Appendix B

MATERIALS TESTING REPORT:
UNIFIED CLASSIFICATION SYSTEM
ASTM D2487

Project Name: _____ Location: _____

Contract No. _____ Contractor: _____

Inspector: _____ Date: _____ Time: _____

Sample location: _____ Field sample No.: _____

Depth: _____ Geologic origin: _____ Type of sample: _____ Tested at: _____

Approved by: _____ Date: _____ Symbol: _____ Description: _____

Identification				Coarse fraction					Fine fraction				Total soil			Classification	
Testing section sample No.	Test hole No.	Field sample No.	Depth (ft)	Maximum size (mm)	Particle shape	Particle condition	Gravel (3 in. to No. 4)	Sand (No. 4 to 200)	Fines (- No. 200)	Plasticity	Dry strength	Dilatance	Organic odor (wet)	Reaction to HCL	Color (wet)	Description (classification, grading, structure, consistancy, moisture condition, inclusions, etc.)	Group symbol

Remarks: _____ Signature: _____

_____ Title: _____ Date: _____

Fig. 1B—Materials testing report: unified classification system (ASTM D2487).

MATERIALS TESTING REPORT:
UNIFIED SOIL CLASSIFICATION SYSTEM VISUAL-MANUAL PROCEDURE
ASTM D2488

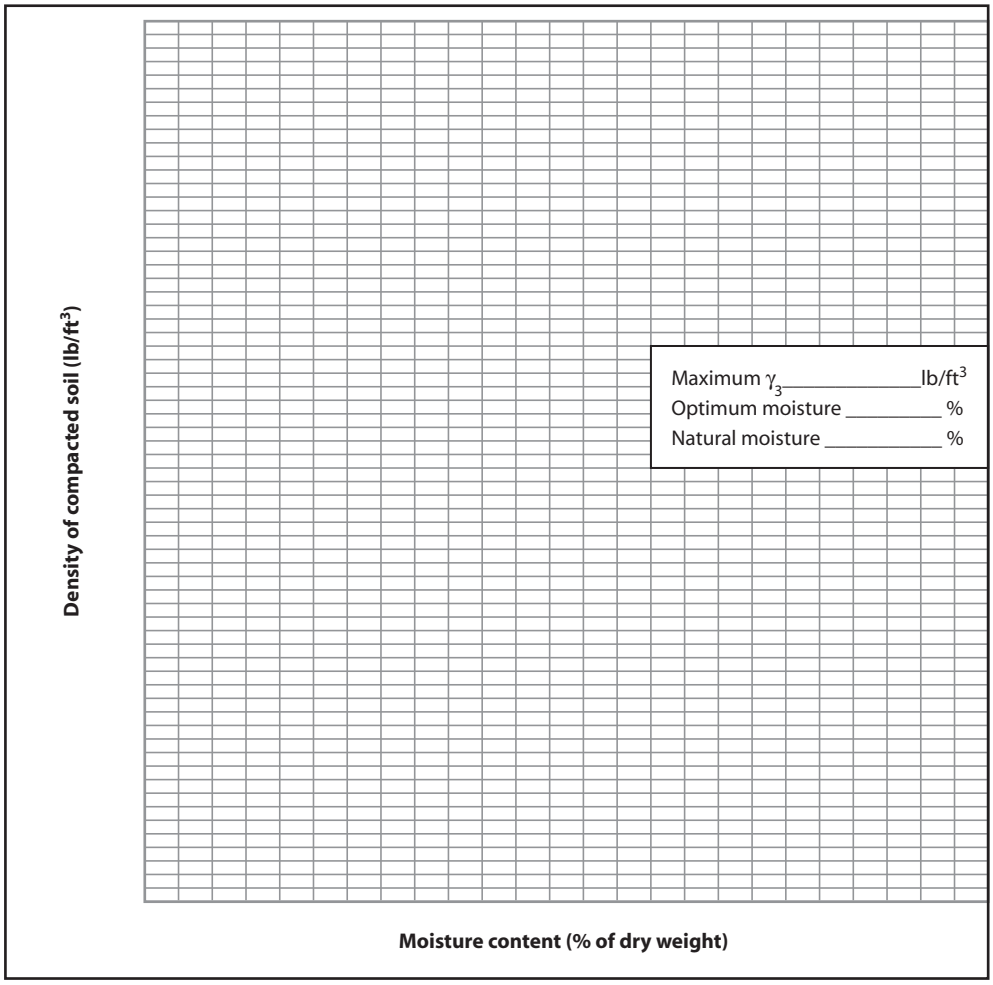
Test	Description	Symbol	Identification
	Angular	A	Irregular shape: sharp edges.
	Subangular	SA	Irregular shape; fairly sharp edges.
	Subrounded	SR	Irregular shape; rounded edges.
	Rounded	R	Fairly regular shape; rounded edges.
Particle condition	Soft	S	Rubber pestle will break particles.
	Vesicular	V	Individual grains contain air voids.
	Dense	D	Massive: grains contain no air voids.
Plasticity	High	H	Tough thread, will remold before plastic limit.
	Medium	M	Medium tough thread, crumbles below plastic limit.
	Low	L	Weak thread, will not remold at plastic limit.
	None	N	Will not form thread.
Dry strength	High	H	Difficult to break by finger pressure.
	Medium	M	Considerable finger pressure to crumble
	Low	L	Will crumble at light finger pressure.
	None	N	Will not form soil pat.
Dilatance	Rapid	R	Water surfaces immediately.
	Slow	S	Water surfaces slowly.
	None	N	Water will not surface.
HCL	Positive	+	Effervescence
	Negative	—	No reaction
Organic odor	Strong	S	Strong odor when moist and hot.
	Weak	W	Weak Odor when moist and hot.
	None	N	No organic odor.

