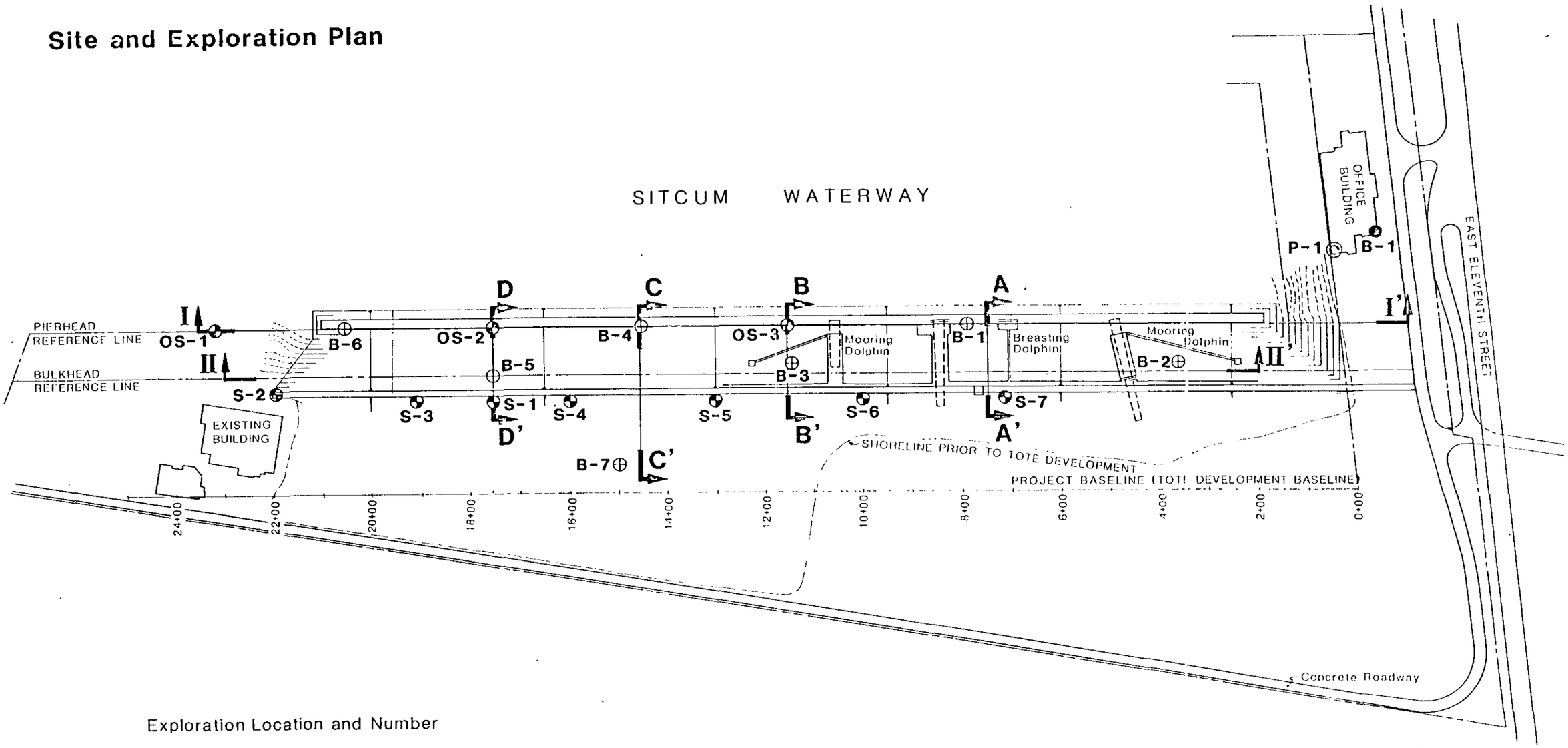
SOILS AND FOUNDATION ENGINEERING STUDY
PROPOSED PORT OF TACOMA TERMINAL DEVELOPMENT
SITCUM WATERWAY
TACOMA, WASHINGTON

APRIL 4, 1978

J-581

HART-CROWSER & ASSOCIATES, INC.
705 N.E. NORTHLAKE WAY
SEATTLE, WASHINGTON 98105

Site and Exploration Plan



Exploration Location and Number

- OS-1 Offshore Boring (J-1042-02, 1982 Study)
- S-1 Land Boring (J-1042-02, 1982 Study)
- B-1 Boring (J-581, April, 1978 Study)
- B-1 Boring (J-995, Port of Tacoma Office Building, 1981 Study)
- P-1 Dutch Cone Probe (J-995, Port of Tacoma Office Building, 1981 Study)

I — I' Profile/Cross Section Location and Designation

PROJECT NORTH

0 200 400
Scale in Feet

J-1042-02 October 1982
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Figure 1

APPENDIX A
FIELD EXPLORATIONS

Borings

Seven offshore borings, denoted B-1 through B-7, were drilled from January 24 to February 11, 1978. The borings were accomplished by a barge-mounted, hollow-stem auger mobile B-40 drill provided by Consolidated Drilling, Inc., under subcontract to our firm. The borings were drilled to depths ranging from 51.5 to 91.0 feet below the mud line elevation. The borings were observed by Mr. Scott Wright, engineering geologist from our firm. In the field, detailed logs of each boring were prepared and representative samples were obtained of each soil type encountered.

Disturbed or relatively undisturbed samples were generally obtained at 2.5 or 5-foot depth intervals. The disturbed samples were obtained using the Standard Penetration Test procedure in which a standard split-spoon sampler is driven into the soil a distance of 18 inches using a 140-pound hammer, free-falling 30 inches. The number of blows required to drive the sampler the last 12 inches is the Standard Penetration Resistance. This resistance, or blow count, provides a measure of the relative density of granular soils and consistency of cohesive soils.

The undisturbed samples were obtained using a three inch outside diameter, seamless-steel Shelby tube that was pushed into the soil using the hydraulic system on the drill rig. Since the samples are not driven, but pushed, they are relatively undisturbed and, hence, suitable for strength, consolidation, or density testing in the laboratory.

The soil samples obtained from the split-spoon sampler were classified in the field and representative portions saved in

air-tight jars. The soil samples contained in the Shelby tubes were field classified by examining the ends of the samples and then sealed for transport to our Seattle laboratory.

The logs of the exploratory borings are presented in Figures A-1 through A-7. The logs are based on our interpretation of the field and laboratory data, and indicate the various types of soils encountered in the borings. They also indicate the depths where these soils, or characteristics of these soils, changed, although the change may be gradual. If the change occurs between samples, it is interpreted. To the left of the classification of materials the number, depth, and types of samples that were taken during the drilling operation are shown. The semi-logarithmic graphical plot on the left presents both the Standard Penetration Resistance values that were obtained during the taking of the split-spoon samples, and the results of laboratory determined moisture contents.

Test Pits

Shallow field explorations were advanced in the area of the proposed parking facilities and the contemplated borrow area using a tractor-mounted backhoe under subcontract to our firm. The explorations were located in the field and continuously observed by Mr. Scott Wright from our firm. In the test pits, disturbed samples of the soils encountered were taken as necessary, classified in the field and transported in air-tight containers to our laboratory for check classification and testing.

Eleven test pits were advanced within the proposed parking areas adjacent to the Sitcum Waterway. The logs of the test pits are presented in Figures A-8 through A-11. The location of the explorations in the proposed borrow area are indicated on the site

plan for that area presented as Figure A-12. Eight test pits were excavated within the proposed borrow area. The logs of these test pits, designated TP-12 through TP-19, are presented as Figures A-13 through A-15. The test pit logs are based on our current interpretation of the field data and indicate the various types of soils encountered in the test pits and the depth where these soils or characteristics of these soils changed, although the change may be gradual. To the left of the classification of materials, the number and depth of samples that were taken during the sampling operations, and laboratory determined moisture contents are shown.

APPENDIX B
LABORATORY TESTS

A laboratory testing program was developed to establish the basic index and engineering properties of the site soils. Laboratory tests were performed on disburbed and undisturbed samples obtained from the seven borings and nineteen test pits accomplished for this study. The laboratory testing procedures are outlined below.

Visual Classification

Soil samples recovered in the borings and test pits were transported to the laboratory where detailed classification was accomplished. The Unified Soil Classification System was utilized as the basis for visual examination and for classification of selected samples for which specific laboratory tests were performed. The Unified Soil Classification System is presented as Figure B-1. Visual classification included consistency or density, color, moisture content, major soil type and the modifying fractions in the sample. Classification was then made, subject to modification after additional testing, such as moisture content and Atterberg limits, had been accomplished, as deemed necessary. The visual classification of samples is incorporated into our soil descriptions in the exploration logs in Appendix A.

Moisture Content

Moisture contents were performed on selected samples in general accordance with ASTM D-2216-71 as soon as possible following their arrival in our Seattle laboratory. The natural water content was determined for the purpose of: (1) Identification and correlation of the soils and (2) Providing basic engineering

properties. The water contents are presented on the boring and test pit logs and where applicable on figures presenting various other test results.

Atterberg Limits

Atterberg limit determinations were accomplished for selected samples of the silts and clayey silts. The liquid limit was determined in general accordance with ASTM D-423-66 and the plastic limit was determined in general accordance with ASTM D-424-54. The results of the Atterberg limit analyses and the plasticity characteristics are summarized on the Plasticity Chart, Figure B-1, which relates the plasticity index (liquid limit minus the plastic limit) to the liquid limit. The results of the Atterberg limit tests are also shown where applicable on figures presenting various other test results.

Grain Size Analyses

Grain size analyses were performed on selected samples in general accordance with ASTM D-422-63 using mechanical analyses and hydrometer analyses. The results of the grain size analyses are presented in Figures B-2 through B-8.

Direct Shear Tests

Direct shear tests were performed in general accordance with ASTM D-3080-72. Sample B-3, S-4 represented clayey silt obtained from a relatively undisturbed Shelby tube sample. Direct shear tests were also performed on samples representing the sand bearing stratum. These samples were combined and poured loosely into a direct shear box ring having an inside diameter equal to 2.50 inches. On each sample, the top and bottom surfaces were fit with perforated metal plates overlain by porous

stones. After applying the normal force, the specimen was saturated and allowed to drain. The specimen was then failed using a loading device at a controlled strain-rate of 0.0048 inches per minute. The results of the direct shear tests are presented graphically on Figures B-9 through B-15 as shear stress versus normal stress.

Triaxial Compression Test

Samples for triaxial testing were selected from relatively homogeneous portions of undisturbed Shelby tube specimens. A section six to seven inches in length was isolated, trimmed flat on both ends, enclosed in a rubber membrane and fit with a porous stone on the top and bottom of the sample. Vacuum was applied to the sample removing excess air from the top and bottom porous stones and from the space between the sample and membrane. The vacuum was removed and a confining pressure was applied to the cell fluid. The type of test performed was the unconsolidated-undrained test in which the sample was loaded shortly after application of the confining pressure such that complete consolidation did not occur and the lines to the sample were closed to prevent pore pressure dissipation during loading. The test was performed at an axial compression rate of approximately 0.026 inches per minute with the test continuing until a strain of 20 percent, or failure, had been achieved. Measurements included time, axial load (to determine deviator stress), and sample deformation (to determine strain). The triaxial compression test results including stress-strain curves and the Mohr strength envelopes are presented on Figures B-16 and B-17.

Consolidation Tests

A one-dimensional consolidation test was performed on a selected

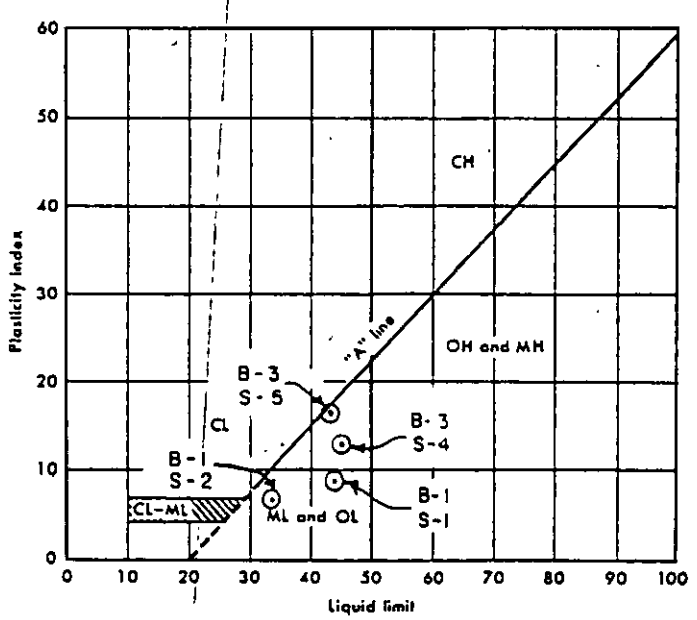
sample of clayey silt to provide data for making settlement magnitude and time rate of settlement calculations. The undisturbed sample was carefully trimmed and fit into a rigid ring with porous stones placed on the top and bottom of the sample to allow drainage. Vertical loads were then applied in increments with each load being allowed to consolidate prior to adding the following increment. Measurements of the time compression were obtained during each load increment and rebound was measured during the unloading portion. Consolidation test results, plotted in terms of percent consolidation (strain) versus applied load (stress), are presented on Figure B-18.

CBR Tests

Laboratory CBR (California Bearing Ratio) tests were performed in general accordance with ASTM D-1883-73 on recompacted samples of the hydraulic sand fill located on the site and from the proposed borrow area. The results, presented as dry density versus moisture content on compacted and soaked samples and CBR versus moisture content are presented in Figure B-19.

UNIFIED SOIL CLASSIFICATION SYSTEM

Major divisions			Group symbols	Typical names	Laboratory classification criteria	
Coarse-grained soils (More than half of material is larger than No. 200 sieve size) 0.08 mm	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent ..... GW, GP, SW, SP; More than 12 per cent ..... GM, GC, SM, SC; 5 to 12 per cent ..... Borderline cases requiring dual symbols**	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM* d	Silty gravels, gravel-sand-silt mixtures	Atterburg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			GM* u			
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterburg limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM* d	Silty sands, sand-silt mixtures	Atterburg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
			SM* u			
			SC	Clayey sands, sand-clay mixtures	Atterburg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half of material is smaller than No. 200 sieve) 0.08 mm	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt	Peat and other highly organic soils		



Plasticity Chart

*Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterburg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

**Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

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March 1978

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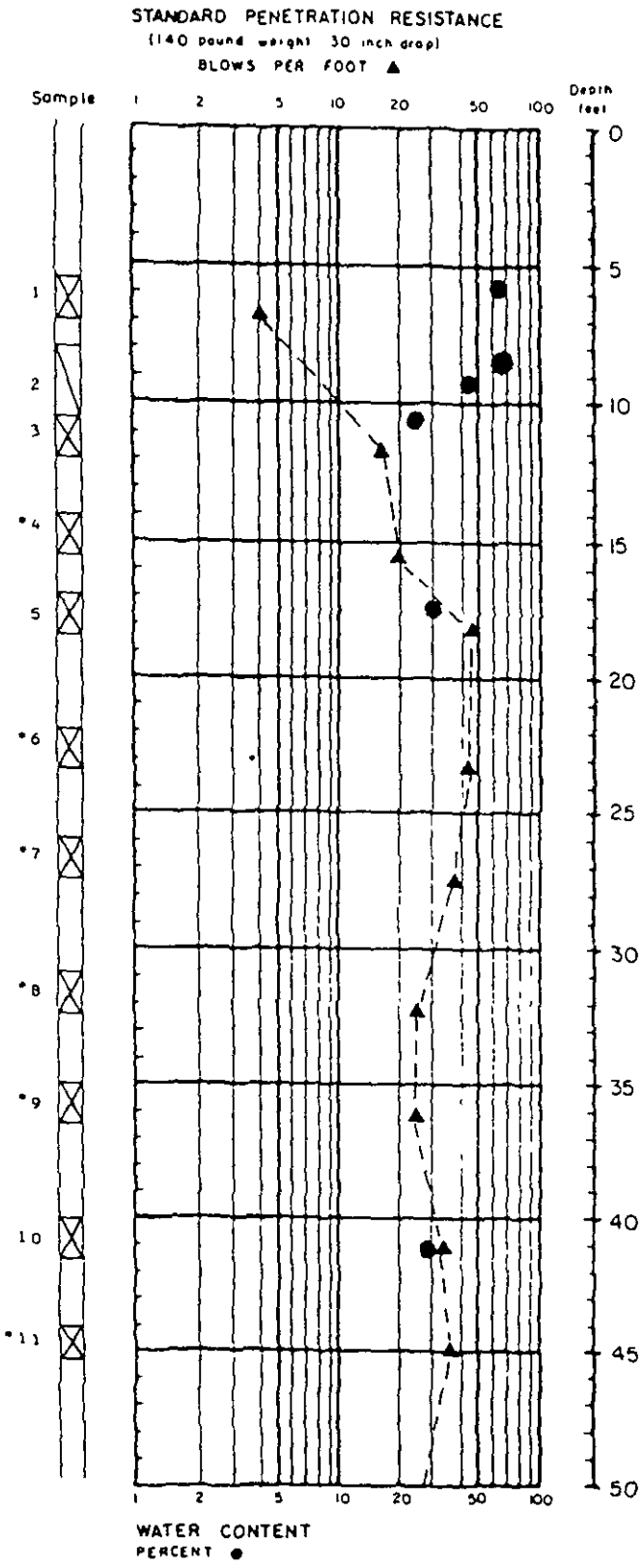
Figure B-1

