

CE 452

CBR Test Method

Designation: D 1883 – 87[ε2]

Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils[1]

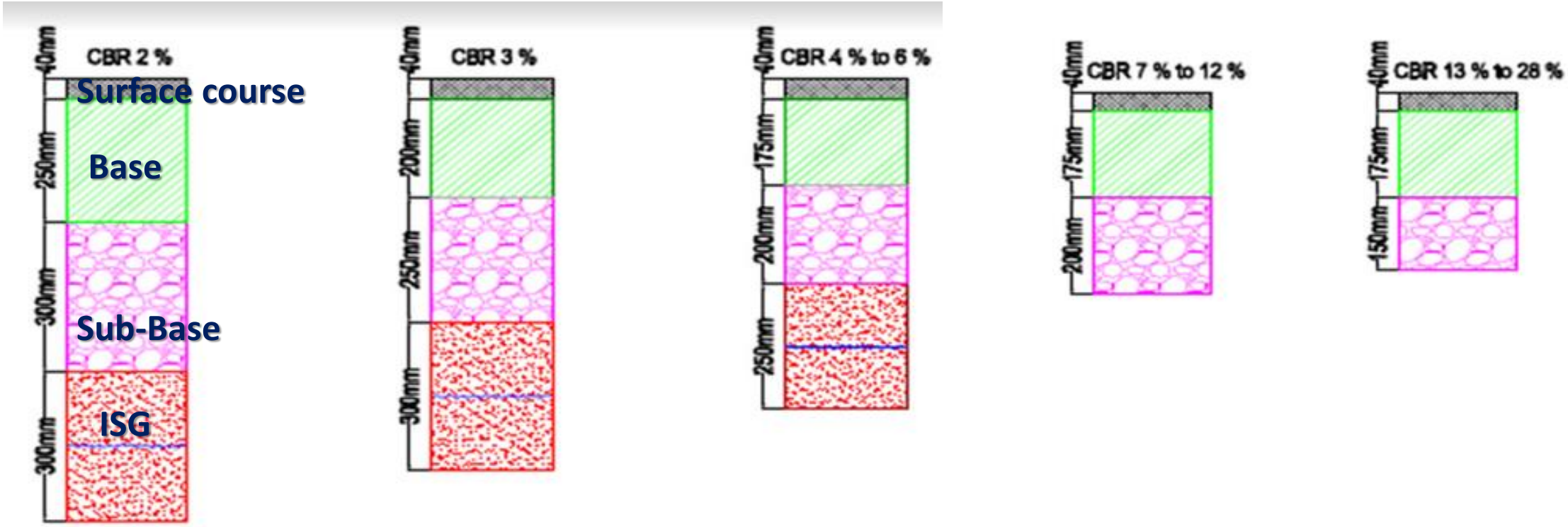
 # The California Bearing Ratio (CBR) test is a simple strength test that compares the bearing capacity of a material with that of a well-graded crushed stone (thus, a high quality crushed stone material should have a CBR @ 100%).

 # It is primarily intended for, but not limited to, evaluating the strength of cohesive materials having maximum particle sizes less than 19 mm (0.75 in.)

 # It was developed by the California Division of Highways around 1930 and was subsequently adopted by numerous states, counties, U.S. federal agencies and internationally. As a result, most agency and commercial geotechnical laboratories in the U.S. are equipped to perform CBR tests.

 # The basic CBR test involves applying load to a small penetration piston at a rate of 1.3 mm (0.05") per minute and recording the total load at penetrations ranging from 0.64 mm (0.025 in.) up to 7.62 mm (0.300 in.).

Effect of CBR value on Pavement Thickness



For same Traffic load (ESAL) thickness of pavement layers varies significantly If CBR value changes.

