GTM-10

TEST METHOD FOR EARTHWORK COMPACTION CONTROL BY NUCLEAR GAUGE

GEOTECHNICAL TEST METHOD
GTM-10
Revision #5

AUGUST 2015

NEW YORK STATE OF OPPORTUNITY. | Department of Transportation | Office of Technical Services | Geotechnical Engineering Bureau

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STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL ENGINEERING BUREAU

AUGUST 2015

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1. SCOPE

This test method describes the procedure for determining the in-place density and moisture of earthwork through the use of a nuclear gauge. The density of the material shall be determined by direct transmission and the moisture content shall be determined by backscatter. This method may be used in conjunction with either the Standard or Modified Proctor Density Test for determining the percent of Maximum Density.

The details included in this test method are for use with the Standard Proctor Test.

2. SUMMARY OF METHOD

The test consists of the following steps which are explained in the test procedure:

- Determining the <u>Wet Density</u>
- Determining the <u>Moisture Content</u>
- Calculating the <u>Dry Density</u>
- Determining the <u>Maximum Density</u>
- Calculating the <u>percent of Maximum Density</u>

3. LICENSING AND CERTIFICATION

3.1 Licensing

New York State requires that the owner of a nuclear gauge be licensed by the State Health Department. The license requires that the operator of the device be certified and that the device be maintained and stored in a safe manner.

3.2 Certification

Operator's certification is acquired by successfully completing training in the theory and use of a nuclear gauge. This training and certification is usually conducted by the manufacturer under the auspices of the State Health Department.

4. TEST PROCEDURE

4.1 <u>Preparation Prior to Testing:</u>

4.1.1 When using this test method for compaction control, it is important that the test be performed immediately after the material has been placed and compacted.

Refer to the manufacturer's operator's manual to determine any restrictions for the use of the gauge in confined areas or other limiting factors. In the event that the gauge cannot be used, the methods described in "Test Method for Earthwork Compaction Control by Sand Cone or Volumeter Apparatus," or any other method approved by the Department shall apply.

4.1.2 Warm-up and check the equipment.

A. <u>Daily</u>

Most nuclear gauges require a warm-up period and standard count determination prior to test operations. The daily standard counts shall be within the limits specified by the manufacturer. Refer to the manufacturer's operator's manual for details.

B. <u>Monthly or Periodic</u>

When in use, the manufacturer's initial standardization shall be checked at least once every thirty (30) calendar days to assure proper equipment operation. When not in use, this gauge calibration shall be checked periodically as recommended by the manufacturer. This field calibration shall be within the appropriate limits set forth by the manufacturer. Refer to the manufacturer's operator's manual for the specific method of performing these checks.

A log book shall be prepared and accompany each gauge. The log will indicate the gauge serial number, the daily standard counts and the monthly or periodic standard calibration counts. The gauge shall not be used if the readings fall outside the specified limits set forth by the manufacturer's manual. The log should include the dates used, the locations of its use and the name(s) of the operator(s).

4.1.3 Remove all loose and disturbed material at the test site. Prepare a flat surface large enough to accommodate the gauge such that the bottom of the gauge is in intimate contact with the test surface. Surface depressions should not exceed ⅛ in. (3 mm). Use native fines to fill any larger depressions. It may be necessary to sieve native material through a No. 10 (2 mm) sieve to obtain sufficient fines.

4.1.4 Using the drill rod and drill rod guide, form a hole at least 2 in. (50 mm) deeper than the maximum test depth. For lift thicknesses that are equal to or less than the probe length, the probe should be placed at the bottom of the compacted lift. Compacted lift thicknesses that exceed the probe length may require excavation and additional tests to evaluate the full thickness of the lift. Note that the additional testing may result in a confined area situation. Refer to Section 4.1.1.

Placing one foot on the drill rod guide will prevent disturbance while driving the drill rod. It will be easier to position the gauge if a light line is scribed in the ground around the outside edge of the drill rod guide. Care should be taken to prevent disturbance of the material surrounding the hole while removing the drill rod.

4.2 Test Location Data

Form SM 418b is used for recording compaction test data. Refer to this form in Appendix F.

Form SM 418b uses US Customary Units (lbs.) for recording the larger weights (test sample & tare, tare, Plus ¾ in. (19 mm) Material, etc.).

4.2.1 Before starting the test, enter all the information required at the top of Form SM 418b, such as: Project, Contract No., Region, County, PIN, Test By and Gauge Ser. No. A specific gravity of 2.60 (Plus ¾ in. (19 mm) material) shall be assumed unless otherwise directed by the Regional Geotechnical Engineer.

1. **Date of Test**
2. **Test No.** - Tests for a project shall be numbered as required by MURK.
3. **Station of Test** - The location of test should be determined accurately.
4. **Offset** - The location of test should be determined accurately.
5. **Location** - The required percent of maximum density for the material depends on its location. Indicate whether the test is performed in the embankment, in the subgrade area, at a structure location or at another area with specific compaction requirements.
6. **Soil Type** - Briefly describe the material tested so that the appropriate Family of Compaction Control Curves is used.

4.3 Testing and Sampling

4.3.1 Place the gauge on the prepared area and insert the probe into the performed hole to the desired depth. Seat the gauge. A properly seated gauge sits firmly on the ground with the probe in firm contact with the side of the probe hole nearest the detectors.

4.3.2 Run three complete one minute tests at each site. Reseat the gauge, as described in 4.3.1, after each test.

From these three tests, for gauges other than direct reading gauges; record, on Form SM 418b lines D and F, the lowest density count and the highest moisture content.

For direct reading gauges; enter, on Form SM 418b lines H, J. K and L, the set of test data obtained at the highest Total Wet Density reading.

4.3.3 Use the spade to remove approximately 15 lbs. (7 kg) of material from the cross hatched area shown on Figure 2, Appendix B. Place the material in the tare; it will be used to determine the control density. The control density shall be performed immediately after removal for the material to avoid moisture loss which may affect density characteristics.

5. DATA AND CALCULATIONS

LINES

A - Standard Count - Density: Refer to the manufacturer's operator's manual.

B - Standard County - Moisture: Refer to the manufacturer's operator's manual.

C - Probe Depth: The actual depth that the probe penetrates into the hole.

D to G - May be omitted if the moisture and density can be read directly from the gauge. Otherwise, enter the appropriate counts and perform the calculations.

H - Wet Density Field (Total) - pcf: Obtained directly from the gauge or through the use of the gauge's conversion tables.

J - Moisture - pcf: Obtained directly from the gauge or through the use of the gauge's conversion tables.

K - Dry Density Field (Total) - pcf: Obtained directly from the gauge or by subtracting the weight of Moisture from the Wet Density Field (Total). (H - J)

L - Moisture Content Field (Total) - %: Obtained directly from the gauge or by dividing the Moisture by the Dry Density Field (Total) and multiplying by 100. Moisture Content values should be recorded to the nearest tenth. {(J ÷ K) x 100}

The moisture content is the ratio of the water in the sample to the dry weight of soil, expressed as a percentage. It is obtained by the following formula:

$$\%\ M.C. = \frac{weight\ of\ water}{weight\ of\ dry\ soil}\ x\ 100$$

LINES

M - Wet Wt. Test Sample & Tare – lbs.: Record the combined weight of the tare and sample obtained as described in 4.3.3.