BORING LOG B-1



SOIL INTERPRETATION

MUDLINE ELEVATION APPROXIMATELY -34 FEET

SOFT, SATURATED, BLACK, ORGANIC RICH CLAYEY SILT WITH SCATTERED WOOD FRAGMENTS

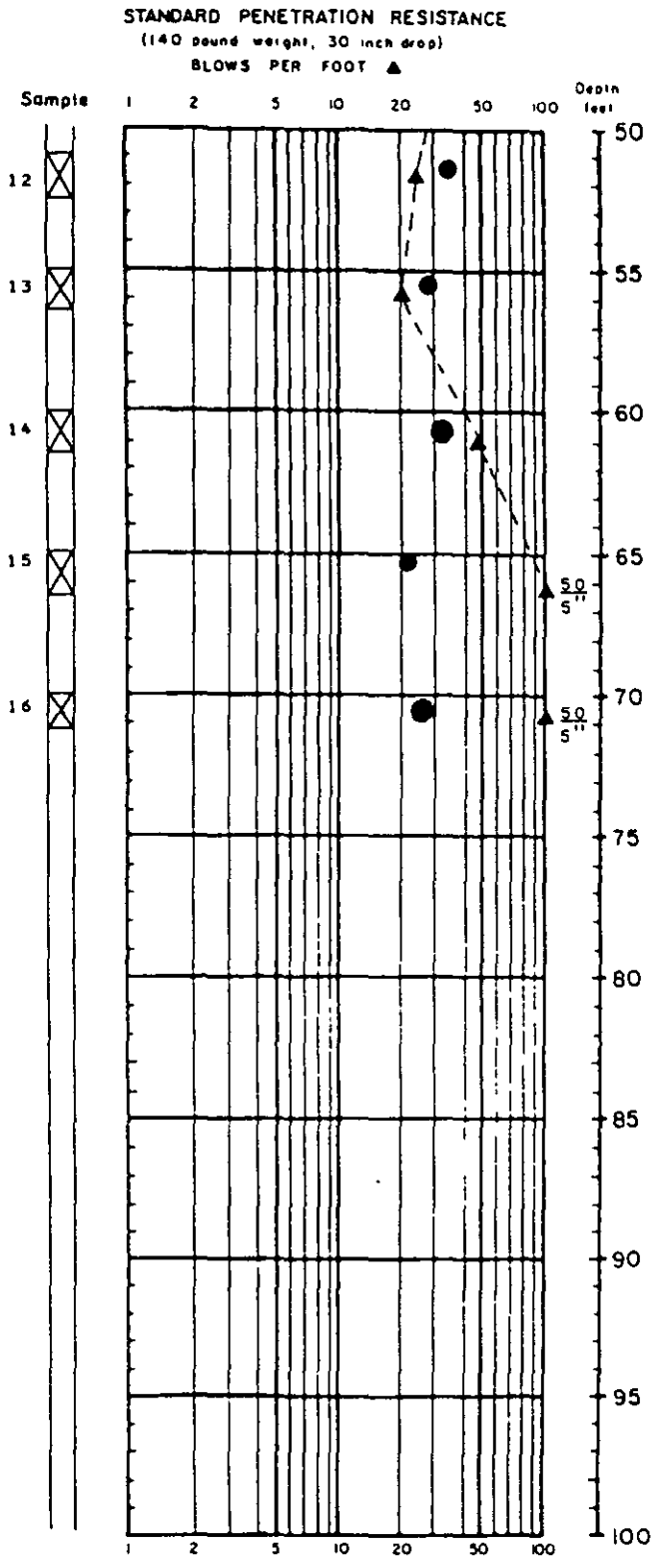
MEDIUM DENSE TO DENSE, SATURATED, GRAY, FINE TO MEDIUM SAND

MEDIUM DENSE, SATURATED, GRAY, SILTY, FINE SAND WITH OCCASIONAL SCATTERED WOOD FRAGMENTS

LEGEND

- ⊠ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- ★ No Sample Recovery
- ▽ Water Level
- ▯ Observation Well

NOTE Soil descriptions are interpretive and actual changes may be gradual.



SOIL INTERPRETATION

MEDIUM DENSE, SATURATED, GRAY, SILTY, FINE SAND WITH OCCASIONAL SCATTERED WOOD FRAGMENTS

MEDIUM DENSE TO VERY DENSE, SATURATED, GRAY FINE TO MEDIUM SAND

BOTTOM OF BORING 71.0 FEET
COMPLETED 1/24/78

LEGEND

- ⊠ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- ★ No Sample Recovery
- ▽ Water Level
- ▯ Observation Well

NOTE Soil descriptions are interpretive and actual changes may be gradual.

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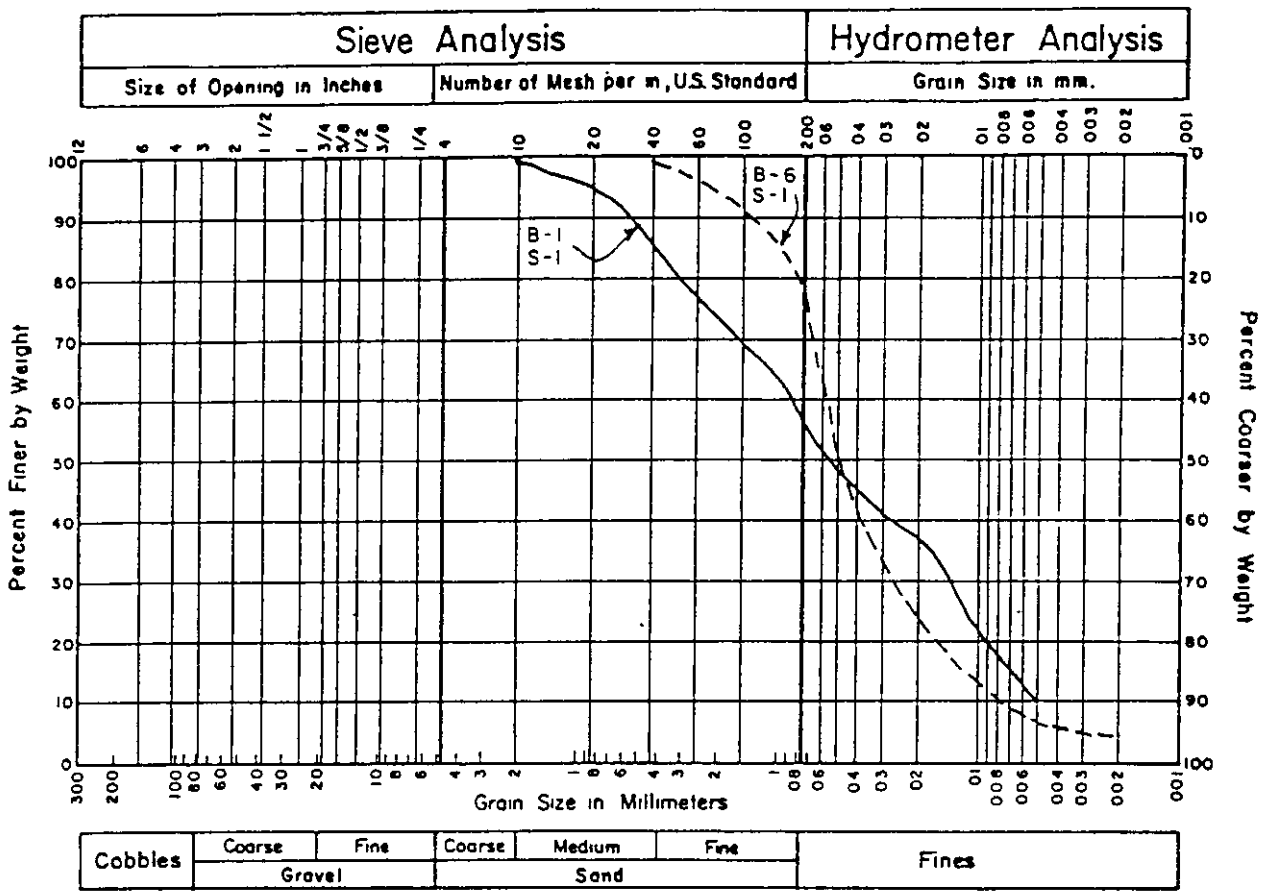
Figure A-1

GRAIN SIZE CLASSIFICATION



Sample	Depth-ft	U.S.C.	Classification	Nat W.C. %	Atterberg Limits LL	PL	PI
B-1 S-1	5.5-7.0	ML	Fine to medium sandy, slightly clayey SILT	63	43	34	9
B-6 S-1	2.0	ML	Fine sandy SILT				

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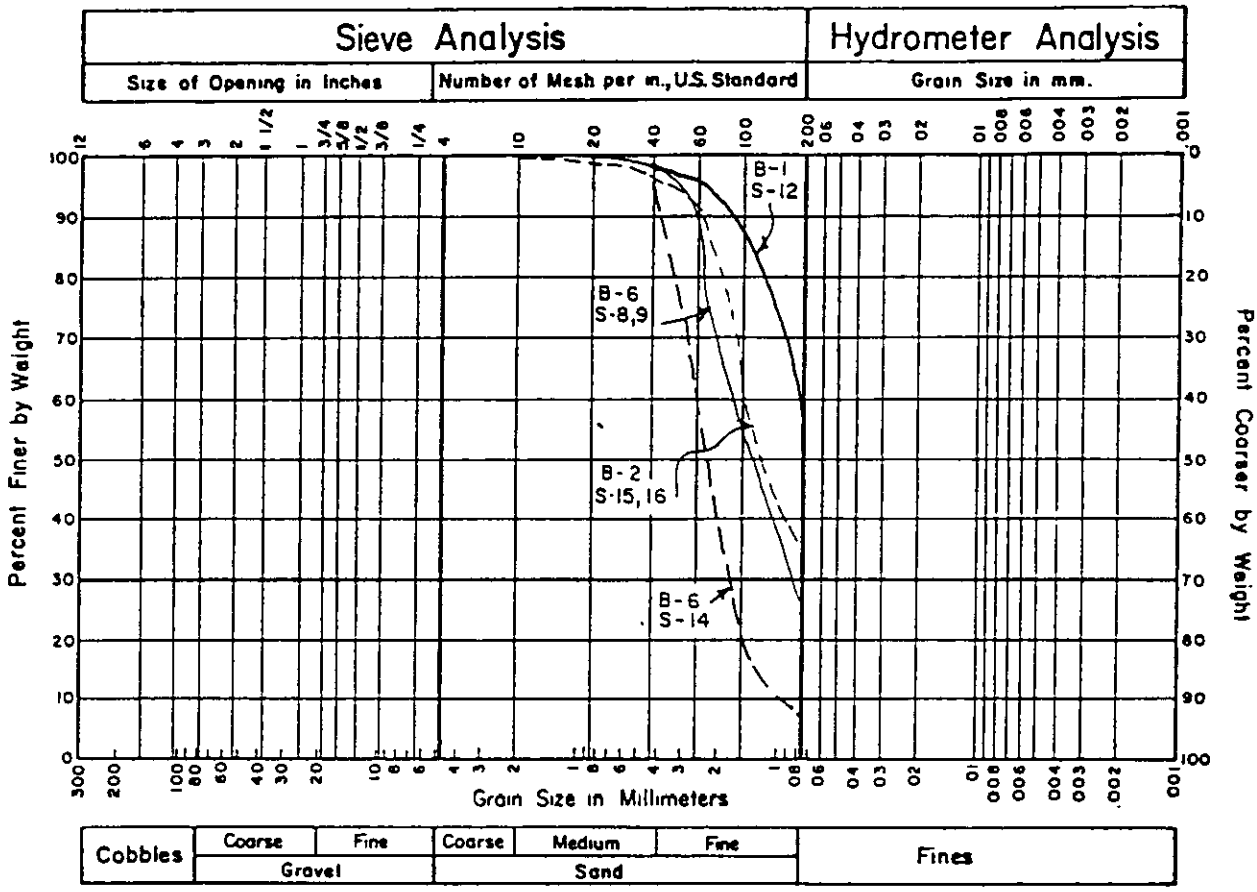
Figure B-2

GRAIN SIZE CLASSIFICATION



Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits LL	PL	PI
B-1 S-12	51-52.5	ML	Fine sandy SILT	34	Non-Plastic		
B-2 S-15, 16	61-62.5 and 66.0-67.5	SM	Silty, fine SAND				
B-6 S-8,9	26-27.5 and 31.5-33	SM	Silty, fine SAND	28	Non-Plastic		
B-6 S-14	57.5-59	SP-SM	Slightly silty, fine SAND		Non-Plastic		

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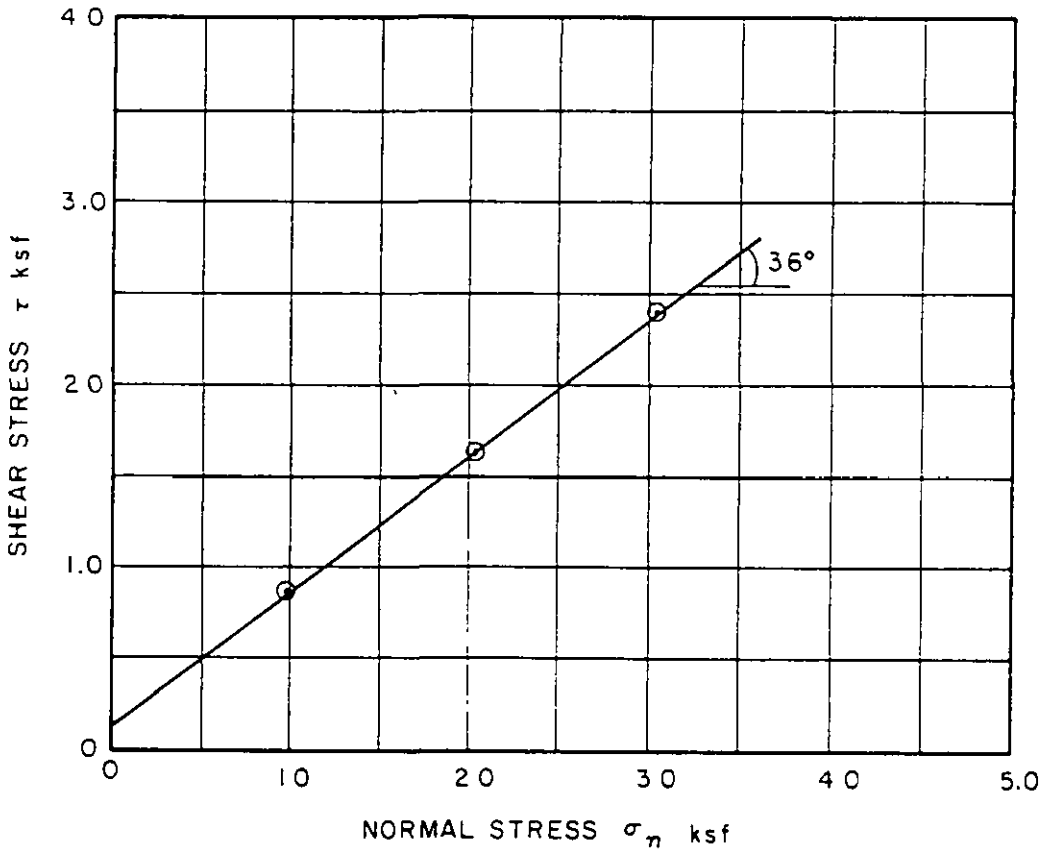
Figure B-5

DIRECT SHEAR TEST RESULTS



TEST NO	SAMPLE	DEPTH FEET	COMPACTION	%WC	ATTERBERG LIMITS LL PL PI	CLASSIFICATION
I	B-1	51.0-52.5	Recompacted	34	Non-Plastic	Fine sandy SILT to silty, fine SAND (ML-SM)
II	S-12					
III						

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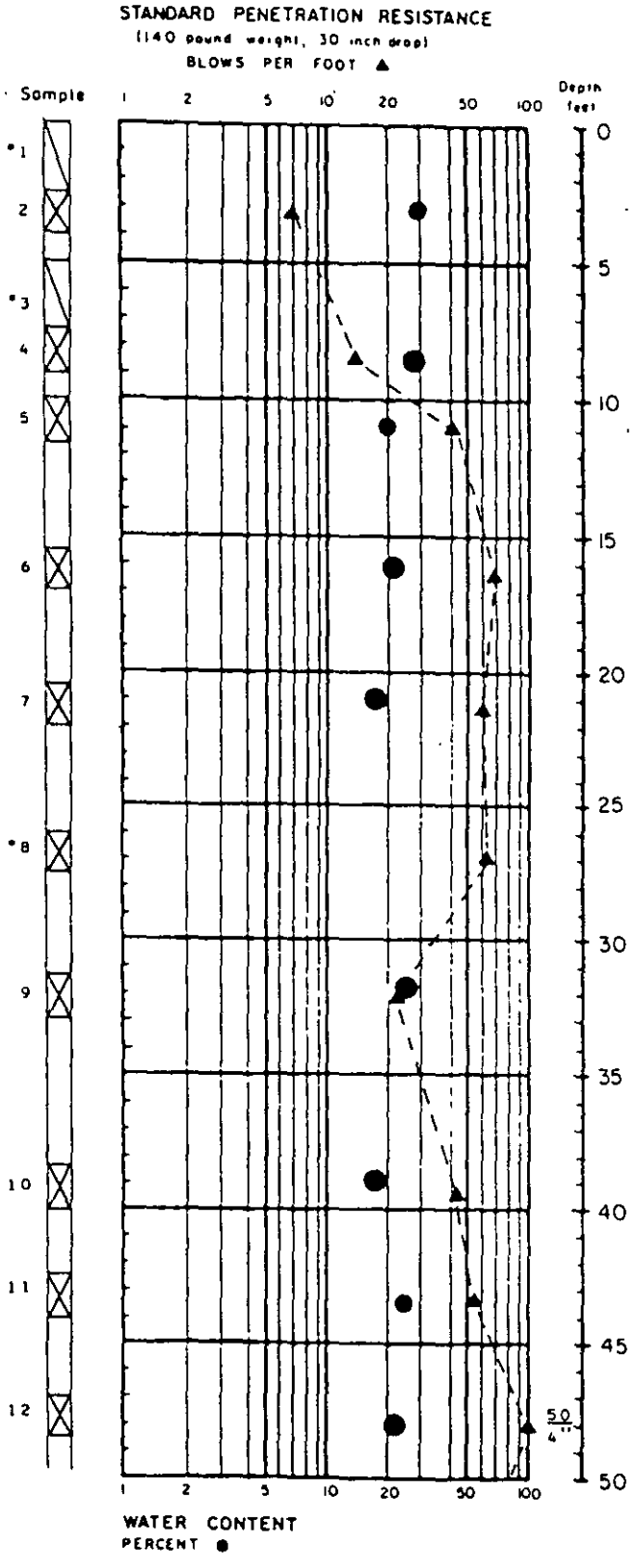
FIG. B-13

BORING LOG B-2



SOIL INTERPRETATION

MUDLINE ELEVATION APPROXIMATELY -20 FEET

LOOSE TO MEDIUM DENSE, SATURATED, GRAY, SILTY FINE AND FINE TO MEDIUM SAND WITH OCCASIONAL WOOD FRAGMENTS

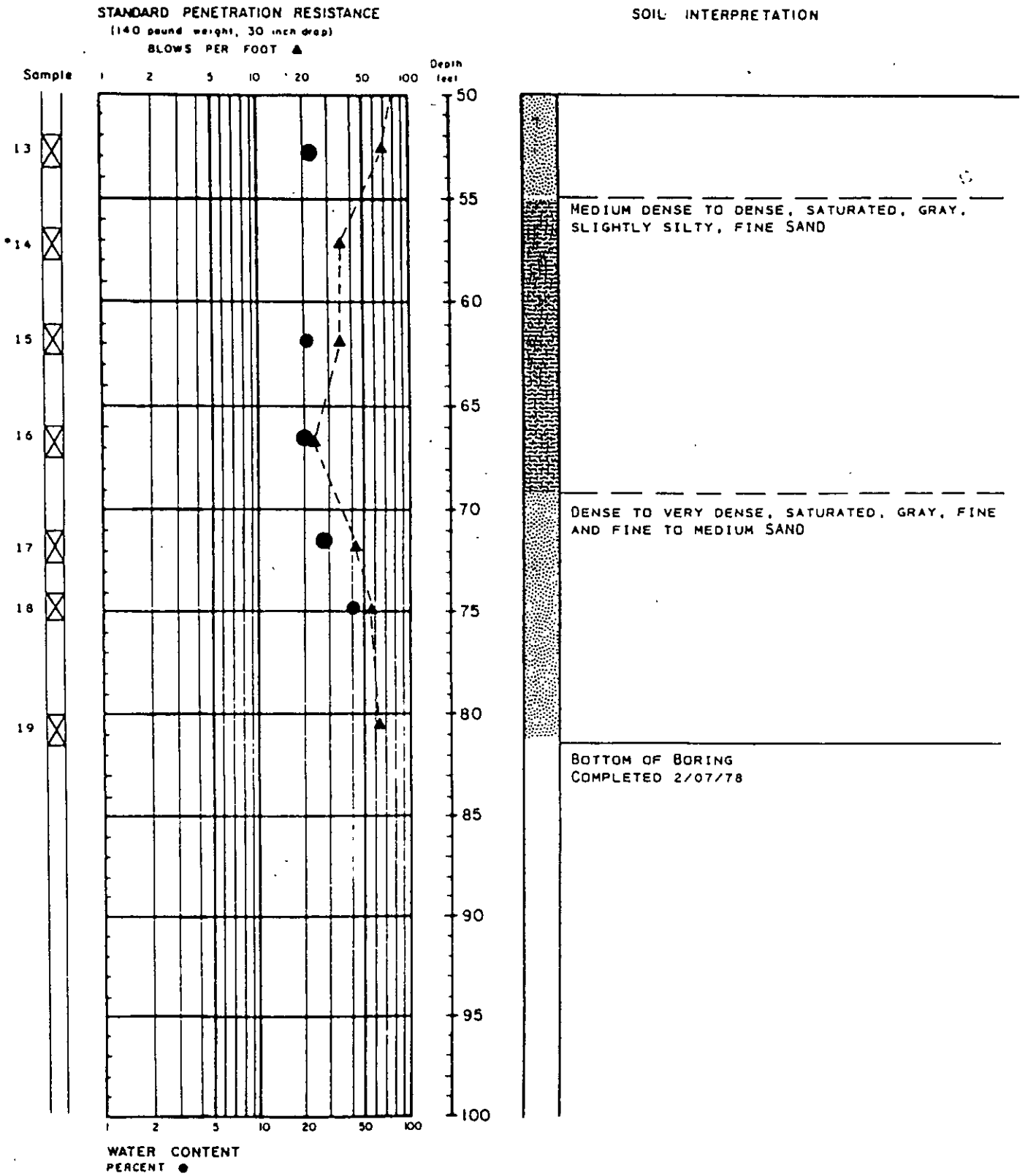
DENSE TO VERY DENSE, SATURATED, GRAY, CLEAN TO SLIGHTLY SILTY, FINE AND FINE TO MEDIUM SAND

(S-9: MEDIUM DENSE, FINE TO COARSE SAND)

LEGEND

- ⊠ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- * No Sample Recovery
- ▽ Water Level
- ▯ Observation Well

NOTE: Soil descriptions are interpretive and actual changes may be gradual



LEGEND

- ⊠ 2" O.D. Split Spoon Sample
- ⧅ 3" O.D. Shelby Sample
- * No Sample Recovery
- ▽ Water Level
- ▯ Observation Well

NOTE: Soil descriptions are interpretive and actual changes may be gradual.

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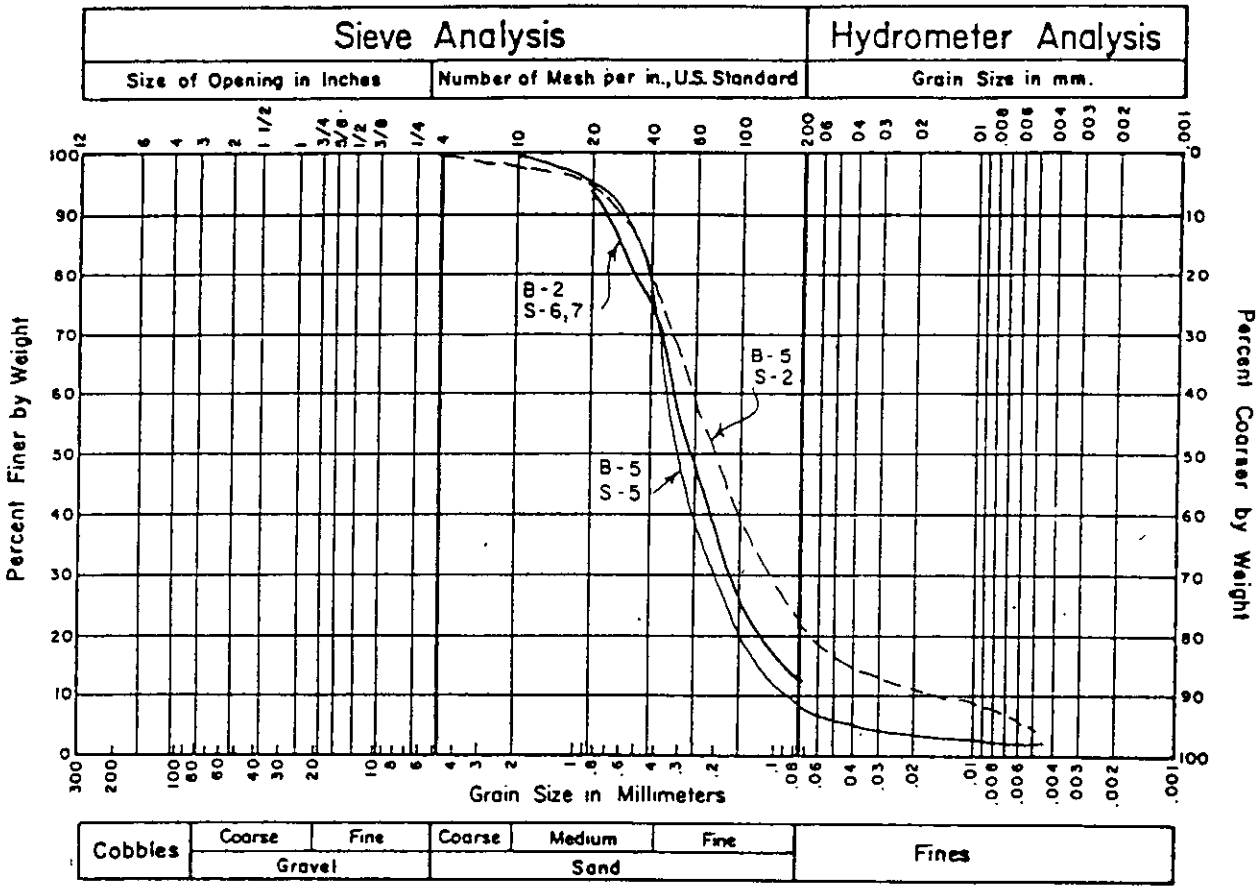
Figure A-2

GRAIN SIZE CLASSIFICATION



Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits LL	PL	PI
B-2 S-6,7	15.5-17.0 and 20.5-22.0	SM	Silty, fine to medium SAND				Non-Plastic
B-5 S-2	2.5-4.0	SM	Silty, fine to medium SAND				
B-5 S-5	10.0-11.5	SP-SM	Slightly silty, fine to medium SAND	28			

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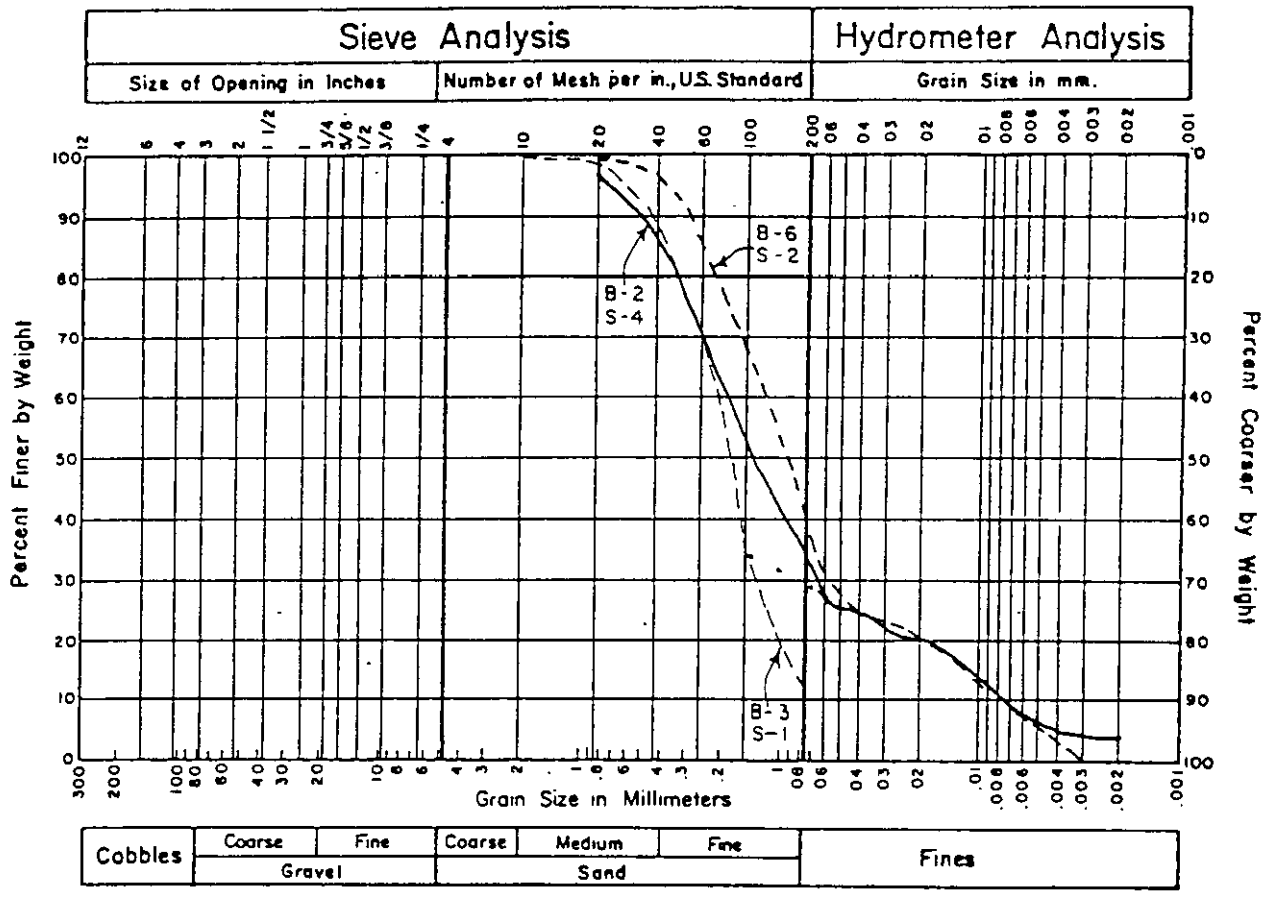
Figure B-4

GRAIN SIZE CLASSIFICATION



Sample	Depth-ft.	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits LL	PL	PI
B-2 S-4	7.5-9	SM	Silty, fine to medium SAND	29	Non-Plastic		
B-3 S-1	1.4-1.9	SM	Silty, fine to medium SAND (Tested after tiaxial Q Test)	22			
B-6 S-2	3.5-5.0	SM	Silty, fine SAND	38			

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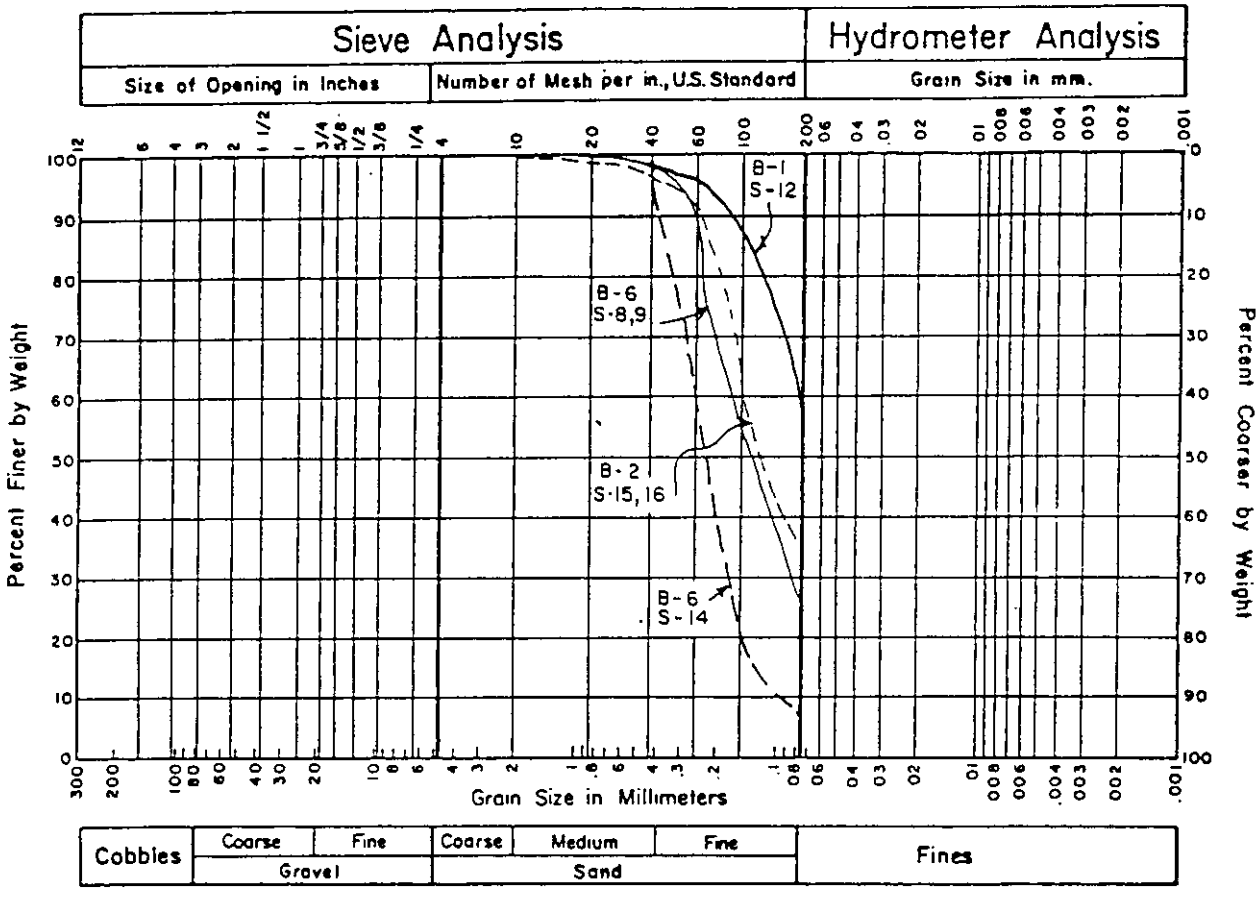
Figure B-3

GRAIN SIZE CLASSIFICATION



Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits LL	PL	PI
B-1 S-12	51-52.5	ML	Fine sandy SILT	34	Non-Plastic		
B-2 S-15, 16	61-62.5 and 66.0-67.5	SM	Silty, fine SAND				
B-6 S-8,9	26-27.5 and 31.5-33	SM	Silty, fine SAND	28	Non-Plastic		
B-6 S-14	57.5-59	SP-SM	Slightly silty, fine SAND		Non-Plastic		

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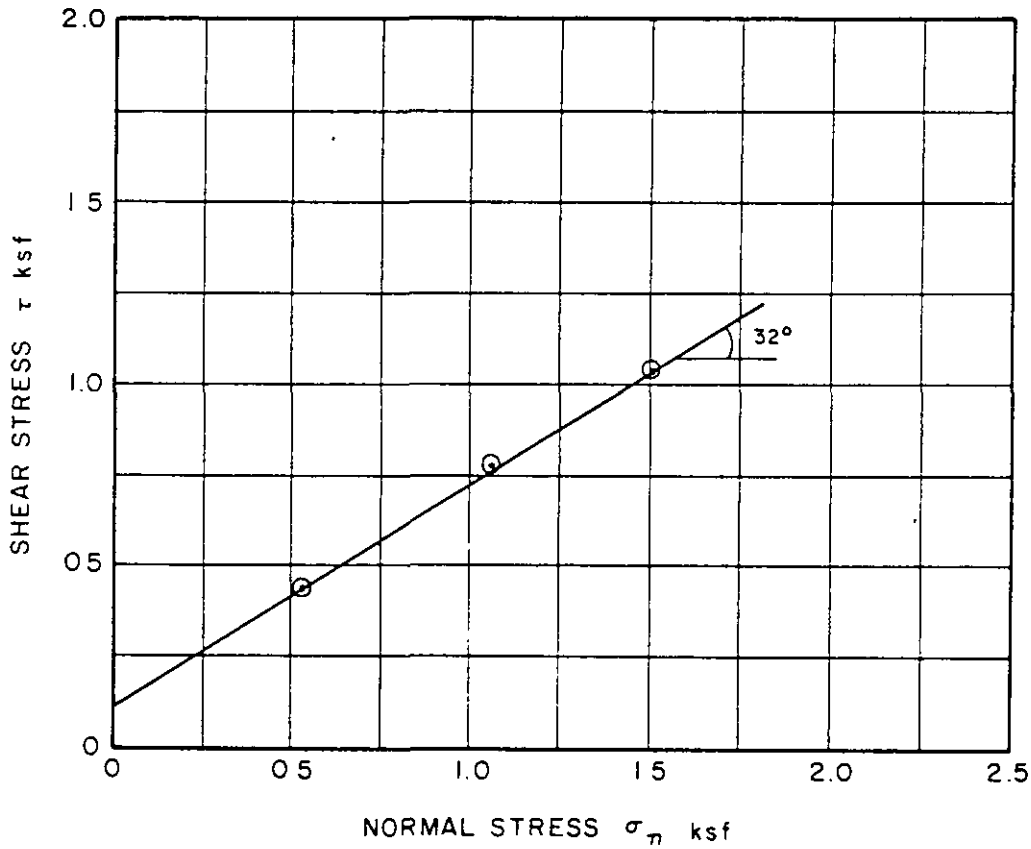
Figure B-5

