Subsurface Explorations and Geotechnical Engineering Study

Proposed TOTE Site Facilities

Alexander Avenue and East Eleventh Street

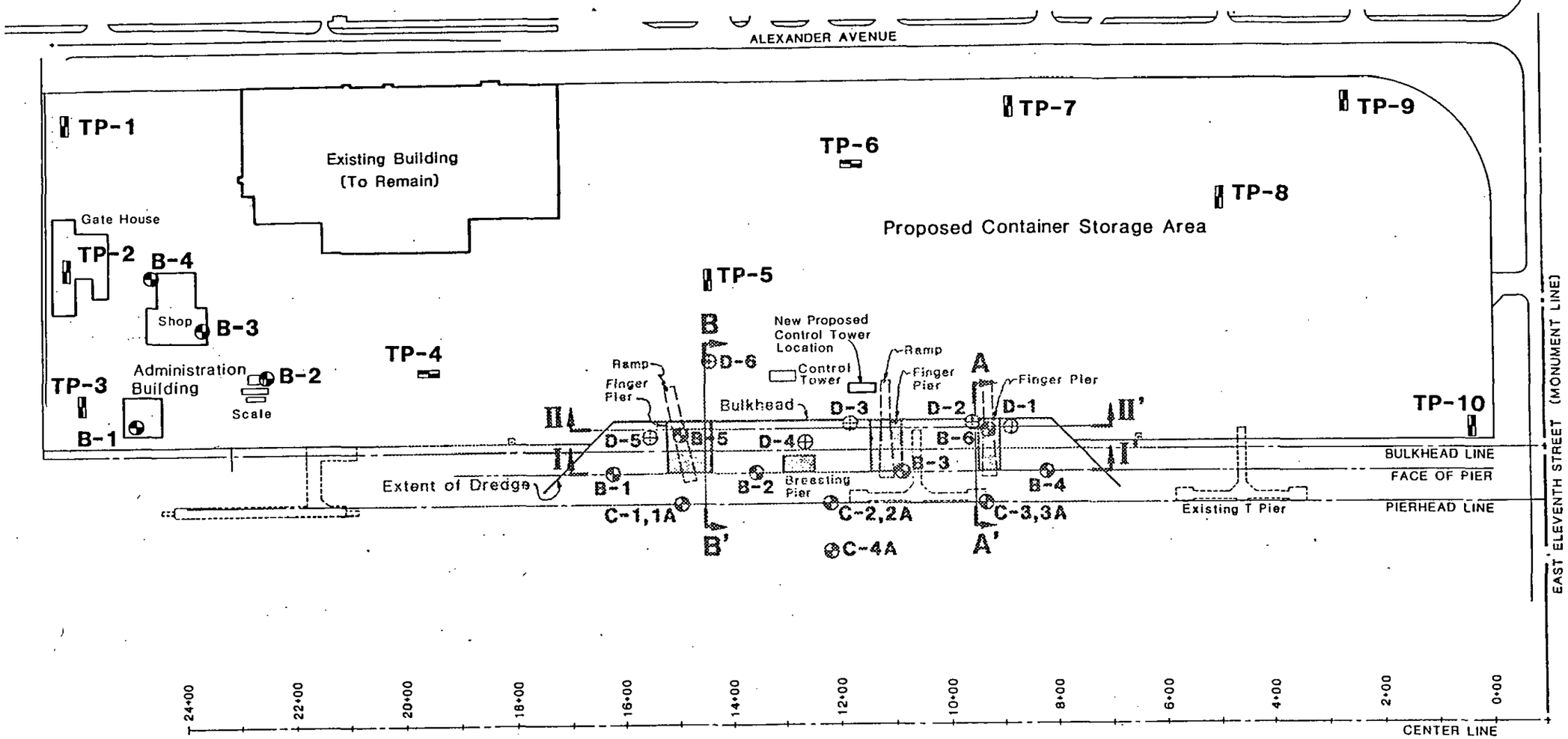
Port of Tacoma, Washington

J-1266

July 6, 1983

HART CROWSER & associates inc.
GEOTECHNICAL CONSULTANTS

Site and Exploration Plan



Exploration Location and Number

- B-1 Onshore Boring (J-1266)
- TP-1 Onshore Test Pit (J-1266)

Previous Hart-Crowser Studies

- C-1 Offshore Boring (J-1042-03)
- B-1 Onland Boring (J-1042-03)
- D-1 Onland Boring (J-1042-04)

I — I' Profile/Cross Section Location and Designation

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Figure 1

APPENDIX A
FIELD EXPLORATIONS

Field explorations consisted of a series of ten backhoe-excavated test pits and four hollow-stem auger borings located across the project site as shown on Figure 1, the Site and Exploration Plan. Previous explorations accomplished on the site by Hart-Crowser & Associates associated with the planned bulkhead and pier (report #J-1042-03 and -04, dated December 23 and December 30, 1982) were also utilized to provide additional information onsusbsurface conditions for this study.

