Calibration of 4” Proctor Mold

Calibration of Proctor Mold

___X__Four Inch Mold _____Six Inch Mold

Mold I. D. #:_____4-1_____
Temperature of Water used for Calibration:_____82°F
Unit Weight of Water:_____lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
4574.3	5514.7	

$$\left[\begin{array}{c}\text{Volume of}\\ \text{Mold}\\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight}\\ \text{of Water}\\ \text{(lb. / cu. ft.)}\end{array}\right] \times [453.6\ \text{(grams / lb.)}]}$$

$$= \frac{(\qquad\qquad)}{(\qquad\qquad) \times (453.6)} = \_\_\_\_\_\ \text{cu. Ft.}$$

Remarks:_____
_____
_____
_____
Calibration Date:_____
Test Operator:_____
Supervisor and Date:_____
Calibration Expiration Date:_____

Calibration of Proctor Mold

___X__Four Inch Mold _____Six Inch Mold

Mold I. D. #:_____4-1_____

Temperature of Water used for Calibration:_____82°F

Unit Weight of Water:_____

Unit weight of Water
Use Table on next page to determine the Unit Weight of Water at 82° F

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Wei Wat Mol
4574.3	5514.7	

$$\left[\begin{array}{c}\text{Volume of}\\ \text{Mold}\\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight}\\ \text{of Water}\\ \text{(lb. / cu. ft.)}\end{array}\right] \times [453.6\ \text{(grams / lb.)}]}$$

$$= \frac{(\qquad\qquad)}{(\qquad\qquad) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

Remarks:_____

_____

_____

_____

Calibration Date:_____

Test Operator:_____

Supervisor and Date:_____

Calibration Expiration Date:_____

APPENDIX A - (Continued)

Temperature	Unit Weight of Water
Temp °F	**lbs/cu. Ft.**
68	62.315
69	62.308
70	62.301
71	62.293
72	62.285
73	62.277
74	62.269
75	62.261
76	62.252
77	62.243
78	62.234
79	62.225
80	62.216
81	62.206
82	62.196
83	62.186
84	62.176
85	62.166
86	62.155

Calibration of Proctor Mold

___X__Four Inch Mold _____Six Inch Mold

Mold I. D. #:_____4-1_____

Temperature of Water used for Calibration:_____82°F

Unit Weight of Water:_____62.196_____lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
4574.3	5514.7	

$$\left[\begin{array}{c}\text{Volume of}\\ \text{Mold}\\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight}\\ \text{of Water}\\ \text{(lb. / cu. ft.)}\end{array}\right] \times [453.6\ \text{(grams / lb.)}]}$$

$$= \frac{(\qquad)}{(\quad 62.196 \quad) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

Remarks:_____

_____

_____

_____

Calibration Date:_____

Test Operator:_____

Supervisor and Date:_____

Calibration Expiration Date:_____

Calibration of Proctor Mold

___X__Four Inch Mold _____Six Inch Mold

Mold I. D. #:_____4-1_____
Temperature of Water used for Calibration:_____82°F
Unit Weight of Water:_____62.196_____lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
4574.3	5514.7	940.4

Calculate: **Weight of water to Fill Mold**

5514.7 (weight of Baseplate, Mold filled with Water, and Glass Plate)
- 4574.3 (weight of Baseplate, Empty Mold, and Glass Plate)
= 940.4

$$= \frac{\left(\text{940.4}\right)}{\left(\text{62.196}\right) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

[(lb. / cu. ft.)]

Remarks:_____

Calibration Date:_____
Test Operator:_____
Supervisor and Date:_____
Calibration Expiration Date:_____

Calibration of Proctor Mold

___X__Four Inch Mold _____Six Inch Mold

Mold I. D. #:_____4-1_____

Temperature of Water used for Calibration:_____82°F

Unit Weight of Water:_____62.196_____lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
4574.3	5514.7	**940.4**

$$\left[\frac{\text{Volume of Mold}}{\text{(cu. ft.)}}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\frac{\text{Unit Weight of Water}}{\text{(lb. / cu. ft.)}}\right] \times [453.6 \text{ (grams / lb.)}]}$$

$$= \frac{(\ 940.4\ )}{(\ 62.196\ ) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

28212.1056

Remarks:_____

Calculate bottom of equation first to get it to one number

62.196 x 453.6 = 28212.1056

Calibration Date:_____

Test Operator:_____

Supervisor and Date:_____

Calibration Expiration Date:_____

Calibration of Proctor Mold

___X__Four Inch Mold _____Six Inch Mold

Mold I. D. #:_____4-1_____
Temperature of Water used for Calibration:_____82°F
Unit Weight of Water:_____62.196_____lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
4574.3	5514.7	**940.4**

$$\left[\frac{\text{Volume of Mold}}{\text{(cu. ft.)}}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\frac{\text{Unit Weight of Water}}{\text{(lb. / cu. ft.)}}\right] \times [453.6 \text{ (grams / lb.)}]}$$

$$= \frac{(\ 940.4\ )}{(\ 62.196\ ) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

28212.1056

.033333209

Divide: 940.4 ÷ 28212.1056
= .033333209

Remarks:_____

Calibration Date:_____
Test Operator:_____
Supervisor and Date:_____
Calibration Expiration Date:_____

Calibration of Proctor Mold

___X__Four Inch Mold _____Six Inch Mold

Mold I. D. #:_____4-1_____
Temperature of Water used for Calibration:_____82°F
Unit Weight of Water:_____62.196_____lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
4574.3	5514.7	**940.4**

$$\left[\frac{\text{Volume of Mold}}{\text{(cu. ft.)}}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\frac{\text{Unit Weight of Water}}{\text{(lb. / cu. ft.)}}\right] \times [453.6 \text{ (grams / lb.)}]}$$

.033333209

$$= \frac{(\ 940.4\ )}{(\ 62.196\ ) \times (453.6)} = \frac{.0333}{}\ \text{cu. Ft.}$$

28212.1056

Remarks:_____
_____
_____
_____

Round to the forth decimal place:
..033333209
= **.0333**

Calibration Date:_____
Test Operator:_____
Supervisor and Date:_____
Calibration Expiration Date:_____

Calibration of 6” Proctor Mold

Calibration of Proctor Mold

_____Four Inch Mold ___X__Six Inch Mold

Mold I. D. #: 11

Temperature of Water used for Calibration: 78

Unit Weight of Water: _____ lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
7064.5	9180.8	

$$\left[\begin{array}{c}\text{Volume of}\\ \text{Mold}\\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight}\\ \text{of Water}\\ \text{(lb. / cu. ft.)}\end{array}\right] \times \left[453.6\ \text{(grams / lb.)}\right]}$$

$$= \frac{(\qquad\qquad)}{(\qquad\qquad) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

Remarks: _____

_____

_____

_____

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

Calibration of Proctor Mold

_____Four Inch Mold ___X__Six Inch Mold

Mold I. D. #: 11

Temperature of Water used for Calibration: 78 ° F

Unit Weight of Water: _____ lb. / cu. Ft.

Unit weight of Water
Use Table on next page to determine the Unit Weight of Water at 78° F

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	V V M
7064.5	9180.8	

$$\left[\begin{array}{c}\text{Volume of}\\ \text{Mold}\\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight}\\ \text{of Water}\\ \text{(lb. / cu. ft.)}\end{array}\right] \times [453.6\ \text{(grams / lb.)}]}$$

$$= \frac{(\qquad\qquad)}{(\qquad\qquad) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

Remarks: _____

_____

_____

_____

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

APPENDIX A - (Continued)

Temperature	Unit Weight of Water
Temp °F	**lbs/cu. Ft.**
68	62.315
69	62.308
70	62.301
71	62.293
72	62.285
73	62.277
74	62.269
75	62.261
76	62.252
77	62.243
78	62.234
79	62.225
80	62.216
81	62.206
82	62.196
83	62.186
84	62.176
85	62.166
86	62.155

Calibration of Proctor Mold

_____Four Inch Mold ___X__Six Inch Mold

Mold I. D. #: 11

Temperature of Water used for Calibration: 78 ° F

Unit Weight of Water: 62.234 lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
7064.5	9180.8	

$$\left[\begin{array}{c}\text{Volume of}\\ \text{Mold}\\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight}\\ \text{of Water}\\ \text{(lb. / cu. ft.)}\end{array}\right] \times [453.6\ \text{(grams / lb.)}]}$$

$$= \frac{(\quad)}{(\ 62.234\ ) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

Remarks: _____

_____

_____

_____

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

Calibration of Proctor Mold

_____Four Inch Mold ___X__Six Inch Mold

Mold I. D. #: 11

Temperature of Water used for Calibration: 78 ° F

Unit Weight of Water: 62.234 lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
7064.5	9180.8	2116.3

Calculate: **Weight of water to Fill Mold**

9180.8 (weight of Baseplate, Mold filled with Water, and Glass Plate)

- 7064.5 (weight of Baseplate, Empty Mold, and Glass Plate)

= 2116.3

$$= \frac{(\ 2116.3\ )}{(\ 62.234\ ) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

[(lb. / cu. ft.)]

Remarks: _____

_____

_____

_____

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

Calibration of Proctor Mold

_____Four Inch Mold ___X__Six Inch Mold

Mold I. D. #: 11

Temperature of Water used for Calibration: 78 ° F

Unit Weight of Water: 62.234 lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
7064.5	9180.8	2116.3

$$\left[\frac{\text{Volume of Mold}}{\text{(cu. ft.)}}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\frac{\text{Unit Weight of Water}}{\text{(lb. / cu. ft.)}}\right] \times [453.6\ \text{(grams / lb.)}]}$$

$$= \frac{(\ 2116.3\ )}{(\ 62.234\ ) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

28229.3424

Remarks: Calculate bottom of equation first to get it to one number
62.234 x 453.6 = 28229.3424

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

Calibration of Proctor Mold

_____Four Inch Mold ___X__Six Inch Mold

Mold I. D. #: 11

Temperature of Water used for Calibration: 78 ° F

Unit Weight of Water: 62.234 lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
7064.5	9180.8	**2116.3**

$$\left[\frac{\text{Volume of Mold}}{\text{(cu. ft.)}}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\frac{\text{Unit Weight of Water}}{\text{(lb. / cu. ft.)}}\right] \times [453.6\ \text{(grams / lb.)}]}$$

$$= \frac{(\ 2116.3\ )}{(\ 62.234\ ) \times (453.6)} = \_\_\_\_\_\ \text{cu. Ft.}$$

.074968094

28229.3424

Remarks: _____

Divide: 2116.3 ÷ 28229.3424 = .074968094

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

Calibration of Proctor Mold

_____Four Inch Mold ___X__Six Inch Mold

Mold I. D. #: 11

Temperature of Water used for Calibration: 78 ° F

Unit Weight of Water: 62.234 lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
7064.5	9180.8	2116.3

$$\left[\frac{\text{Volume of Mold}}{\text{(cu. ft.)}}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\text{Unit Weight of Water (lb. / cu. ft.)}\right] \times \left[453.6\ \text{(grams / lb.)}\right]}$$

.074968094

$$= \frac{(\ 2116.3\ )}{(\ 62.234\ ) \times (453.6)} = \underline{\ .0750\ } \text{ cu. Ft.}$$

28229.3424

Remarks: _____

Round to the forth decimal place

.074968094

= .0750

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

Calculation of Standard Sand and Sand Cone Apparatus

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: _____

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	
2	6631	9627	
3	6631	9630	

Average Weight of Sand to Fill Mold =_____grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

$$= \frac{}{(453.6) \times (\quad)} = \quad = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	
2	6031	4512	
3	6027	4508	

Average Weight of Sand to Fill Funnel and Baseplate =_____grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{}{(453.6) \times (\quad)} = \quad = \text{ft.}^3$$

Remarks:_____ $I = D_s \times V_{fb}$ _____

_____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: _____

Identification of Sand: _____

Volume of Mold used in calibration
a 6" mold is used in the calibration of the sand.
Go back to the previous form where the volume of the 6" mold was calculated and bring that volume over to this form.

