

APPENDIX C

ASPHALT FIELD TECHNICIAN

PROFICIENCY TEST

Nuclear Gauge Standard Count Procedure

Field Determination of Percent Density of Compacted Asphalt Concrete Mixtures
by VTM-22

Field Determination of Bulk Specific Gravity of Asphalt Concrete Mixtures by
VTM-6

Roller Pattern by VTM-76

Control Strip by VTM-76

Stratified Random Numbering

Test Section by VTM-76 / Rd. & Bridge Spec. 315

Note: Proctor information and questions they will ask you are in bold font.

Nuclear Gauge Procedures

Note to Examiner: *Provide student with a thin-lift nuclear gauge and reference block and an air gap spacer.*

Gauge Warm Up and Standard Count Procedure

This test must be demonstrated.

- Standard counts should be taken on the job site at the beginning of each workday.
- Select site at least 10 feet from any structure and 33 feet from other radioactive sources.
- Minimum density of the selected site should be 100 lb/ft³ .
- Wear TLD. Warm up gauge.
- Place reference block on flat surface and place air gap spacer on it.
- Gauge in “Safe” position. Handle side of gauge on the 2-legged side of spacer.
- Take standard count.
- After beep - record the count and accept count by pressing “yes”.

What would you do if the count fails?

- Gauge is set to use when the gauge displays the “ready” mode.

You will be conducting a Roller Pattern, Control Strip and Test Section on a SM12.5D.

You will tell me how to run each test. When needed, I will give you the appropriate form to complete. I may ask you some questions to prompt you for more information.

Equipment

- Approved Paving Equipment (pavers, rollers)
- Thin Lift Nuclear Density Gauge
- Nuclear Gauge Template and white or other approved spray paint
- Rolling Device that will measure from 1-1000 linear feet, or any other device approved by the Engineer
- Rotary Saw or Coring Machine for sawing core/plug by a dry method
- Equipment to weigh cores/plugs

Roller Pattern

Give the student prepared TL-56 and TL-57 forms.

Procedure:

The Roller Pattern and Control Strip must be constructed within the first 500 -1000 feet of mix placement.

- Roller pattern length is 75 feet plus an additional 50 feet on either end to accommodate roller positioning.
- If it is a mix that you have no experience with, it is recommended that you start by making two passes.
- Take 3 random density readings over most of the 75-foot section.

Have student mark locations on the attached form.

- To take readings nuclear gauge should be parallel with the roadway with the source toward the paving train and no closer than **12 inches** to an unsupported edge.

How close to the edge could you test if this was a base mix?

- Using template and spray paint mark each location. (Do NOT paint the gauge!!)
- Gauge should be in backscatter position and set in **30 second** mode.
- Average the 3 readings.
- Plot density versus passes on the TL-57.

Two sets of readings are already averaged. Plot them on the TL-57. Then I will give you 3 more readings to calculate density and plot. Tell me when to stop giving you sets of numbers (when you have obtained optimum density) Then fill in answers on the shaded areas of the forms.

Roller Pattern (continued)

- Continue making passes, taking and recording readings, adding and averaging readings until maximum density is obtained.
- Process shall continue until average density decreases. After the first decrease, make 1 additional pass to insure this was not a false break. This pass will be made with roller in static mode. If mat continues to decrease in density, then maximum density is density achieved one roller pass before the initial decrease in density.
- Typically a **decrease in density of 0.5 lb/ft³** indicates that maximum density has been achieved.

What is a false break?

- Density increases on next roller pass after a decrease in density.

What would you do if a false break occurs?

Continue to make passes with roller in static mode until the density decreases a second time. Once the density has decreased, make an additional pass in static mode. If the density decreases on this pass, then the maximum density will be the highest density achieved with the least amount of passes.

Stratified Random Numbering

Give the student the TL-58 form for Contol Strip testing.

Select the nuclear density test site locations for test sites 9 & 10. The random number table is on the bottom of the TL-58 provided.