N - Wt. Tare - lbs.: Record the weight of the tare (sample container).

P - Wet Wt. Test Sample - lbs.: Subtract the weight of tare from the weight of wet soil and tare. (M - N)

5.1 Determination of Plus ¾ in. (19 mm) Material and Moisture Content

To evaluate the field density, it is must be compared to a control density. The control density is expressed in terms of the dry density of the minus ¾ in. (19 mm) portion of the material. The method of determining the control density is described in Section 5.2.

The field density, Line H, is in total wet density units. To compare it to the control density (minus ¾ in. (19 mm) dry units) the percentage of plus ¾ in. (19 mm) material and the moisture content of the minus ¾ in. (19 mm) material must be determined. These values are then used to correct the Wet Density Field (Total) Line H into the proper units for comparison.

Separate the sample on the ¾ in. (19 mm) sieve and proceed as follows:

LINES

Q - Wet Wt. Plus ¾ in. (19 mm) & Tare – lbs.

R - Wt. of Tare - lbs. - This weight shall be predetermined, written on the tare and periodically checked.

S - Wet Wt. Plus ¾ in. (19 mm) - lbs.: (Q - R)

T - % Plus ¾ in. (19 mm) (Wet) - Divide the wet weight of the plus ¾ in. (19 mm) material by the wet weight of the total test sample and multiply by 100 to express as a percentage. {(S ÷ P) x 100}

U - % Minus ¾ in. (19 mm) (Wet): Subtract the % plus ¾ in. (19 mm) material from 100.0%. (100.0 - T)

V - Dry Wt. Test Sample - lbs.: Divide wet weight of total test sample by 1.0 plus the Moisture Content, expressed as a decimal. {P ÷ (1.0 + L/100)}

W - Dry Wt. Plus ¾ in. (19 mm) - lbs.: To calculate the dry weight of the plus ¾ in. (19 mm) material, an assumed absorption value of 2.0% is used. Therefore, divide the wet weight of the plus ¾ in. (19 mm) material by 1.02. (S ÷ 1.02)

X - % Plus ¾ in. (19 mm) (Dry): Divide the dry weight of the plus ¾ in. (19 mm) material by the dry weight of the total test sample and multiply by 100 to express as a percentage. {(W ÷ V) x 100}

Y - % Minus ¾ in. (19 mm) (Dry): Subtract the % plus ¾ in. (19 mm) (Dry) from 100.0%. (100.0 - X)

Z - Moisture Content Minus ¾ in. (19 mm) - %: Determine from the moisture nomograph (Appendix D) using (X) and (L), or (L - 2(X/100)) / (Y/100).

AA - Wet Density Field (Minus ¾ in. (19 mm) - pcf (Density Correction Curves): Use Lines H and T to determine the corrected Minus ¾ in. (19 mm) in-place wet density from the density correction curve (see example in Appendix C). Locate the value from Line H, Wet Density Field (Total) on the vertical scale. Proceed horizontally to intersect the diagonal line corresponding to the % plus ¾ in. (19 mm) (Wet) Line T. From this intersection, proceed vertically to read the Wet Density of Minus ¾ in. (19 mm) material. Value may also be calculated ((H×U)/100)/(1.00-(((H×T)/100)/162.24)). Unless otherwise instructed by the Regional Geotechnical Engineer, use the Density Correction Curves for Plus ¾ in. (19 mm) material with a Specific Gravity of 2.60.

BB - Dry Density Field (Minus ¾ in. (19 mm)) - pcf - The dry density is obtained by dividing the wet density by 1.00 plus the moisture content of the minus ¾ in. (19 mm) material, expressed as a decimal. {AA ÷ (1.00 + Z/100)}

5.2 Control Density

The in-place density (Minus ¾ in. (19 mm)) - must be compared with a control density (Minus ¾ in. (19 mm)) to determine the percent of maximum density. The Compaction Control Curves (Minus ¾ in. (19 mm)) (Page 13) represent the compaction characteristics of most New York State soils. The maximum control density for the soil being tested is found by plotting the one point Standard Proctor Test values on the appropriate control curve.

The one point Standard Proctor Test is performed in the following manner:

The test sample (Minus ¾ in. (19 mm)) is compacted in a 1/30 $ft.^3$ (944 cm^3) compaction cylinder in three layers, giving each layer 25 well distributed blows of the 5½ lb. (2.5 kg) rammer, freely dropped from a height of 12 in. (300 mm). The density cylinder shall rest on a level, uniform, rigid foundation, such as provided by a solid wood block of minimum dimension 10 in. W x 10 in. L x 12 in. H (250 mm W x 250 mm L x 300 mm H). The three layers should be approximately equal in thickness and of such thickness that, when compacted, the compacted soil will extend approximately ¼ in. to 1 in. (6.3 mm to 25 mm) above the cylinder into the collar. A wide-mouth container could be used for measuring the approximate amount of soil required per layer. After compaction, the collar is removed and the sample is trimmed down level with the top of the cylinder. The sample is then weighed.

The in-place minus ¾ in. (19 mm) dry density is then compared with the maximum control minus ¾ in. (19 mm) dry density.

LINES

CC - Wt. Cylinder and Minus ¾ in. (19 mm) - lbs.

DD - Wt. Cylinder - lbs.

EE - Wt. Minus ¾ in. (19 mm) - lbs.: The weight of the compacted soil is obtained by subtracting the weight of cylinder from the wt. cylinder and minus ¾ in. (19 mm) (CC - DD)

FF - Wet Density Minus ¾ in. (19 mm) - pcf: The dry density is obtained by dividing the wet weighty by the volume of the cylinder (1/30 $ft.^3$).
{EE ÷ 1/30} = (EE x 30)

GG - Dry Density Minus ¾ in. (19 mm) - pcf: The dry density is obtained by dividing the wet density by 1.0 plus the moisture content in decimal form.
{FF ÷ (1.0 + Z/100)}

HH - Max. Dry Density Minus ¾ in. (19 mm) - pcf: There are two families of Compaction Control Curves included in Appendix E. One of these families is appropriate for the soil type described on Line 6.

The values of dry density Line GG and moisture content Line Z are used to plot a point on the appropriate Compaction Control Curves. Draw a curve through this point so that it is parallel and similar to the adjacent curves. The *Maximum Dry Density Minus ¾ in. (19 mm)* value is obtained where this curve intercepts the Locus of Maximum Density.

JJ - Opt. Moisture Content - %: The *"optimum moisture content"* is the moisture content at the intersection of the curve with the Locus of Maximum Density.

