DRUMMOND COMPANY, INC.

MAXINE MINE

SLURRY IMPOUNDMENT NO. 1

ABANDONMENT PLAN

ASMC PERMIT NO. P-3629
(MINE NO. 89)

PREPARED FOR

THE ALABAMA SURFACE MINING COMMISSION

DECEMBER, 2013

Post Office Box 1549
Jasper, Alabama 35502-1549

Telephone: (205) 387-0501
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DRUMMOND COMPANY, INC.

December 30, 2013

Mr. Michael Harrison, P.E.
Alabama Surface Mining Commission
Post Office Box 2390
Jasper, Alabama 35502-2390

RE: Drummond Company, Inc.
Mine No. 89
P- 3629

Dear Michael:

I hereby certify the attached Abandonment Plans for Maxine Mine Slurry Impoundment No. 1the above referenced mine are in accordance with current prudent engineering practices and the Regulations of the Alabama Surface Mining Commission and are true and correct to the best of my knowledge and belief.

If you have any questions or required additional information, please feel free to call.

Sincerely,
Drummond Company, Inc.

Steven R. Ingle, P.E.
Alabama Registration No. 18213

ABANDONMENT PLAN
MAXINE SLURRY IMPOUNDMENT NO. 1
MSHA ID NO. 1211-AL7-00064-01

PROJECT DESCRIPTION

In accordance with 30 CFR 77.216-5, the following abandonment plan has been prepared for the Maxine Mine Slurry Impoundment No. 1. This plan contains provisions to preclude the probability of future impoundment of water, sediment, or slurry, provide for major slope stability and includes a schedule for plan implementation.

The Maxine Slurry Impoundment No. 1 is located in Jefferson County, Alabama on the Mine No. 89 site. It is located in the NW/SE, NE/SW, SE/SW, SW/SE of Section 3, Township 17 South, Range 6 West.

In the MSHA approved March 18, 1977 Addendum No. 1 to Review of Impoundment No. 1, Slurry Impoundment No. 1 had the following design conditions:

			Difference from Dam Crest
Existing dam crest elevation	=	395.0 feet MSL	N/A
Proposed spillway crest elevation	=	379.8 feet MSL	15.2 feet
Maximum water elevation PMP Storm	=	390.7 feet MSL	4.3 feet

With the above approved MSHA design conditions, there is a minimum of 15.2 feet from the dam crest elevation to the spillway crest elevation.

DESCRIPTION OF ABANDONMENT

No slurry has been pumped to the impoundment since the mine closed in 1983. Very little water is impounded at this time. Most of the impoundment is dry with some vegetation growing in the dried fines. Removal of coal in the impoundment will consist of removing coal fines from existing Maxine Slurry Impoundment No.1 to a feasibly economic extent. In the recovery of the coal fines, the abandonment of Impoundment No. 1 is also being conducted.

Removal of coal fines consists of removing coal fines utilizing mobile equipment since they are in a dry state. Once the fines are removed they will be transported offsite for raw coal sales, coal processing and/or stockpiled. Fines will be removed in approximately 5 foot lifts, $\pm$ 2 feet, over the entire working surface or stage level of the impoundment. Removal of fines will continue at each working stage level until an economic cut off is reached, as determined by economic recovery factors and the quality of the impounded fines, or the moisture of the coal fines will not allow their removal utilizing mobile equipment. If it is determined that certain areas within the working stage level contain uneconomically recoverable or unmarketable quality of

fines, those areas will be abandoned and covered prior to implementing the removal of a subsequent lift surrounding the area. At the point where the cutoff of the recovery of the fines become uneconomical or the quality of the impounded fines will not meet market requirements, removal operations will be ceased and the impoundment will be reclaimed by treating the remaining slurry material with proper nutrients and covered with a minimum of one (1) foot of the best available material and vegetated as stated in the reclamation plan in Part IV of the ASMC permit.

As shown by the attached cross sections and planview drawings, a maximum of 2 - 5 foot lifts, resulting in a total of 10 feet, ± 2 feet, will be removed over the entire working surface or stage level of the impoundment prior to the embankment and spillway being lowered proportionately. This will keep the same freeboard between the spillway and top of dam, 15.2 feet as required by approved MSHA Design Plans, and also maintain 3 to 4 feet of depth in the impoundment for treatment of runoff. With this scenario in mind, a vertical distance of 23.2 to 27.2 feet, other than within the treatment area, will exist prior to the lowering of the top of dam and spillway crest. It is proposed to lower the top of dam and spillway in 10 foot lifts. All working slopes will be maintained to ensure stability. To ensure compliance with this abandonment plan, cross sections, certified by either qualified registered professional engineer or land surveyor, will be supplied to the ASMC on a quarterly basis beginning on July 2014, illustrating the condition of the impoundment and the location of the fines level in relation to the vertical range listed above.

A minimum crest width of 30 feet will be maintained on the top of the dam and the lowered spillways will remain at 39 feet in width. Relocated spillways will be constructed in natural material along the eastern abutment and be constructed in such a manner to prevent any discharges from flowing over the embankment. If not constructed in durable rock, riprap will be used to line the channel.

Once the dam and spillway have been lowered, the process will be repeated until an economic cut off is reached.

Removal of the embankment is necessary since it was constructed by the upstream method and removing coal fines could cause a failure of the upstream face of the embankment. The embankment will be removed utilizing mobile equipment in a controlled manner. It was originally proposed to dispose of the removed embankment material within Excess Spoil Fills No. 1 and 2. As part of revision application R-2, Excess Spoil Fills No. 1 and 2 will be deleted with no acreage change to the permit. The removed embankment material will now be spread in thin lifts upon surface of the impoundment where fines recovery has been completed to create a working surface. The impoundment surface will then be reclaimed by treating the surface with proper nutrients and covered with a minimum of one (1) foot of the best available material and vegetated as stated in the reclamation plan in Part IV of the ASMC permit.

Once economically feasible recovery of the coal fines has been achieved, a temporary water impoundment will remain until the disturbed area is reclaimed and runoff in the area meets applicable limits. This impoundment will remain for at least two years

after the last augmented seeding of the area disturbed during fines removal. Once this is accomplished, a removal plan will be submitted to the ASMC prior to removal.

At that time, removal of the sediment pond can be performed once approval from the Alabama Surface Mining Commission is received. Typically, removal will consist of removing any water impounded by pumps or siphons. The embankment and spillway will be lowered to prevent future impounding of water or sediment. The final channel will be riprapped to prevent erosion. All areas disturbed will be revegetated in accordance with the approved revegetation plan.

Attached are a vicinity map, impoundment plan view and profile views which show the facility and abandonment details.

STABILITY ANALYSIS DATA

The static and dynamic loading stability analyses were performed using the Simplified Bishop Method. The computer program used was the REAME Slope Stability Program as developed by Dr. Yang H. Haung, P.E. of the University of Kentucky.

SOIL PROPERTIES

The soil properties used in the stability analysis were taken from the original design plans and amendments of the Maxine Slurry Impoundment No. 1. Attached is Appendix II Laboratory Testing of the November 1, 1976 detailed design plans.

	COHESION (PSF)	ANGLE OF INT. FRC.	DESIGN DENSITY (PCF)
Dam Material Coarse Refuse	600.0	29.0	117.0
Dam Material Fine Refuse	660.0	14.5	76.0
Foundation Bed Rock	10,000.0	45.0	170.0

DESIGN DATA

1) Current top of Dam Elevation = 384.0.

2) Current Embankment top width = 70.0'.

3) Current Primary Spillway Elevation = 373.0'.

4) Current Embankment Downstream Slope = 1.9H:1V.

5) Current Embankment Upstream Slope = 2.1H:1V.

6) Current Slurry Elevation = 360.0.

7) Proposed Slurry Elevation prior to reduction in Embankment Elevation = 357.0

8) Current Embankment Height, as measured from the top of the embankment to the toe of the downstream slope, = 124.0 ft.

9) DMIN = 0.00

Maxine Mine Slurry Impoundment No. 1 was evaluated under static loading conditions. A pore pressure ratio of 0.1 was used in the stability analyses. The stability

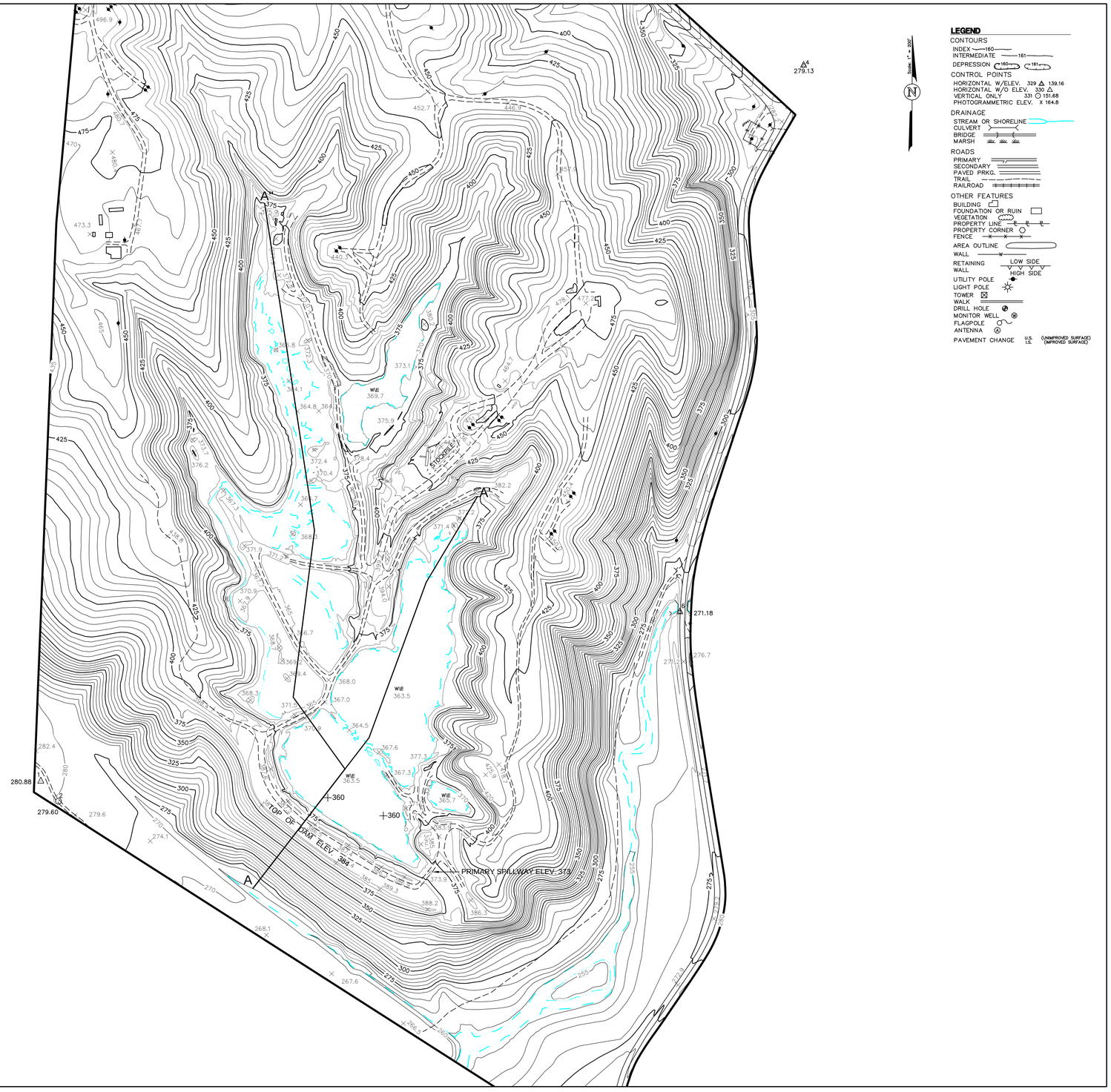
analyses were performed using an approximate form of the limiting equilibrium approach as developed by Bishop. The location of the failure surface yielding the minimum safety factor was determined by allowing the computer to use a grid and search routine. The computer program used was the Reame Slope Stability program by Dr. Yang H. Huang, P.E. of the University of Kentucky. Results of the stability analyses show that **Maxine** Mine **Slurry Impoundment** No. 1 can be abandoned safely.

See the attached Plan View and Cross Section A-A', as taken from June 2013 aerial photography and field survey, for Maxine Slurry Impoundment No. 1's current conditions.

SAFETY FACTORS

MAXINE SLURRY IMPOUNDMENT NO. 1

LOCATION	STATIC SAFETY FACTOR	DYNAMIC SAFETY FACTOR
DOWNSTREAM	1.5	1.2
UPSTREAM	3.4	1.8



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P.O. BOX 1549 JASPER, AL 35502
205-387-0501 OFFICE

drawn by:	HOCUTT	job number:	–
checked by:	S.E.W.	initial date:	7–30–13
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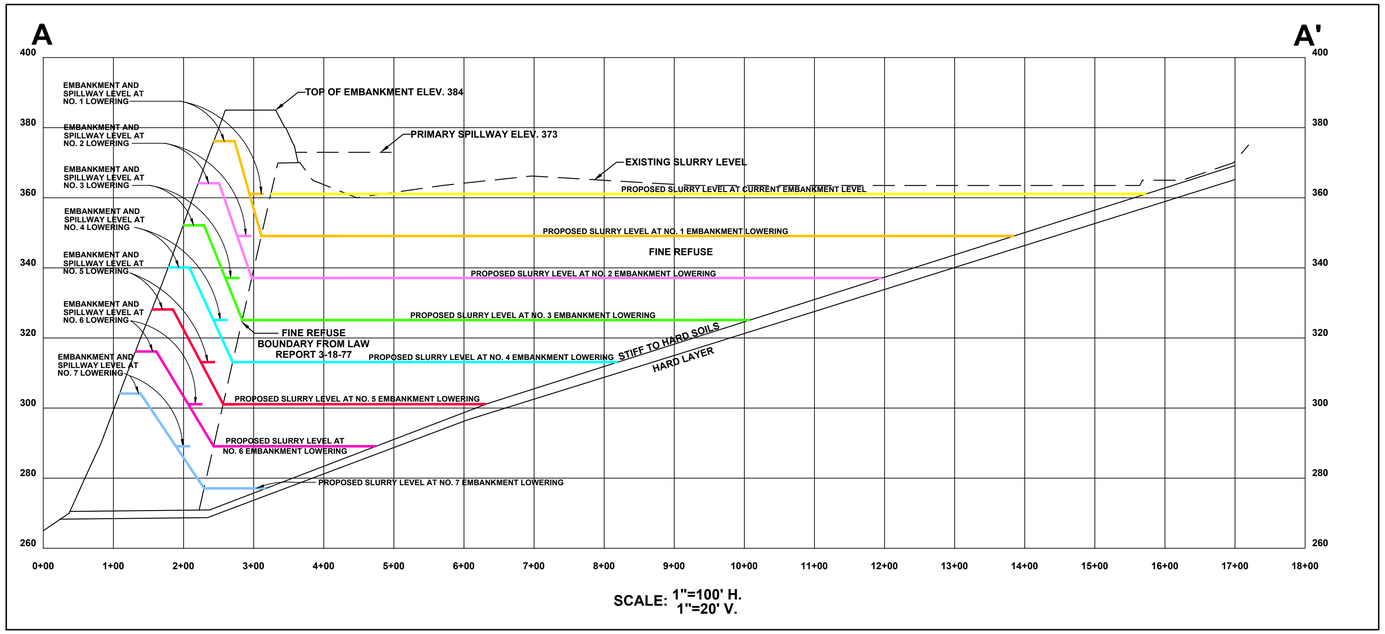
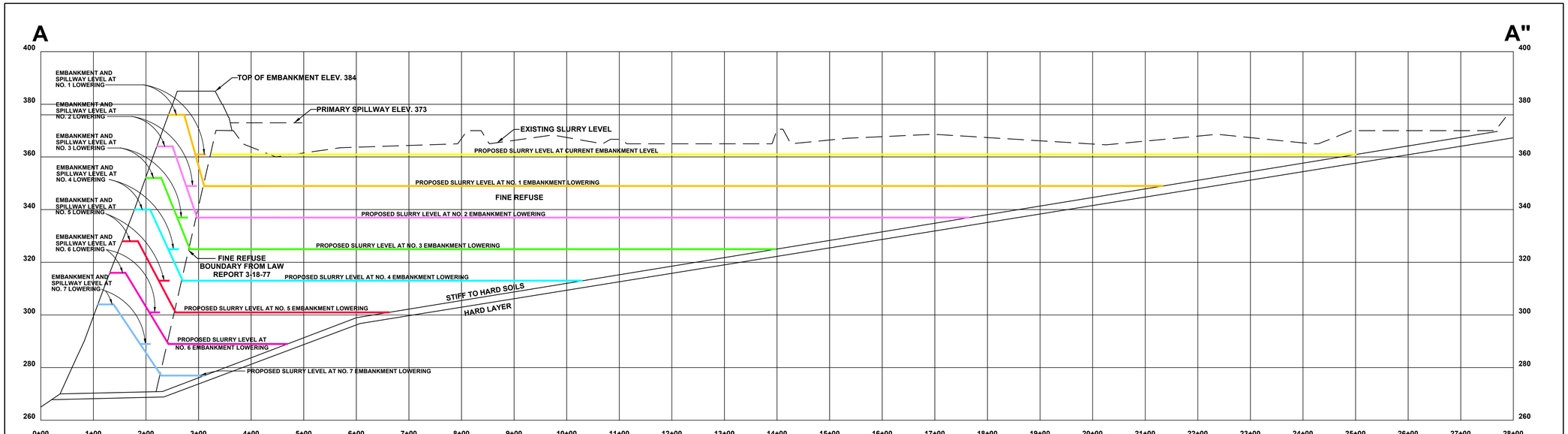
Mine No. 89
P-3629
Maxine Slurry Impoundment No. 1
June 2013 Photography
Planview



SCALE: 1"=100' H.
1"=20' V.