The exploration locations shown were measured in the field by taping from existing site features. The elevations were interpolated from those indicated on topographic plans of the site provided by the Port of Tacoma. The locations and elevations should be considered accurate only to the degree implied by the method used.

Four hollow-stem auger borings were drilled on June 13 and 14, 1983 to depths of 8.5 and 11.5 feet below the ground surface. The borings were advanced with a truck-mounted drill rig under subcontract to Hart-Crowser & Associates using a 3-3/8-inch inside diameter hollow auger. The drilling was accomplished under the continuous observation of an engineering geologist from our firm. Detailed field logs were prepared of each boring and representative samples were obtained on 5-foot sample depth intervals. Both relatively undisturbed (Shelby) and disturbed (split-spoon) samples were taken.

The disturbed samples were obtained by using the Standard Penetration Test procedure as described in ASTM D-1587. The number of blows required to drive the sampler with a 140-pound hammer free-falling 30 inches was recorded in three 6-inch intervals. The number of blows required to drive the sampler the final 12 inches is the Standard Penetration Resistance which is plotted on theboring logs at the respective sample elevations. The Penetration Resistance or "N" value is a measure of the in-place density of the sampled soils and is used to classify the samples into relative density categories. Samples were recovered from the split-barrel sampler, classified and placed in water-tight jars to return to our laboratory for further testing. Relatively undisturbed, 3-inch diameter samples were obtained by pushing thin-walled steel tubes below thebottom of the auger. The tubes were sealed at the ends and returned to our laboratory for later extrusion and classification. The boring logs presented on Figures A-1 through A-4 are a graphic representation of the information interpreted from drilling action, samples recovered, and laboratory tests. The depth where the soils, or characteristics of these soils changed is noted. The change may be gradual.

The test pit explorations were conducted on June 13, 1983 and continuously observed and logged in the field by Mr. John Zipper, geotechnical engineer from our firm. The test pits provided visual information as to subsurface conditios immediately below the ground surface to depths of up to 10.5 feet.

Representative jar and large-volume bag samples were obtained in each of the test pits. These samples were taken at locations where changes in the soil

types were observed. Variations in subsurface soils are often gradual and a specific location for sampling is a matter of judgement to select the most representative sample for that soil type. The samples were selected for the purpose of obtaining a record for further classification of the soils encountered, and to perform laboratory testing on these soils.

The logs of the test pits are presented in Figures A-5 through A-9. These logs are based on our current interpretation of the field and laboratory data. The logs indicate the various types of soils encountered in the test pits and the depths where these soils or characteristics of these soils changed, although the change may be gradual. Densities, which are indicated on the logs in parentheses, were interpreted in the field. To the left of the classification of soil, the location of sampling, sample numbers and laboratory determined moisture contents are shown.

