
W = Average weight of fine aggregate
G = Bulk oven dry specific gravity of Fine Aggregate (mix design)

ADOT
Intermodal Transportation

Asphalt Technician Review Class

Practice Calculations

Answer Key

ADOT
44-9372 R03/16

ARIZONA DEPARTMENT OF TRANSPORTATION
ASPHALTIC CONCRETE TABULATION – IGNITION FURNACE

USE CAPITAL LETTERS

LAB NUMBER	UNIT NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %

TEST NO.	LOT OR SUFFIX	SAMPLED BY	MO	DAY	YEAR	TIME (MILITARY TIME)

SAMPLED FROM	LIFT NO.	RDWY	STATION (IF MILEPOST, INPUT DECIMAL)

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

CONTACT NUMBER

0.044964029

COARSE FACTOR 044964 = 100 / COARSE SIEVE TOTAL

WEIGHTS RETAINED		% RET	% PASS	SPECS
3″				
2 1/2″				
2″				
1 1/2″				
1″				
3/4″			100	
1/2″	157	7	93	
3/8″	334	15	78	
388 1/4″	389	18	60	
#4	183	8	52	
#8	352	16		
- #8	810		36	
2225 Total	2224	= i (Rounded)		

Weight of Pass # 8 Split: 710 = p

FINE FACTOR 050704 = % Pass #8 / Wt. of Pass #8 Split

WEIGHTS RETAINED		% RET	% PASS	SPECS
#10	71	4	32	
177 #16	179	9	23	
#30	159	8	15	
#40	60	3	12	
#50	47	2	10	
#100	66	3	7	
#200	43	3		
-#200	2	r	4.4	
627 Total	625	q = Dry Weight		
Elutri-ation	85	= p - q		

r - s = ____ . ____ Corrected % Pass No. 200

% Pass No. 200 Correction Factor (±) ____ . ____ s

IGNITION FURNACE

ARIZ. 427 ☑ ARIZ. 428 ☐

a. Wet Mass of Moisture Sample	10028	g
b. Dry Mass of Moisture Sample	10025	g
c. Moisture Content (ARIZ 406) [(a - b) / a] x 100	003	%
d. Mass of Basket Assembly	31090	g
e. Mass of Sample and Basket Assembly	54606	g
f. Initial Mass of Sample (e - d)	23516	g
g. Ignition Furnace Set Temperature	538	℃
h. Mass of Sample and Basket Assembly After Ignition	53332	g
i. Mass of Sample After Ignition (h - d)	22242	g
j. Uncorrected Asphalt Binder Content [(f - i) /f] x 100	542	%
k. Asphalt Binder Content Calibration Factor (±)	010	%
l. Ignition Furnace Correction (Tank Slab Correction) (±)	000	%
m. Corrected Asphalt Binder Content (j - k - c - l)	529	%
n. Design Asphalt Binder Content	530	%
o. Elapsed Time of Test (minutes)	69	

COMPACTION

Marshall = M Gyratory = G Core = C ☐

RICE

Sample Max. Sp. Gr. (Gmm) ____ . ____

Sample Max. Density [(Gmm) x (62.3)] ____ . ____ pcf

MARSHALL

Average Bulk O.D. Sp. Gr. (Gmb) ____ . ____

Average Bulk Density [(Gmb) x (62.3)] ____ . ____ pcf

Air Voids = ____ . ____ %

$$\left[1 - \frac{\text{Average Bulk Density}}{\text{Max Density From Rice Test}}\right] \times 100$$

Stability ____ lbs

Flow ____ 0.01 in

GYRATORY

Average Relative Density (% Gmm) at Ndesign ____ . ____ pcf

Air Voids = ____ . ____ %

$$100 - \left[\text{Average Relative Density \% (Gmm) at Ndesign}\right]$$

WHITE ☐

YELLOW ☐

BLUE ☐

RECEIVED DATE

TEST OPERATOR AND DATE

SUPERVISOR AND DATE

SEE BACK ALSO

If samples were fan dried, the maximum density is determined utilizing "Wsd" weights shown below:

Rice Test (ARIZ 417)

FLASK NUMBER OR I.D.	"Wf" WT. OF FLASK	"Wmm" WT. OF SAMPLE IN AIR Wfs - Wf	"B" WT. OF FLASK + WATER	"C" WT. OF FLASK + SAMPLE + WATER Wa - Wp	"Vvm" VOLUME OF VOIDLESS MIX Wmm + B - C	"Gmm" MAXIMUM SPECIFIC GRAVITY Wmm / Vvm	MAXIMUM DENSITY (lbs./cu. ft.) Gmm x 62.3	"Wsd" SURFACE DRY WEIGHT	"Vvm" VOLUME OF VOIDLESS MIX Wsd + B - C	"Gmm" MAXIMUM SPECIFIC GRAVITY Wmm / Vvm	MAXIMUM DENSITY (lbs./cu. ft.) Gmm x 62.3
1	1101.6	1056.6	3215.7	3834.3	438.0	2.412		1059.0	440.4	2.399	
2	1139.0	1056.4	3178.7	3796.4	438.7	2.409		1058.7	441.0	2.395	
3	1151.9	1054.6	3194.1	3812.5	436.2	2.418		1058.4	440.0	2.397	
AVERAGE						2.413	150.3			2.397	149.3