KK - % of Maximum Density Obtained: The percentage of Maximum Density is determined by dividing the actual minus ¾ in. (19 mm) dry density by the control density (minus ¾ in. (19 mm) dry) and multiplying by 100.
{(BB)HH) x 100}

LL - Minimum Percent Density Required: Enter the minimum percent of Maximum Density required by the specifications for the test location on Line (LL).

The percent of the Maximum Density obtained (Line KK) is compared with the Minimum Percent Density required (Line LL). If Line (KK) is greater than or equal to Line (LL), check the PASS block. If Line (KK) is less than Line (LL), check the FAIL block.

APPENDIX

APPENDIX A

EQUIPMENT

1. NUCLEAR GAUGE - Shall be capable of determining the moisture by backscatter and the density by direct transmission. A radiation source shall be housed in a probe marked in increments no greater than 2 in. (50 mm) and capable of being extended at least 8 in. (200 mm). The probe shall be capable of being locked securely at the desired depths. It shall be safe, portable and ruggedly built for use on the construction site. The manufacturer's calibration data shall accompany each gauge.

2. Reference Standard - A substance of uniform, unchanging density shall be provided with each gauge for the purpose of performing daily, monthly or periodic calibration checks. See Figure 1, Appendix A.

3. Drill Rod Guide - A device used to position the drill rod perpendicular to the test surface. See Figure 1, Appendix A.

