

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

NUCLEAR FIELD DENSITY - MOISTURE TEST FOR
RANDOM MATERIAL HAVING LESS THAN 40%
OF + 3/4 INCH (+19 mm) MATERIAL

1.0 PURPOSE

- 1.1 The purpose of this procedure is to determine the density and moisture content of random materials.

2.0 SCOPE

- 2.1 This method of testing is applicable to random materials used for embankments, subgrades, backfill, and soil cement base courses.

3.0 REFERENCES

- 3.1 MP 717.04.21
MP 712.21.26
AASHTO T-99, Method C

4.0 EQUIPMENT

- 4.1 One complete nuclear density-moisture gauge unit meeting the requirements specified in MP 717.04.21. A copy of the manufacturer's print-out of standard counts is to be included.
- 4.2 One $1/30 \text{ ft}^3$ (0.000943 m^3) proctor mold assembly with a 5.5 LB (2.5 kg) rammer meeting the requirements of AASHTO T-99.
- 4.3 One steel foundation plate having minimum dimensions of 15 in. x 15 in. x 5/8 in. (380 mm x 380 mm x 16 mm) or a 200 LB (91 kg) block of concrete.
- 4.4 One extruder for removing specimens from proctor mold.

- 4.5 One balance having a capacity of at least 10 kg and sensitive to 1.0 g.
- 4.6 One stove for drying moisture samples.
- 4.7 One 32 oz. (900 g) ballpeen hammer or equivalent.
- 4.8 Two pans with a capacity to hold 10 LB (4500 g) of material.
- 4.9 One pan suitable for drying moisture samples.
- 4.10 One wire brush
- 4.11 One 3/4 in. (19 mm) U.S. Standard Sieve
- 4.12 One scoop
- 4.13 One ruler or tape measure
- 4.14 One measuring tape (should be a minimum of 50 ft (15 m))
- 4.15 One 2 in. (50 mm) approximate size paint brush
- 4.16 One 18 in. (450 mm) chisel or equivalent
- 4.17 One draw knife
- 4.18 Supply of data sheets and attached tables
- 4.19 One appropriate vehicle for transporting nuclear gauge and test equipment.
- 5.0 PERSONNEL TRAINING
- 5.1 All personnel performing the testing must have the minimum training requirements specified in MP 717.04.21.
- 5.2 All personnel must know and follow the requirements of the Nuclear Regulatory Commission.
- 6.0 ROUNDING OF DATA
- 6.1 Test values and calculations are to be rounded according to the following procedure:

- 6.1.1 If the figure following the last significant number to be retained is larger than five, increase the last significant number to be retained by one.
- 6.1.2 If the figure following the last significant number to be retained is five, and there are no figures beyond five except zeros, the last significant number to be retained is increased by one if odd, or left unchanged if even.
- 6.1.3 If the figure following the last significant number to be retained is five and there are figures following the five, the last significant number to be retained is increased by one.
- 6.1.4 If the figure following the last significant number to be retained is less than five, the significant number is left unchanged.
- 6.2 Test values and calculations shall be rounded to the following nearest significant digit.

Station Number:	1 ft. (0.1 m)
Offset:	1 ft. (0.1 m)
Lift Thickness:	1/2 in. (10 mm)
Depth Below Grade:	1 ft. (0.1 m)
Dry Density (DA):	1 LB/ft ³ (10 kg/m ³)
Moisture (MA):	1 LB/ft ³ (10 kg/m ³)
Dry Density - 19 mm material (DB):	1 LB/ft ³ (10 kg/m ³)
Moisture (MB):	1%
Excavated Material + Pan (CA):	1 g
Pan (CB):	1 g
Excavated Material (CC):	1 g
+3/4 in. (+19 mm) Material + Pan (CD):	1 g
Pan (CE):	1 g
+3/4 in. (+19 mm) Material (CF):	1 g
+3/4 in. (+19 mm) Material (CG):	1%
Weight of Soil + Mold (PA):	1 g
Mold (PC):	1 g
Weight of Soil (PD):	1 g
Wet Density (PE):	1 LB/ft ³ (10 kg/m ³)
Dry Density (PF):	1 LB/ft ³ (10 kg/m ³)
Wet Weight + Pan (SA):	1 g
Pan (SB):	1 g
Wet Weight (SC):	1 g
Dry Weight + Pan (SD):	1 g
Dry Weight (SE):	1 g

Moisture (SF):	1 g
Moisture (SG):	1%
Optimum Moisture (OA):	1%
Maximum Density (DC):	1 LB/ft ³ (10 kg/m ³)
Relative Density (DE):	1%
Average DE (X):	0.1%
Target (T):	1%
Quality Index (L):	0.01
Within Tolerance (DF):	1%
Minimum Percent for 100% Pay (DG):	1%

7.0 PREPARATION FOR TESTING

- 7.1 Weigh the pans and proctor mold and record the weights on the sides of the equipment. The weights should be checked at least on a monthly basis.
- 7.2 All test data is to be recorded on the attached form.
- 7.3 Standardization of the nuclear gauge
 - 7.3.1 Warm up the gauge for a minimum of 20 minutes.
 - 7.3.2 Standardization of the gauge must be performed away from metal and other objects.
 - 7.3.3 Clean the top of the standard block and the bottom of the gauge with a cloth.
 - 7.3.4 Place the gauge on the standard block with the gauge turned the correct way. For the Troxler 3411 gauge, the scaler end of the gauge must be tight against the standard block flange.
 - 7.3.5 Make the necessary adjustments on the gauge for standardization and take a four minute count for density and moisture.
 - 7.3.6 Compare the standard counts to the manufacturer's standard counts. The standard count must be within $\pm 2\%$ for density and $\pm 4\%$ for moisture from the manufacturer's standards.
 - 7.3.7 If the gauge is not within the specified tolerances for either moisture or density, repeat Section 7.3.5 - 7.3.6. If the gauge will not standardize for either moisture or density after 4 attempts, there is probably something

wrong with the gauge. There may be electronics problems, the gauge needs calibrated, or a stability check needs to be performed. Refer to MP 717.04.21 for a more detailed explanation. In any case, do not use a gauge for testing that will not properly standardize.

- 7.3.8 When a gauge is used for testing pipe or structure backfill in a trench, first check the standardization of the gauge according to Sections 7.3.1 - 7.3.6. If the gauge is functioning properly, then standardize the gauge in the trench. The standard counts in the trench are used for testing in the trench only and the tolerances would not be applied to the standard counts taken in the trench. When the gauge is moved to a non-trench condition for testing, new standard counts would be required.
- 7.3.9 Gauges are to be standardized before testing and at least every four hours during testing.
- 7.4 Record the project number, item number, etc.
- 7.5 The lot number has the following prefix letter designations based on the use of the material:
- Embankment - F
 - Subgrade - S
 - Base - B
 - Pipe and Structure Backfill - P
- 7.6 Randomly locate the test site according to MP 712.21.26.
- 8.0 PROCEDURE
- 8.1 Density and moisture determination
- 8.1.1 Smooth the test site selected for testing. Fill any voids in the surface using the fines scraped from the surface. Avoid adding excessive fines that would form a build-up on the surface (no more than 1/8 in. (3 mm)).
- 8.1.2 Place the guide plate on the test site. Next, place the drive rod in the plate guide and while standing on the plate, drive the rod at least 2 in. (50 mm) deeper than the location where the end of the gauge source rod will be when testing. The gauge source rod can be extended in

2 in. (50 mm) increments. The source rod must be as deep as possible within the lift but must not extend beyond the lift. For example, a 5 inch (125 mm) lift would be tested with the source rod in the 100 mm position and the hole would be 8 inch (150 mm) deep. Carefully remove the drive rod to prevent material from falling into the hole.

- 8.1.3 Place the gauge over the test site and insert the source rod to the desired depth. Pull the gauge tight against the side of the hole toward the scaler. Make sure the gauge is sitting flush on the material.
- 8.1.4 Take a one minute density and moisture reading. Record the dry density (DA) and moisture (MA).
- 8.2 Determination of the percent of + 3/4 in. (+3/4 in. (+19 mm)) material
 - 8.2.1 Excavate approximately 4500 g of material immediately beneath the test site. Excavate the material from the test hole toward the scaler end of the gauge and to the depth of the position where the source rod was located. Keep the excavated material covered to prevent moisture loss.
 - 8.2.2 Zero the scales. The scales are to be located in an enclosed area of the vehicle that is protected from air movement. The scales are to be checked for zero before each weighing. Weigh the excavated material (CA).
 - 8.2.3 All of the material weighed in 8.2.2 shall be passed over the 3/4 in. (19 mm) sieve. Break up any clumps of soil that are retained on the sieve and clean the fines from the + 3/4 in. (+3/4 in. (+19 mm)) material.
 - 8.2.4 Weigh the +3/4 in. (+19 mm) material (CD) obtained in 8.2.3.
 - 8.2.5 Calculate the percent of +3/4 in. (+19 mm) material (CG) by using the equations on the form. If the percent of +3/4 in. (+19 mm) material is 40% or more, terminate the test. Refer to MP 717.04.21 for instructions for dealing with the material.

- 8.2.6 Determine the bulk specific gravity (CH) of the dominant +3/4 in. (+19 mm) material by using the values from the following table:

Bulk Specific Gravity

Soft Shale:	2.4
Hard Shale:	2.5
Sandstone:	2.5
Gravel:	2.6
Limestone:	2.7
Red Shale (Iron Bearing)	2.7

- 8.3 Determination of the dry density of the -3/4 in. (-19 mm) material and percent field moisture.
- 8.3.1 The dry density of the -3/4 in. (-19 mm) material (DB) can be calculated by the equation on the form or obtained from the tables for converting total dry density to density of the -3/4 in. (-19 mm) material. The index with the tables explains how to use the tables.
- 8.3.2 Calculate the percent field moisture (MB) by the equation on the form.
- 8.4 One point proctor
- 8.4.1 Place the proctor mold with collar and base attached on the foundation plate. The foundation plate must be firmly seated so that it does not rock when compacting the material. Mix the -3/4 in. (-19 mm) material obtained in 8.2.3. Form a specimen by compacting the material in the mold in three equal layers (38 mm $\pm$ 7 mm). Each layer is compacted by 25 uniformly distributed blows with the metal rammer dropped freely from a height of 305 mm. Stand on the edges of the mold base while compacting the specimen. The rammer must be held vertically.
- 8.4.2 After the specimen has been made, remove the extension collar. The sample must not extend more than 13 mm above nor be below the top of the mold. A new specimen shall be made if it is too high or low. Carefully trim the material flush with the top of the mold by using the draw knife. Fill any voids in the surface with the fines obtained from the trimming. Use the paint brush to clean

the fines from the outside of the mold. Remove the mold base and by holding the mold vertically, visually check the bottom of the mold to determine if the material extends beyond the mold. Do not turn the mold upside down nor trim the bottom. If the material extends beyond the bottom of the mold, perform another specimen with special precautions to seat and tighten the mold to the base.

- 8.4.3 Weigh the soil plus mold (PA). Record the values in the first column (left of dashed line) in the one point proctor section.
- 8.4.4 Remove the specimen from the mold by using the extruder. Place the specimen back in the remaining -3/4 in. (-19 mm) material.
- 8.4.5 Perform the calculations using the equations on the form to determine the dry density of the one point proctor (PE).
- 8.5 Determination of the maximum density and optimum moisture
 - 8.5.1 To determine the maximum density and optimum moisture, plot the percent field moisture (MB) and the dry density of the one point proctor (PE) on the maximum density-optimum moisture table (copy attached). The values at the intersection of the density line and moisture column are the maximum density (DC) and optimum moisture (OA). If there are no values given, the sample is either too wet or too dry to determine the maximum density and optimum moisture. When the plotted point is to the right of the maximum densities and optimum moistures, the sample is too wet and when the plotted value is to the left, the sample is too dry.
 - 8.5.2 If the sample is found to be too wet, air dry the -3/4 in. (-19 mm) material to decrease the moisture content between four percentage points below optimum and optimum moisture. The sample is dried by spreading the sample on a sheet of metal, canvas, etc. Do not dry the sample on a stove. If the sample is too dry, add water to increase the moisture content to the above moisture range. Care should be taken not to over dry or add too much water to the sample.