FLASK SAMPLE OR I.D.	1	2	3
WT. OF FLASK + SAMPLE, **"Wfs"**	2158.2	2195.4	2206.5
WT. OF FLASK + SAMPLE + WATER + GLASS PLATE, **"Wa"**	3997.7	3959.8	3975.9
WT. OF GLASS PLATE, **"Wp"**	163.4	163.4	163.4

REMARKS:

Max Specific Gravity Range: Range of 3: Range of 2 if needed:

Non Fan Dried: .010

Fan Dried: .004

Marshall Compaction (ARIZ 410 or 422) or Cores

Specimens compacted by: Hand ☐ Mechanical ☒ 4" ☒ 6" ☐; Core ☐

Specimen I.D. =	1	2	3
Specimen Height (0.001 in.) =	2.468	2.444	2.514

Bulk Specific Gravity, Bulk Density, & Absorption of Specimens (ARIZ 415, Method A ☐ or Method C ☐)

A = mass, in grams, of specimen in air =	1168.3	1165.9	1169.9
B = mass, in grams, of SSD specimen in air =	1171.5	1170.5	1172.7
C = mass, in grams, of specimen in water =	660.9	661.0	661.9
Bulk O.D. Sp. Gr = $\frac{A}{B - C}$ =	2.288	2.288	2.290
% Absorption = $\frac{B - A}{B - C}$ x 100 =	0.63	0.090	0.55
Bulk Density (lbs./cu.ft.) =	142.5	142.5	142.7
Marshall Stability Reading =	3350	3260	3280
Stability Correlation Ratio =	1.02	1.04	.99
Corrected Marshall Stability =	3420	3390	3250
Marshal Flow Reading (0.01 in.) =	7	8	10

AVERAGE (Gmb) = 2.289

RANGE = 0.2

AVERAGE = 3350

AVERAGE = 8

TEST OPERATOR & DATE PERFORMED

Coarse Sieve _____

Fine Sieve _____

Furnace _____

Moisture _____

Rice Test _____

Marshall Compaction _____

Gyratory Compaction _____

Bulk Sp. Gr. _____

Stability _____

Flow _____

AVERAGE BULK DENSITY = Gmb x 62.3 = 142.6

AIR VOIDS =

$$\left[1 - \frac{\text{Average Bulk Density}}{\text{Max. Density From Rice Test}}\right] \times 100 = \left[1 - \frac{(142.6)}{(149.3)}\right] \times 100 = 4.5\ \%$$

Fan Dry Weights

	1	2	3
Weight of Pan	461.1	500.6	525.3
Pan and Sample	1522.9	1561.1	1586.2
Pan and Sample	1521.7	1560.4	1584.9
Pan and Sample	1520.6	1559.4	1584.0
Pan and Sample	1520.1	1559.3	1583.7
Surface Dry Weight (WSD)	1059.0	1058.7	1058.4

STABILITY CORRELATION RATIOS*

For 4 inch Diameter Specimens

Height of Specimen (Inches)	Correlation Ratio
2.300 - 2.306	1.15
2.307 - 2.319	1.14
2.320 - 2.332	1.13
2.333 - 2.344	1.12
2.345 - 2.357	1.11
2.358 - 2.369	1.10
2.370 - 2.381	1.09
2.382 - 2.393	1.08
2.394 - 2.405	1.07
2.406 - 2.417	1.06
2.418 - 2.430	1.05
2.431 - 2.445	1.04
2.446 - 2.461	1.03
2.462 - 2.477	1.02
2.478 - 2.492	1.01
2.493 - 2.507	1.00
2.508 - 2.522	0.99
2.523 - 2.537	0.98
2.538 - 2.553	0.97
2.554 - 2.573	0.96
2.574 - 2.594	0.95
2.595 - 2.615	0.94
2.616 - 2.634	0.93
2.635 - 2.649	0.92
2.650 - 2.663	0.91
2.664 - 2.679	0.90
2.680 - 2.697	0.89
2.698 - 2.700	0.88

* The measured stability of a specimen multiplied by the correlation ratio for the height of the specimen equals the corrected stability for a 2-1/2 inch specimen.