SCALE: 1"=100' H.
1"=20' V.

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rev no./date:	–	rev no./date:	2–18–14

Mine No. 89
P-3629
Maxine Slurry Impoundment No. 1
June 2013 Photography
Cross Sections

APPENDIX II

LABORATORY TESTING

APPENDIX II

LABORATORY TESTING

PHYSICAL SOIL PROPERTIES

The in-place physical properties are described by the specific gravity, wet unit weight, moisture content, dry unit weight, void ratio, and percent saturation of the soil. The specific gravity and moisture content are determined according to ASTM Specification D 854 and D 2216, respectively. The wet unit weight is found by obtaining a known volume of the soil and dividing the wet sample weight by the known volume. The dry unit weight, void ratio, and percent saturation are calculated values. The soil's physical properties are presented on the Soil Data Summary Sheets and on the individual test data sheets included in this Appendix.

GRAIN SIZE TESTS

Grain size tests were performed on representative samples of the embankment materials to determine the particle size distribution. The grain size distribution of soils coarser than a number 200 sieve (0.074 mm opening) is determined by passing the samples through a standard set of nested sieves. Materials passing the number 200 sieve are suspended in water and the grain size distribution calculated from the measured settlement rate. These tests are similar to those described by ASTM Specifications D 421 and D 422. The grain size test results are presented on the Soil Data Report Sheets.

RELATIVE DENSITY TESTS

Relative density tests were performed on representative coarse refuse material to determine its minimum and maximum dry densities. These tests were run in accordance with the procedure described in ASTM Specification D 2049. Both the dry and the wet methods were used to obtain the maximum density. The test results are presented on Report of Minimum and Maximum Density Sheets.

TRIAXIAL SHEAR TESTS

The strength parameters of the embankment materials were obtained by triaxial shear testing of undisturbed and remolded samples. Several sections of the undisturbed samples were extruded

from the sampling tube for triaxial shear testing. For the remolded samples, the actual in-situ density and moisture content obtained from density tests in test pits were used to remold the samples. Some of the laboratory remolded samples were prepared by using a grain size curve parallel to the actual field grain size distribution and using a 3/4-inch maximum particle size. The samples were then trimmed into cylinders 1.4 or 2.8 inches in diameter and encased in rubber membranes. Each was then placed in a compression chamber and confined by all-round air pressure until required consolidation was complete. The axial load was then applied until the sample failed in shear. The test results are presented in the form of Stress-Strain Curves and Mohr Diagrams on the accompanying Triaxial Shear Test Sheets

DIRECT SHEAR TESTS

Because of the large particle size of the coarse refuse materials, a special testing device consisting of a box approximately 10-inch cubed was used for shear testing. Some of the laboratory remolded samples were prepared by using a grain size curve parallel to the actual field grain size distribution and using a 3/4-inch maximum particle size. The sample was compacted in the mold to the required density and moisture content. The sample was then allowed to consolidate at the required normal stress, up to a maximum of 5 ksf. The shear boxes were then separated about 3/4 inch (maximum grain size of the material used in the test). The material was next sheared horizontally while maintaining the applied normal stress. The results of the test are presented on the attached Direct Shear Test sheets.

PERMEABILITY TESTS

The permeability tests were conducted under the guidelines of ASTM D 2434-68. The material was remolded at the desired density and moisture content in a box about 9.5 inches squared and 10 inches deep. The sample was confined and sandwiched between porous plates. The sample was allowed to consolidate under 500 psf pressure, then it was saturated. Readings were taken with the constant head apparatus until a stabilized flowrate was obtained. This flowrate was then used to calculate the coefficient of permeability, k.

COMPACTION TESTS

A representative sample of the fine refuse material was obtained for laboratory compaction tests. A Standard Proctor compaction test (ASTM D 698-66T) was performed on this soil to determine its compaction characteristics, including its maximum dry density and optimum moisture content. The test results are presented on the attached Compaction Test Sheet.

PROPERTIES
OF
COARSE REFUSE

SOIL DATA SUMMARY SHEET
ALABAMA BY-PRODUCTS CORPORATION
MAXINE MINE
IMPOUNDMENT NO. 1
B-2392

COARSE REFUSE

Boring No. or Location	Sample Depth	Sample Type	Unconfined Compressive Strength, ksf Friction Angle (ϕ) Cohesion (c)	Unit Weight pcf		% Finer No. 200	Specific Gravity	Void Ratio	Natural Moisture %	Atterberg Limits			T	U	C	P
				Wet	Dry					L.L.	P.L.	P.I.				
Composite of TP's	1' to 5'	Bag	ϕ_{dst}= 26° c_{dst} = 0.70 ksf	117.4*	108.3*	6.1	2.40	0.200*	8.4*				X		X	
Composite of TP's	1' to 5'	Bag	ϕ_{cu}= 22° c_{cu} = 0.68 ksf	124.8*	115.1*		2.40	0.301*	8.4*				X			
TP1	4'	Jar							9.0							
TP2	3'	Jar							4.3							

*Remolded Properties
uu - Unconsolidated Undrained
cu - Consolidated Undrained
dst - Direct Shear Test

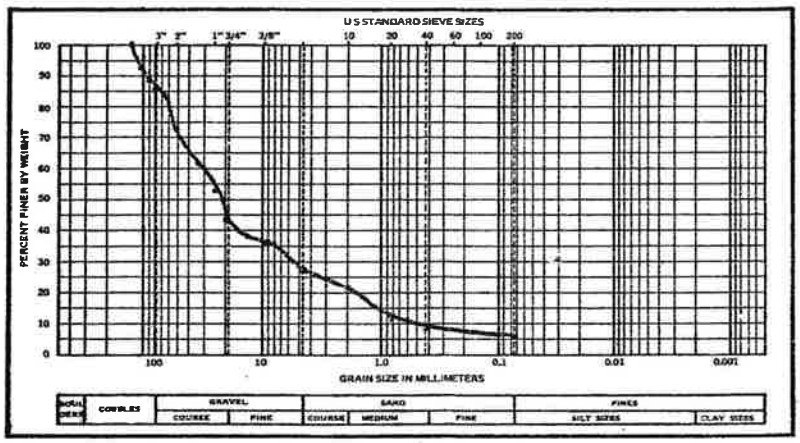
NOTES:
1. Soil tests performed in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System
3. T = see Triaxial Test Results or Direct Shear Test Results
4. U = see Unconfined Compression Test Results
5. C = see Relative Density Test Results
6. P = see Proctor Test Results

LETCO SOIL DATA REPORT SHEET

OIL PROPERTIES FOR B-2392
ORING NUMBER = MAXINE
MPLE IDENTIFICATION = BAG (COARSE REFUSE)

IEVE ANALYSIS

IEVE JMBER	#CUM WT RETAINED	PERCENT FINER
4	4.4	93.1
12	6.7	89.4
3	9.2	85.6
12	10.0	84.3
2	18.5	71.0
15	25.1	60.7
1	30.5	52.2
34	34.3	46.2
12	38.6	39.6
38	41.2	35.6
4	47.1	26.3
10	50.9	20.3
20	175.0	11.8
40	222.2	9.4
60	249.5	8.1
00	271.3	7.0
00	291.4	6.1



LASTICITY PROPERTIES OF MAT. PASSING NO. 40 SIEVE

OIL SAMPLE IS NON-PLASTIC

PPROX. SOIL PROP. BASED ON ABOVE DATA AND EMPIRICAL RELATIONSHIPS

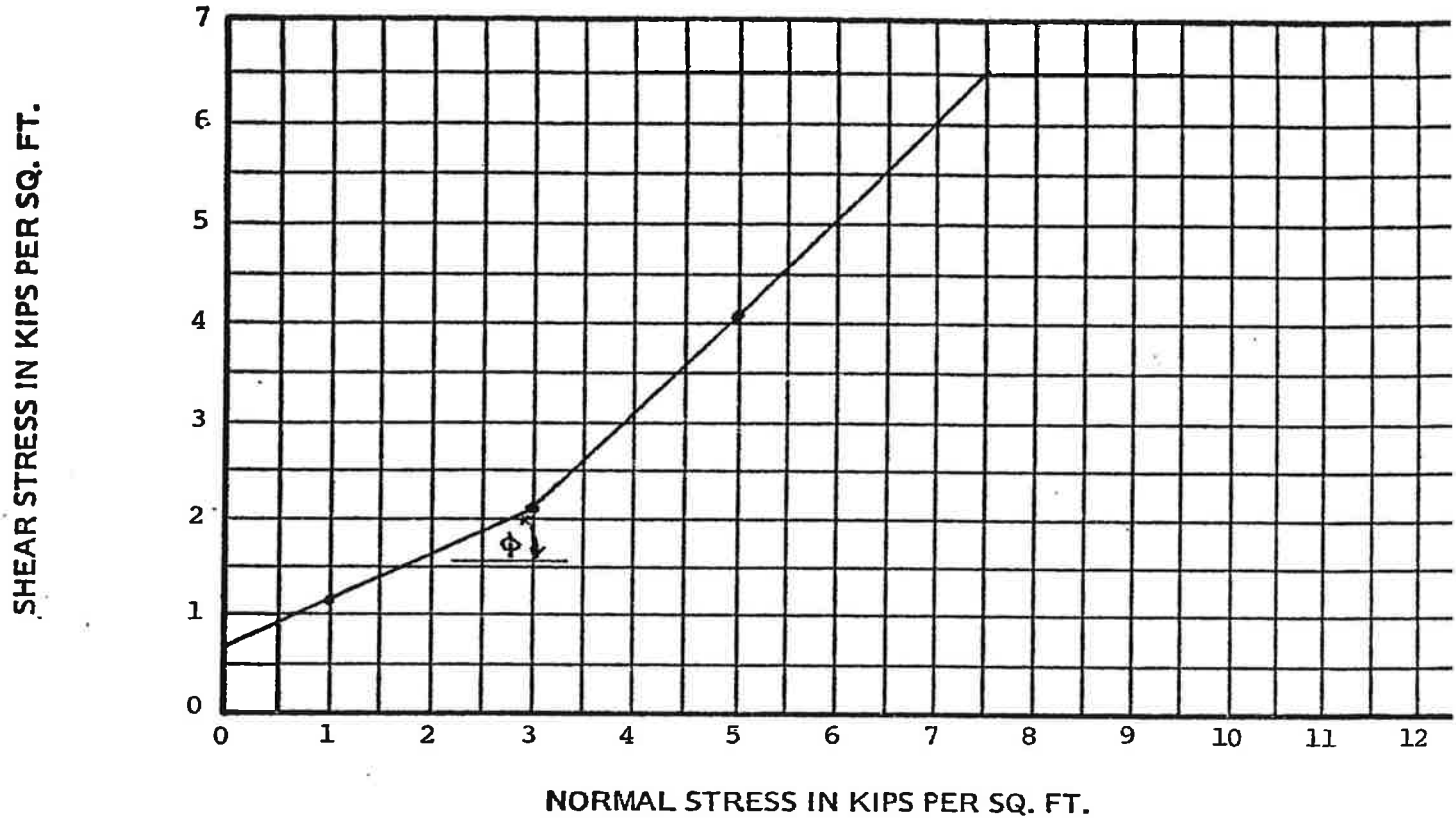
OEFF. OF CURVATURE = 5.73
NIFORMITY COEFF. = 28.61
AX AND MIN DRY DENSITY = 144 AND120 PCF
ERMEABILITY COEFF. =0.27E+00 CM/SEC

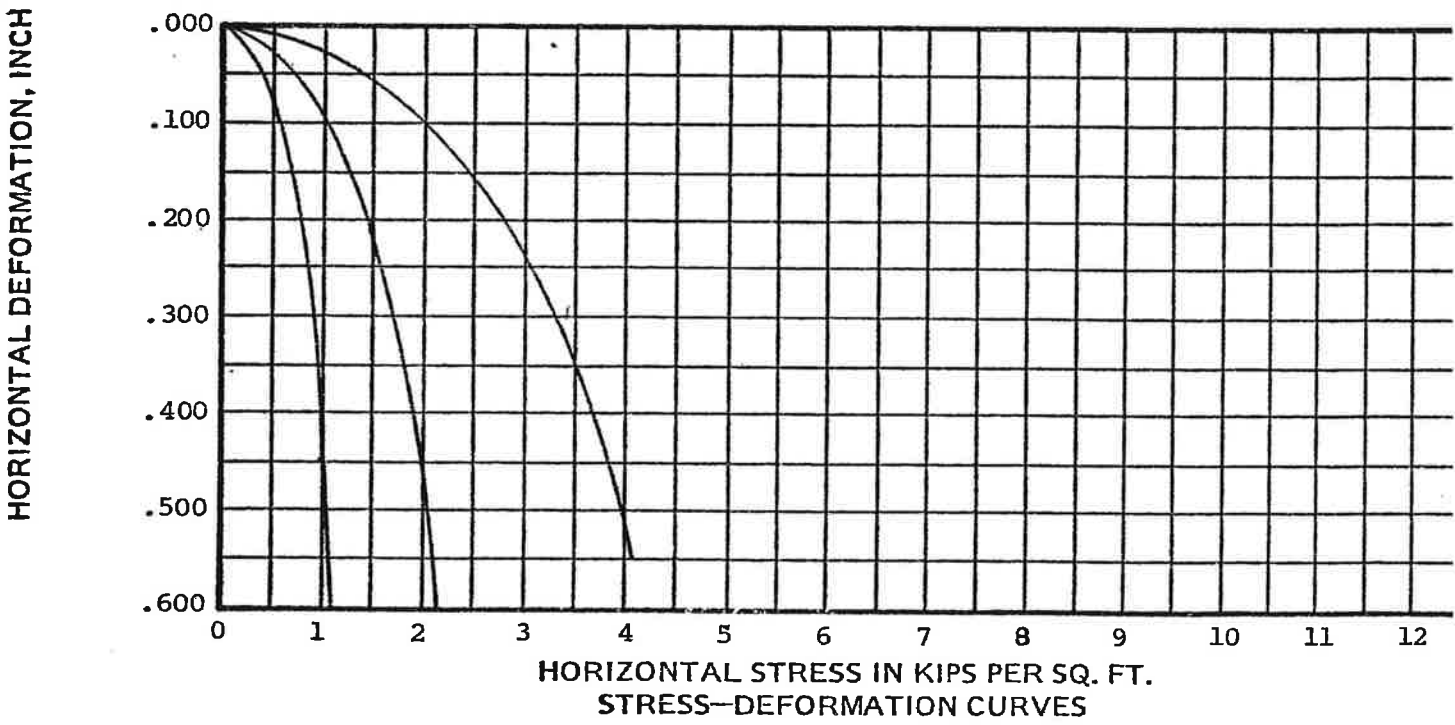
ERCENTAGE CLASSIFICATION IS
73.7% GRAVEL 20.2% SAND 6.1% FINES

NIFIED SOIL CLASSIFICATION IS
P-GM POORLY GRADED SILTY GRAVEL

ASHO SOIL CLASSIFICATION IS
1 GRAVEL AND SAND

Checked By
Laboratory.....
Engineering.....