4. Drill Rod - A device for forming a hole to receive the probe, having a diameter not greater than ⅛ in. (3 mm) larger than the diameter of the probe.

5. Density Cylinder - 1/30 $ft.^3$ (944 cm^3) volume, in accordance with Geotechnical Engineering Bureau Drawing No. SM 1563, Appendix A.

6. Rammer - Refer to AASHTO T-99 or T-180.

7. Scale - Minimum of 20 lb. (9 kg) capacity to weigh directly to the nearest 0.01 lb. (5 g).

8. Steel Straightedge – 9 to 12 in. (230 mm to 300 mm) length.

9. Sieves – ¾ in. (19 mm) and No. 10 (2 mm).

10. Tares – 10 qt. (9.5 L) size or larger (pail).

11. Spoon - Basting type.

*12. Cans - Friction top with covers, 1 gal (3.7 L).

*13. Pans – 24 in. (600 mm) square and 3 or 4 in. (75 mm or 100 mm) high.

*14. Paint Brush – 2 in. (50 mm) size.

15. Spade - Square end, approx. 8 in. (200 mm) width and 12 in. (300 mm) height.

16. Hammer – 4 lb. (2 kg) minimum weight.

17. Compaction Control Curves - Family 1 and Family 2 (3 sheets), dated 02/28/77. See Appendix E.

18. Plus ¾ in. (19 mm) Correction Curve - A curve for a specific gravity of 2.60 is included. See Appendix C. Curves for other specific gravities are available from the Regional Geotechnical Engineer.

19. Moisture Nomograph - Moisture relationship between total sample and Minus ¾ in. (19 mm) material. See Appendix D.

20. Form SM 418b - Field Compaction Data Sheet - Nuclear Direct Transmission.

* The equipment annotated by asterisks is not essential, but is considered desirable.

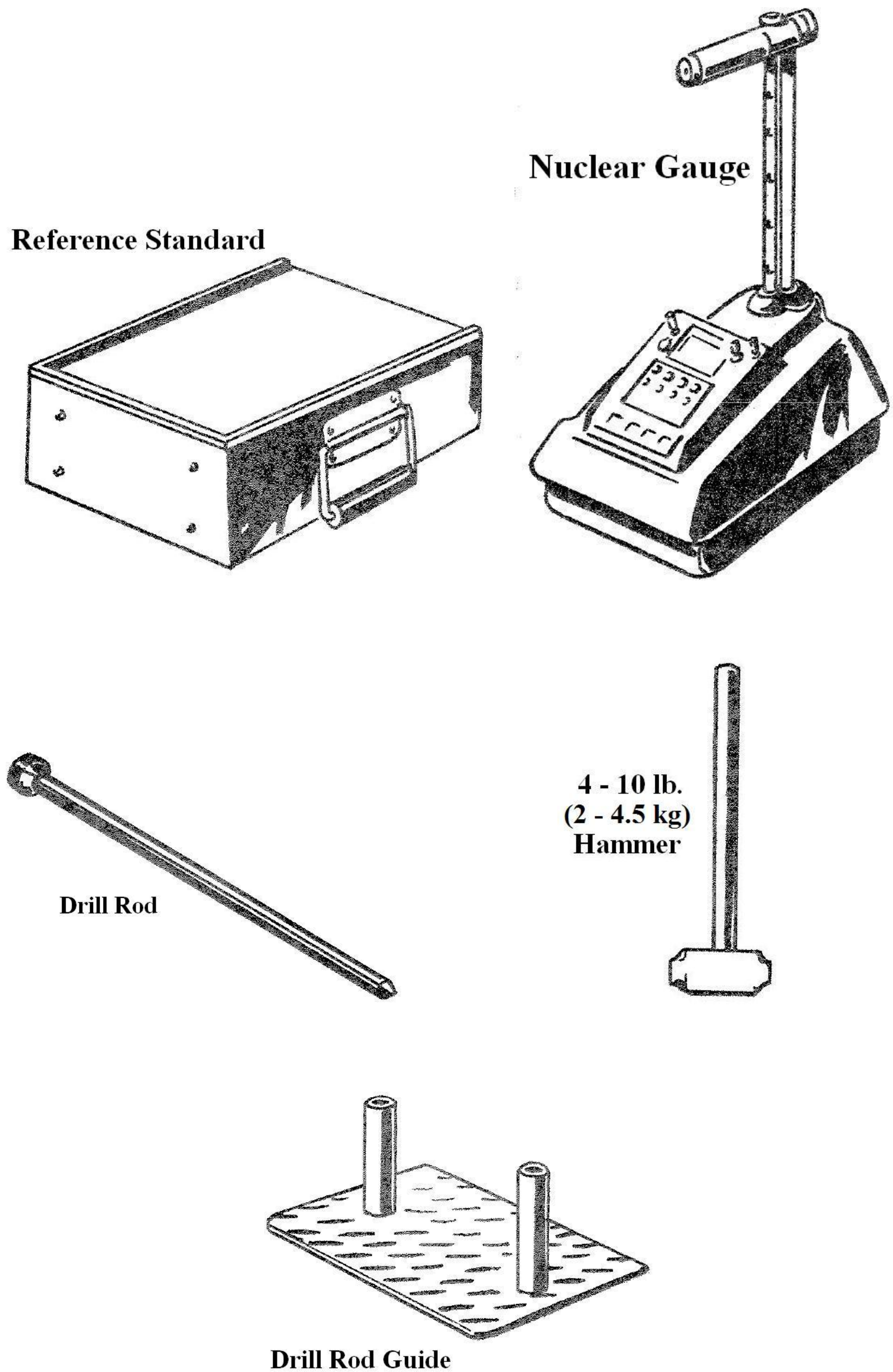
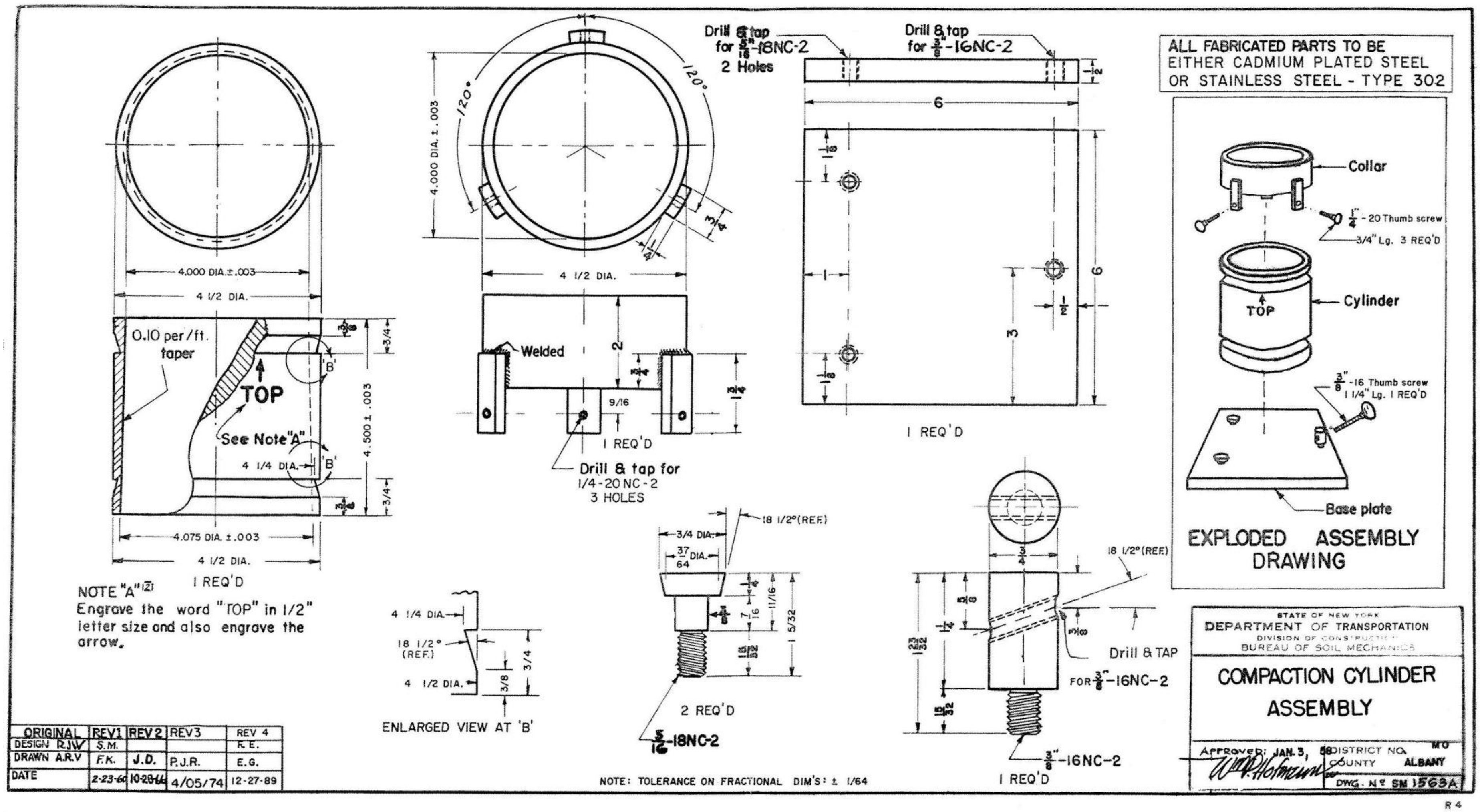