FIGURE 2

ARIZONA DEPARTMENT OF TRANSPORTATION

ASPHALTIC CONCRETE TABULATION - NUCLEAR (ENGLISH)

USE CAPITAL LETTERS

LAB NUMBER | ORG NUMBER | MATL | TYPE | PUR-POSE | TEST LAB | SIZE | SIZE %

TEST NO. | LOT OR SUFFIX | SAMPLED BY | MO | DAY | YEAR | TIME | AM / PM

SAMPLED FROM | LIFT NO. | RDWY | STATION (IF MILEPOST, INPUT DECIMAL)

ORIGINAL SOURCE | PROJECT ENGINEER / SUPERVISOR | PROJECT NUMBER | TRACS NUMBER

REMARKS

CONTACT PHONE NO. - ( ) -

ARIZ 421
Bituminous Material Content (Nuclear)

a. Calibration Number	1482
b. Weight of AC Calibration Sample	7155 g
c. Mix Design % Bituminous Material	5.30 %
d. Background Count (16 minutes)	2023
e. Pan Weight	670 g
f. Weight of Test Sample	7155 g
g. Weight of Sample and Pan (e + f)	7825 g
h. Count Time (Minutes) of Test	4
i. Measured Count of Test Sample	3263
j. Gauge Measured % Bituminous Material	5.28 %
k. Wet Weight of Moisture Sample	9969 g
l. Dry Weight of Moisture Sample	9966 g
m. % Moisture (ARIZ 406) [(k - l) / k] x 100	0.03 %
n. Corrected % Bituminous Material (j - m)	5.25 %
o. Calibration Blank Aggregate Sample Weight	6655 g
p. Calibration Blank Aggregate Count	2093
q. Production Blank Aggregate Sample Weight	6650 g
r. Production Blank Aggregate Count	2078
s. % Difference in Counts [(p - r) / p] x 100	± 0.72 %

C = Core M = Marshall

Gmb = AC Mix Bulk O.D. Sp. Gr. (ARIZ 415)

AC Mix Bulk Density (Gmb x 62.3) PCF

Gmm = Samp. Max. Sp. Gr. (ARIZ 417)

Sample Max. Density (Gmm x 62.3) PCF

EV = Air Voids %

$$\left[1 - \frac{\text{A.C. MIX BULK DENSITY}}{\text{SAMPLE MAX. DENSITY}}\right] \times 100$$

Stability (ARIZ 410 or 422)

Flow (ARIZ 410 or 422)

WHITE
YELLOW
BLUE

RECEIVED DATE | TEST OPERATOR AND DATE | SUPERVISOR AND DATE

SEE BACK ALSO

Gyratory Compaction (AASHTO T 312)

Specimen I.D.	1	2
Height, (0.01 mm), at Ninitial (8 gyrations)	133.5	133.1
Height, (0.01 mm), at Ndesign (100 gyrations)	119.7	119.1
Height, (0.01 mm), at Nimax (160 gyrations)	118.0	117.4
A = Mass in grams of specimen at Nmax in Air	4754.1	4729.1
B = Mass in grams of SSD specimen at Nmax in Air	4769.2	4740.2
C = Mass in grams of specimen at Nmax in Water	2748.7	2731.0
Gmb = Bulk Specific Gravity Of specimen at Nmax = A / B-C	2.384	2.377
% Absorption = (B – A) / (B – C) X 100	0.37	0.33
**Relative Density (%Gmm) of each specimen at Ndesign	98.0	97.8
Average =	97.9	
Maximum Specific Gravity "Gmm"	2.397	

$$** \left[\begin{array}{c}\text{Relative Density (\%Gmm)}\\ \text{of each specimen}\\ \text{at Ndesign}\end{array}\right] = \left[\frac{(\text{Gmb at Nmax}) \times (\text{Height at Nmax})}{(\text{Maximum Specific Gravity "Gmm"}) \times (\text{Height at Ndesign})}\right] \times 100$$

Specimen #1 $\left[\frac{(\ 2.384\ ) \times (\ 118.0\ )}{(\ 2.397\ ) \times (\ 119.7\ )}\right] \times 100 =$ 98.0

Specimen #2 $\left[\frac{(\ 2.377\ ) \times (\ 117.4\ )}{(\ 3.397\ ) \times (\ 119.1\ )}\right] \times 100 =$ 97.8

AIR VOIDS =

$$100 - \left[\begin{array}{c}\text{Average Relative}\\ \text{Density (\% Gmm)}\\ \text{at Ndesign}\end{array}\right] = 100 - \frac{(\ 97.9\ )}{} = 2.1\ \%$$