- 8.5.3 Rerun one point proctor
- 8.5.3.1 Once the sample has been air dried or water added, thoroughly mix the sample and perform another one point proctor according to 8.4.1 - 8.4.4. Record the data in the second column (right of dashed line) in the one point proctor section.
- 8.5.3.2 Calculate the wet density of the rerun one point proctor (PE) by using the equations on the form.
- 8.5.4 Stove dried moisture
- 8.5.4.1 Scoop out a representative sample between 200 g and 400 g from the sample in 8.5.3.1. The moisture determination can be made in conjunction with making the rerun one point proctor specimen. Place the sample in the pan for drying samples and determine the sample weight plus pan (SA).
- 8.5.4.2 Adjust the stove flame to a low heat so that the sample will not oxidize during drying. Occasionally stir the sample and be very careful not to lose any of the sample. Once the sample appears dry, weigh the sample and record the weight. Place the sample back on the stove and dry for approximately two minutes. Weigh the sample and compare the two weights. The weights should be the same (constant). If there is a decrease in weight, reheat the sample again for two minutes and weigh. Continue this process until two consecutive weighings are the same and this weight is dry weight plus pan (SD).
- 8.5.4.3 By using the equations on the form, calculate the percent moisture (SG).
- 8.5.5 Use the percent moisture (SG) from the stove dried moisture to calculate the dry density of the rerun one point proctor (PE).
- 8.5.6 Plot the dry density of the rerun one point proctor (PE) and the percent stove dried moisture (SG) on the maximum density-optimum table to obtain the maximum density (DC) and the optimum moisture (OA).

9.0 MOISTURE EVALUATION

9.1 Obtain the $\pm$ moisture tolerance (OB) from the project's governing specifications.

9.2 To determine the acceptable moisture range, add the plus tolerance and subtract the minus tolerance from the optimum moisture. The field moisture (MB) must be within this range for the moisture to meet specifications. If the moisture fails specifications, corrective action is required.

10.0 DENSITY EVALUATION

10.1 Calculate the percent relative density (DE) by the equation on the form.

10.2 If the percent relative density (DE) is 105 or more, the test results may be in error. Plot the dry density of the -3/4 in. (-19 mm) material (DB) and the percent field moisture (MB) on the maximum density-optimum moisture table to check the validity of the test results. The plotted point should fall on or to the left of the darkened blocks (zero air voids). Another method of checking the test results is to calculate the maximum moisture content possible (zero air voids) by the following equation:

Maximum moisture content possible (English) = $(62.4/DB - .373)100$

Maximum moisture content possible (Metric) = $(1000/DB - 0.373)100$

When the test results are equal to or less than the above evaluation, the results are acceptable.

10.3 When the conditions in 10.2 are not met, perform another complete test, including a one point proctor, at a new random location. The checks in 10.2 would again be made if the test results are 105% or more. If the conditions in 10.2 are still not met, obtain a sample and determine the specific gravity of both the +3/4 in. (+19 mm) and -3/4 in. (-19 mm) material, performed separately. Then recalculate the test results using the specific gravity of the +3/4 in. (+19 mm) material to determine the dry density of the -3/4 in. (-19 mm) material (DB). If the percent relative density is still 105% or more, perform the following calculation using the specific gravity of the -3/4 in. (-19 mm) material.

Maximum moisture content = $(62.4/DB - 1/Sp. Gr.)100$

Maximum moisture content = $(1000/DB - 1/Sp. Gr.)100$

The field moisture (MB) must be equal to or less than the maximum moisture content (new zero air voids). If the test results still appear to be invalid, an immediate investigation must be conducted.

11.0 LOT EVALUATION

11.1 Five tests are required for a lot evaluation. Each test shall be performed according to previous sections of this procedure.

11.2 Calculate the average relative density (x) for the five tests in the lot.

11.3 Obtain the target percentage of dry density (T) from the project's governing specifications.

11.4 Determine the range (R) of the relative densities (DE) by subtracting the smallest value from the largest.

11.5 Calculate the quality index (QL) by using the equation on the form.

11.6 Enter the table for estimating the percent of a lot within tolerance (copy attached). Determine the percent within tolerance (DF) which corresponds to the QL value calculated in 11.5 above.

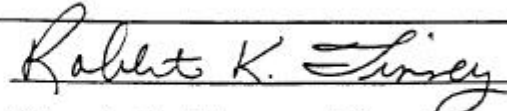
11.7 Obtain the minimum percent for 100% pay (DG) from the project's governing specifications.

11.8 In order for a lot to meet specifications for density, the percent within tolerance (DF) must be equal to or greater than the percent for 100% pay (DG). Corrective action is required to bring a failing lot into specification requirements.

12.0 GENERAL REQUIREMENTS

12.1 In order for a lot to meet specifications, the requirements in 9.2 and 11.8 must be met.

- 12.2 The maximum density, optimum moisture, and percent of +3/4 in. (+19 mm) material may be used for subsequent tests in a lot if the -3/4 in. (-19 mm) material does not change. When the material changes, the determination of new control data is required. There must be at least one, one point proctor, for each lot.
- 12.3 If the test results indicate that the material meets specifications and the material exhibits pumping or displacing action under the weight of construction equipment, the test results are probably in error. Obtain a sample of the material and determine the maximum density and optimum moisture according to AASHTO T99, Method C. Until the laboratory test results are obtained, the material in question would be dried and recompact until the pumping stops. The area would then be retested and this moisture content used as the upper limit for moisture during the interim period.
- 12.4 During the compaction of soil cement base course, if the material starts to shear, cease rolling even though the required specifications for compaction are not met. The material is accepted for compaction and the proper documentation in the project's records would be made.
- 12.5 Independent tests for similarity checks can be recorded on the form. Use only the applicable sections of the form.


Robert K. Tinney, Director
Contract Administration Division

RTK:Sra

Attachments

MP 207.07.20
ATTACHMENT 2

TABLE FOR ESTIMATING PERCENT OF LOT WITHIN TOLERANCE

Quality Index (QL) Positive Values	Percent Within Tolerance
.66	99
.65	98
.62	97
.60	96
.58	95
.57	94
.55	93
.53	92
.51	91
.50	90
.48	89
.46	88
.45	87
.44	86
.42	85
.41	84
.40	83
.38	82
.37	81
.36	80
.34	79
.33	78
.32	77
.30	76
.29	75
.28	74
.27	73
.25	72
.24	71
.23	70
.22	69
.21	68
.19	67
.18	66
.17	65
.16	64
.15	63
.14	62
.13	61
.11	60
.10	59
.09	58
.08	57
.07	56
.06	55
.05	54
.04	53
.02	52
.01	51
.00	50

Quality Index (QL) Negative Values	Percent Within Tolerance
.00	50
.01	49
.02	48
.04	47
.05	46
.06	45
.07	44
.08	43
.09	42
.10	41
.11	40
.13	39
.14	38
.15	37
.16	36
.17	35
.18	34
.19	33
.21	32
.22	31
.23	30
.24	29
.25	28
.27	27
.28	26
.29	25
.30	24
.32	23
.33	22
.34	21
.36	20
.37	19
.38	18
.40	17
.41	16
.42	15
.44	14
.45	13
.46	12
.48	11
.50	10
.51	9
.53	8
.55	7
.57	6
.58	5
.60	4
.62	3
.63	2
.66	1

MAXIMUM DENSITY-OPTIMUM MOISTURE TABLE

DRY DENSITY OF ONE POINT PROCTOR

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
130			131 9	130 9																
129		131 9	130 9	129 9																
128		130 9	130 9	128 10																
127	131 9	130 9	128 10	127 10																
126	131 9	130 9	128 10	127 10	126 10															
125	130 9	128 10	127 10	126 10	125 10															
124		128 10	126 10	125 11	125 11	124 11														
123		127 10	126 10	124 11	123 11	123 11														
122		126 10	125 11	124 11	123 12	122 12														
121		126 11	125 12	123 12	122 12	121 12	121 12													
120		125 11	124 11	122 12	121 12	120 12	120 12													
119			123 12	122 12	120 12	120 13	119 13													
118			122 12	120 12	120 13	119 13	118 13	118 13												
117				120 12	119 13	118 13	117 13	117 13												
116				119 13	118 13	117 13	117 14	116 14												
115				118 13	117 14	116 14	116 14	115 14	115 14											
114				117 13	116 14	116 14	115 14	114 14	114 14											
113					116 14	115 14	114 14	114 15	113 15											
112					115 14	115 15	113 15	113 15	112 15	112 15										
111					115 14	113 15	112 15	111 15	111 16	111 16										
110					113 15	112 15	111 15	111 16	110 16	110 16										
109						112 15	111 16	110 16	109 16	109 16										
108						111 16	110 16	109 16	109 17	108 17										
107							110 16	109 17	108 17	107 17	107 17									
106							109 17	108 17	107 17	106 18	106 18									
105							108 17	107 17	106 18	105 18	105 18	105 18								
104								107 17	106 18	105 18	104 19	104 19	104 19							
103								106 18	105 19	105 19	104 19	103 19	103 19	103 19						
102								105 18	104 19	103 19	102 20	102 20	102 20	102 20						
101									104 19	103 20	102 20	101 20	101 20	101 21	101 21					
100									103 19	102 20	101 20	101 21	100 21	100 21	100 21	100 21				
99									102 20	101 21	101 21	100 21	100 21	99 21	99 22	99 22				
98										100 21	99 21	99 21	98 22	98 22	98 22	98 22	98 22			
97										100 21	99 21	99 22	98 22	98 22	98 22	97 22	97 23			
96											99 22	98 22	98 22	98 22	97 23	97 23	96 23			
95											99 22	98 22	97 23	97 23	96 23	95 24	95 24	95 24		
94											98 22	97 23	96 23	95 24	95 24	94 24	94 24	94 24	94 24	
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

PERCENT MOISTURE

MAXIMUM DENSITY-OPTIMUM MOISTURE TABLE

DRY DENSITY OF ONE POINT PROCTOR

	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1790	1850 14	1830 14	1810 15	1800 15	1790 15	1790 15									
1780	1840 14	1820 15	1810 15	1790 15	1790 15	1780 15									
1770	1820 14	1810 15	1800 15	1780 15	1780 16	1770 16									
1760	1810 15	1800 15	1790 15	1780 16	1770 16	1760 16									
1750		1790 15	1780 15	1770 16	1760 16	1750 16	1750 16								
1740		1790 15	1770 16	1760 16	1750 16	1750 16	1740 17								
1730		1780 15	1770 16	1760 16	1750 16	1740 17	1730 17								
1720			1760 16	1750 16	1740 17	1730 17	1720 17								
1710			1750 16	1740 17	1730 17	1720 17	1710 17								
1700			1750 16	1730 17	1720 17	1710 17	1700 18								
1690			1740 17	1720 17	1720 17	1710 18	1700 18	1690 18							
1680			1730 17	1720 17	1710 17	1700 18	1690 18	1680 18							
1670			1720 17	1710 17	1700 18	1690 18	1680 18	1670 19							
1660				1710 18	1700 18	1680 18	1670 19	1660 19							
1650				1700 18	1690 18	1680 18	1670 19	1660 19	1650 19						
1640				1690 18	1680 18	1670 19	1660 19	1650 19	1640 19						
1630				1680 18	1670 19	1660 19	1650 19	1640 20	1630 20	1630 20	1630 20				
1620					1660 19	1650 19	1640 20	1630 20	1620 20	1620 20	1620 20				
1610					1650 19	1640 20	1630 20	1620 20	1620 21	1610 21	1610 21				
1600					1650 20	1630 20	1620 20	1610 21	1610 21	1600 21	1600 21	1600 21			
1590					1640 20	1630 20	1620 21	1610 21	1600 21	1600 21	1590 21	1590 21			
1580					1630 20	1620 20	1610 21	1600 21	1590 21	1580 22	1580 22	1580 22			
1570						1610 21	1600 21	1590 21	1580 22	1580 22	1580 22	1570 22	1570 22		
1560						1600 21	1590 21	1580 22	1570 22	1570 22	1570 22	1560 22	1560 22		
1550						1600 21	1590 22	1580 22	1570 22	1570 22	1560 23	1560 23	1550 23		
1540						1590 21	1580 22	1580 22	1570 22	1560 22	1550 23	1550 23	1540 23	1540 23	
1530							1580 22	1570 22	1570 22	1550 23	1540 23	1530 23	1530 23	1530 23	
1520							1570 22	1570 22	1560 23	1540 23	1530 23	1530 24	1520 24	1520 24	
1510							1570 22	1560 22	1550 23	1530 23	1520 24	1520 24	1510 24	1510 24	1510 24
1500							1570 22	1560 23	1530 23	1520 24	1510 24	1510 24	1500 24	1500 25	1500 25
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