DIRECT SHEAR TEST RESULTS



TEST NO.	SAMPLE	DEPTH FEET	COMPACTION	%WC	ATTERBERG LIMITS LL PL PI	CLASSIFICATION
I	B-2	7.5-9	Recompacted	29	Non-Plastic	Silty, fine to medium SAND (SM)
II	S-4					
III						

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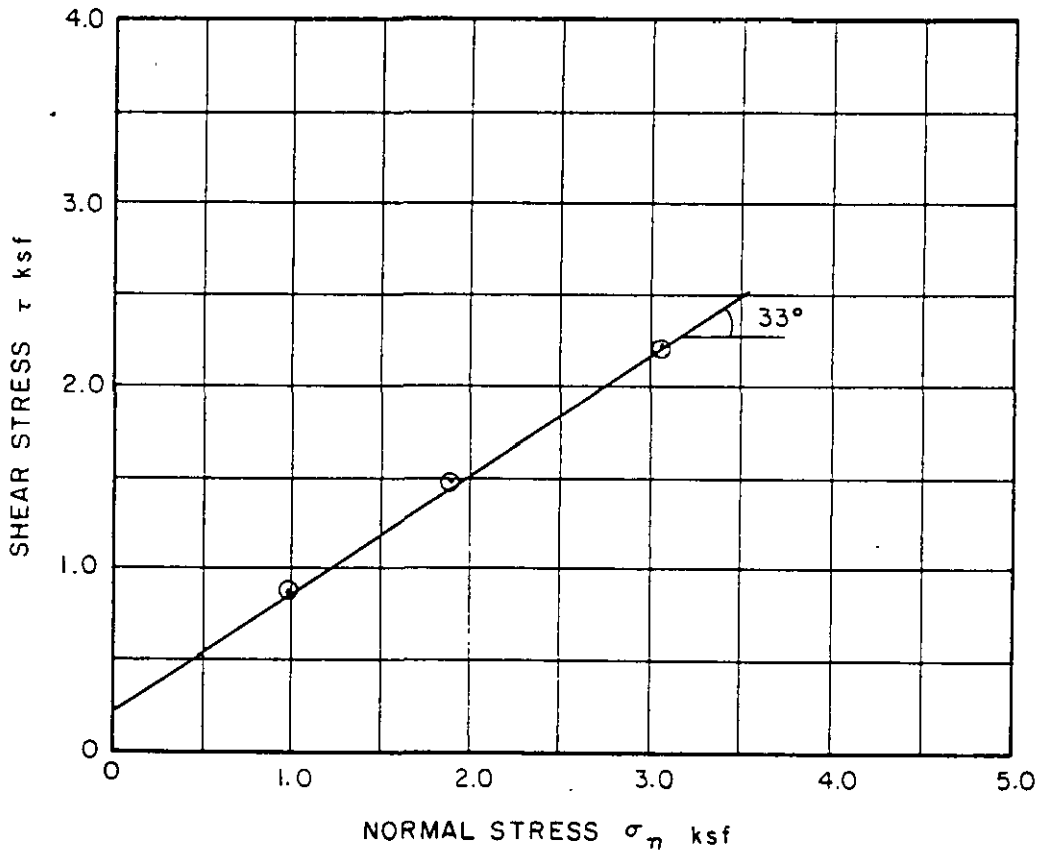
FIG. B-10

DIRECT SHEAR TEST RESULTS



TEST NO	SAMPLE	DEPTH FEET	COMPACTION	%WC	ATTERBERG LIMITS LL PL PI	CLASSIFICATION
I	B-2	15.5-22.0	Recompacted		Non-Plastic	Silty, fine to medium SAND (SM)
II	S-6,7					
III						

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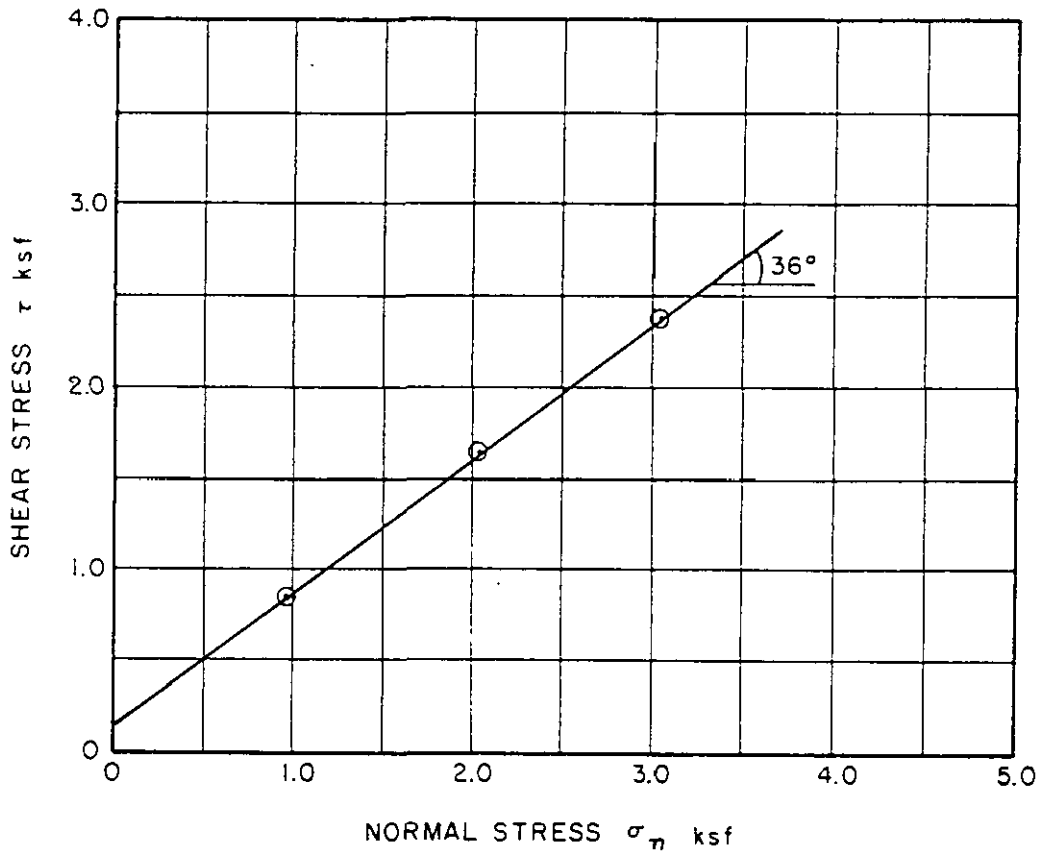
FIG. B-11

DIRECT SHEAR TEST RESULTS



TEST NO.	SAMPLE	DEPTH FEET	COMPACTION	%W.C	ATTERBERG LIMITS LL PL PI	CLASSIFICATION
I						
II	B-2 S-15,16	61.0-67.5	Recompacted		Non-Plastic	Silty, fine SAND (SM)
III						

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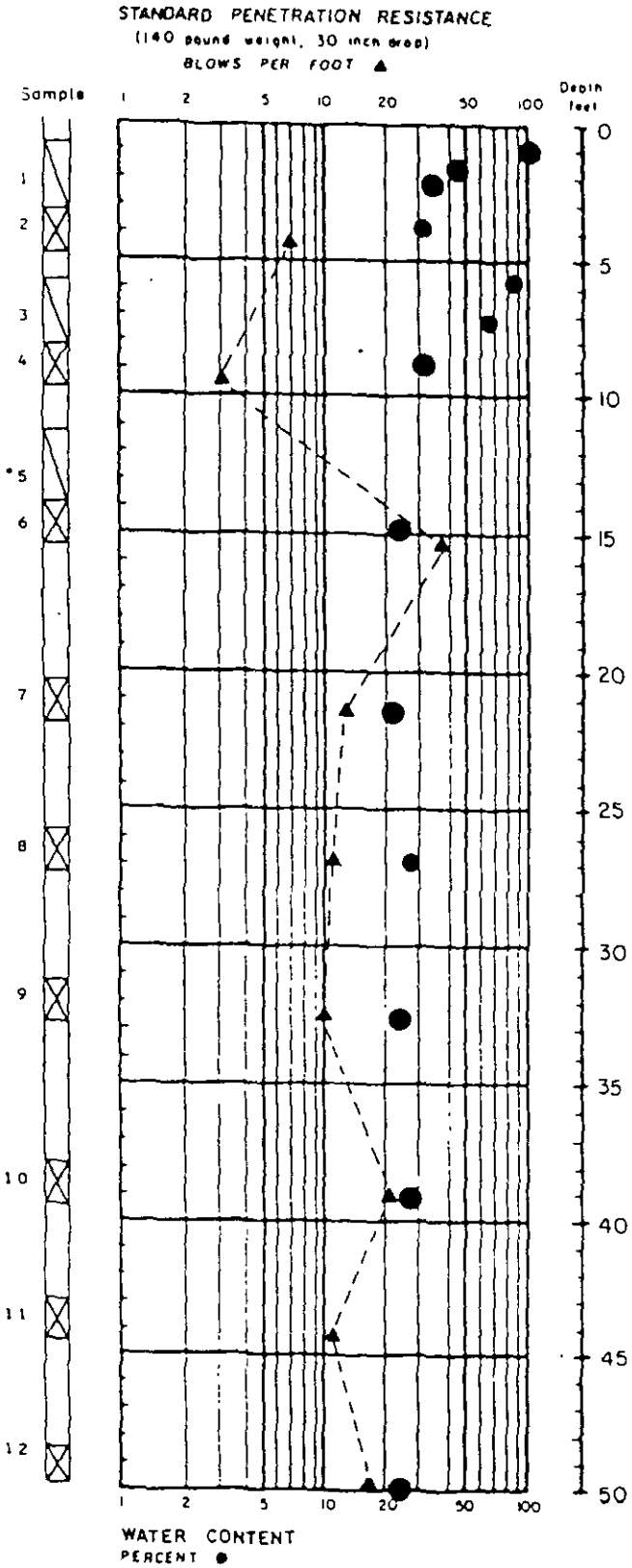
FIG. B-15

BORING LOG B-6



SOIL INTERPRETATION

MUDLINE ELEVATION APPROXIMATELY -31 FEET

SOFT, SATURATED, GRAY, SLIGHTLY CLAYEY, SILTY FINE SAND WITH SCATTERED WOOD FRAGMENTS

LOOSE, SATURATED, DARK GRAY, SILTY, VERY FINE TO FINE SAND

SOFT, BLACK, CLAYEY, SILTY FINE SAND WITH NUMEROUS WOOD FRAGMENTS

MEDIUM DENSE TO DENSE SATURATED, GRAY, VERY FINE TO MEDIUM SAND

MEDIUM DENSE, SATURATED, GRAY, SLIGHTLY SILTY VERY FINE SAND

LEGEND

⊠ 2" O.D. Split Spoon Sample

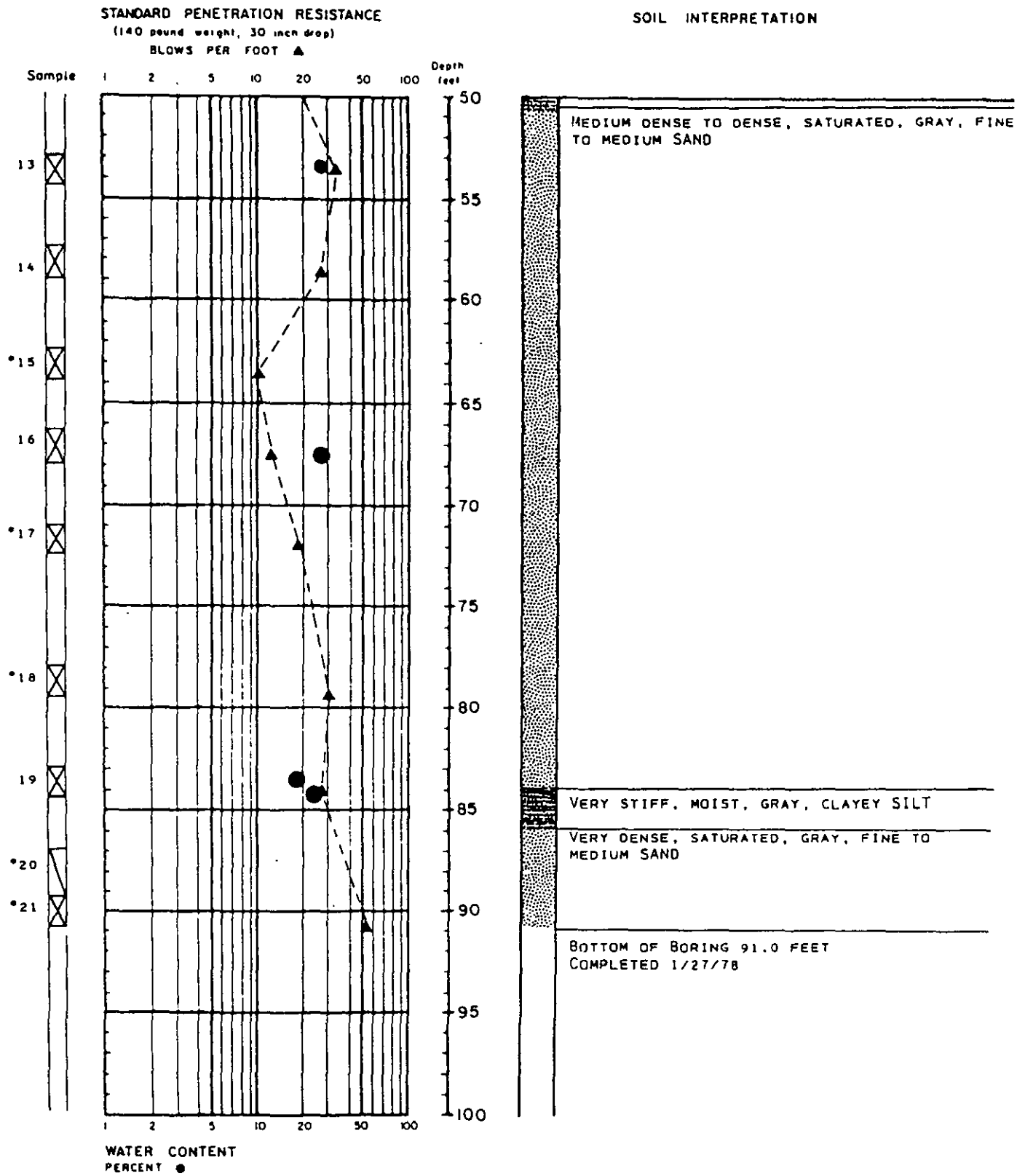
⊠ 3" O.D. Shelby Sample

* No Sample Recovery

Water Level

Observation Well

NOTE Soil descriptions are interpretive and actual changes may be gradual



LEGEND

- ⊠ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- ★ No Sample Recovery
- Water Level
- Observation Well

NOTE: Soil descriptions are interpretive and actual changes may be gradual.

J-581 FEB 1978

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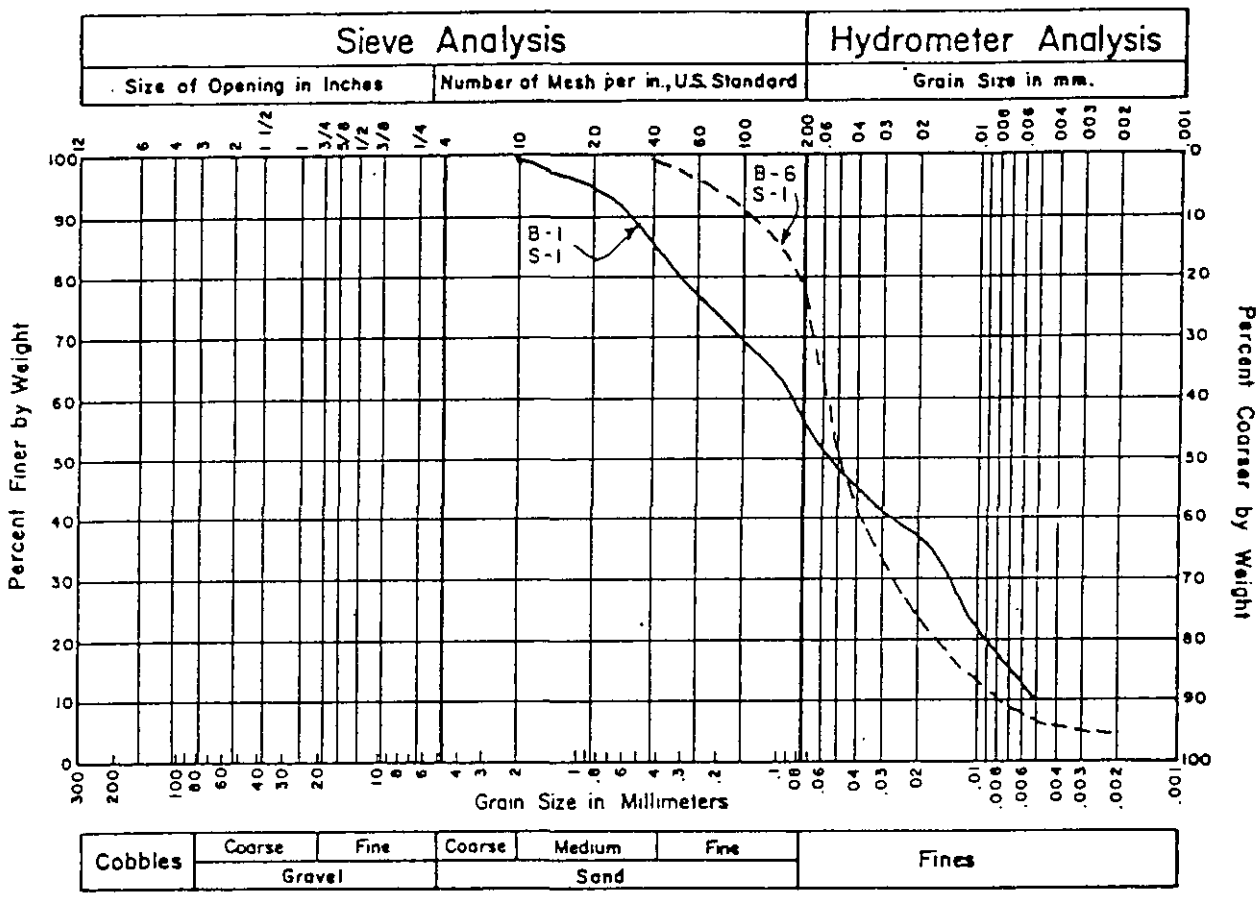
Figure A-6

GRAIN SIZE CLASSIFICATION



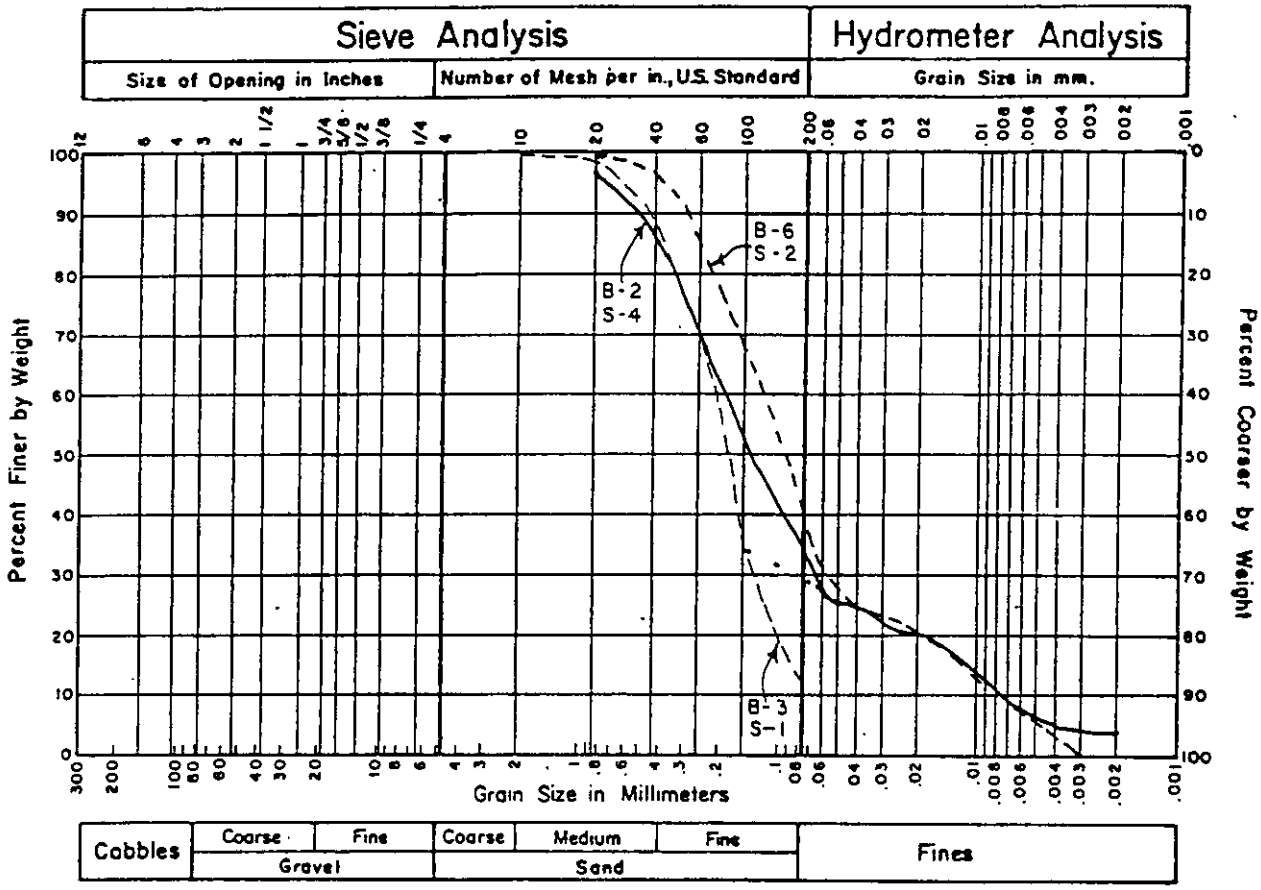
Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits LL	PL	PI
B-1 S-1	5.5-7.0	ML	Fine to medium sandy, slightly clayey SILT	63	43	34	9
B-6 S-1	2.0	ML	Fine sandy SILT				

J-581 March 1978

HART-CROWSER & associates inc.

Figure B-2

GRAIN SIZE CLASSIFICATION



Sample	Depth-ft.	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits LL	PL	PI
B-2 S-4	7.5-9	SM	Silty, fine to medium SAND	29	Non-Plastic		
B-3 S-1	1.4-1.9	SM	Silty, fine to medium SAND (Tested after tiaxial Q Test)	22			
B-6 S-2	3.5-5.0	SM	Silty, fine SAND	38			

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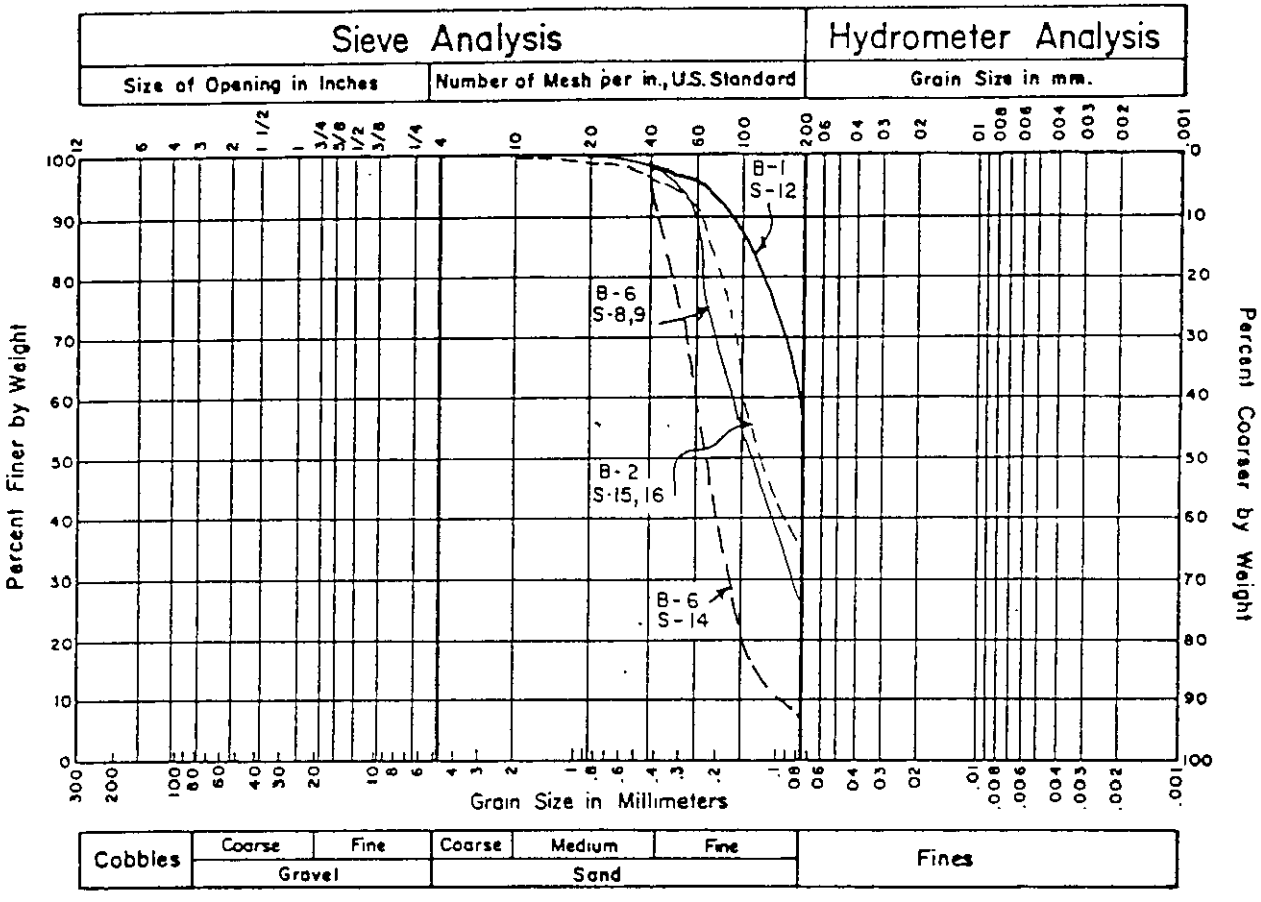
Figure B-3

GRAIN SIZE CLASSIFICATION



Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits LL	PL	PI
B-1 S-12	51-52.5	ML	Fine sandy SILT	34	Non-Plastic		
B-2 S-15, 16	61-62.5 and 66.0-67.5	SM	Silty, fine SAND				
B-6 S-8,9	26-27.5 and 31.5-33	SM	Silty, fine SAND	28	Non-Plastic		
B-6 S-14	57.5-59	SP-SM	Slightly silty, fine SAND		Non-Plastic		

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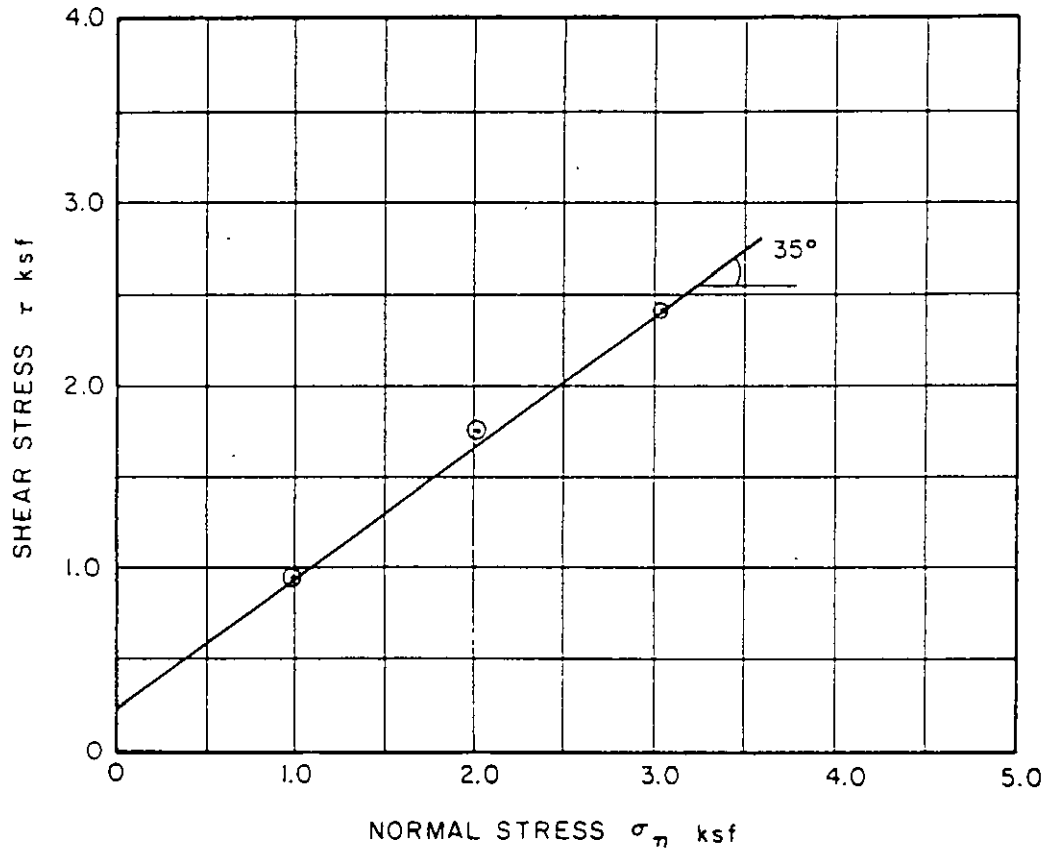
Figure B-5

DIRECT SHEAR TEST RESULTS



TEST NO	SAMPLE	DEPTH FEET	COMPACTION	%WC	ATTERBERG LIMITS LL PL PI	CLASSIFICATION
I	B-6 S08,9	26.0-33.0	Recompacted	28	Non-Plastic	Silty, fine SAND (SM)
II						
III						

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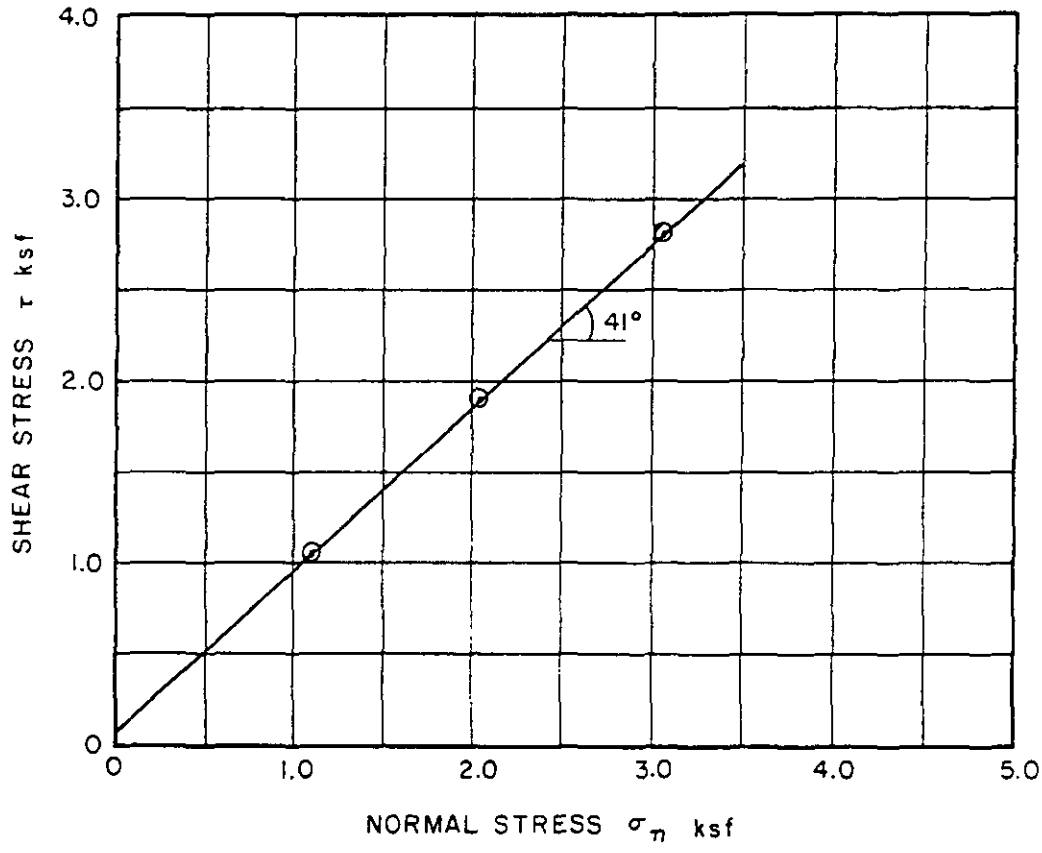
FIG. B-12

DIRECT SHEAR TEST RESULTS



TEST NO.	SAMPLE	DEPTH FEET	COMPACTION	%W.C.	ATTERBERG LIMITS LL PL PI	CLASSIFICATION
I	B-6	57.5-59.0	Recompacted		Non-Plastic	Slightly silty, fine SAND (SP-SM)
II	S-14					
III						

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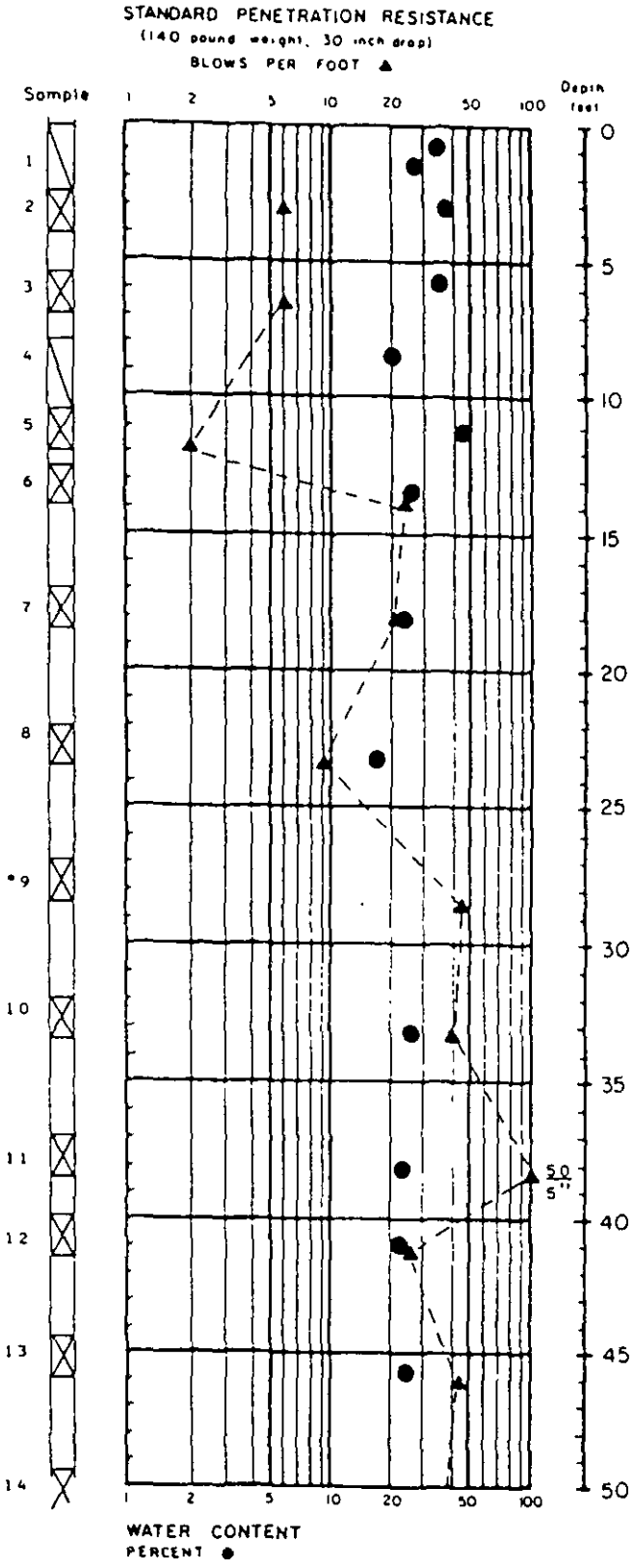
FIG. B-14