Figure 1 Nuclear Gauge and Equipment

APPENDIX A



ALL FABRICATED PARTS TO BE EITHER CADMIUM PLATED STEEL OR STAINLESS STEEL - TYPE 302
Collar
Cylinder
Base plate
EXPLODED ASSEMBLY DRAWING
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
BUREAU OF SOIL MECHANICS
COMPACTION CYLINDER ASSEMBLY
NOTE "A"
Engrave the word "TOP" in 1/2" letter size and also engrave the arrow.
ENLARGED VIEW AT 'B'
NOTE: TOLERANCE ON FRACTIONAL DIM'S: ± 1/64
Drill & tap for 1/4-20 NC-2 3 HOLES
Welded
TOP
See Note "A"
0.10 per/ft. taper
1 REQ'D
2 REQ'D
DWG. Nº SM 1563A
R 4

APPENDIX B

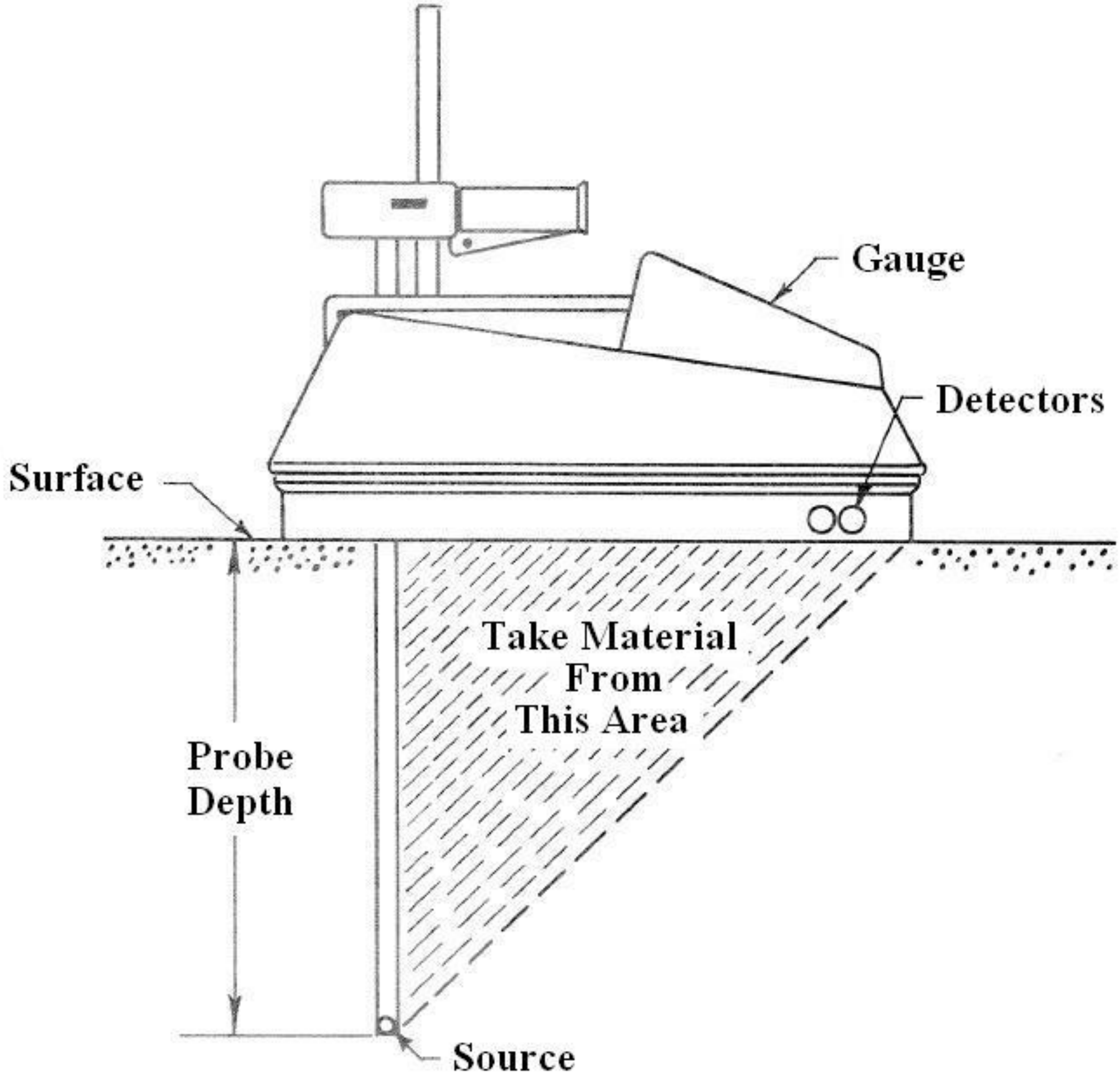
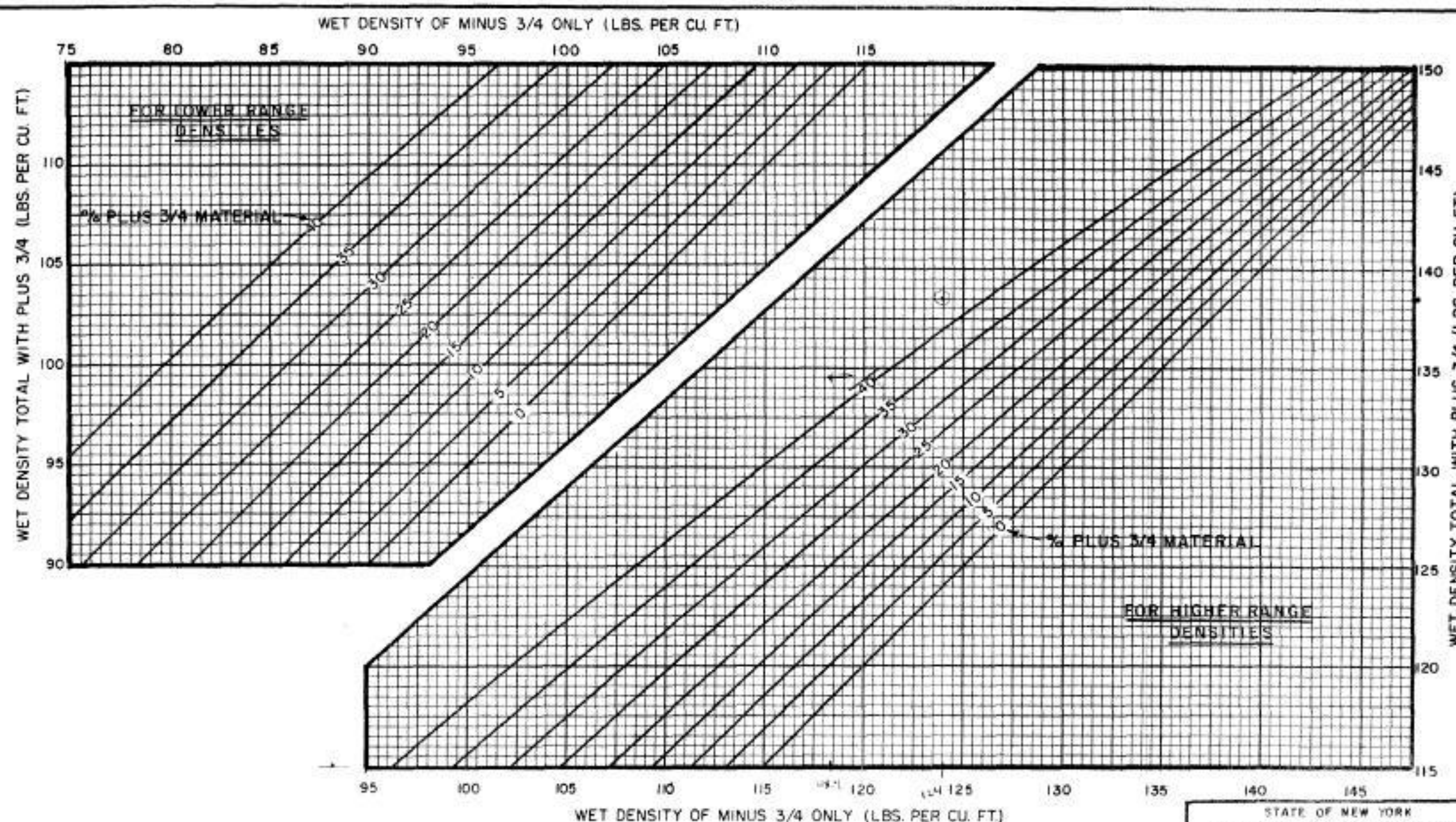


Figure 2 Illustration Showing Where Material for One Point Proctor Test is Obtained.

APPENDIX C



- FORMULA USED -

$$W.D._{(-3/4)} = \frac{W.D.T. \times F_{(-3/4)}}{1.00 - \left(\frac{W.D.T. \times F_{(+3/4)}}{62.4 \times S.G._{(+3/4)}}\right)}$$