PERCENT MOISTURE

MAXIMUM DENSITY-OPTIMUM MOISTURE TABLE

DRY DENSITY OF ONE POINT PROCTOR

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2080			2090 9	2080 9											
2070		2100 9	2080 9	2070 9											
2060		2090 9	2080 9	2060 10											
2050		2090 9	2070 9	2050 10											
2040		2090 9	2060 10	2050 10	2040 10										
2030	2100 9	2080 9	2050 10	2040 10	2030 10										
2020	2100 9	2080 9	2050 10	2030 10	2020 10										
2010	2090 9	2070 9	2040 10	2030 10	2010 10										
2000	2090 9	2060 10	2030 10	2020 10	2000 11										
1990		2050 10	2030 10	2010 11	2000 11	1990 11									
1980		2040 10	2020 10	2000 11	1990 11	1980 11									
1970		2040 10	2020 10	2000 11	1980 11	1970 11									
1960		2030 10	2010 11	1990 11	1970 11	1960 12									
1950		2020 10	2000 11	1980 11	1960 12	1950 12									
1940		2020 10	2000 11	1970 11	1950 12	1940 12	1940 12								
1930		2010 11	1990 11	1980 12	1950 12	1940 12	1930 12								
1920		2010 11	1980 11	1960 12	1940 12	1930 12	1920 12								
1910			1970 11	1950 12	1930 12	1920 12	1910 13								
1900			1960 12	1940 12	1920 12	1910 13	1900 13								
1890			1950 12	1930 12	1910 12	1900 13	1890 13								
1880				1920 12	1910 13	1890 13	1890 13	1880 13							
1870				1910 13	1900 13	1880 13	1880 13	1870 13							
1860				1900 13	1890 13	1880 13	1870 13	1860 14							
1850				1900 13	1880 13	1870 13	1860 14	1850 14							
1840				1890 13	1870 13	1860 14	1850 14	1840 14	1840 14						
1830				1880 13	1870 13	1860 14	1850 14	1840 14	1830 14						
1820				1870 13	1860 14	1850 14	1840 14	1830 14	1820 14						
1810					1860 14	1850 14	1830 14	1820 14	1810 15						
1800					1850 14	1840 14	1820 14	1810 15	1800 15						
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

PERCENT MOISTURE

TABLES FOR CONVERTING
TOTAL DRY DENSITY TO DENSITY
OF THE -3/4 in. (-19 mm) MATERIAL

INSTRUCTIONS FOR USING THE TABLES

To use the tables, locate in the index the page number corresponding to the specific gravity (CH), the total dry density (DA), and the percent of +3/4 in. (+19 mm) material (CG). Turn to the selected page and locate the total dry density in the left column and read across the page to the column corresponding to the percent of +3/4 in. (+19 mm) material. The percents of +3/4 in. (+19 mm) material are listed across the top of the page. The value at the intersection is the dry density of the -3/4 in. (-19 mm) material (DB).

EXAMPLE:

Given: Specific Gravity = 2.5
Percent of +3/4 in. (+19 mm) material = 29
Total Dry Density = 1 970 kg/m³

Turn to the index with the values and select Page 20. Next, turn to Page 20 and notice that a specific gravity of 2.5 is listed at the top of the page. Read down the left column and locate 1 970 kg/m³. Then read across the page to the column corresponding to 29%. The value of 1 880 kg/m³ at the intersection is the dry density of the -3/4 in. (-19 mm) material.

INDEX

PERCENT OF +3/4 in. (+19 mm) MATERIAL	TOTAL DRY DENSITY	PAGE NUMBER
Specific Gravity of 2.4		
1 - 10	1280 - 1770	1
1 - 10	1780 - 2260	2
1 - 10	2270 - 2560	3
11 - 20	1280 - 1770	4
11 - 20	1780 - 2260	5
11 - 20	2270 - 2560	6
21 - 30	1280 - 1770	7
21 - 30	1780 - 2260	8
21 - 30	2270 - 2560	9
31 - 40	1280 - 1770	10
31 - 40	1780 - 2260	11
31 - 40	2270 - 2560	12
Specific Gravity of 2.5		
1 - 10	1280 - 1770	13
1 - 10	1780 - 2260	14
1 - 10	2270 - 2560	15
11 - 20	1280 - 1770	16
11 - 20	1780 - 2260	17
11 - 20	2270 - 2560	18
21 - 30	1280 - 1770	19
21 - 30	1780 - 2260	20
21 - 30	2270 - 2560	21
31 - 40	1280 - 1770	22
31 - 40	1780 - 2260	23
31 - 40	2270 - 2560	24
Specific Gravity of 2.6		
1 - 10	1280 - 1770	25
1 - 10	1780 - 2260	26
1 - 10	2270 - 2560	27
11 - 20	1280 - 1770	28
11 - 20	1780 - 2260	29
11 - 20	2270 - 2560	30
21 - 30	1280 - 1770	31
21 - 30	1780 - 2260	32
21 - 30	2270 - 2560	33
31 - 40	1280 - 1770	34
31 - 40	1780 - 2260	35
31 - 40	2270 - 2560	36
Specific Gravity of 2.7		
1 - 10	1280 - 1770	37
1 - 10	1780 - 2260	38
1 - 10	2270 - 2560	39
11 - 20	1280 - 1770	40
11 - 20	1780 - 2260	41
11 - 20	2270 - 2560	42
21 - 30	1280 - 1770	43
21 - 30	1780 - 2260	44
21 - 30	2270 - 2560	45
31 - 40	1280 - 1770	46
31 - 40	1780 - 2260	47
31 - 40	2270 - 2560	48

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.4

DD	← PERCENT of + 3/4 MATERIAL →									
	1	2	3	4	5	6	7	8	9	10
80								75		
81	80	80	79	79	78	78	77	77	76	75
			80	80						
83	83	82	81	81	80	80	79	79	78	78
								80		
85	85	84	84	83	83	82	81	81	80	80
		85								
87	87	86	86	85	85	84	84	83	83	82
89	89	88	88	87	87	86	86	85	85	84
90	90									85
91	91	90	90	89	89	88	88	87	87	86
				90						
93	93	92	92	91	91	91	90	90	89	89
										90
95	95	94	94	93	93	93	92	92	91	91
		95								
97	97	96	96	96	95	95	94	94	94	93
								95		
99	99	98	98	98	97	97	97	96	96	95
100	100	99	99	99	98	98	98	97	97	96
101	101	100	100	100	99	99	99	98	98	98
102	102	101	101	101	100	100	100	99	99	99
103	103	102	102	102	101	101	101	100	100	100
104	104	103	103	103	103	102	102	102	101	101
105	105	104	104	104	104	103	103	103	102	102
106	106	105	105	105	105	104	104	104	103	103
107	107	106	106	106	106	105	105	105	105	104
108	108	108	107	107	107	106	106	106	106	105
109	109	109	108	108	108	108	107	107	107	106
110	110	110	109	109	109	109	108	108	108	108
111	111	111	110	110	110	110	109	109	109	109
112	112	112	111	111	111	111	111	110	110	110
113	113	113	112	112	112	112	112	111	111	111
114	114	114	113	113	113	113	113	112	112	112
115	115	115	114	114	114	114	114	114	113	113
116	116	116	116	115	115	115	115	115	114	114
117	117	117	117	116	116	116	116	116	116	115
118	118	118	118	117	117	117	117	117	117	116
119	119	119	119	118	118	118	118	118	118	118
120	120	120	120	120	119	119	119	119	119	119

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.4

DD	←————— PERCENT of + 3/4 MATERIAL —————→									
	1	2	3	4	5	6	7	8	9	10
121	121	121	121	121	120	120	120	120	120	120
122	122	122	122	122	121	121	121	121	121	121
123	123	123	123	123	123	122	122	122	122	122
124	124	124	124	124	124	124	123	123	123	123
125	125	125	125	125	125	125	124	124	124	124
126	126	126	126	126	126	126	126	125	125	125
127	127	127	127	127	127	127	127	127	127	126
128	128	128	128	128	128	128	128	128	128	128
129	129	129	129	129	129	129	129	129	129	129
130	130	130	130	130	130	130	130	130	130	130
131	131	131	131	131	131	131	131	131	131	131
132	132	132	132	132	132	132	132	132	132	132
133	133	133	133	133	133	133	133	133	133	133
134	134	134	134	134	134	134	134	134	134	134
135	135	135	135	135	135	135	135	135	135	135
136	136	136	136	136	136	136	136	136	136	136
137	137	137	137	137	137	137	137	137	138	138
138	138	138	138	138	138	138	138	139	139	139
139	139	139	139	139	139	139	140	140	140	140
140	140	140	140	140	140	141	141	141	141	141
141	141	141	141	141	141	142	142	142	142	142
142	142	142	142	142	143	143	143	143	143	143
143	143	143	143	143	144	144	144	144	144	144
144	144	144	144	145	145	145	145	145	145	145
145	145	145	145	146	146	146	146	146	146	146
146	146	146	146	147	147	147	147	147	147	148
147	147	147	147	148	148	148	148	148	149	149
148	148	148	149	149	149	149	149	149	150	150
149	149	149	150	150	150	150	150	150	151	151
150	150	150	151	151	151	151	151	152	152	152
151	151	151	152	152	152	152	152	153	153	153
152	152	152	153	153	153	153	154	154	154	154
153	153	153	154	154	154	154	155	155	155	155
154	154	154	155	155	155	155	156	156	156	156
155	155	155	156	156	156	156	157	157	157	158
156	156	156	157	157	157	158	158	158	158	159
157	157	158	158	158	158	159	159	159	159	160
158	158	159	159	159	159	160	160	160	161	161
159	159	160	160	160	160	161	161	161	162	162
160	160	161	161	161	161	162	162	162	163	163

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.4

DD	← PERCENT of + 3/4 MATERIAL →									
	11	12	13	14	15	16	17	18	19	20
80										
81	75	74	73	73	72	71	71	70	69	68
									70	70
83	77	76	76	75	74	74	73	72	72	71
85	79	79	78	77	77	76	75	75	74	73
87	81	81	80	80	79	78	78	77	76	76
89	84	83	83	82	81	81	80	80	79	78
90									80	80
91	86	85	85	84	84	83	83	82	81	81
93	88	88	87	87	86	86	85	84	84	83
95	90	90	90	89	89	88	87	87	86	86
97	93	92	92	91	91	90	90	89	89	88
									90	90
99	95	95	94	94	93	93	92	92	91	91
100	96	96	95	95	94	94	93	93	93	92
101	97	97	96	96	96	95	95	94	94	93
102	98	98	98	97	97	96	96	95	95	95
103	99	99	99	98	98	98	97	97	96	96
104	101	100	100	99	99	99	98	98	97	97
105	102	101	101	101	100	100	100	99	99	98
106	103	102	102	102	101	101	101	100	100	100
107	104	104	103	103	103	102	102	102	101	101
108	105	105	104	104	104	103	103	103	102	102
109	106	106	106	105	105	105	104	104	104	103
110	107	107	107	106	106	106	106	105	105	105
111	108	108	108	108	107	107	107	106	106	106
112	110	109	109	109	109	108	108	108	107	107
113	111	110	110	110	110	109	109	109	109	108
114	112	112	111	111	111	111	110	110	110	110
115	113	113	112	112	112	112	112	111	111	111
116	114	114	114	113	113	113	113	113	112	112
117	115	115	115	115	114	114	114	114	114	113
118	116	116	116	116	116	115	115	115	115	115
119	117	117	117	117	117	117	116	116	116	116
120	119	118	118	118	118	118	118	117	117	117