BORING LOG B-3



SOIL INTERPRETATION

MUDLINE ELEVATION APPROXIMATELY -12.5 FEET

VERY SOFT, SATURATED, BLACK, SANDY, CLAYEY, ORGANIC SILT WITH NUMEROUS WOOD FRAGMENTS

LOOSE, SATURATED, DARK GRAY, SILTY FINE SAND WITH NUMEROUS WOOD FRAGMENTS

SOFT, SATURATED, GRAY, CLAYEY SILT

MEDIUM DENSE, SATURATED, SILTY, FINE SAND GRADING TO SLIGHTLY SILTY, FINE TO MEDIUM SAND

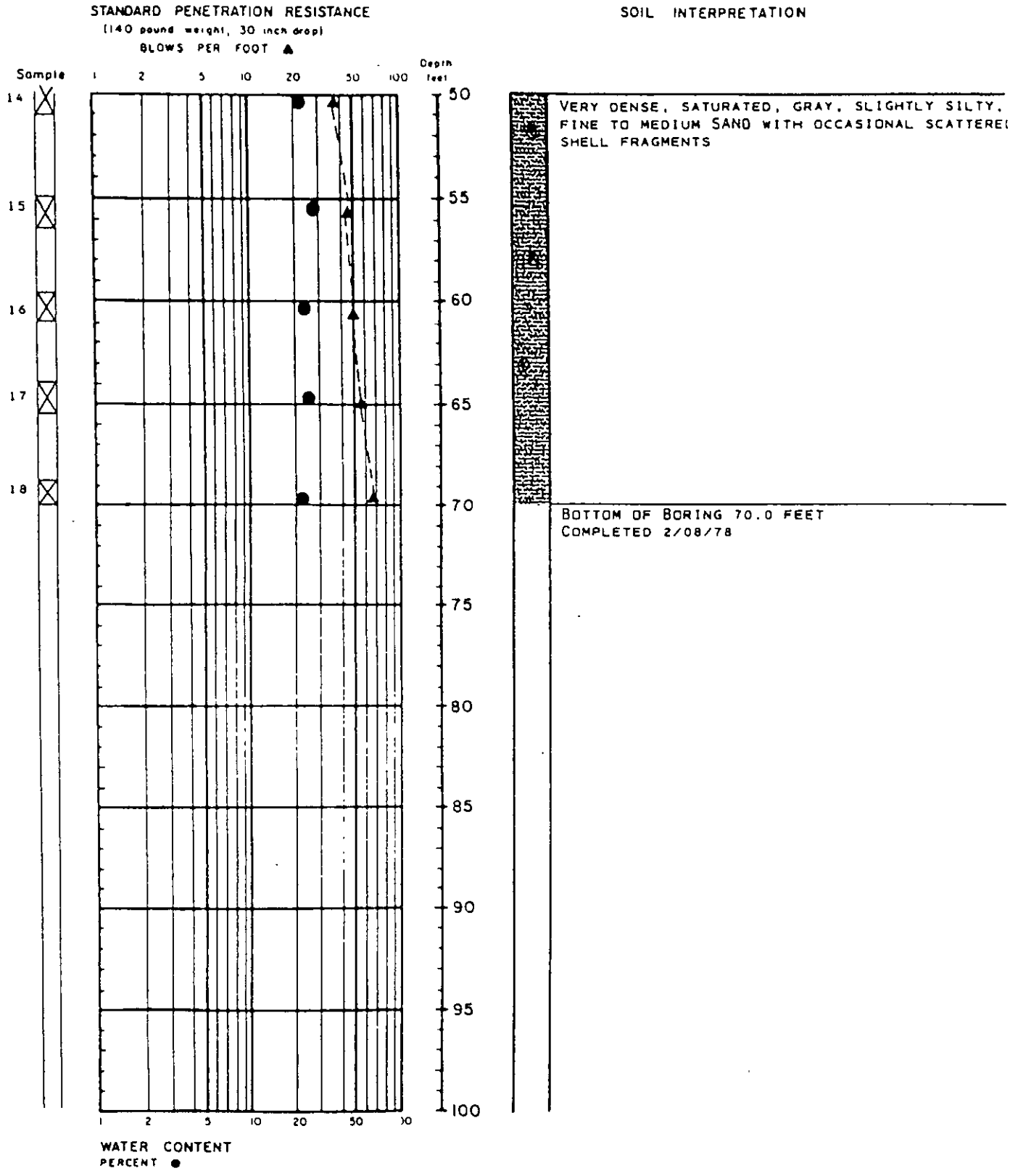
LOOSE, SATURATED, GRAY, SILTY, VERY FINE TO FINE SAND

DENSE TO VERY DENSE, SATURATED, GRAY, SLIGHTLY SILTY, FINE TO MEDIUM SAND WITH OCCASIONAL SCATTERED SHELL FRAGMENTS

LEGEND

- ⊠ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- * No Sample Recovery
- ▽ Water Level
- ▯ Observation Well

NOTE Soil descriptions are interpretive and actual changes may be gradual



LEGEND

⊠ 2" O.D. Split Spoon Sample

⊠ 3" O.D. Shelby Sample

★ No Sample Recovery

▽ Water Level

▯ Observation Well

NOTE Soil descriptions are interpretive and actual changes may be gradual.

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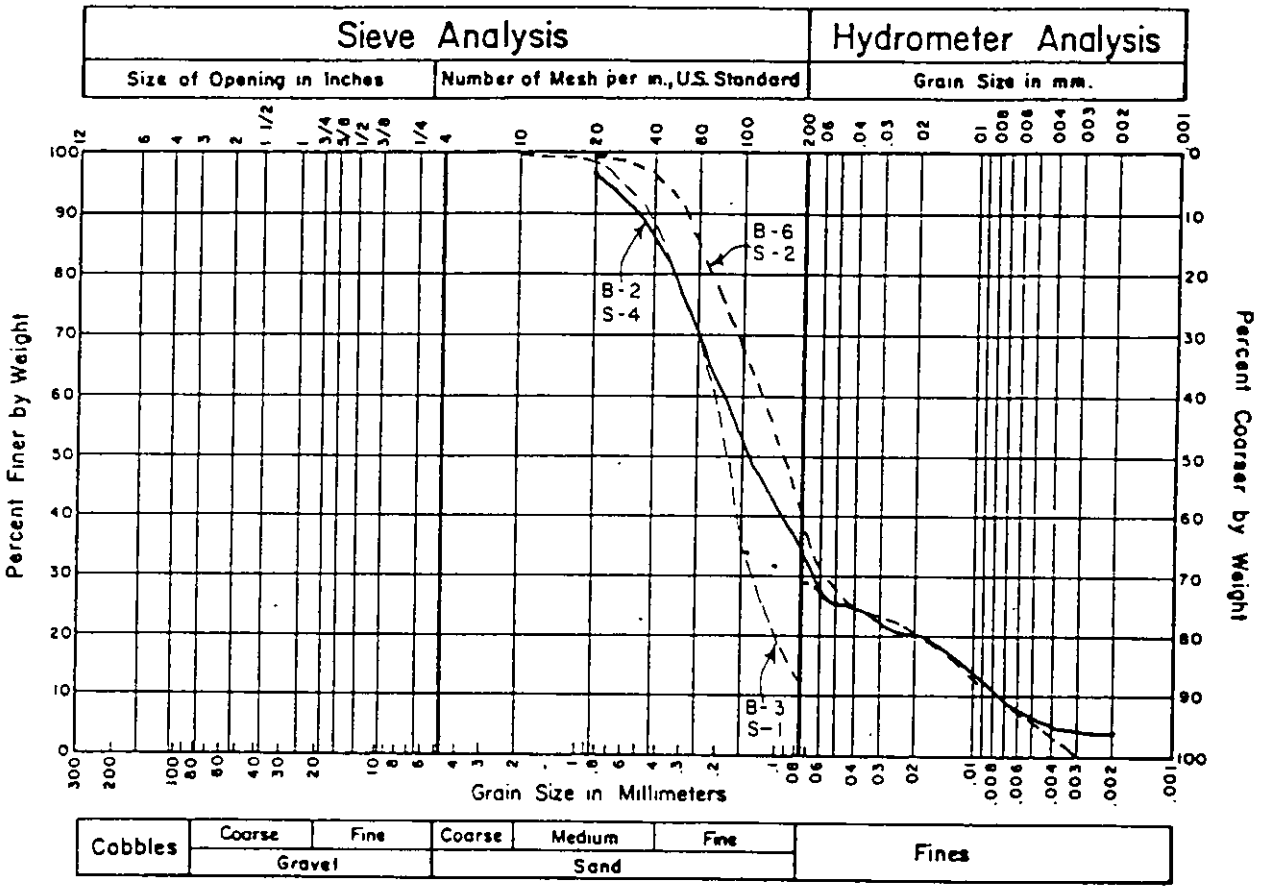
Figure A-3

GRAIN SIZE CLASSIFICATION



Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits LL	PL	PI
B-2 S-4	7.5-9	SM	Silty, fine to medium SAND	29	Non-Plastic		
B-3 S-1	1.4-1.9	SM	Silty, fine to medium SAND (Tested after tiaxial Q Test)	22			
B-6 S-2	3.5-5.0	SM	Silty, fine SAND	38			

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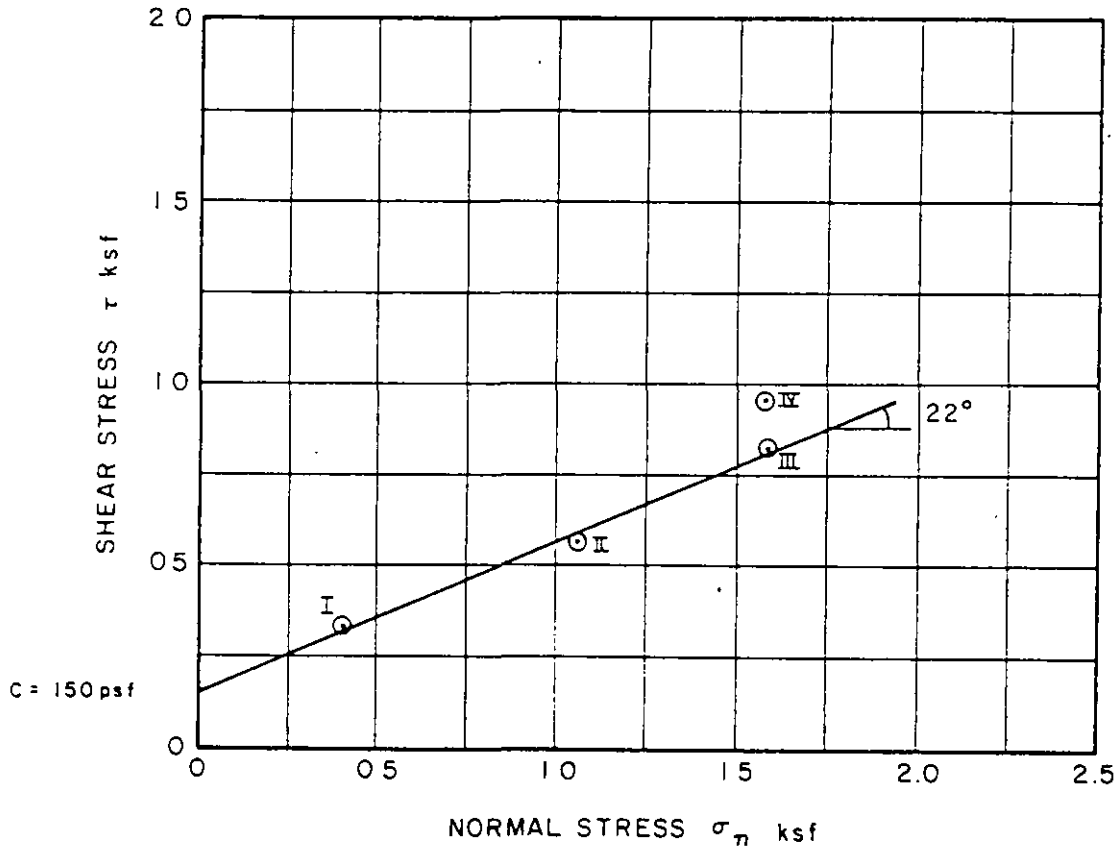
HART-CROWSER & associates inc.
Figure B-3

DIRECT SHEAR TEST RESULTS



TEST NO	SAMPLE	DEPTH FEET	ET UNIT WT.	%WC After	ATTERBERG LIMITS LL	PL	PI	CLASSIFICATION
I*	B-3	9.8	104.4	54				Soft, gray, saturated clayey SILT (ML)
II*	S-4	9.9	104.6	53	44	31	13	
III*		10.0	103.1	53				
IV*		10.1	102.4	54				

* Tests I-III consolidated at 410 psf, then run at plotted normal stress.
Test IV consolidated and run at plotted normal stress

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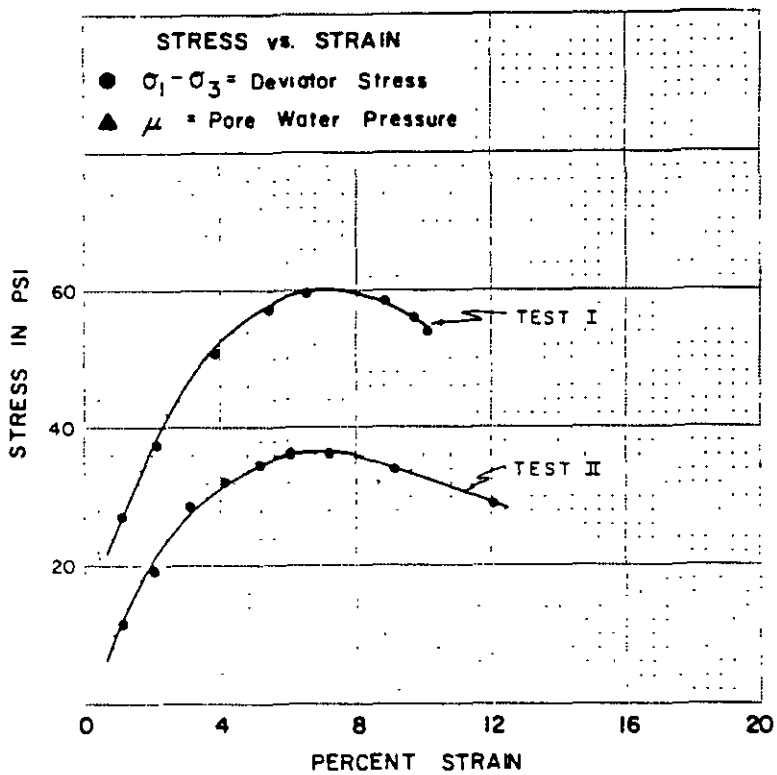
HART-CROWSER & associates inc.
FIG. 8-9

TRIAXIAL COMPRESSION TESTS



Sample Classification

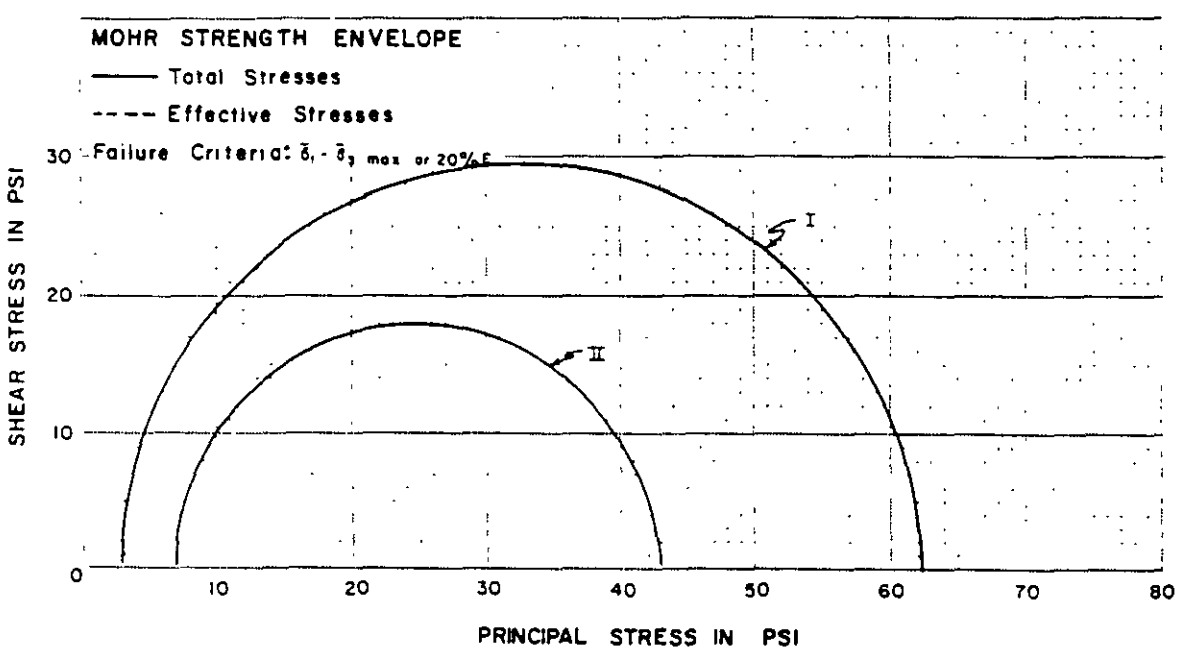
Silty, Fine to Medium SAND

Type of Test

Unconsolidated, Undrained, Quick

TEST NO.	I	II	III
BORING NO.	B-3	B-3	
SAMPLE NO.	S-1	S-1	
CHAMBER PRESSURE, PSI	3 0	7 0	
HEIGHT, INCHES	6 22	6 0	
DIAMETER, INCHES	2.83	2.83	
UNIT WT., PCF.	114 4	——*	
W.C. %, BEFORE TEST			
W.C. %, AFTER TEST			