Control Strip Density

Procedure:

- Control strip length is 300 feet.
- Roll using the same number of passes it took to obtain optimum density in Roller Pattern.
- Select the 10 reading sites, using Stratified Random numbers - given to VDOT inspector before testing begins.
- Use template to mark test site locations. Template should be parallel with the roadway with the arrows toward the paving train.
- Test no closer than 1 foot from edge of application width.
- Nuclear gauge readings shall be taken in the backscatter position and **one minute mode**.
- Record readings on the TL-58

Using the TL-58 and TL-60 forms:

- Add and average readings.
- Transfer densities to column H of the TL-60.
- Select sites to be cored - 3 sites closest to target density (circle them).
- Core and run bulk density by VTM-6.
- Average SSD Bulk Specific Gravity per site.
- Average percent density - VTM-22.

Is this Control Strip acceptable? Why or why not?

- Density meets or exceeds minimum density requirement of Table III-3 of Section 315 Road & Bridge Spec.
- This becomes the target density if acceptable.

Field Determination of Percent Density of Compacted Asphalt Concrete Mixtures

Procedure:

- Using a rotary saw as specified by VDOT cut two 4 x 4 inch specimens or using a coring machine, cut two 4 inch diameter core specimens.
- Three sites selected for coring/sawing are closest to target density.
- Cores shall be cut dry.
- Freeze the roadway using CO₂ or dry ice.
- Cut the core and freeze road again.
- Gently pry around core or plug to break it loose from underlying layer.
- Care taken not to crack or break off any part of the core.
- Measure thickness of test specimen and record it on the TL-60.
- Determine bulk specific gravity according to VTM-6.

What would you do if the core/plug is damaged?

- Discard and use another core/plug taken from the same area.
- Percent Density = $\frac{\text{Bulk Specific Gravity}}{\text{Theoretical Maximum Specific Gravity}} \times 100$
- Report depth to nearest 0.1 inch.
- Report percent density to nearest 0.1 percent.

Is theoretical maximum specific gravity used throughout the job?

- Theoretical maximum specific gravity used as denominator for the percent compaction determination shall be determined by a moving average of 5 values. Until 5 values are obtained, the theoretical maximum specific gravity used shall be a simple average.
- Theoretical maximum specific gravity of mixture is supplied by lab testing.

What percent difference in density is allowed between two specimens from the same test site.

- No more than 2.0%.

What would you do if the difference was more than allowed?

- Discard and obtain two more specimens from a new test site.

**Field Determination of Bulk Specific Gravity of Compacted Asphalt Mixtures
Using Saturated Surface Dry Specimens**

***This test must be demonstrated on one core.
Give student TL-60 to show calculations***

Equipment

- Balance - 2000 gram - accuracy 1.0 gram
- Balance equipped with suitable suspension apparatus and holder to permit weighing the specimen while suspended from the center of scale pan of balance.
- Water Bath - for immersing the specimen in water while suspended under the balance.
- Holder shall be immersed in water to a depth sufficient to cover it and the test sample during weighing.

Procedure: - Show work on TL-60 (No need to designate A,B,C)

- Weigh specimen in air. Column A on TL-60. (This is “A” in the VTM calculation.)
- Immerse specimen in water bath for one minute and determine the weight. Column B on TL-60. (This is “C” in the VTM calculation.)
- Surface dry the specimen by quickly blotting all sides with a towel and then weigh in air. Column E on TL-60. (This is “B” in the VTM calculation.)
- If specimen removed by a process that does not use water, no further drying is needed.
- Wet specimens removed by coring shall be dried to a constant mass at 125± 5°F until further drying does not alter the mass 0.1percent. (Initially dried overnight and then weighed at 2 hour intervals).
- Calculate the bulk specific gravity :
$$\frac{A}{B-C}$$
 Show work on TL-60.
- Report value to two decimal places.