Group	Organic odor	Visual examination			Character of fines (- No. 40)		
		Grading	Percent fines	Dominant fraction	Dilatance	Dry strength	Plasticity
ML	Weak	Not a criterion for classification	Over 50	Fines	Rapid	None-slow	None-Low
CL	"		"	"	None-slow	Medium-High	Medium
CH	"		"	"	None	High	High
MH	"		"	"	None - slow	Low- medium	Low-medium
OL,OH	Strong		"	"	None	Low- medium	Medium (spongy)
SM	Weak		12 - 50	Sand	Fines classify as ML or MH		
GM	"		"	Gravel			
SC	"		"	Sand	Fines classify as CL or CH		
GC	"		"	Gravel			
SP	"	Poor	Under 5	Sand	Not a criterion for classification		
GP	"	"	"	Gravel			
SW	"	Well	"	Sand			
GW	"			Gravel			
Pt	Strong	Identify by high fibrous organic content					

Fig. 2B—Materials testing report: unified soil classification system visual-manual procedure (ASTM D2488).

Material Testing Report
Reference Density Compaction Curve

Project _____ Laboratory No. _____
Field sample No. _____ Location _____ Depth _____
Geologic origin _____ Tested at _____ Approved by _____ Date _____
Classification _____ LL _____ PI _____ Curve No. _____ of _____
Maximum particle size in test _____ Standard (ASTM D-698), method _____
Specific gravity (Gs): -No. 4 _____ Modified (ASTM D-1557), method _____
+No. 4 _____



Remarks _____

Fig. 3B—Material testing report, reference density compaction curve.

Worksheet for Reference Density Compaction Data

Project _____ **Site** _____ **Sample No.** _____

Compaction Data						
1. Weight of cylinder plus moist soil _____(lb)						
2. Weight of cylinder _____(lb)						
3. Weight of moist soil = [1] - [2] _____(lb)						
4. Wet density = [3] ÷ volume of cylinder _____(lb/ft^3)						
5. Dry density = ([4] × 100) ÷ 100 + [6]) _____(lb/ft^3)						

Moisture Determination Data						
6. Moisture content[1] = ([10] ÷ [12]) × 100_____(%)						
7. Container No._____						
8. Weight of container plus moist soil _____(g)						
9. Weight of container plus dry soil _____(g)						
10. Weight of moisture = [8] - [9] _____(g)						
11. Weight of container _____(g)						
12. Weight of dry soil = [9] - [11] _____(g)						

Volume of cylinder _____ ft^3 using: ASTM Standard D 698/D 1557 _____, method _____

Procedure data: weight of hammer: _____ lb, drop _____ in., number of lifts _____

Completed by _____ Date _____ Computed by _____ Date _____

Checked by _____ Date _____ Recorded by _____ Date _____

Fig. 4B—Worksheet for reference density compaction data.