* Sample to fragile to attempt weigh – possibly slightly disturbed



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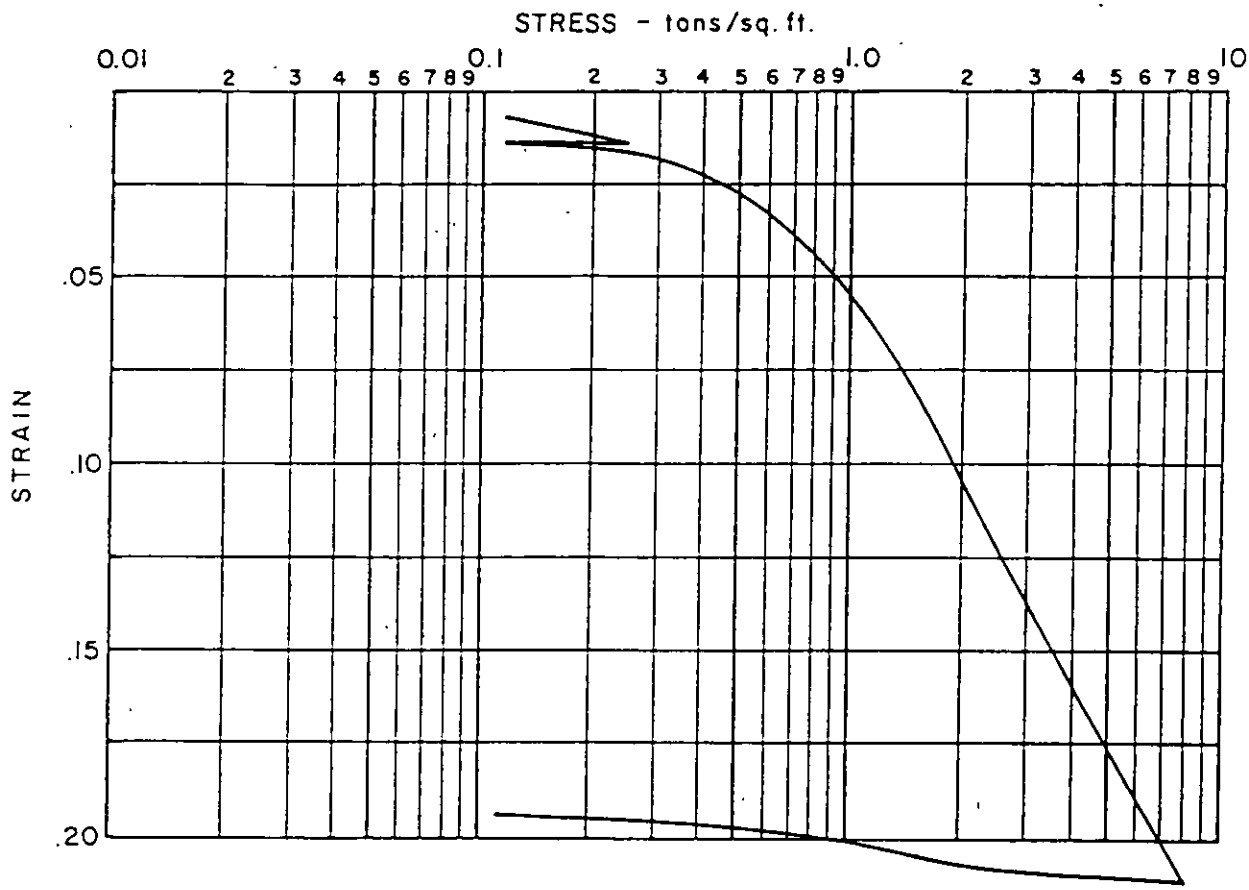
HART-CROWSER & associates inc.

Figure B-17

CONSOLIDATION TEST RESULTS



SAMPLE	DEPTH, feet	% WATER CONTENT Before	After	ATTERBERG LIMITS LL	PL	PI	CLASSIFICATION	UNIT Wt. Wet	Dry
B-3 S-4	≈10.2	54	41	44	31	13	Soft, gray, saturated, clayey SILT (ML)	103.0/	

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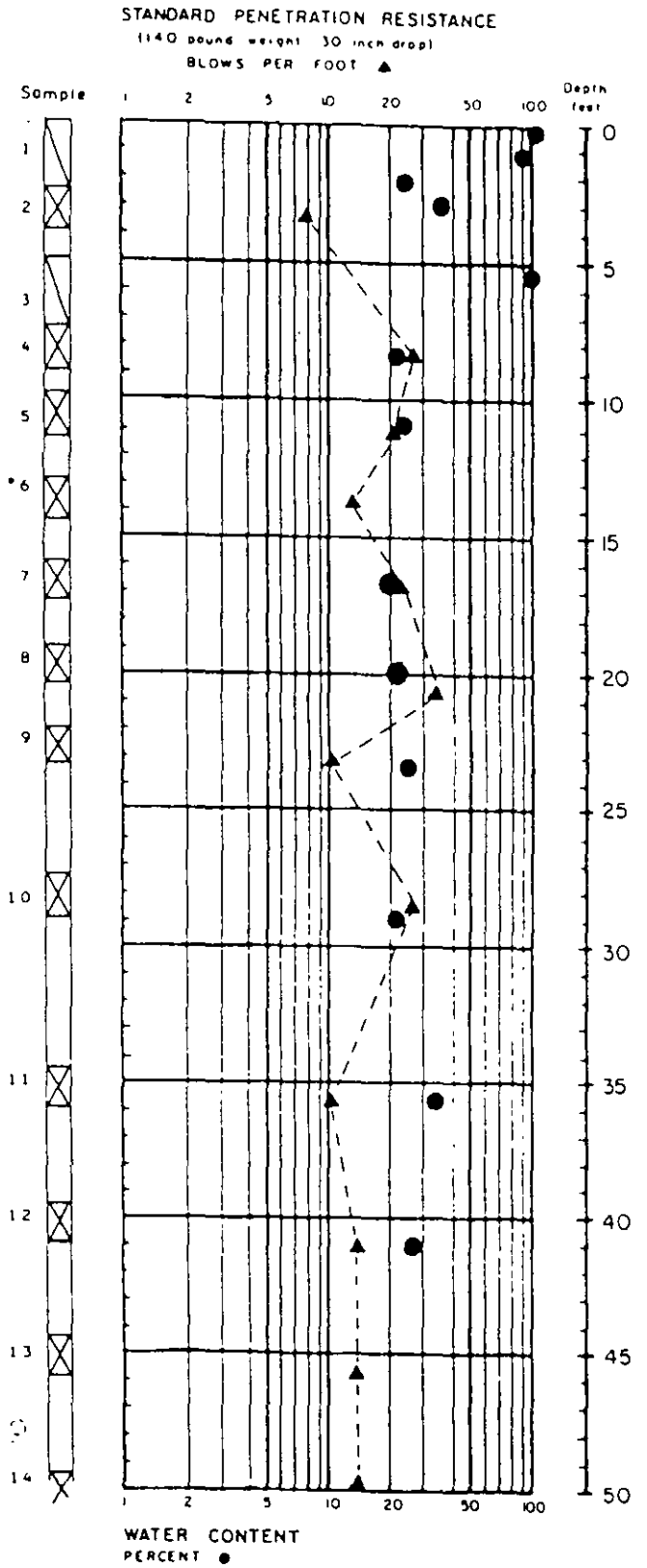
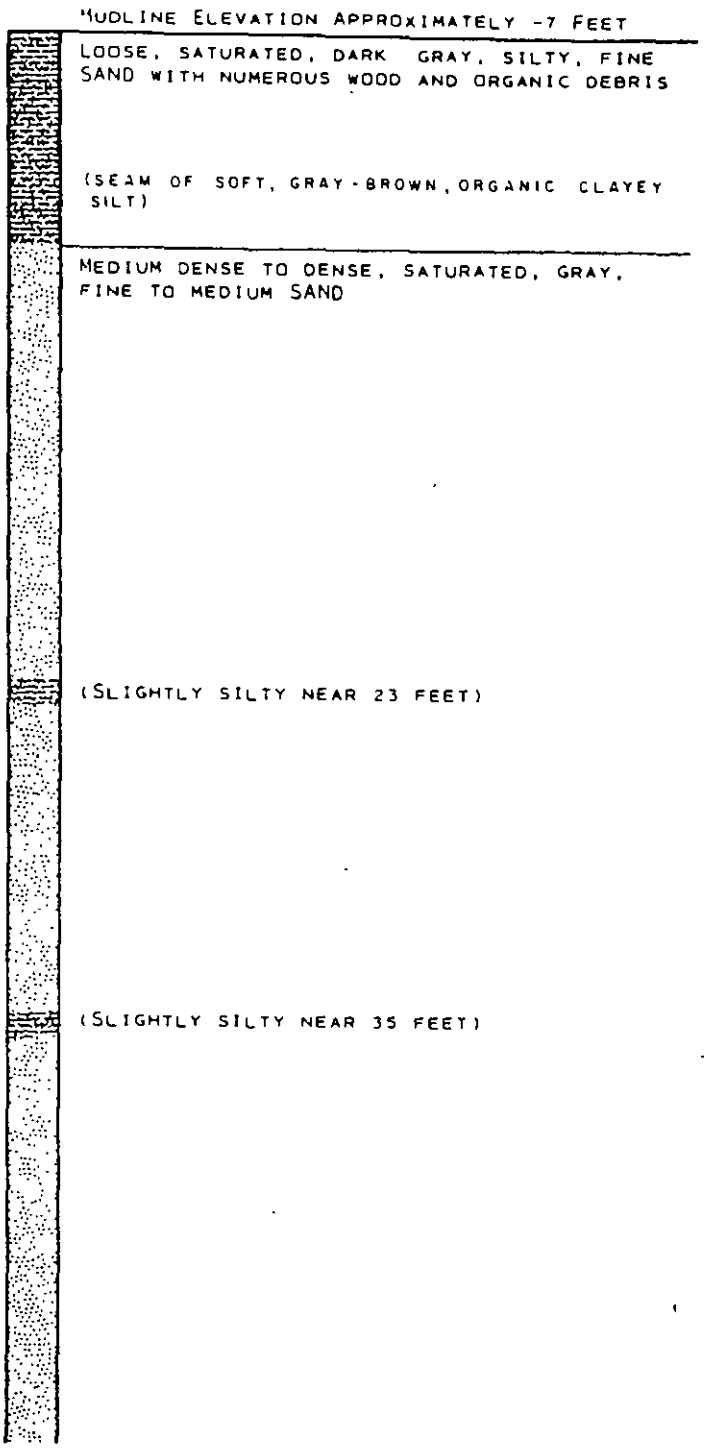
HART-CROWSER & associates inc.
Figure B-18

BORING LOG B-5



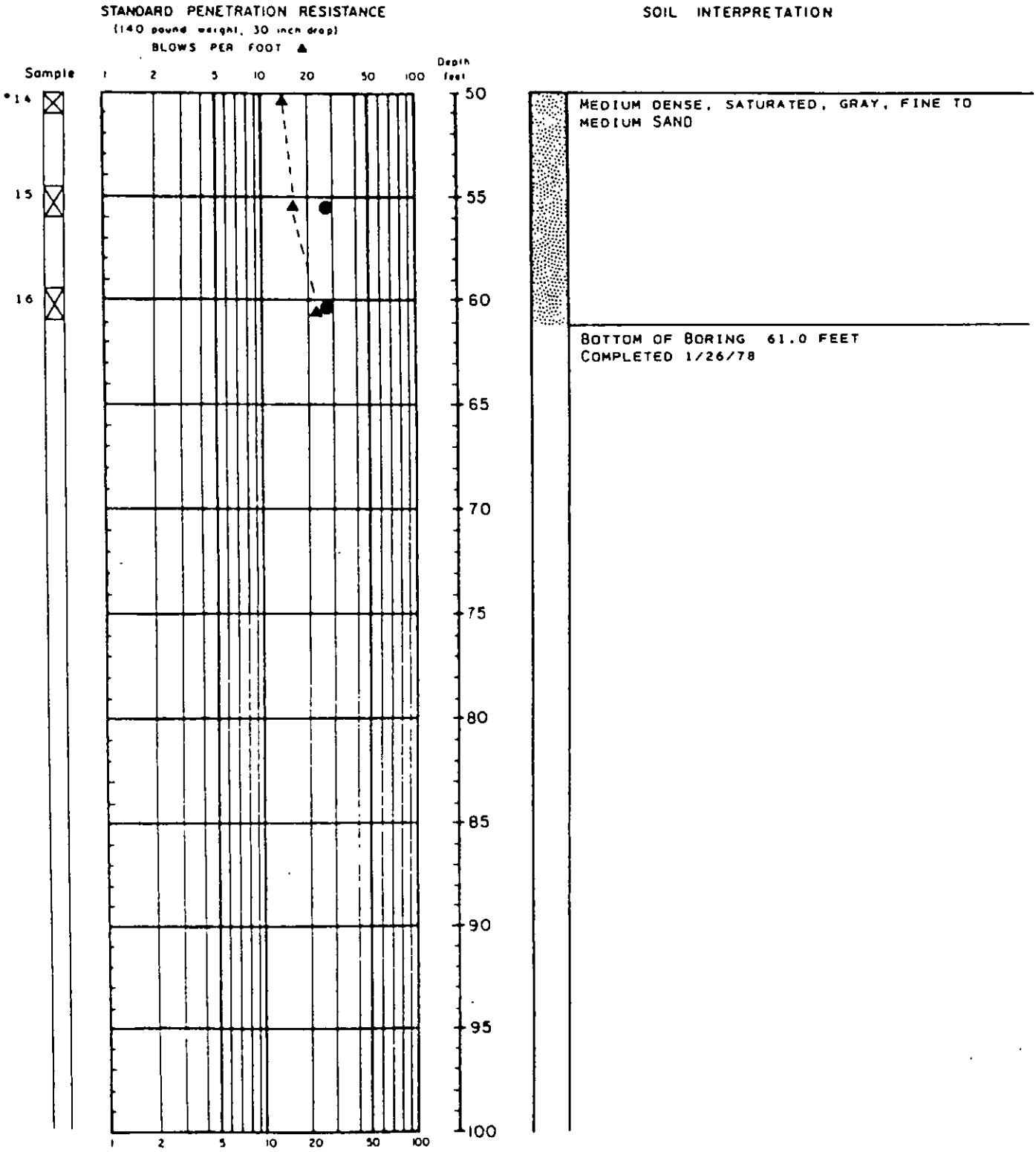
SOIL INTERPRETATION



LEGEND

- ⊠ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- * No Sample Recovery
- Water Level
- Observation Well

NOTE Soil descriptions are interpretive and actual changes may be gradual



LEGEND

- ⊠ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- ★ No Sample Recovery
- ▽ Water Level
- ▯ Observation Well

NOTE Soil descriptions are interpretive and actual changes may be gradual.

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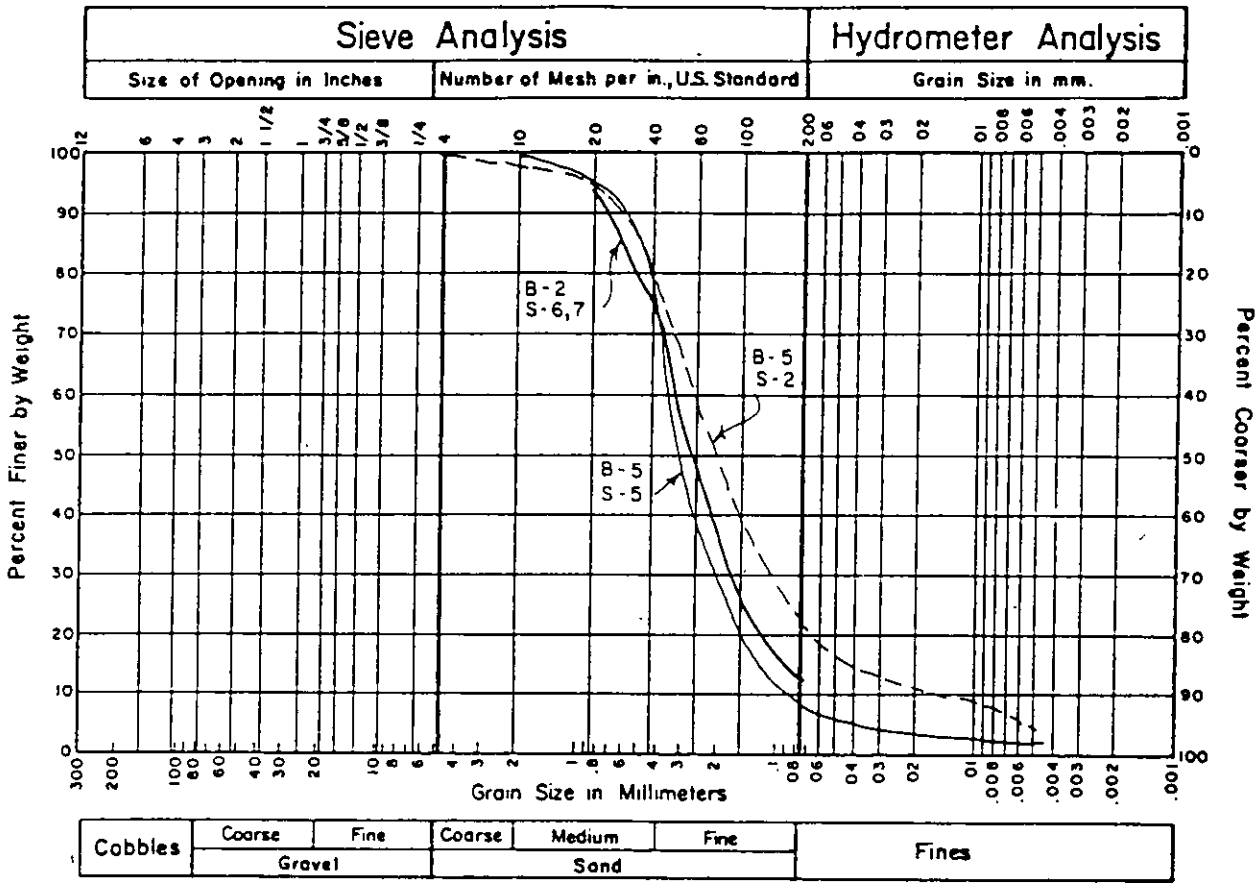
Figure A-5