Test Section

Procedure:

- Standard Test Section lot shall be 5000 feet in length. Each lot is divided into five sublots of equal length.
- Roll using the same number of passes as used for the Control Strip.
- 10 density reading locations are determined by stratified random numbers given to VDOT inspector before testing begins.
- Mark with template and paint parallel with the roadway with the arrows toward the paving train.
- Test no closer than 1 foot from the edge of application width.
- Nuclear gauge readings shall be taken in the **backscatter position** and one **minute mode**.
- Record readings on the TL-59.

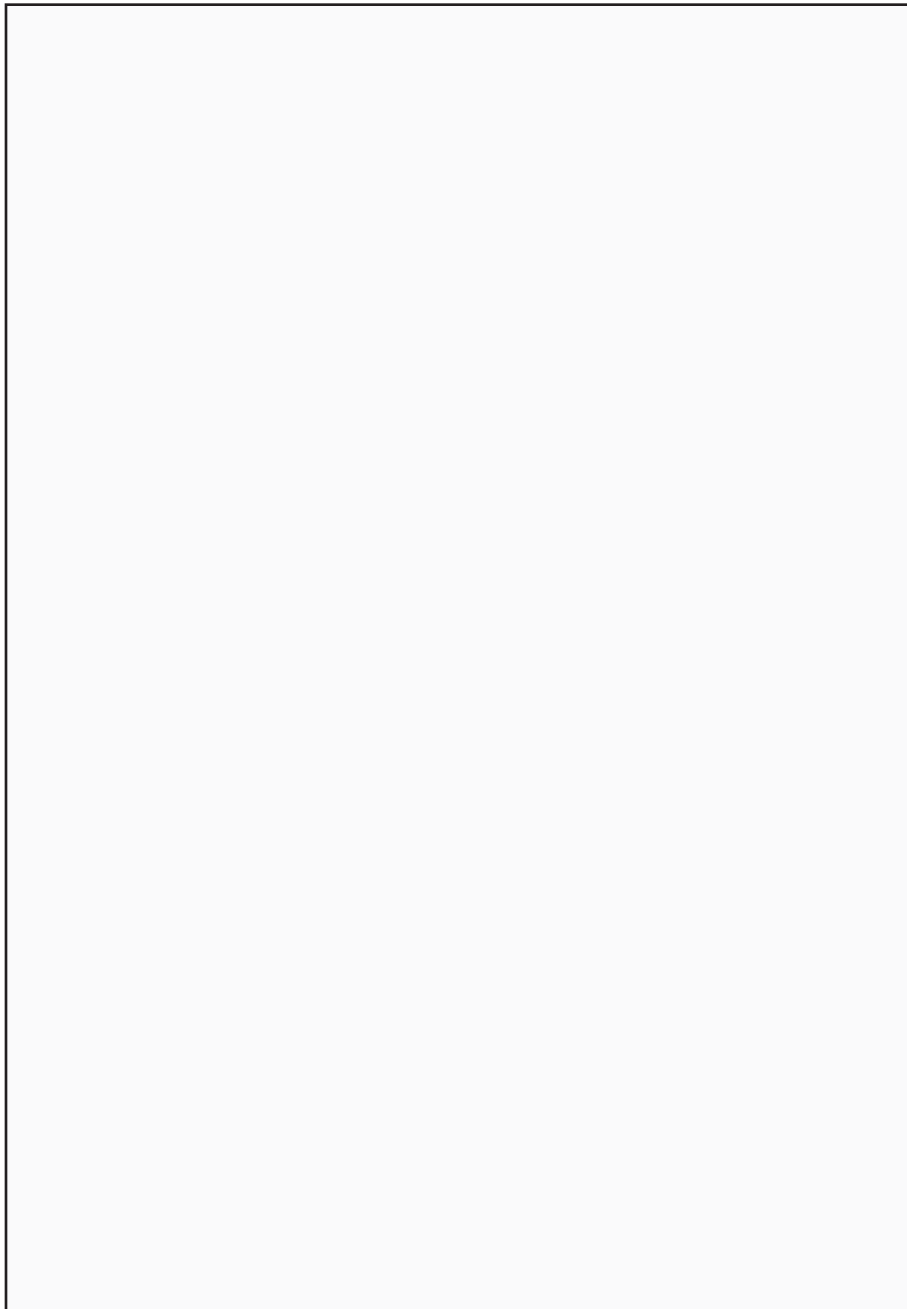
Give student TL-59 to Complete

- Average each set of subplot readings.
- Determine average density reading.
- Compare average density with Control Strip Target Density to determine if acceptable. [Divide Average Density by Control Strip Target Density x 100.]

Is this Test Section acceptable? Why or why not?

Average density must fall within acceptance range of 98-102 % of target density. No two consecutive subplot readings shall have density readings outside of the acceptance range.

Reading Sites for Roller Pattern
Mark locations for taking nuclear density readings.
This represents one lane.