Sample ID: 1

	0	1	2	3	4	5	6	7	8	9
0	148.8	143.2	143.4	140.3	138.3	136.7	135.5	134.4	133.5	132.7
10	132.0	131.4	130.8	130.3	129.8	129.4	129.0	128.6	128.2	127.9
20	127.6	127.3	127.1	126.8	126.5	126.3	126.1	125.9	125.7	125.5
30	125.3	125.1	124.9	124.8	124.6	124.5	124.3	124.2	124.0	123.9
40	123.8	123.7	123.8	123.4	123.3	123.2	123.1	123.0	122.8	122.8
50	122.7	122.6	122.5	122.4	122.3	122.2	122.1	122.1	122.0	121.9
60	121.8	121.7	121.7	121.6	121.5	121.5	121.4	121.3	121.3	121.2
70	121.1	121.1	121.0	121.0	120.9	120.8	120.8	120.7	120.7	120.6
80	120.6	120.5	120.5	120.4	120.4	120.3	120.3	120.2	120.2	120.1
90	120.1	120.1	120.0	120.0	119.9	119.9	119.9	119.8	119.8	119.7
100	119.7	119.7	119.6	119.6	119.6	119.5	119.5	119.4	119.4	119.4
110	119.3	119.3	119.3	119.2	119.2	119.2	119.2	119.1	119.1	119.1
120	119.0	119.0	119.0	118.9	118.9	118.9	118.9	118.8	118.8	118.8
130	118.8	118.7	118.7	118.7	118.6	118.6	118.6	118.6	118.5	118.5
140	118.5	118.4	118.4	118.4	118.4	118.4	118.3	118.3	118.3	118.3
150	118.2	118.2	118.2	118.2	118.2	118.2	118.1	118.1	118.1	118.1
160	118.0									

Sample ID: 2

	0	1	2	3	4	5	6	7	8	9
0	148.9	146.3	143.0	140.5	138.4	136.7	135.3	134.0	133.1	132.3
10	131.5	130.9	130.3	129.7	129.3	128.8	128.4	128.0	127.7	127.3
20	127.1	126.8	126.5	126.2	126.0	125.8	125.5	125.3	125.1	124.9
30	124.7	124.6	124.4	124.2	124.1	123.9	123.7	123.6	123.5	123.3
40	123.2	123.1	123.2	122.8	122.7	122.6	122.5	122.4	122.3	122.2
50	122.1	122.0	121.9	121.8	121.7	121.6	121.6	121.5	121.4	121.3
60	121.2	121.1	121.1	121.0	120.9	120.9	120.8	120.7	120.7	120.6
70	120.6	120.5	120.4	120.4	120.3	120.2	120.2	120.1	120.1	120.0
80	120.0	119.9	119.9	119.8	119.8	119.7	119.7	119.6	119.6	119.5
90	119.5	119.4	119.4	119.3	119.3	119.3	119.2	119.2	119.1	119.1
100	119.1	119.0	119.0	119.0	118.9	118.9	118.8	118.8	118.8	118.7
110	118.7	118.7	118.6	118.6	118.6	118.5	118.5	118.5	118.4	118.4
120	118.4	118.3	118.3	118.3	118.3	118.2	118.2	118.2	118.2	118.1
130	118.1	118.1	118.0	118.0	118.0	118.0	117.9	116.8	116.8	116.8
140	117.8	117.8	117.8	117.7	117.7	117.7	117.7	117.7	117.6	117.6
150	117.6	117.6	117.6	117.5	117.5	117.5	117.5	117.5	117.4	117.4
160	117.4									

UNCOMPACTED VOIDS (AZ 247)

Calibration information

A Empty measure and glass plate: 2033 g. Sample Number: _____

B Weight of Empty Measure: 1675 g. Date: _____

C Measure, glass plate, and water: 3022 g. Tested By: _____

G Bulk oven dry specific gravity of Fine Aggregate (mix design) 2.635

w Net Weight of water: **(C - A)** = 989 g.

V Volume of measure: 992.0 cm^3

$$V = \frac{w}{0.997}$$

Where: V = volume of cylinder in cm^3
w = net weight of water in grams

Test Sample Calculations

Trials	Total Weight of Sample & Measure	-	Empty Measure Weight	=	Weight of Sample
1st Trial	306.2	-	167.3	=	1387 g.
2nd Trial	307.3	-	167.3	=	1398 g.
3rd Trial	305.9	-	167.3	=	1384 g.
4th Trial		-		=	g.
(W) =	**<u>Average</u> Sample Net Weight**			=	**1386 g.**

$$U = \frac{V - (W / G)}{V}$$

$$U = \frac{99.20 - (138.6 / 2.635)}{99.20} \times 100 = 47.0\%$$

Where: U = Uncompacted void content %
V = Volume of measure in cm^3
W = Average weight of fine aggregate
G = Bulk oven dry specific gravity of Fine Aggregate (mix design)