BULK SAND DENSITY DETERMINATION AND CALIBRATION OF CONE AND BASE PLATE FOR ASTM D1556

Project Name: _____ Location: _____

Contractor: _____ Contract No. _____ Test No. _____

Material source: _____ Tested by: _____ Date: _____

Bulk Density of Sand

		Trial 1	Trial 2	Trial 3	Avg.
(1) Volume of Mold, ft^3 (predetermined)					
(2) Initial Weight of Jar + Sand	(lbs)				
(3) Final Weight of Jar + Sand	(lbs)				
(4) Weight of Sand in Cone & Plate	(lbs)				
(5) Weight of Sand in Mold, lbs	(2) – (3) – (4)				
(6) Bulk Density of Sand, lbs/ft^3	(5) / (1)				

	Trial 1	Trial 2	Trial 3
Percent Difference From Average			

% Difference from Avg. = [(Avg. of 3 trials – Trial #___) / Avg. of 3 Trials] x 100

(Trials should not exceed 1% difference from the average.)

Weight of Sand in Cone & Plate

		Trial 1	Trial 2	Trial 3	Avg.
(7) Initial Weight of Jar + Sand	(lbs)				
(8) Final Weight of Jar + Sand	(lbs)				
(9) Weight of Sand in Cone and Plate (8) – (7)	(lbs)				

	Trial 1	Trial 2	Trial 3
Percent Difference From Average			

% Difference from Avg. = [(Avg. of 3 trials – Trial #___) / Avg. of 3 Trials] x 100

(Trials should not exceed 1% difference from the average.)

Fig. 5B—Bulk sand density determination and calibration of cone and base plate for ASTM D1556.

IN-PLACE MOISTURE-DENSITY DETERMINATION:
TEST RECORD FOR SAND CONE METHOD
ASTM D1556

Fined grained soils—less than 5% + oversize[1]

Location: _____ Site No. _____

Watershed: _____ Subwatershed: _____

Contract No. _____ Contractor: _____

Tested by: _____ Computed by: _____ Checked by: _____

Test No.	Date	Location of test			Moisture (%)	Material classification
		Station	Centerline offset	Elevation		

Size of sand cone: _____

Test No.	Date	Spec. requirements		Test results	
		Moisture range (%)	Mass dry density (lb/ft^3)	Moisture (%)	Mass dry density (lb/ft^3)

Remarks: _____

[1]Oversize correction required based on method selected in ASTM D698 or D1557.
Indicate weight and volume units used in test.

Fig. 6B—In-place moisture-density determination: test record for sand cone method (ASTM D1556), fine-grained soils–less than 5% + oversize[1].

IN-PLACE MOISTURE-DENSITY DETERMINATION: TEST DATA FOR SAND CONE METHOD ASTM D1556 Fined grained soils—less than 5% + oversize[1]

Volume Determination	Test No.			
	1	2	3	4
1. Bulk density of sand (predetermined): _____				
2. Initial weight of sand, cone, and container: _____				
3. Final weight of sand, cone, and container: _____				
4. Weight of sand in hole, plate, and cone = [2] – [3]: _____				
5. Weight of sand in plate plus cone (predetermined): _____				
6. Weight of sand in hole = [4] – [5]: _____				
7. Volume of hole = [6] ÷ [1]: _____				

Moisture Determination	Container No.			
	1	2	3	4
Sample tested using: direct heat ____ oven ___ microwave ___				
8. Weight of moist sample and container: _____				
9. Weight of dry sample and container: _____				
10. Weight of moisture = [10] – [11]: _____				
11. Weight of container: _____				
12. Weight of dry sample = [9] – [11]: _____				
13. Moisture content = ([10] ÷ [12]) 100: _____				
14. Correction for ignition: _____				
15. Corrected moisture content = [13] – [14]: _____				

Density Determination	Container No.			
	1	2	3	4
16. Weight of moist sample plus container: _____				
17. Weight of container: _____				
18. Weight of moist sample = _____				
19. Wet density = [18] ÷ [7]: _____				
20. Dry density = [18] ÷ [1 + [15]/100]:_____				
21. Required density = _____				
22. Ratio[1] = ([20] ÷ [21]) 100: _____				

[1]Oversize correction required based on method selected in ASTM D698 or D1557.
Indicate weight and volume units used in test.

Fig. 7B—In-place moisture-density determination: test data for sand cone method (ASTM D1556) fine-grained soil–less than 5% + oversize[1].

IN-PLACE MOISTURE-DENSITY DETERMINATION:
TEST RECORDS FOR THE RUBBER BALLOON METHOD
ASTM D2167
Fine-grained soils—less than 5% + no. 4 sieve

Location: _____ Site No. _____

Project Name: _____

Contract No. _____ Contractor: _____

Tested by: _____ Computed by: _____ Checked by: _____

Test No.	Date	Location of test			Borrow source, location, and depth	Material classification
		Station	Centerline offset	Elevation		

Test No.	Date	Spec. requirements (%)		Test results (%)		Curve No.	Wet density check	
		Moisture range	Compaction	Moisture	Compaction		1-Point	Curve

Remarks: _____

Fig. 8B—In-place moisture-density determination: test records for the rubber balloon method (ASTM D2167) fine-grained soils–less than 5% + no. 4 sieve.

IN-PLACE MOISTURE-DENSITY DETERMINATION: TEST DATA FOR THE RUBBER BALLOON METHOD ASTM D2167

Fine-grained soils—less than 5% + no. 4 sieve

Volume Determination	Test No.			
	1	2	3	4
1. Final base reading:_____				
2. Initial case reading:_____				
3. Volume of hole = [1] – [2]: _____				

Moisture Determination	Container No.			
	1	2	3	4
Sample tested using: direct heat ____ oven ___ microwave ___				
4. Weight of moist sample and container: _____				
5. Weight of dry sample and container: _____				
6. Weight of moisture = [4] – [5]: _____				
7. Weight of container: _____				
8. Weight of dry sample = [5] – [7]: _____				
9. Moisture content = ([6] ÷ [8]) 100: _____				
10. Correction for ignition: _____				
11. Corrected moisture content = [9] – [10]: _____				

Density Determination	Container No.			
	1	2	3	4
12. Weight of moist sample plus container: _____				
13. Weight of container: _____				
14. Weight of moist sample = _____				
15. Wet density = [14] ÷[3]				
16. Dry density = [15] ÷ [1 + [11]/100]:_____				
17. Required density: _____				
18. Ratio[1] = ([16] ÷[17]) 100: _____				

[1]Oversize correction required based on method selected in ASTM D698 or D1557.
Indicate weight and volume units used in test.

Fig. 9B—In-place moisture-density determination: test data for the rubber balloon method (ASTM D2167), fine-grained soils–less than 5% + no. 4 sieve.

IN-PLACE MOISTURE-DENSITY DETERMINATION:
CALIBRATED CYLINDER METHOD TEST RECORD
ASTM D2937
Fine-grained soils—less than 5% + no. 4 sieve

Location: _____ Site No. _____

Project Name: _____

Contract No. _____ Contractor: _____

Tested by: _____ Computed by: _____ Checked by: _____

Test No.	Date	Location of test			Borrow source, location, and depth	Material classification
		Station	Centerline offset	Elevation		

Test No.	Date	Spec. requirements (%)		Test results (%)		Curve No.	Wet density check	
		Moisture range	Compaction	Moisture	Compaction		1-Point	Curve

Remarks: _____

Fig. 10B—In-place moisture-density determination: calibrated cylinder method test record (ASTM D2937) fine-grained soils–less than 5% + no. 4 sieve.

IN-PLACE MOISTURE-DENSITY DETERMINATION: CALIBRATED CYLINDER METHOD TEST DATA ASTM D2937

Fine-grained soils—less than 5% + no. 4 sieve

Volume Determination	Test No. 1	Test No. 2	Test No. 3	Test No. 4
1. Volume of cylinder (volume of hole)				

Moisture Determination	Test No. 1	Test No. 2	Test No. 3	Test No. 4
Sample tested using: direct heat ____ oven ___ microwave ___				
2. Weight of moist sample plus container: _____				
3. Weight of dry sample plus container: _____		Container No.		
4. Weight of moisture = [2] – [3]: _____				
5. Weight of container: _____				
6. Weight of dry sample = [3] – [5]: _____				
7. Moisture content = ([4] ÷ [6])*100: _____ (%)				
8. Correction for ignition: _____ (%)				
9. Corrected moisture content = [7] – [8]: _____ (%)				

Density Determination				
10. Weight of moist sample plus cylinder:_____				
11. Weight of cylinder: _____				
12. Weight of moist sample = [10] – [11]: _____				
13. Wet density=[12] ÷[1]: _____				
14. Fill dry density: [13] ÷ [1 + [9]/100]:_____				
15. Maximum dry density: _____				
16. Ratio[1] = ([14] ÷ [15])*100: _____ (%)				

[1] Ratio of fill dry density to maximum dry density.
Indicate weight and volume units used in test.

Fig. 11B—In-place moisture-density determination: calibrated cylinder method test data (ASTM D2937), fine-grained soils–less than 5% + no. 4 sieve.

IN-PLACE MOISTURE-DENSITY DETERMINATION: TEMPLATE AND PLASTIC LINER METHOD TEST RECORD ASTM D5030

Location: _____ Site No. _____

Project Name: _____

Contract No. _____ Contractor: _____

Tested by: _____ Computed by: _____ Checked by: _____

Test No.	Date	Location of test			Borrow source, location, and depth	Material classification
		Station	Centerline offset	Elevation		

Size of template: _____

Test No.	Date	Specified requirements		Test results		
		Moisture range (%)	Density (lb/ft^3)	Moisture (%)	Density (lb/ft^3)	Compaction (%)

Remarks: _____

Fig. 12B—In-place moisture-density determination: template and plastic liner method test record (ASTM D5030).

IN-PLACE MOISTURE-DENSITY DETERMINATION: TEMPLATE AND PLASTIC LINER METHOD TEST DATA ASTM D5030

Volume Determination		Test No. 1	2	3	4
1. Weight of water plus container before filling template: _____	( )				
2. Weight of water plus container after filling template: _____	( )				
3. Weight of water required to fill template = [1] – [2]: _____	( )				
4. Weight of water plus container before filling template and hole: ____	( )				
5. Weight of water plus container after filling template and hole: _____	( )				
6. Weight of water to fill template and hole = [4] – [5]: _____	( )				
7. Net weight of water to fill hole = [6] – [3]: _____	( )				
8. Volume = [7] ÷ [62.4] : _____	( )				

Moisture Determination		Container No. 1	2	3	4
Sample tested using: direct heat ____ oven ___ microwave ___					
9. Weight of moist sample and container: _____	( )				
10. Weight of dry sample and container: _____	( )				
11. Weight of moisture = [9] – [10]: _____	( )				
12. Weight of container: _____	( )				
13. Weight of wet sample = [9] – [12]: _____	( )				
14. Weight of dry sample = [10] – [12]: _____	( )				
15. Moisture content = ([11] ÷ [14]) 100: _____	(%)				
16. Correction for ignition: _____	(%)				
17. Corrected moisture content = [15] – [16]: _____	(%)				

Density Determination		Test No. 1	2	3	4
18. Total weight of soil removed from the hole: _____	( )				
19. Total wet density = [18] ÷ [8]: _____	( )				
20. Total dry density = [19] ÷ [1 + [17 ÷ 100]]:_____	( )				
21. Required density = _____	( )				
22. Ratio[1] = _____	( )				

[1] Ratio of fill dry density to maximum dry density.
Indicate weight and volume units used in test.

Fig. 13B—In-place moisture-density determination: template and plastic liner method test data (ASTM D5030).

NUCLEAR COMPACTION TEST DATA FOR ASTM D6938

Project _____
Job number _____
Date _____
Taken by _____

Test number	1	2	3	4	5	6	7	8	9	10
Station										
Offset										
Elevation										
Mode & depth										
Density count										
Wet density										
Moisture cnt.										
% Moisture										
Moisture corr.										
Dry density										
Std. density										
Opt. moisture										
% Compaction										

Test number	11	12	13	14	15	16	17	18	19	20
Station										
Offset										
Elevation										
Mode & depth										
Density count										
Wet density										
Moisture cnt.										
% Moisture										
Moisture corr.										
Dry density										
Std. density										
Opt. moisture										
% Compaction										

Density	Moisture

Remarks: _____

Fig. 14B—Nuclear compaction test data for ASTM D6938.

Moisture Content Determination
Summary Data Sheet for ASTM Methods

Kind of material _____ Location _____ Owner_____

Project name_____ Site no._____

Contract no._____ Contractor_____

Dried by oven ☐ direct heat ☐ microwave ☐ carbide ☐

Test no.	Date of test	Location of test (structure or station, offset)	Elevation	WW[1]	DW[1]	TW[1]	Moisture content (%)[2]				Tested by
							Oven D2216	Direct heat D4959	Microwave D4643	Carbide D7944	

[1] WW-Weight of moisture sample and container DW=Weight of dry sample and container TW=Weight of container

[2] Moisture content (%)=[(WW–DW)÷(DW–TW)]*100

Fig. 15B—Moisture content determination summary data sheet for ASTM methods.

ASTM D2216	Moisture Content Oven				Designation USBR 5300
PROJECT Example Computations			FEATURE		
TESTED BY DATE		COMPUTED BY DATE		CHECKED BY DATE	
SAMPLE NUMBER	1	2			UNITS
CONTAINER NUMBER	15	20			
DATE PLACED IN OVEN	9/8/86	9/8/86			☒ g
MASS OF CONTAINER + WET SPECIMEN	366.1	374.6			
MASS OF CONTAINER + DRY SPECIMEN	348.0	342.1			☐ Kg
MASS OF CONTAINER	129.4	118.0			
MASS OF WATER	18.1	32.5			☐ lbm
MASS OF DRY SPECIMEN	218.6	224.1			
MOISTURE CONTENT (%)	8.3	14.5			

ASTM D2216	Moisture Content Oven				Designation USBR 5300
PROJECT			FEATURE		
TESTED BY DATE		COMPUTED BY DATE		CHECKED BY DATE	
SAMPLE NUMBER					UNITS
CONTAINER NUMBER					
DATE PLACED IN OVEN					☐ g
MASS OF CONTAINER + WET SPECIMEN					
MASS OF CONTAINER + DRY SPECIMEN					☐ Kg
MASS OF CONTAINER					
MASS OF WATER					☐ lbm
MASS OF DRY SPECIMEN					
MOISTURE CONTENT (%)					

Fig. 16B—Moisture content oven.

ASTM D4643	Moisture Determination Using Microwave Oven				Designation USBR 5315
SAMPLE NUMBER 1		PROJECT **Example Computations**		FEATURE	
TESTED BY	DATE	COMPUTED BY	DATE	CHECKED BY	DATE
DISH NUMBER 36			MASS OF DISH (g) 146.30		
TIME IN OVEN (min)	TOTAL TIME IN OVEN (min)	MASS OF DISH SOIL (g)	MASS OF SOIL (g)	MASS OF WATER (g)	MOISTURE CONTENT (%)
0	0	231.62	—	—	—
3	3	217.75	71.45	13.87	19.4
1	4	216.22	69.92	15.40	22.0
1	5	215.72	69.42	15.90	22.9
1	6	215.48	69.18	16.14	23.3
1	7	215.32	69.02	16.30	23.6
1	8	215.22	68.92	16.40	23.8
1	9	215.19	68.89	16.43	23.8
1	10	215.19	68.89	16.43	23.8

Fig. 17B—Moisture content determination summary data sheet for ASTM methods.

Moisture Determination Using Direct Heat					ASTM D4959
TESTED BY	DATE	COMPUTED BY	DATE	CHECKED BY	DATE
Example Computations					

PAN NUMBER (g)	113
MASS OF PAN + WET SOIL (g)	282.82
MASS OF PAN + DRY SOIL (g)	260.40
MASS OF PAN (g)	165.95
MASS OF WATER (g)	22.42
MASS OF DRY SOIL (g)	94.45
PERCENT MOISTURE (g)	23.7

REMARKS: _____

NOTE: Correction may be needed for loss due to ignition of organic material.

Moisture Determination Using Direct Heat					ASTM D4959
TESTED BY	DATE	COMPUTED BY	DATE	CHECKED BY	DATE

PAN NUMBER	
MASS OF PAN + WET SOIL (g)	
MASS OF PAN + DRY SOIL (g)	
MASS OF PAN (g)	
MASS OF WATER (g)	
MASS OF DRY SOIL (g)	
PERCENT MOISTURE (g)	

REMARKS: _____

NOTE: Correction may be needed for loss due to ignition of organic material.

Fig. 18B—Moisture determination using direct heat.