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.4

DD	← PERCENT of + 3/4 MATERIAL →									
	11	12	13	14	15	16	17	18	19	20
121	120	120	119	119	119	119	119	119	118	118
122	121	121	121	120	120	120	120	120	120	120
123	122	122	122	122	121	121	121	121	121	121
124	123	123	123	123	123	123	122	122	122	122
125	124	124	124	124	124	124	124	124	123	123
126	125	125	125	125	125	125	125	125	125	125
127	126	126	126	126	126	126	126	126	126	126
128	128	127	127	127	127	127	127	127	127	127
129	129	129	129	129	129	128	128	128	128	128
130	130	130	130	130	130	130	130	130	130	130
131	131	131	131	131	131	131	131	131	131	131
132	132	132	132	132	132	132	132	132	132	132
133	133	133	133	133	133	133	133	133	133	133
134	134	134	134	134	134	134	134	134	135	135
135	135	135	135	136	136	136	136	136	136	136
136	137	137	137	137	137	137	137	137	137	137
137	138	138	138	138	138	138	138	138	138	138
138	139	139	139	139	139	139	139	139	139	140
139	140	140	140	140	140	140	140	141	141	141
140	141	141	141	141	141	142	142	142	142	142
141	142	142	142	142	143	143	143	143	143	143
142	143	143	144	144	144	144	144	144	144	145
143	144	145	145	145	145	145	145	145	146	146
144	146	146	146	146	146	146	147	147	147	147
145	147	147	147	147	147	148	148	148	148	148
146	148	148	148	148	149	149	149	149	149	150
147	149	149	149	149	150	150	150	150	151	151
148	150	150	150	151	151	151	151	152	152	152
149	151	151	152	152	152	152	153	153	153	153
150	152	152	153	153	153	153	154	154	154	155
151	153	154	154	154	154	155	155	155	156	156
152	154	155	155	155	156	156	156	156	157	157
153	156	156	156	156	157	157	157	158	158	158
154	157	157	157	158	158	158	159	159	159	160
155	158	158	158	159	159	159	160	160	160	161
156	159	159	160	160	160	161	161	161	162	162
157	160	160	161	161	161	162	162	163	163	163
158	161	162	162	162	163	163	163	164	164	165
159	162	163	163	163	164	164	165	165	165	166
160	163	164	164	165	165	165	166	166	167	167

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.4

DD	← PERCENT of + 3/4 MATERIAL →									
	21	22	23	24	25	26	27	28	29	30
80										
81	67	67	66	65	64	63	62	61	60	59
83	70	69	68	68	67	66	65	64	63	62
85	73	72	71	70	69	69	68	67	66	65
87	75	74	74	73	72	71	70	70	69	68
89	78	77	76	75	75	74	73	72	72	71
90										
91	80	79	79	78	77	77	76	75	74	74
93	83	82	81	81	80	79	79	78	77	76
95	85	85	84	83	83	82	81	81	80	79
97	88	87	87	86	85	85	84	83	83	82
99	90	90	89	89	88	87	87	86	86	85
100	92	91	91	90	89	89	88	88	87	86
101	93	92	92	91	91	90	90	89	88	88
102	94	94	93	93	92	92	91	90	90	89
103	95	95	94	94	93	93	92	92	91	91
104	97	96	96	95	95	94	94	93	93	92
105	98	97	97	97	96	96	95	95	94	94
106	99	99	98	98	97	97	96	96	95	95
107	100	100	100	99	99	98	98	97	97	96
108	102	101	101	100	100	100	99	99	98	98
109	103	103	102	102	101	101	101	100	100	99
110	104	104	103	103	103	102	102	102	101	101
111	105	105	105	104	104	104	103	103	103	102
112	107	106	106	106	105	105	105	104	104	104
113	108	108	107	107	107	106	106	106	105	105
114	109	109	109	108	108	108	107	107	107	106
115	111	110	110	110	109	109	109	108	108	108
116	112	112	111	111	111	110	110	110	110	109
117	113	113	113	112	112	112	112	111	111	111
118	114	114	114	114	113	113	113	113	112	112
119	116	115	115	115	115	115	114	114	114	114
120	117	117	116	116	116	116	116	115	115	115

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.4

DD	←			PERCENT of + 3/4 MATERIAL				→		
	21	22	23	24	25	26	27	28	29	30
121	118	118	118	118	117	117	117	117	117	116
122	119	119	119	119	119	119	118	118	118	118
123	121	121	120	120	120	120	120	120	119	119
124	122	122	122	122	121	121	121	121	121	121
125	123	123	123	123	123	123	122	122	122	122
126	124	124	124	124	124	124	124	124	124	124
127	126	126	126	125	125	125	125	125	125	125
128	127	127	127	127	127	127	127	127	126	126
129	128	128	128	128	128	128	128	128	128	128
130	130	129	129	129	129	129	129	129	129	129
131	131	131	131	131	131	131	131	131	131	131
132	132	132	132	132	132	132	132	132	132	132
133	133	133	133	133	133	133	133	133	133	134
134	135	135	135	135	135	135	135	135	135	135
135	136	136	136	136	136	136	136	136	136	136
136	137	137	137	137	137	137	138	138	138	138
137	138	138	139	139	139	139	139	139	139	139
138	140	140	140	140	140	140	140	140	141	141
139	141	141	141	141	141	142	142	142	142	142
140	142	142	142	143	143	143	143	143	143	144
141	143	144	144	144	144	144	144	145	145	145
142	145	145	145	145	145	146	146	146	146	146
143	146	146	146	147	147	147	147	147	148	148
144	147	147	148	148	148	148	149	149	149	149
145	149	149	149	149	149	150	150	150	150	151
146	150	150	150	150	151	151	151	152	152	152
147	151	151	152	152	152	152	153	153	153	154
148	152	153	153	153	153	154	154	154	155	155
149	154	154	154	154	155	155	155	156	156	156
150	155	155	155	156	156	156	157	157	157	158
151	156	156	157	157	157	158	158	158	159	159
152	157	158	158	158	159	159	159	160	160	161
153	159	159	159	160	160	160	161	161	162	162
154	160	160	161	161	161	162	162	163	163	164
155	161	162	162	162	163	163	164	164	164	165
156	162	163	163	164	164	165	165	165	166	166
157	164	164	165	165	165	166	166	167	167	168
158	165	165	166	166	167	167	168	168	169	169
159	166	167	167	168	168	169	169	170	170	171
160	167	168	168	169	169	170	170	171	172	172

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.4

DD	← PERCENT of + 3/4 MATERIAL →									
	31	32	33	34	35	36	37	38	39	40
80										
81	58	57	56	55	54	52	51	50	49	47
60										
83	61	60	59	58	57	56	54	53	52	50
85	64	63	62	61	60	59	58	56	55	54
87	67	66	65	64	63	62	61	60	58	57
89	70	69	68	67	66	65	64	63	62	60
90										
91	73	72	71	70	69	68	67	66	65	64
93	76	75	74	73	72	71	70	69	68	67
95	78	78	77	76	75	74	73	72	71	70
80										
97	81	81	80	79	78	77	77	76	75	74
99	84	84	83	82	81	81	80	79	78	77
100	86	85	84	84	83	82	81	81	80	79
101	87	87	86	85	84	84	83	82	81	80
102	89	88	87	87	86	85	85	84	83	82
103	90	89	89	88	87	87	86	85	85	84
104	92	91	90	90	89	88	88	87	86	85
105	93	92	92	91	91	90	89	89	88	87
106	94	94	93	93	92	91	91	90	90	89
107	96	95	95	94	94	93	92	92	91	90
108	97	97	96	96	95	95	94	93	93	92
109	99	98	98	97	97	96	96	95	94	94
110	100	100	99	99	98	98	97	97	96	95
111	102	101	101	100	100	99	99	98	98	97
112	103	103	102	102	101	101	100	100	99	99
113	105	104	104	103	103	102	102	101	101	100
114	106	106	105	105	104	104	104	103	103	102
115	107	107	107	106	106	106	105	105	104	104
116	109	109	108	108	107	107	107	106	106	105
117	110	110	110	109	109	109	108	108	108	107
118	112	112	111	111	111	110	110	110	109	109
119	113	113	113	112	112	112	111	111	111	110
120	115	114	114	114	114	113	113	113	112	112

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.4

DD	← PERCENT of + 3/4 MATERIAL →									
	31	32	33	34	35	36	37	38	39	40
121	116	116	116	115	115	115	115	114	114	114
122	118	117	117	117	117	116	116	116	116	115
123	119	119	119	118	118	118	118	118	117	117
124	121	120	120	120	120	120	119	119	119	119
125	122	122	122	122	121	121	121	121	121	120
126	123	123	123	123	123	123	123	122	122	122
127	125	125	125	125	124	124	124	124	124	124
128	126	126	126	126	126	126	126	126	126	125
129	128	128	128	128	127	127	127	127	127	127
130	129	129	129	129	129	129	129	129	129	129
131	131	131	131	131	131	131	131	131	130	130
132	132	132	132	132	132	132	132	132	132	132
133	134	134	134	134	134	134	134	134	134	134
134	135	135	135	135	135	135	135	135	135	135
135	136	137	137	137	137	137	137	137	137	137
136	138	138	138	138	138	138	138	139	139	139
137	139	139	140	140	140	140	140	140	140	140
138	141	141	141	141	141	141	142	142	142	142
139	142	142	143	143	143	143	143	143	144	144
140	144	144	144	144	144	145	145	145	145	145
141	145	145	146	146	146	146	146	147	147	147
142	147	147	147	147	147	148	148	148	149	149
143	148	148	149	149	149	149	150	150	150	150
144	149	150	150	150	151	151	151	151	152	152
145	151	151	152	152	152	152	153	153	153	154
146	152	153	153	153	154	154	154	155	155	155
147	154	154	154	155	155	156	156	156	157	157
148	155	156	156	156	157	157	158	158	158	159
149	157	157	157	158	158	159	159	160	160	160
150	158	159	159	159	160	160	161	161	162	162
151	160	160	160	161	161	162	162	163	163	164
152	161	162	162	162	163	163	164	164	165	165
153	163	163	163	164	164	165	165	166	167	167
154	164	164	165	165	166	166	167	168	168	169
155	165	166	166	167	167	168	169	169	170	170
156	167	167	168	168	169	170	170	171	171	172
157	168	169	169	170	171	171	172	172	173	174
158	170	170	171	172	172	173	173	174	175	175
159	171	172	172	173	174	174	175	176	176	177
160	173	173	174	175	175	176	177	177	178	179

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.5

DD	← PERCENT of + 3/4 MATERIAL →									
	1	2	3	4	5	6	7	8	9	10
80								75		
81	80	80	79	79	78	77	77	76	75	75
83	82	82	81	81	80	80	79	78	78	77
85	84	84	83	83	82	82	81	80	80	79
	85	85								80
87	86	86	85	85	84	84	83	83	82	81
89	89	88	88	87	86	86	85	85	84	84
90	90									85
91	91	90	90	89	89	88	88	87	86	86
93	93	92	92	91	91	90	90	89	89	88
								90		
95	95	94	94	93	93	92	92	91	91	90
		95								
97	97	96	96	95	95	94	94	93	93	93
								95		
99	99	98	98	97	97	97	96	96	95	95
100	100	99	99	98	98	98	97	97	96	96
101	101	100	100	99	99	99	98	98	97	97
102	102	101	101	101	100	100	99	99	99	98
103	103	102	102	102	101	101	100	100	100	99
104	104	103	103	103	102	102	101	101	101	100
105	105	104	104	104	103	103	103	102	102	101
106	106	105	105	105	104	104	104	103	103	103
107	107	106	106	106	105	105	105	104	104	104
108	108	107	107	107	106	106	106	105	105	105
109	109	108	108	108	108	107	107	107	106	106
110	110	109	109	109	109	108	108	108	107	107
111	111	110	110	110	110	109	109	109	108	108
112	112	111	111	111	111	110	110	110	109	109
113	113	113	112	112	112	111	111	111	111	110
114	114	114	113	113	113	113	112	112	112	111
115	115	115	114	114	114	114	113	113	113	113
116	116	116	115	115	115	115	114	114	114	114
117	117	117	116	116	116	116	115	115	115	115
118	118	118	117	117	117	117	117	116	116	116
119	119	119	118	118	118	118	118	117	117	117
120	120	120	119	119	119	119	119	118	118	118

