Part 16 of 19 of Appendices for Resource Report No. 13 LNG

APPENDIX C

SPT Hammer Energy Calibrations

APPENDIX C

Standard Penetration Test (SPT) Hammer Energy Calibration

Energy calibration measurements of the hammers used during Standard Penetration Test (SPT) sampling operations offshore, onboard the *Skate 3* jack-up drilling platform, were performed between September 17 and 21, 2015 for the proposed Alaska LNG offshore facilities located in the Cook Inlet, offshore the Kenai Peninsula, Alaska.

Purpose and Scope

The purpose of SPT hammer energy calibration described herein is to determine the average energy transferred from the exploration rig's hammer to the drilling rods during SPT sampling. The measured energy may then be used to correct the measured SPT N-values to a standardized energy level, typically 60% of the theoretical energy (N_{60}).

The energy testing methods are described in ASTM D4633 *Standard Test Method for Energy Measurement of Dynamic Penetrometers*. A summary of the purpose and scope is summarized below:

- Mobilize Pile Driving Analyzer (PDA) equipment and personnel on board the *Skate 3* jack-up drilling platform,
- Determine SPT hammer energy at select sampling intervals, by measuring the force (from strain) and velocity (from acceleration) using an instrumented rod section, and a PDA, and
- Present the test results, hammer energy calibrations, and findings of the study.

Instrumentation and Testing

SPT hammer energy calibration was performed in general accord with ASTM D4633 using the Pile Driving Analyzer (PDA) model PAX in conjunction with an instrumented 0.61m (2-foot) section of a NWJ drilling rod (Serial No. 333NWJ), manufactured by Pile Dynamics, Inc. of Cleveland, Ohio. Each instrumented rod consists of two strain sensors in full-bridge configuration with each strain bridge mounted to cancel any bending in the rod section. Similarly, two accelerometers are also bolted directly to the rod section for data collection. Attachment 1 includes the calibration certificates for the rod sections as well as the calibration certificates of the accelerometers.

Since the drill-rods used on the *Skate 3* jack-up drilling platform was of the NWY type, two adapters, one positioned above and one below the instrumented NWJ rod section, were fabricated to allow the instrumented NWJ rod to be threaded tightly between the NWY drill-rod just beneath the SPT hammer, and the drill-rod string below. For selected sampling intervals, the PDA digitized and stored strain and acceleration data at a sampling rate of 100 kHz for each impact of the SPT hammer. During the hammer impact, the PDA multiplied the strain wave by the rod area and modulus to obtain the force wave, and integrated the acceleration to obtain the velocity wave. By integrating the product of force and velocity over the time of the impact, the PDA can then determine the net energy delivered to the sample rods during each blow. For each borehole tested, the PDA operator reviewed the results, performed data quality checks, and obtained an adequate number and range of sample SPT blows in order to properly characterize the hammer energy performance for the range of intended sampling intervals.

Test Sequence

Two SPT hammers, designated SPT-02 and SPT-09, were tested between September 17 and 21, 2015. Each of these hammers were manually operated by the crew on the *Skate 3* jack-up drilling platform. The drill rig used was a Comacchio Model MC1200 hydraulic skid mounted drilling rig capable of operating all rotary and/or percussive drilling operations. Data for the SPT hammer energy calibration were obtained at various sampling intervals from two boring locations, designated MB-6 and MB-18.

Each SPT hammer, SPT-02 and SPT-09, was operated by the lead driller onboard the *Skate 3* jack-up drilling platform. Attachments 2 and 3 contain Field Notes taken during testing and plots of the PDA data collected at each of the boring locations, which includes the lengths of the rod sections used at each borehole location. During the SPT hammer energy calibrations, six data sets were collected at each borehole location, presented in Tables 1 and 2 (which exceeds the minimum of three required by ASTM D4633). Each table includes the test dates, boring location, rig type, sample depth, blow counts recorded typically for three consecutive 6-in. penetrations (where applicable), and the uncorrected N-value (sum of blow counts for the subsequent two 6-in. penetrations after the initial 6-in. seating blow).

Due to the sensitivity of the instruments, erroneous blow information (very low energy) is sometimes collected by the PDA computer during minor impact or vibration events from the hammer's subassembly or other hoisting devices on the rig. This data was identified and removed from the SPT test records so average energies are calculated based on the representative hammer blows during SPT testing.

Table 1: Summary of SPT Data Sets - *Skate 3* Jack-up Drilling Platform, Drill Rig Comacchio Model MC1200, Borehole MB-6, Hammer SPT-02

Test Date	Data Set No.	Boring Location	Sample Depth	Blow Counts per 6-in. and N-value*
09-17-15	1	MB-6	39.4 ft	3 / 4 / 8 / 12 N = 12
09-17-15	2	MB-6	59.1 ft	1 / 3 / 14 / 23 N = 17
09-17-15	3	MB-6	78.7 ft	6 / 17 / 29 / 43 N = 46
09-18-15	4	MB-6	104.9 ft	19 / 36 / 45 for 3.9-in. N = Refusal
09-18-15	5	MB-6	118.1 ft	50 for 5.5-in. N = Refusal
09-18-15	6	MB-6	137.8 ft	46 / 10 for 0.4-in. N = Refusal

Table 2: Summary of SPT Data Sets - *Skate 3* Jack-up Drilling Platform, Drill Rig Comacchio Model MC1200, Borehole MB-18, Hammer SPT-09

Test Date	Data Set No.	Boring Location	Sample Depth	Blow Counts per 6-in. and N-value*
09-19-15	1	MB-18	19.7 ft	6 / 39 / 50 for 4.7-in. N = Refusal
09-20-15	2	MB-18	39.4 ft	12 / 29 / 50 N = 79
09-20-15	3	MB-18	63.7 ft	16 / 33 / 44 N = 77
09-20-15	4	MB-18	83.3 ft	8 / 16 / 22 / 25 N = 38
09-21-15	5	MB-18	103.0 ft	20 / 41 / 39 N = 80
09-21-15	6	MB-18	120.4 ft	31 / 50 for 1.6-in. N = Refusal

* - Blow counts per 6-in. represent blow counts recorded typically for three consecutive 6-in. penetrations (where applicable), and N is the uncorrected sum of blow counts for the subsequent two 6-in. penetrations after the initial 6-in. seating blow.

Evaluation of SPT Energy

Test results were evaluated utilizing the F-V energy method described in ASTM D4633. The PDA computes EMX, the energy transferred to the rods as measured at the gage location using force, F(t), and velocity, v(t), by the following equation:

$$EMX = EFV = \int_a^b F(t) \cdot v(t)\, dt$$

The time “a” corresponds to the start of the record just before impact of the hammer and “b” is the time the energy transferred reaches a maximum value.

Discussion of SPT Calibration Results

Field Notes, and plots and tables prepared from the PDA data for each data set, at each of the boring locations, are presented in Attachments 2 and 3. Each PDA plot contains three main graphs. The left-hand graph shows CSX (maximum average compressive stress) and CSI (maximum individual gage stress) plotted versus blow number. Together these plots show the difference between the two force measurements. The center plot shows EMX (maximum energy) and ETR (energy transfer ratio which is EMX divided by theoretical hammer energy). These plots indicate the hammer efficiency and consistency during testing. The right-hand graph shows FMX (maximum force) and BPM (blows per minute) to give a relative hammer “operational performance” during testing. The tabulated output for each data set also includes statistical evaluations: average, maximum, minimum, and standard deviation.

To arrive at overall performance of each hammer tested, we used the average statistical evaluations from the data sets, shown in Tables 3 and 4. Notes on the operational performance of the hammers tested are provided in the Field Notes in Attachments 2 and 3.

The uncorrected N-values can be corrected using the following equations:

$$N_{60} = N_{measured} \times \text{Correction Factor}$$

$$N_{60} = N_{measured} \times (ETR/60\%)$$

An average of all the ETR values for each data set was used in the above equation to calculate an average correction factor. These correction factors may be applied to the uncorrected N-values from sampling intervals in these and other borings not tested with the PDA, provided the rig and hammer combinations are not modified, and are maintained in their current condition and operated in the same manner.

Table 3: Summary of SPT Results - *Skate 3* Jack-up Drilling Platform, Drill Rig Comacchio Model MC1200, Borehole MB-6, Hammer SPT-02

Data Set	BPM	FMX (kips)	EMX (kip-ft)	ETR (%)	$N_{measured}$	N_{60}
1	11.8	37.1	0.281	80.2	12	14
2	10.8	40.5	0.276	78.7	17	20
3	10.1	41.8	0.246	70.2	46	54
4	11.2	39.4	0.177	50.5	Refusal	Refusal
5	8.4	34.6	0.266	75.9	Refusal	Refusal
6	11.1	38.0	0.247	70.5	Refusal	Refusal
Average Overall Performance	10.6	38.6	0.249	71.0	**Correction Factor = 1.18**	

Table 4: Summary of SPT Results - *Skate 3* Jack-up Drilling Platform, Drill Rig Comacchio Model MC1200, Borehole MB-18, Hammer SPT-09

Data Set	BPM	FMX (kips)	EMX (kip-ft)	ETR (%)	$N_{measured}$	N_{60}
1	12.6	33.2	0.240	68.6	Refusal	Refusal
2	10.7	40.2	0.242	69.3	79	78
3	11.7	40.3	0.238	68.0	77	76
4	11.7	39.5	0.219	62.7	38	38
5	10.9	37.3	0.192	54.9	80	79
6	10.3	44.2	0.119	34.0	Refusal	Refusal
Average Overall Performance	11.3	39.1	0.208	59.6	**Correction Factor = 0.99**	

Conclusions

The SPT hammer calibration energy measurements for the two hammers (SPT-02 and SPT-09) on the *Skate 3* jack-up drilling platform using a Comacchio Model MC1200 hydraulic skid mounted drilling rig, are presented on Tables 3 and 4 above, which summarizes the average calculated transferred energies (EMX) in accordance with ASTM D4633. On average, the Energy Transfer Ratio (ETR) of the hammers was 71.0% and 59.6%, for the SPT-02 and SPT-09 hammers, respectively.

Attachments:

Attachment 1: Sensor Calibrations
Attachment 2: Field Notes, and Plots and Tables of PDA Data - *Skate 3* Jack-up Drilling Platform, Drill Rig Comacchio Model MC1200, Borehole MB-6, Hammer SPT-02
Attachment 3: Field Notes, and Plots and Tables of PDA Data - *Skate 3* Jack-up Drilling Platform, Drill Rig Comacchio Model MC1200, Borehole MB-18, Hammer SPT-09

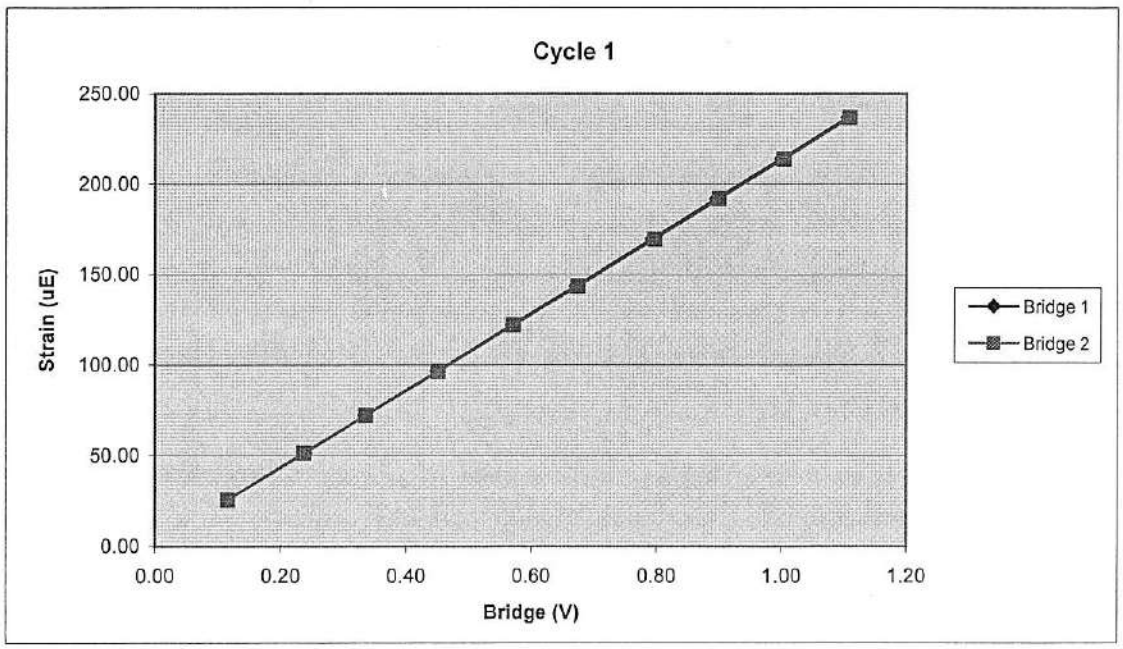
ATTACHMENT 1

Sensor Calibrations

333NWJ		Cycle 1		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	1038.93	25.63	0.12	0.12
3	2112.50	51.34	0.24	0.24
4	2998.51	72.10	0.34	0.34
5	4030.95	96.42	0.45	0.45
6	5109.63	121.88	0.57	0.57
7	6031.46	143.53	0.67	0.67
8	7140.85	169.65	0.79	0.80
9	8079.21	191.78	0.90	0.90
10	9034.10	214.09	1.00	1.00
11	9994.90	236.67	1.11	1.11

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**9062.28**	**Force Calibration (lb/V)**	**9020.00**
Offset	-38.24	Offset	-28.48
Correlation	0.999990	Correlation	0.999989
Strain Calibration (µE/V)	**213.39**	**Strain Calibration (µE/V)**	**212.39**
Offset	0.56	Offset	0.79
Correlation	0.999996	Correlation	0.999994

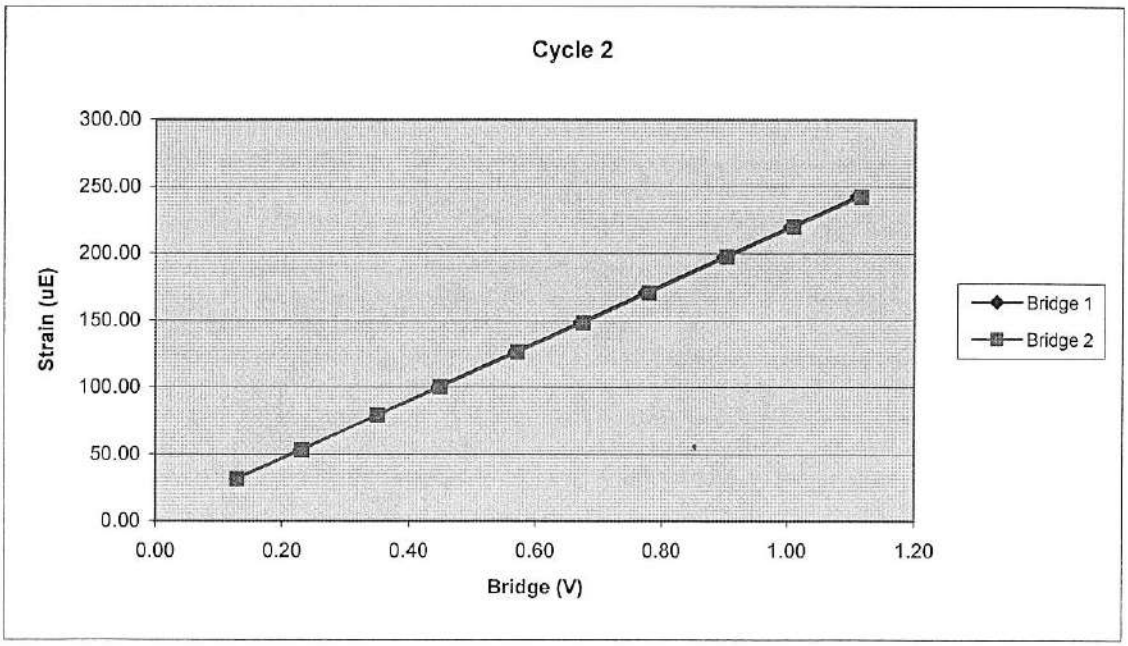
Force Strain Calibration	
EA (Kips)	**42468.92**
Offset	-61.97
Correlation	0.999998



333NWJ		Cycle 2		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	1138.32	31.42	0.13	0.13
3	2045.78	53.13	0.23	0.23
4	3129.98	79.01	0.35	0.35
5	4010.08	99.98	0.45	0.45
6	5118.68	126.12	0.57	0.57
7	6067.28	148.26	0.67	0.67
8	7005.84	170.48	0.77	0.78
9	8154.78	197.38	0.90	0.90
10	9110.07	219.90	1.00	1.01
11	10089.37	242.56	1.11	1.12

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**9123.54**	**Force Calibration (lb/V)**	**9074.39**
Offset	**-49.69**	Offset	**-53.66**
Correlation	**0.999993**	Correlation	**0.999988**
Strain Calibration (µE/V)	**215.17**	**Strain Calibration (µE/V)**	**214.02**
Offset	**3.89**	Offset	**3.79**
Correlation	**0.999998**	Correlation	**0.999998**

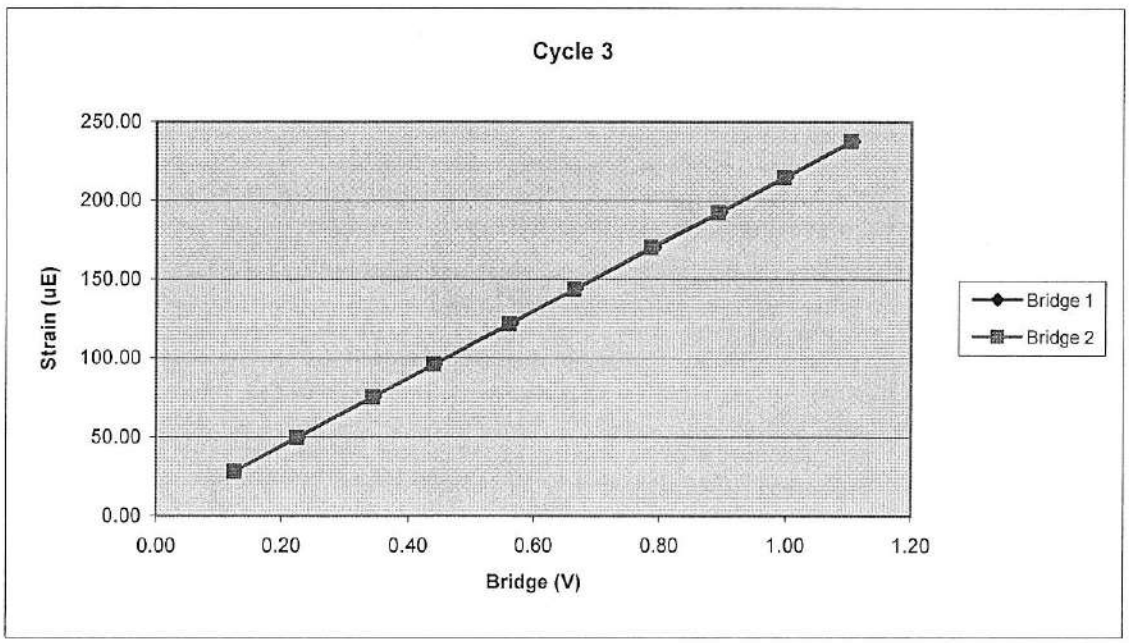
Force Strain Calibration	
EA (Kips)	**42400.74**
Offset	**-214.40**
Correlation	**0.999992**



333NWJ		Cycle 3		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	1125.52	28.24	0.13	0.12
3	2016.06	49.68	0.23	0.22
4	3101.05	75.29	0.35	0.34
5	3977.02	95.97	0.44	0.44
6	5073.81	121.83	0.56	0.56
7	6005.68	143.75	0.67	0.66
8	7133.76	170.21	0.79	0.79
9	8082.95	192.52	0.90	0.89
10	9043.75	214.97	1.00	1.00
11	10017.53	237.71	1.11	1.10

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**9067.17**	**Force Calibration (lb/V)**	**9087.50**
Offset	**-32.75**	Offset	**-17.10**
Correlation	**0.999991**	Correlation	**0.999996**
Strain Calibration (µE/V)	**213.44**	**Strain Calibration (µE/V)**	**213.91**
Offset	**1.42**	Offset	**1.79**
Correlation	**0.999998**	Correlation	**0.999998**

Force Strain Calibration	
EA (Kips)	**42481.93**
Offset	**-93.13**
Correlation	**0.999995**



Bridge Excitation (V)	5
Shunt Resitor (ohm)	60.4k

Calibration Factors	333NWJ		
Bridge 1 (µE/V)	214.00	Bridge 2 (µE/V)	213.44
EA Factor (Kips)	42450.53	Area (in^2)	1.42

Calibrated by: _____
Calibrated Date: 3/26/2013

Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.

QBTA: ON [ALT-F1/BB=60] Pile Dynamics, Inc. TG F2 DPF

Pile Dynamics
07-Jun-13 13:50

FS — 10 | BN 36 SL 53/ 3440/ 99 | PJ: sn PN: HOPBAR | A 4 F 2 | -- VS 3.3

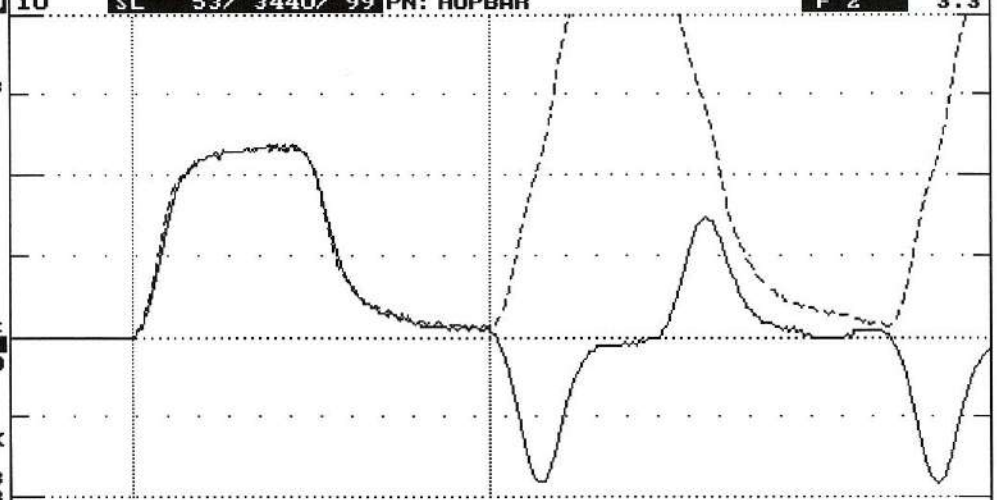
LE 39.6 ft
AR 1.7 in2
EM 30000 Ksi
SP 0.492 K/ft3
WS 16810 ft/s
WC 17043 ft/s

JC 0.40
FM 1.00
VM 1.00

EA/C 30.3 Ks/ft
UN KIPS*0.1
FR 20000 MB 30

DL -30
VT -1
PK 1 TM-PEAK

F1/2 500/ 213
F3/4 213/ 213
A1/2 999/ 999
A3/4 999/ 360



TS 12 E B PD: k1481 LP 0.00 ft
TB 8.0 T1 9.6 2L/C 4.7 VA 1000 VE 1022 LI 1.0

ACCEPT SQ-OFF FL-OFF PR-OFF

VMX= 3.9 FMX= 60 AMX= 149
EMX= 0.2 MEX= 117 FVP= 1.00

contact Pile Dynamics USA
with your questions
tel USA - 216 - 831- 6131
fax USA - 216 - 831- 0916

ACCELEROMETER CALIBRATION N.I.S.T. Traceable

SERIAL NUMBER: K1481 PR

CALIBRATION FACTOR: .072 mv/G

PAK (*5000): 360 DATE: 7-Jun-13

PDA OPERATOR: [signature]

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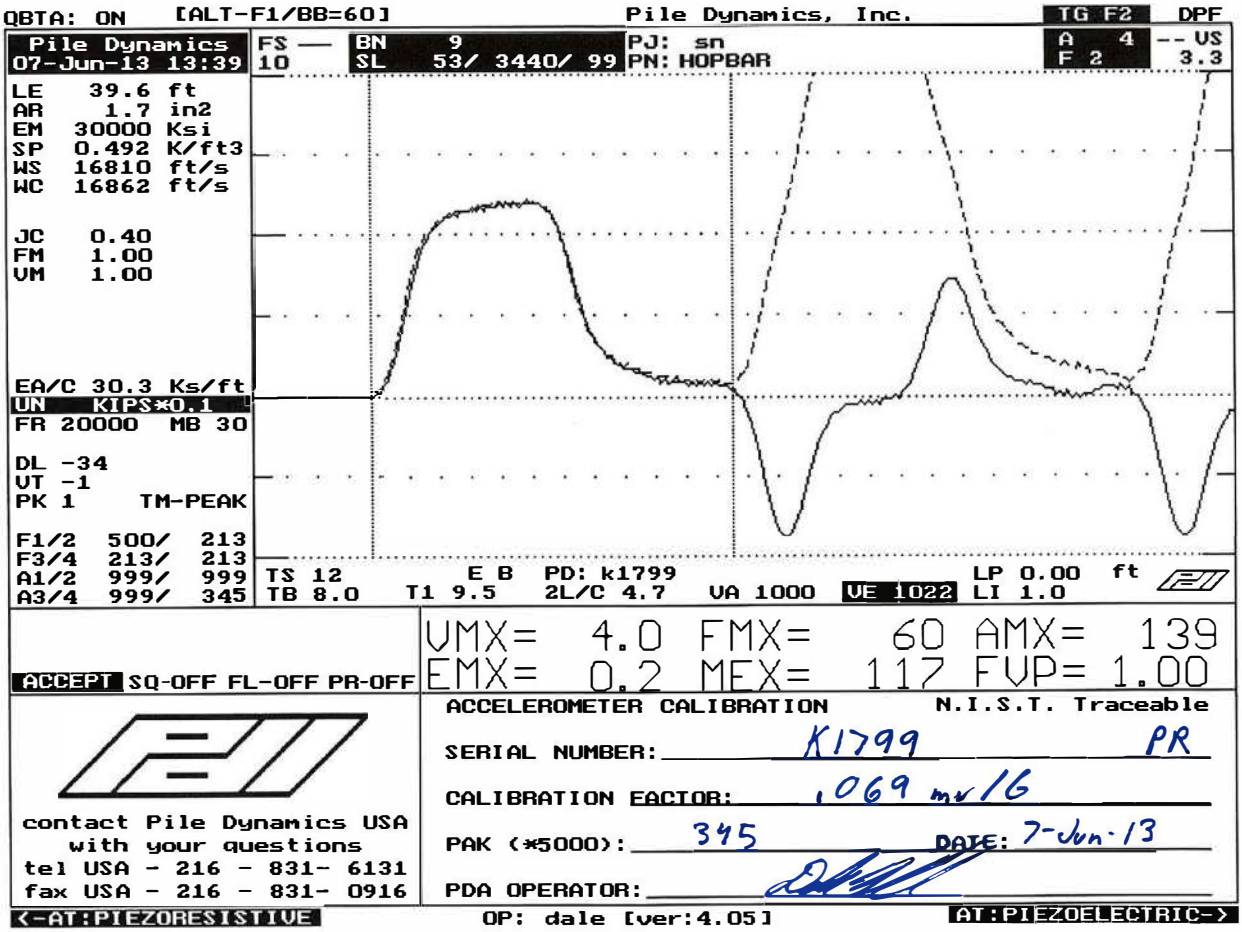
QBTA: ON [ALT-F1/BB=60]
Pile Dynamics, Inc.
TG F2 DPF
Pile Dynamics
07-Jun-13 13:39
FS 10
BN 9
SL 53/ 3440/ 99
PJ: sn
PN: HOPBAR
A 4
F 2
-- US
3.3
LE 39.6 ft
AR 1.7 in2
EM 30000 Ksi
SP 0.492 K/ft3
WS 16810 ft/s
WC 16862 ft/s
JC 0.40
FM 1.00
VM 1.00
EA/C 30.3 Ks/ft
UN KIPS*0.1
FR 20000 MB 30
DL -34
VT -1
PK 1 TM-PEAK
F1/2 500/ 213
F3/4 213/ 213
A1/2 999/ 999
A3/4 999/ 345
TS 12
TB 8.0
E B
T1 9.5
PD: k1799
2L/C 4.7
VA 1000
VE 1022
LP 0.00 ft
LI 1.0
ACCEPT SQ-OFF FL-OFF PR-OFF
VMX= 4.0 FMX= 60 AMX= 139
EMX= 0.2 MEX= 117 FVP= 1.00
contact Pile Dynamics USA
with your questions
tel USA - 216 - 831- 6131
fax USA - 216 - 831- 0916
ACCELEROMETER CALIBRATION
N.I.S.T. Traceable
SERIAL NUMBER: K1799 PR
CALIBRATION FACTOR: .069 mv/G
PAK (*5000): 345
DATE: 7-Jun-13
PDA OPERATOR:
<-AT:PIEZORESISTIVE
OP: dale [ver:4.05]
AT:PIEZOELECTRIC->
F1

ATTACHMENT 2

Field Notes, and Plots and Tables of PDA Data
Skate 3 Jack-up Drilling Platform, Drill Rig Comacchio Model MC1200
Borehole MB-6, Hammer SPT-02

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Ph: (713) 369-5400 F (713) 369-5518

Project #	04.10140334
Project Name	Alaska LNG Project
SPT Tester	J. Greenwald / A. Fee
Rig(s)	Skate 3A/Comacchio MC1200
Rig Operator(s)	Fugro Seacore
Test Date(s)	9/17/15 - 9/18/15

SPT ENERGY CALIBRATION

Rig and Hammer Description

Rig Model / Serial #	Skate 3A/Commacchio MC1200
Hammer Model / Serial #	SPT-02

Notes on Operational Performance

DS1: 12"Casing to 5.7 m, 7"Casing to 12 m, DTM= 19.9m, Test from 12-12.6m
DS2: 12" Casing to 9.9 m, 7"Casing to 18 m, DTM=19.1m, Test from 18-18.6m
DS3: 12"Casing to 4.9 m, 7" Casing to 19.5 m, Geobor(5.5") to 24 m, DTM=19.8 m, Test: 24-24.6m
DS4: 12" Casing to 4.2m, 7"Casing to 19.5m, Geobor(5.5") to 30 m, DTM=19.8 m, Test 30 - 30.4m
DS5: 12" Casing to 4.2m, 7"Casing to 19.5m, Geobor(5.5") to 36 m, DTM= 19.8 m, Test 36 - 36.14m
DS6: 12"Casing to 4.2m, 7" Casing to 19.5m, Geobor(5.5") to 42 m, DTM= 19.8 m, Test 42 - 42.16m

* DS4 to DS6 - Computer recorded more blows than counted, possibly due to hammer bouncing (?).

Instrumentation

Name:	333NWJ	Area = 1.42 in^2 = 9.16 cm^2
Strains*:	F1 / (F3): 333NWJ-1	Gage Factor = 214 με/V
	F2 / (F4): 333NWJ-2	Gage Factor = 213.44 με/V
Accelerometers*:	A1 / (A3) K1481	Gage Factor = 360 (mV/G x 5000)
	A2 / (A4) K1799	Gage Factor = 345 (mV/G x 5000)

*Circle utilized channel

Data Set 1 **Data File Name:** SKATE3A-SPT02-MB06-12m **Location:** MB-06 **Rig:** Skate3A **Date & Time:** 9/17/15 0900

Starting depth of sample = "LP"	12.0 m
List of rod sections from sampler to ~~instrument~~ hammer	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (11 x 3m) + 0.254 = 34.054m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731 m
Blows observed (uncorrected)	3-4-8-12
Offsets**: F1 / (F3) = -0.17 V F2 / (F4) = -0.3 V A1 / (A3) = -0.01 V A2 / (A4) = -0.01 V	
**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799	

Data Set 2 **Data File Name:** SKATE3A-SPT02-MB06-18m3 **Location:** MB-06 **Rig:** Skate3A **Date & Time:** 9/17/15 15:55

Starting depth of sample = "LP"	18.0m
List of rod sections from sampler to instrument	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (12 x 3m + 2 x 1.5m) + 0.254 = 40.054m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731 m
Blows observed (uncorrected)	1-3-14-23
Offsets**: F1 / (F3) = -0.17 V F2 / (F4) = -0.30 V A1 / (A3) = -0.01 V A2 / (A4) = 0.01 V	
**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799	

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Ph: (713) 369-5400 F (713) 369-5518

Project #	04.10140334
Project Name	Alaska LNG Project
SPT Tester	J. Greenwald / A. Fee
Rig(s)	Skate 3A
Rig Operator(s)	Fugro Seacore
Test Date(s)	9/17/15 - 9/18/15

SPT ENERGY CALIBRATION

Data Set 3 **Data File Name:** SKATE3A-SPT02-MB06-24m_5 **Location:** MB-06 **Rig:** Skate 3A **Date & Time:** 9/17/2015 2127

Starting depth of sample = "LP"	24.0m
List of rod sections from sampler to instrument	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (15x3m) + 0.254 = 46.054m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731 m
Blows observed (uncorrected)	6-17-29-43
Offsets**: F1 / F3 = -0.14V F2 / F4 = -0.27V A1 / A3 = -0.01V A2 / A4 = 0.01V	
**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799	

Data Set 4 **Data File Name:** SKATE3A-SPT02-MB06-30M **Location:** MB-06 **Rig:** SKATE3A **Date & Time:** 9/18/2015 0122

Starting depth of sample = "LP"	30.0m
List of rod sections from sampler to instrument	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (17x3m) + 0.254 = 52.054m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731
Blows observed (uncorrected)	19-36-45/10cm 40cm penetration
Offsets**: F1 / F3 = -0.17V F2 / F4 = -0.30V A1 / A3 = -0.01V A2 / A4 = 0.01V	
**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799	

Data Set 5 **Data File Name:** SKATE3A-SPT02-MB06-36M **Location:** MB-06 **Rig:** SKATE 3A **Date & Time:** 9/18/15 0421

Starting depth of sample = "LP"	36.0m
List of rod sections from sampler to instrument	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (19x3m) + 0.254 = 58.054m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731
Blows observed (uncorrected)	50/14cm
Offsets**: F1 / F3 = -0.18V F2 / F4 = -0.30V A1 / A3 = -0.01V A2 / A4 = 0.01V	
**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799	

Data Set 6 **Data File Name:** SKATE3A-SPT02-MB06-42M **Location:** MB-06 **Rig:** Skate 3A **Date & Time:** 9/18/15 0855

Starting depth of sample = "LP"	42.0m
List of rod sections from sampler to instrument	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (21x 3m) + 0.254 = 64.054
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731
Blows observed (uncorrected)	46 - 10/1cm
Offsets**: F1 / F3 = -0.26V F2 / F4 = -0.30V A1 / A3 = -0.01V A2 / A4 = 0.01V	
**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799	

* Blows recorded on log different than SPT Cal Form for DS6. We essentially had 50/15cm in first interval, but hit [LP] button after 46 blows.

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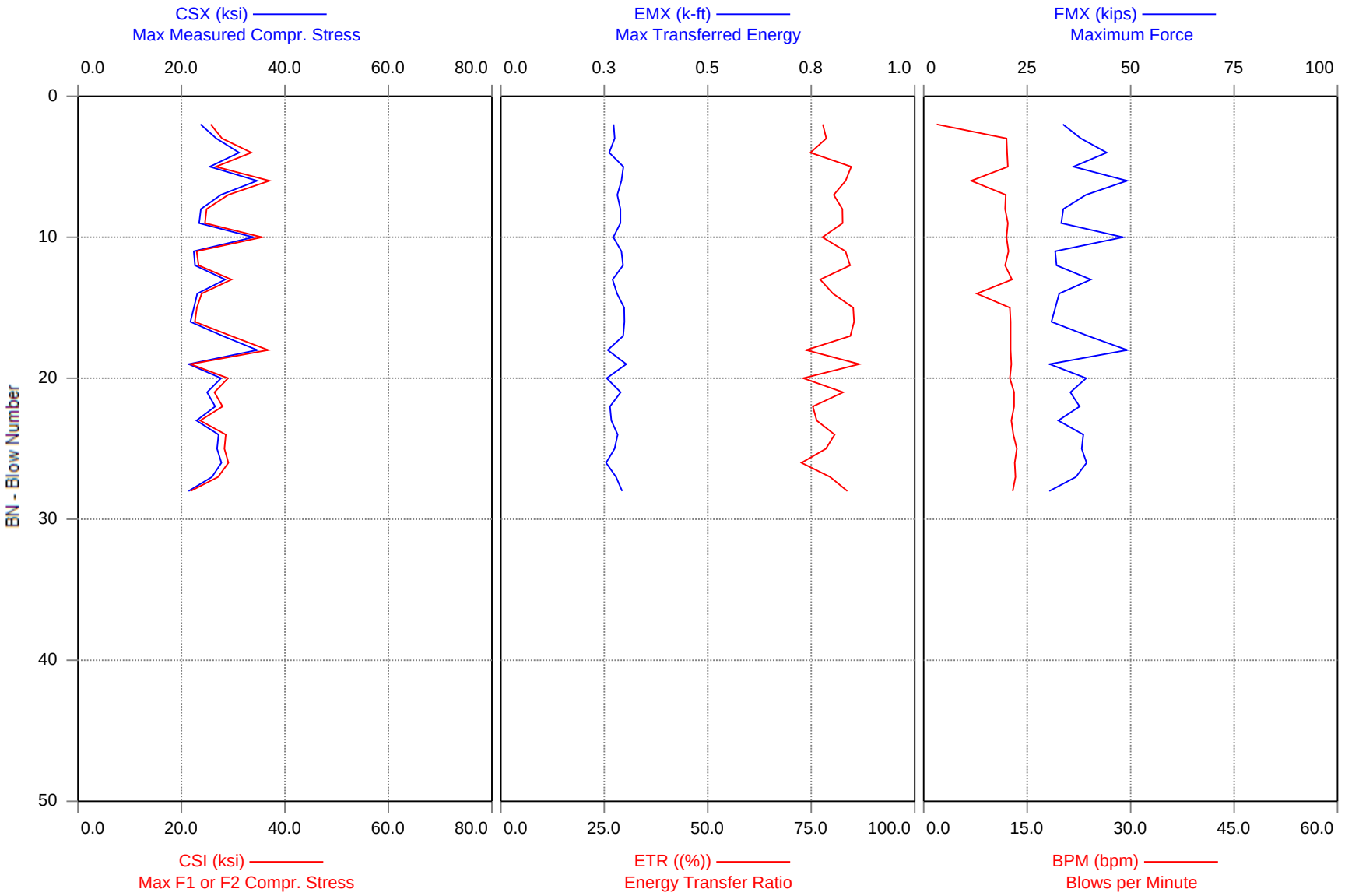
Printed: 18-November-2015 Test started: 17-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 39.37-ft (12m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 39.37-ft (12m)
OP: JG

MB06 - 39.37-ft (12m)
Date: 17-September-2015

AR: 1.42 in²
LE: 111.73 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
2	39.54	5	23.7	25.6	0.272	77.8	33.6	1.9	14.0	108.3	789
3	39.70	5	26.7	27.9	0.275	78.6	38.0	12.0	11.6	104.2	891
4	39.87	5	31.1	33.5	0.262	74.8	44.2	12.1	14.5	107.5	1,038
5	39.87	20,833	25.5	26.7	0.296	84.7	36.2	12.2	11.2	104.7	849
6	39.87	20,833	34.6	37.0	0.292	83.3	49.1	6.9	16.0	107.0	1,153
7	40.12	3	27.6	29.0	0.282	80.4	39.2	11.9	12.8	105.1	920
8	40.37	3	23.8	24.9	0.289	82.5	33.7	11.8	12.1	104.7	792
9	40.37	10,417	23.4	24.6	0.289	82.6	33.2	12.2	12.1	104.9	780
10	40.44	11	33.9	35.5	0.272	77.7	48.1	12.0	16.4	104.9	1,130
11	40.51	11	22.4	22.9	0.291	83.3	31.8	12.3	12.0	102.4	746
12	40.58	11	22.6	23.3	0.295	84.4	32.1	11.8	12.2	103.1	754
13	40.66	11	28.4	29.7	0.270	77.2	40.4	12.8	13.8	104.3	948
14	40.73	11	23.0	23.9	0.281	80.3	32.7	7.7	12.1	103.7	768
15	40.80	11	22.4	23.0	0.298	85.1	31.8	12.5	13.0	102.6	747
16	40.87	11	21.7	22.6	0.299	85.3	30.9	12.6	12.4	103.9	724
17	40.87	10,417	28.0	29.6	0.296	84.5	39.7	12.6	14.0	105.9	933
18	40.92	18	34.6	36.8	0.258	73.8	49.2	12.6	16.6	106.1	1,154
19	40.96	18	21.4	21.8	0.303	86.6	30.4	12.7	13.0	101.6	714
20	41.01	18	27.7	29.0	0.256	73.1	39.3	12.5	13.8	104.8	922
21	41.05	18	25.0	26.4	0.289	82.7	35.4	13.1	13.5	105.7	832
22	41.10	18	26.5	27.9	0.264	75.4	37.7	13.1	14.4	105.3	884
23	41.14	18	22.9	23.6	0.267	76.3	32.5	12.7	13.0	103.2	764
24	41.19	18	27.2	28.6	0.282	80.7	38.6	13.0	13.8	105.2	906
25	41.23	18	26.9	28.3	0.275	78.5	38.2	13.5	13.8	105.3	896
26	41.28	18	27.7	29.1	0.254	72.6	39.4	13.2	13.5	104.9	924
27	41.32	18	25.9	27.1	0.278	79.6	36.8	13.3	13.7	104.6	863
28	41.37	18	21.4	21.8	0.293	83.7	30.4	12.9	13.4	101.8	712
		Average	26.1	27.4	0.281	80.2	37.1	11.8	13.4	104.7	872
		Std. Dev.	3.8	4.3	0.014	4.0	5.4	2.4	1.3	1.6	127

Total number of blows analyzed: 27

BL# Sensors

1-1 F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)
2-28 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

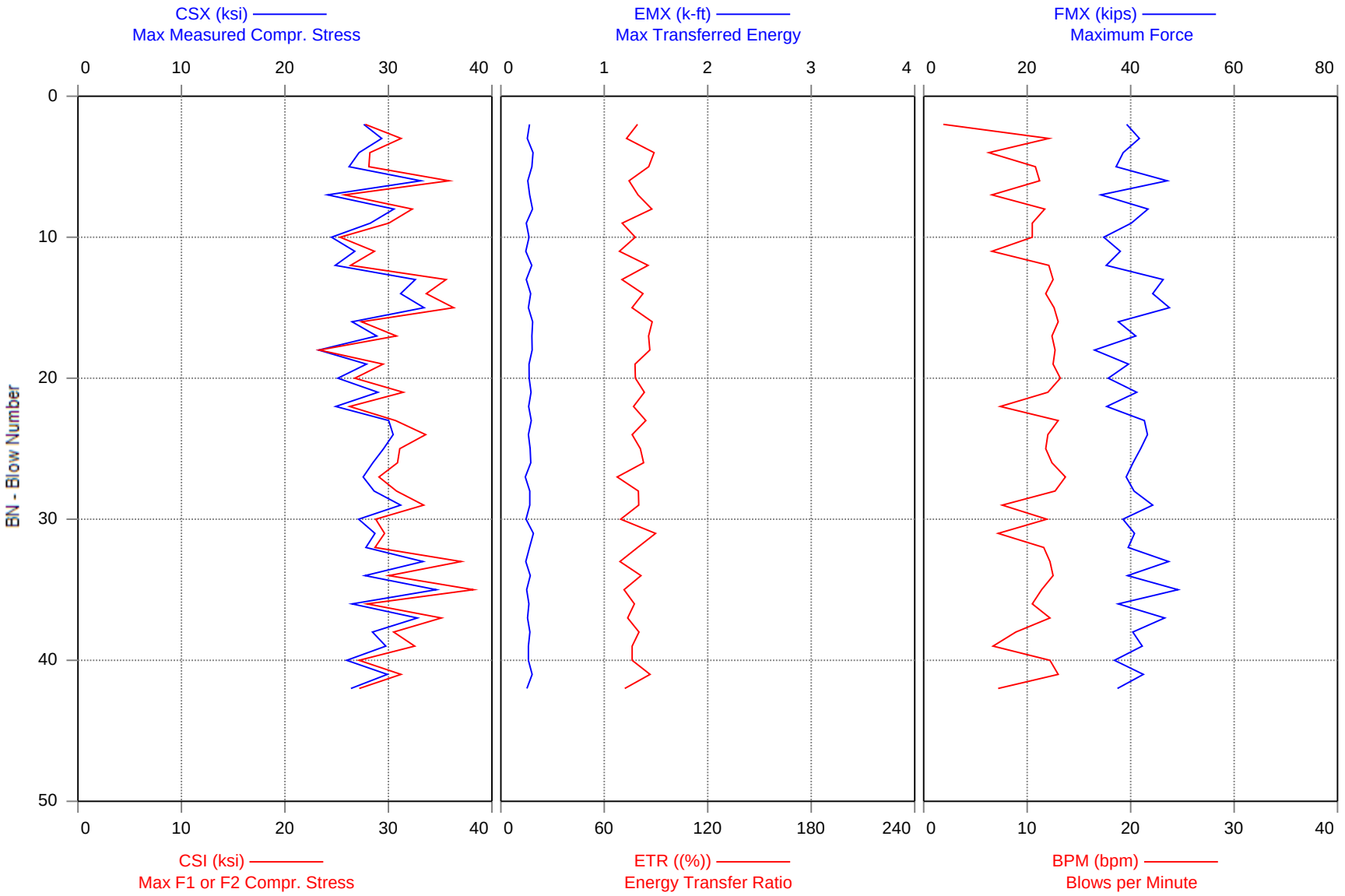
Time Summary

Drive 2 minutes 27 seconds 11:52 AM - 11:54 AM BN 1 - 28

GRL Engineers, Inc. - Seminar - PDIPLOT2 Ver 2015.1.50.1 - Case Method & iCAP® Results

Printed: 18-November-2015 Test started: 17-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 59.06-ft (18m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 59.06-ft (18m)
OP: JG

MB06 - 59.06-ft (18m)
Date: 17-September-2015

AR: 1.42 in²
LE: 131.41 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
2	59.06	168	27.6	27.8	0.277	79.3	39.2	1.9	12.8	100.5	921
3	59.56	2	29.4	31.2	0.255	72.9	41.7	12.1	14.2	106.4	979
4	59.56	336	27.2	28.2	0.311	88.8	38.6	6.3	13.4	103.8	905
5	59.56	336	26.2	28.1	0.300	85.8	37.2	10.8	12.8	107.3	873
6	59.81	3	33.1	35.8	0.260	74.4	47.0	11.2	15.9	108.2	1,104
7	60.06	3	24.1	25.8	0.278	79.5	34.3	6.6	12.9	106.8	804
8	60.06	2,016	30.5	32.3	0.306	87.5	43.4	11.7	15.7	105.8	1,018
9	60.06	2,016	28.3	30.0	0.246	70.3	40.1	10.5	13.6	106.3	942
10	60.06	2,016	24.5	25.3	0.273	77.9	34.8	10.5	12.6	103.3	817
11	60.06	2,016	26.8	28.7	0.241	68.8	38.0	6.6	14.3	107.1	892
12	60.06	2,016	24.9	26.3	0.299	85.4	35.3	12.1	12.9	106.0	829
13	60.06	2,016	32.6	35.6	0.246	70.2	46.3	12.5	15.2	109.1	1,087
14	60.06	2,016	31.2	33.7	0.288	82.4	44.3	11.8	16.2	108.0	1,039
15	60.06	2,016	33.4	36.3	0.266	76.1	47.5	12.6	16.1	108.6	1,115
16	60.06	2,016	26.5	27.4	0.307	87.8	37.6	13.0	13.0	103.4	883
17	60.06	2,016	28.9	30.8	0.300	85.7	41.0	12.4	15.2	106.6	963
18	60.06	2,016	23.3	23.3	0.302	86.4	33.0	12.7	12.9	100.2	775
19	60.06	2,016	27.9	29.5	0.272	77.8	39.6	12.5	15.1	105.7	930
20	60.31	3	25.1	26.8	0.273	78.0	35.7	13.2	13.6	106.5	837
21	60.56	3	29.0	31.4	0.291	83.2	41.2	12.0	15.5	108.4	967
22	60.58	34	24.9	26.3	0.269	76.9	35.4	7.4	13.2	105.4	830
23	60.60	34	30.0	30.7	0.294	84.1	42.6	13.0	15.9	102.2	1,001
24	60.63	34	30.5	33.6	0.266	76.1	43.3	12.0	15.6	110.3	1,015
25	60.65	34	29.5	31.1	0.283	80.9	41.9	11.8	16.3	105.3	984
26	60.68	34	28.5	30.9	0.290	82.8	40.5	12.4	15.0	108.3	950
27	60.70	34	27.6	29.1	0.236	67.5	39.1	13.7	13.3	105.5	919
28	60.72	34	28.6	30.8	0.279	79.7	40.6	12.7	15.0	107.6	954
29	60.75	34	31.2	33.4	0.280	80.0	44.3	7.6	15.2	107.2	1,039
30	60.77	34	27.1	28.8	0.243	69.5	38.5	11.9	13.8	106.1	904
31	60.80	34	28.7	29.6	0.314	89.7	40.8	7.2	14.9	103.2	957
32	60.82	34	27.8	28.7	0.278	79.3	39.5	11.6	15.8	103.1	928
33	60.84	34	33.3	37.0	0.242	69.1	47.3	12.2	15.4	111.1	1,111
34	60.87	34	27.7	30.1	0.284	81.2	39.4	12.5	14.6	108.3	925
35	60.89	34	34.6	38.2	0.250	71.5	49.2	11.4	15.8	110.4	1,154
36	60.92	34	26.5	27.9	0.271	77.4	37.6	10.5	14.3	105.5	883
37	60.94	34	32.8	35.1	0.258	73.6	46.6	12.2	15.3	107.1	1,093
38	60.96	34	28.5	30.5	0.280	80.1	40.4	8.9	14.7	107.2	949
39	60.99	34	29.8	32.5	0.267	76.2	42.2	6.7	14.9	109.4	992
40	61.01	34	26.0	27.2	0.267	76.2	36.9	12.2	12.8	104.6	866
41	61.04	34	29.9	31.2	0.303	86.6	42.5	13.0	14.1	104.4	997
42	61.06	34	26.4	27.2	0.252	71.9	37.5	7.2	12.3	103.1	879
		Average	28.5	30.3	0.276	78.7	40.5	10.8	14.4	106.2	951
		Std. Dev.	2.7	3.4	0.021	6.1	3.9	2.6	1.2	2.5	91

Total number of blows analyzed: 41

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 59.06-ft (18m) MB06 - 59.06-ft (18m)
OP: JG Date: 17-September-2015

BL# Sensors

1-1 F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)
2-42 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

Time Summary

Drive 3 minutes 59 seconds 6:47 PM - 6:51 PM BN 1 - 42

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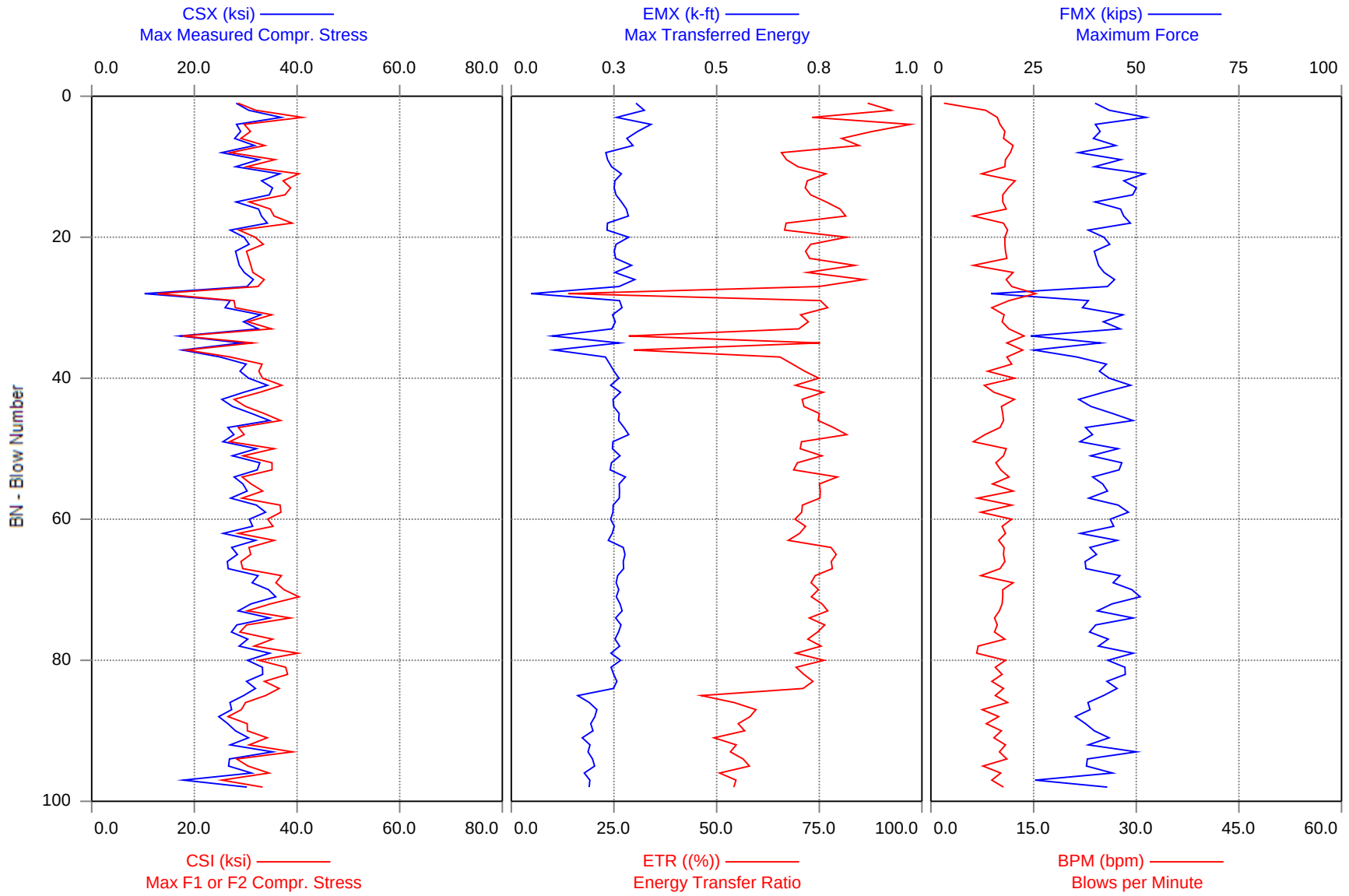
Printed: 18-November-2015 Test started: 18-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 78.74-ft (24m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 78.74-ft (24m)
OP: AF

MB06 - 78.74-ft (24m)
Date: 18-September-2015

AR: 1.42 in²
LE: 151.10 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
1	78.74	8	28.1	28.5	0.304	86.8	40.0	1.9	13.5	101.3	938
2	78.84	8	30.6	32.0	0.324	92.5	43.5	8.0	14.6	104.5	1,020
3	78.94	8	36.9	41.0	0.257	73.3	52.4	9.7	15.6	111.2	1,230
4	79.04	8	28.2	29.7	0.340	97.2	40.1	10.1	13.4	105.3	941
5	79.14	8	29.0	30.9	0.308	87.9	41.2	10.8	13.8	106.5	968
6	79.24	8	27.9	29.1	0.282	80.4	39.6	10.6	14.3	104.4	929
7	79.27	30	31.7	33.7	0.296	84.7	45.0	12.0	15.3	106.3	1,057
8	79.30	30	25.3	27.0	0.230	65.8	35.9	11.6	12.2	106.5	843
9	79.32	30	32.6	35.7	0.234	67.0	46.3	10.9	14.8	109.6	1,086
10	79.35	30	28.0	30.2	0.244	69.8	39.8	10.8	13.3	107.7	935
11	79.38	30	36.6	40.4	0.268	76.6	52.0	7.4	17.5	110.1	1,221
12	79.41	30	33.1	37.3	0.252	72.1	47.0	12.3	15.2	112.7	1,103
13	79.43	30	35.2	38.7	0.251	71.6	50.0	11.3	15.6	110.0	1,174
14	79.46	30	34.6	37.7	0.255	72.9	49.1	10.5	16.9	108.8	1,153
15	79.49	30	28.1	30.7	0.268	76.7	40.0	10.5	14.1	109.1	938
16	79.52	30	32.5	34.8	0.280	80.1	46.2	11.0	16.5	107.0	1,084
17	79.55	30	33.1	35.5	0.285	81.4	46.9	6.2	16.6	107.4	1,102
18	79.57	30	34.2	39.0	0.234	66.9	48.6	10.6	15.7	114.2	1,140
19	79.60	30	27.0	28.7	0.233	66.6	38.3	11.2	14.3	106.4	900
20	79.63	30	29.7	31.8	0.286	81.7	42.1	10.8	15.5	107.3	989
21	79.66	30	30.7	33.4	0.255	72.9	43.6	10.8	15.5	109.0	1,022
22	79.68	30	28.0	30.2	0.251	71.7	39.8	10.9	14.1	107.6	934
23	79.71	30	28.4	30.6	0.254	72.6	40.3	11.1	14.3	107.8	946
24	79.74	30	28.7	31.0	0.293	83.7	40.8	6.2	14.7	107.8	958
25	79.76	48	29.7	31.4	0.252	72.1	42.2	12.0	14.9	105.7	990
26	79.77	48	31.5	33.6	0.301	85.9	44.7	11.0	16.0	106.7	1,050
27	79.79	48	30.3	32.4	0.262	74.9	43.0	11.8	15.5	107.0	1,010
28	79.81	48	10.3	12.9	0.049	13.9	14.7	15.3	6.2	124.7	344
29	79.83	48	27.0	27.7	0.263	75.3	38.3	11.4	15.1	102.8	899
30	79.84	48	26.0	28.0	0.270	77.0	36.9	8.9	14.0	107.6	867
31	79.86	48	32.9	35.1	0.247	70.4	46.7	10.7	15.9	106.6	1,097
32	79.88	48	29.6	30.4	0.253	72.3	42.0	10.4	14.9	102.8	986
33	79.90	48	32.5	35.1	0.245	70.0	46.1	11.4	14.5	108.0	1,082
34	79.91	48	17.2	17.7	0.100	28.6	24.4	13.6	8.7	103.2	572
35	79.93	48	29.1	31.4	0.263	75.1	41.3	11.1	14.5	107.8	970
36	79.95	48	17.7	18.5	0.104	29.8	25.1	13.4	9.9	104.8	589
37	79.96	48	25.1	27.0	0.229	65.5	35.6	11.1	12.4	107.8	835
38	79.98	48	30.1	33.2	0.240	68.5	42.7	11.8	15.1	110.3	1,003
39	80.00	48	28.9	32.6	0.250	71.4	41.0	8.3	14.8	112.7	963
40	80.02	48	30.6	33.3	0.262	74.9	43.4	12.2	16.0	108.9	1,019
41	80.03	48	34.3	37.1	0.242	69.2	48.6	7.8	15.5	108.2	1,142
42	80.05	48	29.6	32.8	0.266	76.0	42.1	9.2	15.1	110.6	988
43	80.07	48	25.3	27.8	0.248	70.8	36.0	12.2	13.4	109.6	845
44	80.08	48	27.5	30.0	0.249	71.3	39.0	10.3	14.4	109.2	915
45	80.10	48	31.1	33.5	0.262	75.0	44.2	10.5	16.0	107.7	1,038

GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 78.74-ft (24m)
OP: AF

MB06 - 78.74-ft (24m)
Date: 18-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
46	80.12	48	34.6	36.8	0.262	74.7	49.2	10.6	19.8	106.3	1,155
47	80.14	48	26.5	28.6	0.275	78.5	37.7	10.1	14.3	107.8	884
48	80.15	48	27.7	29.7	0.286	81.7	39.4	7.9	15.3	107.2	924
49	80.17	48	25.6	26.9	0.247	70.7	36.3	6.2	14.7	105.2	852
50	80.19	48	32.1	35.5	0.246	70.4	45.6	11.0	14.9	110.8	1,069
51	80.21	48	27.4	29.5	0.265	75.6	38.9	10.6	15.9	107.7	914
52	80.22	48	32.7	35.1	0.244	69.7	46.5	9.5	15.3	107.3	1,092
53	80.24	48	32.3	35.1	0.241	68.8	45.8	10.2	15.0	108.9	1,075
54	80.25	74	27.7	29.3	0.278	79.4	39.4	11.4	14.8	105.6	925
55	80.26	74	29.5	31.1	0.263	75.0	41.8	9.0	14.6	105.5	982
56	80.27	74	30.3	33.3	0.263	75.3	43.0	12.0	15.3	110.0	1,009
57	80.28	74	27.1	29.3	0.263	75.1	38.4	6.8	13.4	108.3	903
58	80.30	74	32.1	36.7	0.248	70.9	45.6	11.8	15.5	114.4	1,070
59	80.31	74	33.9	36.8	0.247	70.7	48.1	7.3	16.8	108.8	1,129
60	80.32	74	30.7	34.3	0.242	69.1	43.7	11.8	15.2	111.5	1,025
61	80.33	74	31.3	35.3	0.251	71.7	44.5	10.4	15.3	112.8	1,045
62	80.34	74	25.6	28.6	0.246	70.2	36.4	10.9	12.8	111.6	854
63	80.35	74	31.9	35.6	0.236	67.5	45.4	9.9	15.4	111.3	1,065
64	80.36	74	27.3	30.6	0.273	77.9	38.7	10.7	13.9	112.4	909
65	80.37	74	28.4	31.0	0.277	79.1	40.3	10.6	14.7	109.1	947
66	80.38	74	26.4	29.1	0.273	77.9	37.5	10.8	13.3	110.0	881
67	80.40	74	26.6	29.4	0.274	78.2	37.8	10.1	13.8	110.7	886
68	80.41	74	32.4	37.0	0.259	74.0	46.0	7.3	15.1	114.0	1,080
69	80.42	74	31.2	35.9	0.255	73.0	44.4	12.0	15.7	114.9	1,042
70	80.43	74	34.5	37.5	0.262	74.8	48.9	10.5	16.8	108.7	1,149
71	80.44	74	35.9	40.4	0.256	73.0	50.9	10.5	17.0	112.5	1,196
72	80.45	74	31.0	34.8	0.265	75.7	44.1	10.4	15.6	112.2	1,035
73	80.46	74	28.6	30.3	0.270	77.1	40.5	10.0	15.4	106.3	952
74	80.47	74	34.7	38.7	0.254	72.6	49.2	9.3	17.2	111.6	1,155
75	80.48	74	28.3	30.2	0.267	76.3	40.1	9.7	14.7	106.8	942
76	80.50	74	27.2	28.9	0.261	74.6	38.6	9.3	14.5	106.1	907
77	80.51	74	30.4	35.2	0.253	72.2	43.2	10.8	15.3	115.9	1,013
78	80.52	74	28.7	31.7	0.264	75.4	40.8	6.9	15.4	110.2	957
79	80.53	74	34.7	40.2	0.243	69.3	49.2	6.7	15.9	115.9	1,156
80	80.54	74	30.4	32.6	0.266	76.1	43.1	10.9	15.2	107.4	1,012
81	80.55	74	33.3	37.8	0.243	69.4	47.2	9.4	16.5	113.6	1,109
82	80.56	74	33.3	38.2	0.249	71.2	47.3	10.4	15.9	114.5	1,111
83	80.57	74	30.2	33.7	0.257	73.5	42.8	8.9	15.5	111.6	1,005
84	80.58	74	31.9	36.5	0.249	71.1	45.3	10.6	15.9	114.4	1,064
85	80.60	74	29.6	33.9	0.162	46.2	42.0	9.4	15.7	114.4	987
86	80.61	74	26.9	30.0	0.190	54.3	38.2	11.2	15.0	111.3	898
87	80.62	74	27.3	29.2	0.208	59.6	38.7	7.5	14.6	106.9	909
88	80.63	74	24.8	26.6	0.203	58.1	35.2	9.9	13.8	107.4	825
89	80.64	74	26.5	30.3	0.193	55.3	37.7	8.1	15.2	114.3	884
90	80.65	74	28.0	30.3	0.199	56.8	39.8	10.3	15.4	108.3	934
91	80.66	74	30.5	34.2	0.173	49.4	43.4	9.2	15.2	111.9	1,018
92	80.67	74	27.0	30.7	0.192	54.8	38.3	10.9	15.4	113.6	900
93	80.68	74	35.3	39.1	0.187	53.3	50.1	10.0	16.7	111.0	1,176
94	80.70	74	26.8	28.2	0.198	56.4	38.1	11.1	14.7	105.3	894
95	80.71	74	26.7	30.5	0.203	58.0	37.9	7.6	16.6	114.2	889
96	80.72	74	31.1	34.5	0.178	50.7	44.2	10.2	16.1	110.9	1,038
97	80.73	74	17.9	25.4	0.191	54.7	25.4	8.9	13.7	141.9	596
98	80.74	74	30.2	33.3	0.190	54.2	42.9	10.6	16.4	110.0	1,008

GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 78.74-ft (24m)
OP: AF

MB06 - 78.74-ft (24m)
Date: 18-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
		Average	29.5	32.3	0.246	70.2	41.8	10.1	14.9	109.6	982
		Std. Dev.	4.1	4.6	0.043	12.1	5.8	1.8	1.7	4.8	136

Total number of blows analyzed: 98

BL# Sensors

1-98 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

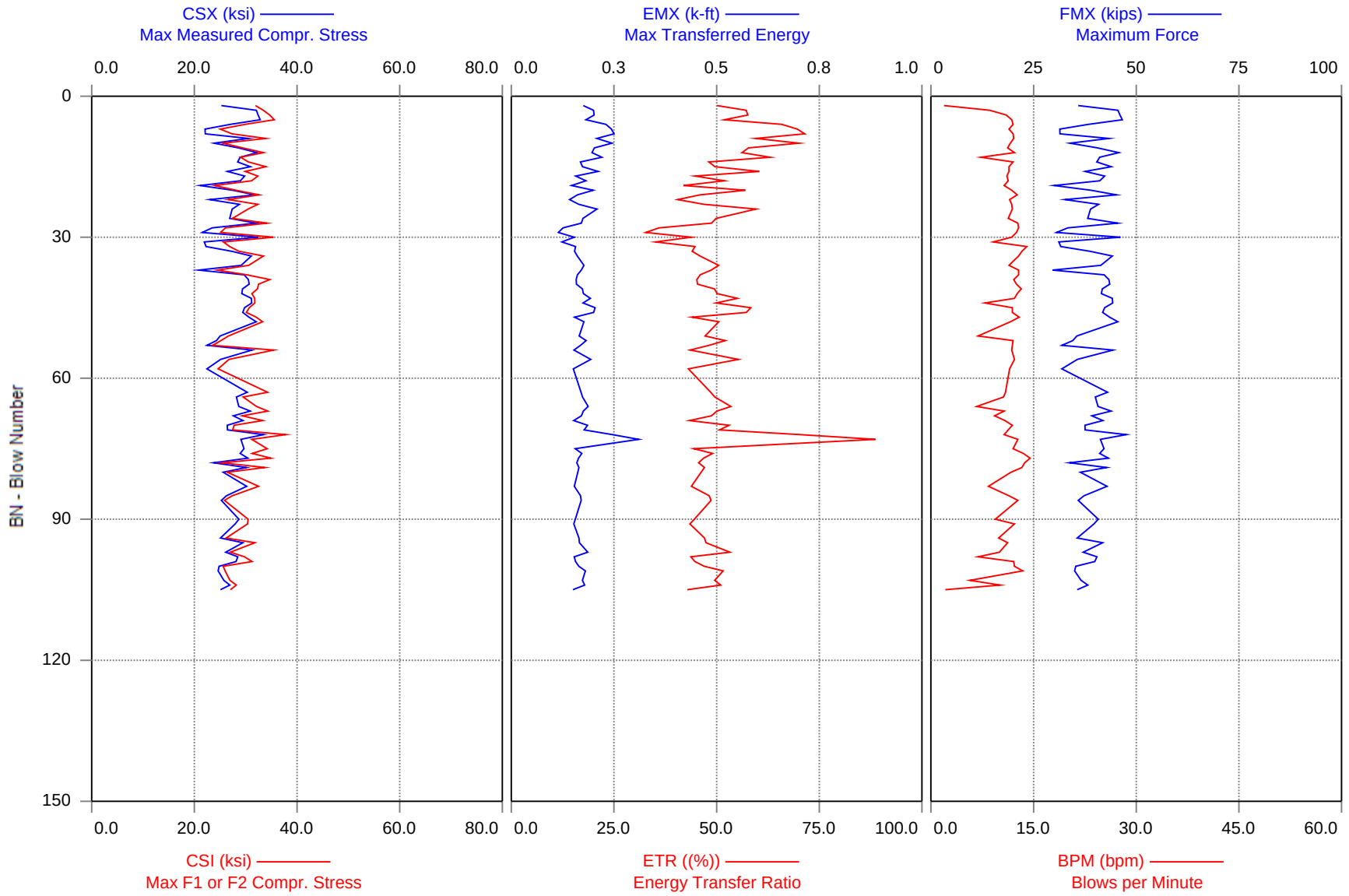
Time Summary

Drive 9 minutes 48 seconds 12:28 AM - 12:38 AM BN 1 - 98

GRL Engineers, Inc. - Seminar - PDIPLOT2 Ver 2015.1.50.1 - Case Method & iCAP® Results