Boring Log B-1

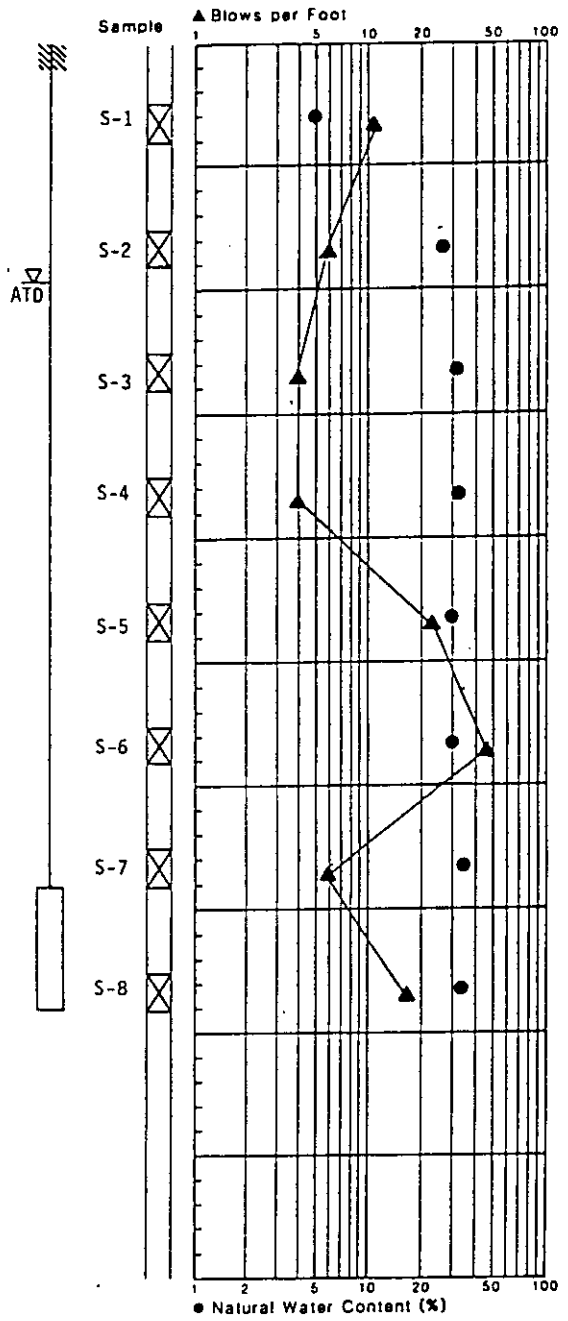
SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 19

Medium dense, damp, gray, fine to medium SAND (FILL).	0 – 5
Loose, saturated, gray, slightly silty, fine to medium SAND (FILL).	5 – 10
Medium dense to dense, saturated, gray, silty to clean, fine to medium SAND.	10 – 30
Medium stiff, saturated, gray, fine sandy SILT.	30 – 35
Medium dense, saturated, gray, silty, fine SAND.	35 – 40
Bottom of Boring at 39.0 Feet. Completed 6/14/83.	40 – 50



Groundwater Level

- Bentonite Seal
- 2/14/83 ATD — Water Level (Date) At Time of Drilling
- Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- ★ No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.

J-1266 June 1983

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Figure A-1

Boring Log B-2

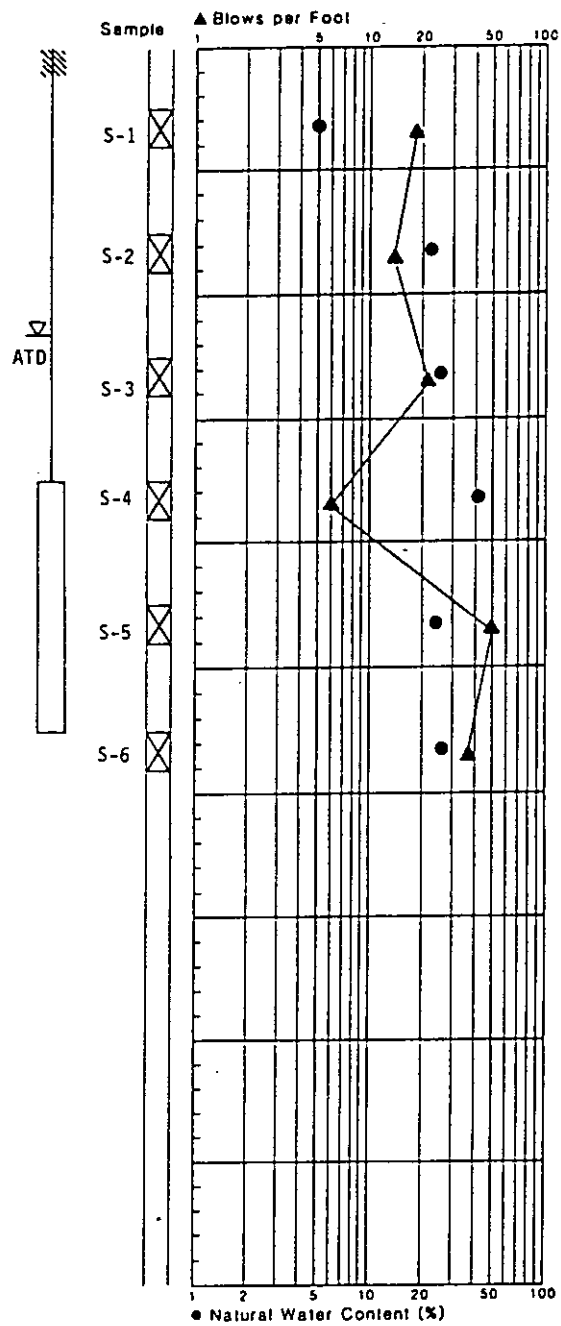
SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE (140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 19