2	6631	9627	
3	6631	9630	

Average Weight of Sand to Fill Mold =_____grams

$$\text{Density of Sand, } D_s = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

$$= \frac{\qquad}{(453.6) \times (\qquad)} = \qquad = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	
2	6031	4512	
3	6027	4508	

Average Weight of Sand to Fill Funnel and Baseplate =_____grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{\qquad}{(453.6) \times (\qquad)} = \qquad = \text{ft.}^3$$

Remarks:_____ $I = D_s \times V_{fb}$ _____

_____

Supervisor and Date: _____

Calibration Expiration Date: _____

Calibration of Proctor Mold

Four Inch Mold

✔ Six Inch

Mold I. D. #: 11

Temperature of Water used for Calibration: 78 °F

Unit Weight of Water: 62.234 lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
7064.5	9180.8	2116.3

$$\left[\begin{array}{c}\text{Volume of} \\ \text{Mold} \\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight} \\ \text{of Water} \\ \text{(lb. / cu. ft.)}\end{array}\right] \times [453.6\ \text{(grams / lb.)}]}$$

.074968094

$$= \frac{(\ 2116.3\ )}{(\ 62.234\ ) \times (453.6)} = \underline{\ .0750\ }\ \text{lb./ cu. Ft.}$$

28229.3424

Remarks: _____

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: _____ .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	
2	6631	9627	
3	6631	9630	

Average Weight of Sand to Fill Mold =_____grams

$$\text{Density of Sand, } D_s = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

$$= \frac{\qquad}{(453.6) \times (\quad .0750 \quad)} = \qquad = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	
2	6031	4512	
3	6027	4508	

Average Weight of Sand to Fill Funnel and Baseplate =_____grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{\qquad}{(453.6) \times (\qquad)} = \qquad = \text{ft.}^3$$

Remarks:_____ $I = D_s \times V_{fb}$ _____

_____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	
3	6631	9630	

Average Weight of Sand to Fill Mold = grams

Three trials are run to determine the **Wt. of Sand to Fill Mold**
For each trial, the weight of sand to fill the mold must be determined.
Trial 1 =
9629
- 6631
= 2998

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	
2	6031	4512	
3	6027	4508	

Average Weight of Sand to Fill Funnel and Baseplate =_____grams

Volume of Funnel and Baseplate, $V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$

$= \frac{\quad}{(453.6) \times (\quad)} = \quad = \quad \text{ft.}^3$

Remarks:_____ $I = D_s \times V_{fb}$ _____

_____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	

Average Weight of Sand to Fill Mold = _____ grams

Three trials are run.
For each trial, the weight of sand to fill the mold must be determined.

Trial 1 = 9629 − 6631 = 2998

Trial 2 = 9627 − 6631 = 2996

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	
2	6031	4512	
3	6027	4508	

Average Weight of Sand to Fill Funnel and Baseplate =_____grams

Volume of Funnel and Baseplate, $V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$

$= \frac{\quad}{(453.6) \times (\quad)} = \quad = \quad \text{ft.}^3$

Remarks:_____ $I = D_s \times V_{fb}$ _____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = _____ grams

Three trials are run.
For each trial, the weight of sand to fill the mold must be determined.

Trial 1 =	Trial 2 =	Trial 3 =
9629	9627	9630
- 6631	- 6631	- 6631
= 2998	= 2996	= 2999

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	
2	6031	4512	
3	6027	4508	

Average Weight of Sand to Fill Funnel and Baseplate =_____grams

Volume of Funnel and Baseplate, $V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$

$= \frac{\quad}{(453.6) \times (\quad)} = \quad = \quad \text{ft.}^3$

Remarks:_____ $I = D_s \times V_{fb}$ _____

_____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration: _____ Test Operator: _____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = _____ grams

$$\text{Density of Sand, } D_s = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

$$= \frac{\qquad}{(453.6) \times (\quad .0750 \quad)} = \qquad = \text{lb./ft.}^3$$

Trial No.	App	Wt. of Sand to Fill Funnel and Baseplate (grams)
1		
2		
3		

Average Weight of Sand to Fill Mold:
2998
+ 2996
+ 2999
= 8993 ÷ 3 = 2997.666667

Avera _____ grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{\qquad}{(453.6) \times (\qquad)} = \qquad = \text{ft.}^3$$

Remarks: _____ $I = D_s \times V_{fb}$ _____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration: _____ Test Operator: _____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: _____ .0750 _____

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams/lb.}) \times (\text{Volume of Mold})}$$

$$= \frac{2998}{(453.6) \times (\quad .0750 \quad)} = \text{_____} = \text{_____ lb./ft.}^3$$

Trial No.	App			Wt. of Sand to Fill Funnel and Baseplate (grams)
1				
2				
3				

Average Weight of Sand to Fill Mold :
2998
+ 2996
+ 2999
= 8993 ÷ 3 = 2997.666667
Rounded to the nearest whole gram
2997.666667 = 2998

Avera = _____ grams

Volume of Fun nd to Fill Funnel and Baseplate
lb.) × (Density of Sand)

$$= \frac{\quad}{(453.6) \times (\quad)} = \text{_____} = \text{_____ ft.}^3$$

Remarks: _____ $I = D_s \times V_{fb}$ _____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: _____ .0750 _____

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{}{34.02} = \text{lb./ft.}^3$$

Trial No.	A	el
1		
2		
3		

Calculate the bottom of the equation first to get it to one number
453.6 x .0750 = 34.02

Average Weight of Sand to Fill Funnel and Baseplate = _____ grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{}{(453.6) \times (\quad)} = \frac{}{} = \text{ft.}^3$$

Remarks: _____ $I = D_s \times V_{fb}$ _____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{\quad}{\quad} = 88.12463257 \text{ lb./ft.}^3$$

34.02

Trial No.	A	Wt. of Sand to Fill Funnel and Baseplate (grams)
1		
2		
3		

Divide: 2998 ÷ 34.02 = 88.12463257

Average Weight of Sand to Fill Funnel and Baseplate = _____ grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{\quad}{(453.6) \times (\quad)} = \frac{\quad}{\quad} = \text{ft.}^3$$

Remarks:_____ $I = D_s \times V_{fb}$ _____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_s = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	A	nd to Fill Funnel eplate (grams)
1		
2		
3		

Round to one decimal place = 88.12~~463257~~ = 88.1

Average Weight of Sand to Fill Funnel and Baseplate = _____ grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{\quad}{(453.6) \times (\quad)} = \quad = \text{ft.}^3$$

Remarks: _____ $I = D_s \times V_{fb}$ _____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	1521
2	6031	4512	
3	6027	4508	

Average Weight of Sand to Fill Funnel and Baseplate = _____ grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

Three trials are run to determine the **Wt. of Sand to Fill Funnel and Baseplate**

Trial 1
6029
- 4508
= 1521

Rema

Supe

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: _____ .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	1521
2	6031	4512	1519
3	6027	4508	

Average Weight of Sand to Fill Funnel and Baseplate = _____ grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

Three trials are run to determine the **Wt. of Sand to Fill Funnel and Baseplate**

Trial 1	Trial 2
6029	6031
- 4508	- 4512
= 1521	= 1519

Rema

Supe

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration: _____ Test Operator: _____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	1521
2	6031	4512	1519
3	6027	4508	1519

Average Weight of Sand to Fill Funnel and Baseplate = _____ grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

Three trials are run to determine the **Wt. of Sand to Fill Funnel and Baseplate**

Trial 1	Trial 2	Trial 3
6029	6031	6027
- 4508	- 4512	- 4508
= 1521	= 1519	= 1519

Rema

Supe

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration: _____ Test Operator: _____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	1521
2	6031	4512	1519
3	6027	4508	1519

Average Weight of Sand to Fill Funnel and Baseplate = _____ grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \text{ft.}^3$$

Average Weight of Sand to Fill Funnel and Baseplate

1521
+ 1519
+ 1519
= 4559 ÷ 3 = 1519.666667

Rema _____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration: _____ Test Operator: _____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	1521
2	6031	4512	1519
3	6027	4508	1519

Average Weight of Sand to Fill Funnel and Baseplate = 1520 grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{1520}{(453.6) \times (\quad)} = \quad = \text{ft.}^3$$

Remarl _____

Superv _____

Calibra _____

Average Weight of Sand to Fill Funnel and Baseplate

1521
+ 1519
+ 1519
= 4559 ÷ 3 = 1519.666667

Rounded to nearest whole gram = 1519.666667 = 1520

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_s = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	1521
2	6031	4512	1519
3	6027	4508	1519

Average Weight of Sand to Fill Funnel and Baseplate = 1520 grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{1520}{(453.6) \times (88.1)} = \text{ft.}^3$$

Remarks:_____ $I = D_s \times V_{fb}$ _____

_____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	1521
2	6031	4512	1519
3	6027	4508	1519

Average Weight of Sand to Fill Funnel and Baseplate = 1520 grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{1520}{(453.6) \times (88.1)} = \frac{\quad}{39962.16} = \text{ft.}^3$$

Rema_____

Supe_____

Calib_____

Calculate bottom of equation first to get it to one number

453.6 x 88.1 = 39962.16

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	1521
2	6031	4512	1519
3	6027	4508	1519

Average Weight of Sand to Fill Funnel and Baseplate = 1520 grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

.038035982

$$= \frac{1520}{(453.6) \times (88.1)} = \frac{}{39962.16} = \text{ft.}^3$$

Remarks:_____

Divide: 1520 ÷ 39962.16 = .038035982

Supervisor and Dat_____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	2998
2	6631	9627	2996
3	6631	9630	2999

Average Weight of Sand to Fill Mold = 2998 grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	1521
2	6031	4512	1519
3	6027	4508	1519

Average Weight of Sand to Fill Funnel and Baseplate = 1520 grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

.038035982

$$= \frac{1520}{(453.6) \times (88.1)} = \frac{.0380}{39962.16} = \text{ft.}^3$$

Remarks:_____

Supervisor and Dat

Calibration Expirati

Divide: 1520 ÷ 39962.16 = .038035982

Round to forth decimal place

= .038035982 = .0380

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: .0750

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	**2998**
2	6631	9627	**2996**
3	6631	9630	**2999**

Average Weight of Sand to Fill Mold = **2998** grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

88.12463257

$$= \frac{2998}{(453.6) \times (.0750)} = \frac{88.1}{34.02} = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	**1521**
2	6031	4512	**1519**
3	6027	4508	**1519**

Average Weight of Sand to Fill Funnel and Baseplate = **1520** grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

.038035982

$$= \frac{1520}{(453.6) \times (88.1)} = \frac{.0380}{39962.16} = \text{ft.}^3$$

Remarks: $I = D_s \times V_{fb}$

Supervisor and Date: _____

Calibration Expiration Date: _____

I = 88.1 x .0380 = 3.3478
Rounded to second decimal place = 3.3478 = **3.35**

I - is used on the Sand Cone Density Form (*next form*)
The Density of the sand (**88.1**) is also used on the Sand Cone Density Form as - **K**

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER | ORG NUMBER | MATL (AB) | TYPE | PURPOSE | TEST LAB | SIZE | SIZE %

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

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

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

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	907	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	363	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$		%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D\ (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	1389	LB.
c. WEIGHT OF MOLD	947	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)		LB.
e. VOLUME OF MOLD		CF
f. WET DENSITY (d / e)		PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	&	
Q. OPTIMUM MOISTURE		%
R. MAXIMUM DRY DENSITY		PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

Sand Cone Density Calculation

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

SAMPLED FROM	LIFT NO.	RDWY	STATION
			+

IF MILEPOST, INPUT DECIMAL

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	1 0.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	1 5.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$		%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D\ (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)		LB.
e. VOLUME OF MOLD		CF
f. WET DENSITY (d / e)		PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	&	
Q. OPTIMUM MOISTURE		%
R. MAXIMUM DRY DENSITY		PCF

This is the one-point proctor section of the form. A Method A one-point proctor was performed.