STRESS—DEFORMATION CURVES

"COHESION," C 0.7 Ksf

ANGLE OF SHEAR RESISTANCE, Φ 26°

UNIT WEIGHT, Y 117.4 PCF

WATER CONTENT, W 8.4%

VOID RATIO, e .20

SPECIFIC GRAVITY = 2.4

0.825" Gap

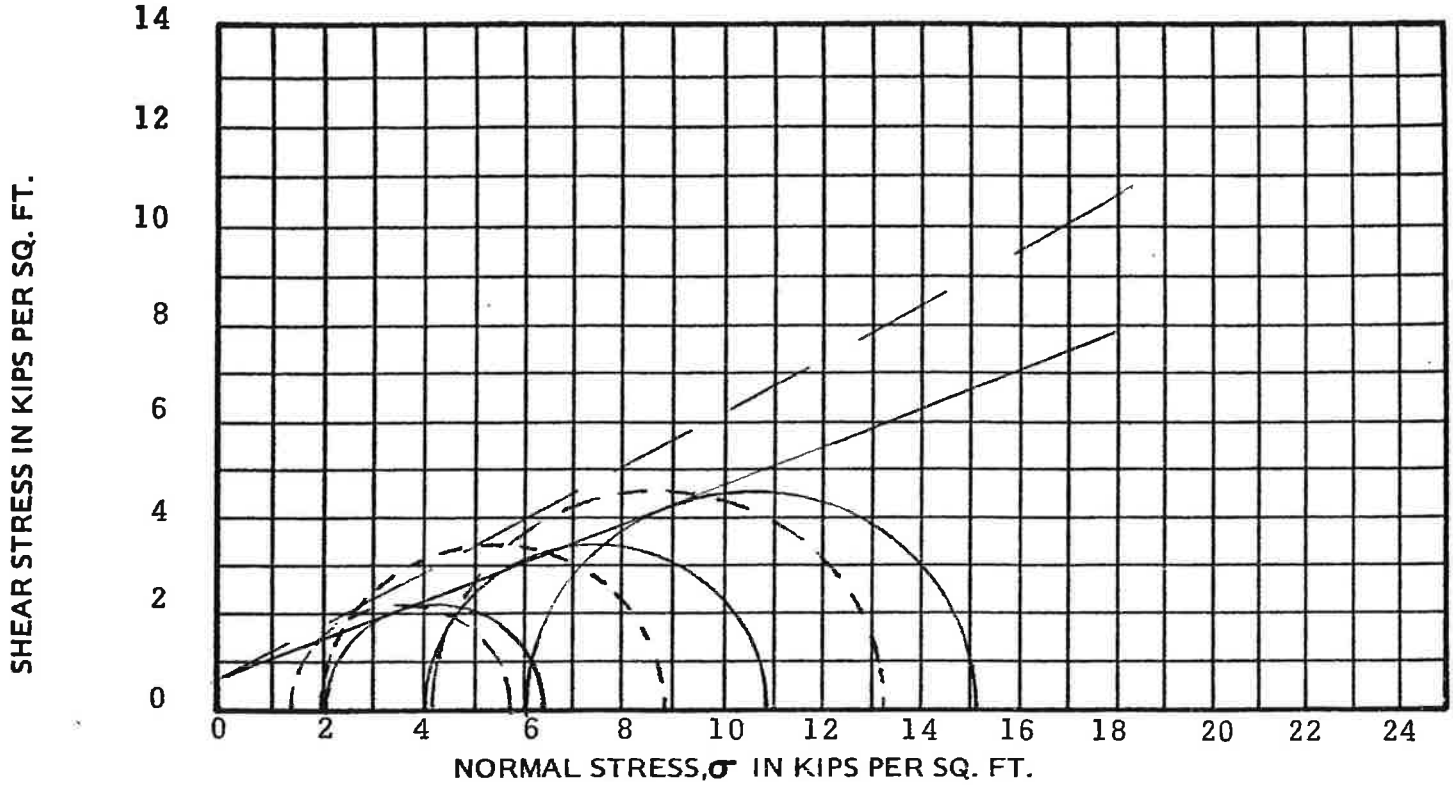
-1" Material

DIRECT SHEAR TEST

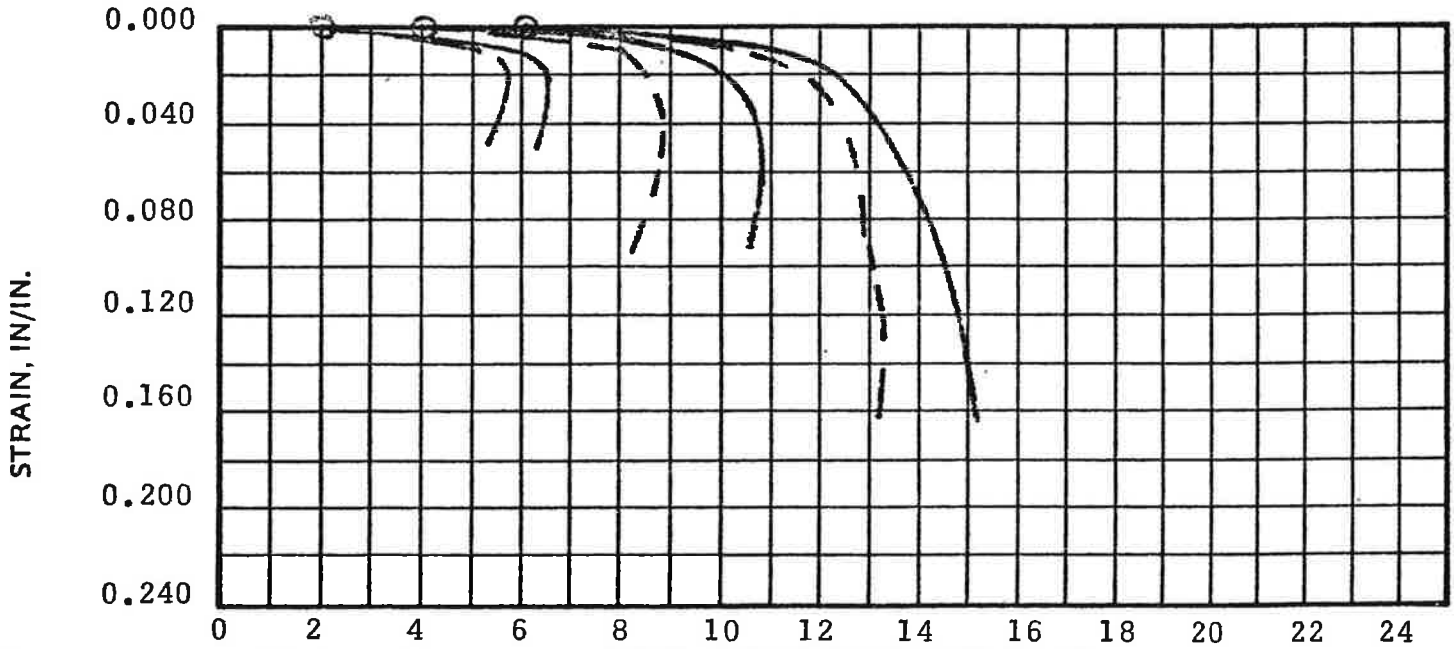
BORING NO. Coarse Refuse SAMPLE NO. Bag

ELEV. OR DEPTH _____ JOB NO. B-2392

LAW ENGINEERING TESTING COMPANY



MOHR DIAGRAMS



Specimens remolded to 124.8 pcf wet @ 8.4%

STRESS-STRAIN AND PORE PRESSURE-STRAIN CURVES

EFFECTIVE COHESION, $\bar{c}$ 0.68 ksf

EFFECTIVE SHEAR ANGLE, $\bar{\Phi}$ 29

TOTAL COHESION, c 0.68 ksf

TOTAL SHEAR ANGLE, Φ 22

CONSOLIDATED PROPERTIES:

Wet Unit Weight: 130.6, 131.0, 131.0

Moisture Content: 11.7, 11.4, 11.4

Void Ratio: .282, .273, .273

SATURATED, CONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST WITH PORE PRESSURE MEASUREMENTS

SAMPLE NO. Bag BORING NO.

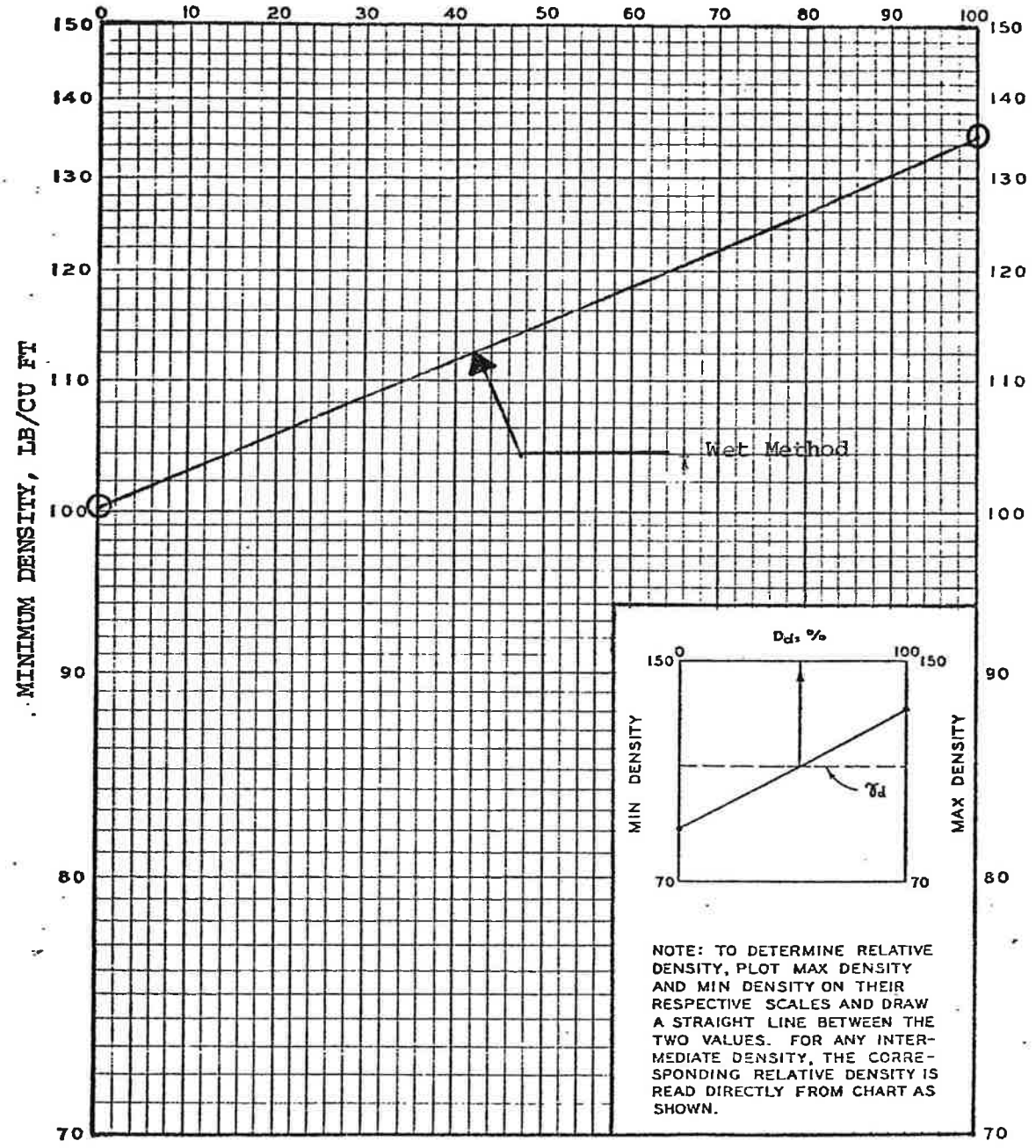
DEPTH 4-7' JOB NO. B-2392

LAW ENGINEERING TESTING COMPANY

Checked By

Laboratory

REPORT OF MINIMUM AND MAXIMUM DENSITY (ASTM D - 2049 - 69)



RELATIVE DENSITY, D_d, PERCENT

JOB NO.: B-2392 BORING NO.: Coarse Refuse

SAMPLE NO.: Bags DEPTH NO.:

LAW ENGINEERING TESTING COMPANY

Laboratory: JK

BM

PROPERTIES
OF
FINE REFUSE (SLURRY)

SOIL DATA SUMMARY SHEET
ALABAMA BY-PRODUCTS CORPORATION
MAXINE MINE
IMPOUNDMENT NO.1
B - 2392

FINE REFUSE

Boring No. or Location	Sample Depth	Sample Type	Unconfined Compressive Strength, Friction Angle (ϕ) Cohesion (c)	Unit Weight pcf		% Finer No. 200	Specific Gravity	Void Ratio	Natural Moisture %	Atterberg Limits			T	U	C	P
				Wet	Dry					L.L.	P.L.	P.I.				
B1A	5' to 6.5'	UD	$\phi_{uu} = 12.5^{o}$ $c_{uu} = 0.68$ ksf	73.5	51.1		1.55	0.894	43.7				X			
B2A	4'	Remolded	$\phi_{cu} = 3.5^{o}$ $c_{cu} = 1.13$ ksf	74.1*	55.4*		1.60	0.802*	33.7*				X			
B3A	4' to 6'	UD	$\phi_{cu} = 32^{o}$ $c_{cu} = 0.44$ ksf	76.0	55.9		1.44	0.606	35.9				X			
B-3	41' to 43'	UD	$\phi_{uu} = 0^{o}$ $c_{uu} = 2.41$ ksf	94.4 87.9	65.1 60.6	82.9	1.59	0.525 0.814	45.1 45.1				X			
B-3	43' to 45'	UD	$\phi_{cu} = 4^{o}$ $c_{cu} = 2.25$ ksf	75.5	54.0		1.47	0.700	39.8				X			
Pond	2'	Bag	$\phi_{dst} = 14.5^{o}$ $c_{dst} = 0.66$ ksf	75.5*	53.9*	83.1	1.59	0.840*	40.0*	← NON PLASTIC →			X		X	X

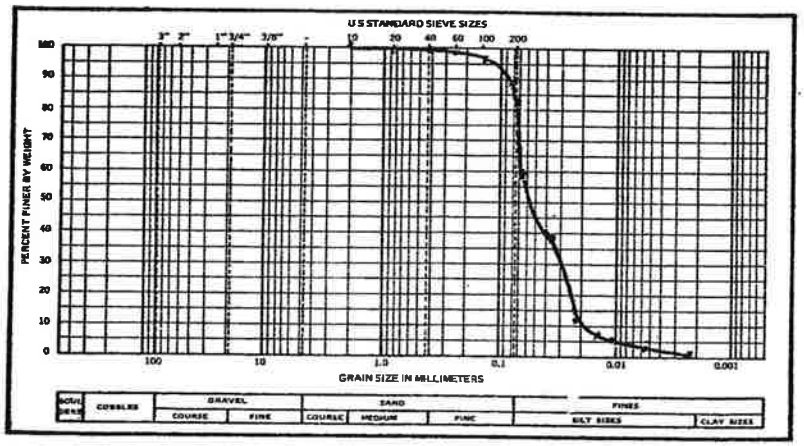
* Remolded Properties
uu - Unconsolidated Undrained
cu - Consolidated Undrained
dst - Direct Shear Test

NOTES:
1. Soil tests performed in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System
3. T = see Triaxial Test Results or Direct Shear Test Results
4. U = see Unconfined Compression Test Results
5. C = see Relative Density Test Results
6. P = see Proctor Test Results
7. UD = Undisturbed Sample

LETCO SOIL DATA REPORT SHEET

SOIL PROPERTIES FOR MAXINE MINE B-2392
BORING NUMBER = POND
SAMPLE IDENTIFICATION = SLURRY (FINE REFUSE)

SPECIFIC GRAVITY = 1.59



SIEVE ANALYSIS

SIEVE NUMBER	#CUM WT RETAINED	PERCENT FINER
10	0.	100.0
20	0.1	99.8
40	0.2	99.7
60	0.5	99.0
00	2.3	95.5
200	8.4	83.1

HYDROMETER ANALYSIS ON SOIL PASSING NO. 10 SIEVE

ELAPSED TIME	HYDRO READING	CORR HYDRO	TEMP	DIA IN MM	PERCENT FINER
0.5	32.0	26.0	25.	0.1021	62.9
1.0	29.5	23.5	25.	0.0722	56.9
2.0	27.0	21.0	25.	0.0510	50.8
5.0	22.0	16.0	25.	0.0337	38.7
15.0	10.5	4.5	25.	0.0210	10.8
30.0	8.8	2.8	25.	0.0149	6.7
60.0	8.6	2.6	25.	0.0105	6.2
250.0	7.2	1.0	24.	0.0054	2.3
1440.0	6.2	0.2	24.	0.0022	0.4

APPROX. SOIL PROP. BASED ON ABOVE DATA AND EMPIRICAL RELATIONSHIPS

COEFF. OF CURVATURE = 0.51
UNIFORMITY COEFF. = 4.42

PERCENTAGE CLASSIFICATION IS
0. % GRAVEL 16.9% SAND 83.1% FINES

Checked By
Laboratory J.K.
Engineering R.M.