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.5

DD	←————— PERCENT of + 3/4 MATERIAL —————→									
	1	2	3	4	5	6	7	8	9	10
121	121	121	120	120	120	120	120	120	119	119
122	122	122	122	121	121	121	121	121	120	120
123	123	123	123	122	122	122	122	122	122	121
124	124	124	124	123	123	123	123	123	123	123
125	125	125	125	124	124	124	124	124	124	124
126	126	126	126	126	125	125	125	125	125	125
127	127	127	127	127	126	126	126	126	126	126
128	128	128	128	128	128	127	127	127	127	127
129	129	129	129	129	129	128	128	128	128	128
130	130	130	130	130	130	130	129	129	129	129
131	131	131	131	131	131	131	131	130	130	130
132	132	132	132	132	132	132	132	132	131	131
133	133	133	133	133	133	133	133	133	133	133
134	134	134	134	134	134	134	134	134	134	134
135	135	135	135	135	135	135	135	135	135	135
136	136	136	136	136	136	136	136	136	136	136
137	137	137	137	137	137	137	137	137	137	137
138	138	138	138	138	138	138	138	138	138	138
139	139	139	139	139	139	139	139	139	139	139
140	140	140	140	140	140	140	140	140	140	140
141	141	141	141	141	141	141	141	141	141	141
142	142	142	142	142	142	142	142	142	142	143
143	143	143	143	143	143	143	143	143	144	144
144	144	144	144	144	144	144	145	145	145	145
145	145	145	145	145	145	145	146	146	146	146
146	146	146	146	146	146	147	147	147	147	147
147	147	147	147	147	148	148	148	148	148	148
148	148	148	148	148	149	149	149	149	149	149
149	149	149	149	149	150	150	150	150	150	150
150	150	150	150	151	151	151	151	151	151	151
151	151	151	151	152	152	152	152	152	152	153
152	152	152	152	153	153	153	153	153	153	154
153	153	153	153	154	154	154	154	154	155	155
154	154	154	155	155	155	155	155	155	156	156
155	155	155	156	156	156	156	156	157	157	157
156	156	156	157	157	157	157	157	158	158	158
157	157	157	158	158	158	158	158	159	159	159
158	158	158	159	159	159	159	160	160	160	160
159	159	159	160	160	160	160	161	161	161	161
160	160	160	161	161	161	161	162	162	162	163

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.5

DD	← PERCENT of + 3/4 MATERIAL →									
	11	12	13	14	15	16	17	18	19	20
80					70					
81	74	73	73	72	71	70	69	69	68	67
83	76	76	75	74	73	73	72	71	70	69
85	79	78	77	76	76	75	74	74	73	72
87	81	80	79	79	78	77	77	76	75	74
89	83	82	82	81	80	80	79	78	78	77
90										
91	85	85	84	83	83	82	82	81	80	79
93	88	87	86	86	85	85	84	83	83	82
95	90	89	89	88	88	87	86	86	85	84
97	92	92	91	90	90	89	89	88	88	87
99	94	94	93	93	92	92	91	91	90	89
100	95	95	94	94	93	93	92	92	91	91
101	97	96	96	95	95	94	94	93	92	92
102	98	97	97	96	96	95	95	94	94	93
103	99	98	98	97	97	96	96	95	95	94
104	100	99	99	99	98	98	97	97	96	96
105	101	101	100	100	99	99	98	98	97	97
106	102	102	101	101	100	100	100	99	99	98
107	103	103	102	102	102	101	101	100	100	99
108	104	104	104	103	103	102	102	102	101	101
109	106	105	105	104	104	104	103	103	102	102
110	107	106	106	106	105	105	104	104	104	103
111	108	107	107	107	106	106	106	105	105	104
112	109	109	108	108	108	107	107	106	106	106
113	110	110	109	109	109	108	108	108	107	107
114	111	111	111	110	110	110	109	109	109	108
115	112	112	112	111	111	111	110	110	110	109
116	113	113	113	113	112	112	112	111	111	111
117	114	114	114	114	113	113	113	113	112	112
118	116	115	115	115	115	114	114	114	113	113
119	117	117	116	116	116	116	115	115	115	114
120	118	118	117	117	117	117	116	116	116	116

WEST VIRGINIA DIVISION OF HIGHWAYS
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.5

DD	PERCENT of + 3/4 MATERIAL									
	11	12	13	14	15	16	17	18	19	20
121	119	119	119	118	118	118	118	117	117	117
122	120	120	120	120	119	119	119	119	118	118
123	121	121	121	121	120	120	120	120	120	119
124	122	122	122	122	122	121	121	121	121	121
125	123	123	123	123	123	123	122	122	122	122
126	125	124	124	124	124	124	124	124	123	123
127	126	126	125	125	125	125	125	125	125	124
128	127	127	127	126	126	126	126	126	126	126
129	128	128	128	128	128	127	127	127	127	127
130	129	129	129	129	129	129	129	128	128	128
131	130	130	130	130	130	130	130	130	130	129
132	131	131	131	131	131	131	131	131	131	131
133	132	132	132	132	132	132	132	132	132	132
134	134	134	134	133	133	133	133	133	133	133
135	135	135	135	135	135	135	135	134	134	134
136	136	136	136	136	136	136	136	136	136	136
137	137	137	137	137	137	137	137	137	137	137
138	138	138	138	138	138	138	138	138	138	138
139	139	139	139	139	139	139	139	139	139	139
140	140	140	140	140	140	141	141	141	141	141
141	141	142	142	142	142	142	142	142	142	142
142	143	143	143	143	143	143	143	143	143	143
143	144	144	144	144	144	144	144	144	144	144
144	145	145	145	145	145	145	145	145	146	146
145	146	146	146	146	146	146	147	147	147	147
146	147	147	147	147	148	148	148	148	148	148
147	148	148	148	149	149	149	149	149	149	149
148	149	149	150	150	150	150	150	150	151	151
149	150	151	151	151	151	151	151	152	152	152
150	152	152	152	152	152	152	153	153	153	153
151	153	153	153	153	153	154	154	154	154	154
152	154	154	154	154	155	155	155	155	155	156
153	155	155	155	156	156	156	156	156	157	157
154	156	156	156	157	157	157	157	158	158	158
155	157	157	158	158	158	158	159	159	159	159
156	158	159	159	159	159	160	160	160	160	161
157	159	160	160	160	160	161	161	161	162	162
158	161	161	161	161	162	162	162	163	163	163
159	162	162	162	163	163	163	163	164	164	164
160	163	163	163	164	164	164	165	165	165	166

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.5

DD	← PERCENT of + 3/4 MATERIAL →									
	21	22	23	24	25	26	27	28	29	30
80										
81	66	65	64	63	62	61	60	59	58	57
83	69	68	67	66	65	64	63	62	61	60
85	71	70	69	68	68	67	66	65	64	63
87	74	73	72	71	70	69	68	67	66	65
89	76	75	75	74	73	72	71	70	69	68
90										70
91	79	78	77	76	76	75	74	73	72	71
93	81	81	80	79	78	77	77	76	75	74
95	84	83	82	82	81	80	79	79	78	77
97	86	86	85	84	84	83	82	81	81	80
99	89	88	88	87	86	86	85	84	83	83
100	90	89	89	88	88	87	86	86	85	84
101	91	91	90	90	89	88	88	87	86	85
102	93	92	91	91	90	90	89	88	88	87
103	94	93	93	92	92	91	90	90	89	88
104	95	95	94	93	93	92	92	91	90	90
105	96	96	95	95	94	94	93	92	92	91
106	98	97	97	96	96	95	94	94	93	93
107	99	98	98	97	97	96	96	95	95	94
108	100	100	99	99	98	98	97	97	96	95
109	101	101	101	100	100	99	99	98	97	97
110	103	102	102	101	101	100	100	99	99	98
111	104	104	103	103	102	102	101	101	100	100
112	105	105	104	104	104	103	103	102	102	101
113	107	106	106	105	105	104	104	104	103	103
114	108	107	107	107	106	106	105	105	104	104
115	109	109	108	108	108	107	107	106	106	105
116	110	110	110	109	109	109	108	108	107	107
117	112	111	111	111	110	110	109	109	109	108
118	113	113	112	112	112	111	111	111	110	110
119	114	114	114	113	113	113	112	112	112	111
120	115	115	115	115	114	114	114	113	113	113

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.5

DD	←			PERCENT of + 3/4 MATERIAL				→		
	21	22	23	24	25	26	27	28	29	30
121	117	116	116	116	116	115	115	115	114	114
122	118	118	117	117	117	117	116	116	116	115
123	119	119	119	118	118	118	118	117	117	117
124	120	120	120	120	120	119	119	119	119	118
125	122	122	121	121	121	121	120	120	120	120
126	123	123	123	122	122	122	122	122	121	121
127	124	124	124	124	124	123	123	123	123	123
128	126	125	125	125	125	125	125	124	124	124
129	127	127	127	126	126	126	126	126	126	125
130	128	128	128	128	128	127	127	127	127	127
131	129	129	129	129	129	129	129	129	128	128
132	131	131	130	130	130	130	130	130	130	130
133	132	132	132	132	132	131	131	131	131	131
134	133	133	133	133	133	133	133	133	133	133
135	134	134	134	134	134	134	134	134	134	134
136	136	136	136	136	136	136	136	136	135	135
137	137	137	137	137	137	137	137	137	137	137
138	138	138	138	138	138	138	138	138	138	138
139	139	139	140	140	140	140	140	140	140	140
140	141	141	141	141	141	141	141	141	141	141
141	142	142	142	142	142	142	142	142	143	143
142	143	143	143	143	144	144	144	144	144	144
143	145	145	145	145	145	145	145	145	145	145
144	146	146	146	146	146	146	146	147	147	147
145	147	147	147	147	148	148	148	148	148	148
146	148	148	149	149	149	149	149	149	150	150
147	150	150	150	150	150	150	151	151	151	151
148	151	151	151	151	152	152	152	152	152	153
149	152	152	153	153	153	153	153	154	154	154
150	153	154	154	154	154	154	155	155	155	155
151	155	155	155	155	156	156	156	156	157	157
152	156	156	156	157	157	157	157	158	158	158
153	157	157	158	158	158	159	159	159	159	160
154	158	159	159	159	160	160	160	161	161	161
155	160	160	160	161	161	161	162	162	162	163
156	161	161	162	162	162	163	163	163	164	164
157	162	163	163	163	164	164	164	165	165	165
158	164	164	164	165	165	165	166	166	166	167
159	165	165	165	166	166	167	167	167	168	168
160	166	166	167	167	168	168	168	169	169	170

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.5

DD	PERCENT of + 3/4 MATERIAL									
	31	32	33	34	35	36	37	38	39	40
80										
81	56	55	53	52	51	49	48	47	45	43
										45
83	59	57	56	55	54	52	51	50	48	47
85	62	60	59	58	57	56	54	53	52	50
87	64	63	62	61	60	59	57	56	55	53
										55
89	67	66	65	64	63	62	61	59	58	57
90										
91	70	69	68	67	66	65	64	63	61	60
93	73	72	71	70	69	68	67	66	65	63
										65
95	76	75	74	73	72	71	70	69	68	67
97	79	78	77	76	75	74	73	72	71	70
99	82	81	80	79	78	77	77	76	75	73
100	83	82	82	81	80	79	78	77	76	75
101	85	84	83	82	81	81	80	79	78	77
102	86	85	85	84	83	82	81	80	79	78
103	88	87	86	85	85	84	83	82	81	80
104	89	88	88	87	86	85	84	84	83	82
105	90	90	89	88	88	87	86	85	84	83
106	92	91	91	90	89	88	88	87	86	85
107	93	93	92	91	91	90	89	88	88	87
108	95	94	94	93	92	92	91	90	89	88
109	96	96	95	94	94	93	92	92	91	90
110	98	97	97	96	95	95	94	93	93	92
111	99	99	98	97	97	96	96	95	94	93
112	101	100	100	99	98	98	97	97	96	95
113	102	102	101	100	100	99	99	98	97	97
114	104	103	103	102	101	101	100	100	99	98
115	105	105	104	104	103	102	102	101	101	100
116	106	106	106	105	105	104	104	103	102	102
117	108	107	107	107	106	106	105	105	104	103
118	109	109	109	108	108	107	107	106	106	105
119	111	110	110	110	109	109	108	108	107	107
120	112	112	111	111	111	110	110	109	109	108

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.5

DD	PERCENT of + 3/4 MATERIAL									
	31	32	33	34	35	36	37	38	39	40
121	114	113	113	113	112	112	111	111	111	110
122	115	115	114	114	114	113	113	113	112	112
123	117	116	116	116	115	115	115	114	114	113
124	118	118	117	117	117	117	116	116	116	115
125	119	119	119	119	118	118	118	117	117	117
126	121	121	120	120	120	120	119	119	119	118
127	122	122	122	122	121	121	121	121	120	120
128	124	124	123	123	123	123	123	122	122	122
129	125	125	125	125	125	124	124	124	124	123
130	127	127	126	126	126	126	126	126	125	125
131	128	128	128	128	128	127	127	127	127	127
132	130	130	129	129	129	129	129	129	129	128
133	131	131	131	131	131	131	130	130	130	130
134	133	132	132	132	132	132	132	132	132	132
135	134	134	134	134	134	134	134	134	134	133
136	135	135	135	135	135	135	135	135	135	135
137	137	137	137	137	137	137	137	137	137	137
138	138	138	138	138	138	138	138	138	138	138
139	140	140	140	140	140	140	140	140	140	140
140	141	141	141	141	141	142	142	142	142	142
141	143	143	143	143	143	143	143	143	143	143
142	144	144	144	144	145	145	145	145	145	145
143	146	146	146	146	146	146	146	147	147	147
144	147	147	147	147	148	148	148	148	148	148
145	148	149	149	149	149	149	150	150	150	150
146	150	150	150	150	151	151	151	151	152	152
147	151	152	152	152	152	152	153	153	153	153
148	153	153	153	154	154	154	154	155	155	155
149	154	155	155	155	155	156	156	156	156	157
150	156	156	156	157	157	157	157	158	158	158
151	157	157	158	158	158	159	159	159	160	160
152	159	159	159	160	160	160	161	161	161	162
153	160	160	161	161	161	162	162	163	163	163
154	162	162	162	163	163	163	164	164	165	165
155	163	163	164	164	165	165	165	166	166	167
156	164	165	165	166	166	167	167	167	168	168
157	166	166	167	167	168	168	169	169	170	170
158	167	168	168	169	169	170	170	171	171	172
159	169	169	170	170	171	171	172	172	173	173
160	170	171	171	172	172	173	173	174	175	175

WEST VIRGINIA DIVISION OF HIGHWAYS
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MP 207.07.20
ATTACHMENT NO. 5
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.6

DD	← PERCENT of + 3/4 MATERIAL →									
	1	2	3	4	5	6	7	8	9	10
80							75	75		
81	80	80	79	78	78	77	76	76	75	74
83	82	82	81	81	80	79	79	78	77	76
							80			
85	84	84	83	83	82	81	81	80	79	79
	85	85							80	
87	86	86	85	85	84	83	83	82	81	81
89	88	88	87	87	86	86	85	84	84	83
90								85	85	
91	90	90	89	89	88	88	87	86	86	85
93	92	92	91	91	90	90	89	89	88	87
							90	90		
95	95	94	94	93	92	92	91	91	90	90
		95								
97	97	96	96	95	95	94	94	93	92	92
							95			
99	99	98	98	97	97	96	96	95	95	94
100	100	99	99	98	98	97	97	96	96	95
101	101	100	100	99	99	98	98	97	97	96
102	102	101	101	100	100	99	99	98	98	97
103	103	102	102	101	101	100	100	100	99	99
104	104	103	103	102	102	102	101	101	100	100
105	105	104	104	103	103	103	102	102	101	101
106	106	105	105	104	104	104	103	103	102	102
107	107	106	106	106	105	105	104	104	103	103
108	108	107	107	107	106	106	105	105	105	104
109	109	108	108	108	107	107	106	106	106	105
110	110	109	109	109	108	108	108	107	107	106
111	111	110	110	110	109	109	109	108	108	107
112	112	111	111	111	110	110	110	109	109	109
113	113	112	112	112	111	111	111	110	110	110
114	114	113	113	113	112	112	112	111	111	111
115	115	114	114	114	114	113	113	113	112	112
116	116	115	115	115	115	114	114	114	113	113
117	117	116	116	116	116	115	115	115	114	114
118	118	117	117	117	117	116	116	116	116	115
119	119	119	118	118	118	117	117	117	117	116
120	120	120	119	119	119	119	118	118	118	117

2.6

DD	←			PERCENT of + 3/4 MATERIAL				→		
	1	2	3	4	5	6	7	8	9	10
121	121	121	120	120	120	120	119	119	119	119
122	122	122	121	121	121	121	120	120	120	120
123	123	123	122	122	122	122	122	121	121	121
124	124	124	123	123	123	123	123	122	122	122
125	125	125	124	124	124	124	124	123	123	123
126	126	126	125	125	125	125	125	125	124	124
127	127	127	127	126	126	126	126	126	125	125
128	128	128	128	127	127	127	127	127	127	126
129	129	129	129	128	128	128	128	128	128	127
130	130	130	130	129	129	129	129	129	129	129
131	131	131	131	131	130	130	130	130	130	130
132	132	132	132	132	131	131	131	131	131	131
133	133	133	133	133	132	132	132	132	132	132
134	134	134	134	134	134	133	133	133	133	133
135	135	135	135	135	135	135	134	134	134	134
136	136	136	136	136	136	136	135	135	135	135
137	137	137	137	137	137	137	137	136	136	136
138	138	138	138	138	138	138	138	138	138	137
139	139	139	139	139	139	139	139	139	139	139
140	140	140	140	140	140	140	140	140	140	140
141	141	141	141	141	141	141	141	141	141	141
142	142	142	142	142	142	142	142	142	142	142
143	143	143	143	143	143	143	143	143	143	143
144	144	144	144	144	144	144	144	144	144	144
145	145	145	145	145	145	145	145	145	145	145
146	146	146	146	146	146	146	146	146	146	146
147	147	147	147	147	147	147	147	147	147	147
148	148	148	148	148	148	148	148	148	149	149
149	149	149	149	149	149	149	149	150	150	150
150	150	150	150	150	150	150	151	151	151	151
151	151	151	151	151	151	152	152	152	152	152
152	152	152	152	152	152	153	153	153	153	153
153	153	153	153	153	154	154	154	154	154	154
154	154	154	154	154	155	155	155	155	155	155
155	155	155	155	156	156	156	156	156	156	156
156	156	156	156	157	157	157	157	157	157	157
157	157	157	157	158	158	158	158	158	158	159
158	158	158	158	159	159	159	159	159	160	160
159	159	159	160	160	160	160	160	160	161	161
160	160	160	161	161	161	161	161	161	162	162

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING

MP 207.07.20
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.6

DD	PERCENT of + 3/4 MATERIAL									
	11	12	13	14	15	16	17	18	19	20
80				70						
81	73	73	72	71	70	69	68	67	67	66
83	76	75	74	73	72	72	71	70	69	68
85	78	77	76	76	75	74	73	72	71	71
87	80	79	79	78	77	76	76	75	74	73
89	82	82	81	80	80	79	78	77	76	76
90										
91	85	84	83	83	82	81	80	80	79	78
93	87	86	86	85	84	84	83	82	81	81
95	89	88	88	87	87	86	85	85	84	83
97	91	91	90	90	89	88	88	87	86	86
99	94	93	92	92	91	91	90	89	89	88
100	95	94	94	93	92	92	91	91	90	89
101	96	95	95	94	94	93	92	92	91	91
102	97	96	96	95	95	94	94	93	92	92
103	98	98	97	97	96	95	95	94	94	93
104	99	99	98	98	97	97	96	95	95	94
105	100	100	99	99	98	98	97	97	96	96
106	101	101	101	100	100	99	98	98	97	97
107	103	102	102	101	101	100	100	99	99	98
108	104	103	103	102	102	101	101	100	100	99
109	105	104	104	104	103	103	102	102	101	101
110	106	106	105	105	104	104	103	103	102	102
111	107	107	106	106	105	105	104	104	104	103
112	108	108	107	107	107	106	106	105	105	104
113	109	109	109	108	108	107	107	106	106	106
114	110	110	110	109	109	109	108	108	107	107
115	112	111	111	110	110	110	109	109	108	108
116	113	112	112	112	111	111	111	110	110	109
117	114	113	113	113	112	112	112	111	111	111
118	115	115	114	114	114	113	113	113	112	112
119	116	116	115	115	115	114	114	114	113	113
120	117	117	117	116	116	116	115	115	115	114

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING

MP 207.07.20
ATTACHMENT NO. 5
20 OF 32

DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.6

DD	← PERCENT of + 3/4 MATERIAL →									
	11	12	13	14	15	16	17	18	19	20
121	118	118	118	117	117	117	117	116	116	116
122	119	119	119	119	118	118	118	117	117	117
123	121	120	120	120	120	119	119	119	118	118
124	122	121	121	121	121	120	120	120	120	119
125	123	123	122	122	122	122	121	121	121	121
126	124	124	123	123	123	123	123	122	122	122
127	125	125	125	124	124	124	124	124	123	123
128	126	126	126	126	125	125	125	125	125	124
129	127	127	127	127	127	126	126	126	126	126
130	128	128	128	128	128	128	127	127	127	127
131	130	129	129	129	129	129	129	128	128	128
132	131	131	130	130	130	130	130	130	129	129
133	132	132	132	131	131	131	131	131	131	131
134	133	133	133	133	132	132	132	132	132	132
135	134	134	134	134	134	134	133	133	133	133
136	135	135	135	135	135	135	135	135	134	134
137	136	136	136	136	136	136	136	136	136	136
138	137	137	137	137	137	137	137	137	137	137
139	139	138	138	138	138	138	138	138	138	138
140	140	140	140	140	140	139	139	139	139	139
141	141	141	141	141	141	141	141	141	141	141
142	142	142	142	142	142	142	142	142	142	142
143	143	143	143	143	143	143	143	143	143	143
144	144	144	144	144	144	144	144	144	144	144
145	145	145	145	145	145	145	145	145	146	146
146	146	146	146	147	147	147	147	147	147	147
147	148	148	148	148	148	148	148	148	148	148
148	149	149	149	149	149	149	149	149	149	149
149	150	150	150	150	150	150	150	150	150	151
150	151	151	151	151	151	151	151	152	152	152
151	152	152	152	152	152	153	153	153	153	153
152	153	153	153	154	154	154	154	154	154	154
153	154	154	155	155	155	155	155	155	155	156
154	155	156	156	156	156	156	156	156	157	157
155	157	157	157	157	157	157	158	158	158	158
156	158	158	158	158	158	159	159	159	159	159
157	159	159	159	159	160	160	160	160	160	161
158	160	160	160	160	161	161	161	161	162	162
159	161	161	161	162	162	162	162	163	163	163
160	162	162	163	163	163	163	164	164	164	164

WEST VIRGINIA DIVISION OF HIGHWAYS
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MP 207.07.20
ATTACHMENT NO. 5
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.6

DD	← PERCENT of + 3/4 MATERIAL →									
	21	22	23	24	25	26	27	28	29	30
80										
81	65	64	63	61	60	59	58	57	56	55
83	67	66	65	64	63	62	61	60	59	57
85	70	69	68	67	66	65	64	63	61	60
87	72	71	70	69	68	67	66	65	64	63
89	75	74	73	72	71	70	69	68	67	66
90										
91	77	76	76	75	74	73	72	71	70	69
93	80	79	78	77	76	76	75	74	73	72
95	82	82	81	80	79	78	77	76	75	75
97	85	84	83	83	82	81	80	79	78	77
99	87	87	86	85	84	84	83	82	81	80
100	89	88	87	86	86	85	84	83	83	82
101	90	89	89	88	87	86	86	85	84	83
102	91	91	90	89	88	88	87	86	85	85
103	92	92	91	90	90	89	88	88	87	86
104	94	93	92	92	91	90	90	89	88	87
105	95	94	94	93	92	92	91	90	90	89
106	96	96	95	94	94	93	92	92	91	90
107	97	97	96	96	95	94	94	93	92	92
108	99	98	98	97	96	96	95	94	94	93
109	100	99	99	98	98	97	97	96	95	95
110	101	101	100	100	99	98	98	97	97	96
111	103	102	102	101	100	100	99	99	98	97
112	104	103	103	102	102	101	101	100	99	99
113	105	105	104	104	103	103	102	101	101	100
114	106	106	105	105	104	104	103	103	102	102
115	108	107	107	106	106	105	105	104	104	103
116	109	108	108	108	107	107	106	106	105	105
117	110	110	109	109	108	108	107	107	106	106
118	111	111	111	110	110	109	109	108	108	107
119	113	112	112	111	111	111	110	110	109	109
120	114	114	113	113	112	112	112	111	111	110

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING

MP 207.07.20
ATTACHMENT NO. 5
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.6

DD	← PERCENT of + 3/4 MATERIAL →									
	21	22	23	24	25	26	27	28	29	30
121	115	115	114	114	114	113	113	113	112	112
122	116	116	116	115	115	115	114	114	114	113
123	118	117	117	117	116	116	116	115	115	115
124	119	119	118	118	118	117	117	117	116	116
125	120	120	120	119	119	119	118	118	118	117
126	122	121	121	121	120	120	120	119	119	119
127	123	123	122	122	122	121	121	121	121	120
128	124	124	124	123	123	123	123	122	122	122
129	125	125	125	125	124	124	124	124	123	123
130	127	126	126	126	126	126	125	125	125	125
131	128	128	127	127	127	127	127	126	126	126
132	129	129	129	129	128	128	128	128	128	127
133	130	130	130	130	130	130	129	129	129	129
134	132	132	131	131	131	131	131	131	130	130
135	133	133	133	133	132	132	132	132	132	132
136	134	134	134	134	134	134	133	133	133	133
137	135	135	135	135	135	135	135	135	135	135
138	137	137	137	136	136	136	136	136	136	136
139	138	138	138	138	138	138	138	138	137	137
140	139	139	139	139	139	139	139	139	139	139
141	141	141	140	140	140	140	140	140	140	140
142	142	142	142	142	142	142	142	142	142	142
143	143	143	143	143	143	143	143	143	143	143
144	144	144	144	144	144	144	144	144	145	145
145	146	146	146	146	146	146	146	146	146	146
146	147	147	147	147	147	147	147	147	147	147
147	148	148	148	148	148	148	149	149	149	149
148	149	149	150	150	150	150	150	150	150	150
149	151	151	151	151	151	151	151	151	152	152
150	152	152	152	152	152	153	153	153	153	153
151	153	153	153	154	154	154	154	154	154	155
152	154	155	155	155	155	155	155	156	156	156
153	156	156	156	156	156	157	157	157	157	157
154	157	157	157	158	158	158	158	158	159	159
155	158	158	159	159	159	159	160	160	160	160
156	160	160	160	160	160	161	161	161	161	162
157	161	161	161	161	162	162	162	163	163	163
158	162	162	163	163	163	163	164	164	164	165
159	163	164	164	164	164	165	165	165	166	166
160	165	165	165	165	166	166	166	167	167	167

WEST VIRGINIA DIVISION OF HIGHWAYS
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ATTACHMENT NO. 5
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.6

DD	← PERCENT of + 3/4 MATERIAL →									
	31	32	33	34	35	36	37	38	39	40
80										
81	53	52	51	49	48	46	45	43	42	40
83	56	55	54	52	51	49	48	46	45	43
85	59	58	57	55	54	53	51	50	48	46
87	62	61	60	58	57	56	54	53	51	50
89	65	64	63	61	60	59	57	56	55	53
90										
91	68	67	66	64	63	62	61	59	58	56
93	71	70	68	67	66	65	64	62	61	60
95	74	73	71	70	69	68	67	66	64	63
97	76	75	74	73	72	71	70	69	68	66
99	79	78	77	76	75	74	73	72	71	70
100	81	80	79	78	77	76	75	74	73	71
101	82	81	80	79	79	78	76	75	74	73
102	84	83	82	81	80	79	78	77	76	75
103	85	84	83	83	82	81	80	79	78	76
104	87	86	85	84	83	82	81	80	79	78
105	88	87	86	86	85	84	83	82	81	80
106	89	89	88	87	86	85	84	83	82	81
107	91	90	89	89	88	87	86	85	84	83
108	92	92	91	90	89	88	88	87	86	85
109	94	93	92	92	91	90	89	88	87	86
110	95	95	94	93	92	92	91	90	89	88
111	97	96	95	95	94	93	92	92	91	90
112	98	98	97	96	95	95	94	93	92	91
113	100	99	98	98	97	96	96	95	94	93
114	101	100	100	99	99	98	97	96	96	95
115	103	102	101	101	100	99	99	98	97	96
116	104	103	103	102	102	101	100	100	99	98
117	105	105	104	104	103	103	102	101	101	100
118	107	106	106	105	105	104	103	103	102	101
119	108	108	107	107	106	106	105	104	104	103
120	110	109	109	108	108	107	107	106	105	105

WEST VIRGINIA DIVISION OF HIGHWAYS
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ATTACHMENT NO. 5
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.6

DD	← PERCENT of + 3/4 MATERIAL →									
	31	32	33	34	35	36	37	38	39	40
122	113	112	112	111	111	110	110	109	109	108
124	116	115	115	114	114	113	113	112	112	111
126	118	118	118	117	117	117	116	116	115	115
128	121	121	121	120	120	120	119	119	119	118
130	124	124	124	123	123	123	122	122	122	121
132	127	127	127	126	126	126	126	125	125	125
134	130	130	130	129	129	129	129	129	128	128
136	133	133	133	133	132	132	132	132	132	131
138	136	136	136	136	135	135	135	135	135	135
140	139	139	139	139	139	138	138	138	138	138
141	140	140	140	140	140	140	140	140	140	140
142	142	142	142	142	142	142	142	142	142	141
143	143	143	143	143	143	143	143	143	143	143
144	145	145	145	145	145	145	145	145	145	145
145	146	146	146	146	146	146	146	146	146	146
146	147	148	148	148	148	148	148	148	148	148
147	149	149	149	149	149	149	149	150	150	150
148	150	150	151	151	151	151	151	151	151	151
149	152	152	152	152	152	153	153	153	153	153
150	153	153	154	154	154	154	154	154	155	155
151	155	155	155	155	155	156	156	156	156	156
152	156	156	157	157	157	157	157	158	158	158
153	158	158	158	158	159	159	159	159	160	160
154	159	159	160	160	160	160	161	161	161	161
155	160	161	161	161	162	162	162	162	163	163
156	162	162	163	163	163	163	164	164	164	165
157	163	164	164	164	165	165	165	166	166	166
158	165	165	166	166	166	167	167	167	168	168
159	166	167	167	167	168	168	169	169	169	170
160	168	168	168	169	169	170	170	171	171	171

WEST VIRGINIA DIVISION OF HIGHWAYS
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.7

DD	← PERCENT of + 3/4 MATERIAL →									
	1	2	3	4	5	6	7	8	9	10
80							75			
81	80	80	79	78	77	77	76	75	74	74
83	82	82	81	80	80	79	78	77	77	76
85	84	84	83	82	82	81	80	79	79	78
	85	85								
87	86	86	85	84	84	83	82	82	81	80
89	88	88	87	87	86	85	85	84	83	82
90										
91	90	90	89	89	88	87	87	86	85	85
93	92	92	91	91	90	89	89	88	88	87
							90			
95	94	94	93	93	92	92	91	90	90	89
	95	95								
97	96	96	95	95	94	94	93	93	92	91
99	99	98	97	97	96	96	95	95	94	94
100	100	99	99	98	97	97	96	96	95	95
101	101	100	100	99	99	98	97	97	96	96
102	102	101	101	100	100	99	99	98	97	97
103	103	102	102	101	101	100	100	99	99	98
104	104	103	103	102	102	101	101	100	100	99
105	105	104	104	103	103	102	102	101	101	100
106	106	105	105	104	104	103	103	102	102	101
107	107	106	106	105	105	104	104	103	103	102
108	108	107	107	106	106	105	105	104	104	104
109	109	108	108	107	107	106	106	106	105	105
110	110	109	109	108	108	108	107	107	106	106
111	111	110	110	109	109	109	108	108	107	107
112	112	111	111	110	110	110	109	109	108	108
113	113	112	112	112	111	111	110	110	110	109
114	114	113	113	113	112	112	111	111	111	110
115	115	114	114	114	113	113	112	112	112	111
116	116	115	115	115	114	114	114	113	113	112
117	117	116	116	116	115	115	115	114	114	114
118	118	117	117	117	116	116	116	115	115	115
119	119	118	118	118	117	117	117	116	116	116
120	120	119	119	119	119	118	118	118	117	117

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.7

DD	← PERCENT of + 3/4 MATERIAL →									
	1	2	3	4	5	6	7	8	9	10
		120	120	120	120					
122	122	121	121	121	121	120	120	120	119	119
										120
124	124	124	123	123	123	122	122	122	122	121
		125								
126	126	126	125	125	125	125	124	124	124	124
128	128	128	127	127	127	127	126	126	126	126
130	130	130	129	129	129	129	129	128	128	128
			130	130	130		130			
132	132	132	131	131	131	131	131	131	130	130
134	134	134	134	133	133	133	133	133	133	132
		135	135							
136	136	136	136	135	135	135	135	135	135	135
138	138	138	138	138	137	137	137	137	137	137
140	140	140	140	140	140	139	139	139	139	139
141	141	141	141	141	141	141	140	140	140	140
142	142	142	142	142	142	142	142	141	141	141
143	143	143	143	143	143	143	143	143	142	142
144	144	144	144	144	144	144	144	144	144	144
145	145	145	145	145	145	145	145	145	145	145
146	146	146	146	146	146	146	146	146	146	146
147	147	147	147	147	147	147	147	147	147	147
148	148	148	148	148	148	148	148	148	148	148
149	149	149	149	149	149	149	149	149	149	149
150	150	150	150	150	150	150	150	150	150	150
151	151	151	151	151	151	151	151	151	151	151
152	152	152	152	152	152	152	152	152	152	152
153	153	153	153	153	153	153	153	153	153	154
154	154	154	154	154	154	154	154	154	155	155
155	155	155	155	155	155	155	156	156	156	156
156	156	156	156	156	156	156	157	157	157	157
157	157	157	157	157	157	158	158	158	158	158
158	158	158	158	158	159	159	159	159	159	159
159	159	159	159	159	160	160	160	160	160	160
160	160	160	160	160	161	161	161	161	161	161