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

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

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	1.03	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100 + E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$		%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D \quad (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)		LB.
e. VOLUME OF MOLD		CF
f. WET DENSITY (d / e)		PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	&	
Q. OPTIMUM MOISTURE		%
R. MAXIMUM DRY DENSITY		PCF

For e. Volume of Mold go back to the form where the Volume of the 4" Mold was calculated and bring that Volume over to this form.

$$\frac{\quad}{100}$$

Calibration of Proctor Mold

✔ Four Inch Mold Six Inch Mold

Mold I. D. #: 19

Temperature of Water used for Calibration: 82 °F

Unit Weight of Water: 62.196 lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
4574.3	5514.7	940.4

$$\left[\begin{array}{c}\text{Volume of} \\ \text{Mold} \\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight} \\ \text{of Water} \\ \text{(lb. / cu. ft.)}\end{array}\right] \times [453.6 \text{ (grams / lb.)}]}$$

.033333209

$$= \frac{(940.4)}{(62.196) \times (453.6)} = \frac{.0333}{28212.1056} \text{ lb./ cu. Ft.}$$

Remarks: _____

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

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

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

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

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

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	1.03	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$		%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D \quad (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)		LB.
e. VOLUME OF MOLD	0.333	C
f. WET DENSITY (d / e)		PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	&	
Q. OPTIMUM MOISTURE		%
R. MAXIMUM DRY DENSITY		PCF

For e. Volume of Mold go back to the form where the Volume of the 4" Mold was calculated and bring that Volume over to this form.

$$E = \frac{\quad}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

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

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	907	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	363	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$		%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D\ (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	4.42	LB.
e. VOLUME OF MOLD	0.333	CF
f. WET DENSITY (d / e)		PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	&	
Q. OPTIMUM MOISTURE		%
R. MAXIMUM DRY DENSITY		PCF

This is the one-point proctor section of the form. A Method A one-point proctor was performed.

d. = b – c 13.89 – 9.47 = 4.42

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PURPOSE	TEST LAB	SIZE	SIZE %
		AB					

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	907	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	363	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100 + E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	
Q. OPTIMUM MOISTURE	11.6	
R. MAXIMUM DRY DENSITY	122.7	

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$		%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D\ (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	1389	LB.
c. WEIGHT OF MOLD	947	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	442	LB.
e. VOLUME OF MOLD	0.0333	CF
f. WET DENSITY (d / e)	132.7	PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	&	
Q. OPTIMUM MOISTURE		%
R. MAXIMUM DRY DENSITY		PCF

f. = d ÷ e 4.42 ÷ .0333 = 132.7327327

Rounded to one decimal place = 132.7327327 = 132.7

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	1 0.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100 + E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)		
O. SPECIFIC GRAVITY OF RETAINED #4	2.6	
P. ABSORPTION OF RETAINED #4	0.	
Q. OPTIMUM MOISTURE	1	
R. MAXIMUM DRY DENSITY	12	

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$ %

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D\ (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	4.42	LB.
e. VOLUME OF MOLD	0.333	CF
f. WET DENSITY (d / e)	132.7	PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	&	
Q. OPTIMUM MOISTURE		%
R. MAXIMUM DRY DENSITY		PCF

Now the **Wet Density** and the **Moisture Content** are plotted on the Family of Curves (*next form*)

$$S = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

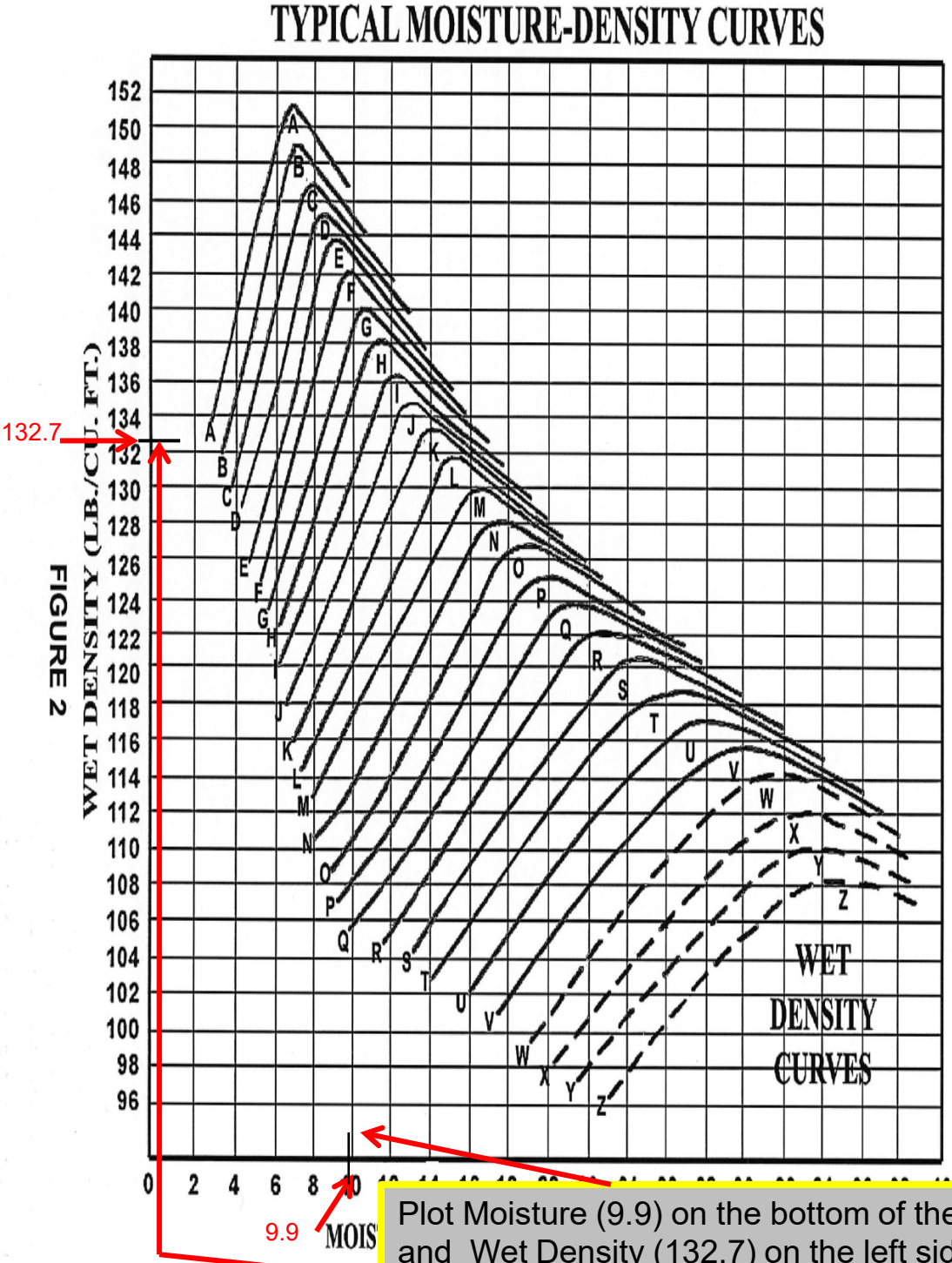


FIGURE 2

Curve	Max Dry Wt. lbs/cu.ft.	Optimum Moisure
A	141.8	6.6
B	139.1	7.2
C	136.3	7.9
D	134.1	8.5
E	132.	9.0
F	129.3	9.7
G	126.6	10.5
H	124.2	11.2
I	121.7	11.9
J	119.3	12.7
K	117.0	13.5
L	114.6	14.6
M	112.0	15.8
N	109.6	16.9
O	107.1	18.1
P	104.7	19.2
Q	102.4	20.3
R	99.9	21.5
S	97.4	22.7
T	94.6	24.4
U	92.1	25.8
V	89.9	27.4
W	87.5	29.5
X	85.0	30.5
Y	83.0	31.5

Plot Moisture (9.9) on the bottom of the form and Wet Density (132.7) on the left side of the form

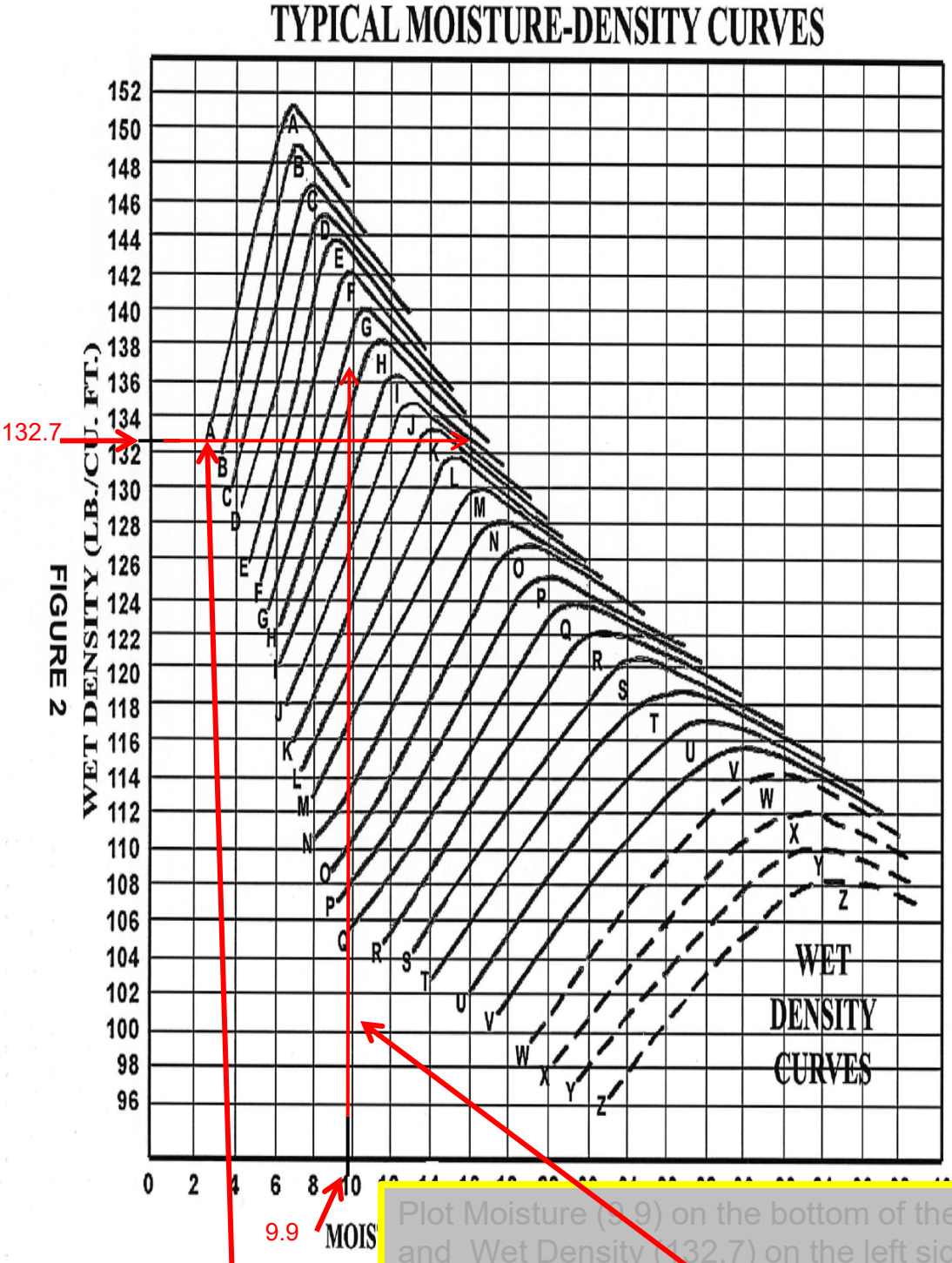


FIGURE 2

Curve	Max Dry Wt. lbs/cu.ft.	Optimum Moisure
A	141.8	6.6
B	139.1	7.2
C	136.3	7.9
D	134.1	8.5
E	132.	9.0
F	129.3	9.7
G	126.6	10.5
H	124.2	11.2
I	121.7	11.9
J	119.3	12.7
K	117.0	13.5
L	114.6	14.6
M	112.0	15.8
N	109.6	16.9
O	107.1	18.1
P	104.7	19.2
Q	102.4	20.3
R	99.9	21.5
S	97.4	22.7
T	94.6	24.4
U	92.1	25.8
V	89.9	27.4
W	87.5	29.5
X	85.0	30.5

