PEM

Moving Kentucky Forward

Engineering And Geotechnical Considerations

synTerra

Science & Engineering Consultants | Date

Compaction

Designation: D 698 – 00a^ε1^

INTERNATIONAL

Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3(600 kN-m/m^3))[1]

This standard is issued under the fixed designation D 698; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Paragraph 10.4.3 was corrected editorially in November 2003.

1. Scope*

1.1 These test methods covers laboratory compaction methods used to determine the relationship between water content and dry unit weight of soils (compaction curve) compacted in a 4 or 6-in. (101.6 or 152.4-mm) diameter mold with a 5.5-lbf (24.4-N) rammer dropped from a height of 12 in. (305 mm) producing a compactive effort of 12,400 ft-lbf/ft^3(600 kN-m/m^3).

NOTE 1—The equipment and procedures are similar as those proposed by R. R. Proctor (*Engineering News Record*—September 7, 1933) with this one major exception: his rammer blows were applied as "12 inch firm strokes" instead of free fall, producing variable compactive effort depending on the operator, but probably in the range 15,000 to 25,000 ft-lbf/ft^3 (700 to 1,200 kN-m/m^3). The standard effort test (see 3.2.2) is sometimes referred to as the Proctor Test.

NOTE 2—Soils and soil-aggregate mixtures should be regarded as natural occurring fine- or coarse-grained soils or composites or mixtures of natural soils, or mixtures of natural and processed soils or aggregates such as silt, gravel, or crushed rock.

1.2 These test methods apply only to soils (materials) that have 30 % or less by mass of particles retained on the ¾-inch (19.0-mm) sieve.

NOTE 3—For relationships between unit weights and water contents of

1.3.1.4 *Blows per layer*—25.

1.3.1.5 *Use*—May be used if 20 % or less by mass of the material is retained on the No. 4 (4.75-mm) sieve.

1.3.1.6 *Other Use*—If this method is not specified, materials that meet these gradation requirements may be tested using Methods B or C.

1.3.2 *Method B*:

1.3.2.1 *Mold*—4-in. (101.6-mm) diameter.

1.3.2.2 *Material*—Passing ⅜-in. (9.5-mm) sieve.

1.3.2.3 *Layers*—Three.

1.3.2.4 *Blows per layer*—25.

1.3.2.5 *Use*—Shall be used if more than 20 % by mass of the material is retained on the No. 4 (4.75-mm) sieve and 20 % or less by mass of the material is retained on the ⅜-in. (9.5-mm) sieve.

1.3.2.6 *Other Use*—If this method is not specified, materials that meet these gradation requirements may be tested using Method C.

1.3.3 *Method C*:

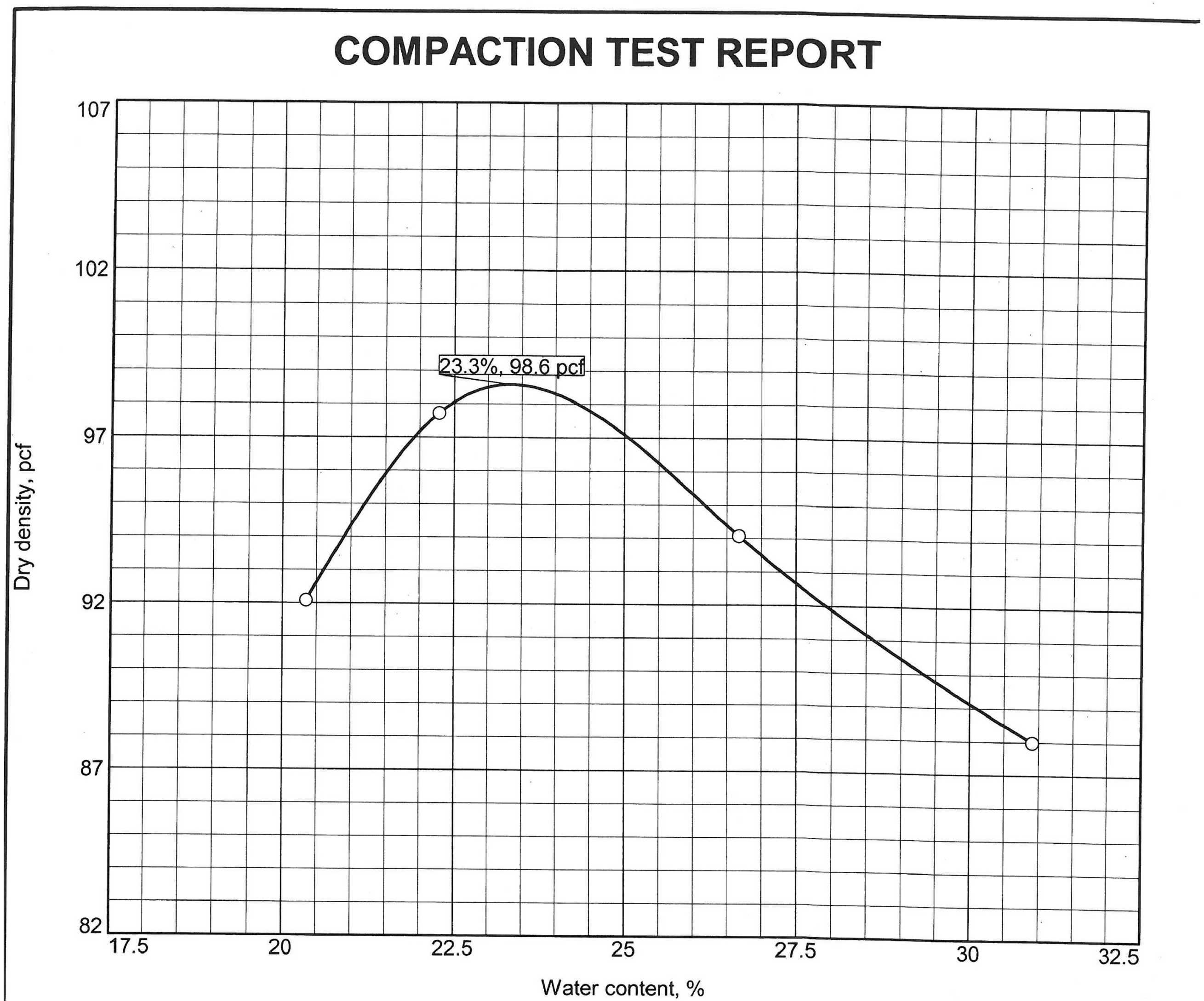
1.3.3.1 *Mold*—6-in. (152.4-mm) diameter.

1.3.3.2 *Material*—Passing ¾-inch (19.0-mm) sieve.

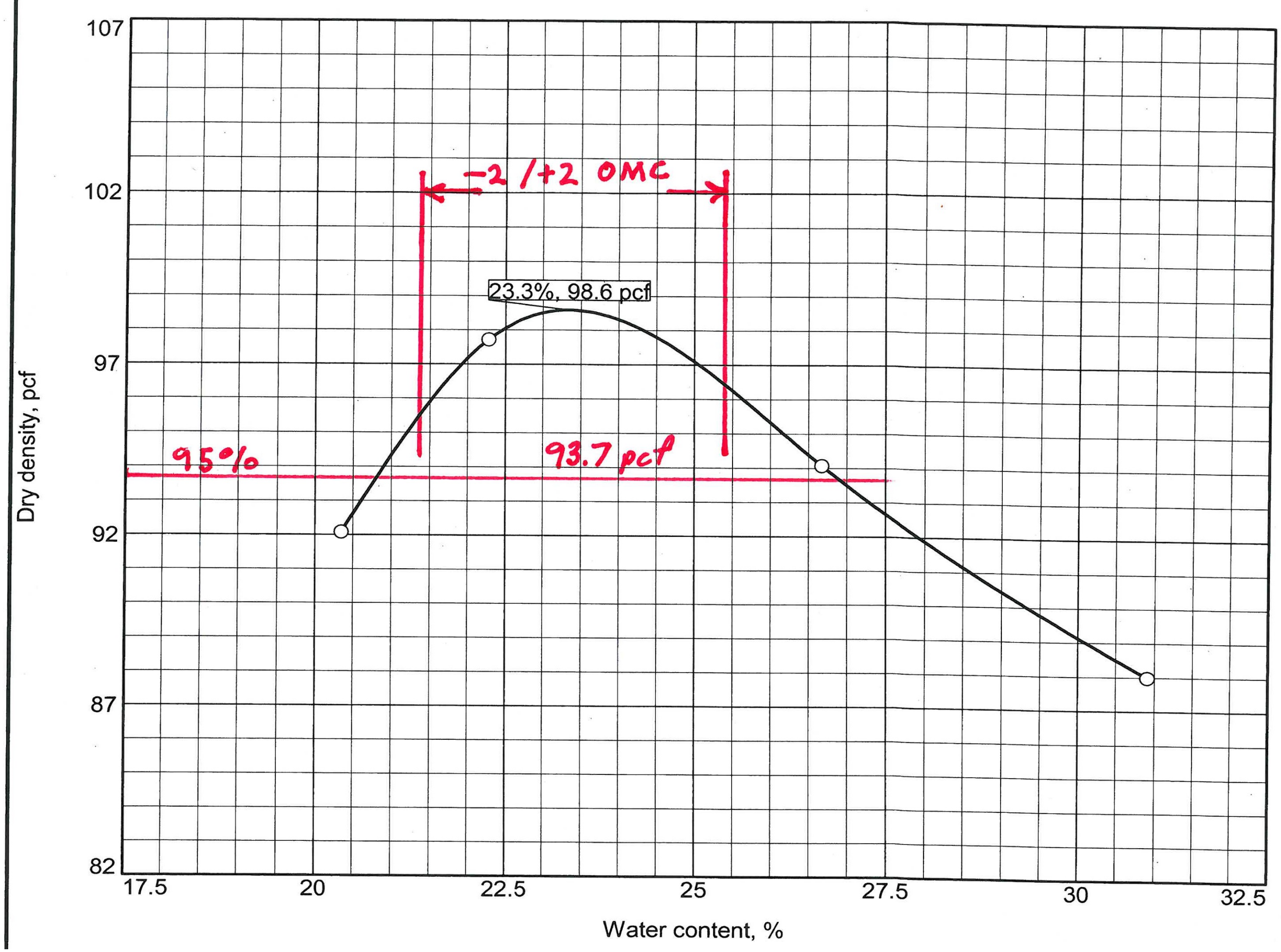
1.3.3.3 *Layers*—Three.

1.3.3.4 *Blows per layer*—56.

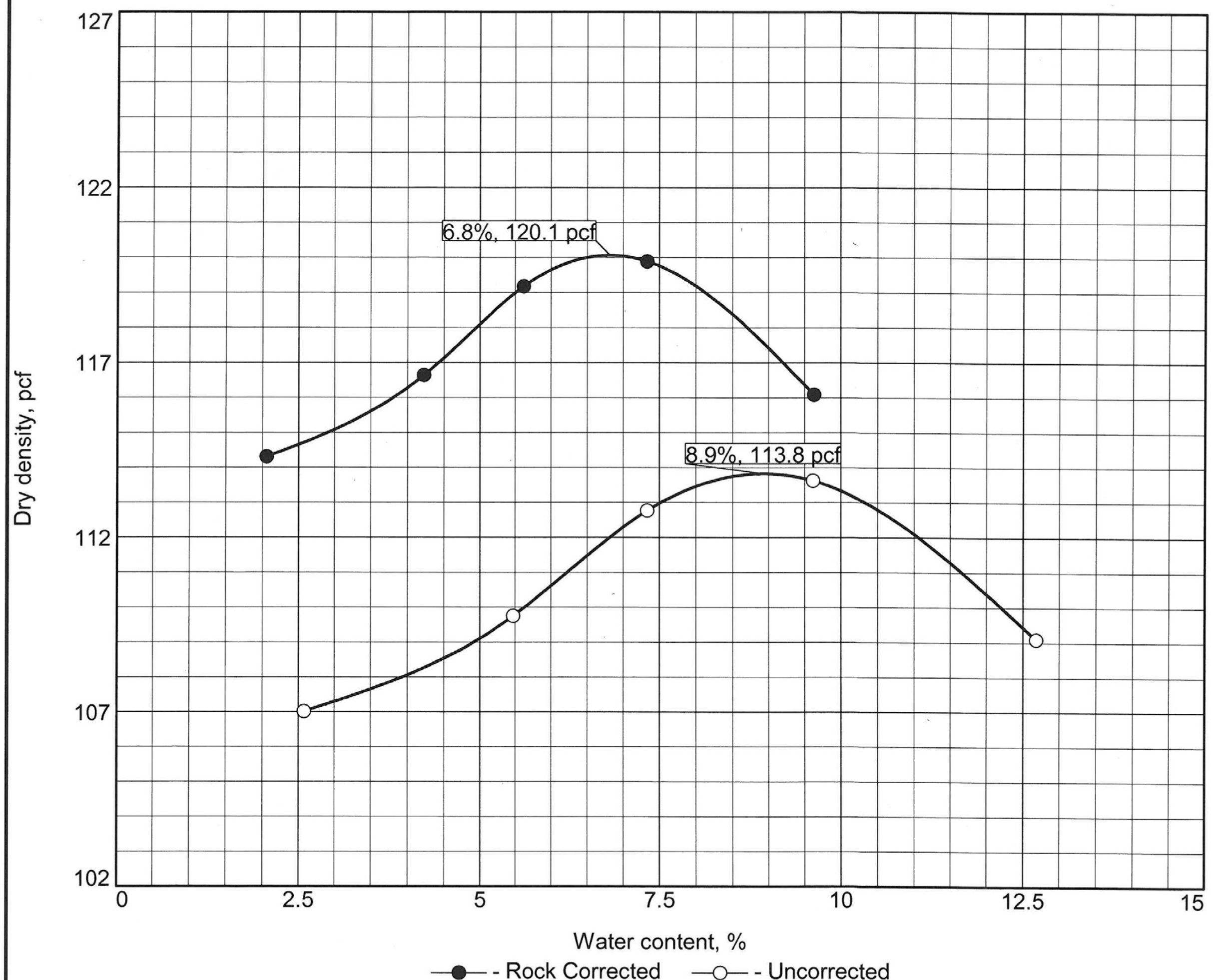

FORNEY
FORNEY INCORPORATED


COMPACTION TEST REPORT
107
102
97
92
87
82
Dry density, pcf
23.3%, 98.6 pcf
17.5
20
22.5
25
27.5
30
32.5
Water content, %

COMPACTION TEST REPORT

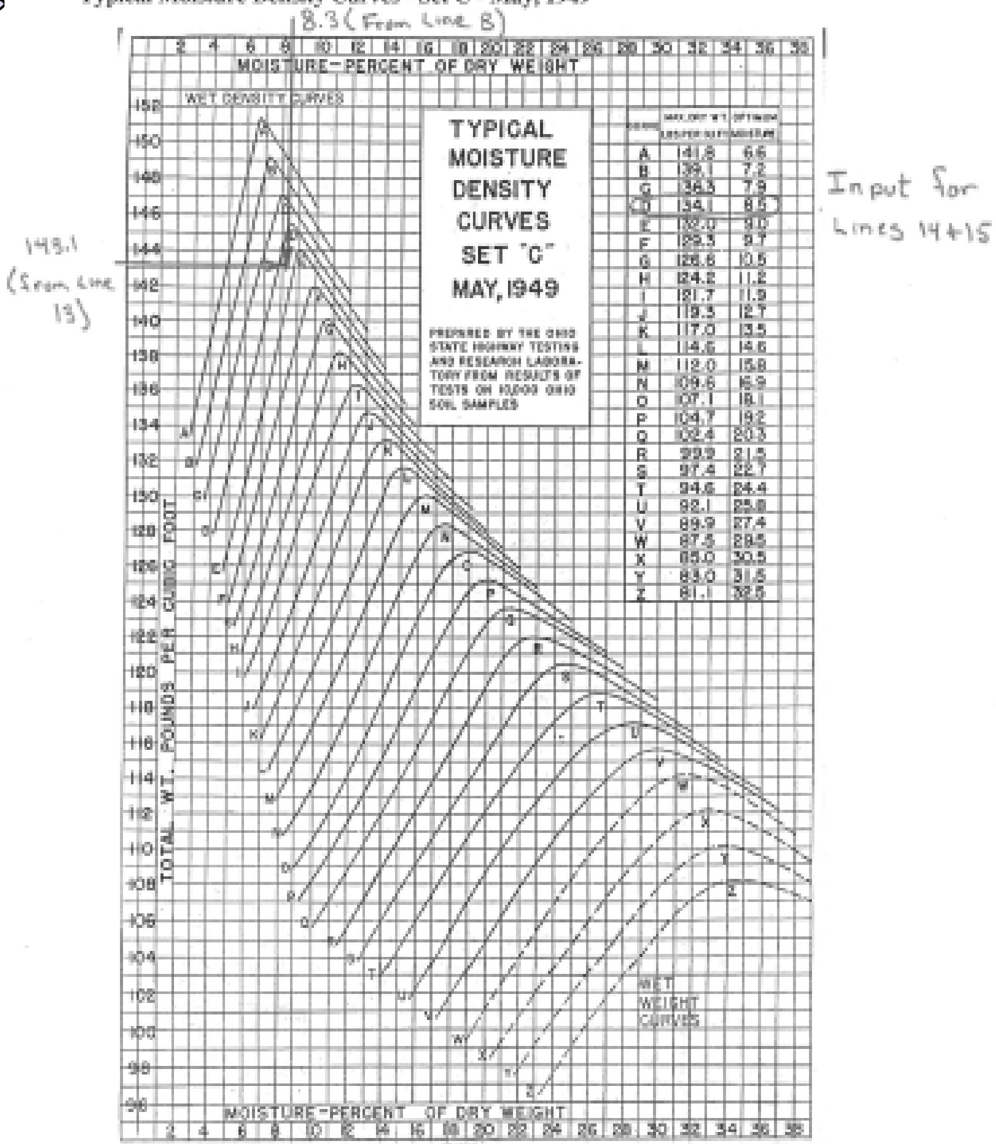


COMPACTION TEST REPORT

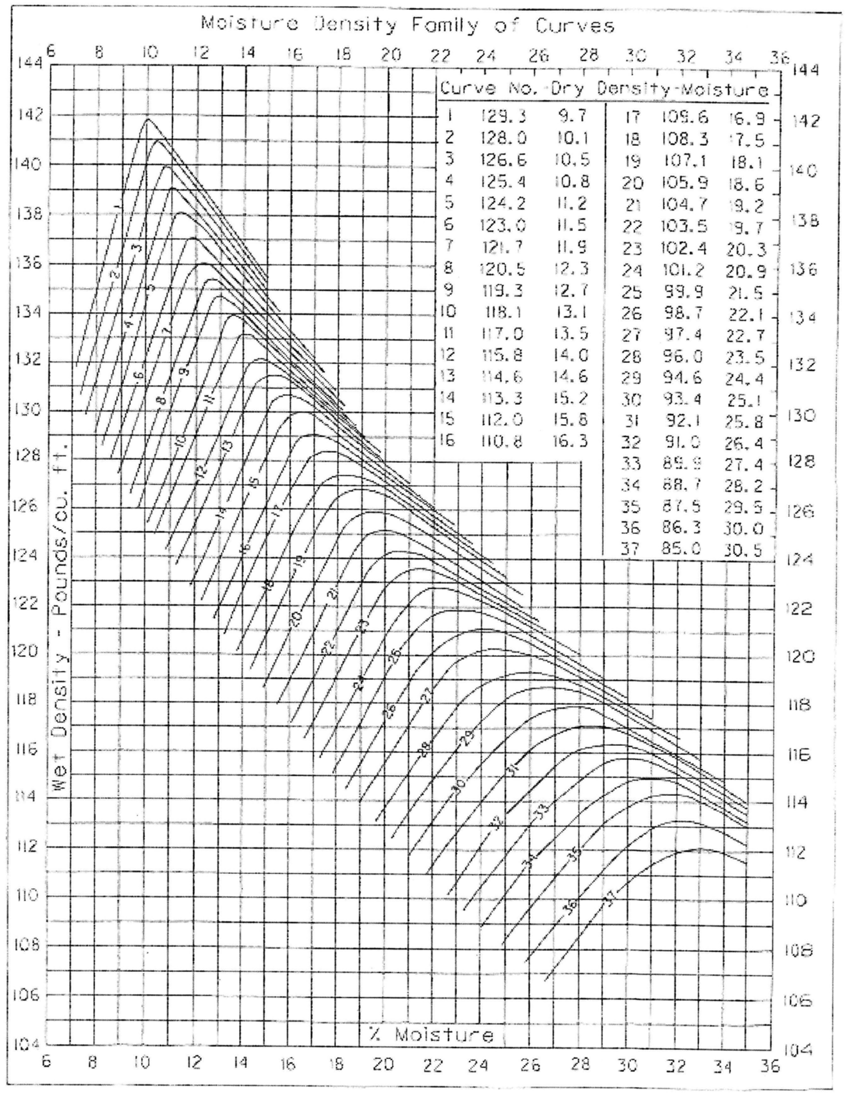


Test specification: ASTM D 698-91 Procedure C Standard
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Typical Moisture Density Curves - Set C - May, 1949

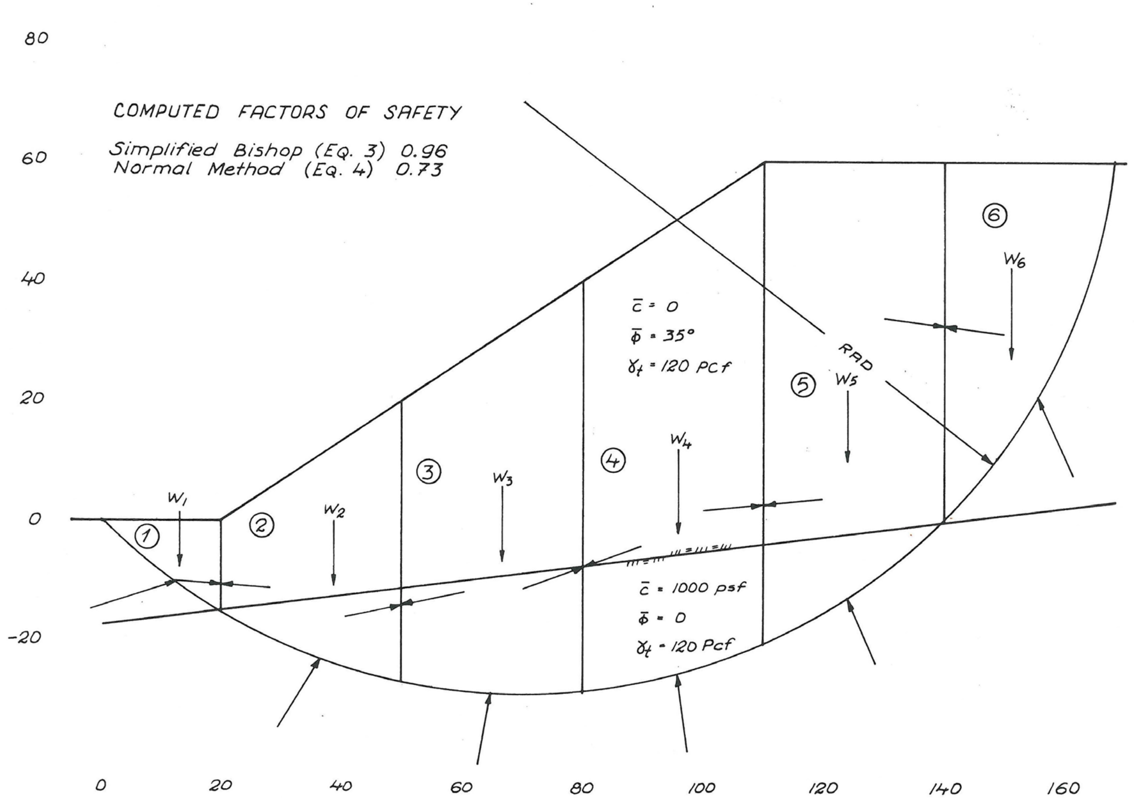


CURVE	MAX. DRY WT. LBS. PER CU. FT.	OPTIMUM MOISTURE
A	141.8	6.6
B	139.1	7.2
C	136.3	7.9
D	134.1	8.5
E	132.0	9.0
F	129.5	9.7
G	126.6	10.5
H	124.2	11.2
I	121.7	11.9
J	119.3	12.7
K	117.0	13.5
L	114.6	14.6
M	112.0	15.8
N	109.6	16.9
O	107.1	18.1
P	104.7	19.2
Q	102.4	20.3
R	99.9	21.5
S	97.4	22.7
T	94.6	24.4
U	92.1	25.8
V	89.9	27.4
W	87.5	28.5
X	85.0	30.5
Y	83.0	31.5
Z	81.1	32.5


Moisture Density Family of Curves
Curve No.-Dry Density-Moisture
1 129.3 9.7
2 128.0 10.1
3 126.6 10.5
4 125.4 10.8
5 124.2 11.2
6 123.0 11.5
7 121.7 11.9
8 120.5 12.3
9 119.3 12.7
10 118.1 13.1
11 117.0 13.5
12 115.8 14.0
13 114.6 14.6
14 113.3 15.2
15 112.0 15.8
16 110.8 16.3
17 109.6 16.9
18 108.3 17.5
19 107.1 18.1
20 105.9 18.6
21 104.7 19.2
22 103.5 19.7
23 102.4 20.3
24 101.2 20.9
25 99.9 21.5
26 98.7 22.1
27 97.4 22.7
28 96.0 23.5
29 94.6 24.4
30 93.4 25.1
31 92.1 25.8
32 91.0 26.4
33 89.9 27.4
34 88.7 28.2
35 87.5 29.5
36 86.3 30.0
37 85.0 30.5
Wet Density - Pounds/cu. ft.
% Moisture

KM 64-512-08
4

Slope Stability Analyses



Slope Stability Analyses

Methods of Analysis

1. Taylor
2. Normal
3. Simplified Bishop
4. Jambu.
5. Wedges and Blocks

Numerous Computer Programs

Analysis Variables and Inputs

- Embankment Slopes
- Existing Ground Lines

? How Were These Determined

Site Surveys? Mapping?
Assumed?

Analysis Variables and Inputs

- Foundation Soil Thickness
- Soil Profile Lithology
- Bedrock Depth

? How Were These Determined

Borings? How Many? Type?

Analysis Variables and Inputs

- Embankment Material Properties
- Foundation Soil Properties

? How Were These Determined

Laboratory Testing ?

Published Average ?

Regulatory Mandated?

Analysis Variables and Inputs

- Embankment Phreatic Surface
- Foundation Soil Groundwater
- Excess Pore Water Pressure ?

? How Were These Determined

Piezometer Measurements?

Seepage Analysis?

Assumed?

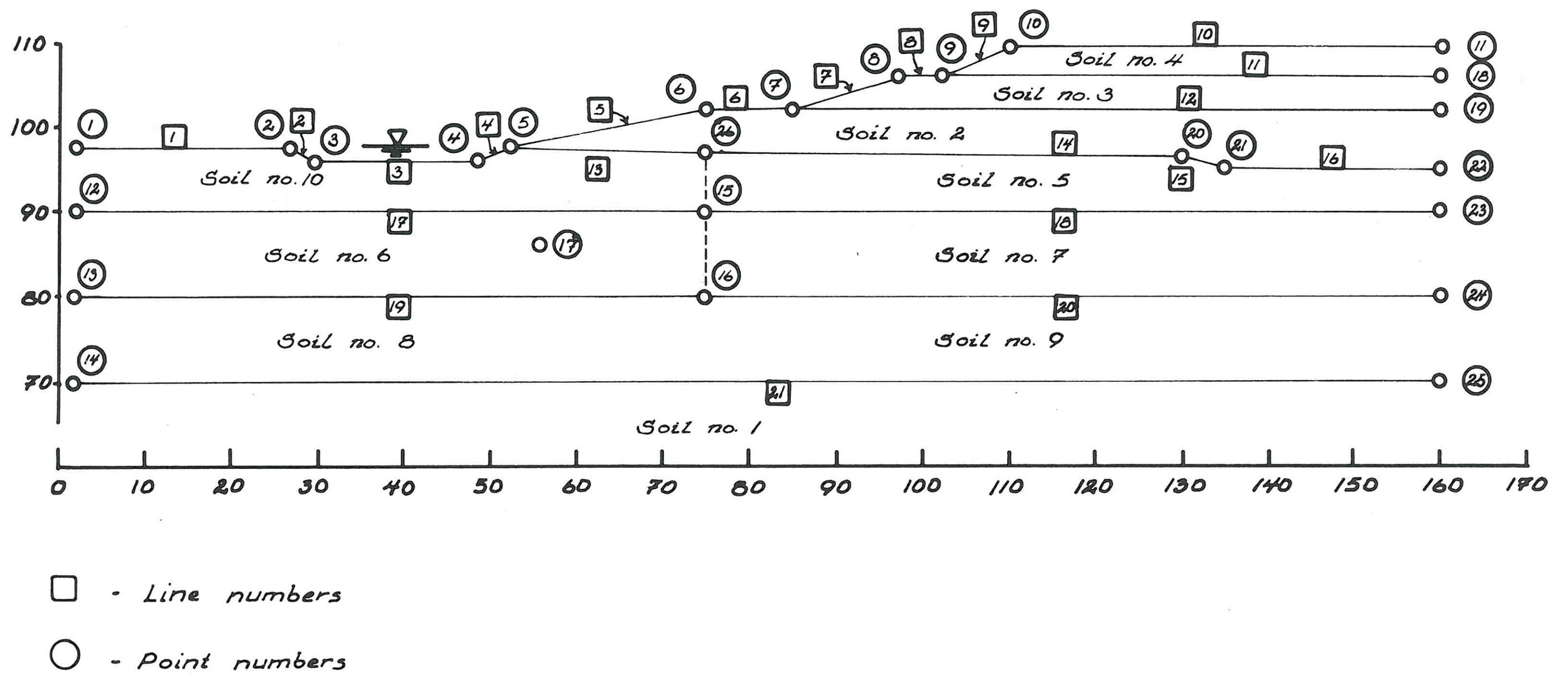
Analysis Variables and Inputs

- Critical Failure Configuration
  - Method Of Analysis

? What Best Models Site

Total Stress or Effective Stress?

Circle ? Wedge ? Block? Random?



CROSS-SECTION OF A TYPICAL SLOPE

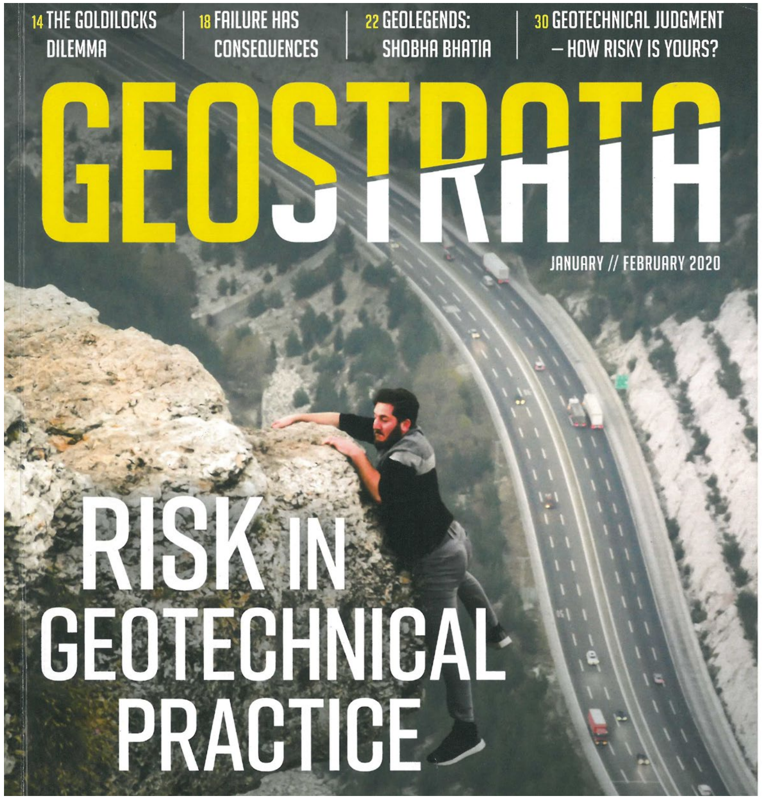
Factor of Safety

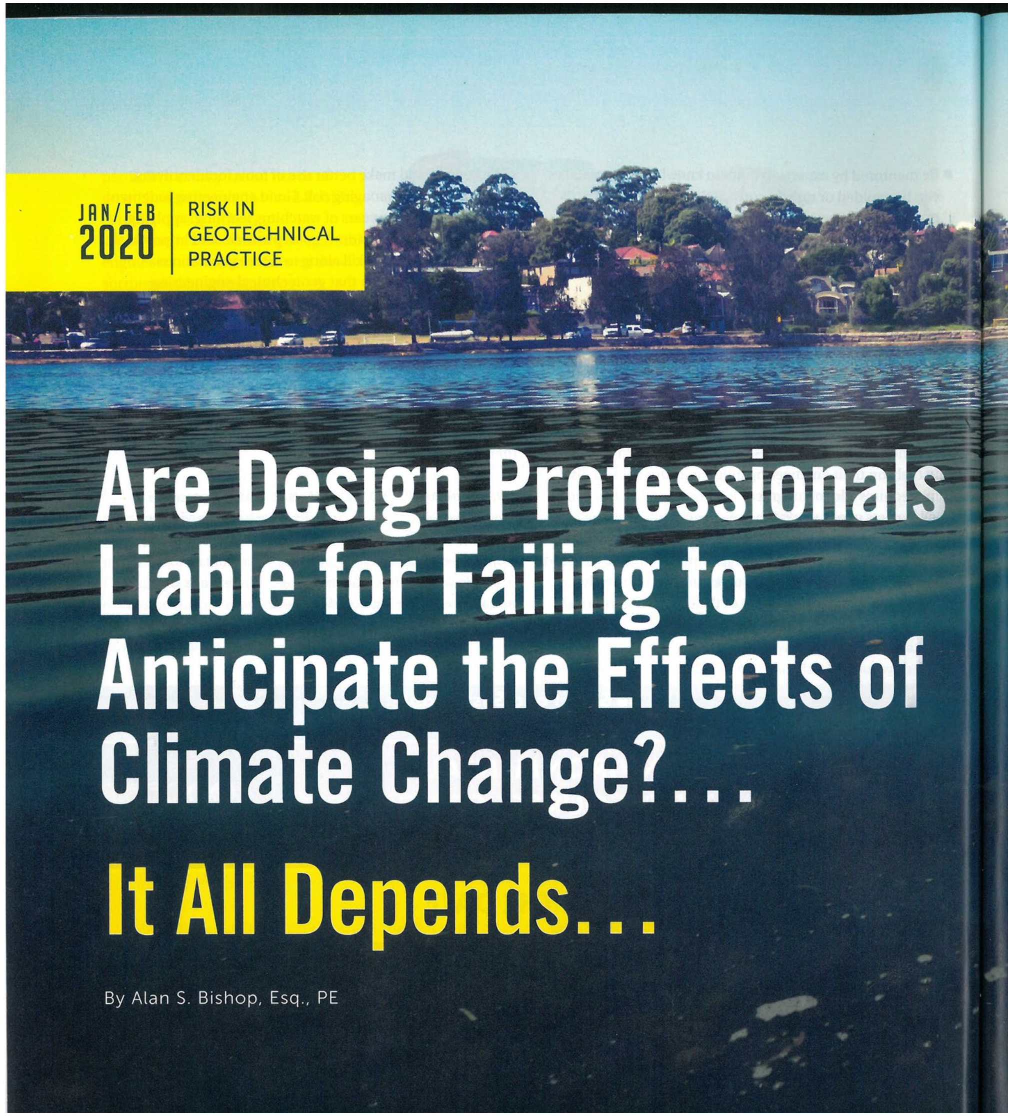
$$F.S. = \frac{\Sigma \text{ Resisting Forces}}{\Sigma \text{ Driving Forces}}$$

F.S. = # +/-

JUDGEMENT

CONSIDERATIONS



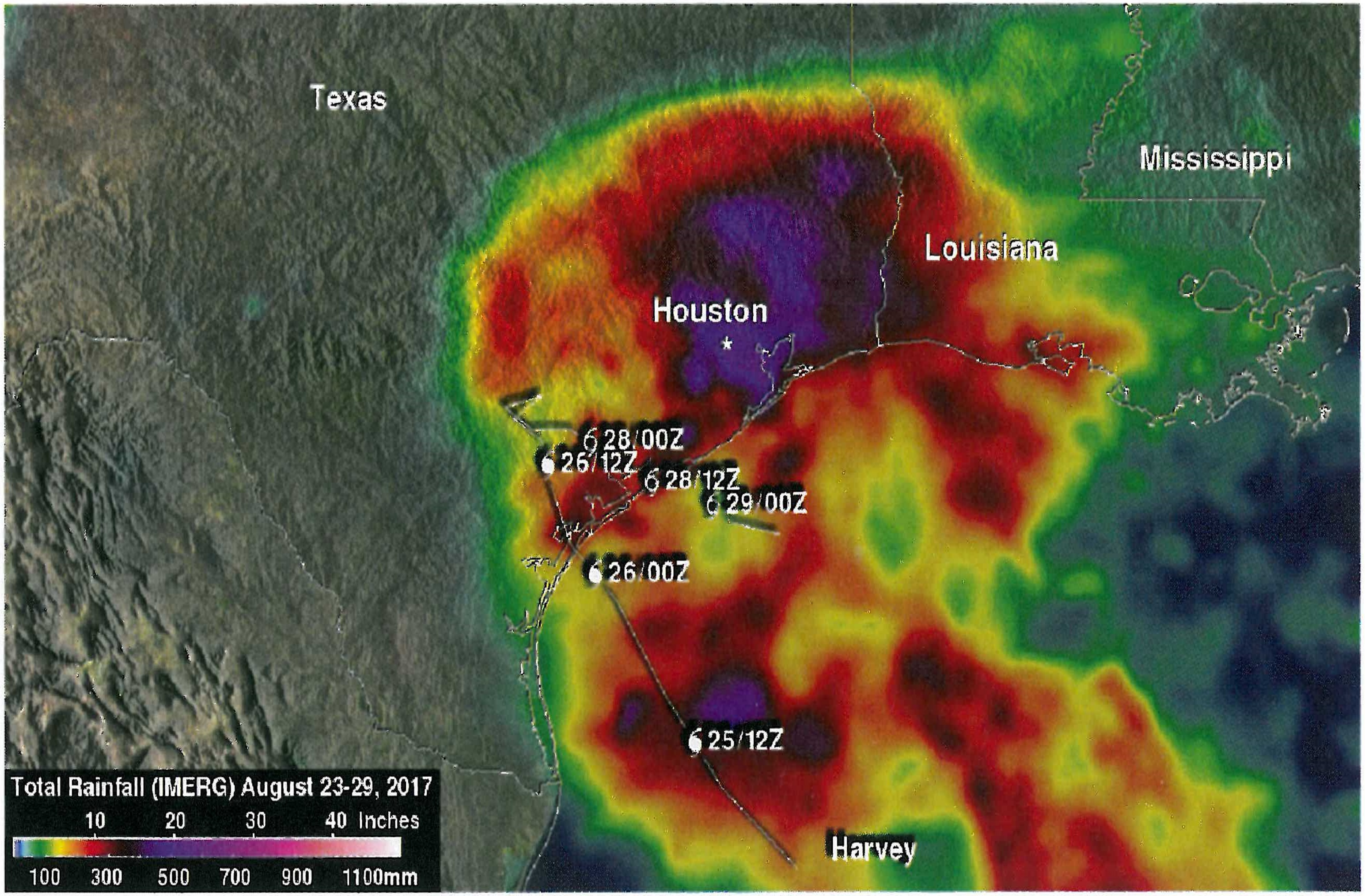


JAN/FEB 2020 | RISK IN GEOTECHNICAL PRACTICE

Are Design Professionals Liable for Failing to Anticipate the Effects of Climate Change?...

It All Depends...

By Alan S. Bishop, Esq., PE


Texas
Mississippi
Louisiana
Houston
28/00Z
26/12Z
28/12Z
29/00Z
26/00Z
25/12Z
Harvey
Total Rainfall (IMERG) August 23-29, 2017
10 20 30 40 Inches
100 300 500 700 900 1100mm

In the eastern U.S.,

100-year storms have

become 85 percent more

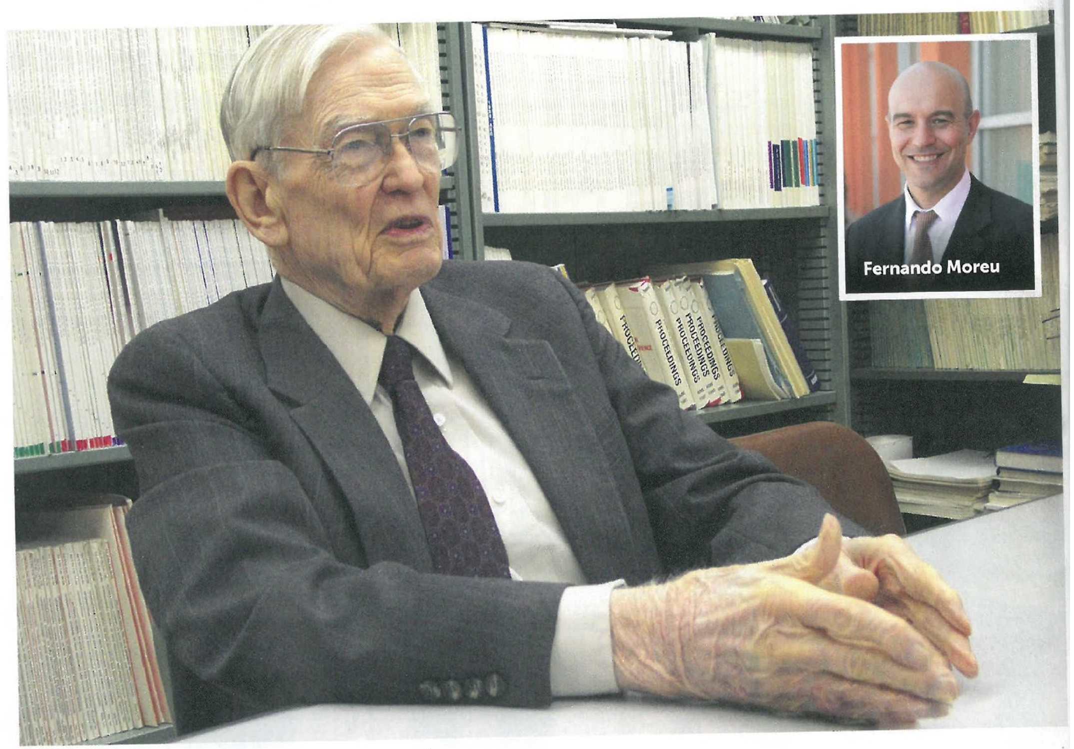
common since 1950.

BUILDING CODE
= or ≠
STANDARD OF PRACTICE
?

// Lessons Learned from GeoLegends

Ralph B. Peck, PhD, PE, NAE, Hon.M.ASCE

By Fernando Moreu, PhD, PE, M.ASCE



I don't do jobs that I can't visit.

I'm not against computers by any means, but I'm against using them blindly.

Engineering Experience
Professional Judgement
Standard of Practice
State of the Art

Design Projects

Construction Challenges

Client Expectations

THANK YOU