WHERE: W.D. − 3/4 = WET DENSITY OF PART PASSING NO. 3/4

$F_{(+3/4)}$ = FRACTION OF PLUS 3/4 OF TOTAL SAMPLE

$F_{(-3/4)}$ = FRACTION OF MINUS 3/4 OF TOTAL SAMPLE

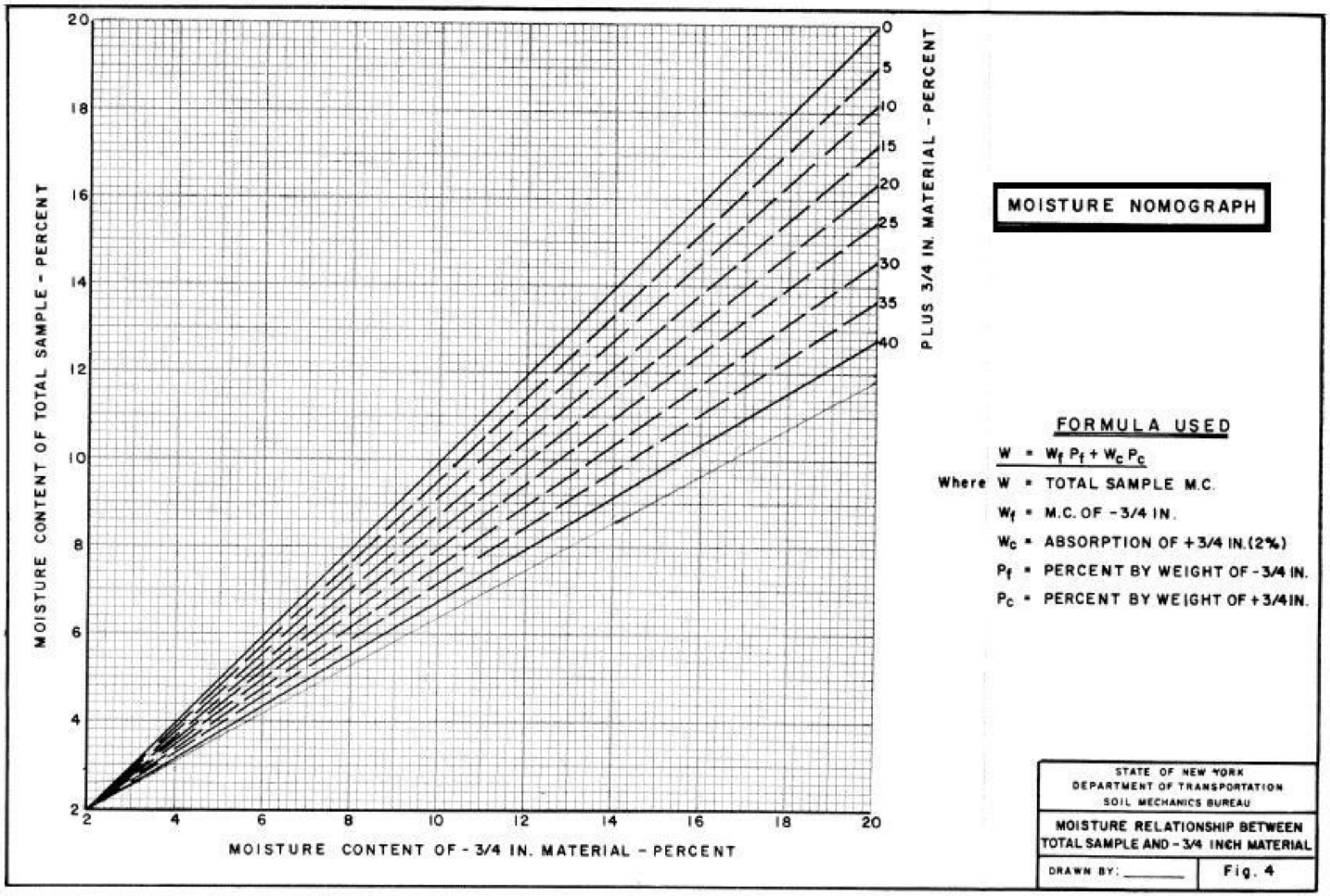
W.D.T. = WET DENSITY OF TOTAL SAMPLE

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF DESIGN AND CONSTRUCTION

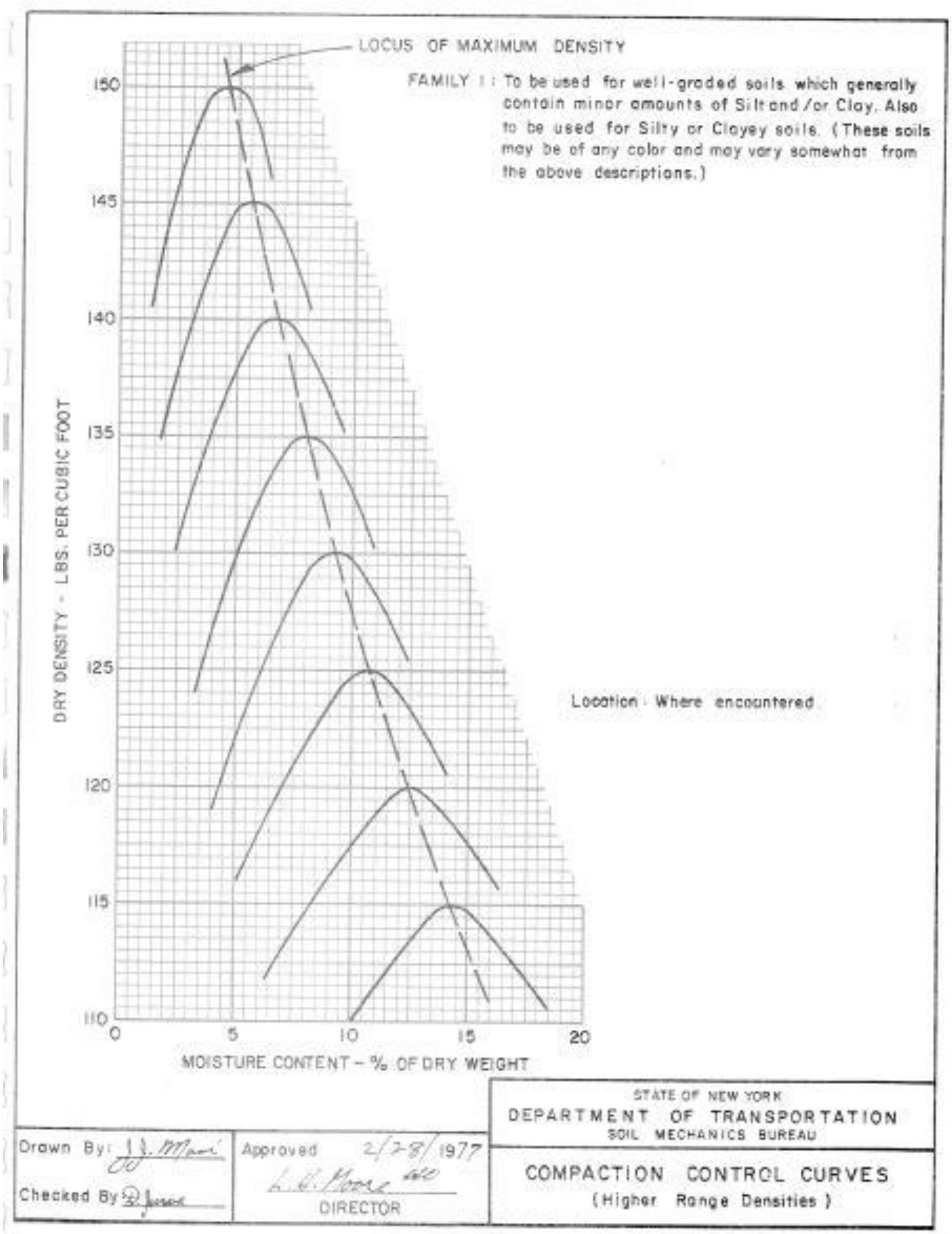
DENSITY CORRECTION CURVES
PLUS 3/4 MATERIAL
SPECIFIC GRAVITY 2.60

APPROVED FEB 1980 DIRECTOR SOIL MECHANICS BUREAU	REGION NO. M.O. COUNTY ALBANY DWG. NO. SM 1694C