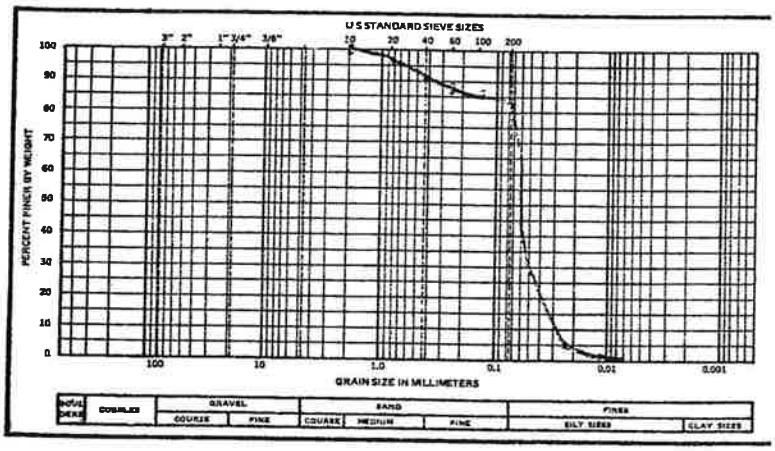
LETCO SOIL DATA REPORT SHEET

SOIL PROPERTIES FOR MAXINE MINE B-2392
BORING NUMBER = B-3
SAMPLE IDENTIFICATION = UD AT 41-43 (FINE REFUSE)

SPECIFIC GRAVITY = 1.59
WET UNIT WEIGHT = 94.4 PCF
NATURAL MOISTURE CONTENT = 45.1 PERCENT
DRY UNIT WT = 65.1 PCF VOID RATIO = 0.525 PERCENT SAT.=136.6

SIEVE ANALYSIS

SIEVE NUMBER	#CUM WT RETAINED	PERCENT FINER
10	0.	100.0
20	3.5	96.5
40	9.5	90.5
60	12.2	87.7
100	13.9	86.1
200	17.1	82.9



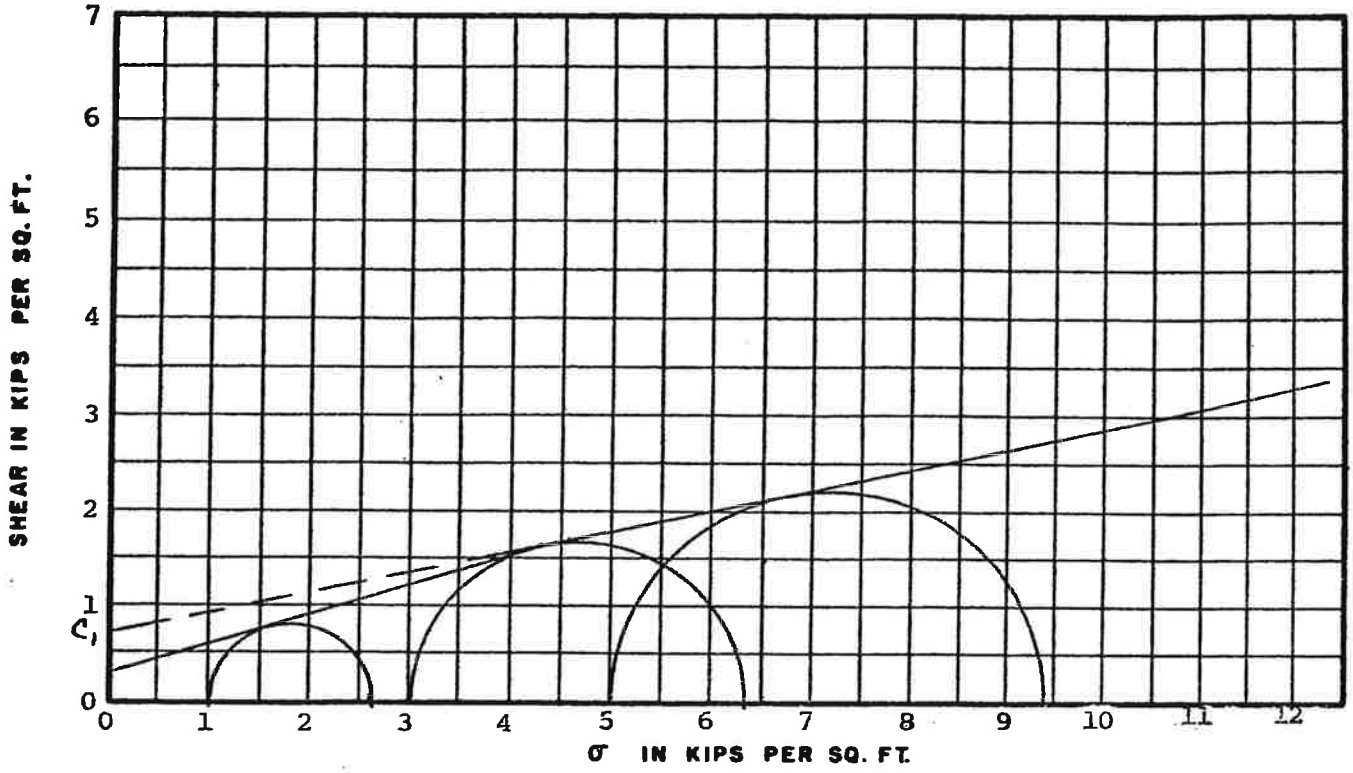
HYDROMETER ANALYSIS ON SOIL PASSING NO. 10 SIEVE

ELAPSED TIME	HYDRO READING	CORR HYDRO	TEMP	DIA IN MM	PERCENT FINER
0.5	34.0	27.0	22.	0.1001	32.7
1.0	33.5	26.5	22.	0.0708	32.1
2.0	33.0	26.0	22.	0.0501	31.5
5.0	32.5	25.5	22.	0.0317	30.9
15.0	28.0	21.0	22.	0.0192	25.5
30.0	10.0	3.0	22.	0.0153	3.6
60.0	8.0	1.0	22.	0.0108	1.2
250.0	6.0	0.6	23.	0.0054	0.7
1440.0	6.0	1.0	22.	0.0023	.2

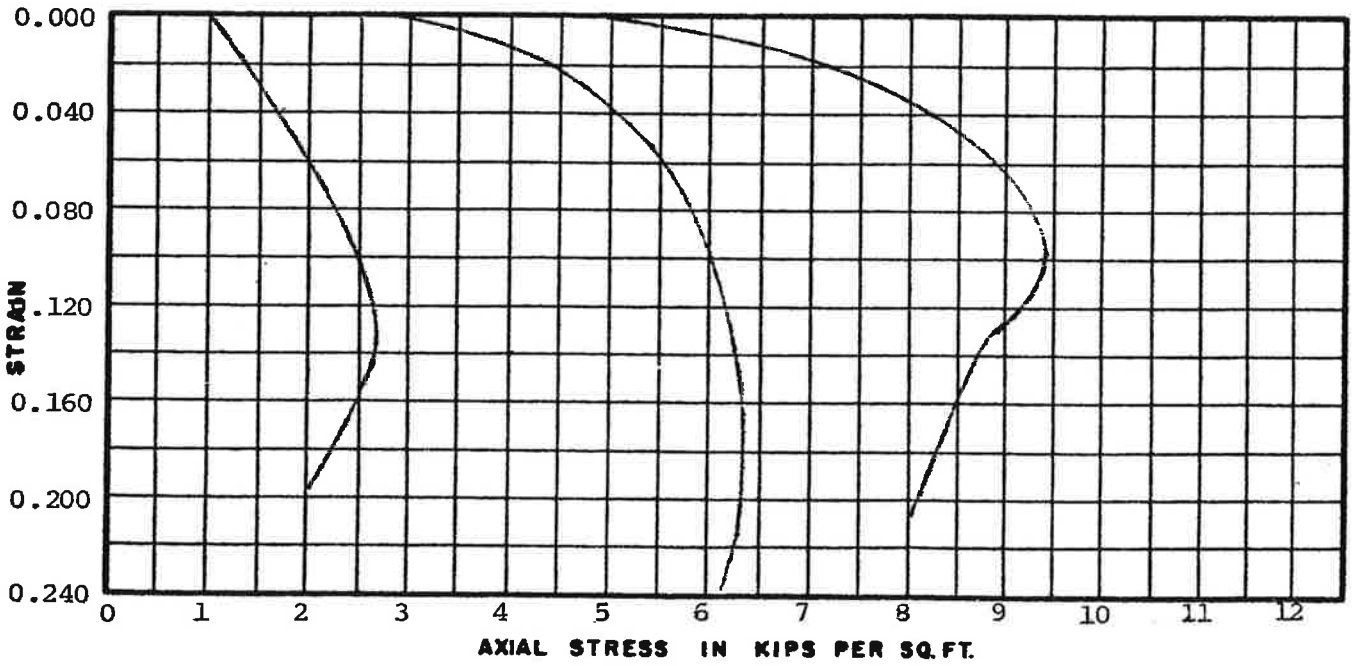
APPROX. SOIL PROP. BASED ON ABOVE DATA AND EMPIRICAL RELATIONSHIPS

COEFF. OF CURVATURE = 0.62
UNIFORMITY COEFF. = 5.23

PERCENTAGE CLASSIFICATION IS
0. % GRAVEL 17.1% SAND 82.9% FINES



MOHR DIAGRAMS — ϕ



STRESS-STRAIN CURVES

Checked By
Laboratory JFC
Engineering

Specific gravity = 1.55

"COHESION", c 0.29 KSF C_1 = 0.68 KSF

ANGLE OF SHEAR RESISTANCE. ϕ 12.5 degrees

Wet
UNIT WEIGHT, γ 72.4, 71.8, 76.2

WATER CONTENT. w 43.7%

VOID RATIO. e 0.921, 0.936, 0.824

Saturation 73.6, 72.4, 82.2

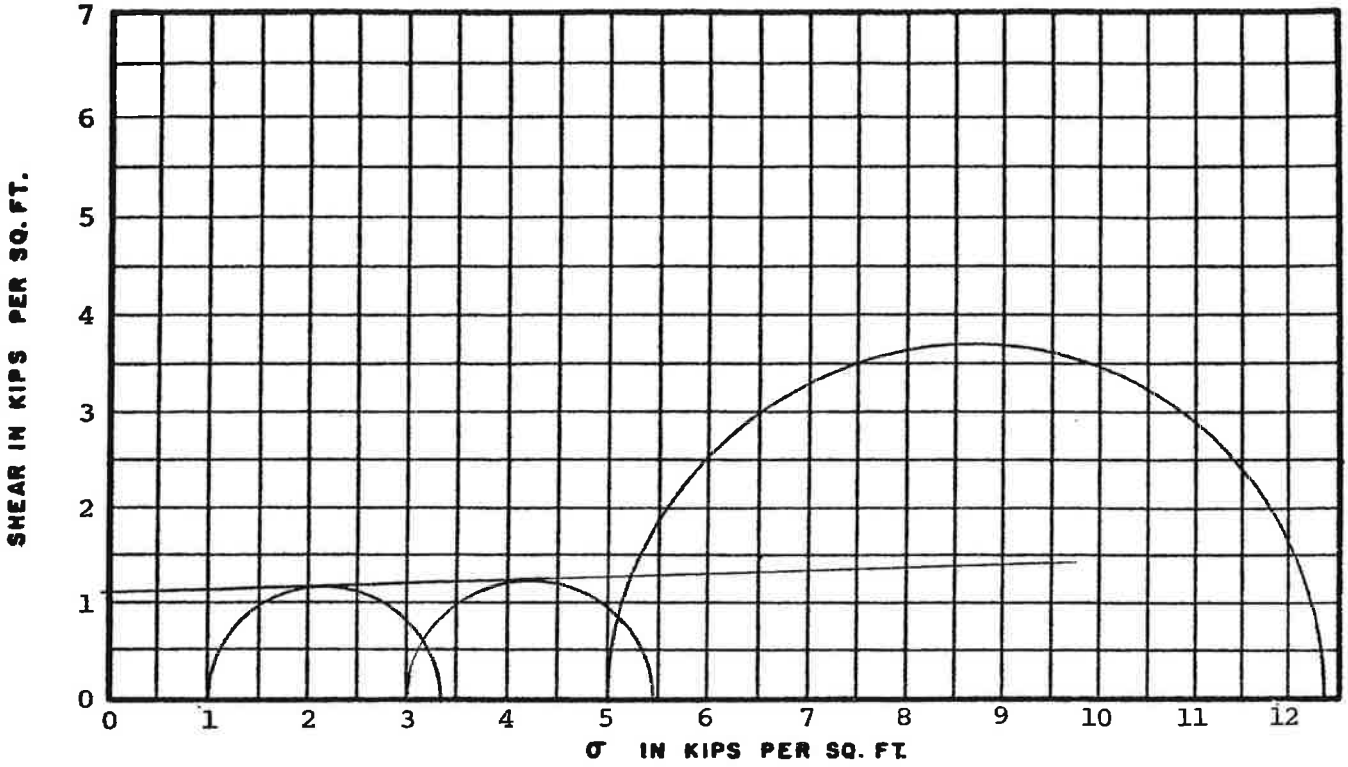
Unconsolidated-Undrained

TRIAXIAL SHEAR TEST

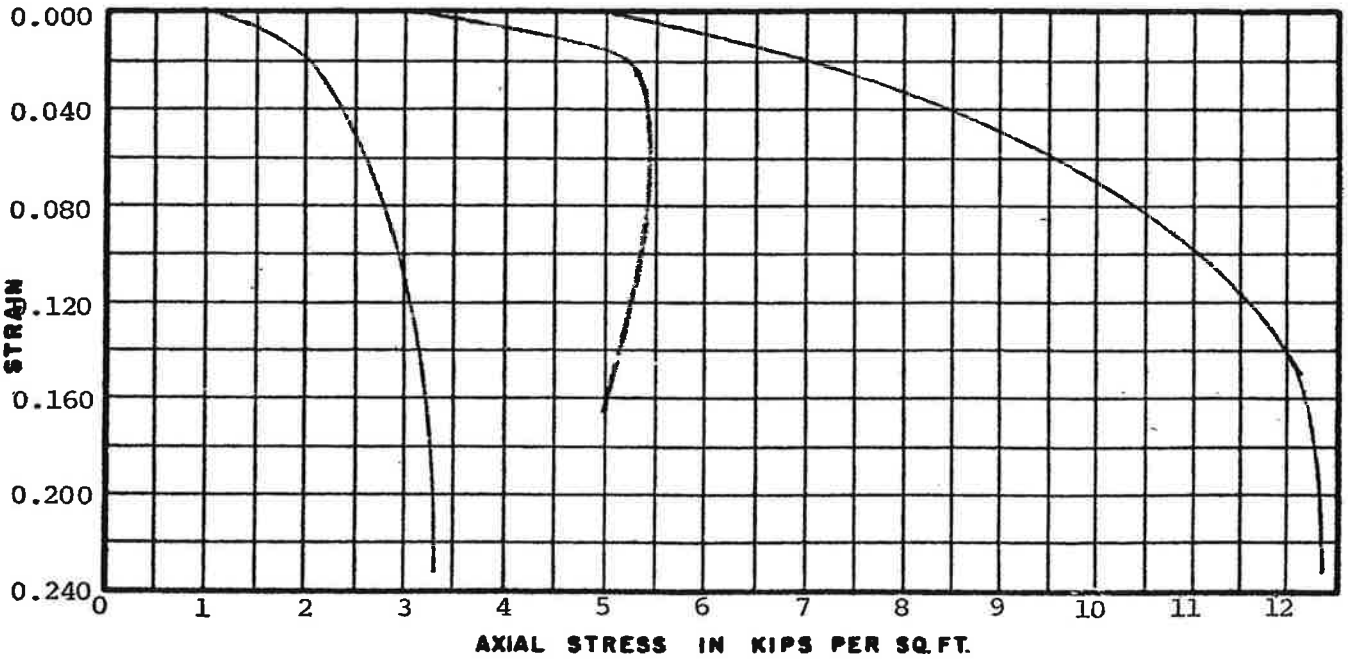
BORING NO. B-1A SAMPLE NO. UD

ELEV. OR DEPTH 5 ft.-6.5 ft. JOB NO. B-2392

LAW ENGINEERING TESTING CO.



MOHR DIAGRAMS — ϕ



STRESS-STRAIN CURVES

Checked By
Laboratory
Engineering

Specimens were remolded

"COHESION", C 1.13 Ksf

ANGLE OF SHEAR RESISTANCE, ϕ 3.5°

UNIT WEIGHT, γ 74.05 Pcf wet

WATER CONTENT, W 33.7

VOID RATIO, e 0.802

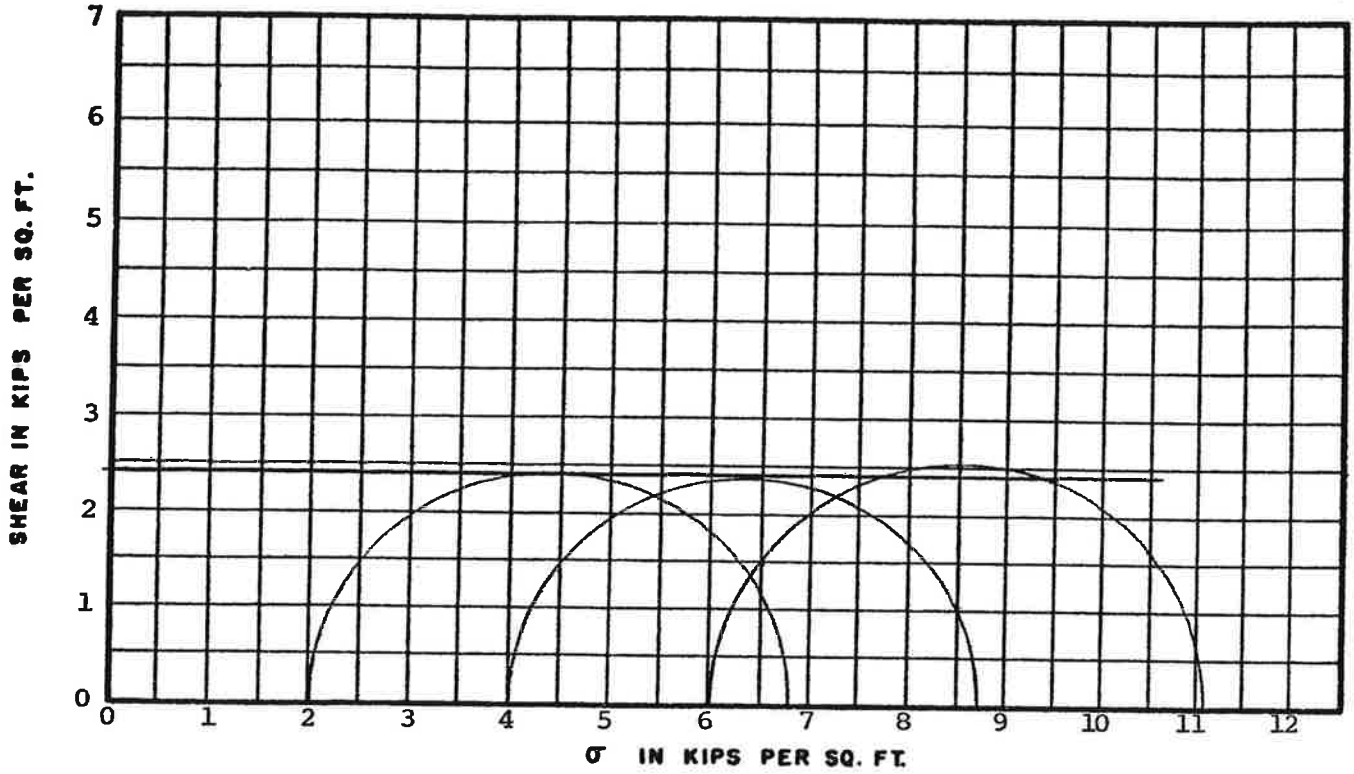
Saturated
Consolidated-Undrained

TRIAXIAL SHEAR TEST

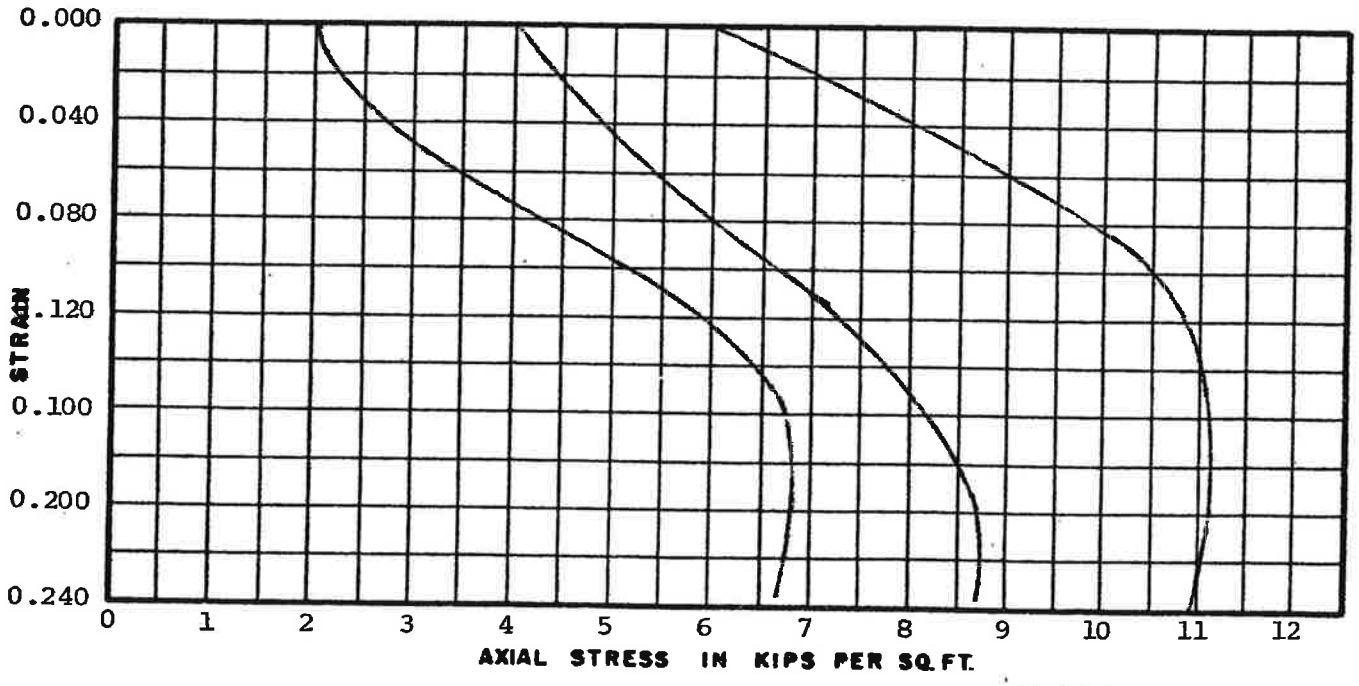
BORING NO. B-2A SAMPLE NO. Remolded

ELEV. OR DEPTH JOB NO. B-2392

LAW ENGINEERING TESTING CO.



MOHR DIAGRAMS — ϕ



STRESS-STRAIN CURVES

Specific Gravity = 1.59

"COHESION", C 2.41 Ksf

ANGLE OF SHEAR RESISTANCE, ϕ 0

UNIT WEIGHT, γ 92.9,95.8,75.0 Pcf(wet)

WATER CONTENT, w 45.1%

VOID RATIO, e 0.772, 0.749, 0.921

Saturation 92.9, 95.7, 77.8

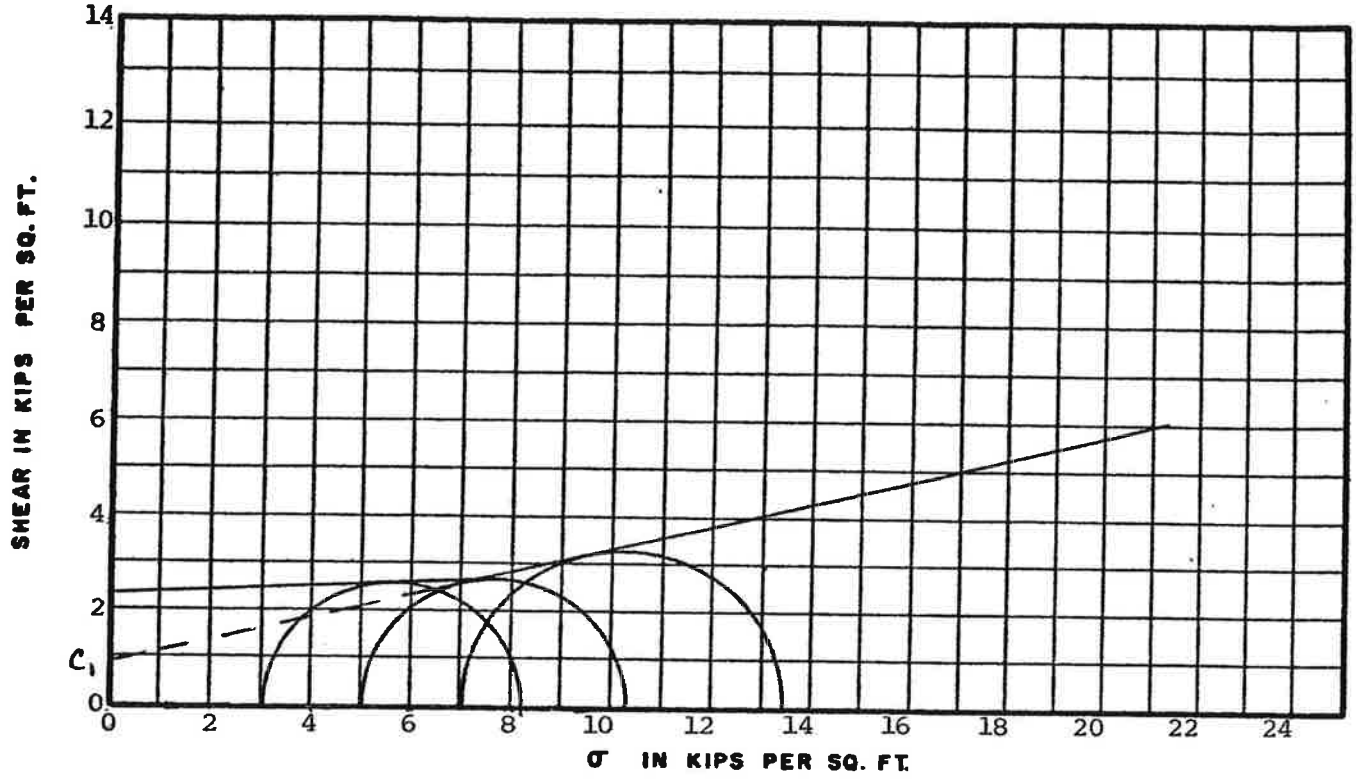
Saturated
Unconsolidated-Undrained

TRIAXIAL SHEAR TEST

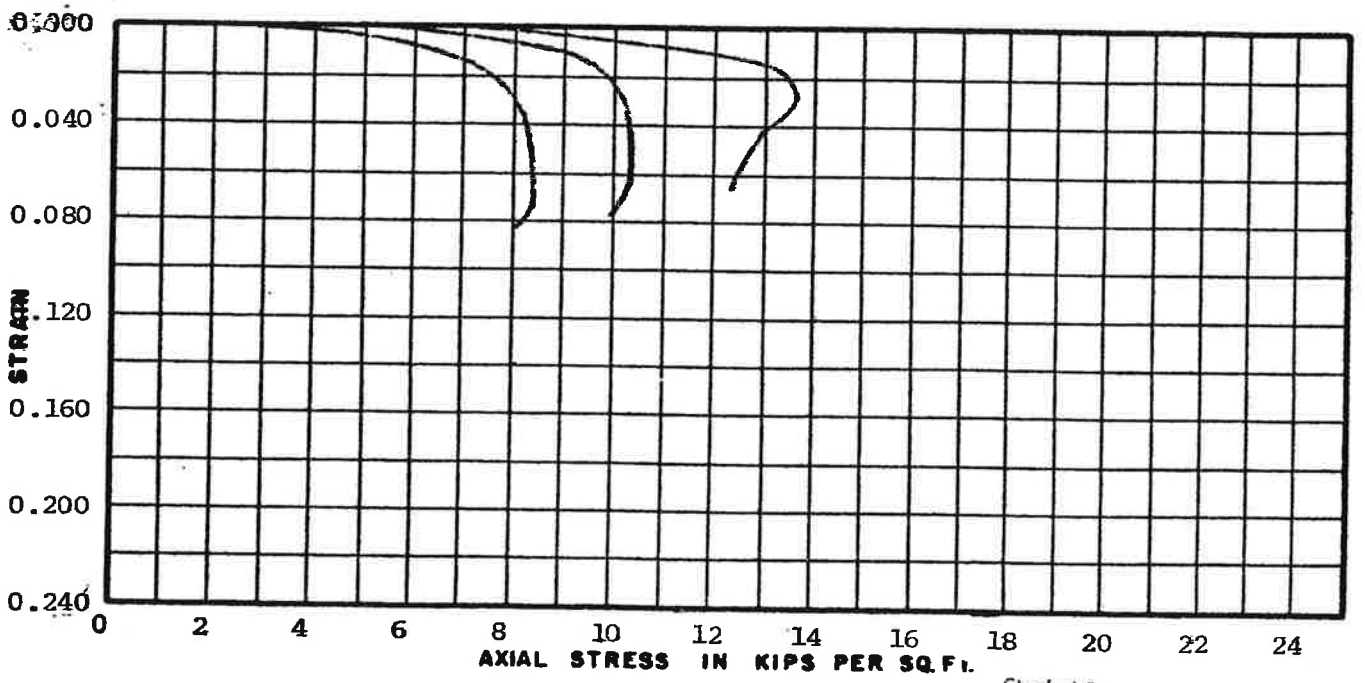
BORING NO. B-3 SAMPLE NO. UD

ELEV. OR DEPTH Slurry JOB NO. B-2392
41-43 feet

LAW ENGINEERING TESTING CO.



MOHR DIAGRAMS — ϕ



STRESS-STRAIN CURVES

Checked By
Laboratory
Engineering

Specific Gravity = 1.47

"COHESION", c 2.25 KSF; C_1 = 0.91 KSF

ANGLE OF SHEAR RESISTANCE. ϕ 4°

Wet UNIT WEIGHT, γ 74.7, 75.6, 76.1

WATER CONTENT, w 39.8 %

VOID RATIO, e 0.718, 0.685

Consolidated properties
Wet unit weight 78.0, 79.9, 83.4
Moisture content 39.4, 30.9, 26.9

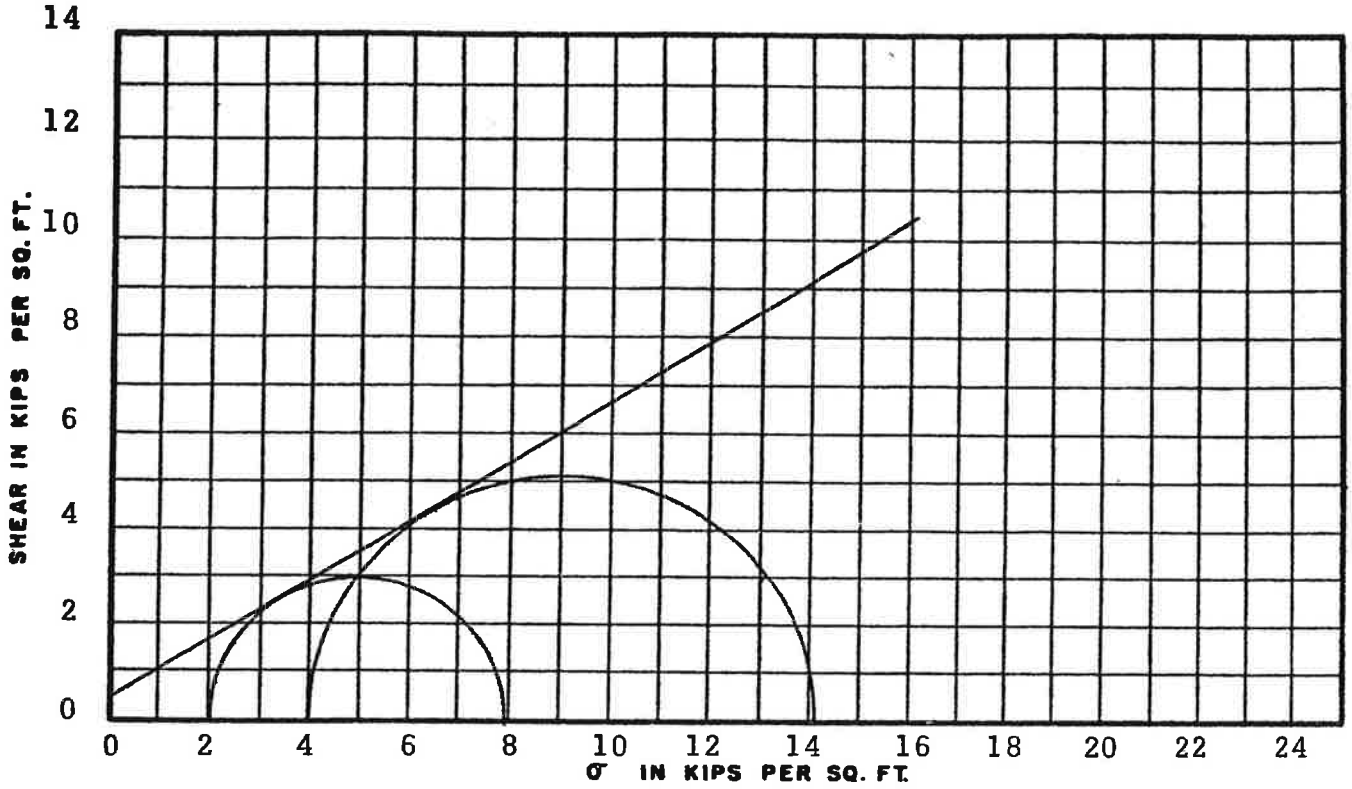
Saturated
Consolidated-Undrained

TRIAXIAL SHEAR TEST

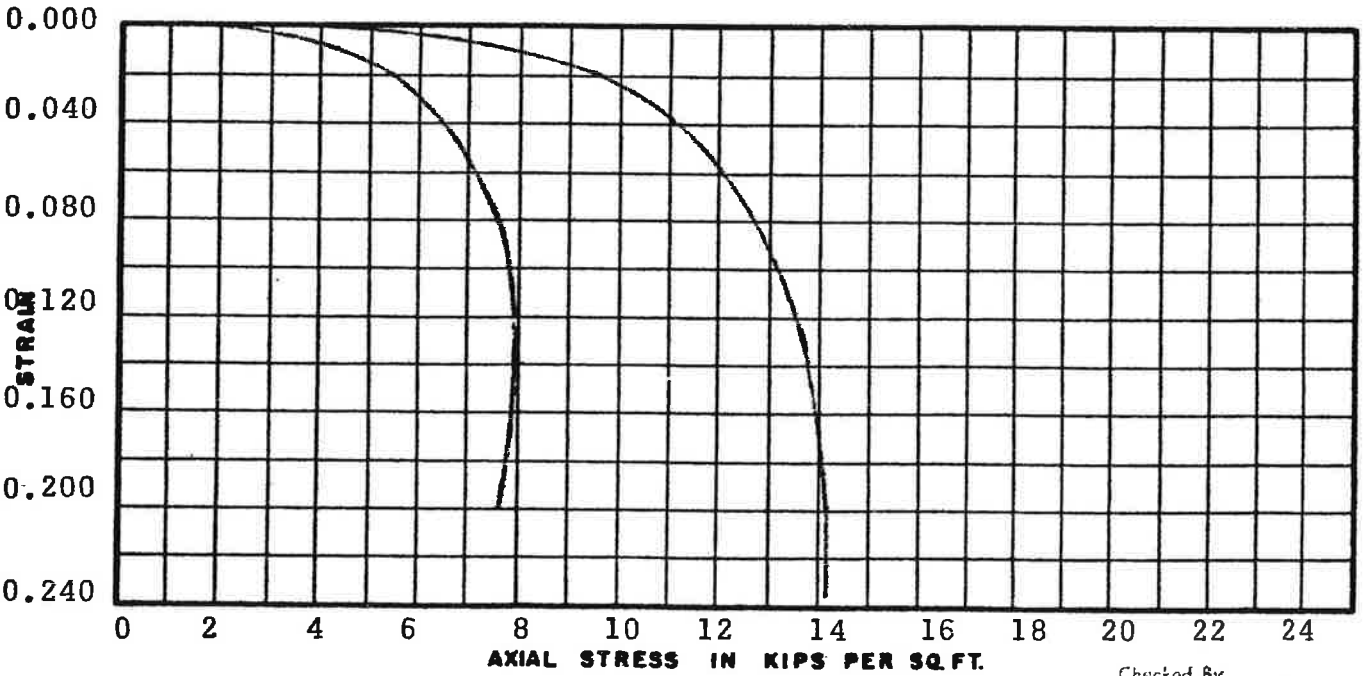
BORING NO. B-3 SAMPLE NO. UD

ELEV. OR DEPTH 43-45 feet JOB NO. B-2392

LAW ENGINEERING TESTING CO.



MOHR DIAGRAMS — ϕ



STRESS-STRAIN CURVES

Checked By
Laboratory
Engineering

Specific Gravity = 1.44

"COHESION", C 0.44 ksf

ANGLE OF SHEAR RESISTANCE. ϕ 32^{o}

Wet UNIT WEIGHT, γ 76.0

WATER CONTENT. W 35.9 %

VOID RATIO. e 0.606

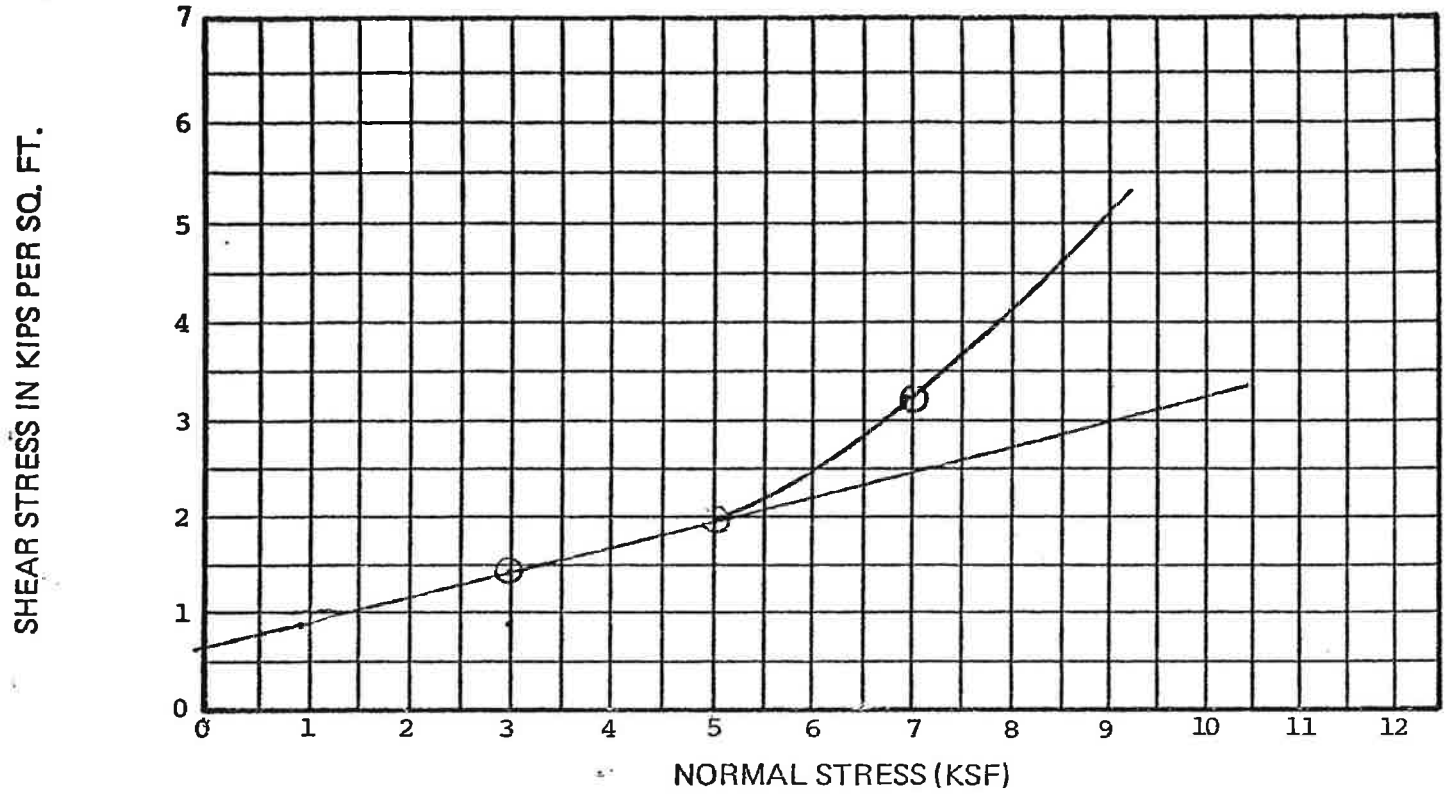
Saturation = 85.2%

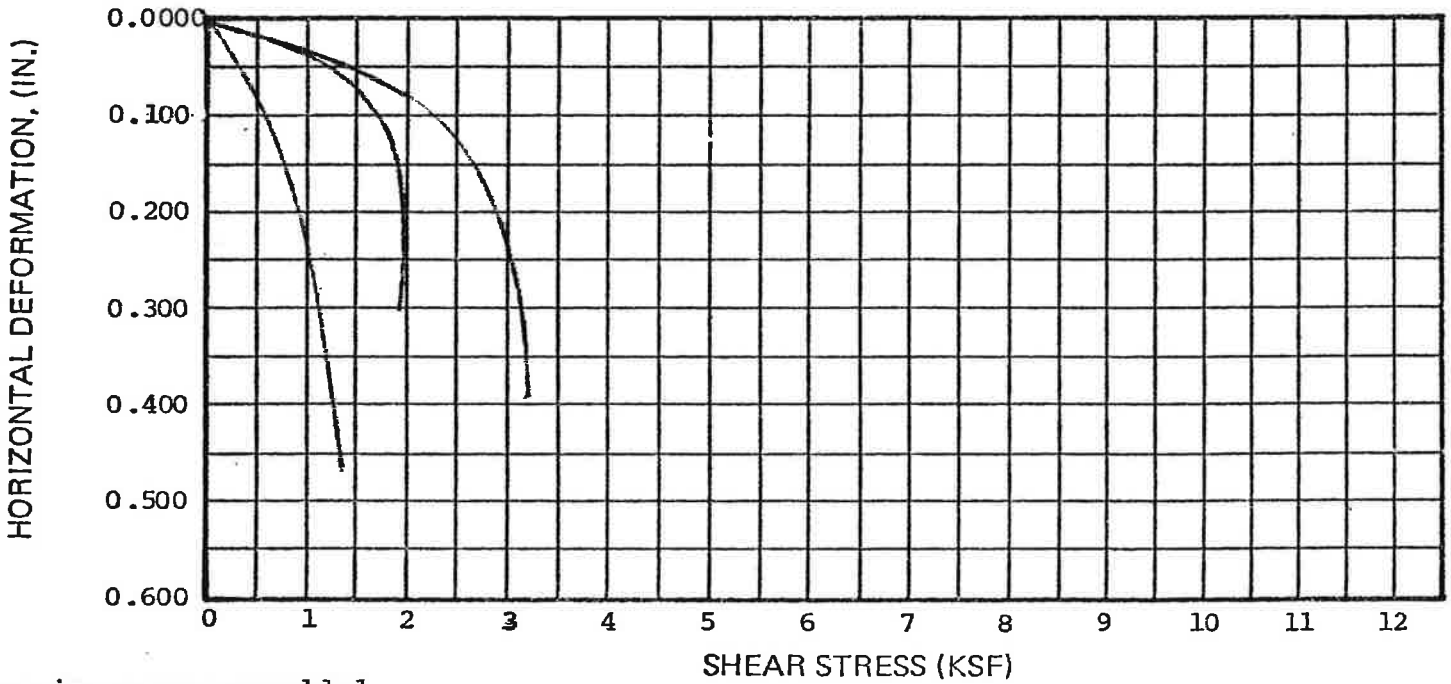
SATURATED
CONSOLIDATED-UNDRAINED
TRIAXIAL SHEAR TEST

BORING NO. B-3A SAMPLE NO. UD

ELEV. OR DEPTH 4 ft. - 6 ft. JOB NO. B-2392

LAW ENGINEERING TESTING CO.





STRESS-DEFORMATION CURVES

Specimens were remolded

SHEAR ANGLE 14.5%

COHESION, C 0.66 Ksf

WET UNIT WEIGHT, PCF 75.5

WATER CONTENT, % 40.0%

SPECIFIC GRAVITY 1.59

VOID RATIO 0.840 SATURATION 75.7

DIRECT SHEAR TEST

JOB NUMBER: B-2392

SAMPLE NUMBER. Slurry

BORING NUMBER:

DEPTH, FT. 0

LAW ENGINEERING TESTING COMPANY

Checked By

Laboratory

Engineering

COMPACTION TEST

JOB NAME Maxine Mine

JOB NO. B-2392

SAMPLE NO. Slurry

METHOD OF TEST D 698 "A"

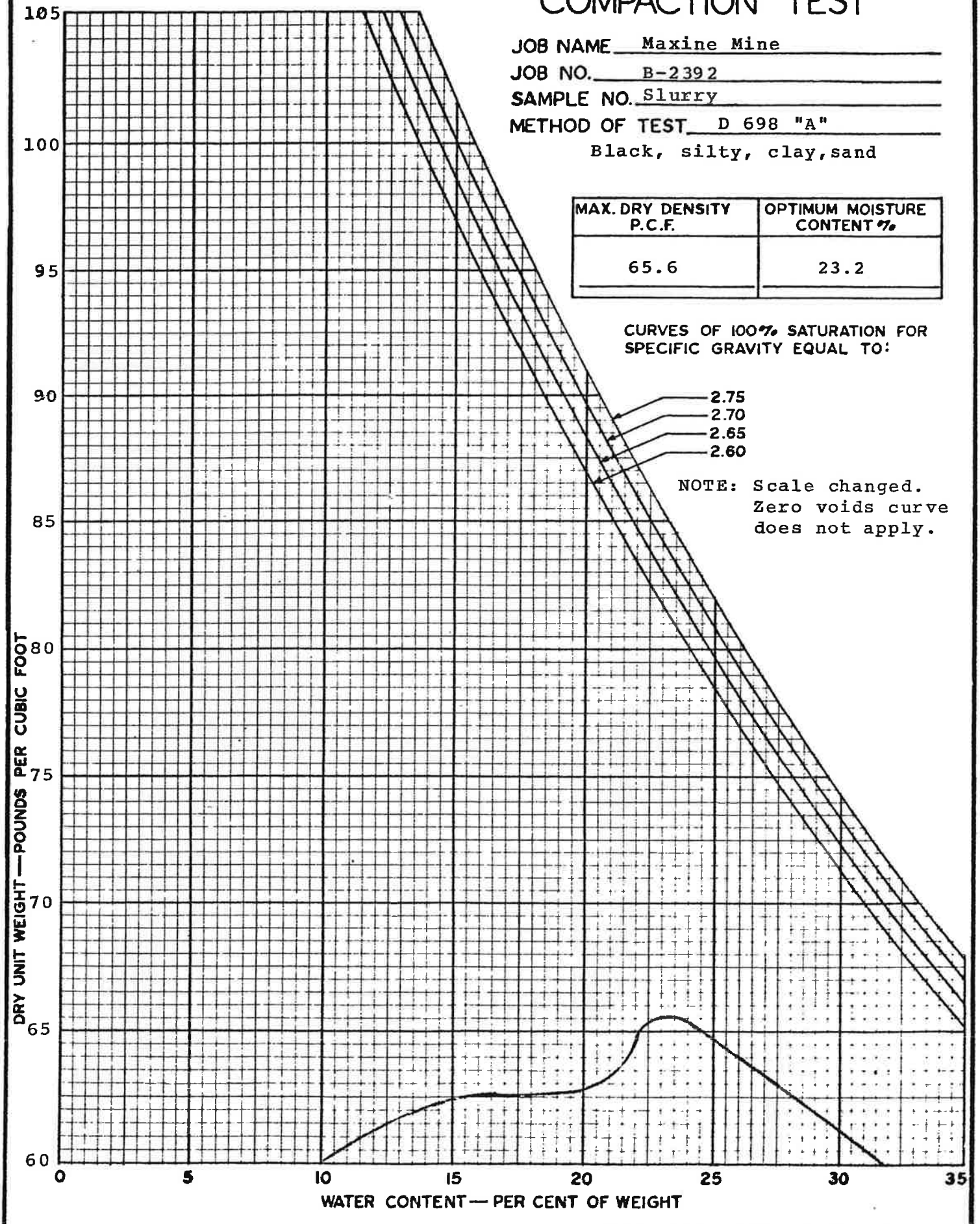
Black, silty, clay, sand

MAX. DRY DENSITY P.C.F.	OPTIMUM MOISTURE CONTENT %
65.6	23.2

CURVES OF 100% SATURATION FOR SPECIFIC GRAVITY EQUAL TO:

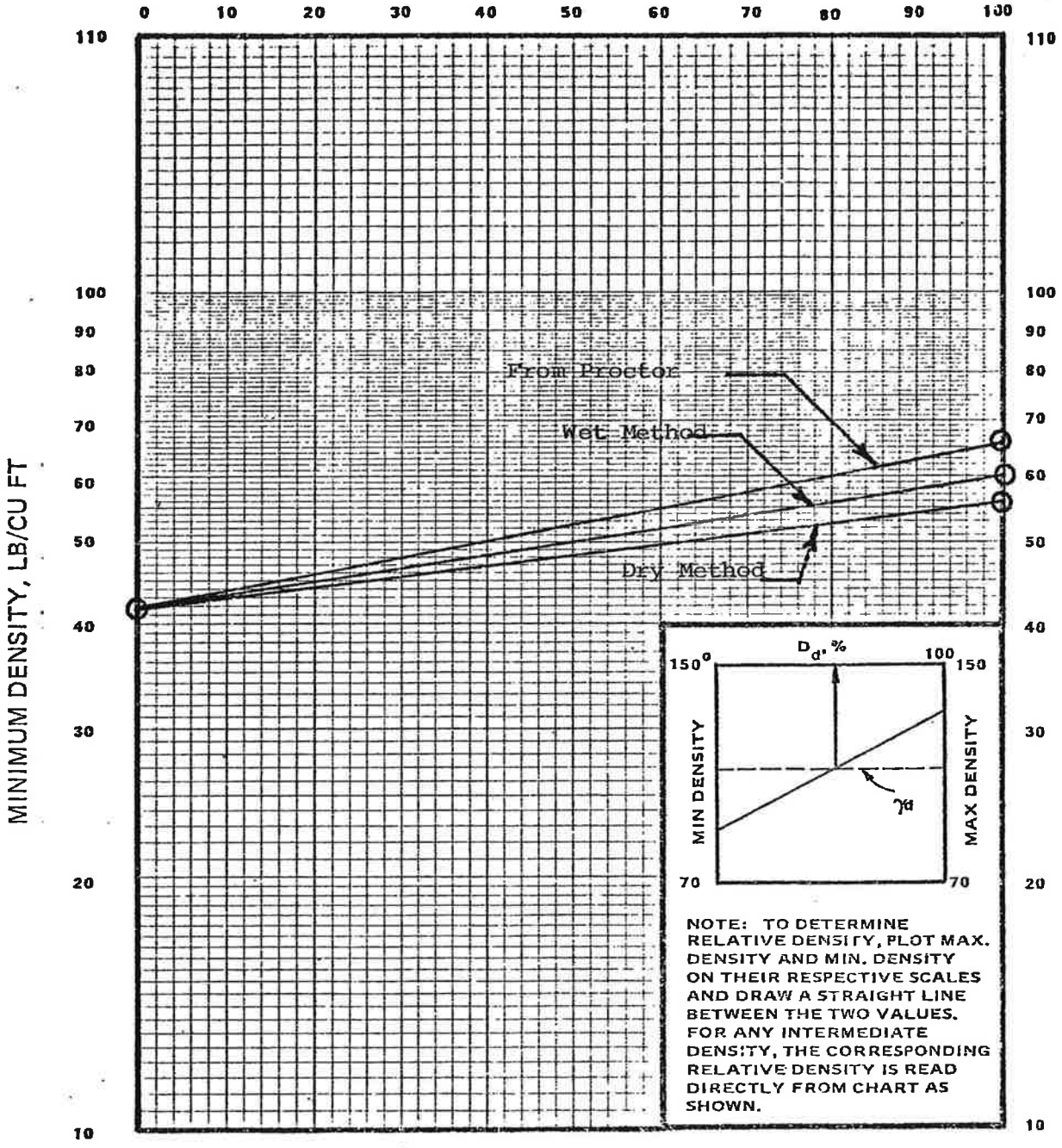
2.75
2.70
2.65
2.60

NOTE: Scale changed. Zero voids curve does not apply.



LAW ENGINEERING TESTING CO.

REPORT OF MINIMUM AND MAXIMUM DENSITY (ASTM D-2049-69)



RELATIVE DENSITY, D_d, PERCENT

LAW ENGINEERING TESTING COMPANY

Birmingham, Alabama

SAMPLE NO.: Bag
BORING NO.: Fine Refuse
DEPTH NO.: Surface

Job No. B-2392

Drawn: JE
Checked: BM
Approved:

Drummond Company, Inc.
Mine No. 89
P-3629
Maxine Slurry Impoundment No. 1
Section A-A'
Downstream Section
Static Condition
Stability Analysis

REAME (Rotational Equilibrium Analysis of Multilayered Embankments)
Implemented on the 16-bit Microcomputers C. F. Hains, Jr. and D. M. Hains
2301 22nd Ave.
Northport, AL 35476
(205)-339-6536

Drummond Company, Inc. Mine No. 89 P-3629 Maxine Slurry Impoundment No. 1 Downstream Section Static Condition

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 5
Number of points on boundary lines are: 3 5 7 9 7

On boundary line no. 1 Point no. and coordinates are:
1 .000 283.000 2 370.000 250.000 3 600.000 250.000

On boundary line no. 2 Point no. and coordinates are:
1 .000 300.000 2 362.000 260.000 3 373.000 260.000 4 550.000 260.000 5 600.000 260.000

On boundary line no. 3 Point no. and coordinates are:
1 .000 357.000 2 185.400 357.000 3 211.000 369.000 4 270.000 370.000 5 373.000 260.000
6 550.000 260.000 7 600.000 260.000

On boundary line no. 4 Point no. and coordinates are:
1 .000 357.000 2 185.400 357.000 3 211.000 369.000 4 219.533 373.000 5 243.000 384.000
6 315.000 386.000 7 490.989 291.640 8 550.000 260.000 9 600.000 260.000

On boundary line no. 5 Point no. and coordinates are:
1 .000 373.000 2 169.175 373.000 3 219.533 373.000 4 243.000 384.000 5

315.000 386.000
6 550.000 260.000 7 600.000 260.000

Line no. and slope of each segment are:

1	-.089	.000					
2	-.110	.000	.000	.000			
3	.000	.469	.017	-1.068	.000	.000	
4	.000	.469	.469	.469	.028	-.536	-.536	.000
5	.000	.000	.469	.028	-.536	.000		

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1
Line no.= 1 Begin pt. no.= 1 End pt. no.= 3

Soil no.	Cohesion	F. angle	Unit wt.
1	10000.000	45.000	170.000
2	660.000	14.500	76.000
3	600.000	29.500	117.000
4	.000	.000	62.400

Seismic coefficient= .000 Min. depth of tallest slice= 0.000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 1 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

No. of points on water table for each case= 6

Under seepage condition 1point no. and coordinates of water table are:
1 .000 373.000 2 169.175 373.000 3 330.082 340.230 4 490.989 291.640 5 550.000 260.000
6 600.000 260.000

point1=(400.000, 386.000) point2=(600.000, 386.000) point3=(600.000, 686.000) NJ= 2 NI= 3
Automatic search will follow after grid with XINC= 100.000 and YINC= 150.000

At point (400.000, 386.000) under seepage 1,the radius and the corresponding factor of safety are:
136.000 4.881

129.611 3.403
Lowest factor of safety= 3.403 and occurs at radius = 129.611

At point (500.000, 386.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

****WARNING AT NEXT CENTER**** When radius is 126.000
center of circle lies below ground line or circle does not intercept ground line properly, or the circle cuts the slope
very slightly, so a large factor of safety is assigned.

At point (600.000, 386.000) under seepage 1the circle does not intercept the slope

At point (400.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
236.000 5.531
228.820 3.425 221.640 1.559
Lowest factor of safety= 1.559 and occurs at radius = 221.640

At point (500.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (600.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

At point (400.000, 586.000) under seepage 1,the radius and the corresponding factor of safety are:
336.000 6.695
328.088 3.660 320.175 1.706
Lowest factor of safety= 1.706 and occurs at radius = 320.175

At point (500.000, 586.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (600.000, 586.000) under seepage 1 The depth of tallest slice is less than DMIN

At point (400.000, 686.000) under seepage 1,the radius and the corresponding factor of

safety are:
436.000 7.233 411.162 1.907
Lowest factor of safety= 1.907 and occurs at radius = 411.162

At point (500.000, 686.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (600.000, 686.000) under seepage 1 The depth of tallest slice is less than DMIN

For piezometric line No. 1

At point (400.000, 486.000) ,RADIUS 221.640
the minimum factor of safety is 1.559

At point (400.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
236.000 5.531
228.820 3.425 221.640 1.559
Lowest factor of safety= 1.559 and occurs at radius = 221.640

At point (500.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

At point (300.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
228.848 22.217 203.154 8.955
Lowest factor of safety= 8.955 and occurs at radius = 203.154

At point (400.000, 636.000) under seepage 1,the radius and the corresponding factor of safety are:
386.000 6.767
377.870 3.764 369.741 1.768
Lowest factor of safety= 1.768 and occurs at radius = 369.741

At point (400.000, 336.000) under seepage 1,the radius and the corresponding factor of safety are:

86.000 6.224
Lowest factor of safety= 6.224 and occurs at radius = 86.000

At point (425.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
236.000 4.320
229.607 2.961
Lowest factor of safety= 2.961 and occurs at radius = 229.607

At point (375.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
235.511 6.914 211.706 1.970
Lowest factor of safety= 1.970 and occurs at radius = 211.706

At point (400.000, 523.500) under seepage 1,the radius and the corresponding factor of safety are:
273.500 5.988
266.023 3.529 258.546 1.615
Lowest factor of safety= 1.615 and occurs at radius = 258.546

At point (400.000, 448.500) under seepage 1,the radius and the corresponding factor of safety are:
198.500 5.158
191.616 3.346 184.733 1.526
Lowest factor of safety= 1.526 and occurs at radius = 184.733

At point (400.000, 411.000) under seepage 1,the radius and the corresponding factor of safety are:
161.000 4.887
154.413 3.333
Lowest factor of safety= 3.333 and occurs at radius = 154.413

At point (425.000, 448.500) under seepage 1,the radius and the corresponding factor of safety are:
198.500 4.010
Lowest factor of safety= 4.010 and occurs at radius = 198.500

At point (375.000, 448.500) under seepage 1,the radius and the corresponding factor of

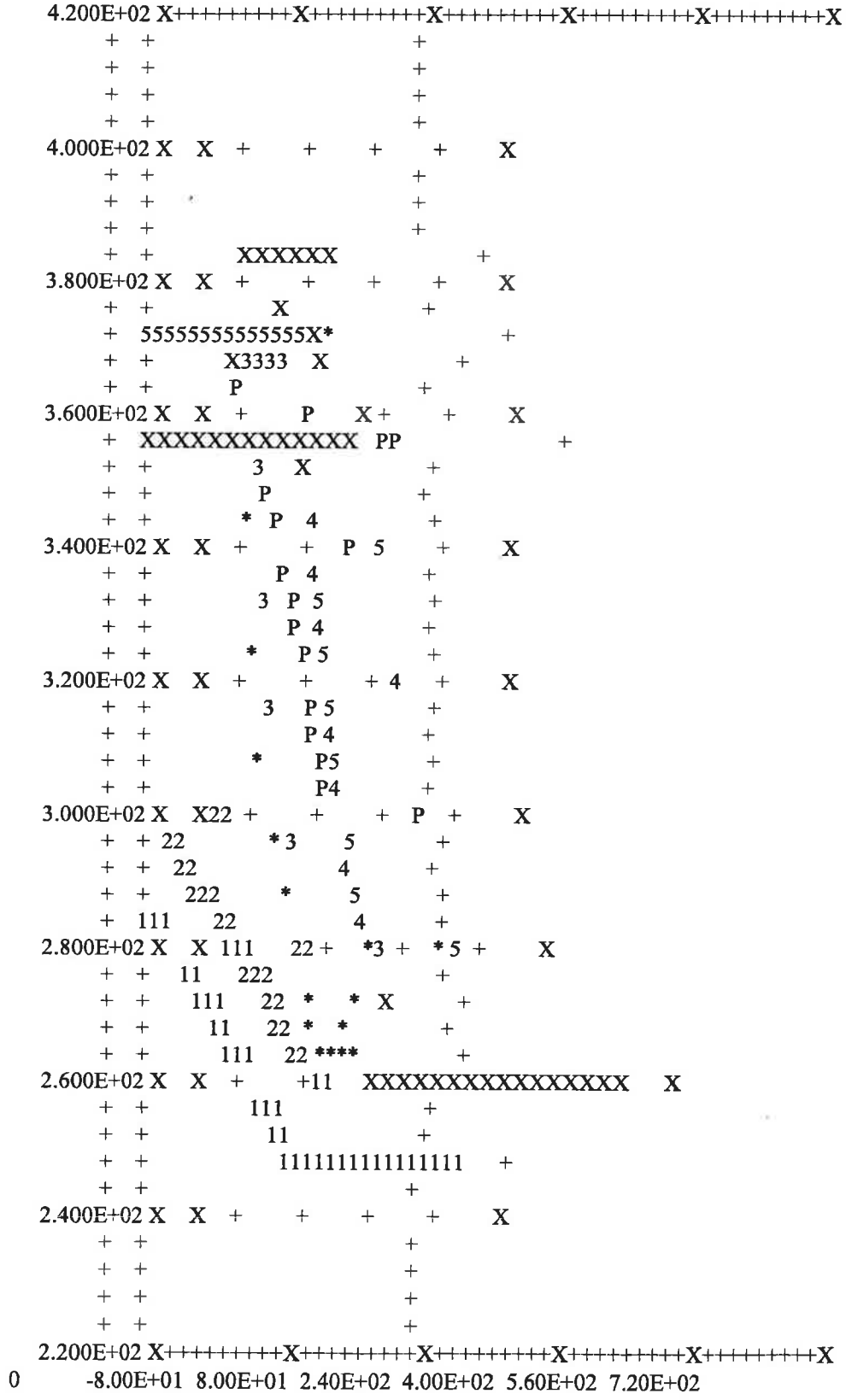
safety are:
198.159 6.418 175.214 1.897
Lowest factor of safety= 1.897 and occurs at radius = 175.214

For piezometric line No. 1

At point (400.000, 448.500) ,RADIUS 184.733
the minimum factor of safety is 1.526

1

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.
The minimum factor of safety is 1.526



Drummond Company, Inc.
Mine No. 89
P-3629
Maxine Slurry Impoundment No. 1
Section A-A'
Downstream Section
Dynamic Condition
Stability Analysis

REAME (Rotational Equilibrium Analysis of Multilayered Embankments)
Implemented on the 16-bit Microcomputers C. F. Hains, Jr. and D. M. Hains
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Drummond Company, Inc. Mine No. 89 P-3629 Maxine Slurry Impoundment No. 1 Downstream Section Dynamic Condition

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 5
Number of points on boundary lines are: 3 5 7 9 7

On boundary line no. 1 Point no. and coordinates are:
1 .000 283.000 2 370.000 250.000 3 600.000 250.000

On boundary line no. 2 Point no. and coordinates are:
1 .000 300.000 2 362.000 260.000 3 373.000 260.000 4 550.000 260.000 5 600.000 260.000

On boundary line no. 3 Point no. and coordinates are:
1 .000 357.000 2 185.400 357.000 3 211.000 369.000 4 270.000 370.000 5 373.000 260.000
6 550.000 260.000 7 600.000 260.000

On boundary line no. 4 Point no. and coordinates are:
1 .000 357.000 2 185.400 357.000 3 211.000 369.000 4 219.533 373.000 5 243.000 384.000
6 315.000 386.000 7 490.989 291.640 8 550.000 260.000 9 600.000 260.000

On boundary line no. 5 Point no. and coordinates are:
1 .000 373.000 2 169.175 373.000 3 219.533 373.000 4 243.000 384.000 5

315.000 386.000
6 550.000 260.000 7 600.000 260.000

Line no. and slope of each segment are:

1	-.089	.000					
2	-.110	.000	.000	.000			
3	.000	.469	.017	-1.068	.000	.000	
4	.000	.469	.469	.469	.028	-.536	-.536	.000
5	.000	.000	.469	.028	-.536	.000		

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1
Line no.= 1 Begin pt. no.= 1 End pt. no.= 3

Soil no.	Cohesion	F. angle	Unit wt.
1	10000.000	45.000	170.000
2	660.000	14.500	76.000
3	600.000	29.500	117.000
4	.000	.000	62.400

Seismic coefficient= .100 Min. depth of tallest slice= 0.000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 1 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

No. of points on water table for each case= 6

Under seepage condition 1point no. and coordinates of water table are:
1 .000 373.000 2 169.175 373.000 3 330.082 340.230 4 490.989 291.640 5 550.000 260.000
6 600.000 260.000

point1=(400.000, 386.000) point2=(600.000, 386.000) point3=(600.000, 686.000) NJ= 2 NI= 3
Automatic search will follow after grid with XINC= 100.000 and YINC= 150.000

At point (400.000, 386.000) under seepage 1,the radius and the corresponding factor of safety are:
136.000 3.910

129.611 2.766
Lowest factor of safety= 2.766 and occurs at radius = 129.611

At point (500.000, 386.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

****WARNING AT NEXT CENTER**** When radius is 126.000
center of circle lies below ground line or circle does not intercept ground line properly, or the circle cuts the slope
very slightly, so a large factor of safety is assigned.

At point (600.000, 386.000) under seepage 1the circle does not intercept the slope

At point (400.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
236.000 4.036
228.820 2.538 221.640 1.163
Lowest factor of safety= 1.163 and occurs at radius = 221.640

At point (500.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (600.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

At point (400.000, 586.000) under seepage 1,the radius and the corresponding factor of safety are:
336.000 4.549
328.088 2.530 320.175 1.184
Lowest factor of safety= 1.184 and occurs at radius = 320.175

At point (500.000, 586.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (600.000, 586.000) under seepage 1 The depth of tallest slice is less than DMIN

At point (400.000, 686.000) under seepage 1,the radius and the corresponding factor of

safety are:
436.000 4.786 411.162 1.264
Lowest factor of safety= 1.264 and occurs at radius = 411.162

At point (500.000, 686.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (600.000, 686.000) under seepage 1 The depth of tallest slice is less than DMIN

For piezometric line No. 1

At point (400.000, 486.000) ,RADIUS 221.640
the minimum factor of safety is 1.163

At point (400.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
236.000 4.036
228.820 2.538 221.640 1.163
Lowest factor of safety= 1.163 and occurs at radius = 221.640

At point (500.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

At point (300.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
228.848 8.419 203.154 3.023
Lowest factor of safety= 3.023 and occurs at radius = 203.154

At point (400.000, 636.000) under seepage 1,the radius and the corresponding factor of safety are:
386.000 4.593
377.870 2.533 369.741 1.193
Lowest factor of safety= 1.193 and occurs at radius = 369.741

At point (400.000, 336.000) under seepage 1,the radius and the corresponding factor of safety are:

86.000 5.238
Lowest factor of safety= 5.238 and occurs at radius = 86.000

At point (425.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
236.000 3.319
229.607 2.322
Lowest factor of safety= 2.322 and occurs at radius = 229.607

At point (375.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
235.511 4.764 211.706 1.394
Lowest factor of safety= 1.394 and occurs at radius = 211.706

At point (400.000, 523.500) under seepage 1,the radius and the corresponding factor of safety are:
273.500 4.238
266.023 2.539 258.546 1.168
Lowest factor of safety= 1.168 and occurs at radius = 258.546

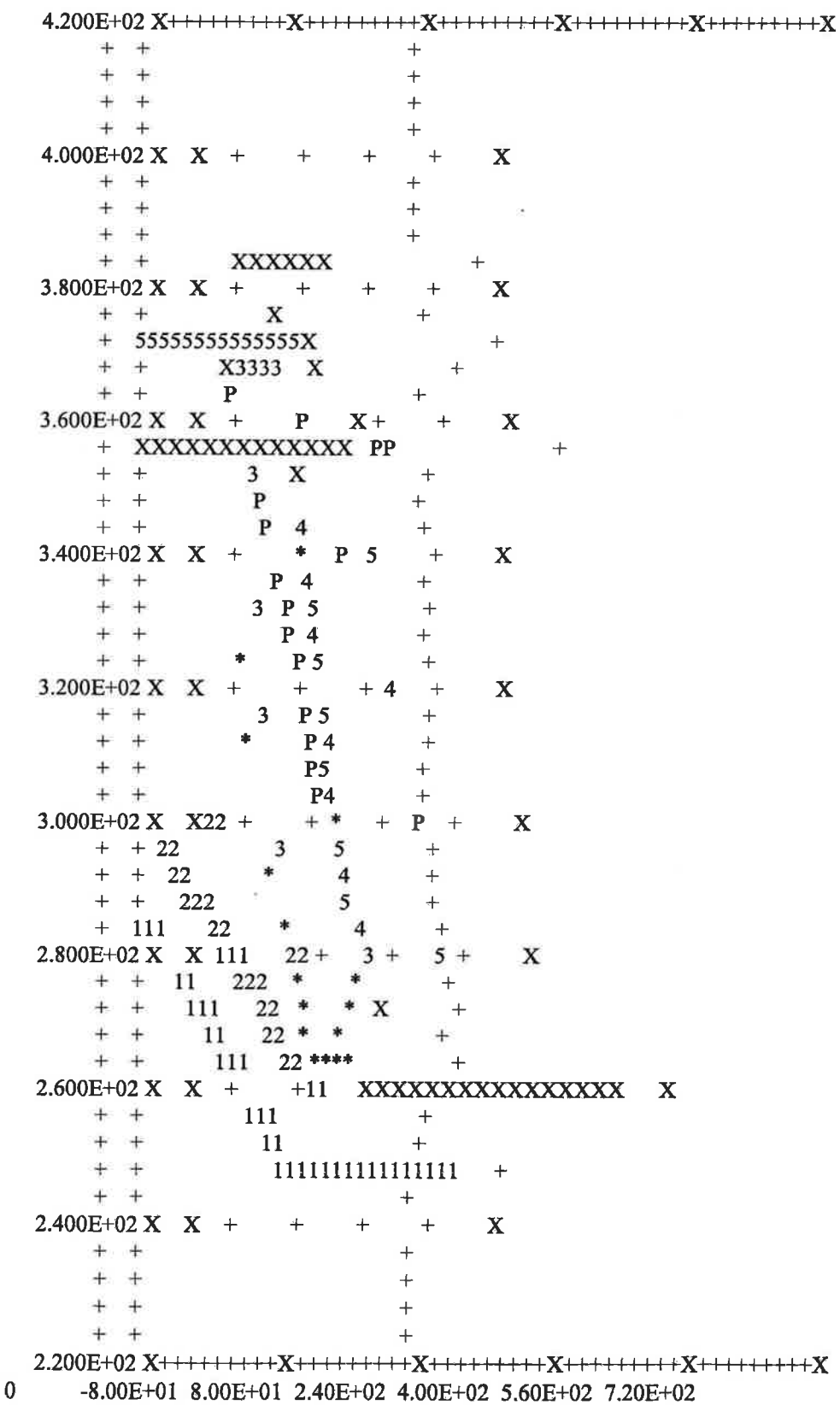
At point (400.000, 448.500) under seepage 1,the radius and the corresponding factor of safety are:
198.500 3.886
191.616 2.562 184.733 1.177
Lowest factor of safety= 1.177 and occurs at radius = 184.733

For piezometric line No. 1

At point (400.000, 486.000) ,RADIUS 221.640
the minimum factor of safety is 1.163

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.