Plot Moisture (9.9) on the bottom of the form
and Wet Density (132.7) on the left side of the form
Draw a straight line up for the moisture
and a straight line across for the wet density

TYPICAL MOISTURE-DENSITY CURVES

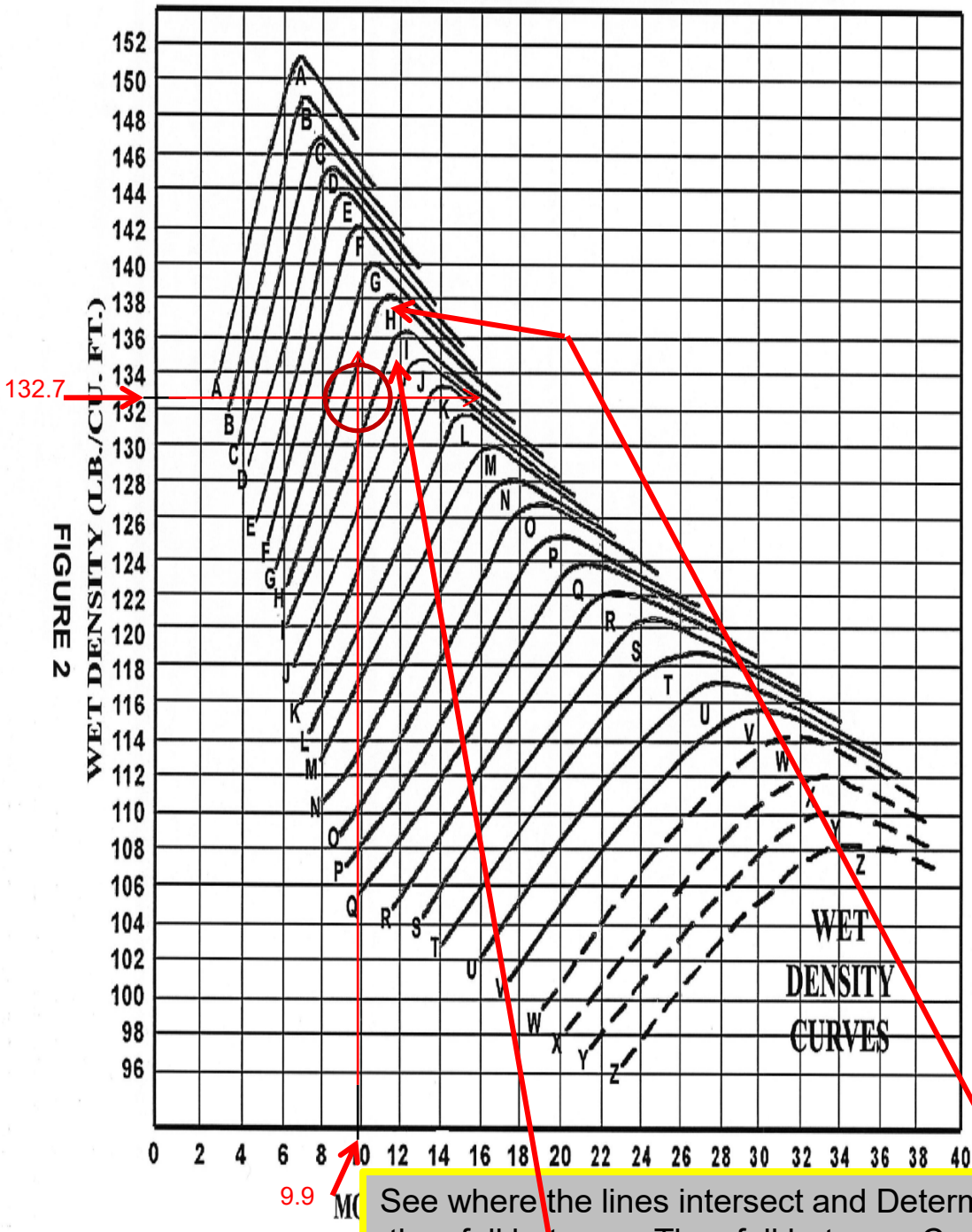


FIGURE 2

Curve	Max Dry Wt. lbs/cu.ft.	Optimum Moisure
A	141.8	6.6
B	139.1	7.2
C	136.3	7.9
D	134.1	8.5
E	132.	9.0
F	129.3	9.7
G	126.6	10.5
H	124.2	11.2
I	121.7	11.9
J	119.3	12.7
K	117.0	13.5
L	114.6	14.6
M	112.0	15.8
N	109.6	16.9
O	107.1	18.1
P	104.7	19.2
Q	102.4	20.3
R	99.9	21.5
S	97.4	22.7
T	94.6	24.4
U	92.1	25.8
V	89.9	27.4
W	87.5	29.5
X	85.0	30.5
Y	83.0	31.5

See where the lines intersect and Determine which curves they fall between. They fall between Curve H on the top and Curve I on the bottom.