Medium dense, damp to wet, gray, fine to medium SAND with occasional shell fragments (FILL).	0–10
Medium dense, saturated, gray, slightly silty, fine SAND (FILL).	10–15
Loose, saturated, gray, silty, fine to medium SAND with interbedded soft, saturated, gray, fine sandy, clayey SILT and organic partings.	15–20
Dense, saturated, dark gray, fine to medium SAND.	20–30
Bottom of Boring at 29.0 Feet. Completed 6/13/83.	30



Groundwater Level

Bentonite Seal

6/14/83 Water Level (Date) At Time of Drilling

ATD

Observation Well Tip or Slotted Section

Sampling

2" O.D. Split Spoon Sample

3" O.D. Shelby Tube Sample

Cutting Sample

★ No Sample Recovery

Laboratory Tests

GS Grain Size Analysis

CN Consolidation Test

K Permeability Test

DS Direct Shear

QU Unconfined Compression, tsf

TV Torvane, tsf

PP Pocket Penetrometer, tsf

TUU Triaxial Unconsolidated Undrained

TCU Triaxial Consolidated Undrained

TCD Triaxial Consolidated Drained

Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

Notes

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J-1266 June 1983

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Figure A-2

Boring Log B-3

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE (140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 19

Loose, damp, gray, fine to medium SAND with scattered shell fragments (FILL).

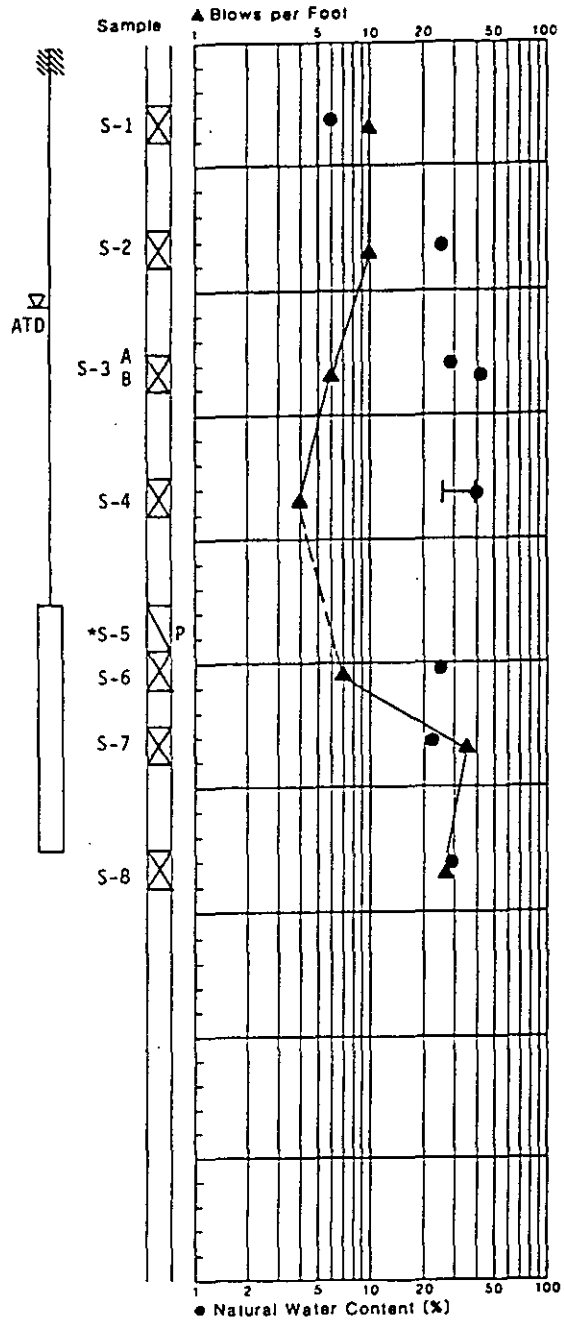
Grades to saturated.