The minimum factor of safety is 1.163



Drummond Company, Inc.
Mine No. 89
P-3629
Maxine Slurry Impoundment No. 1
Section A-A'
Upstream Section
Static Condition
Stability Analysis

REAME (Rotational Equilibrium Analysis of Multilayered Embankments)
Implemented on the 16-bit Microcomputers C. F. Hains, Jr. and D. M. Hains
2301 22nd Ave.
Northport, AL 35476
(205)-339-6536

Drummond Company, Inc. Mine No. 89 P-3629 Maxine Slurry Impoundment No. 1 Upstream Section Static Condition

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 5
Number of points on boundary lines are: 3 5 7 9 7

On boundary line no. 1 Point no. and coordinates are:
1 .000 283.000 2 370.000 250.000 3 600.000 250.000

On boundary line no. 2 Point no. and coordinates are:
1 .000 300.000 2 362.000 260.000 3 373.000 260.000 4 550.000 260.000 5 600.000 260.000

On boundary line no. 3 Point no. and coordinates are:
1 .000 357.000 2 185.400 357.000 3 211.000 369.000 4 270.000 370.000 5 373.000 260.000
6 550.000 260.000 7 600.000 260.000

On boundary line no. 4 Point no. and coordinates are:
1 .000 357.000 2 185.400 357.000 3 211.000 369.000 4 219.533 373.000 5 243.000 384.000
6 315.000 386.000 7 490.989 291.640 8 550.000 260.000 9 600.000 260.000

On boundary line no. 5 Point no. and coordinates are:
1 .000 373.000 2 169.175 373.000 3 219.533 373.000 4 243.000 384.000 5

315.000 386.000
6 550.000 260.000 7 600.000 260.000

Line no. and slope of each segment are:

1	-.089	.000						
2	-.110	.000	.000	.000				
3	.000	.469	.017	-1.068	.000	.000		
4	.000	.469	.469	.469	.028	-.536	-.536	.000
5	.000	.000	.469	.028	-.536	.000		

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1
Line no.= 1 Begin pt. no.= 1 End pt. no.= 3

Soil no.	Cohesion	F. angle	Unit wt.
1	10000.000	45.000	170.000
2	660.000	14.500	76.000
3	600.000	29.500	117.000
4	.000	.000	62.400

Seismic coefficient= .000 Min. depth of tallest slice= 0.000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 1 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

No. of points on water table for each case= 6

Under seepage condition 1point no. and coordinates of water table are:
1 .000 373.000 2 169.175 373.000 3 330.082 340.230 4 490.989 291.640 5 550.000 260.000
6 600.000 260.000

point1=(50.000, 536.000) point2=(50.000, 386.000) point3=(150.000, 386.000) NJ= 3 NI= 2
Automatic search will follow after grid with XINC= 50.000 and YINC= 75.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (50.000, 536.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (50.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (50.000, 436.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (50.000, 386.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 536.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 436.000) under seepage 1,the radius and the corresponding factor of safety are:

118.191 52.382

114.511 12.972

Lowest factor of safety= 12.972 and occurs at radius = 114.511

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 386.000) under seepage 1,the radius and the corresponding factor of safety are:

100.841 310.523

Lowest factor of safety= 310.523 and occurs at radius = 100.841

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 536.000) under seepage 1,the radius and the corresponding factor of safety are:

221.515 3.718
217.614 3.748 213.713 3.790
Lowest factor of safety= 3.718 and occurs at radius = 221.515

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:

187.800 3.633 172.840 3.857
Lowest factor of safety= 3.633 and occurs at radius = 187.800

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 436.000) under seepage 1,the radius and the corresponding factor of safety are:

162.693 17.783 142.754 4.266 122.816 4.633
156.047 12.688 149.401 4.170 136.108 4.330 129.462 4.437
Lowest factor of safety= 4.170 and occurs at radius = 149.401

At point (150.000, 386.000) under seepage 1,the radius and the corresponding factor of safety are:

115.918 34.153 95.335 7.885 74.751 15.641
109.057 26.409 102.196 12.309 88.473 9.482 81.612 12.473
Lowest factor of safety= 7.885 and occurs at radius = 95.335

For piezometric line No. 1

At point (150.000, 486.000) ,RADIUS 187.800
the minimum factor of safety is 3.633

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
187.800 3.633 172.840 3.857
Lowest factor of safety= 3.633 and occurs at radius = 187.800

****WARNING AT NEXT CENTER**** when RADIUS is 219.965
either the OVERTURNING or the RESISTING MOMENT is 0, so a large factor of safety is assigned

At point (200.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
219.965**********
Lowest factor of safety=********** and occurs at radius = 219.965

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 561.000) under seepage 1,the radius and the corresponding factor of safety are:
240.508 3.812
Lowest factor of safety= 3.812 and occurs at radius = 240.508

At point (150.000, 411.000) under seepage 1,the radius and the corresponding factor of safety are:
140.819 25.639 120.256 4.911 99.692 6.406
133.965 18.804 127.110 8.674 113.401 5.250 106.546 5.695
Lowest factor of safety= 4.911 and occurs at radius = 120.256

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (162.500, 486.000) under seepage 1,the radius and the corresponding factor of

safety are:
197.927 3.378 180.942 3.430 163.956 3.525
Lowest factor of safety= 3.378 and occurs at radius = 197.927

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

****WARNING AT NEXT CENTER**** when RADIUS is 208.312
either the OVERTURNING or the RESISTING MOMENT is 0, so a large factor of safety is assigned

At point (175.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
208.312**********
Lowest factor of safety=********** and occurs at radius = 208.312

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (162.500, 504.750) under seepage 1,the radius and the corresponding factor of safety are:
209.199 3.415 193.709 3.452
Lowest factor of safety= 3.415 and occurs at radius = 209.199

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (162.500, 467.250) under seepage 1,the radius and the corresponding factor of safety are:
187.854 9.519 169.134 3.436 150.413 3.568
181.614 3.376 175.374 3.400 162.893 3.458 156.653 3.497
Lowest factor of safety= 3.376 and occurs at radius = 181.614

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (162.500, 448.500) under seepage 1,the radius and the corresponding factor of safety are:
179.183 16.215 158.446 3.497 137.710 3.675
172.271 12.068 165.358 3.469 151.534 3.537 144.622 3.604
Lowest factor of safety= 3.469 and occurs at radius = 165.358

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

****WARNING AT NEXT CENTER**** when RADIUS is 198.766
either the OVERTURNING or the RESISTING MOMENT is 0, so a large factor of safety is assigned

At point (175.000, 467.250) under seepage 1,the radius and the corresponding factor of safety are:
198.766**********
Lowest factor of safety=********** and occurs at radius = 198.766

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 467.250) under seepage 1,the radius and the corresponding factor of safety are:
177.153 3.671 160.572 3.938
Lowest factor of safety= 3.671 and occurs at radius = 177.153

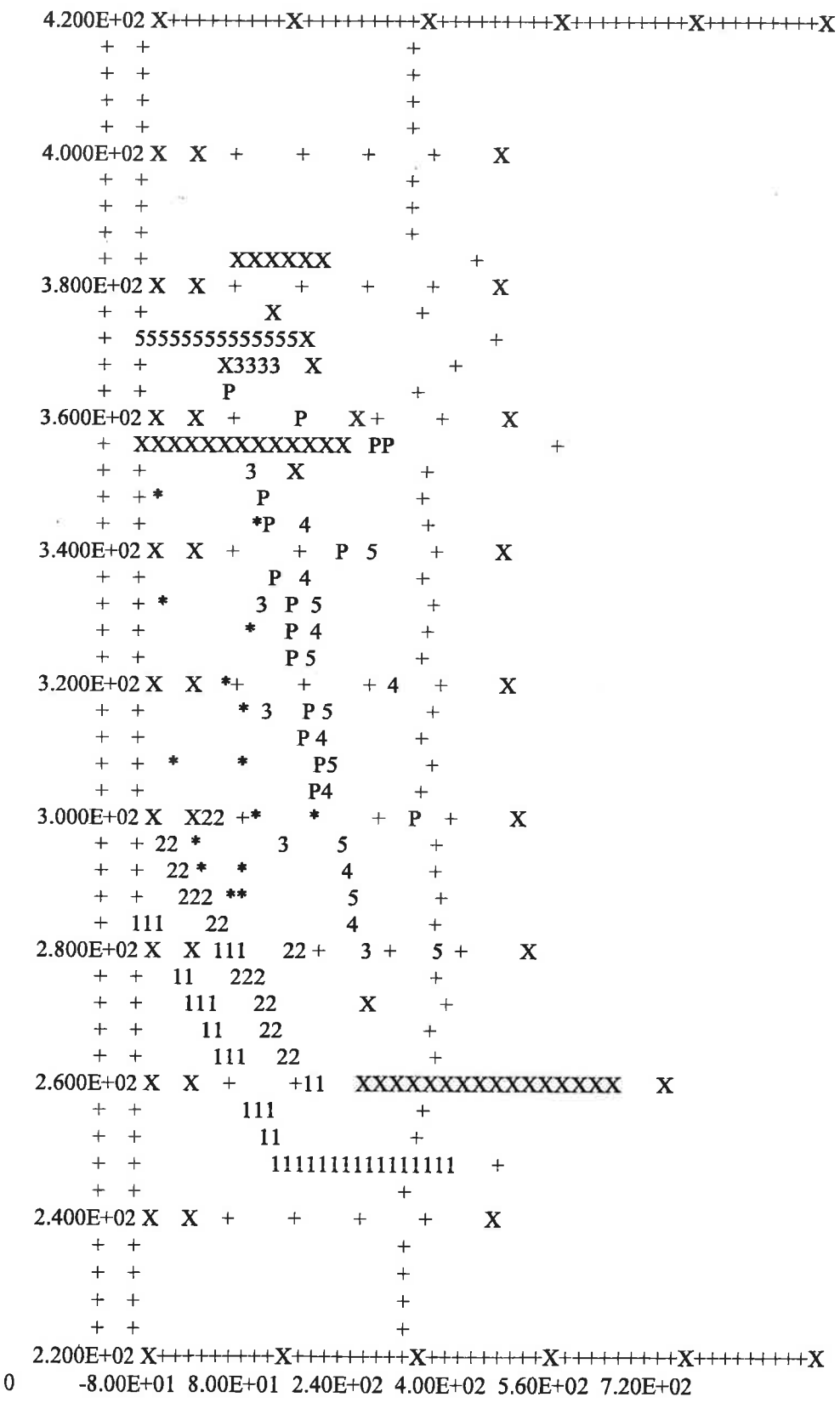
For piezometric line No. 1

At point (162.500, 467.250) ,RADIUS 181.614
the minimum factor of safety is 3.376

1

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.

The minimum factor of safety is 3.376



315.000 386.000
6 550.000 260.000 7 600.000 260.000

Line no. and slope of each segment are:

1	-.089	.000					
2	-.110	.000	.000	.000			
3	.000	.469	.017	-1.068	.000	.000	
4	.000	.469	.469	.469	.028	-.536	-.536	.000
5	.000	.000	.469	.028	-.536	.000		

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1
Line no.= 1 Begin pt. no.= 1 End pt. no.= 3

Soil no.	Cohesion	F. angle	Unit wt.
1	10000.000	45.000	170.000
2	660.000	14.500	76.000
3	600.000	29.500	117.000
4	.000	.000	62.400

Seismic coefficient= .100 Min. depth of tallest slice= 0.000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 1 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

No. of points on water table for each case= 6

Under seepage condition 1point no. and coordinates of water table are:
1 .000 373.000 2 169.175 373.000 3 330.082 340.230 4 490.989 291.640 5 550.000 260.000
6 600.000 260.000

point1=(50.000, 536.000) point2=(50.000, 386.000) point3=(150.000, 386.000) NJ= 3 NI= 2
Automatic search will follow after grid with XINC= 50.000 and YINC= 75.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (50.000, 536.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (50.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (50.000, 436.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (50.000, 386.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 536.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 436.000) under seepage 1,the radius and the corresponding factor of safety are:

118.191 4.717
114.511 3.839

Lowest factor of safety= 3.839 and occurs at radius = 114.511

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 386.000) under seepage 1,the radius and the corresponding factor of safety are:

100.841 16.603 83.273 4.650 65.705 5.014
94.985 4.617 89.129 4.545 77.417 4.783 71.561 4.937

Lowest factor of safety= 4.545 and occurs at radius = 89.129

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 536.000) under seepage 1,the radius and the corresponding factor of safety are:

221.515 2.004
217.614 2.054 213.713 2.115
Lowest factor of safety= 2.004 and occurs at radius = 221.515

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:

187.800 1.890 172.840 2.070
Lowest factor of safety= 1.890 and occurs at radius = 187.800

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 436.000) under seepage 1,the radius and the corresponding factor of safety are:

162.693 8.466 142.754 2.133 122.816 2.410
156.047 6.355 149.401 2.068 136.108 2.198 129.462 2.284
Lowest factor of safety= 2.068 and occurs at radius = 149.401

At point (150.000, 386.000) under seepage 1,the radius and the corresponding factor of safety are:

115.918 13.356 95.335 3.224 74.751 4.530
109.057 11.100 102.196 5.299 88.473 3.548 81.612 4.049
Lowest factor of safety= 3.224 and occurs at radius = 95.335

For piezometric line No. 1

At point (150.000, 486.000) ,RADIUS 187.800
the minimum factor of safety is 1.890

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
187.800 1.890 172.840 2.070
Lowest factor of safety= 1.890 and occurs at radius = 187.800

****WARNING AT NEXT CENTER**** when RADIUS is 198.110
either the OVERTURNING or the RESISTING MOMENT is 0, so a large factor of safety is assigned

At point (200.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:
219.965 37.852 198.110**********
Lowest factor of safety= 37.852 and occurs at radius = 219.965

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (100.000, 486.000) under seepage 1 The depth of tallest slice is less than DMIN

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (150.000, 561.000) under seepage 1,the radius and the corresponding factor of safety are:
240.508 2.090
Lowest factor of safety= 2.090 and occurs at radius = 240.508

At point (150.000, 411.000) under seepage 1,the radius and the corresponding factor of safety are:
140.819 10.865 120.256 2.393 99.692 2.958
133.965 8.709 127.110 4.260 113.401 2.533 106.546 2.703
Lowest factor of safety= 2.393 and occurs at radius = 120.256

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (162.500, 486.000) under seepage 1,the radius and the corresponding factor of safety are:

197.927 1.777 180.942 1.890 163.956 2.063

Lowest factor of safety= 1.777 and occurs at radius = 197.927

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (175.000, 486.000) under seepage 1,the radius and the corresponding factor of safety are:

208.312 232.194

Lowest factor of safety= 232.194 and occurs at radius = 208.312

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (162.500, 504.750) under seepage 1,the radius and the corresponding factor of safety are:

209.199 1.801 193.709 1.922

Lowest factor of safety= 1.801 and occurs at radius = 209.199

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (162.500, 467.250) under seepage 1,the radius and the corresponding factor of safety are:

187.854 5.085 169.134 1.875 150.413 2.047

181.614 1.797 175.374 1.833 162.893 1.916 156.653 1.971

Lowest factor of safety= 1.797 and occurs at radius = 181.614

For piezometric line No. 1

At point (162.500, 486.000) ,RADIUS 197.927

the minimum factor of safety is 1.777

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.

The minimum factor of safety is 1.777