ASTM D 4944	Determining Moisture Content of Soil Using the Calcium Carbide Method	Designation USBR 5310

PROJECT: **Example Computations** | FEATURE:

SAMPLE NUMBER: 60N | CLASSIFICATION SYMBOL: ML | INSTRUMENT NUMBER: 8225-14

CALIBRATION EQUATION: y = 1.196 x + 0.02 | DATE:

TESTED BY: | DATE: | CHECKED BY: | DATE:

SAMPLE NUMBER (1)	NOMINAL SPECIMEN SIZE (g) (2)*	DIAL GAUGE READING ON CCRD (3)	CORRECTED READING (4)**	MOISTURE CONTENT FROM CALIBRATION CURVE (%) (5)
60N-8	26	9.0	9.0	10.8
-12	26	10.5	10.5	12.6
-20	26	16.5	16.5	19.8
-24	26	17.7	17.7	21.2
-28	13 (half-size)	10.3	20.6	24.7
-30	13 (half-size)	11.3	22.6	27.0
60N-108	26	9.6	9.6	11.5
-112	26	11.4	11.4	13.7

*If the moisture content of the full specimen exceeds the limit of the gauge on the testing equipment, a half-sized specimen is used.
**If (2) = half-size specimen, (4) = (3) x 2.
If (2) = full-size specimen, (4) = (3).

Fig. 19B—Determining moisture content of soil using the calcium carbide method.

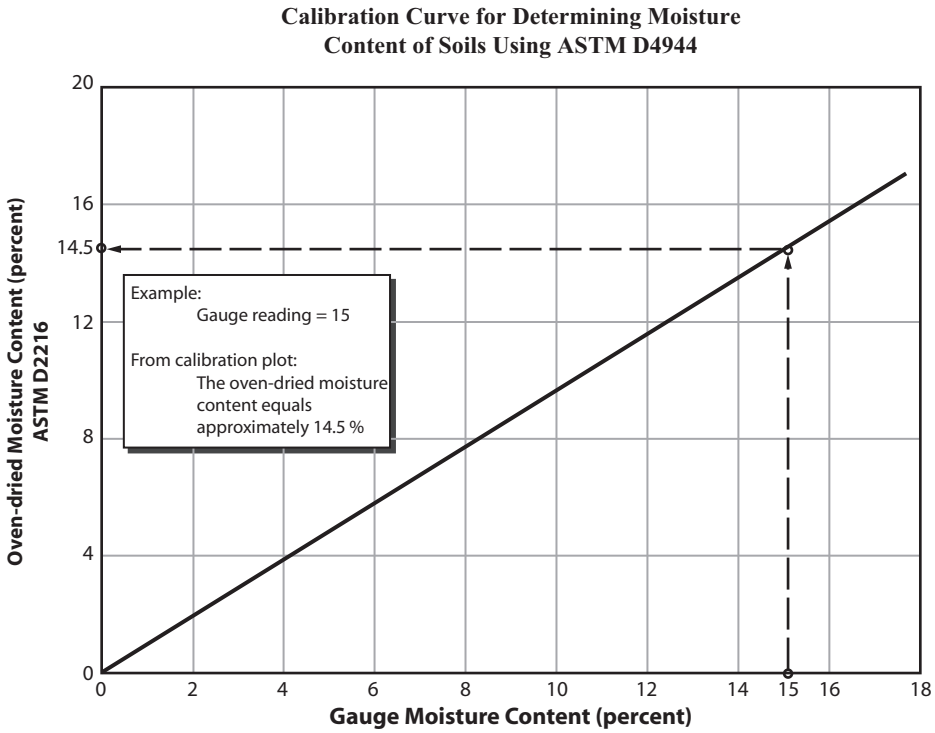


Fig. 20B—Calibration curve for determining moisture content of soils using ASTM D4944.

TEST FILL REPORT

Project Name: _____ Location: _____

Contract No. _____ Contractor: _____

Inspector: _____ Date: _____ Time: _____

Location of Test Fill: _____

Specified Lift Thickness (inches): _____ Specified Mass Density (pcf): _____ Specified Moisture Content: ____

Material:

Placing Method	Type of Fill	Unified Classification	% Passing ¾"	Maximum Particle Size (inches)

Test Fill Field Data:

Thickness of Fill (inches)	Length and Width (feet)	In-Place Dry Density of Mass (pcf)	Moisture Content of Test Fill (%)	No. of Test	Test Location

Equipment:

Type of Compaction Equipment	Operational Speed (mph)	(Number of Passes)

Remarks: _____

Signature of Inspector: _____ Date: _____

Fig. 21B—Test fill report.