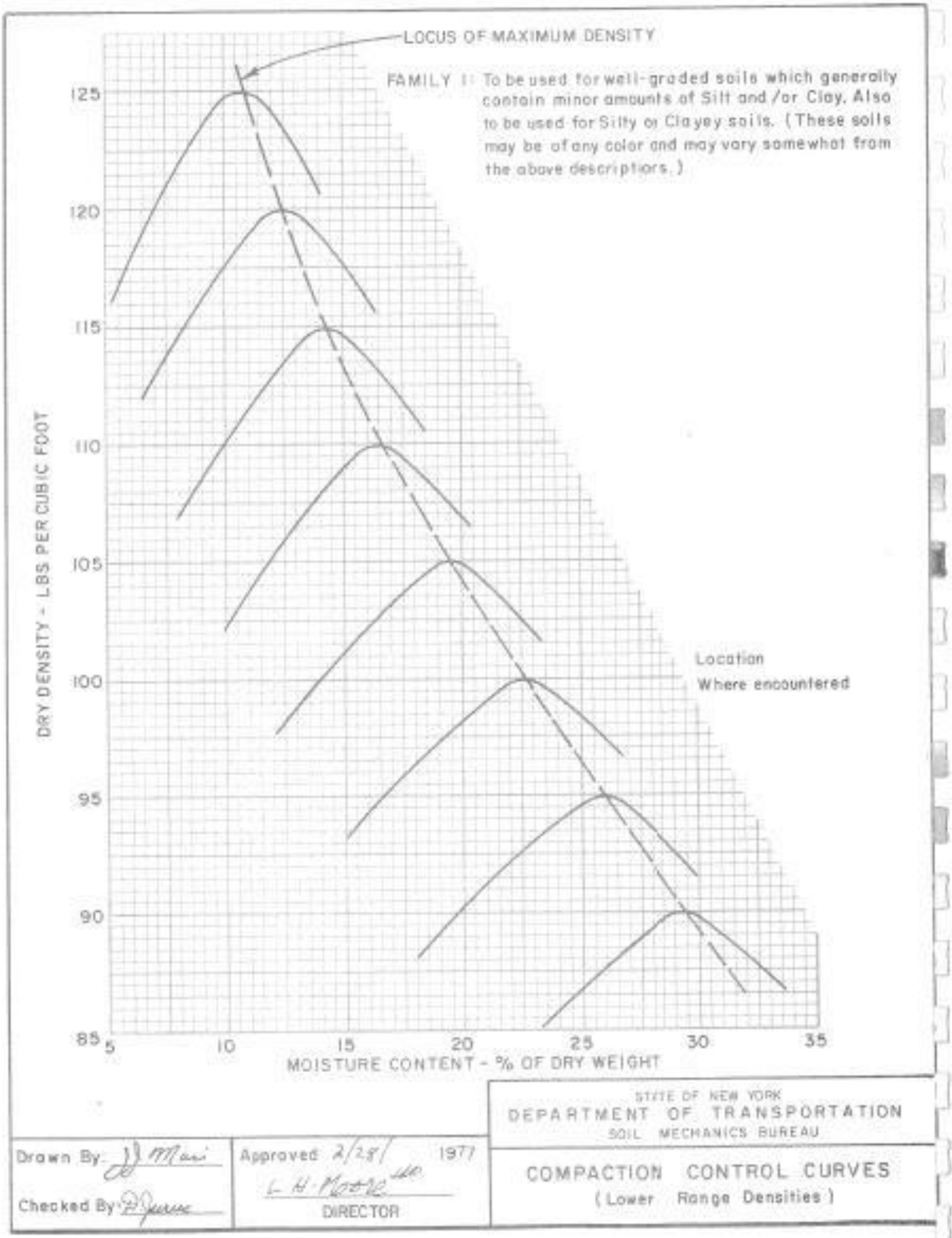
APPENDIX D


MOISTURE NOMOGRAPH
MOISTURE CONTENT OF TOTAL SAMPLE - PERCENT
MOISTURE CONTENT OF - 3/4 IN. MATERIAL - PERCENT
PLUS 3/4 IN. MATERIAL - PERCENT
0
5
10
15
20
25
30
35
40
FORMULA USED
W = Wf Pf + Wc Pc
Where W = TOTAL SAMPLE M.C.
Wf = M.C. OF -3/4 IN.
Wc = ABSORPTION OF +3/4 IN. (2%)
Pf = PERCENT BY WEIGHT OF -3/4 IN.
Pc = PERCENT BY WEIGHT OF +3/4 IN.
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU
MOISTURE RELATIONSHIP BETWEEN TOTAL SAMPLE AND - 3/4 INCH MATERIAL
DRAWN BY:
Fig. 4