Scope:

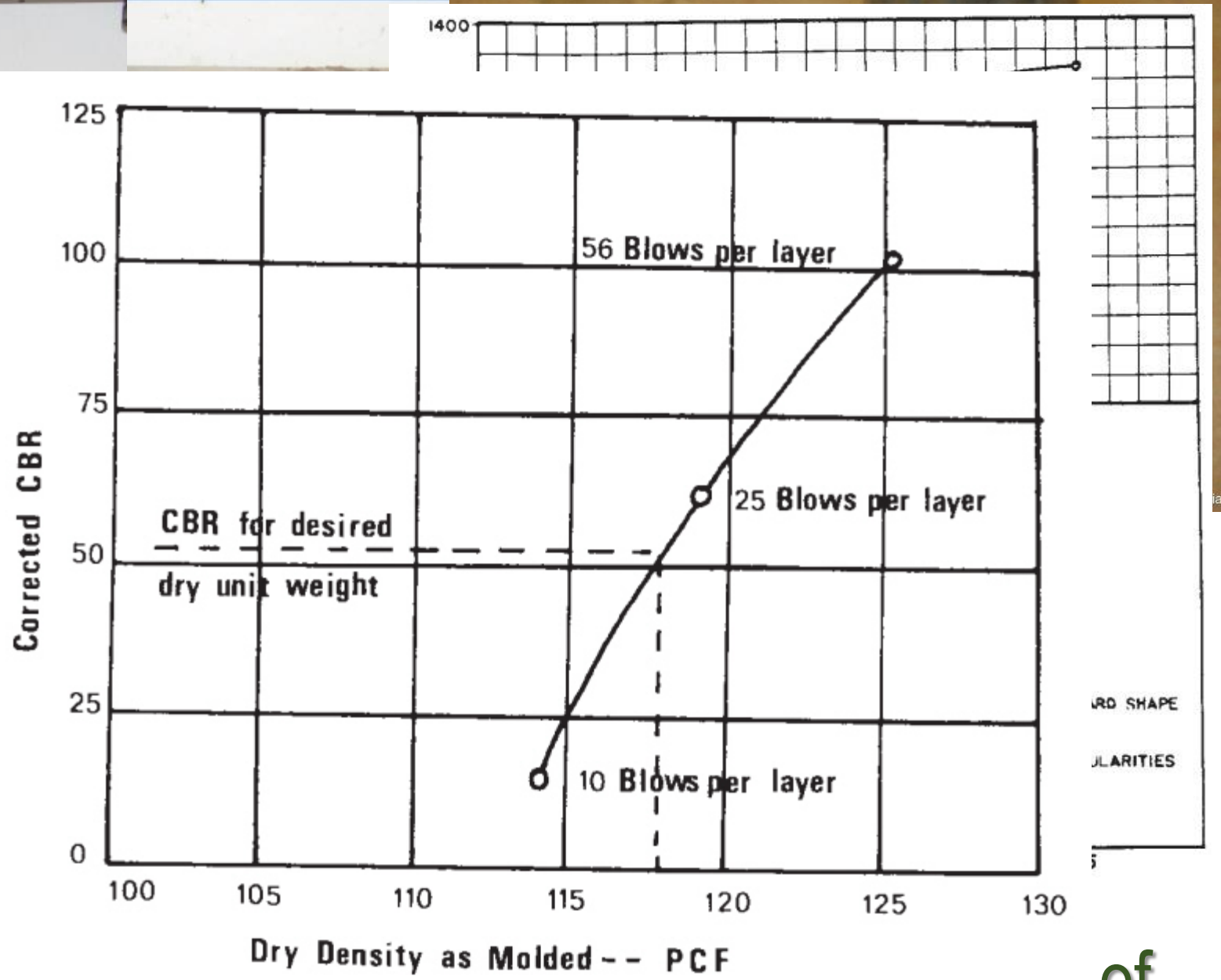
- This test method covers the determination of the CBR of pavement subgrade, subbase, and base courses materials from laboratory compacted specimens.
- This test method is primarily intended for, but not limited to, evaluating the strength of cohesive materials having maximum particle sizes less than 19 mm (0.75 in.)
- When materials having maximum particle sizes greater than ¾” (19 mm) gradation modification required.