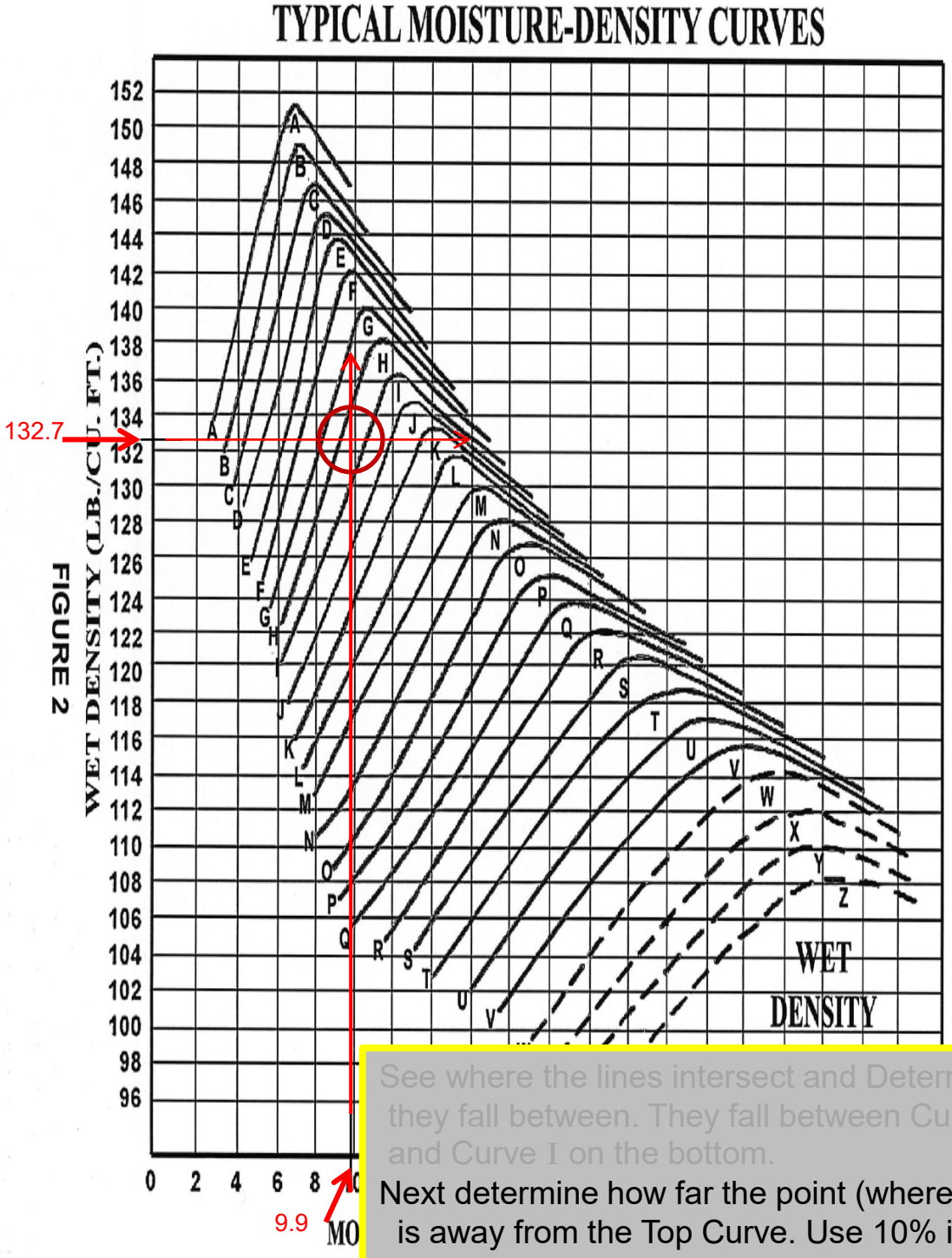


FIGURE 2

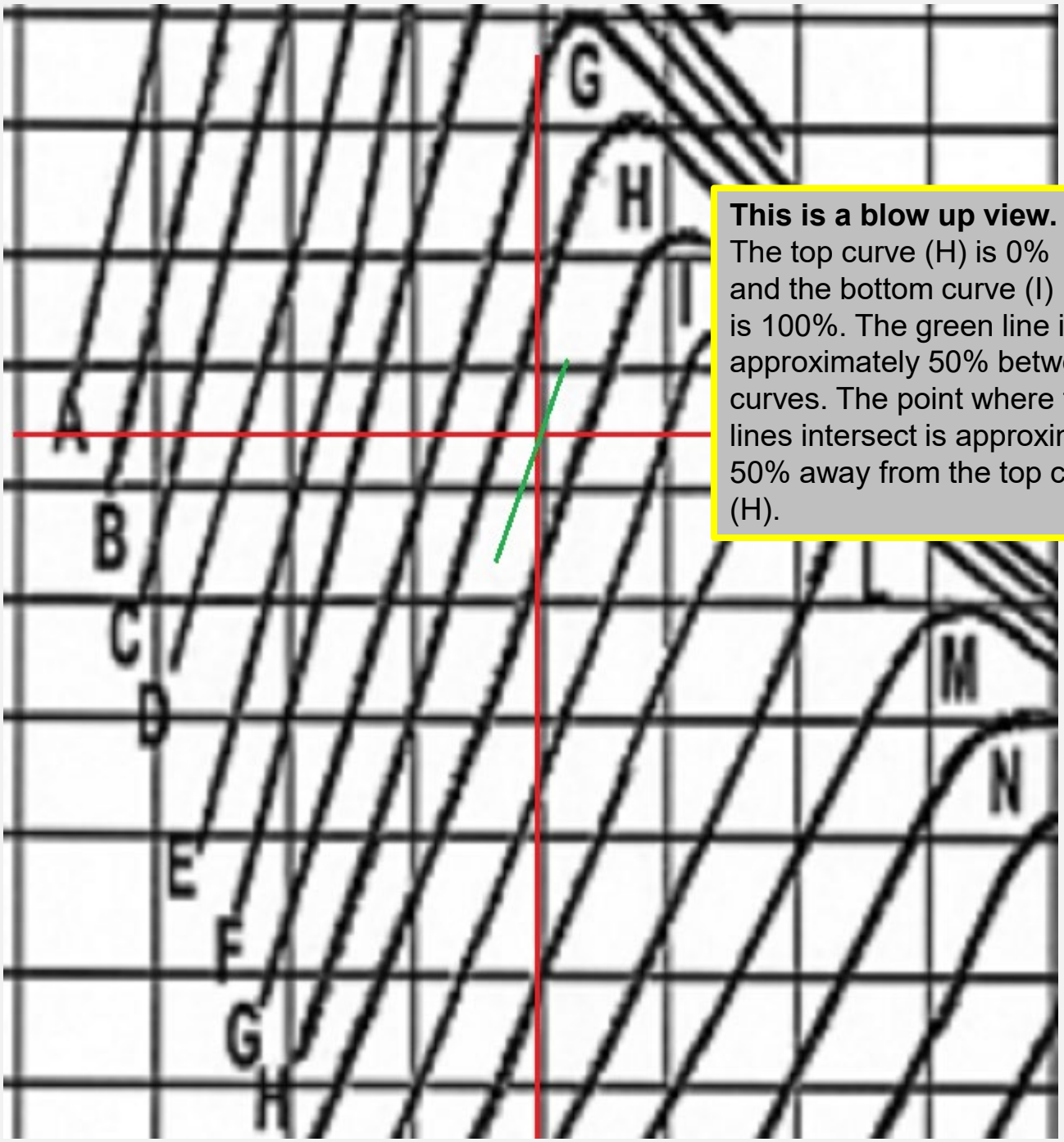
Curve	Max Dry Wt. lbs/cu.ft.	Optimum Moisure
A	141.8	6.6
B	139.1	7.2
C	136.3	7.9
D	134.1	8.5
E	132.	9.0
F	129.3	9.7
G	126.6	10.5
H	124.2	11.2
I	121.7	11.9
J	119.3	12.7
K	117.0	13.5
L	114.6	14.6
M	112.0	15.8
N	109.6	16.9
O	107.1	18.1
P	104.7	19.2
Q	102.4	20.3
R	99.9	21.5
S	97.4	22.7
T	94.6	24.4
U	92.1	25.8

See where the lines intersect and Determine which curves they fall between. They fall between Curve H on the top and Curve I on the bottom.

Next determine how far the point (where the lines intersect) is away from the Top Curve. Use 10% increments.

The point (where the lines intersect) is approximately 50% away from Curve H.

(some variation in the percent away from the top curve is allowable. If you determine your point is 40% or 60% then that would be acceptable)



This is a blow up view.
The top curve (H) is 0% and the bottom curve (I) is 100%. The green line is approximately 50% between the curves. The point where the lines intersect is approximately 50% away from the top curve (H).

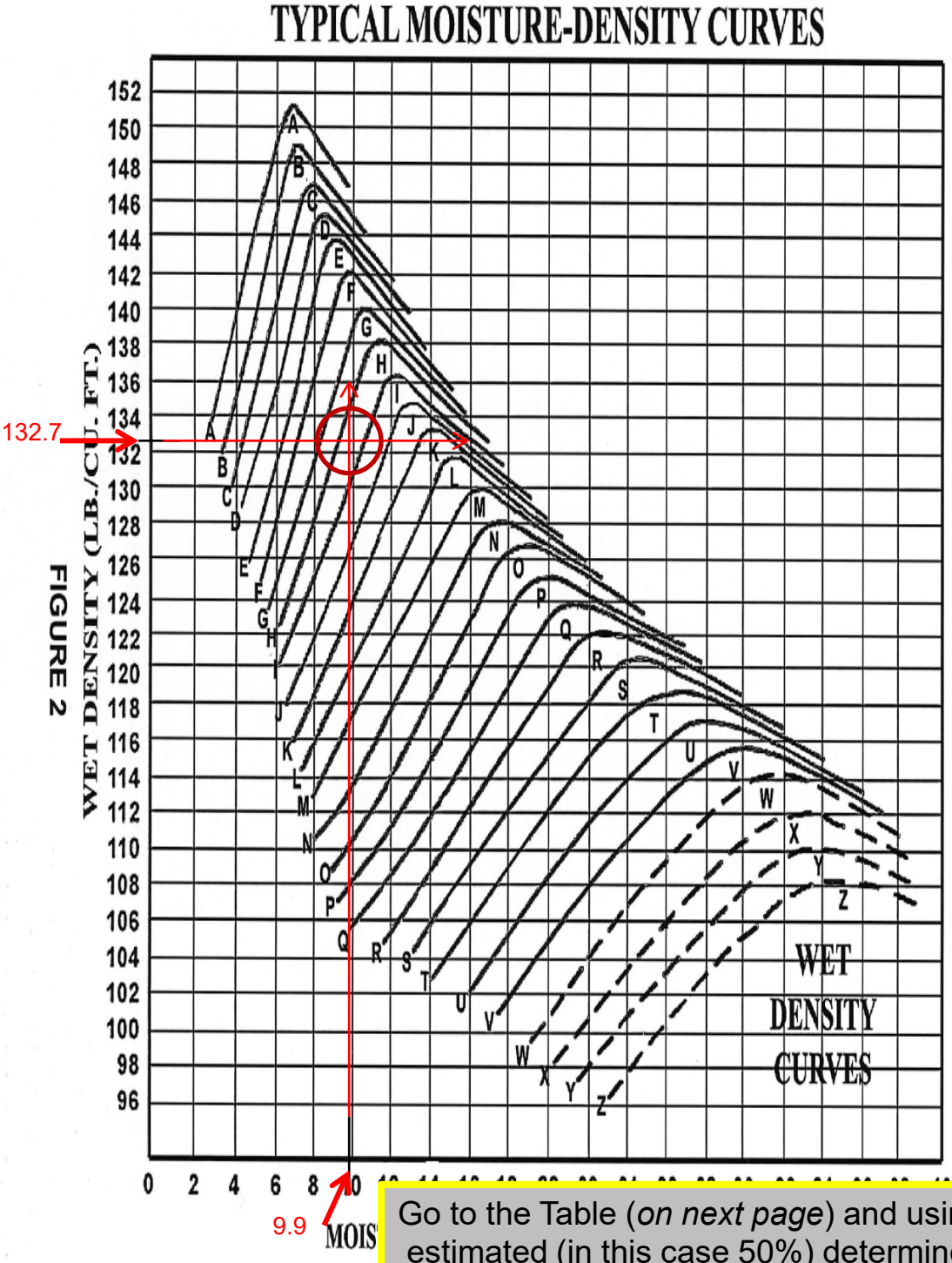


FIGURE 2

Curve	Max Dry Wt. lbs/cu.ft.	Optimum Moisure
A	141.8	6.6
B	139.1	7.2
C	136.3	7.9
D	134.1	8.5
E	132.	9.0
F	129.3	9.7
G	126.6	10.5
H	124.2	11.2
I	121.7	11.9
J	119.3	12.7
K	117.0	13.5
L	114.6	14.6
M	112.0	15.8
N	109.6	16.9
O	107.1	18.1
P	104.7	19.2
Q	102.4	20.3
R	99.9	21.5
S	97.4	22.7
T	94.6	24.4
U	92.1	25.8
V	89.9	27.4
W	87.5	29.5
X	85.0	30.5
Y	83.0	31.5

Go to the Table (*on next page*) and using the percentage estimated (in this case 50%) determine the Max Dry Density and the Optimum Moisture.

A	141.8	6.6	F	129.3	9.7	K	117.0	13.5	P	104.7	19.2	U	92.1	25.8
10%	141.5	6.7	10%	129.0	9.8	10%	116.8	13.6	10%	104.5	19.3	10%	91.9	26.0
20%	141.3	6.7	20%	128.8	9.9	20%	116.5	13.7	20%	104.2	19.4	20%	91.7	26.1
30%	141.0	6.8	30%	128.5	9.9	30%	116.3	13.8	30%	104.0	19.5	30%	91.4	26.3
40%	140.7	6.8	40%	128.2	10.0	40%	116.0	13.9	40%	103.8	19.6	40%	91.2	26.4
50%	140.5	6.9	50%	128.0	10.1	50%	115.8	14.1	50%	103.6	19.8	50%	91.0	26.6
60%	140.2	7.0	60%	127.7	10.2	60%	115.6	14.2	60%	103.3	19.9	60%	90.8	26.8
70%	139.9	7.0	70%	127.4	10.3	70%	115.3	14.3	70%	103.1	20.0	70%	90.6	26.9
80%	139.6	7.1	80%	127.1	10.3	80%	115.1	14.4	80%	102.9	20.1	80%	90.3	27.1
90%	139.4	7.1	90%	126.9	10.4	90%	114.8	14.5	90%	102.6	20.2	90%	90.1	27.2
B	139.1	7.2	G	126.6	10.5	L	114.6	14.6	Q	102.4	20.3	V	89.9	27.4
10%	138.8	7.3	10%	126.4	10.6	10%	114.3	14.7	10%	102.2	20.4	10%	89.7	27.6
20%	138.5	7.3	20%	126.1	10.6	20%	114.1	14.8	20%	101.9	20.5	20%	89.4	27.8
30%	138.3	7.4	30%	125.9	10.7	30%	113.8	15.0	30%	101.7	20.7	30%	89.2	28.0
40%	138.0	7.5	40%	125.6	10.8	40%	113.6	15.1	40%	101.4	20.8	40%	88.9	28.2
50%	137.7	7.6	50%	125.4	10.9	50%	113.3	15.2	50%	101.2	20.9	50%	88.7	28.5
60%	137.4	7.6	60%	125.2	10.9	60%	113.0	15.3	60%	100.9	21.0	60%	88.5	28.7
70%	137.1	7.7	70%	124.9	11.0	70%	112.8	15.4	70%	100.7	21.1	70%	88.2	28.9
80%	136.9	7.8	80%	124.7	11.1	80%	112.5	15.6	80%	100.4	21.3	80%	88.0	29.1
90%	136.6	7.8	90%	124.4	11.1	90%	112.3	15.7	90%	100.2	21.4	90%	87.7	29.3
C	136.4	7.9	H	124.2	11.2	M	112.0	15.8	R	99.9	21.5	W	87.5	29.5
10%	136.1	8.0	10%	124.0	11.3	10%	111.8	15.9	10%	99.7	21.6	10%	87.3	29.6
20%	135.9	8.0	20%	123.7	11.3	20%	111.5	16.0	20%	99.4	21.7	20%	87.0	29.7
30%	135.6	8.1	30%	123.5	11.4	30%								
40%	135.4	8.1	40%	123.2	11.5	40%								
50%			50%	123.0	11.6	50%								
60%	135.0	8.3	60%	122.7	11.6	60%								
70%	134.8	8.3	70%	122.5	11.7	70%								
80%	134.5	8.4	80%	122.2	11.8	80%								
90%	134.3	8.4	90%	122.0	11.8	90%								
D	134.1	8.5	I	121.7	11.9	N								
10%	133.9	8.6	10%	121.5	12.0	10%								
20%	133.7	8.6	20%	121.2	12.1	20%								
30%	133.5	8.7	30%	121.0	12.1	30%								
40%	133.3	8.7	40%	120.7	12.2	40%								
50%	133.1	8.8	50%	120.5	12.3	50%								
60%	132.8	8.8	60%	120.3	12.4	60%								
70%	132.6	8.9	70%	120.0	12.5	70%								
80%	132.4	8.9	80%	119.8	12.5	80%								
90%	132.2	9.0	90%	119.5	12.6	90%	107.4	18.0	90%	94.9	24.2	90%	83.2	31.4
E	132.0	9.0	J	119.3	12.7	O	107.1	18.1	T	94.6	24.4	Y	83.0	31.5
10%	131.7	9.1	10%	119.1	12.8	10%	106.9	18.2	10%	94.4	24.5	10%	82.8	31.6
20%	131.5	9.1	20%	118.8	12.9	20%	106.6	18.3	20%	94.1	24.7	20%	82.6	31.7
30%	131.2	9.2	30%	118.6	12.9	30%	106.4	18.4	30%	93.9	24.8	30%	82.4	31.8
40%	130.9	9.3	40%	118.4	13.0	40%	106.1	18.5	40%	93.6	25.0	40%	82.2	31.9
50%	130.7	9.4	50%	118.2	13.1	50%	105.9	18.7	50%	93.4	25.1	50%	82.1	32.0
60%	130.4	9.4	60%	117.9	13.2	60%	105.7	18.8	60%	93.1	25.2	60%	81.9	32.1
70%	130.1	9.5	70%	117.7	13.3	70%	105.4	18.9	70%	92.9	25.4	70%	81.7	32.2
80%	129.8	9.6	80%	117.5	13.3	80%	105.2	19.0	80%	92.6	25.5	80%	81.5	32.3
90%	129.6	9.6	90%	117.2	13.4	90%	104.9	19.1	90%	92.4	25.7	90%	81.3	32.4
F	129.3	9.7	K	117.0	13.5	P	104.7	19.2	U	92.1	25.8	Z	81.1	32.5

The point fell between Curves H & I

The estimated percentage away from the top curve (H) is 50%.