APPENDIX E

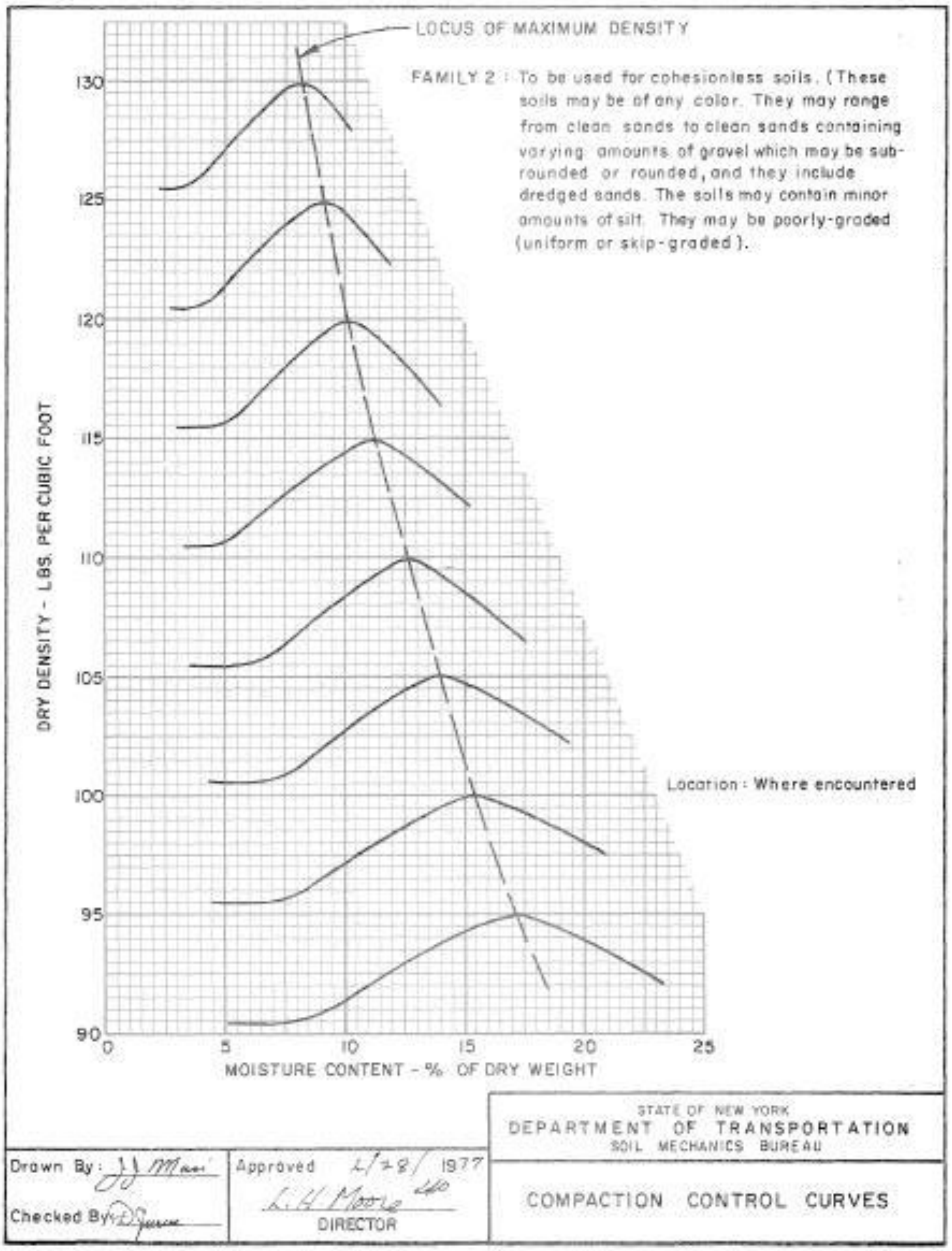

LOCUS OF MAXIMUM DENSITY
FAMILY I : To be used for well-graded soils which generally contain minor amounts of Silt and /or Clay. Also to be used for Silty or Clayey soils. (These soils may be of any color and may vary somewhat from the above descriptions.)
DRY DENSITY - LBS. PER CUBIC FOOT
150
145
140
135
130
125
120
115
110
0
5
10
15
20
MOISTURE CONTENT – % OF DRY WEIGHT
Location : Where encountered
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU
COMPACTION CONTROL CURVES
(Higher Range Densities)
Drawn By:
Checked By
Approved 2/28/1977
DIRECTOR

APPENDIX E



LOCUS OF MAXIMUM DENSITY
FAMILY I: To be used for well-graded soils which generally contain minor amounts of Silt and/or Clay. Also to be used for Silty or Clayey soils. (These soils may be of any color and may vary somewhat from the above descriptions.)
Location Where encountered
DRY DENSITY - LBS PER CUBIC FOOT
125
120
115
110
105
100
95
90
85
5
10
15
20
25
30
35
MOISTURE CONTENT - % OF DRY WEIGHT
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU
COMPACTION CONTROL CURVES
(Lower Range Densities)
Drawn By:
Checked By:
Approved 2/28/ 1977
L. H. Moore
DIRECTOR

APPENDIX E



LOCUS OF MAXIMUM DENSITY
FAMILY 2 : To be used for cohesionless soils. (These soils may be of any color. They may range from clean sands to clean sands containing varying amounts of gravel which may be sub-rounded or rounded, and they include dredged sands. The soils may contain minor amounts of silt. They may be poorly-graded (uniform or skip-graded).
Location : Where encountered
DRY DENSITY - LBS. PER CUBIC FOOT
130
125
120
115
110
105
100
95
90
0
5
10
15
20
25
MOISTURE CONTENT - % OF DRY WEIGHT
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU
Drawn By:
Checked By:
Approved 4/28/1977
DIRECTOR
COMPACTION CONTROL CURVES

NYSDOT GEOTECHNICAL ENGINEERING BUREAU

FIELD COMPACTION DATA SHEET

NUCLEAR DIRECT TRANSMISSION

PROJECT:						CONTRACT NO.:	
REGION:		COUNTY:		PIN:		TESTED BY:	
G_S - Bulk Saturated Surface Dry:				GAUGE SER. NO.:		CHECKED BY:	

1	Date of Test	
2	Test No.	
3	Station of Test	
4	Offset	
5	Location	
6	Soil Type	

A	Standard Count - DENSITY						
B	Standard Count – MOISTURE						
C	Probe Depth						
D	Test Density Count	**(use lowest of 3)**					
E	Density Count Ratio	**(D/A)**					
F	Test Moisture Count	**(use highest of 3)**					
G	Moisture Count Ratio	**(F/B)**					
H	Wet Density Field (Total) in PCF	**(Table or Direct Reading)***					
J	Moisture in PCF	**(Table or Direct Reading)***					
K	Dry Density Field (Total) in %	**(H-J) or Direct Reading***					
L	Moisture Content Field (Total) in %	**((J/K)×100) or Direct Reading***					
M	Wet Wt. Test Samples & Tare in Lbs.						
N	Wt. Tare in Lbs.						
P	Wet Wt. Test Sample in Lbs.	**(M-N)**					
Q	Wet Wt. Plus ¾” & Tare in Lbs.						
R	Wt. Tare in Lbs.						
S	Wet Wt. Plus ¾” in Lbs.	**(Q-R)**					
T	% Plus ¾” (Wet)	**(S/P)×100**					
U	% Minus ¾” (Wet)	**(100.0-T)**					
V	Dry Wt. Test Sample in Lbs.	**(P/(1.0+(L/100)))**					
W	Dry Wt. Plus ¾” in Lbs.	**(S/1.02)**					
X	% Plus ¾” (Dry)	**((W/V)×100)**					
Y	% Minus ¾” (Dry)	**(100.0-X)**					
Z	Moisture Content (Minus ¾”) in %	**Moisture Nomograph use X & L or (L - 2(X/100)) / (Y/100)**					
AA	Wet Density Field(Minus ¾”) in PCF	**Density Correction use H & T or ((H×U)/100) / (1.00-(((H×T)/100) / 162.24))**					
BB	Dry Density Field(Minus ¾”) in PCF	**(AA/(1+(Z/100)))**					
CC	Wt. Cylinder & (Minus ¾”) in Lbs.		CONTROL				
DD	Wt. Cylinder in Lbs.						
EE	Wt. Minus ¾” in Lbs.	**(CC-DD)**					
FF	Wet Density Minus ¾” in PCF	**(EE×30.0) or (EE/(1/30))**					
GG	Dry Density Minus ¾” in PCF	**(FF/(1+(Z/100)))**					
HH	MAX Dry Density Minus ¾” in PCF	**Compaction Control Curves**					
JJ	Optimum Moisture Content in %	**Compaction Control Curves**					
KK	% of Maximum Density Obtained	**((BB/HH)×100)**					
LL	Minimum % Density Required						
	PASS	**KK ≥ LL**					
	FAIL	**KK < LL**					

***- For Direct Reading Gauges (i.e. - Troxler 3440) use the set of test data with the highest Total Wet Density (Line H).**

Remarks: