

SUPPLEMENTAL REPORT
GEOTECHNICAL INVESTIGATION
MAGNET DEVELOPMENT LABORATORY FACILITY
SUPERCONDUCTING SUPER COLLIDER PROJECT
ELLIS COUNTY, TEXAS

FOR

The PB/MK Team
Dallas, Texas

**MASON
JOHNSTON
& ASSOCIATES, INC.**

geotechnical consultants

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INTRODUCTION

The Geotechnical Investigation conducted for Subcontract No. SC-A42-1002 was reported initially before all laboratory testing was completed. This supplemental report contains a brief description of tests performed on bulk samples from the site and swell tests on selected samples from the borings. This report should be used in conjunction with Report No. MJA 5730/90 dated 10 September 1990.

In addition to the tests reported herein, comments on drainage questions raised after the submittal of the initial report are discussed in this supplemental report.

LABORATORY TESTS

The expansive characteristics of the overburden soils were

investigated in the laboratory by conducting Absorption-Pressure and Swell Tests on three selected samples of the near-surface clays obtained from the borings for this study. These tests provide a measure of the maximum pressure that may be expected to be generated when the soil sample is exposed to water and restrained from movement and a measure of the maximum free swell when total vertical restraint is removed. These tests were performed in general accordance with ASTM D 4546. After a specimen is trimmed into a rigid steel ring, it is placed in a standard consolidometer with porous stones on the top and bottom surfaces of the specimen. A small balancing load is placed on the specimen and water is introduced into the consolidometer to cover the specimen and the porous stones. The vertical height of the specimen is monitored and load is added as needed to keep the specimen from swelling. The swell pressure is determined as the total pressure required to keep the specimen from swelling. After reaching this equilibrium pressure, the specimen is unloaded in decrements of one-half and one-quarter of the maximum load and finally the load is reduced to zero while monitoring the increase in height, or swell, of the specimen. A companion specimen was set up for each specimen tested as described above. The swell pressure only was determined for the companion specimen. Graphical results of the Absorption-Pressure and Swell tests are presented on Plates 1 through 3.

Two large volume samples were obtained at the site and returned

GEOLOGISTS

to our laboratory for testing. These samples were taken from near-surface clays at the east and west ends of the proposed MDL structure. To aid in the classification process, Atterberg Limits were performed on representative portions of each sample. The results of these Atterberg Limit determinations are presented on Plates 4 and 5. As the limits were similar, the two samples were combined for further testing. Standard Proctor Compaction (ASTM D 698) and California Bearing Ratio, CBR, (ASTM D 1883) tests were performed on the combined sample. The results of these tests are presented on Plates 6 through 10. Similar tests were performed on a portion of the combined sample mixed with six percent hydrated lime by weight. The test results are presented on Plates 11 through 15.

PAVING

As discussed in the initial geotechnical report, the swell tests and plasticity/moisture condition of the near-surface clays indicate that these soils may be subject to significant volume changes with changes in soil moisture. We recommend that clay soils at grade be stabilized with hydrated lime for use as subbase. A minimum treatment depth of six (6) inches is recommended and, subject to modification during construction, a hydrated lime content of six (6) percent by dry soil weight (approximately 6 pounds per cubic foot of soil treated) would be expected to effectively stabilize the subgrade soil at this site.

The CBR results indicate that the untreated near-surface clay, compacted to at least 95 percent of maximum dry density determined by a Standard Proctor Compaction test (ASTM D 698) and at the optimum moisture content determined by that test, has a CBR value in excess of 3. The CBR value determined for lime treated material is greater than 20. We recommend that these values be used in pavement design.

DRAINAGE

The soil surface outside the MDL structure should be prepared to provide positive drainage away from the structure. We understand that the grade beams will be formed by vertical excavation (trenching) in the near-surface weathered limestone. We recommend that concrete be placed for these grade beams within 8 hours after excavation to take advantage of the rebound of the limestone, thus helping to seal off drainage paths for exterior water moving under the grade beam and collecting under the floor slab. With this type of foundation preparation, we believe that a perimeter drainage system will not be needed. Care should be taken when planning landscaping around the structure to keep from creating sources of exterior water.

It is recommended that the soil and foundation engineer be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in

the design and specifications.

In the event that any changes in the nature, design or location of the building are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

The analyses and recommendations submitted in this report are based in part upon the data obtained from 14 borings. The nature and extent of variations between the borings may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

We appreciate the opportunity to work with you on this phase of the project. Please do not hesitate to call if we can be of further assistance.



Respectfully submitted,

John W. Johnston
John W. Johnston, P.E.

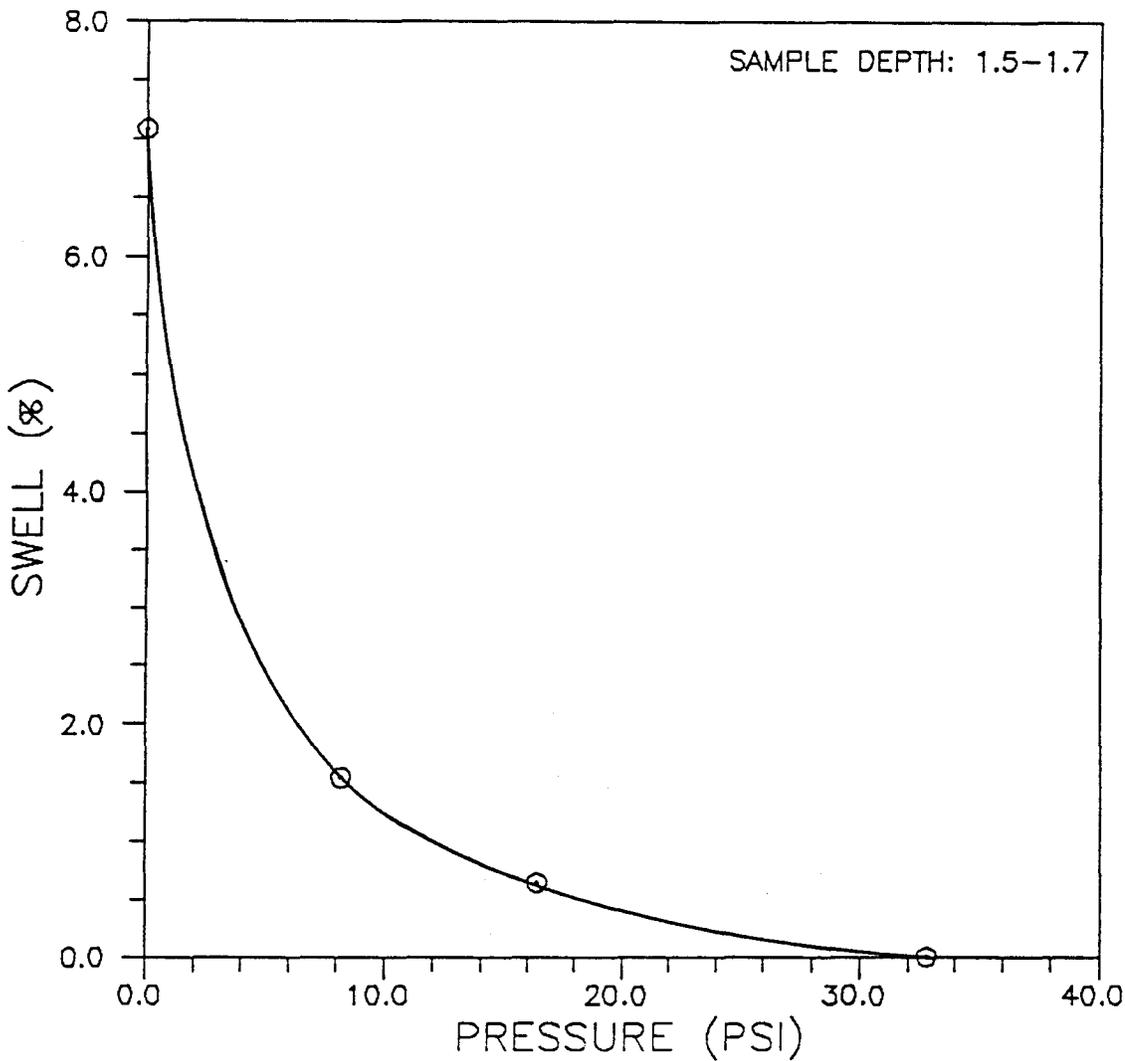
Aubrey D. Henley
Aubrey D. Henley, R.G.

Mason-Johnston & Associates, Inc.

14 November 1990

MJ 5730888

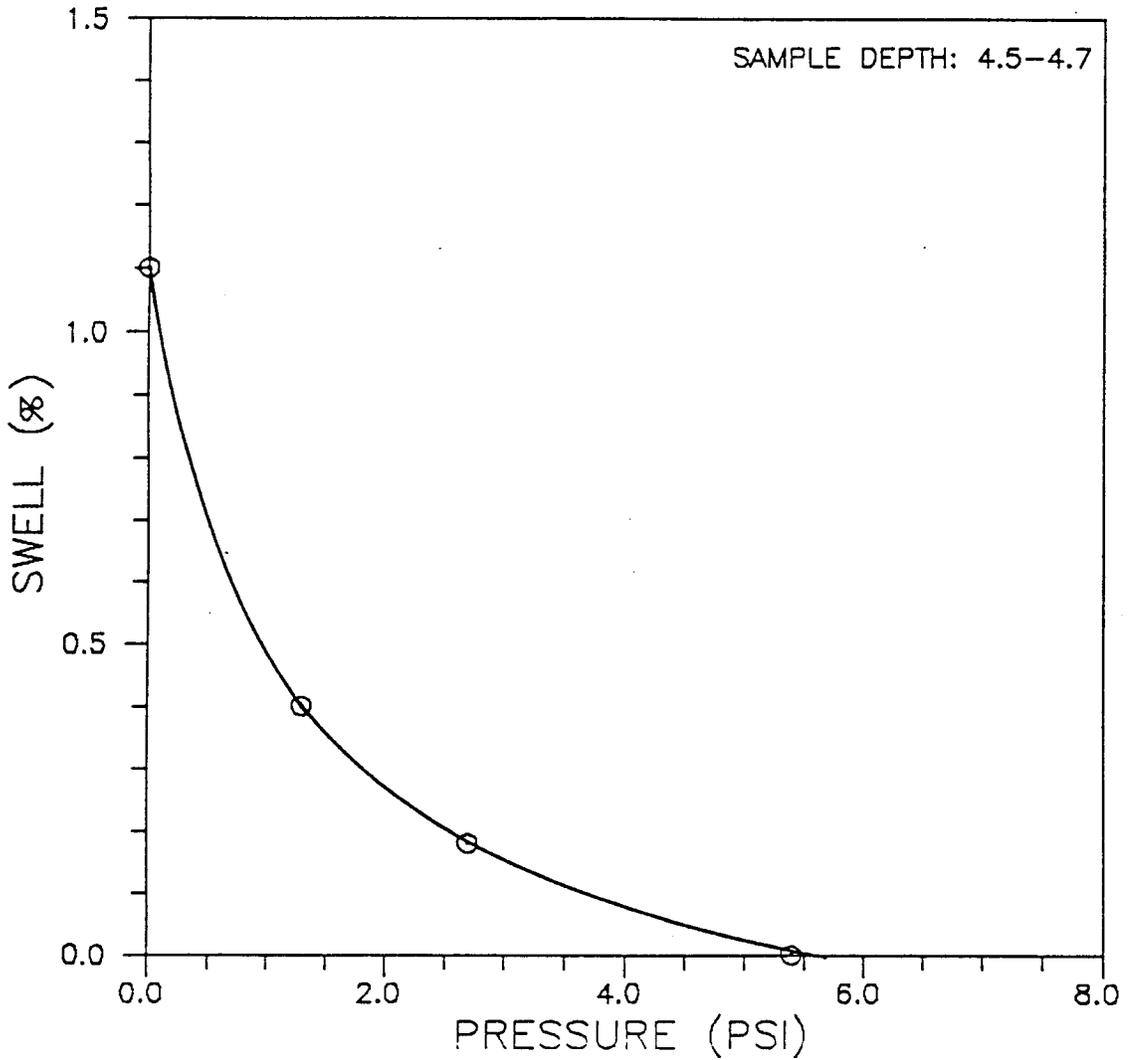
BORING NO.: MDL-5
 DEPTH (FT): 1.5-1.9
 CLAY, hard, dk. brown



SAMPLE DEPTH:	1.5-1.7	1.7-1.9
DRY UNIT WEIGHT (PCF):	91.1	90.7
M.C. BEFORE TEST (%):	28.5	28.2
M.C.AFTER TEST (%):	36.5	32.2
GAIN IN MOISTURE (%):	8.0	4.0
SWELL POTENTIAL (PSI):	32.8	31.4

MAGNET DEVELOPMENT FACILITY	
SWELL POTENTIAL PLOT	
MASON-JOHNSTON & ASSOCIATES, INC. GEOLOGISTS-ENGINEERS	
JOB NO.: 5730	PLATE 1

BORING NO.: MDL-5
 DEPTH (FT): 4.5-4.9
 CLAY, hard, tan



SAMPLE DEPTH:	4.5-4.7	4.7-4.9
DRY UNIT WEIGHT (PCF):	97.5	100.7
M.C. BEFORE TEST (%):	21.3	18.7
M.C.AFTER TEST (%):	26.1	24.0
GAIN IN MOISTURE (%):	4.8	5.4
SWELL POTENTIAL (PSI):	5.4	3.6

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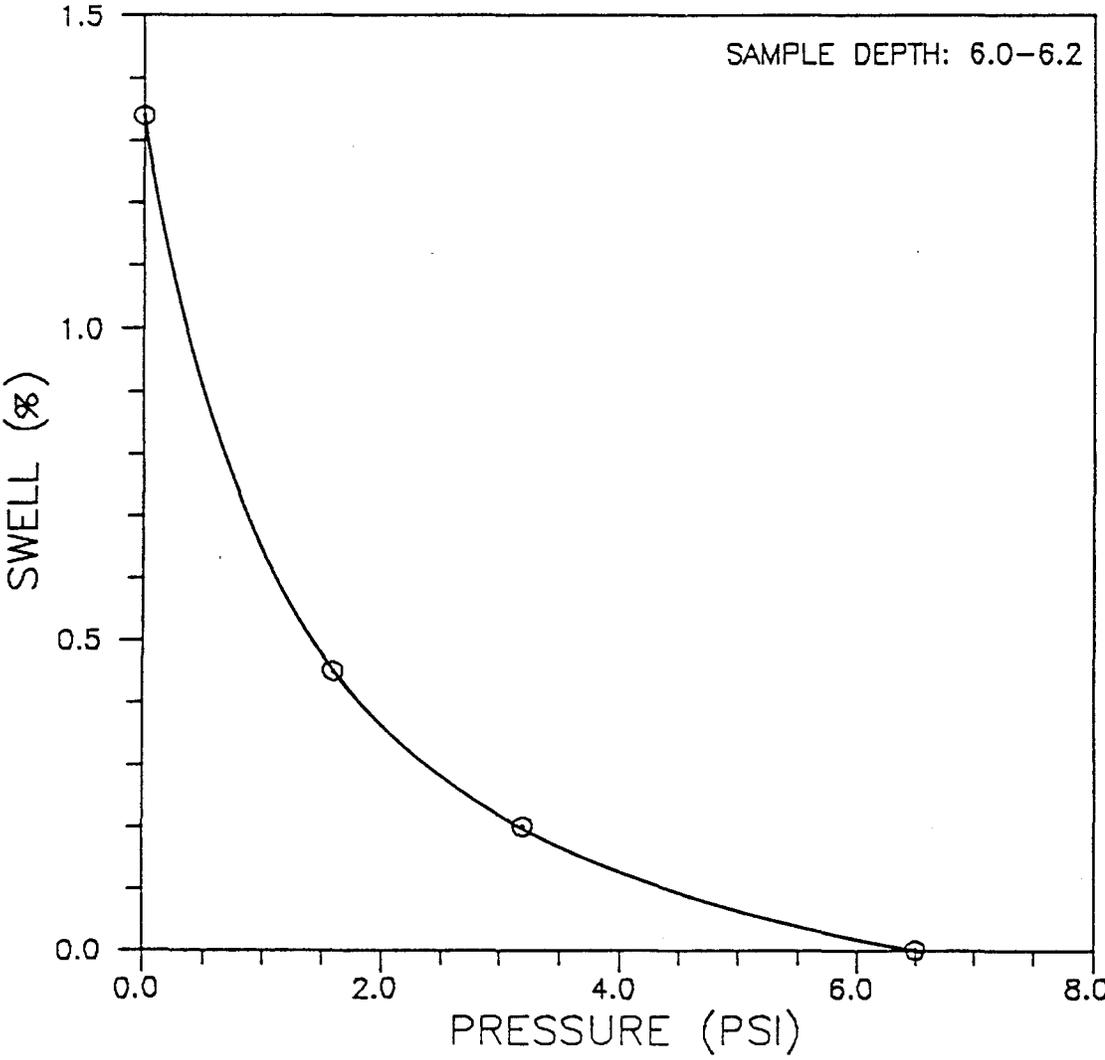
SWELL POTENTIAL PLOT

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JOB NO.: 5730

PLATE 2

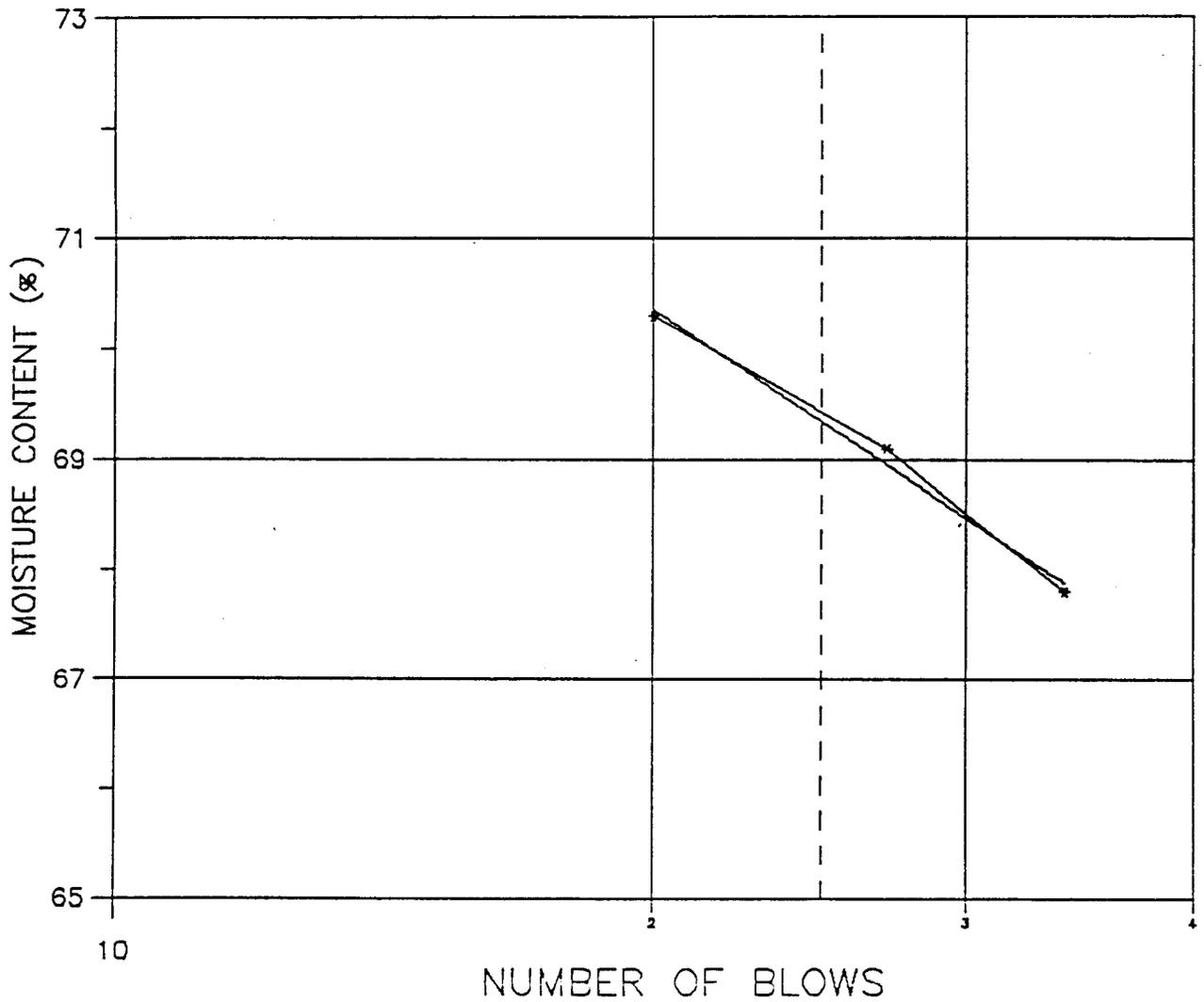
BORING NO.: MDL-6
 DEPTH (FT): 6.0-6.4
 CLAY, v. stiff, tan



SAMPLE DEPTH:	6.0-6.2	6.2-6.4
DRY UNIT WEIGHT (PCF):	100.8	102.2
M.C. BEFORE TEST (%):	21.3	21.8
M.C. AFTER TEST (%):	26.3	24.4
GAIN IN MOISTURE (%):	5.0	2.7
SWELL POTENTIAL (PSI):	6.5	5.7

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SWELL POTENTIAL PLOT	
MASON-JOHNSTON & ASSOCIATES, INC. GEOLOGISTS-ENGINEERS	
JOB NO.: 5730	PLATE 3

BORING NO.: LG. VOL. SAMPLE
 LOCATION: EAST SIDE OF SITE
 CLAY, brown w/ wea. L.S. frags.



M.C. = $-4.676 \cdot \ln(\text{BLOWS}) + 84.371$
 L.L. = 69 AT 25 BLOWS

L.L. = 69
 P.L. = 40
 P.I. = 29

MAGNET DEVELOPMENT FACILITY

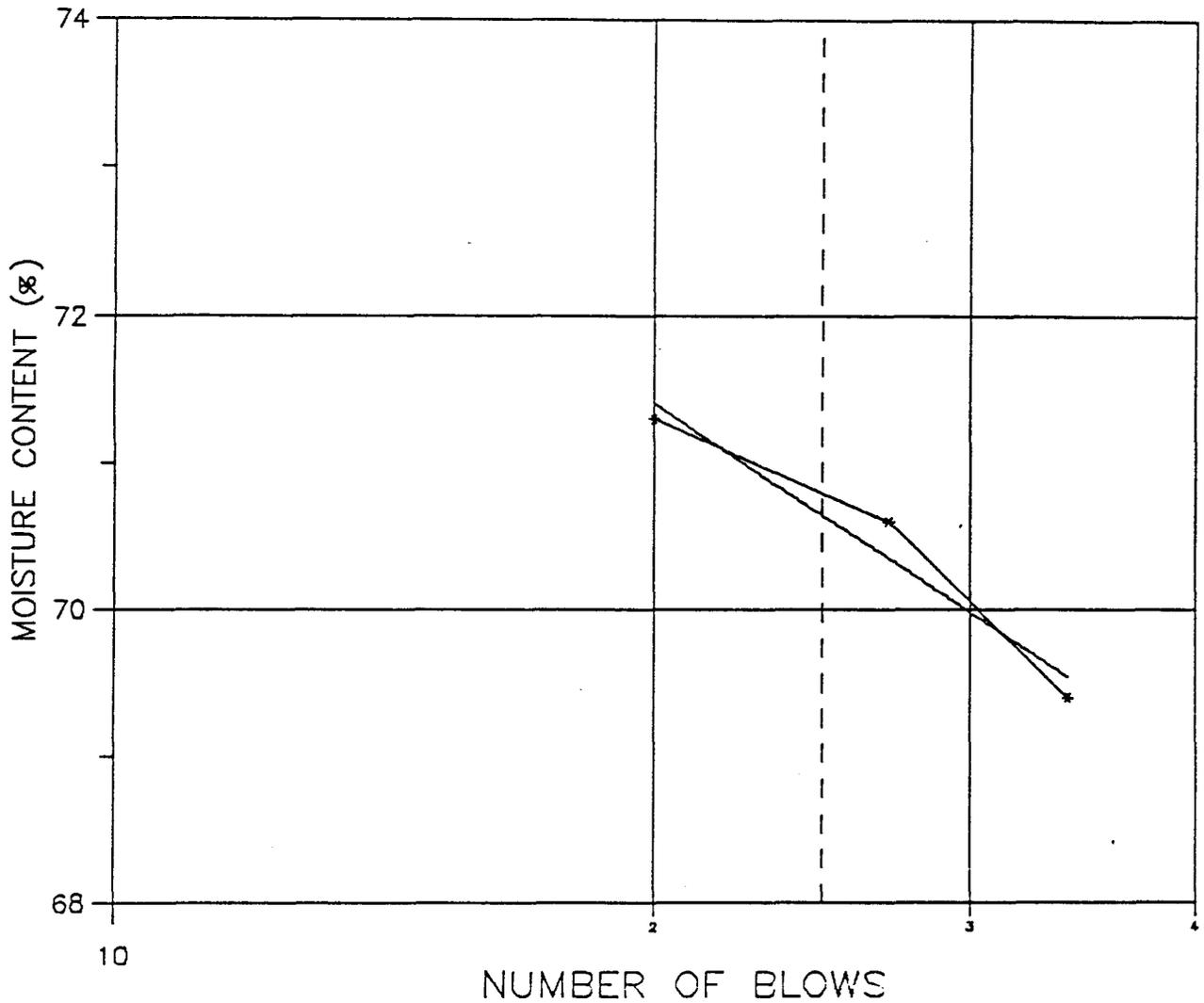
ATTERBERG LIMITS

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 GEOLOGISTS-ENGINEERS

JOB NO.: 5730

PLATE 4

BORING NO.: LG. VOL. SAMPLE
 LOCATION: WEST SIDE OF SITE
 CLAY, dk. gray



M.C. = $-3.519 \cdot \ln(\text{BLOWS}) + 81.951$
 L.L. = 71 AT 25 BLOWS

L.L. = 71
 P.L. = 37
 P.I. = 34

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ATTERBERG LIMITS

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JOB NO.: 5730

PLATE 5

OPTIMUM MOISTURE-DENSITY TEST

MAGNET DEVELOPMENT FACILITY

JOB NO: 5730

TEST METHOD : ASTM D-698

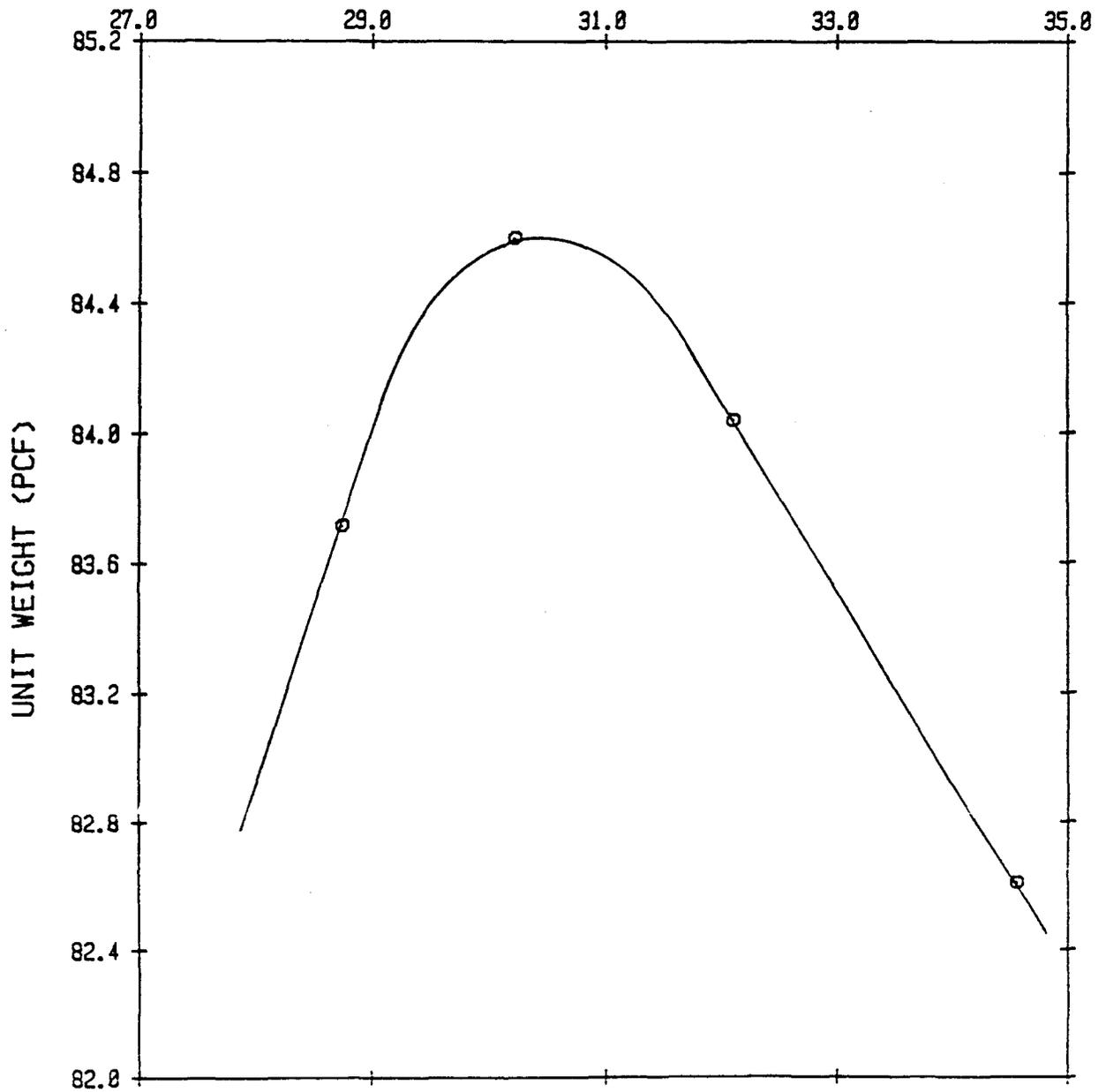
BORING # L. VOL.

OPTIMUM MOISTURE= 30.5%

DEPTH:

MAX UNIT DRY WEIGHT= 84.6 pcf

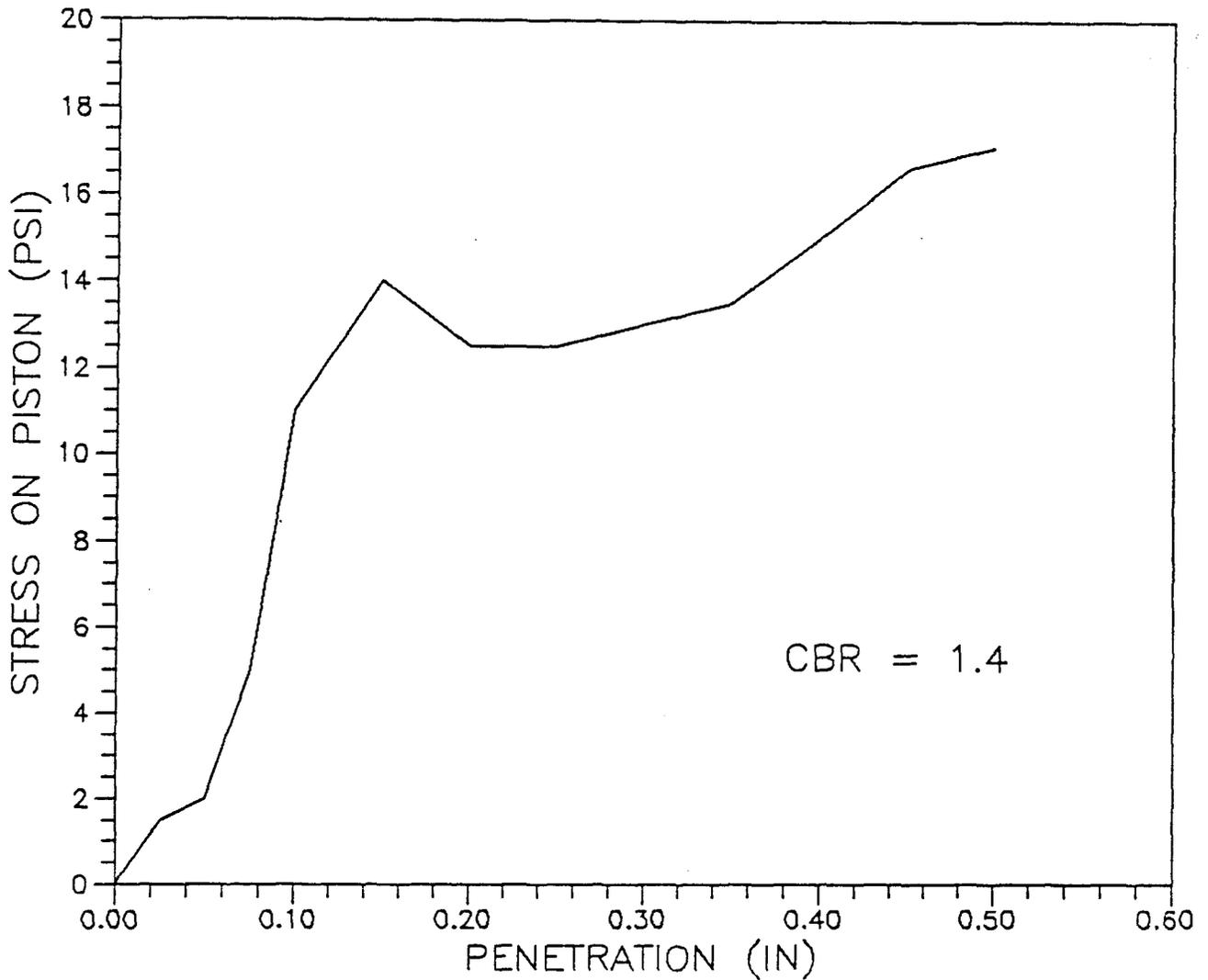
MOISTURE CONTENT (%)



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LARGE VOLUME SAMPLE
CLAY, dk. gray & brown

10 BLOWS



CBR = 1.4

TEST TYPE: CALIFORNIA BEARING RATIO
(ASTM D 1883)

PREPARATION & COMPACTION:
(ASTM D 698)

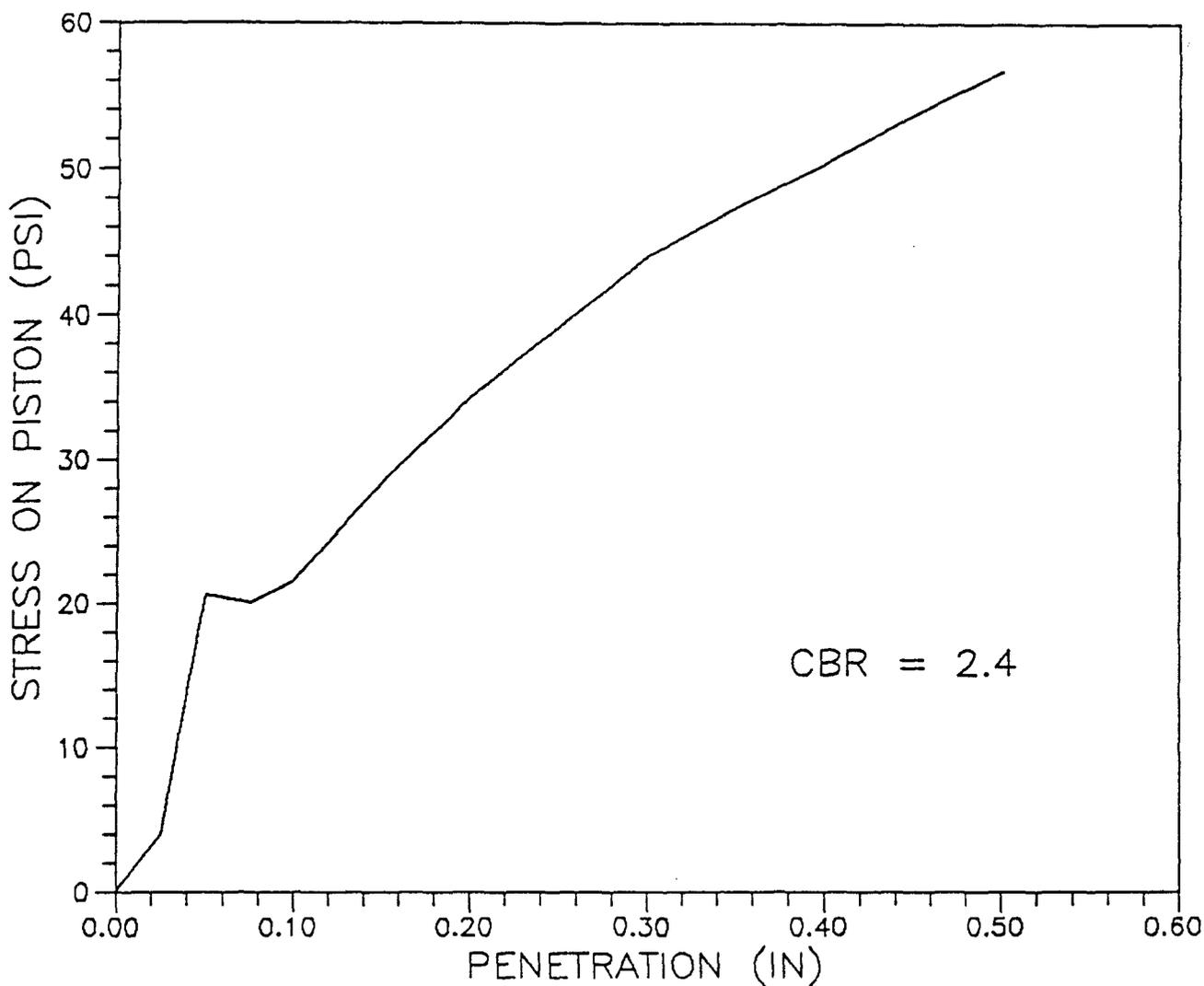
CONDITION OF SAMPLE: SOAKED
DRY UNIT WEIGHT-BEFORE SOAK (pcf): 64.3
DRY UNIT WEIGHT-AFTER SOAK (pcf): 64.1
MOISTURE CONTENT BEFORE TEST (%): 30.1
MOISTURE CONTENT TOP 1" LAYER (%): 50.3

SWELL (% OF INITIAL HEIGHT): 2.79
SURCHARGE AMOUNT (gms): 4535.9

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CALIFORNIA BEARING RATIO	
MASON-JOHNSTON & ASSOCIATES, INC. GEOLOGISTS-ENGINEERS	
JOB NO.: 5730	PLATE 7

LARGE VOLUME SAMPLE
CLAY, dk. gray & brown

25 BLOWS



TEST TYPE: CALIFORNIA BEARING RATIO
(ASTM D 1883)

PREPARATION & COMPACTION:
(ASTM D 698)

CONDITION OF SAMPLE: SOAKED
DRY UNIT WEIGHT-BEFORE SOAK (pcf): 74.0
DRY UNIT WEIGHT-AFTER SOAK (pcf): 71.3
MOISTURE CONTENT BEFORE TEST (%): 30.7
MOISTURE CONTENT TOP 1" LAYER (%): 44.9

SWELL (% OF INITIAL HEIGHT): 3.47
SURCHARGE AMOUNT (gms): 4535.9

MAGNET DEVELOPMENT FACILITY

CALIFORNIA BEARING RATIO

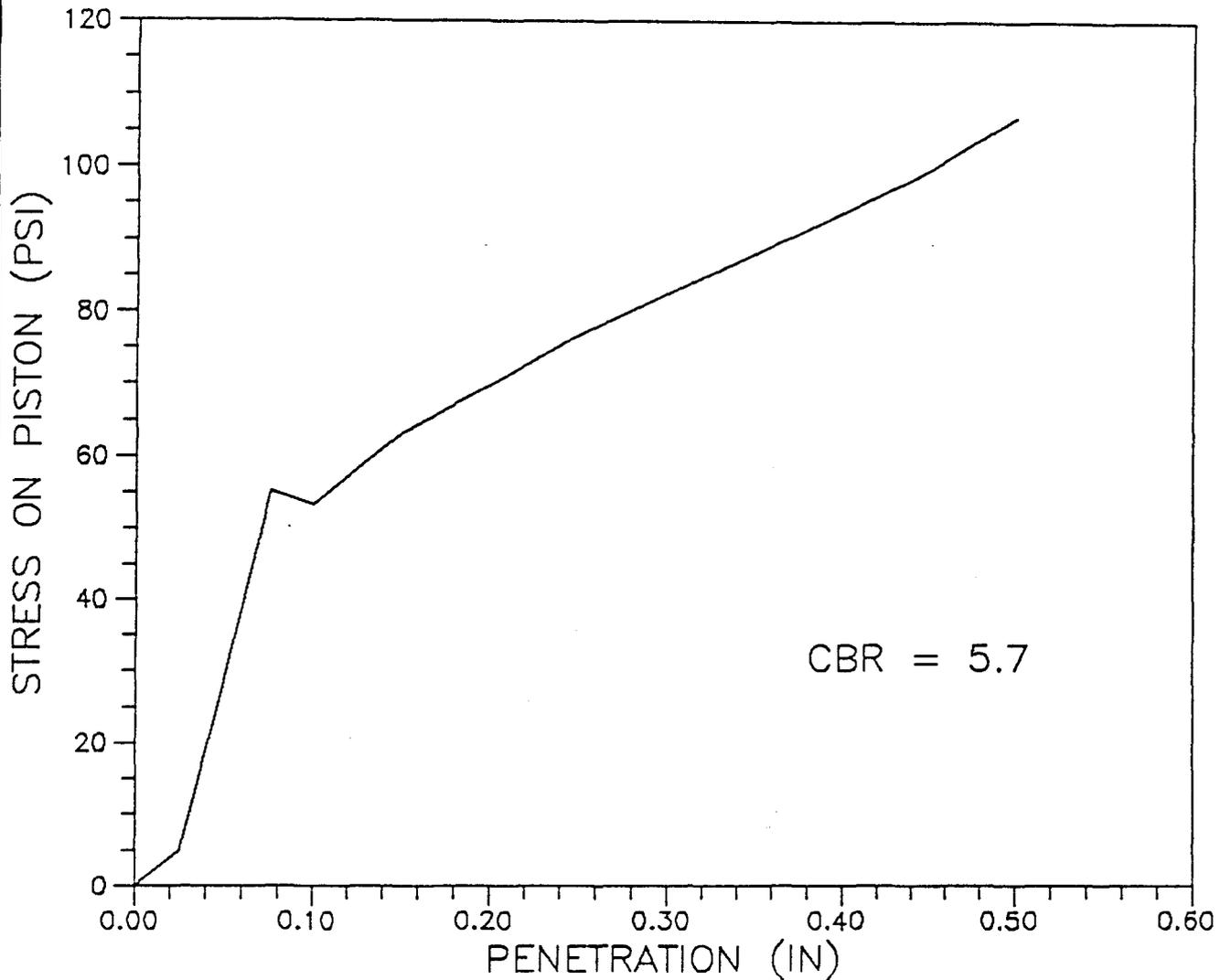
MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5730

PLATE 8

LARGE VOLUME SAMPLE
CLAY, dk. gray & brown

56 BLOWS



TEST TYPE: CALIFORNIA BEARING RATIO
(ASTM D 1883)

PREPARATION & COMPACTION:
(ASTM D 698)

CONDITION OF SAMPLE: SOAKED
DRY UNIT WEIGHT—BEFORE SOAK (pcf): 81.6
DRY UNIT WEIGHT—AFTER SOAK (pcf): 77.4
MOISTURE CONTENT BEFORE TEST (%): 30.3
MOISTURE CONTENT TOP 1" LAYER (%): 40.6

SWELL (% OF INITIAL HEIGHT): 2.51
SURCHARGE AMOUNT (gms): 4535.9

MAGNET DEVELOPMENT FACILITY

CALIFORNIA BEARING RATIO

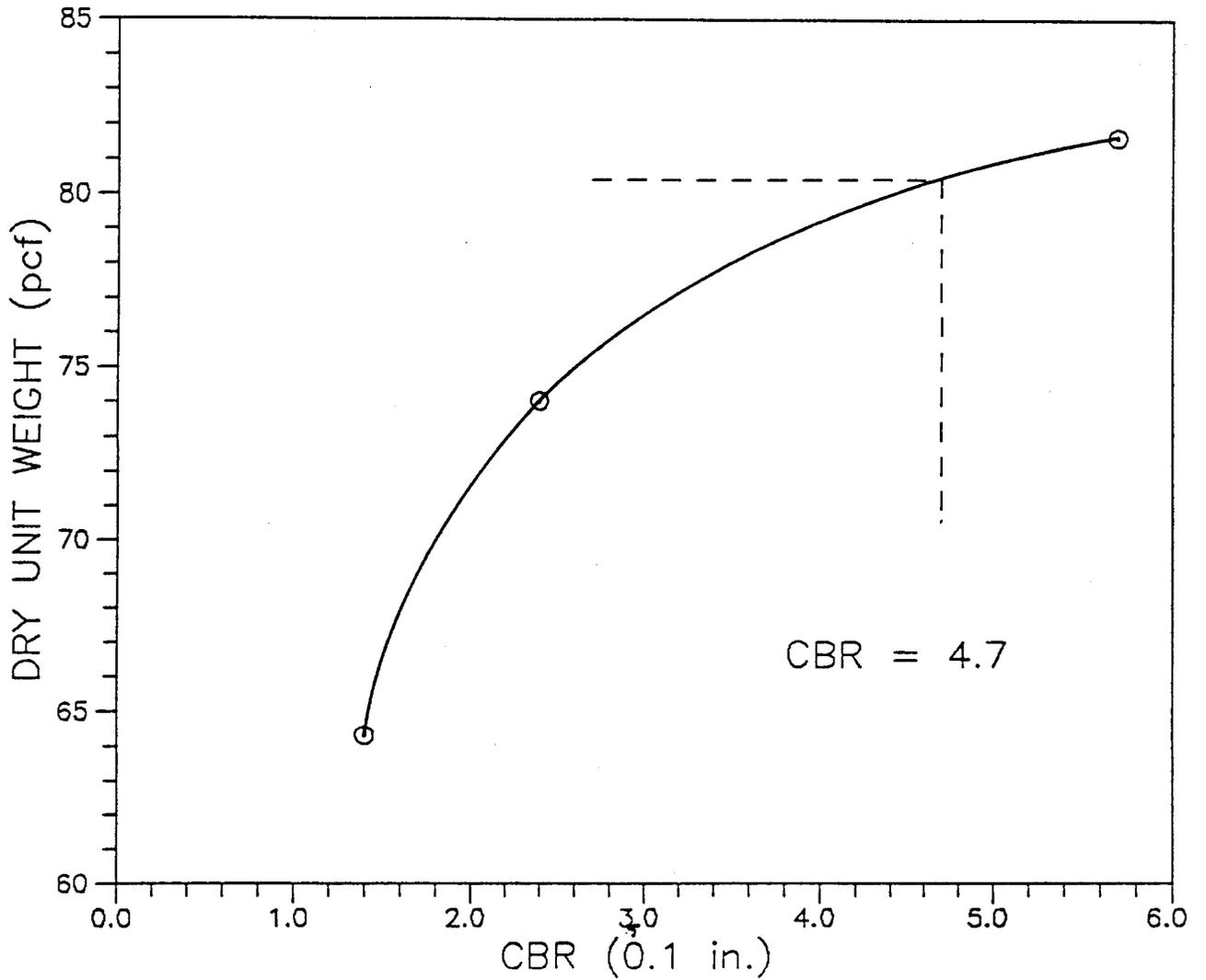
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GEOLOGISTS—ENGINEERS

JOB NO.: 5730

PLATE 9

LARGE VOLUME SAMPLE
CLAY, dk. gray & brown

MAXIMUM DRY DENSITY (ASTM D-698) = 84.6 pcf
95% of 84.6 pcf = 80.4 pcf



TEST TYPE: CALIFORNIA BEARING RATIO
(ASTM D 1883)

PREPARATION & COMPACTION:
(ASTM D 698)

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CALIFORNIA BEARING RATIO

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GEOLOGISTS-ENGINEERS

JOB NO.: 5730

PLATE 10

OPTIMUM MOISTURE-DENSITY TEST

MAGNET DEVELOPMENT FACILITY

JOB NO: 5730

TEST METHOD : ASTM D-698

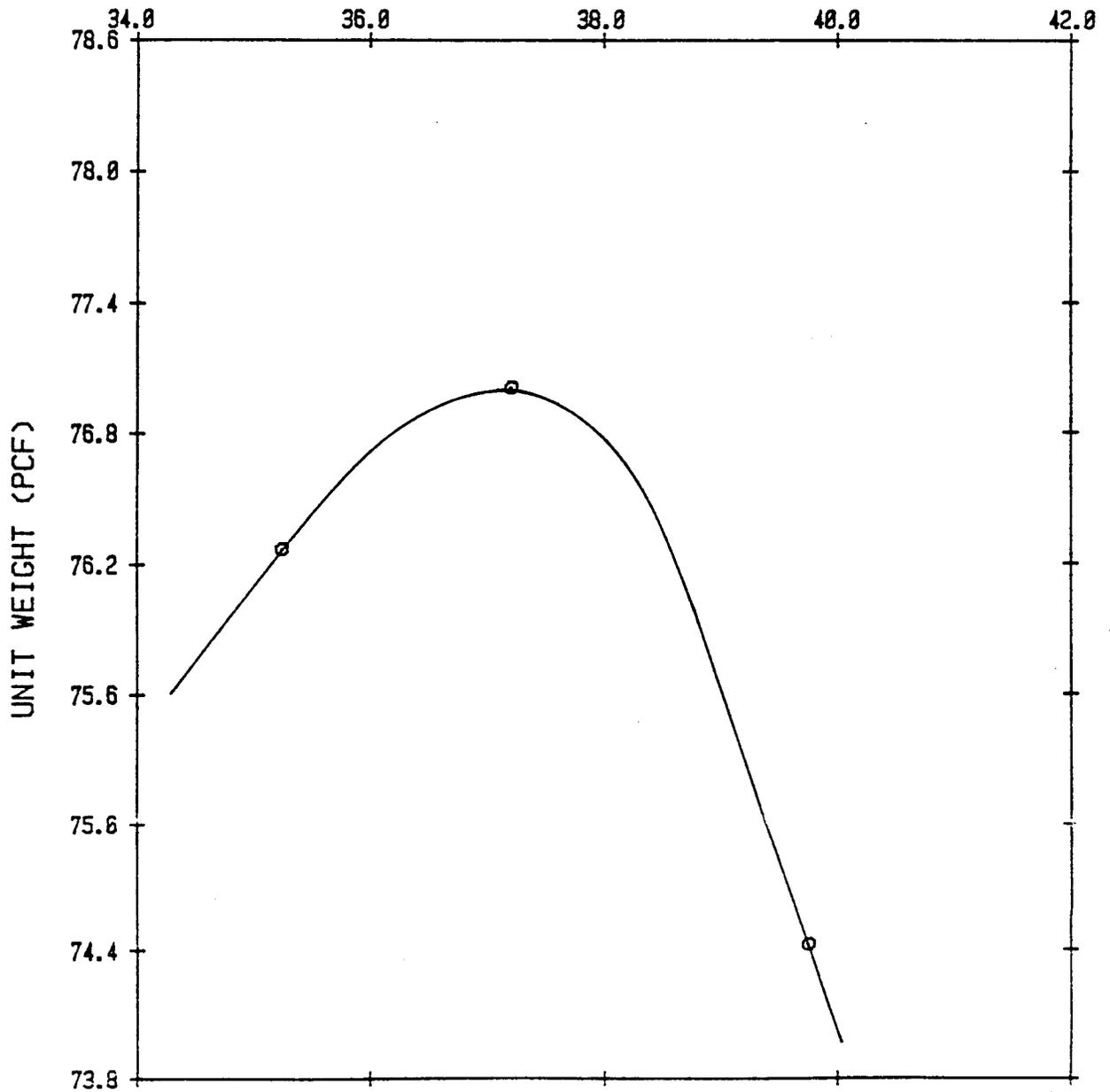
BORING # L. VOL.

OPTIMUM MOISTURE= 37.2%

DEPTH: 6% LIME

MAX UNIT DRY WEIGHT= 77.0 pcf

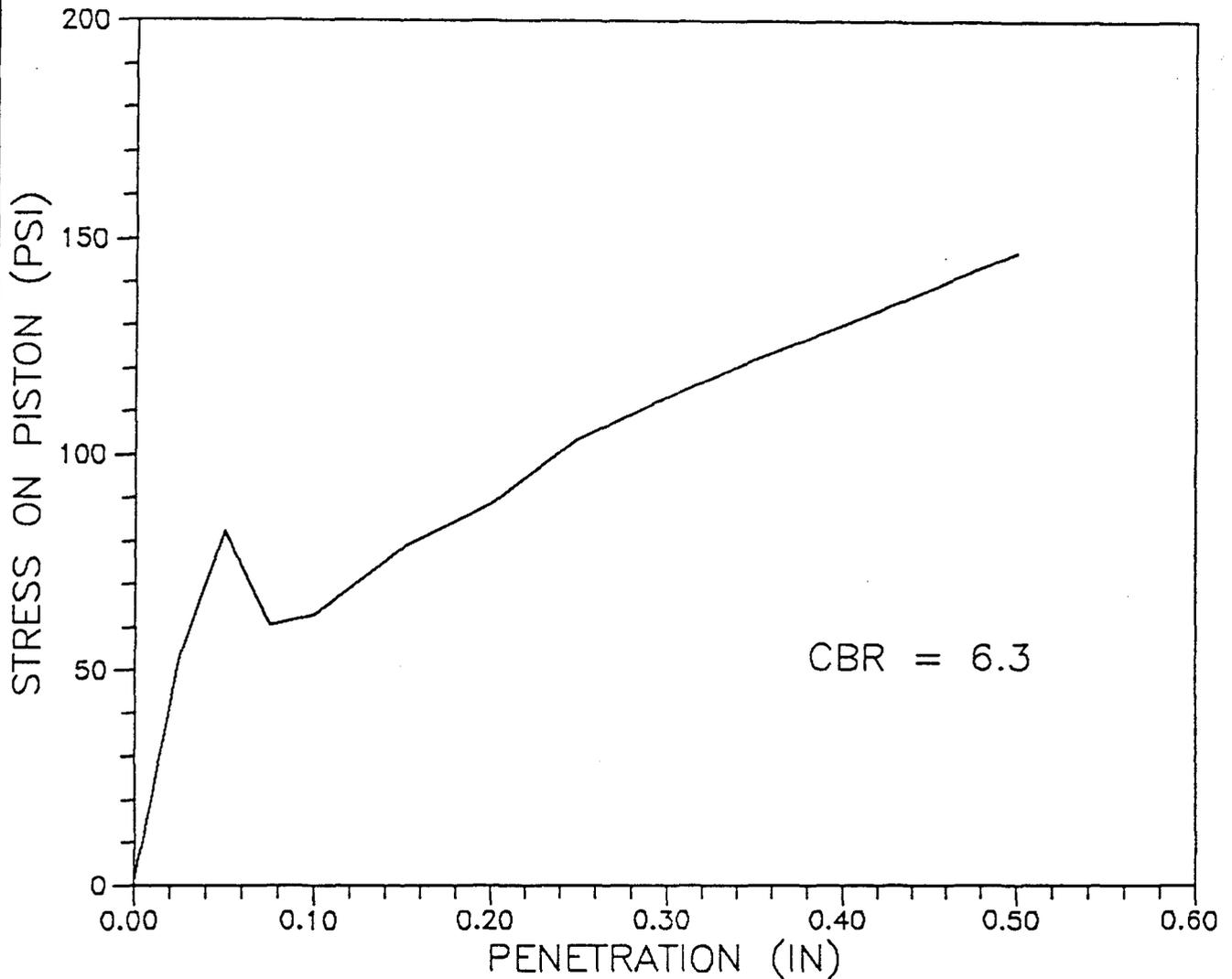
MOISTURE CONTENT (%)



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LARGE VOLUME SAMPLE
CLAY, dk. gray & brown
w/ 6% ADDED LIME

10 BLOWS



CBR = 6.3

TEST TYPE: CALIFORNIA BEARING RATIO
(ASTM D 1883)

PREPARATION & COMPACTION:
(ASTM D 698)

CONDITION OF SAMPLE: SOAKED
DRY UNIT WEIGHT-BEFORE SOAK (pcf): 63.3
DRY UNIT WEIGHT-AFTER SOAK (pcf): 64.6
MOISTURE CONTENT BEFORE TEST (%): 36.4
MOISTURE CONTENT TOP 1" LAYER (%): 51.9

SWELL (% OF INITIAL HEIGHT): 0.07
SURCHARGE AMOUNT (gms): 4535.9

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CALIFORNIA BEARING RATIO

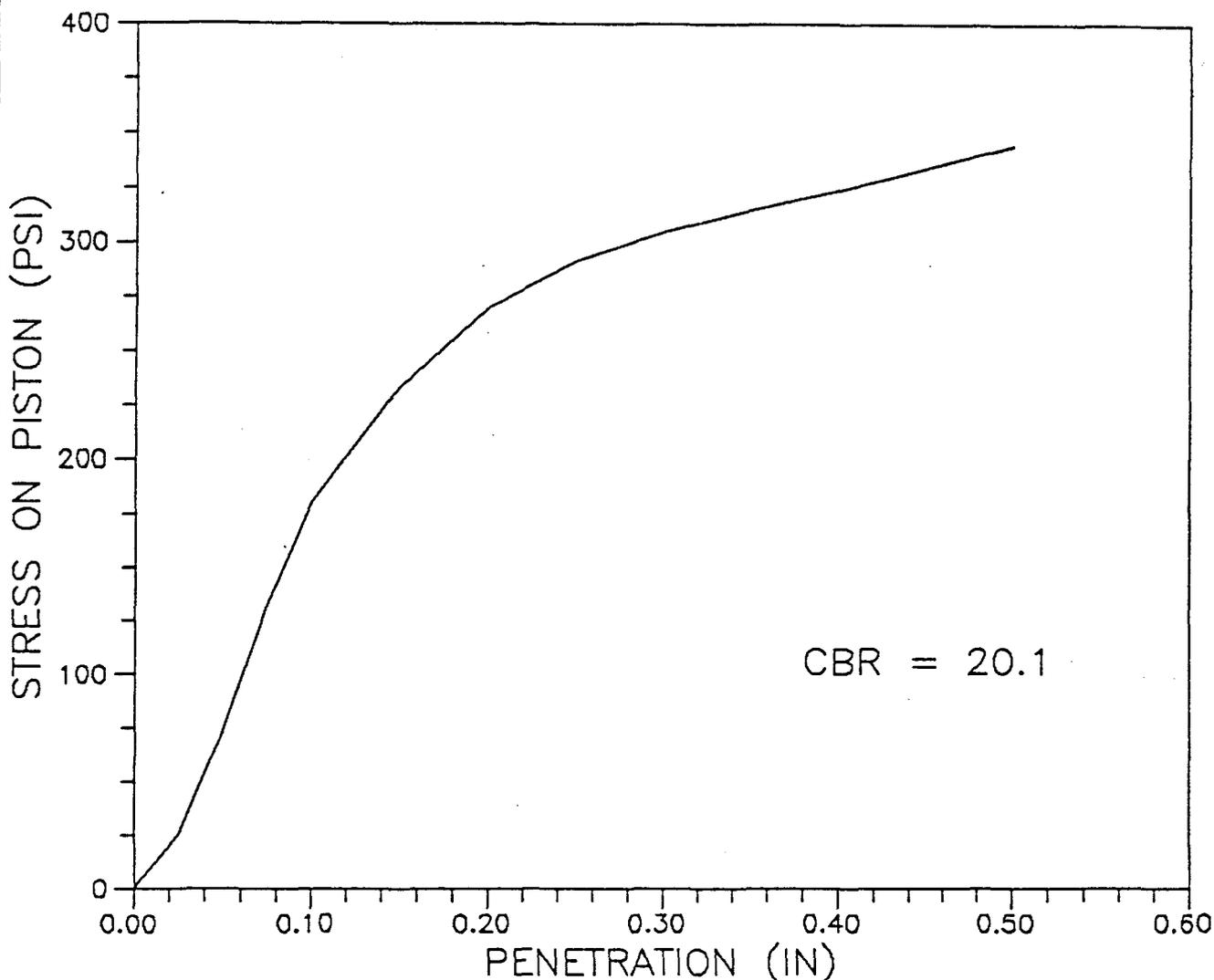
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GEOLOGISTS-ENGINEERS

JOB NO.: 5730

PLATE 12

LARGE VOLUME SAMPLE
CLAY, dk. gray & brown
w/ 6% ADDED LIME

25 BLOWS



CBR = 20.1

TEST TYPE: CALIFORNIA BEARING RATIO
(ASTM D 1883)

PREPARATION & COMPACTION:
(ASTM D 698)

CONDITION OF SAMPLE: SOAKED
DRY UNIT WEIGHT—BEFORE SOAK (pcf): 70.5
DRY UNIT WEIGHT—AFTER SOAK (pcf): 71.9
MOISTURE CONTENT BEFORE TEST (%): 38.7
MOISTURE CONTENT TOP 1" LAYER (%): 42.5

SWELL (% OF INITIAL HEIGHT): 0.04
SURCHARGE AMOUNT (gms): 4535.9

MAGNET DEVELOPMENT FACILITY

CALIFORNIA BEARING RATIO

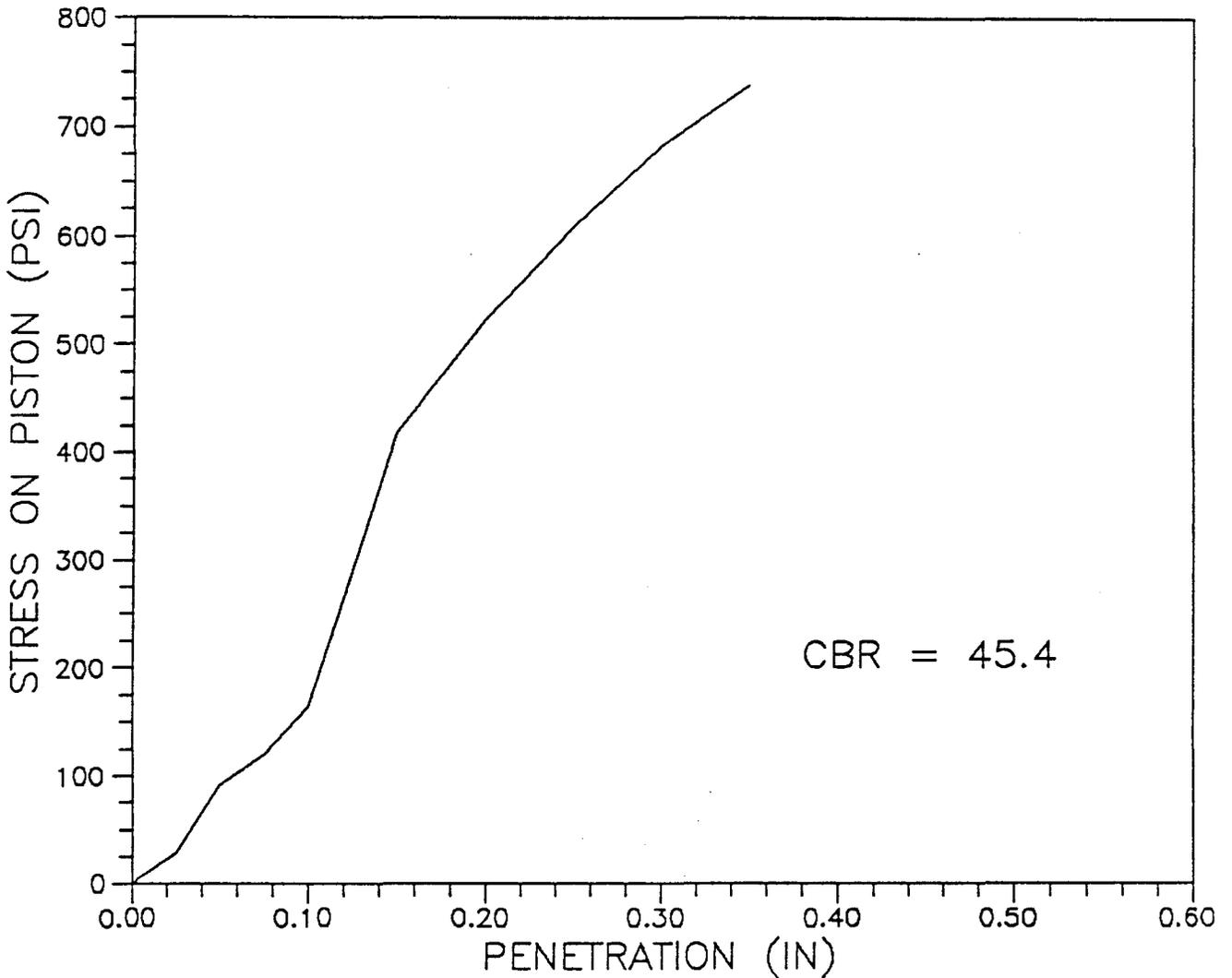
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GEOLOGISTS—ENGINEERS

JOB NO.: 5730

PLATE 13

LARGE VOLUME SAMPLE
 CLAY, dk. gray & brown
 w/ 6% ADDED LIME

56 BLOWS



CBR = 45.4

TEST TYPE: CALIFORNIA BEARING RATIO
 (ASTM D 1883)

PREPARATION & COMPACTION:
 (ASTM D 698)

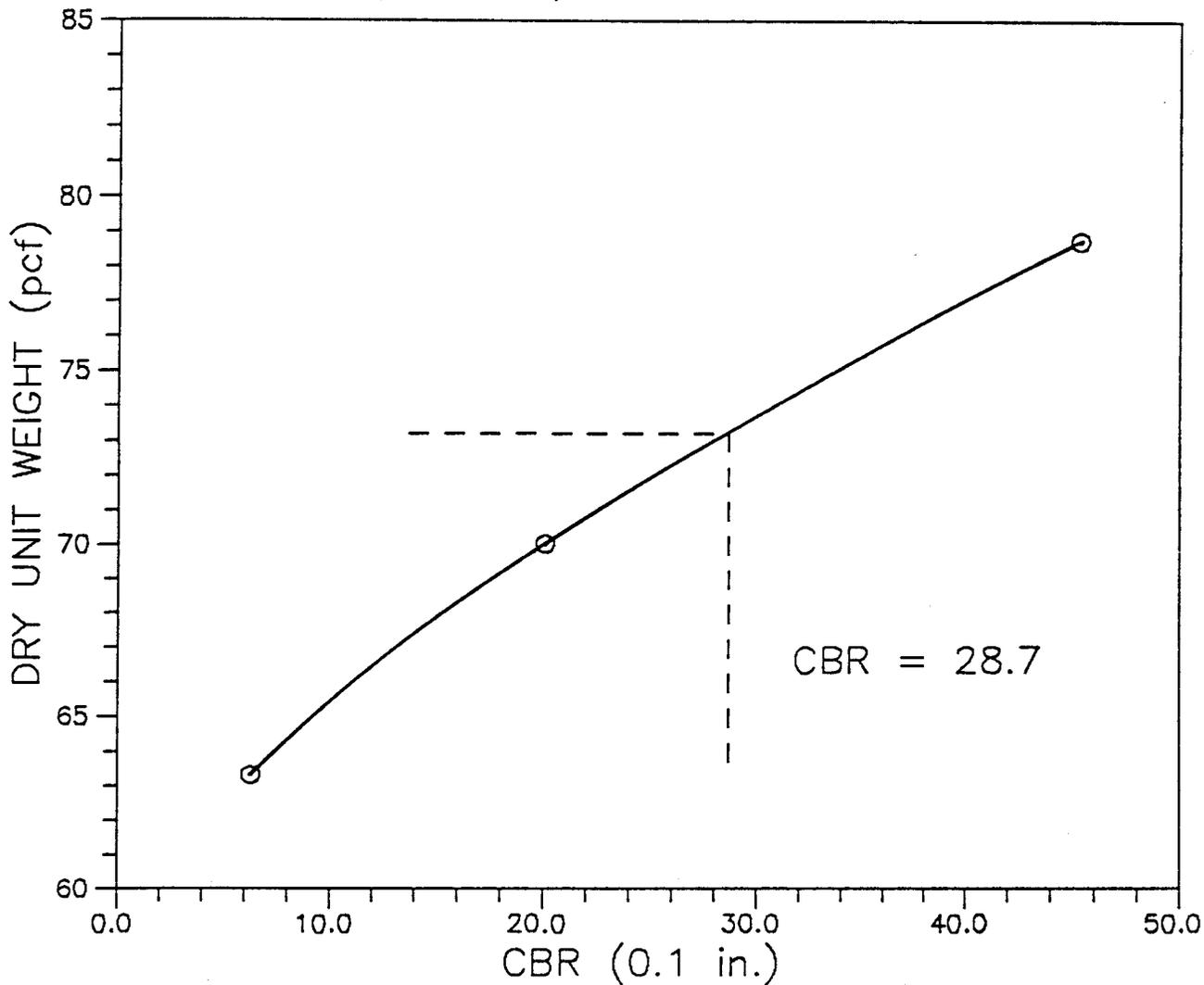
CONDITION OF SAMPLE: SOAKED
 DRY UNIT WEIGHT—BEFORE SOAK (pcf): 78.7
 DRY UNIT WEIGHT—AFTER SOAK (pcf): 79.3
 MOISTURE CONTENT BEFORE TEST (%): 36.9
 MOISTURE CONTENT TOP 1" LAYER (%): 37.2

SWELL (% OF INITIAL HEIGHT): 0.00
 SURCHARGE AMOUNT (gms): 4535.9

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CALIFORNIA BEARING RATIO	
MASON—JOHNSTON & ASSOCIATES, INC. GEOLOGISTS—ENGINEERS	
JOB NO.: 5730	PLATE 14

LARGE VOLUME SAMPLE
CLAY, dk. gray & brown
w/ 6% ADDED LIME

MAXIMUM DRY DENSITY (ASTM D-698) = 77.0 pcf
95% of 77.0 pcf = 73.2 pcf



CBR = 28.7

TEST TYPE: CALIFORNIA BEARING RATIO
(ASTM D 1883)

PREPARATION & COMPACTION:
(ASTM D 698)

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CALIFORNIA BEARING RATIO

MASON-JOHNSTON & ASSOCIATES, INC.
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JOB NO.: 5730

PLATE 15