ASPHALT NUCLEAR DENSITY THIN LIFT WORKSHEET ROLLER PATTERN

Control Strip No 1

Project or Schedule PM-1C-04 Item No. C Date 10/17/05

Route 72 From MP 6.5 To MP 8.5

Directional Lane NBL Lane Passing
(NBL, SBL, etc.) (inside, center, etc.)

Mix Type SM12.5D Application Rate: 220 lbs/yd² (kg/m²)

Producer ACE Asphalt Location Macey, VA

Roller Type: Roller 1 DD-1234 Roller 2 DD-4756 Roller 3

Roller Pattern Data

Gauge Model 4640B Serial No 2625 Calibration Date 8/29/05 Depth Setting 2.0 in. (mm)

Pass No <u>2V</u>	Nuclear Density	Pass No <u>6S</u>	Nuclear Density
Site 1	<u>142.3</u>	Site 1	<u> </u>
Site 2	<u>141.6</u>	Site 2	<u> </u>
Site 3	<u>142.1</u>	Site 3	<u> </u>
AVERAGE	<u>142.0</u>	AVERAGE	<u> </u>

Pass No <u>3V</u>	Nuclear Density	Pass No <u> </u>	Nuclear Density
Site 1	<u>146.0</u>	Site 1	<u> </u>
Site 2	<u>148.1</u>	Site 2	<u> </u>
Site 3	<u>145.7</u>	Site 3	<u> </u>
AVERAGE	<u>146.6</u>	AVERAGE	<u> </u>

Pass No <u>4S</u>	Nuclear Density	Pass No <u> </u>	Nuclear Density
Site 1	<u> </u>	Site 1	<u> </u>
Site 2	<u> </u>	Site 2	<u> </u>
Site 3	<u> </u>	Site 3	<u> </u>
AVERAGE	<u> </u>	AVERAGE	<u> </u>

Pass No <u>5S</u>	Nuclear Density	Pass No <u> </u>	Nuclear Density
Site 1	<u> </u>	Site 1	<u> </u>
Site 2	<u> </u>	Site 2	<u> </u>
Site 3	<u> </u>	Site 3	<u> </u>
AVERAGE	<u> </u>	AVERAGE	<u> </u>