Soft, saturated, gray, fine sandy, clayey SILT.

Loose, saturated, gray, silty, fine to medium SAND.

Medium dense to dense, saturated, dark gray, slightly silty to clean, fine to medium SAND with SILT interbeds below 31 feet.

Bottom of Boring at 34.0 Feet.
Completed 6/13/83.



Groundwater Level

Bentonite Seal

2/4/83 ATD — Water Level (Date) At Time of Drilling

Observation Well Tip or Slotted Section

Sampling

2" O.D. Split Spoon Sample

3" O.D. Shelby Tube Sample

Cutting Sample

* No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
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Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

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J-1266 June 1983

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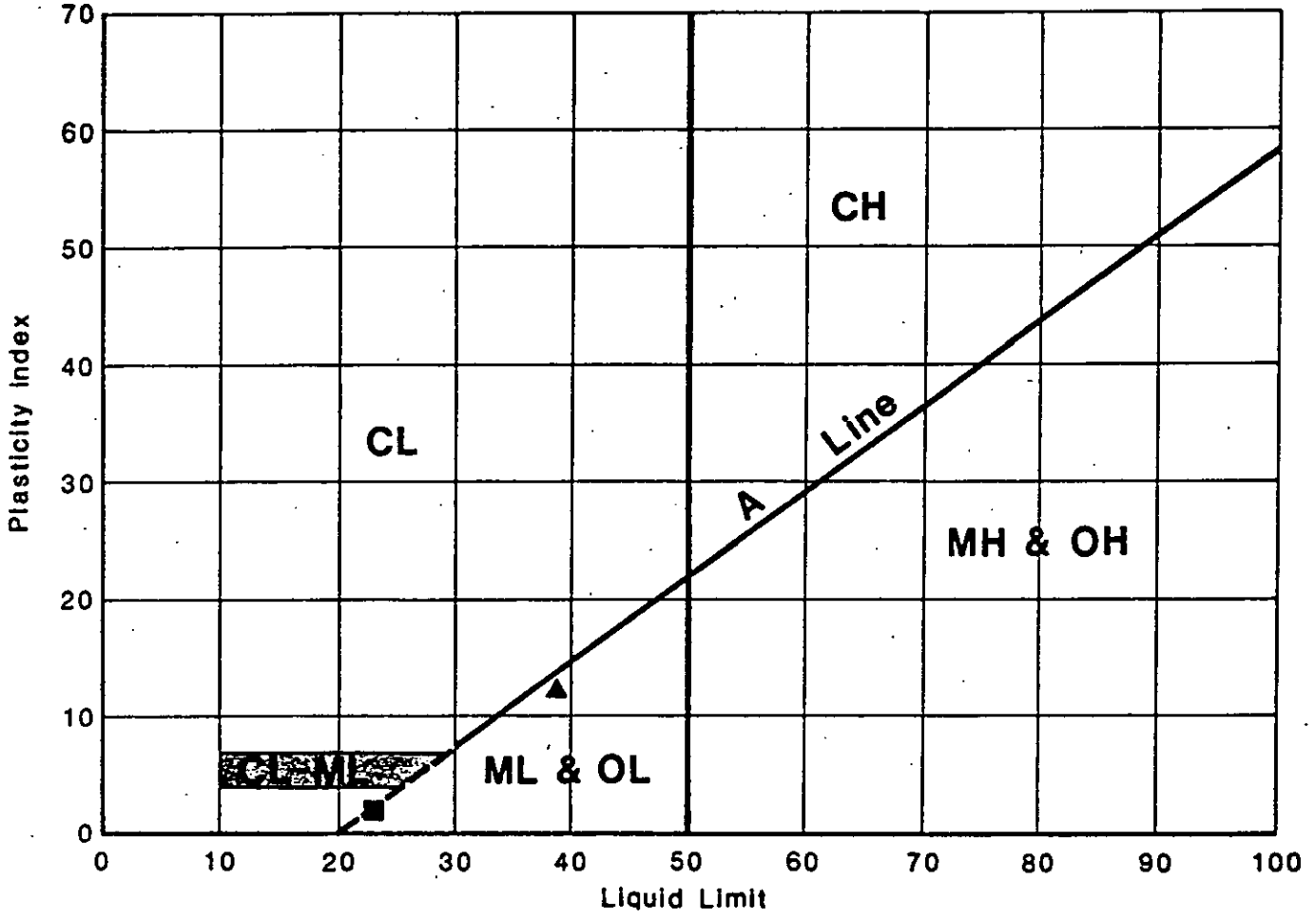
Figure A-3

Plasticity Chart



SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	WATER CONTENT IN PERCENT NAT.	L.L.	P.L.	P.I.	CLASSIFICATION	USC
▲	B-3	S-4	17.5-19.0	40	39	27	12	Fine sandy, clayey SILT	ML
■	B-4	S-8	37.5-39.0	35	23	21	2	Fine sandy, clayey SILT	ML

L.L. LIQUID LIMIT
P.L. PLASTIC LIMIT
P.I. PLASTICITY INDEX
USC UNIFIED SOIL CLASSIFICATION

J-1266 June 1983
HART-CROWSER & associates, inc.
Figure B-2

Boring Log B-4

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE (140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 19

Loose, damp, gray, fine to medium SAND (FILL).

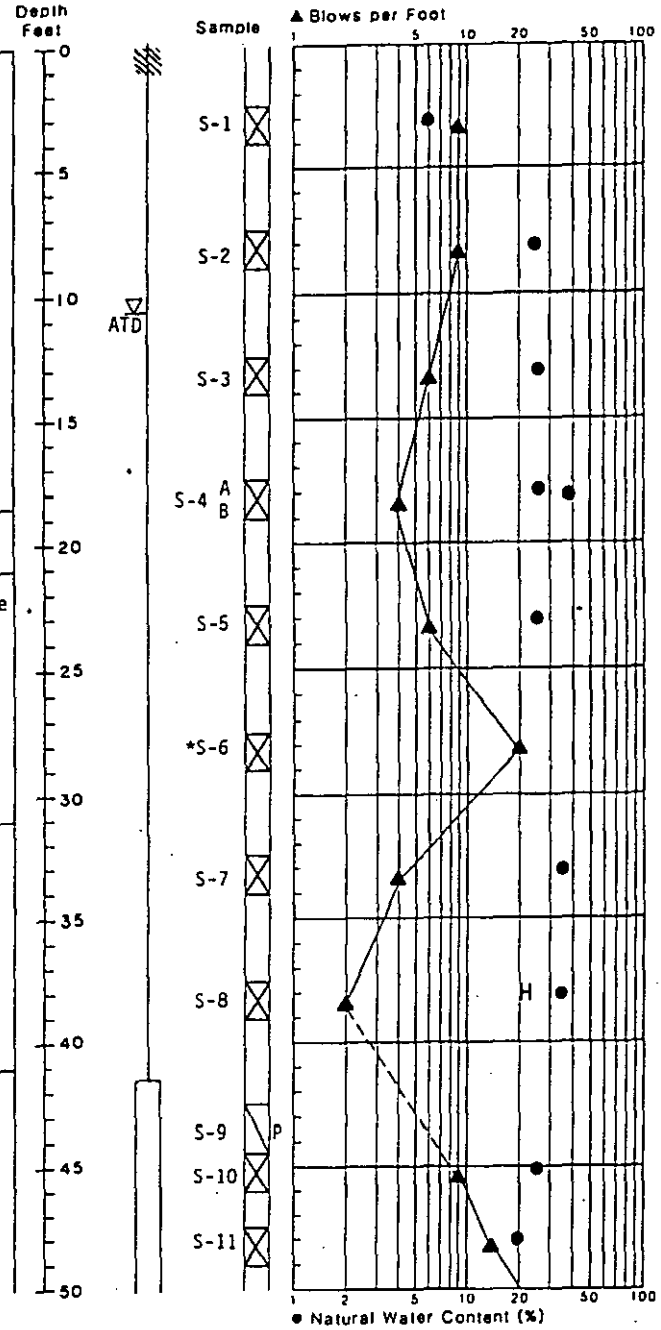
Grades wet to saturated.

Soft, saturated, gray, fine sandy, clayey SILT.

Loose to medium dense, saturated, gray, silty, fine to medium SAND.

Very soft, saturated, gray, fine sandy SILT.

Loose to medium dense, saturated, gray, slightly silty, fine to medium SAND.



Groundwater Level

Bentonite Seal

2/4/83

ATD Water Level (Date) At Time of Drilling

Observation Well Tip or Slotted Section

Sampling

2" O.D. Split Spoon Sample

3" O.D. Shelby Tube Sample

Cutting Sample

* No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
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DS	Direct Shear
QU	Unconfined Compression, tsf
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TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

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J-1266 June 1983

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Sheet 1 of 2 Figure A-4

Boring Log B-4

SOIL INTERPRETATION

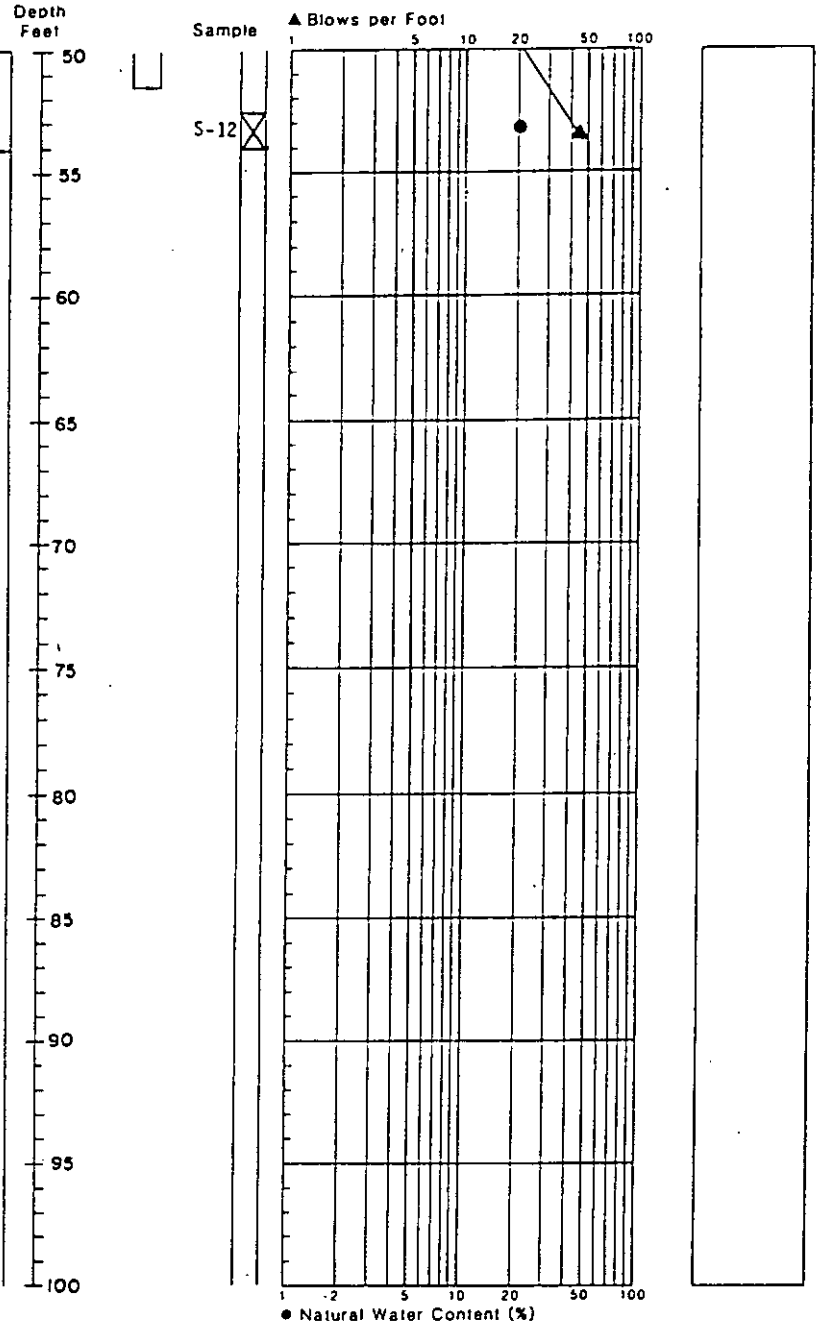
STANDARD PENETRATION RESISTANCE

(140 pound weight, 30 inch drop)

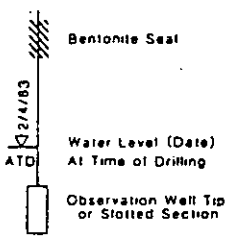
LABORATORY TESTS

Dense, saturated, gray, fine to medium SAND.