- This test method provides for the determination of the CBR of a material at Optimum water content of a range of water content from a specified compaction test and a specified dry unit weight.
- The dry unit weight is usually given as a percentage of maximum dry unit weight from the compaction tests (Test Method D 698 or D 1557).
- **All specimens shall be soaked prior to penetration.**

Summar

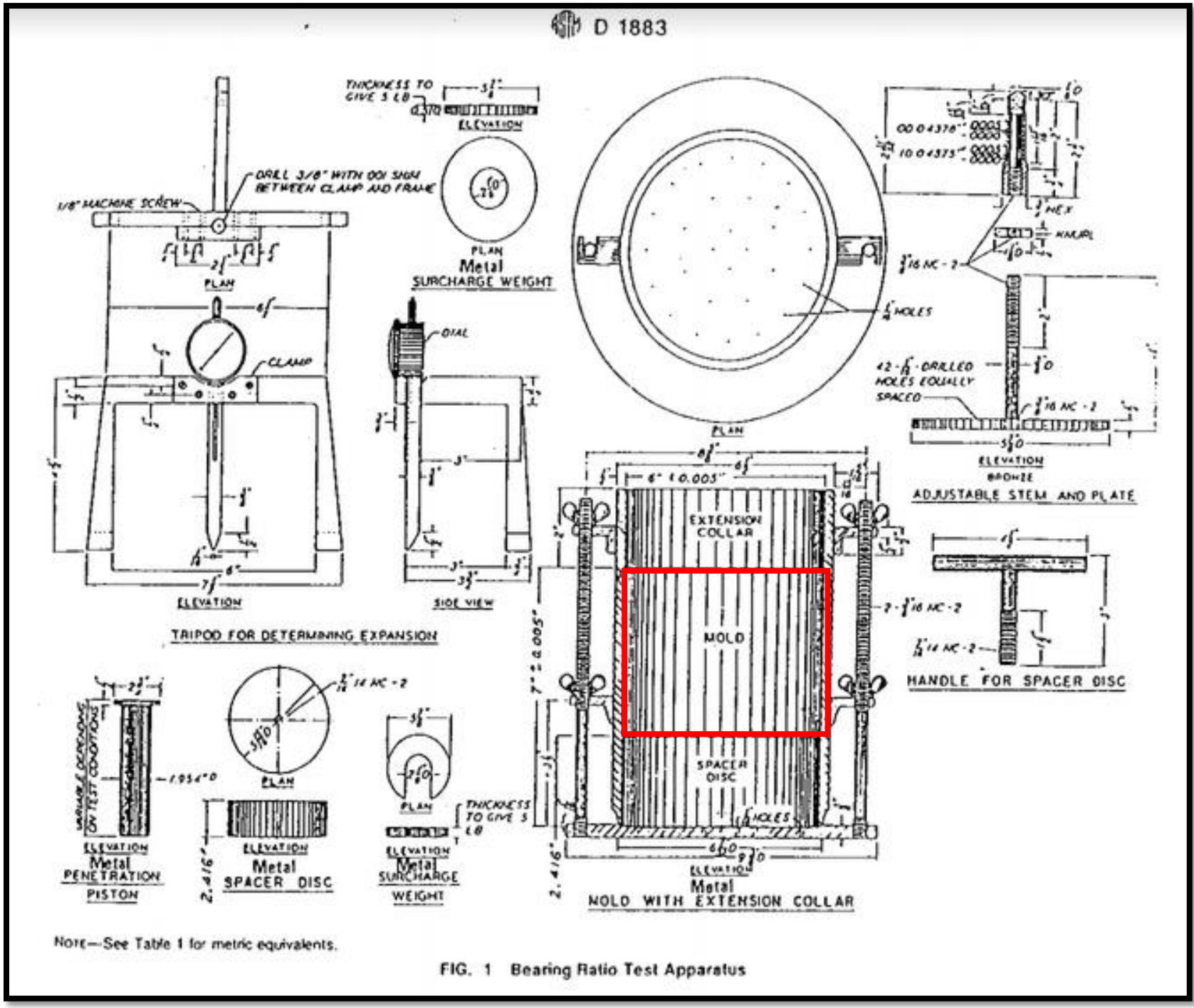
- Tests perfor
  content (Opt
- The specim
  (10, 25 and
  the desired
- After soakin
  to penetration by a cylind
- Results of stress (Loa
  determine CBR for each
- The CBR at the specified density is determined from a graph of CBR vs unit weight.





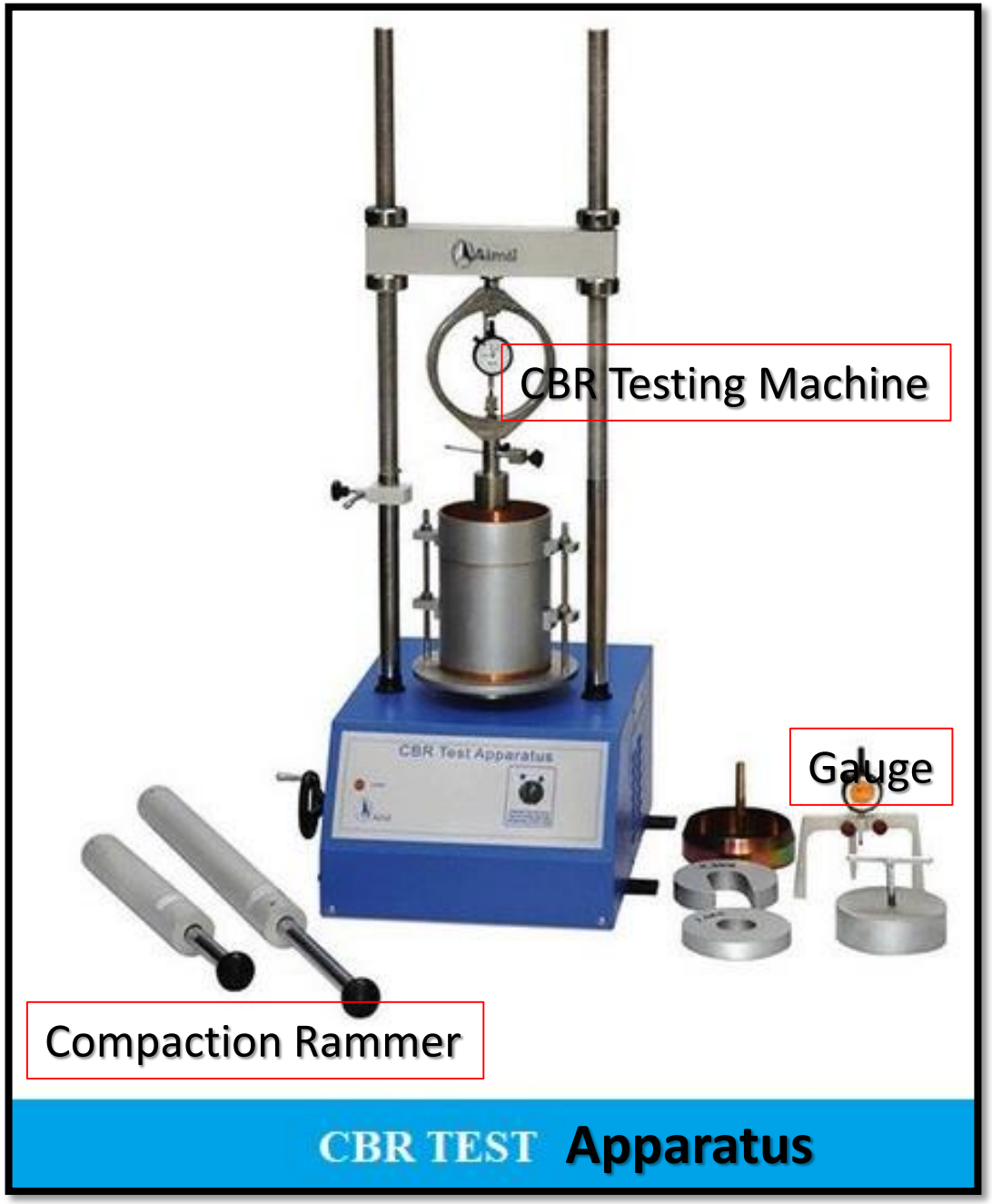
CBR Apparatus:

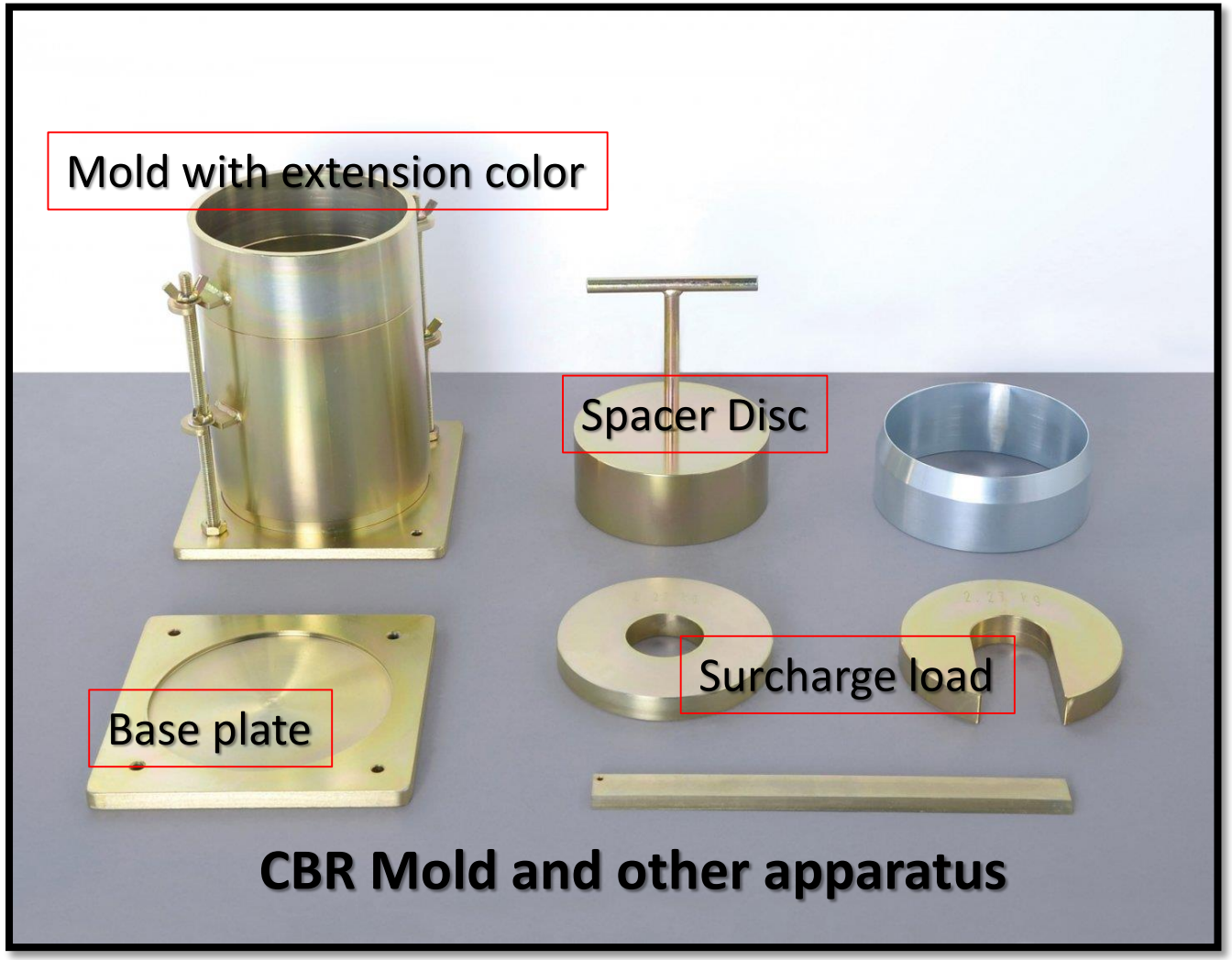
- **Loading Machine:** Capacity at least 10000 lbs **(loading rate 0.05 in/min)**, minimum load division 10 lbs or less.
- **Mold:** Cylindrical mold inside diameter 6 in and a height 7 in. Extension collar at least 2 in height and a metal base plate having at least 28 nos 1/16-in dia holes uniformly spaced over the plate.
- When assembled with spacer disc in the bottom of the mold, the mold shall have an internal volume of 0.075 ft3 (excluding extension collar)



CBR Apparatus:

- Spacer Disk: A circular metal spacer disc having a minimum outside diameter of 5 15/16 in (150.8 mm). The spacer disc height is 2.416”.
- Rammer: A rammer is required for compaction. Weight 2.6 kg with a drop of 310 mm (or) weight 4.89 kg a drop 450 mm.
- Expansion Measuring Device: A dial gauge to measure the amount of swell during soaking.
- Weights: One or two metal weights having a total mass of 4.54 kg. The weight shall have diameter 5 7/8” to 5 15/16”and shall have a center hole of approximately 2 1/8 in.
- Penetration Piston: A metal piston 1.954” in diameter and not less than 4 in long.
- Dial gauges: Two dial gauges to read load and penetration.


CBR Testing Machine
Gauge
Compaction Rammer
CBR TEST Apparatus


Mold with extension color
Spacer Disc
Surcharge load
Base plate
CBR Mold and other apparatus

Specimen Preparation:

- Take the dry soil sample
- Measure required water
- Add water to the soil
- Assemble the mold
- Fill the mold with soil sample by 5 layer (each layer compacted by 10/25/56 blows) with rammer.
- Made three sample (with 10 blows, 25 blows and 56 blows).
- Soaked for 4 days.

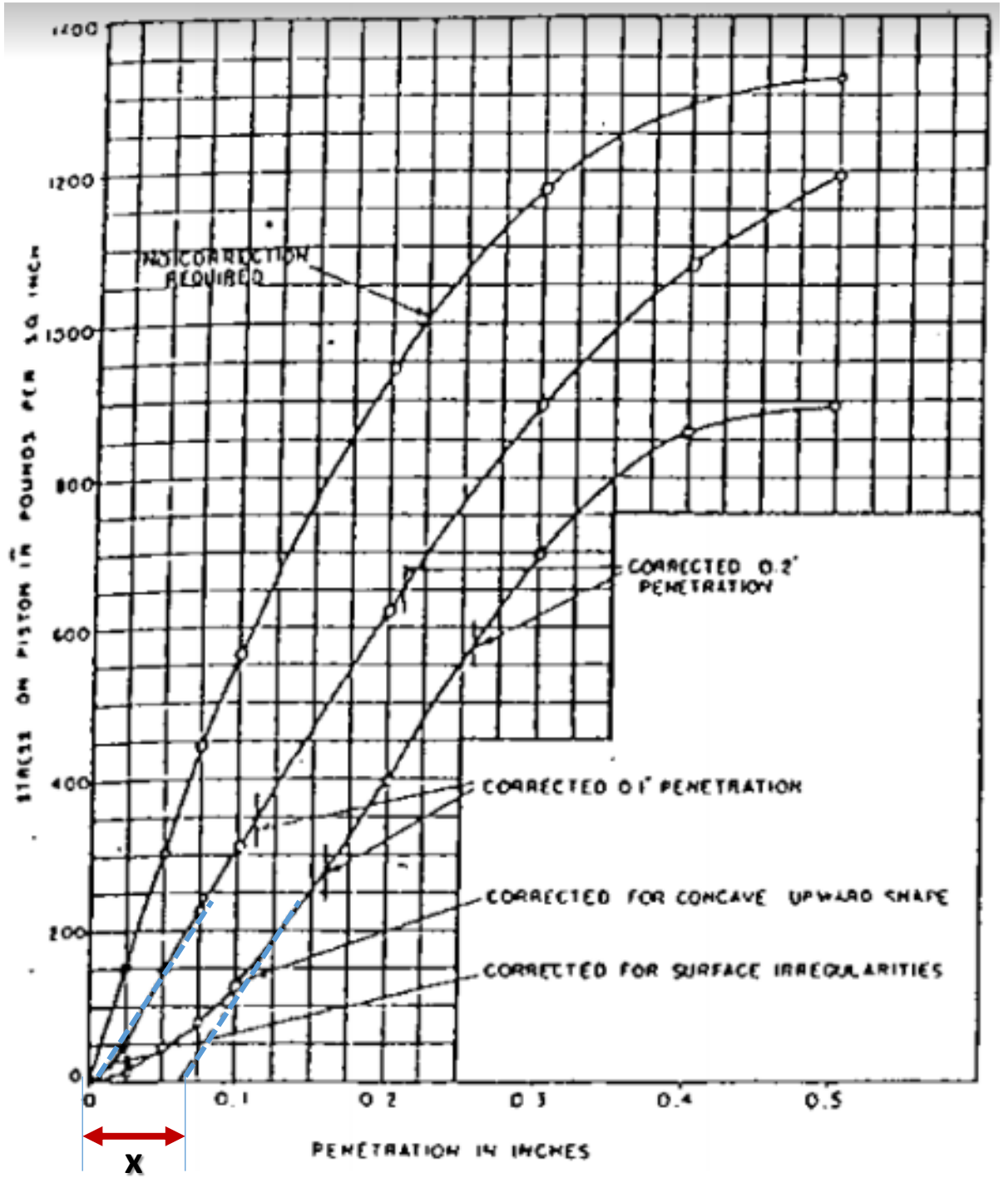
Procedure of Testing:

- Place the surcharge weights on the specimen (4.54 kg)
- The surcharge weights shall be equal to that used during the soaking period.
- Seat the penetration piston on the soil surface and apply the smallest possible load, but in no case in excess of 10 lb.
- Apply the load on the penetration piston at the rate of 0.050 in/min
- Record the load readings at penetrations of 0.025 in, 0,050 in, 0.075 in, 0.100 in, 0.125 in, o.0150 in, 0.175 in, 0.200 in, 0.300 in, 0.400 in and 0.500 in.

Calculation:

- **Load Penetration Curve:** Calculate the penetration stress in pounds per square and plot the stress – penetration curve.
- In some cases the stress-penetration curve may be concave upward initially, because of surface irregularities or other causes.
- In such cases the zero point shall be adjusted.

- If origin shifted by x unit corrected stress value for 0.100” should be stress value at (0.100+x)” penetration.



CBR Calculation:

- **CBR at (0.100 in) =** $\frac{Corrected\ stress\ value\ at\ 0.100\ in\ penetration}{Standard\ stress, 1000\ psi}$ **X 100**

- **CBR at (0.200 in) =** $\frac{Corrected\ stress\ value\ at\ 0.200\ in\ penetration}{Standard\ stress, 1500\ psi}$ **X 100**

The CBR for the soil is normally reported at 0.100 in penetration.
Normally CBR value at 0.100 in > CBR value at 0.200 in penetration.
When CBR value at 0.200 in is greater return the test.
If check test gives a similar result, use the bearing ratio at 0.200 in penetration.

Design CBR:

- From 3 specimens we have obtained 3 CBR value and dry density.
- Plot CBR (corrected) vs Dry density curve.
- From the graph we can obtained Design CBR value at % Maximum Dry density.

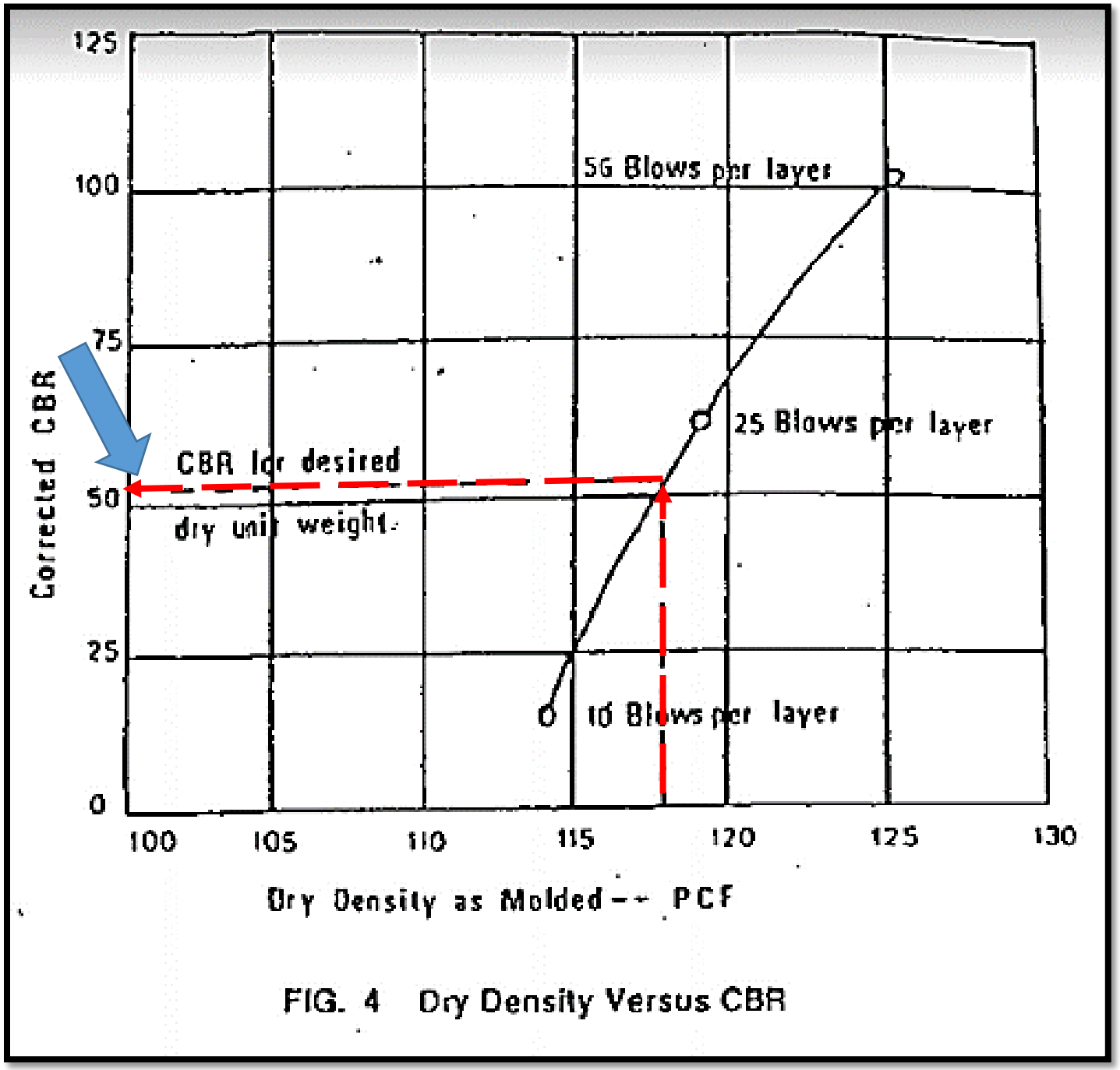


FIG. 4 Dry Density Versus CBR

DEPARTMENT OF CIVIL ENGINEERING, BUET
TRANSPORTATION ENGINEERING LABORATORY

CALIFORNIA BEARING RATIO
(CBR Test)

..... Date : .....

Sent by: .....

.....

Ref. : ..... Date : .....

Sample : ..... Test Method: ASTM D1883 (87)

Sample Identification: .....

Compaction Method: Standard Compaction (ASTM D698)/Modified Compaction (ASTM D1557)

Date of Compaction: .....

Date of Test: .....

Optimum Moisture Content: % Max. Dry Density: lb/cft

Mold: Height of the Mold: 7"

Diameter of the Mold: 6"

Calibration of the Proving Ring:

y(lb) = 8.6543x + 44.39

y = load in lb; x = load dial reading

Spacer Disk: Height of the spacer disk: 2.416"

Compacted height of the sample: 4.584"

Volume of the compacted sample: 0.075 cft.

No. of Blows	Mold No.	Wt. of Mold + Base plate (gm)	Wt of compacted sample +mold+ baseplate (gm)	Wt. of compacted sample (gm)	Wet Density (PCF)	Can No.	Wt of can (gm)	Wt. of can + wet sample (gm)	Wt. of can + dry sample (gm)	Moisture Content (%)	Dry Density (PCF)	Penetration Dial Reading								Soaking Dial Reading	
												63.5	127	190.5	254	317.5	381	444.5	508		
												Penetration									
												.025"	.05"	.075"	.1"	.125"	.15"	.175"	.2"	Initial	Final
												Load Dial Reading									


Thank you