Testing Performed by Observed by
VDOT Inspector

ASPHALT NUCLEAR DENSITY THIN LIFT ROLLER PATTERN - Graph

Control Strip No 1

Project or Schedule PM-1C-05 Item No C Date 10/17/05

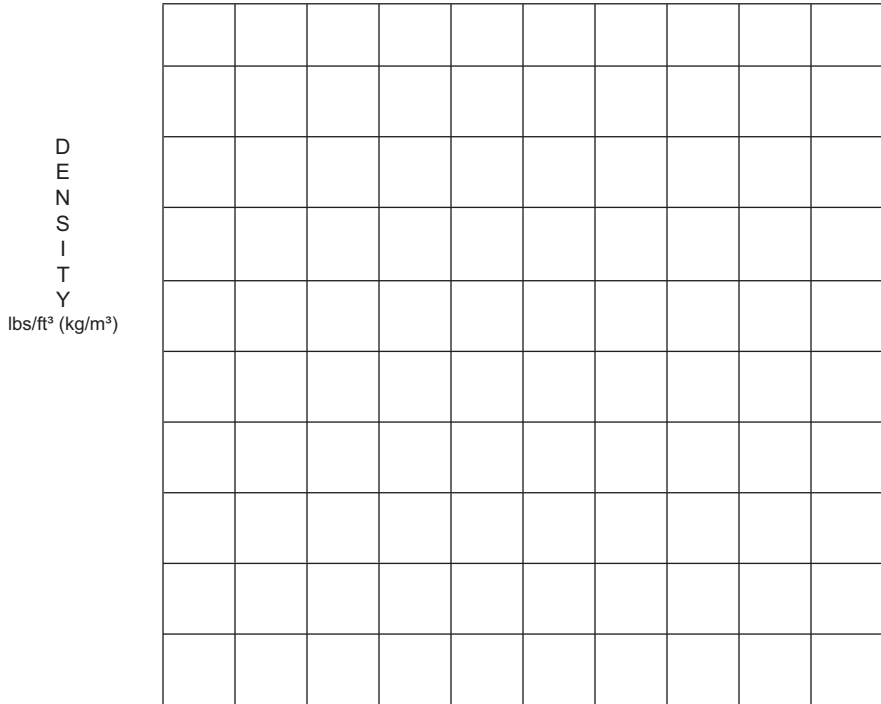
Route 72 From MP 6.5 To MP 8.5

Directional Lane NBL Lane Passing
(NBL, SBL, etc) (Inside, Center, etc.)

Mix Type SM-12.5D Application Rate 220 lbs/yd² (kg/m²)

Producer ACE Asphalt Location Macey, VA

Gauge Model 4640B Serial No 2625 Calibration Date 8/29/05 Depth Setting 2.0 in. in. (mm)



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 lbs/ft³ (kg/m³)

NUMBER OF ROLLER PASSES

Optimum Density lbs/ft³ (kg/m³)
(from peak of roller pattern curve)

Optimum Number of Passes:

Number of Roller Passes Roller 1 Roller 2 Roller 3 _____

Testing Performed By _____ Observed By _____
VDOT Inspector

**VIRGINIA DEPARTMENT OF TRANSPORTATION
ASPHALT NUCLEAR DENSITY THIN LIFT WORKSHEET
CONTROL STRIP TARGET DENSITY**

Control Strip Number 1

Using the random number table below, select the density reading sites for test site 9 and test site 10. This is a 9 foot wide lane.

or C Date 10/17/05

h 6.5 To 8.5

Lane Passing
(Inside, Center, etc.)

Mix Type SM-12.5D Application Rate 220 lbs/yd² (kg/m²)

Producer Ace Asphalt Location Macey, VA

CONTROL STRIP TARGET DENSITY DETERMINATION

<u>TEST SITE</u>	<u>DISTANCE</u>	<u>OFFSET</u>	<u>ENTER GAUGE READING</u>	
Site 1	<u>83 ft.</u>	<u>6 ft. Rt</u>	<u>148.5</u>	lb/ft ³ (<u> </u> kg/m ³)
Site 2	<u>17 ft.</u>	<u>2 ft. Rt</u>	<u>146.3</u>	lb/ft ³ (<u> </u> kg/m ³)
Site 3	<u>73 ft.</u>	<u>4 ft. Rt</u>	<u>146.2</u>	lb/ft ³ (<u> </u> kg/m ³)
Site 4	<u>107 ft.</u>	<u>4 ft. Rt</u>	<u>149.7</u>	lb/ft ³ (<u> </u> kg/m ³)
Site 5	<u>98 ft.</u>	<u>2 ft. Rt</u>	<u>146.3</u>	lb/ft ³ (<u> </u> kg/m ³)
Site 6	<u>180 ft.</u>	<u>7 ft. Rt</u>	<u>149.0</u>	lb/ft ³ (<u> </u> kg/m ³)
Site 7	<u>104 ft.</u>	<u>3 ft. Rt</u>	<u>147.8</u>	lb/ft ³ (<u> </u> kg/m ³)
Site 8	<u>40 ft.</u>	<u>9 ft. Rt</u>	<u>147.2</u>	lb/ft ³ (<u> </u> kg/m ³)
Site 9	<u> </u>	<u> </u>	<u>148.7</u>	lb/ft ³ (<u> </u> kg/m ³)
Site 10	<u> </u>	<u> </u>	<u>149.3</u>	lb/ft ³ (<u> </u> kg/m ³)
		Total	<u> </u>	lb/ft ³ (<u> </u> kg/m ³)
		Average	<u> </u>	lb/ft ³ (<u> </u> kg/m ³)

Distance From Beginning of Control Strip	Distance From Sublot Start	Paving Width							
		Distance From Reference Line							
Control Strip	Test Section	8 ft. width	9 ft. width	10 ft. width	11ft. width	12 ft. width	13 ft. width	14 ft. width	

83	16		2	6	5	2	1	2	4
17	437		6	2	8	9	8	11	11
73	412		5	4	8	2	3	7	11
107	964		5	4	8	6	10	6	8
98	113		3	2	7	10	9	2	11
180	834		3	7	3	3	2	9	7
104	92		1	3	5	9	7	5	1
40	959		3	9	6	4	6	4	5
65	716		6	8	8	2	3	4	7
99	402		1	4	2	3	4	8	9

ASPHALT NUCLEAR DENSITY TEST SECTION

Project or Schedule PM-1C-05 Item No. C Date 10/17/05
 Route 72 Mile Post From: 6.5
 Directional Lane NBL Mile Post To: 8.5 Lane Passing
(NBL, SBL, etc.) (inside, center, etc.)
 Mix Type SM-12.5D Application Rate: 220 lbs/yd² (kg/m²)
 Mix Producer Ace Asphalt Plant Location Macey, VA
 Lot No 1 Width of Application 11 Lot Length 5000 ft (m)

Gauge Model 4640B Serial Number 2325 Calibration Date 8/29/05 Depth Setting 2.0 in. (mm)

Sublot Number	Lane <small>(Inside, Center, etc.)</small>	Test Site Location		Nuclear Density	Sublot Average	
		Distance	Offset		lb/ft ³ (kg/m ³)	lb/ft ³ (kg/m ³)
1a	Passing	136 ft.	4 ft. RT	147.1		
1b	Passing	794 ft.	10 ft. RT	149.3		148.2
2a	Passing	252 ft.	7 ft. RT	147.1		
2b	Passing	631 ft.	2 ft. RT	148.6		147.9
3a	Passing	256 ft.	2 ft. RT	148.0		
3b	Passing	759 ft.	2 ft. RT	147.4		147.7
4a	Passing	308 ft.	6 ft. RT	146.6		
4b	Passing	652 ft.	4 ft. RT	148.0		
5a	Passing	162 ft.	10 ft. RT	145.9		
5b	Passing	938 ft.	2 ft. RT	147.3		
6a						
6b						
7a						
7b						
				Average		lb/ft ³ (kg/m ³)
				Target Nuclear Control Strip Density		lb/ft ³ (kg/m ³)
Control Strip No <u>1</u>	% of Target Nuclear Control Strip Density					98 - 102 (Acceptance Range)

Lot length x width x application rate / 18000

Remarks

Table III-3
Density Requirements

Mix Type	Min. Control Strip Density %
SM-9.5A, SM-12.5A	92.5
SM-9.5D, SM-12.5D	92.2
SM-9.5E, SM-12.5E	92.2
IM-19.0A	92.2
IM-19.0D	92.0
BM-25.0A, BM-25.0D	91.5