GRAIN SIZE CLASSIFICATION



Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits LL	PL	PI
B-2 S-6,7	15.5-17.0 and 20.5-22.0	SM	Silty, fine to medium SAND				Non-Plastic
B-5 S-2	2.5-4.0	SM	Silty, fine to medium SAND				
B-5 S-5	10.0-11.5	SP-SM	Slightly silty, fine to medium SAND	28			

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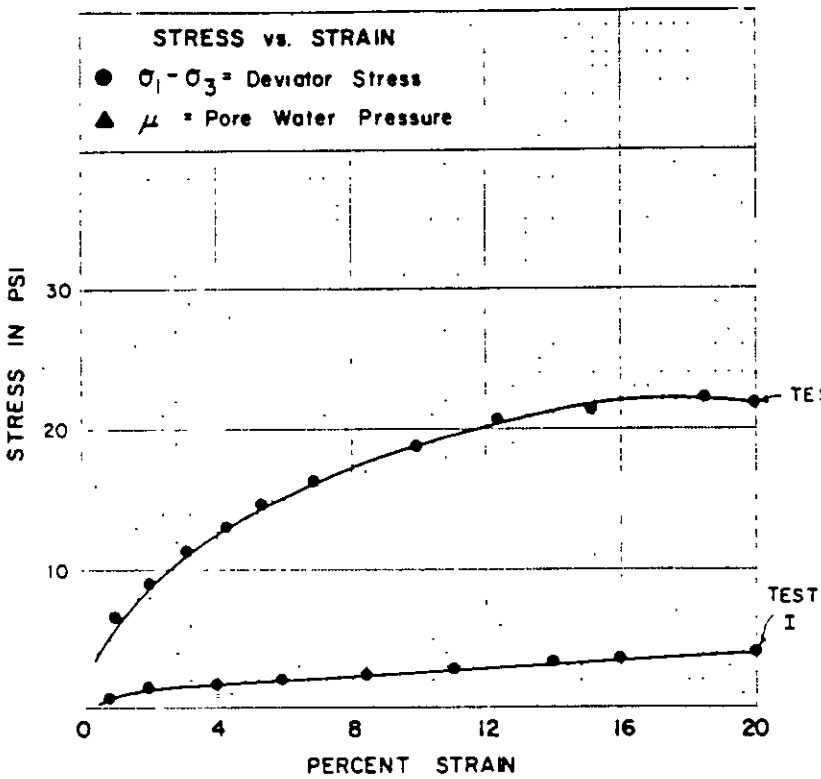
HART-CROWSER & associates inc.
Figure B-4

TRIAXIAL COMPRESSION TESTS



Sample Classification

I Organic Sandy Silt with Organic Debris

II Silty Sand with Organic Debris

Type of Test

Unconsolidated, Undrained, Quick

TEST NO.	I	II	III
BORING NO.	B-5	B-5	
SAMPLE NO.	S-1	S-1	
CHAMBER PRESSURE, PSI	3.0	7.0	
HEIGHT, INCHES	5.55	5.28	
DIAMETER, INCHES	2.83	2.83	
UNIT WT., PCF.	83.3	97.3	
W.C. %, BEFORE TEST			
W.C. %, AFTER TEST			

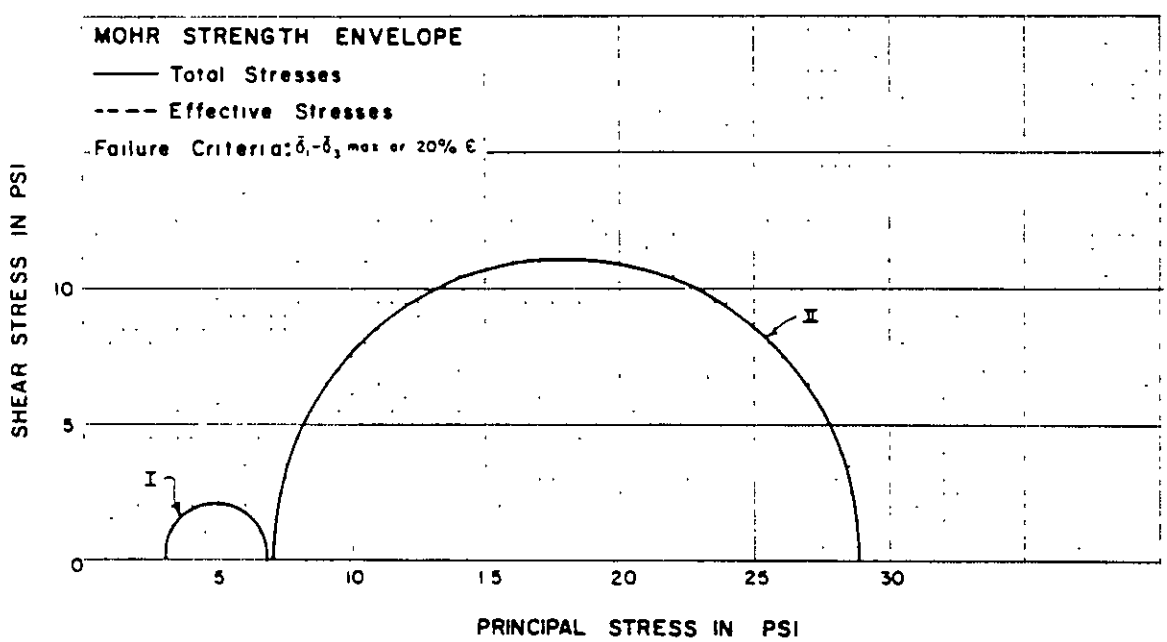


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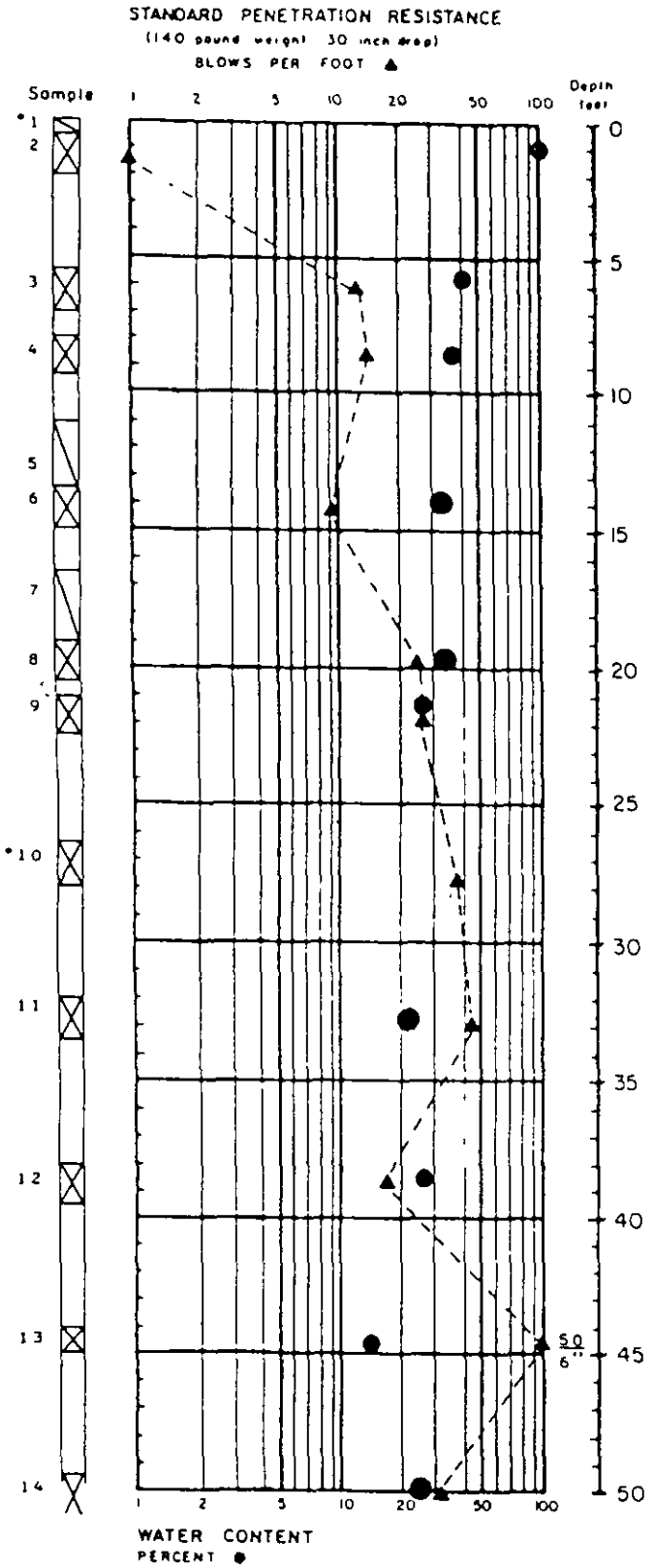
Figure B-16

BORING LOG B-7



SOIL INTERPRETATION

MUDLINE ELEVATION APPROXIMATELY -12 FEET

VERY SOFT, MIXTURE OF SILTY SAND AND WOOD FRAGMENTS

LOOSE TO MEDIUM DENSE, SATURATED, GRAY, SILTY, FINE SAND WITH SCATTERED SHELL FRAGMENTS

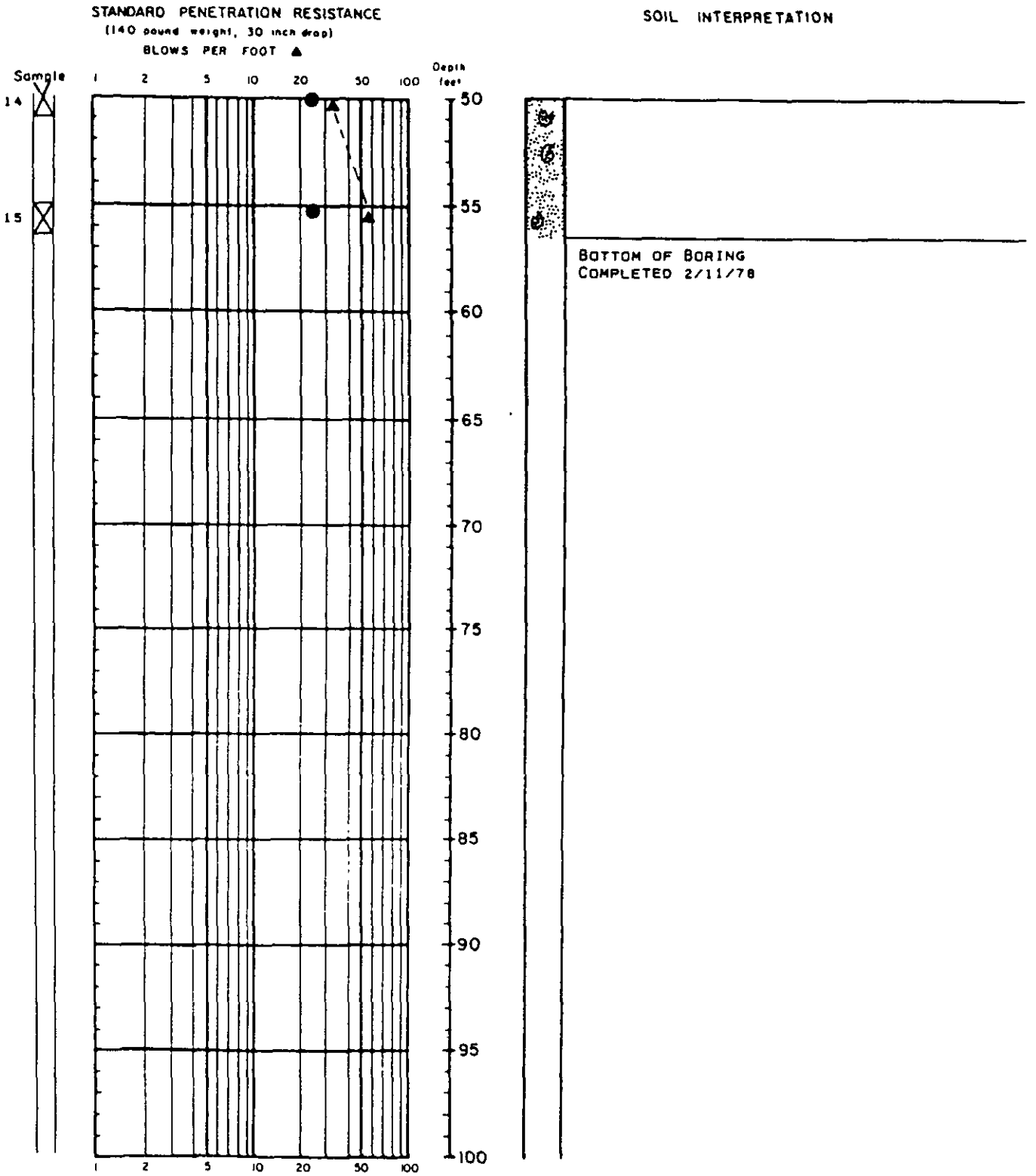
LOOSE TO MEDIUM DENSE, SATURATED, GRAY, SILTY, FINE SAND AND FINE SANDY SILT

MEDIUM DENSE TO VERY DENSE, SATURATED, GRAY, FINE TO MEDIUM SAND WITH SCATTERED SHELL FRAGMENTS

LEGEND

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Sample
- ★ No Sample Recovery
- Water Level
- Observation Well

NOTE Soil descriptions are interpretive and actual changes may be gradual



LEGEND

⊠ 2" O.D. Split Spoon Sample

⊘ 3" O.D. Shelby Sample

* No Sample Recovery

Water Level

Observation Well

NOTE Soil descriptions are interpretive and actual changes may be gradual

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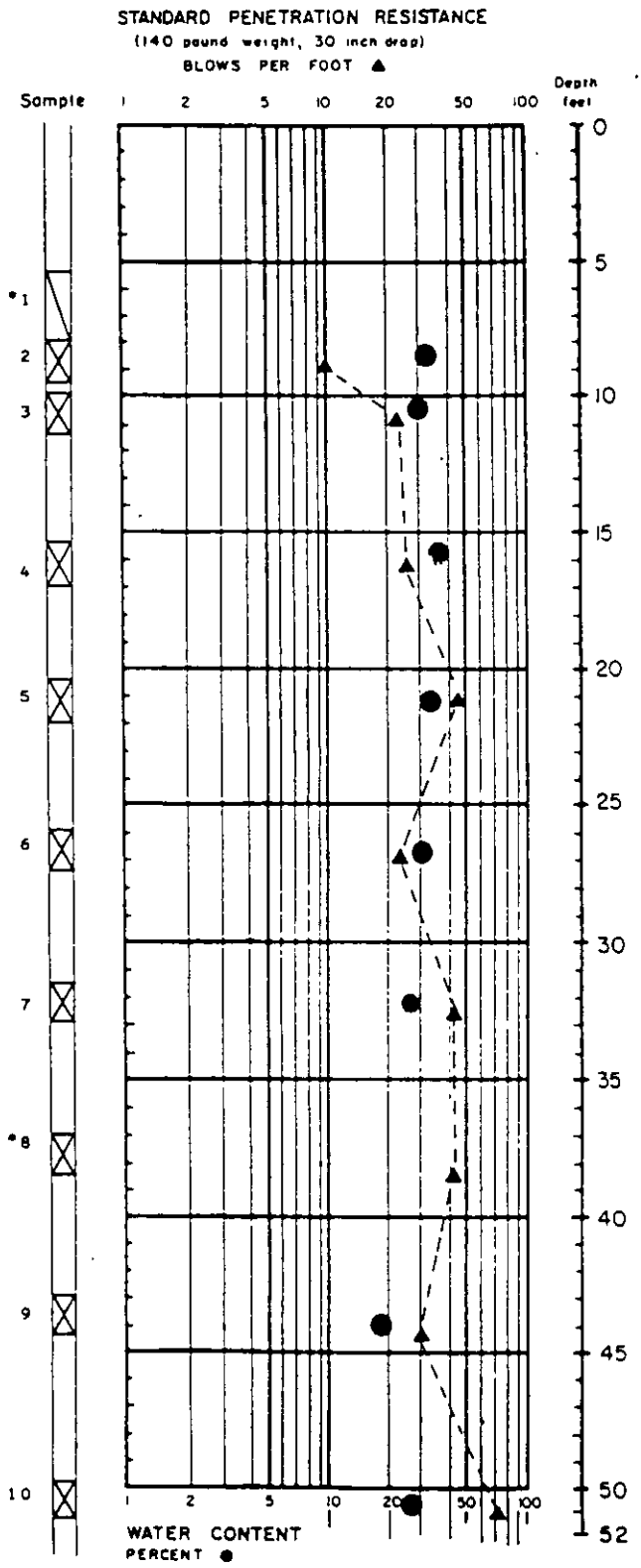
Figure A-7

BORING LOG B-4



SOIL INTERPRETATION

MUDLINE ELEVATION APPROXIMATELY -36 FEET

VERY SOFT, SATURATED, BLACK, ORGANIC, CLAYEY SILT

MEDIUM DENSE TO DENSE, SATURATED, GRAY, SLIGHTLY SILTY, FINE AND FINE TO MEDIUM SAND WITH OCCASIONAL SCATTERED WOOD AND SHELL FRAGMENTS

MEDIUM DENSE, SATURATED, GRAY, SILTY, FINE SAND INTERBEDDED WITH LENSES OF STIFF, WET, GRAY, CLAYEY SILT

DENSE TO VERY DENSE, SATURATED, GRAY, SLIGHTLY SILTY, FINE TO MEDIUM SAND

BOTTOM OF BORING 51.5 FEET
COMPLETED 2/01/78

LEGEND

⊠ 2" O.D. Split Spoon Sample

⊠ 3" O.D. Shelby Sample

* No Sample Recovery

Water Level

Observation Well

NOTE: Soil descriptions are interpretive and actual changes may be gradual.

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Figure A-4