Bottom of Boring at 54.0 Feet.
Completed 6/13/83.



Groundwater Level



Sampling

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- 3" O.D. Shelby Tube Sample
- Cutting Sample
- * No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
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Natural Water Content

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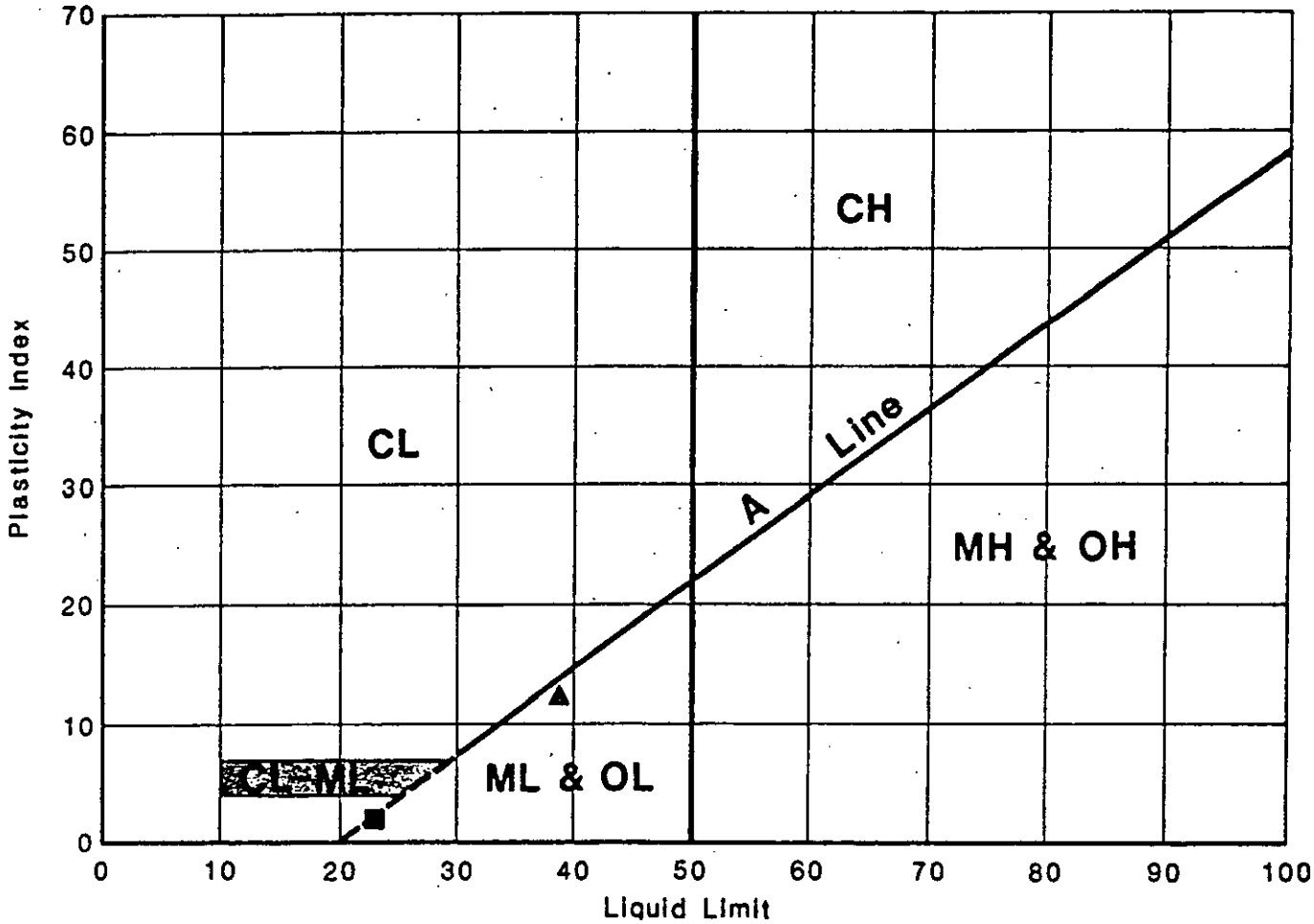
Sheet 2 of 2 Figure A-4

Plasticity Chart



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L.L. LIQUID LIMIT
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USC UNIFIED SOIL CLASSIFICATION

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Figure B-2