This gives a Maximum Dry Density of **123.0** and a Optimum Moisture of **11.6**

Report these results on the **Sand Cone Density** form

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

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

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

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

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

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	907	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	363	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$		%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D\ (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	1389	LB.
c. WEIGHT OF MOLD	947	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	442	LB.
e. VOLUME OF MOLD	0.333	CF
f. WET DENSITY (d / e)	132.7	PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	H & I	50%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	123.0	PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	1.03	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR NUMBE		
PROCTOR METHO	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

Lab Proctor Data

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$		%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D \quad (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	4.42	LB.
e. VOLUME OF MOLD	0.333	CF
f. WET DENSITY (d / e)	132.7	PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	H & I	50%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	123.0	PCF

A one point proctor is run to verify the Lab Proctor data.
If the Maximum Dry Density from the one point proctor is within **1.0 pcf** of the Lab Proctor Maximum Dry Density then the Lab Proctor data is still valid. Any further calculations on this form requiring The Optimum Moisture and Maximum Dry Density will use the Lab Proctor Data.

(if on the Exam, you are not within 1.0 pcf of the Lab Maximum Dry Density, then carefully re-plot the family of curves.)

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

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

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

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

...INEER / ...OR | PROJECT NUMBER | TRACS NUMBER

...RKS

Now we can calculate to determine the Percent Compaction of our test site.

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE		9.07		LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE		3.63		LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)				LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE		1.03		%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE				%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	1	5.69		LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE		6.48		LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)				LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE		3.35		LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)				LB.
K. DENSITY OF SAND		88.1		PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$				CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$				PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$				PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$				%
COMPACTION SPECIFICATION		100		%

PROCTOR DENSITY

PROCTOR NUMBER				
PROCTOR METHOD (A, C, D, OR 1)			A	
O. SPECIFIC GRAVITY OF RETAINED #4	2	.65	1	
P. ABSORPTION OF RETAINED #4		0.87		%
Q. OPTIMUM MOISTURE		11.6		%
R. MAXIMUM DRY DENSITY	1	22.7		PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE				%
T. CORRECTED MAXIMUM DRY DENSITY				PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$				%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D\ (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	1	3.89		LB.
c. WEIGHT OF MOLD		9.47		LB.
d. WEIGHT OF COMPACTED SOIL (b-c)		4.42		LB.
e. VOLUME OF MOLD	0	.333		CF
f. WET DENSITY (d / e)	1	32.7		PCF
g. MOISTURE CONTENT		9.9		%
FAMILY OF CURVES IDENTIFICATION		H & I		50%
Q. OPTIMUM MOISTURE		11.6		%
R. MAXIMUM DRY DENSITY	1	23.0		PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

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

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

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

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

REMARKS

C = A – B
C = 9.07 – 3.63
C = 5.44

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	1.03	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER	
PROCTOR METHOD (A, C, D, OR 1)	A
O. SPECIFIC GRAVITY OF RETAINED #4	2.651
P. ABSORPTION OF RETAINED #4	0.87 %
Q. OPTIMUM MOISTURE	11.6 %
R. MAXIMUM DRY DENSITY	122.7 PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE	%
T. CORRECTED MAXIMUM DRY DENSITY	PCF

[illegible] 100	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D\ (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	4.42	LB.
e. VOLUME OF MOLD	0.333	CF
f. WET DENSITY (d / e)	132.7	PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	H & I	50%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	123.0	PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER | ORG NUMBER | MATL: A B | TYPE | PURPOSE | TEST LAB | SIZE | SIZE %

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

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

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

REMARKS

a = (B ÷ A) x 100
a = (3.63 ÷ 9.07) x 100
a = 40.02205072
Rounded to the whole number
= 40 %

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$	40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D\ (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	1389	LB.
c. WEIGHT OF MOLD	947	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	442	LB.
e. VOLUME OF MOLD	0333	CF
f. WET DENSITY (d / e)	1327	PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	H & I	50%
Q. OPTIMUM MOISTURE	116	%
R. MAXIMUM DRY DENSITY	1230	PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

SAMPLED FROM

ORIGINAL SOURCE

PROJECT ENGINEER SUPERVISOR

REMARKS

The formula for E. is here
Fill in the information for each letter and then do the calculation.
Work inside the ( ) first then the [ ]
100 – 40 = 60
60 x 10.3 = 618
618 + 40 = 658
658 ÷ 100 = 6.58
Rounded to one decimal place = 6.6

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE		9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE		3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE		10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	1	5.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE		6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)			LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE		3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)			LB.
K. DENSITY OF SAND		88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$			CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$			PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$			PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$			%
COMPACTION SPECIFICATION		100	%

PROCTOR DENSITY

PROCTOR NUMBER			
PROCTOR METHOD (A, C, D, OR 1)		A	
O. SPECIFIC GRAVITY OF RETAINED #4	2	6.51	
P. ABSORPTION OF RETAINED #4		0.87	%
Q. OPTIMUM MOISTURE		11.6	%
R. MAXIMUM DRY DENSITY	1	22.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE			%
T. CORRECTED MAXIMUM DRY DENSITY			PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$		40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D\ (100 - a)] + a}{100} \qquad 10.3 \quad 40 \quad 40$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	1	3.89	LB.
c. WEIGHT OF MOLD		9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)		4.42	LB.
e. VOLUME OF MOLD	0	.333	CF
f. WET DENSITY (d / e)	1	32.7	PCF
g. MOISTURE CONTENT		9.9	%
FAMILY OF CURVES IDENTIFICATION		H & I	50%
Q. OPTIMUM MOISTURE		11.6	%
R. MAXIMUM DRY DENSITY	1	23.0	PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER | ORG NUMBER | MATL: A B | TYPE | PURPOSE | TEST LAB | SIZE | SIZE %

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

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

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

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE	6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)	9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

H = F – G
H = 15.69 – 6.48
H = 9.21

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$	40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$F = \frac{[D\ (100 - a)] + a}{} \qquad 10.3 \quad 40 \quad 40$$

RIZ 232)

	13.89	LB.
	9.47	LB.
	4.42	LB.
e. VOLUME OF MOLD	0.333	CF
f. WET DENSITY (d / e)	132.7	PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	H & I	50%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	123.0	PCF

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

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

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

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

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

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE	6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)	9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)	5.86	LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

J = H – I
J = 9.21 – 3.35
J = 5.86

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$	40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D\ (100 - a)] + a}{100} \qquad 10.3,\ 40,\ 40$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
	9.47	LB.
	4.42	LB.
	0.333	CF
	132.7	PCF
	99	%
FAMILY OF CURVES IDENTIFICATION	H & I	50%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	123.0	PCF

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE	6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)	9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)	5.86	LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$	.0665	CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$	40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D\ (100 - a)] + a}{100} \qquad 10.3,\ a = 40,\ 40$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
	4.42	LB.
	3.3	CF
	2.7	PCF
	99	%
	& I	50%
	16	%
R. MAXIMUM DRY DENSITY	123.0	PCF

L = J ÷ K
L = 5.86 ÷ 88.1
L = .066515323
Rounded to 4 decimal places
= .0665

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE	6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)	9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)	5.86	LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$	.0665	CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$	136.4	PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

M = A ÷ L
M = 9.07 ÷ .0665
M = 136.3909774
Rounded to 1 decimal place
= 136.4

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$	40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D\ (100 - a)] + a}{100} \qquad 10.3,\ 40,\ 40$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	4.42	LB.
	3.3	CF
	2.7	PCF
	99	%
	& I	50%
	16	%
	30	PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER | ORG NUMBER | MATL: A B | TYPE | PURPOSE | TEST LAB | SIZE | SIZE %

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

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

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

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE	6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)	9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)	5.86	LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$	.0665	CF
M. WET DENSITY = $\left(\frac{A}{I}\right)$	136.4	PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$	128.0	PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$	40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D\ (100 - a)] + a}{100} \qquad 10.3,\ a = 40,\ a = 40$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
		LB.
		CF
		PCF
		%
		%
		PCF

50%

N = (M ÷ (100 + E)) x 100
N = (136.4 ÷ (100 + 6.6)) x 100
N = (136.4 ÷ 106.6) x 100
N = 1.279549719 x 100
N = 127.9549719
Rounded to 1 decimal place
= 128.0

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE		9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE		3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE		10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69		LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE		6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE		3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		5.86	LB.
K. DENSITY OF SAND		88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$	.0665		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$	136.4		PCF
N. DRY DENSITY = $\left(\frac{M}{100 + E}\right) \times 100$	128.0		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$			%
COMPACTION SPECIFICATION		100	%

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$ — 40 %

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D\ (100 - a)] + a}{100} \qquad \text{(10.3, 40, 40)}$$

For calculating the % compaction there are two formulas. (N ÷ R) x 100 or (N ÷ T) x 100. The only time (N ÷ R) x 100 is used, is when there is less than 10% retained on the #4 sieve. This sample has 40% retained so we have to use (N ÷ T) x 100. We have to calculate T and we also have to calculate S.

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

PROCTOR DENSITY

PROCTOR NUMBER			
PROCTOR METHOD (A, C, D, OR 1)		A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651		
P. ABSORPTION OF RETAINED #4		0.87	%
Q. OPTIMUM MOISTURE		11.6	%
R. MAXIMUM DRY DENSITY	122.7		PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE			%
T. CORRECTED MAXIMUM DRY DENSITY			PCF

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100}$$

40

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PURPOSE	TEST LAB	SIZE	SIZE %
		A B					

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

SAMPLED FROM

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE		9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE		3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE		10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69		LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE		6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE		3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		5.86	LB.
K. DENSITY OF SAND		88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$	0.0665		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$	136.4		PCF
N. DRY DENSITY = $\left(\frac{M}{100 + E}\right) \times 100$	128.0		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$			%
COMPACTION SPECIFICATION		100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$: 40 %

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D\ (100 - a)] + a}{100} \qquad 10.3,\ a = 40,\ a = 40$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB
d. WEIGHT OF COMPACTED SOIL (b-c)	4.42	LB.
e. VOLUME OF MOLD	0.0333	CF
f. WET DENSITY (d / e)	132.7	PCF

The formulas for calculating S and T are to the right. Fill in the information for each letter and then calculate. Make sure to use the Lab proctor information.

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100} \qquad Q = 11.6,\ a = 40,\ a = 40$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100} \qquad R = 122.7,\ a = 40,\ a = 40,\ O = 2.651$$

40

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PURPOSE	TEST LAB	SIZE	SIZE %
		A B					

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE	6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)	9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)	5.86	LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$	0.0665	CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$	136.4	PCF
N. DRY DENSITY = $\left(\frac{M}{100 + E}\right) \times 100$	128.0	PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE	7.4	%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$	40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D \quad (100 - a)] + a}{100} \qquad \text{(10.3, 40, 40)}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	4.42	LB.
e. VOLUME OF MOLD	0.0333	CF
f. WET DENSITY (d / e)	132.7	PCF

Calculate S. Work inside the ( ) first then the [ ].

S = 100 – 40 = 60

60 x 11.6 = 696

696 + 40 = 736

736 ÷ 100 = 7.36

Rounded to 1 decimal place = 7.4

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q \ (100 - a)] + a}{100} \qquad \text{(11.6, 40, 40)}$$

$$T = \frac{[R \ (100 - a)] + [(56.2)\ (a)(O)]}{100} \qquad \text{(122.7, 40, 40, 2.651)}$$

40

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

SAMPLED FROM

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE		9	0 7	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE		3	6 3	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		5	4 4	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE		1	0 3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE			6 6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	1	5	6 9	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE		6	4 8	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		9	2 1	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE		3	3 5	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		5	8 6	LB.
K. DENSITY OF SAND		8	8 1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$	.0	6	6 5	CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$	1	3	6 4	PCF
N. DRY DENSITY = $\left(\frac{M}{100 + E}\right) \times 100$	1	2	8 0	PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$				%
COMPACTION SPECIFICATION		1	0 0	%

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$ 4 0 %

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D \ (100 - a)] + a}{100} \qquad 10.3 \quad 40 \quad 40$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	1	3	8	9	LB.

PROCTOR DENSITY

PROCTOR NUMBER					
PROCTOR METHOD (A, C, D, OR 1)				A	
O. SPECIFIC GRAVITY OF RETAINED #4	2	6	5	1	
P. ABSORPTION OF RETAINED #4		0	8	7	%
Q. OPTIMUM MOISTURE		1	1	6	%
R. MAXIMUM DRY DENSITY	1	2	2	7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE			7	4	%
T. CORRECTED MAXIMUM DRY DENSITY	1	3	3	2	PCF

Calculate T. Work inside the ( ) first then the [ ]. Work each side of the + sign separately then add then together.

T = 100 – 40 = 60

60 x 122.7 = 7362

work the other side of the + sign

56.2 x 40 x 2.651 = 5959.448

Add together

7362 + 5959.448 = 13321.448

13321.448 ÷ 100 = 133.21448

Rounded to 1 decimal place = 133.2

0%

$$S = \frac{[Q \ (100 - a)] + a}{100} \qquad 11.6 \quad 40 \quad 40$$

$$T = \frac{[R \ (100 - a)] + [(56.2)\,(a)(O)]}{100} \qquad 122.7 \quad 40 \quad 40 \quad 2.651$$

40

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE	6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)	9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)	5.86	LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$	.0665	CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$	136.4	PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$	128.0	PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$	96	%
COMPACTION SPECIFICATION	100	%

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) \times 100$	40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D\ (100 - a)] + a}{100} \qquad \text{(D = 10.3, a = 40, a = 40)}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	1389	LB.

Now we can calculate the
% Compaction using (N ÷ T) x 100
% compaction = 128.0 ÷ 133.2
= .960960961
.960960961 x 100 = 96.0960961
Rounded to the whole number
= 96

0%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE	7.4	%
T. CORRECTED MAXIMUM DRY DENSITY	133.2	PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100} \qquad \text{(Q = 11.6, a = 40, a = 40)}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100} \qquad \text{(R = 122.7, a = 40, O = 2.651)}$$

40

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

LAB NUMBER	ORG NUMBER	MATL	TYPE	PUR-POSE	TEST LAB	SIZE	SIZE %
		A B					

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)	5.44	LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE	6.6	%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)	9.21	LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE	3.35	LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)	5.86	LB.
K. DENSITY OF SAND	88.1	PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$	0.0665	CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$	136.4	PCF
N. DRY DENSITY = $\left(\frac{M}{100+E}\right) \times 100$	128.0	PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$	96	%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE	7.4	%
T. CORRECTED MAXIMUM DRY DENSITY	133.2	PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right) X\ 100$	40	%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

$$E = \frac{[D\ (100 - a)] + a}{100} \qquad E = \frac{[10.3\ (100 - 40)] + 40}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)	4.42	LB.
e. VOLUME OF MOLD	0.333	CF
f. WET DENSITY (d / e)	132.7	PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	H & I	50%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	123.0	PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\ (100 - a)] + a}{100} \qquad S = \frac{[11.6\ (100 - 40)] + 40}{100}$$

$$T = \frac{[R\ (100 - a)] + [(56.2)\ (a)(O)]}{100} \qquad T = \frac{[122.7\ (100 - 40)] + [(56.2)\ (40)(2.651)]}{100}$$

Blank Forms

Calibration of Proctor Mold

___X__Four Inch Mold _____Six Inch Mold

Mold I. D. #:_____4-1_____
Temperature of Water used for Calibration:_____82°F
Unit Weight of Water:_____lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
4574.3	5514.7	

$$\left[\begin{array}{c}\text{Volume of}\\ \text{Mold}\\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight}\\ \text{of Water}\\ \text{(lb. / cu. ft.)}\end{array}\right] \times [453.6\ \text{(grams / lb.)}]}$$

$$= \frac{(\qquad\qquad)}{(\qquad\qquad) \times (453.6)} = \_\_\_\_\_\ \text{cu. Ft.}$$

Remarks:_____
_____
_____
_____
Calibration Date:_____
Test Operator:_____
Supervisor and Date:_____
Calibration Expiration Date:_____

Calibration of Proctor Mold

_____Four Inch Mold ___X__Six Inch Mold

Mold I. D. #: 11

Temperature of Water used for Calibration: 78

Unit Weight of Water: _____ lb. / cu. Ft.

Weight of Baseplate, Empty Mold, and Glass Plate (grams)	Weight of Baseplate, Mold Filled With Water, and Glass Plate (grams)	Weight of Water to fill Mold (grams)
7064.5	9180.8	

$$\left[\begin{array}{c}\text{Volume of}\\ \text{Mold}\\ \text{(cu. ft.)}\end{array}\right] = \frac{\text{Weight of Water to Fill Mold (grams)}}{\left[\begin{array}{c}\text{Unit Weight}\\ \text{of Water}\\ \text{(lb. / cu. ft.)}\end{array}\right] \times \left[453.6\ \text{(grams / lb.)}\right]}$$

$$= \frac{(\qquad\qquad)}{(\qquad\qquad) \times (453.6)} = \_\_\_\_\_ \text{ cu. Ft.}$$

Remarks: _____

_____

_____

_____

Calibration Date: _____

Test Operator: _____

Supervisor and Date: _____

Calibration Expiration Date: _____

CALIBRATION OF DENSITY SAND AND SAND CONE APPARATUS
ARIZ 229
(A Modification of AASHTO T 191)

Date of Calibration:_____ Test Operator:_____

I. D. No. of Mold used in calibration: 11

Volume of Mold used in calibration: _____

Identification of Sand: _____

Identification of Sand Cone Apparatus: _____

Trial No.	Wt. of Baseplate And Empty Mold (grams)	Wt. of Baseplate and Mold Filled with Sand (grams)	Wt. of Sand to Fill Mold (grams)
1	6631	9629	
2	6631	9627	
3	6631	9630	

Average Weight of Sand to Fill Mold =_____grams

$$\text{Density of Sand, } D_S = \frac{\text{Average Weight of Sand to Fill Mold}}{(453.6 \text{ grams / lb.}) \times (\text{Volume of Mold})}$$

$$= \frac{}{(453.6) \times (\quad)} = \quad = \text{lb./ft.}^3$$

Trial No.	Initial Wt. of Apparatus (grams)	Final Wt. of Apparatus (grams)	Wt. of Sand to Fill Funnel and Baseplate (grams)
1	6029	4508	
2	6031	4512	
3	6027	4508	

Average Weight of Sand to Fill Funnel and Baseplate =_____grams

$$\text{Volume of Funnel and Baseplate, } V_{fb} = \frac{\text{Average Weight of Sand to Fill Funnel and Baseplate}}{(453.6 \text{ grams / lb.}) \times (\text{Density of Sand})}$$

$$= \frac{}{(453.6) \times (\quad)} = \quad = \text{ft.}^3$$

Remarks:_____ $I = D_s \times V_{fb}$ _____

_____

Supervisor and Date: _____

Calibration Expiration Date: _____

ARIZONA DEPARTMENT OF TRANSPORTATION
SAND CONE DENSITY (ARIZ 230)

USE CAPITAL LETTERS

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

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

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

ORIGINAL SOURCE	PROJECT ENGINEER / SUPERVISOR	PROJECT NUMBER	TRACS NUMBER

REMARKS

A. TOTAL WET WEIGHT OF MATERIAL FROM THE HOLE	9.07	LB.
B. WET WEIGHT OF MATERIAL RETAINED ON THE #4 SIEVE	3.63	LB.
C. WET WEIGHT OF MATERIAL PASSING THE #4 SIEVE (A-B)		LB.
D. MOISTURE OF THE MATERIAL PASSING THE #4 SIEVE	10.3	%
E. MOIST. CORRECTED FOR MATERIAL RETAINED ON THE #4 SIEVE		%
F. WEIGHT OF SAND & APPARATUS BEFORE FILLING HOLE	15.69	LB.
G. WEIGHT OF SAND & APPARATUS AFTER FILLING HOLE	6.48	LB.
H. WEIGHT OF SAND TO FILL HOLE AND CONE (F-G)		LB.
I. WEIGHT OF SAND TO FILL CONE AND BASE PLATE		LB.
J. WEIGHT OF SAND TO FILL HOLE (H-I)		LB.
K. DENSITY OF SAND		PCF
L. VOLUME OF HOLE $\left(\frac{J}{K}\right)$		CF
M. WET DENSITY = $\left(\frac{A}{L}\right)$		PCF
N. DRY DENSITY = $\left(\frac{M}{100 + E}\right) \times 100$		PCF
COMPACTION = $\left(\frac{N}{R}\right) \times 100$ OR $\left(\frac{N}{T}\right) \times 100$		%
COMPACTION SPECIFICATION	100	%

PROCTOR DENSITY

PROCTOR NUMBER		
PROCTOR METHOD (A, C, D, OR 1)	A	
O. SPECIFIC GRAVITY OF RETAINED #4	2.651	
P. ABSORPTION OF RETAINED #4	0.87	%
Q. OPTIMUM MOISTURE	11.6	%
R. MAXIMUM DRY DENSITY	122.7	PCF

CORRECTION FOR RETAINED #4 (METHOD A OR ONE-POINT ONLY)

S. CORRECTED OPTIMUM MOISTURE		%
T. CORRECTED MAXIMUM DRY DENSITY		PCF

a. RETAINED ON #4 = $\left(\frac{B}{A}\right)$ X 100		%

IF RET. ON #4 IS MORE THAN 50% (60% IF AB), GO NO FURTHER.

FOR METHOD A OR ONE POINT ONLY

$$E = \frac{[D \quad (100 - a)] + a}{100}$$

ONE POINT PROCTOR (ARIZ 232)

b. WEIGHT OF MOLD & SOIL	13.89	LB.
c. WEIGHT OF MOLD	9.47	LB.
d. WEIGHT OF COMPACTED SOIL (b-c)		LB.
e. VOLUME OF MOLD		CF
f. WET DENSITY (d / e)		PCF
g. MOISTURE CONTENT	9.9	%
FAMILY OF CURVES IDENTIFICATION	&	
Q. OPTIMUM MOISTURE		%
R. MAXIMUM DRY DENSITY		PCF

TEST OPERATOR AND DATE

RESIDENT ENGINEER, PROJECT SUPERVISOR, OR LABMAN AND DATE

FOR METHOD A OR ONE POINT ONLY

$$S = \frac{[Q\,(100 - a)] + a}{100}$$

$$T = \frac{[R\,(100 - a)] + [(56.2)\,(a)(O)]}{100}$$

TYPICAL MOISTURE-DENSITY CURVES

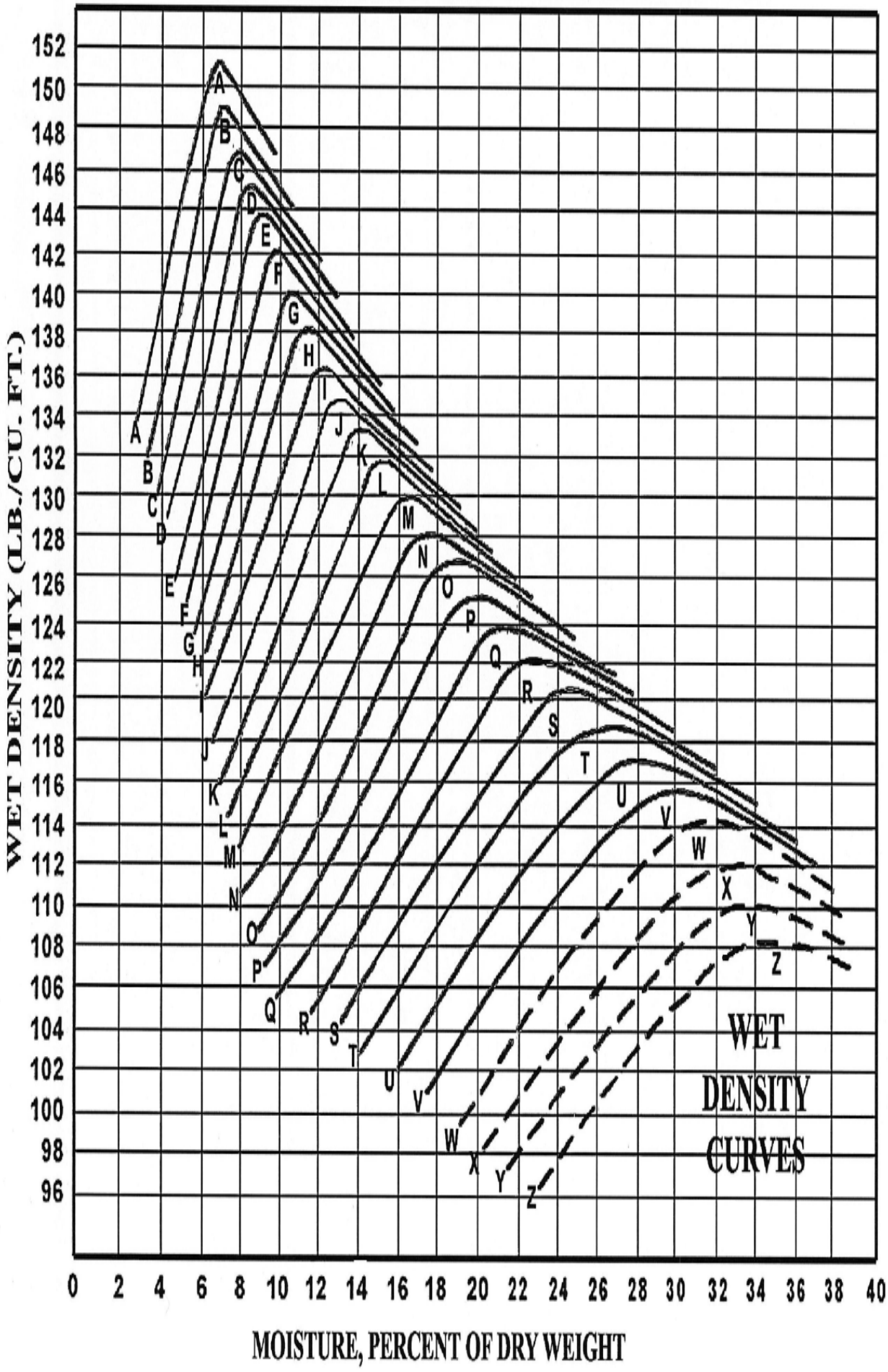


FIGURE 2

Curve	Max Dry Wt. lbs/cu.ft.	Optimum Moisure
A	141.8	6.6
B	139.1	7.2
C	136.3	7.9
D	134.1	8.5
E	132.	9.0
F	129.3	9.7
G	126.6	10.5
H	124.2	11.2
I	121.7	11.9
J	119.3	12.7
K	117.0	13.5
L	114.6	14.6
M	112.0	15.8
N	109.6	16.9
O	107.1	18.1
P	104.7	19.2
Q	102.4	20.3
R	99.9	21.5
S	97.4	22.7
T	94.6	24.4
U	92.1	25.8
V	89.9	27.4
W	87.5	29.5
X	85.0	30.5
Y	83.0	31.5
Z	81.1	32.5

A	141.8	6.6	F	129.3	9.7	K	117.0	13.5	P	104.7	19.2	U	92.1	25.8
10%	141.5	6.7	10%	129.0	9.8	10%	116.8	13.6	10%	104.5	19.3	10%	91.9	26.0
20%	141.3	6.7	20%	128.8	9.9	20%	116.5	13.7	20%	104.2	19.4	20%	91.7	26.1
30%	141.0	6.8	30%	128.5	9.9	30%	116.3	13.8	30%	104.0	19.5	30%	91.4	26.3
40%	140.7	6.8	40%	128.2	10.0	40%	116.0	13.9	40%	103.8	19.6	40%	91.2	26.4
50%	140.5	6.9	50%	128.0	10.1	50%	115.8	14.1	50%	103.6	19.8	50%	91.0	26.6
60%	140.2	7.0	60%	127.7	10.2	60%	115.6	14.2	60%	103.3	19.9	60%	90.8	26.8
70%	139.9	7.0	70%	127.4	10.3	70%	115.3	14.3	70%	103.1	20.0	70%	90.6	26.9
80%	139.6	7.1	80%	127.1	10.3	80%	115.1	14.4	80%	102.9	20.1	80%	90.3	27.1
90%	139.4	7.1	90%	126.9	10.4	90%	114.8	14.5	90%	102.6	20.2	90%	90.1	27.2
B	139.1	7.2	G	126.6	10.5	L	114.6	14.6	Q	102.4	20.3	V	89.9	27.4
10%	138.8	7.3	10%	126.4	10.6	10%	114.3	14.7	10%	102.2	20.4	10%	89.7	27.6
20%	138.5	7.3	20%	126.1	10.6	20%	114.1	14.8	20%	101.9	20.5	20%	89.4	27.8
30%	138.3	7.4	30%	125.9	10.7	30%	113.8	15.0	30%	101.7	20.7	30%	89.2	28.0
40%	138.0	7.5	40%	125.6	10.8	40%	113.6	15.1	40%	101.4	20.8	40%	88.9	28.2
50%	137.7	7.6	50%	125.4	10.9	50%	113.3	15.2	50%	101.2	20.9	50%	88.7	28.5
60%	137.4	7.6	60%	125.2	10.9	60%	113.0	15.3	60%	100.9	21.0	60%	88.5	28.7
70%	137.1	7.7	70%	124.9	11.0	70%	112.8	15.4	70%	100.7	21.1	70%	88.2	28.9
80%	136.9	7.8	80%	124.7	11.1	80%	112.5	15.6	80%	100.4	21.3	80%	88.0	29.1
90%	136.6	7.8	90%	124.4	11.1	90%	112.3	15.7	90%	100.2	21.4	90%	87.7	29.3
C	136.3	7.9	H	124.2	11.2	M	112.0	15.8	R	99.9	21.5	W	87.5	29.5
10%	136.1	8.0	10%	124.0	11.3	10%	111.8	15.9	10%	99.7	21.6	10%	87.3	29.6
20%	135.9	8.0	20%	123.7	11.3	20%	111.5	16.0	20%	99.4	21.7	20%	87.0	29.7
30%	135.6	8.1	30%	123.5	11.4	30%	111.3	16.1	30%	99.2	21.9	30%	86.8	29.8
40%	135.4	8.1	40%	123.2	11.5	40%	111.0	16.2	40%	98.9	22.0	40%	86.5	29.9
50%	135.2	8.2	50%	123.0	11.6	50%	110.8	16.4	50%	98.7	22.1	50%	86.3	30.0
60%	135.0	8.3	60%	122.7	11.6	60%	110.6	16.5	60%	98.4	22.2	60%	86.0	30.1
70%	134.8	8.3	70%	122.5	11.7	70%	110.3	16.6	70%	98.2	22.3	70%	85.8	30.2
80%	134.5	8.4	80%	122.2	11.8	80%	110.1	16.7	80%	97.9	22.5	80%	85.5	30.3
90%	134.3	8.4	90%	122.0	11.8	90%	109.8	16.8	90%	97.7	22.6	90%	85.3	30.4
D	134.1	8.5	I	121.7	11.9	N	109.6	16.9	S	97.4	22.7	X	85.0	30.5
10%	133.9	8.6	10%	121.5	12.0	10%	109.4	17.0	10%	97.1	22.9	10%	84.8	30.6
20%	133.7	8.6	20%	121.2	12.1	20%	109.1	17.1	20%	96.8	23.0	20%	84.6	30.7
30%	133.5	8.7	30%	121.0	12.1	30%	108.9	17.3	30%	96.6	23.2	30%	84.4	30.8
40%	133.3	8.7	40%	120.7	12.2	40%	108.6	17.4	40%	96.3	23.4	40%	84.2	30.9
50%	133.1	8.8	50%	120.5	12.3	50%	108.4	17.5	50%	96.0	23.6	50%	84.0	31.0
60%	132.8	8.8	60%	120.3	12.4	60%	108.1	17.6	60%	95.7	23.7	60%	83.8	31.1
70%	132.6	8.9	70%	120.0	12.5	70%	107.9	17.7	70%	95.4	23.9	70%	83.6	31.2
80%	132.4	8.9	80%	119.8	12.5	80%	107.6	17.9	80%	95.2	24.1	80%	83.4	31.3
90%	132.2	9.0	90%	119.5	12.6	90%	107.4	18.0	90%	94.9	24.2	90%	83.2	31.4
E	132.0	9.0	J	119.3	12.7	O	107.1	18.1	T	94.6	24.4	Y	83.0	31.5
10%	131.7	9.1	10%	119.1	12.8	10%	106.9	18.2	10%	94.4	24.5	10%	82.8	31.6
20%	131.5	9.1	20%	118.8	12.9	20%	106.6	18.3	20%	94.1	24.7	20%	82.6	31.7
30%	131.2	9.2	30%	118.6	12.9	30%	106.4	18.4	30%	93.9	24.8	30%	82.4	31.8
40%	130.9	9.3	40%	118.4	13.0	40%	106.1	18.5	40%	93.6	25.0	40%	82.2	31.9
50%	130.7	9.4	50%	118.2	13.1	50%	105.9	18.7	50%	93.4	25.1	50%	82.1	32.0
60%	130.4	9.4	60%	117.9	13.2	60%	105.7	18.8	60%	93.1	25.2	60%	81.9	32.1
70%	130.1	9.5	70%	117.7	13.3	70%	105.4	18.9	70%	92.9	25.4	70%	81.7	32.2
80%	129.8	9.6	80%	117.5	13.3	80%	105.2	19.0	80%	92.6	25.5	80%	81.5	32.3
90%	129.6	9.6	90%	117.2	13.4	90%	104.9	19.1	90%	92.4	25.7	90%	81.3	32.4
F	129.3	9.7	K	117.0	13.5	P	104.7	19.2	U	92.1	25.8	Z	81.1	32.5