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.7

DD	← PERCENT of + 3/4 MATERIAL →									
	11	12	13	14	15	16	17	18	19	20
80			70							
81	73	72	71	70	69	68	67	66	65	64
				70						
83	75	74	73	72	71	71	70	69	68	67
85	77	76	76	75	74	73	72	71	70	69
87	79	79	78	77	76	75	74	74	73	72
89	82	81	80	79	79	78	77	76	75	74
90					80					
91	84	83	82	82	81	80	79	78	78	77
93	86	85	85	84	83	82	82	81	80	79
95	88	88	87	86	86	85	84	83	83	82
97	91	90	89	89	88	87	87	86	85	84
			90							
99	93	92	92	91	90	90	89	88	87	87
100	94	93	93	92	91	91	90	89	89	88
101	95	95	94	93	93	92	91	91	90	89
102	96	96	95	94	94	93	93	92	91	90
103	97	97	96	96	95	94	94	93	92	92
104	99	98	97	97	96	96	95	94	94	93
105	100	99	99	98	97	97	96	96	95	94
106	101	100	100	99	99	98	97	97	96	95
107	102	101	101	100	100	99	99	98	97	97
108	103	103	102	101	101	100	100	99	99	98
109	104	104	103	103	102	102	101	100	100	99
110	105	105	104	104	103	103	102	102	101	100
111	106	106	105	105	104	104	103	103	102	102
112	108	107	107	106	106	105	105	104	103	103
113	109	108	108	107	107	106	106	105	105	104
114	110	109	109	108	108	107	107	106	106	105
115	111	110	110	110	109	109	108	108	107	107
116	112	112	111	111	110	110	109	109	108	108
117	113	113	112	112	111	111	111	110	110	109
118	114	114	113	113	113	112	112	111	111	110
119	115	115	115	114	114	113	113	113	112	112
120	117	116	116	115	115	115	114	114	113	113

WEST VIRGINIA DIVISION OF HIGHWAYS
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.7

DD	← PERCENT of + 3/4 MATERIAL →									
	11	12	13	14	15	16	17	18	19	20
122	119	118	118	118	117	117	117	116	116	115
	120	120								
124	121	121	120	120	120	119	119	119	118	118
126	123	123	123	122	122	122	121	121	121	120
128	125	125	125	125	124	124	124	124	123	123
130	128	128	127	127	127	127	126	126	126	125
132	130	130	130	129	129	129	129	128	128	128
					130					
134	132	132	132	132	131	131	131	131	131	130
136	134	134	134	134	134	134	133	133	133	133
138	137	137	136	136	136	136	136	136	136	135
140	139	139	139	139	139	138	138	138	138	138
141	140	140	140	140	140	140	140	139	139	139
142	141	141	141	141	141	141	141	141	141	140
143	142	142	142	142	142	142	142	142	142	142
144	143	143	143	143	143	143	143	143	143	143
145	145	145	145	144	144	144	144	144	144	144
146	146	146	146	146	146	146	146	146	145	145
147	147	147	147	147	147	147	147	147	147	147
148	148	148	148	148	148	148	148	148	148	148
149	149	149	149	149	149	149	149	149	149	149
150	150	150	150	150	150	150	150	150	150	150
151	151	151	151	151	151	152	152	152	152	152
152	152	153	153	153	153	153	153	153	153	153
153	154	154	154	154	154	154	154	154	154	154
154	155	155	155	155	155	155	155	155	155	155
155	156	156	156	156	156	156	156	156	157	157
156	157	157	157	157	157	157	158	158	158	158
157	158	158	158	158	159	159	159	159	159	159
158	159	159	159	160	160	160	160	160	160	160
159	160	160	161	161	161	161	161	161	162	162
160	161	162	162	162	162	162	162	163	163	163

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING

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ATTACHMENT NO. 5
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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.7

DD	← PERCENT of + 3/4 MATERIAL →									
	21	22	23	24	25	26	27	28	29	30
80										
81	63	62	61	60	59	57	56	55	54	52
83	66	65	64	62	61	60	59	58	56	55
85	68	67	66	65	64	63	62	60	59	58
87	71	70	69	68	67	65	64	63	62	61
89	73	72	71	70	69	68	67	66	65	64
90										
91	76	75	74	73	72	71	70	69	68	66
93	78	77	76	76	75	74	73	72	70	69
95	81	80	79	78	77	76	75	74	73	72
97	83	83	82	81	80	79	78	77	76	75
99	86	85	84	83	83	82	81	80	79	78
100	87	86	86	85	84	83	82	81	80	79
101	88	88	87	86	85	84	84	83	82	81
102	90	89	88	87	87	86	85	84	83	82
103	91	90	89	89	88	87	86	85	85	84
104	92	92	91	90	89	88	88	87	86	85
105	93	93	92	91	91	90	89	88	87	86
106	95	94	93	93	92	91	90	90	89	88
107	96	95	95	94	93	93	92	91	90	89
108	97	97	96	95	95	94	93	92	92	91
109	99	98	97	97	96	95	94	94	93	92
110	100	99	99	98	97	97	96	95	94	94
111	101	100	100	99	99	98	97	97	96	95
112	102	102	101	101	100	99	99	98	97	96
113	104	103	102	102	101	101	100	99	99	98
114	105	104	104	103	103	102	101	101	100	99
115	106	106	105	104	104	103	103	102	101	101
116	107	107	106	106	105	105	104	103	103	102
117	109	108	108	107	107	106	105	105	104	104
118	110	109	109	108	108	107	107	106	106	105
119	111	111	110	110	109	109	108	108	107	106
120	112	112	112	111	111	110	110	109	108	108

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.7

DD	← PERCENT of + 3/4 MATERIAL →									
	21	22	23	24	25	26	27	28	29	30
121	114	113	113	112	112	111	111	110	110	109
122	115	115	114	114	113	113	112	112	111	111
123	116	116	115	115	115	114	114	113	113	112
124	118	117	117	116	116	115	115	115	114	114
125	119	118	118	118	117	117	116	116	115	115
126	120	120	119	119	119	118	118	117	117	116
127	121	121	121	120	120	120	119	119	118	118
128	123	122	122	122	121	121	121	120	120	119
129	124	124	123	123	123	122	122	122	121	121
130	125	125	125	124	124	124	123	123	123	122
131	126	126	126	126	125	125	125	124	124	124
132	128	127	127	127	127	126	126	126	125	125
133	129	129	128	128	128	128	127	127	127	126
134	130	130	130	129	129	129	129	128	128	128
135	131	131	131	131	131	130	130	130	130	129
136	133	133	132	132	132	132	131	131	131	131
137	134	134	134	133	133	133	133	133	132	132
138	135	135	135	135	135	134	134	134	134	134
139	137	136	136	136	136	136	136	135	135	135
140	138	138	138	137	137	137	137	137	137	136
141	139	139	139	139	139	138	138	138	138	138
142	140	140	140	140	140	140	140	140	139	139
143	142	142	141	141	141	141	141	141	141	141
144	143	143	143	143	143	143	142	142	142	142
145	144	144	144	144	144	144	144	144	144	144
146	145	145	145	145	145	145	145	145	145	145
147	147	147	147	147	147	147	147	147	146	146
148	148	148	148	148	148	148	148	148	148	148
149	149	149	149	149	149	149	149	149	149	149
150	150	150	151	151	151	151	151	151	151	151
151	152	152	152	152	152	152	152	152	152	152
152	153	153	153	153	153	153	153	153	154	154
153	154	154	154	154	155	155	155	155	155	155
154	156	156	156	156	156	156	156	156	156	156
155	157	157	157	157	157	157	157	158	158	158
156	158	158	158	158	159	159	159	159	159	159
157	159	159	160	160	160	160	160	160	161	161
158	161	161	161	161	161	161	162	162	162	162
159	162	162	162	162	163	163	163	163	163	164
160	163	163	164	164	164	164	164	165	165	165

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.7

DD	← PERCENT of + 3/4 MATERIAL →									
	31	32	33	34	35	36	37	38	39	40
80										
81	51	49	48	46	45	43	41	40	38	36
83	54	52	51	49	48	46	45	43	41	39
85	57	55	54	52	51	49	48	46	45	43
87	59	58	57	55	54	53	51	49	48	46
89	62	61	60	58	57	56	54	53	51	49
90										
91	65	64	63	62	60	59	57	56	54	53
93	68	67	66	65	63	62	61	59	58	56
95	71	70	69	68	66	65	64	62	61	59
97	74	73	72	71	69	68	67	66	64	63
99	77	76	75	74	72	71	70	69	68	66
100	78	77	76	75	74	73	72	70	69	68
101	80	79	78	77	76	74	73	72	71	69
102	81	80	79	78	77	76	75	74	72	71
103	83	82	81	80	79	78	76	75	74	73
104	84	83	82	81	80	79	78	77	76	74
105	86	85	84	83	82	81	80	78	77	76
106	87	86	85	84	83	82	81	80	79	78
107	88	88	87	86	85	84	83	82	81	79
108	90	89	88	87	86	85	84	83	82	81
109	91	91	90	89	88	87	86	85	84	83
110	93	92	91	90	89	88	88	87	86	84
111	94	93	93	92	91	90	89	88	87	86
112	96	95	94	93	92	92	91	90	89	88
113	97	96	96	95	94	93	92	91	90	89
114	99	98	97	96	96	95	94	93	92	91
115	100	99	99	98	97	96	95	95	94	93
116	102	101	100	99	99	98	97	96	95	94
117	103	102	102	101	100	99	99	98	97	96
118	104	104	103	102	102	101	100	99	99	98
119	106	105	105	104	103	103	102	101	100	99
120	107	107	106	105	105	104	103	103	102	101

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DENSITY OF -3/4 INCH MATERIAL WITH THE +3/4 INCH MATERIAL SPECIFIC GRAVITY OF 2.7

DD	← PERCENT of + 3/4 MATERIAL →									
	31	32	33	34	35	36	37	38	39	40
121	109	108	108	107	106	106	105	104	104	103
122	110	110	109	108	108	107	107	106	105	104
123	112	111	111	110	109	109	108	108	107	106
124	113	113	112	112	111	110	110	109	108	108
125	115	114	114	113	112	112	111	111	110	109
126	116	116	115	115	114	113	113	112	112	111
127	117	117	117	116	116	115	115	114	113	113
128	119	118	118	118	117	117	116	116	115	114
129	120	120	120	119	119	118	118	117	117	116
130	122	121	121	121	120	120	119	119	118	118
131	123	123	122	122	122	121	121	120	120	119
132	125	124	124	124	123	123	122	122	122	121
133	126	126	125	125	125	124	124	124	123	123
134	128	127	127	127	126	126	126	125	125	124
135	129	129	128	128	128	128	127	127	127	126
136	130	130	130	130	129	129	129	128	128	128
137	132	132	131	131	131	131	130	130	130	129
138	133	133	133	133	132	132	132	132	131	131
139	135	135	134	134	134	134	134	133	133	133
140	136	136	136	136	136	135	135	135	135	134
141	138	138	137	137	137	137	137	137	136	136
142	139	139	139	139	139	138	138	138	138	138
143	141	141	140	140	140	140	140	140	140	139
144	142	142	142	142	142	142	141	141	141	141
145	144	143	143	143	143	143	143	143	143	143
146	145	145	145	145	145	145	145	145	145	144
147	146	146	146	146	146	146	146	146	146	146
148	148	148	148	148	148	148	148	148	148	148
149	149	149	149	149	149	149	149	149	149	149
150	151	151	151	151	151	151	151	151	151	151
151	152	152	152	152	152	153	153	153	153	153
152	154	154	154	154	154	154	154	154	154	154
153	155	155	155	155	156	156	156	156	156	156
154	157	157	157	157	157	157	157	158	158	158
155	158	158	158	158	159	159	159	159	159	159
156	159	160	160	160	160	160	161	161	161	161
157	161	161	161	162	162	162	162	162	163	163
158	162	163	163	163	163	163	164	164	164	164
159	164	164	164	165	165	165	165	166	166	166
160	165	166	166	166	166	167	167	167	168	168