Printed: 18-November-2015 Test started: 18-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 104.99-ft (30m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 104.99-ft (30m)
OP: AF

MB06 - 104.99-ft (30m)
Date: 18-September-2015

AR: 1.42 in²
LE: 170.78 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
2	105.02	33	25.3	31.9	0.175	50.1	35.9	1.9	13.7	126.3	842
3	105.04	33	32.1	33.4	0.200	57.2	45.6	8.6	14.0	104.2	1,069
4	105.07	33	32.4	34.7	0.202	57.6	46.0	11.0	14.6	107.0	1,080
5	105.09	33	32.8	35.6	0.182	51.9	46.6	11.8	14.8	108.4	1,094
6	105.12	33	27.0	29.9	0.231	65.9	38.3	12.0	14.3	110.7	900
7	105.14	33	22.1	25.0	0.244	69.6	31.4	11.4	12.0	113.3	736
8	105.17	33	22.1	27.3	0.250	71.5	31.4	12.0	12.8	123.4	738
9	105.19	33	30.5	33.9	0.208	59.5	43.3	12.1	15.6	111.1	1,017
10	105.22	33	23.8	25.6	0.245	70.0	33.9	11.6	12.2	107.4	795
11	105.24	33	28.6	29.4	0.202	57.7	40.6	11.2	14.1	102.9	953
12	105.27	33	32.2	33.5	0.197	56.2	45.7	12.2	15.1	103.9	1,074
13	105.29	33	28.9	29.0	0.221	63.0	41.1	7.3	14.1	100.2	964
14	105.32	33	28.4	30.5	0.168	48.1	40.4	12.0	14.0	107.4	948
15	105.34	33	30.9	33.9	0.174	49.6	43.9	11.4	14.4	109.7	1,031
16	105.37	33	26.5	29.9	0.211	60.4	37.6	11.4	14.9	113.1	882
17	105.39	33	29.8	32.4	0.157	44.8	42.3	11.1	14.0	108.6	993
18	105.42	33	29.0	31.2	0.182	51.9	41.1	11.3	14.3	107.6	965
19	105.44	33	21.1	23.9	0.147	41.9	30.0	10.7	12.1	113.3	704
20	105.47	33	27.4	28.1	0.199	57.0	39.0	11.8	13.7	102.4	915
21	105.49	33	31.8	32.6	0.161	46.0	45.2	12.6	15.0	102.6	1,060
22	105.50	66	23.0	26.6	0.142	40.5	32.7	11.5	12.6	115.5	767
23	105.52	66	28.8	32.4	0.164	46.9	40.9	11.8	14.3	112.5	959
24	105.53	66	27.4	30.5	0.209	59.6	38.9	11.9	13.1	111.3	912
26	105.55	66	26.9	27.4	0.174	49.9	38.2	11.3	12.9	101.9	896
27	105.57	66	32.0	34.2	0.171	48.8	45.5	12.7	14.7	106.6	1,067
28	105.58	66	23.5	26.1	0.126	35.9	33.3	12.8	11.9	111.0	782
29	105.59	66	21.5	25.1	0.115	32.7	30.6	12.5	11.4	116.5	718
30	105.60	66	32.5	35.4	0.153	43.8	46.1	11.8	14.6	109.0	1,083
31	105.62	66	21.9	25.6	0.123	35.2	31.1	9.1	11.9	116.9	731
32	105.63	66	22.3	26.9	0.157	44.7	31.6	14.0	12.3	120.7	742
33	105.64	66	27.3	28.7	0.154	44.0	38.7	13.3	13.0	105.1	909
34	105.65	66	31.1	33.4	0.161	46.0	44.2	12.8	14.6	107.5	1,037
36	105.68	66	29.1	30.6	0.177	50.5	41.4	11.4	13.7	105.0	971
37	105.69	66	20.9	24.5	0.170	48.7	29.6	12.8	11.9	117.5	695
38	105.70	66	29.7	30.2	0.161	46.0	42.2	12.8	14.1	101.7	990
39	105.72	66	30.5	34.7	0.158	45.2	43.3	12.1	14.8	113.7	1,017
40	105.73	66	30.7	32.5	0.159	45.3	43.5	12.5	13.9	106.1	1,022
41	105.74	66	29.4	32.3	0.173	49.5	41.7	13.2	14.2	109.9	979
42	105.75	66	29.2	31.2	0.175	50.1	41.5	12.6	13.8	106.7	974
43	105.77	66	31.1	31.8	0.193	55.0	44.2	12.2	14.1	102.1	1,037
44	105.78	66	31.2	31.8	0.175	49.9	44.3	7.9	14.0	102.0	1,039
45	105.79	66	29.8	30.7	0.204	58.3	42.3	11.9	14.1	103.1	993
46	105.80	66	29.4	30.1	0.200	57.2	41.8	11.9	13.9	102.4	981
47	105.82	66	30.7	32.0	0.154	44.0	43.5	12.9	14.1	104.5	1,022
48	105.83	66	32.1	33.3	0.177	50.5	45.5	11.6	15.4	103.8	1,069

GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 104.99-ft (30m)
OP: AF

MB06 - 104.99-ft (30m)
Date: 18-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
51	105.87	66	25.0	26.6	0.165	47.2	35.5	6.9	12.5	106.5	834
52	105.88	66	24.3	25.2	0.182	52.1	34.5	12.0	12.9	103.6	810
53	105.89	66	22.5	23.6	0.169	48.1	31.9	11.9	11.9	104.9	749
54	105.90	66	31.2	35.5	0.152	43.5	44.3	11.8	14.2	113.7	1,041
56	105.93	66	25.1	26.7	0.193	55.3	35.7	12.2	13.8	106.4	837
58	105.95	66	22.4	24.6	0.151	43.1	31.9	11.5	11.7	109.7	748
63	106.01	109	30.3	34.3	0.170	48.5	43.0	10.9	13.6	113.0	1,010
64	106.01	109	28.2	29.5	0.173	49.5	40.0	10.6	13.1	104.7	940
66	106.03	109	28.7	32.1	0.187	53.5	40.7	6.7	13.2	112.0	955
67	106.04	109	30.9	34.3	0.175	50.1	43.9	10.7	14.0	111.1	1,030
68	106.04	109	27.6	29.3	0.171	48.7	39.2	9.3	13.1	106.3	920
69	106.05	109	29.5	33.3	0.152	43.4	41.9	10.8	13.7	113.0	983
70	106.06	109	26.4	27.7	0.186	53.0	37.5	11.9	12.6	105.0	880
71	106.07	109	26.4	27.5	0.178	50.7	37.5	11.3	12.5	103.8	881
72	106.07	109	33.5	37.8	0.246	70.4	47.5	10.7	14.3	112.9	1,116
73	106.08	109	29.1	31.2	0.310	88.6	41.3	12.7	12.6	107.3	969
75	106.10	109	29.7	34.2	0.156	44.4	42.2	12.0	13.8	115.1	989
76	106.10	109	28.9	31.3	0.172	49.0	41.1	13.5	13.9	108.1	964
77	106.11	109	30.4	34.9	0.164	46.8	43.2	14.5	13.9	114.8	1,014
78	106.12	109	23.8	25.4	0.160	45.6	33.7	13.7	11.7	107.0	792
79	106.13	109	30.1	33.7	0.165	47.0	42.8	13.3	14.0	111.8	1,005
80	106.13	109	25.6	26.4	0.162	46.2	36.4	11.7	12.5	103.1	854
83	106.16	109	30.2	32.5	0.154	43.9	42.9	8.4	13.3	107.7	1,006
85	106.17	109	26.2	27.4	0.169	48.2	37.3	11.4	13.2	104.3	875
86	106.18	109	25.3	25.9	0.170	48.6	35.9	12.7	13.2	102.4	842
90	106.21	109	28.7	30.5	0.156	44.6	40.7	9.4	14.0	106.2	956
91	106.22	109	28.0	30.4	0.152	43.5	39.7	12.2	13.8	108.6	932
94	106.24	109	25.1	26.2	0.165	47.0	35.6	9.9	13.5	104.5	836
95	106.25	109	29.5	31.8	0.166	47.4	41.8	11.2	13.8	108.0	982
97	106.26	109	26.1	27.0	0.186	53.2	37.1	10.0	13.9	103.4	871
98	106.27	109	28.5	29.8	0.153	43.7	40.4	6.9	13.2	104.6	949
99	106.28	109	28.1	31.2	0.156	44.7	39.9	12.1	13.7	111.1	937
100	106.28	109	24.8	25.6	0.164	47.0	35.3	12.2	13.3	103.2	828
101	106.29	109	24.6	26.0	0.181	51.6	35.0	13.4	13.4	105.5	821
103	106.31	109	25.7	26.9	0.173	49.5	36.6	5.7	14.0	104.6	858
104	106.31	109	26.9	28.2	0.178	51.0	38.2	10.1	14.5	104.7	897
105	106.32	109	25.1	27.0	0.150	42.9	35.6	2.1	13.1	107.8	836
		Average	27.8	30.0	0.177	50.5	39.4	11.2	13.6	108.3	926
		Std. Dev.	3.2	3.4	0.030	8.5	4.5	2.2	0.9	5.1	107

Total number of blows analyzed: 82

BL# Sensors

1-1 F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)

2-105 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

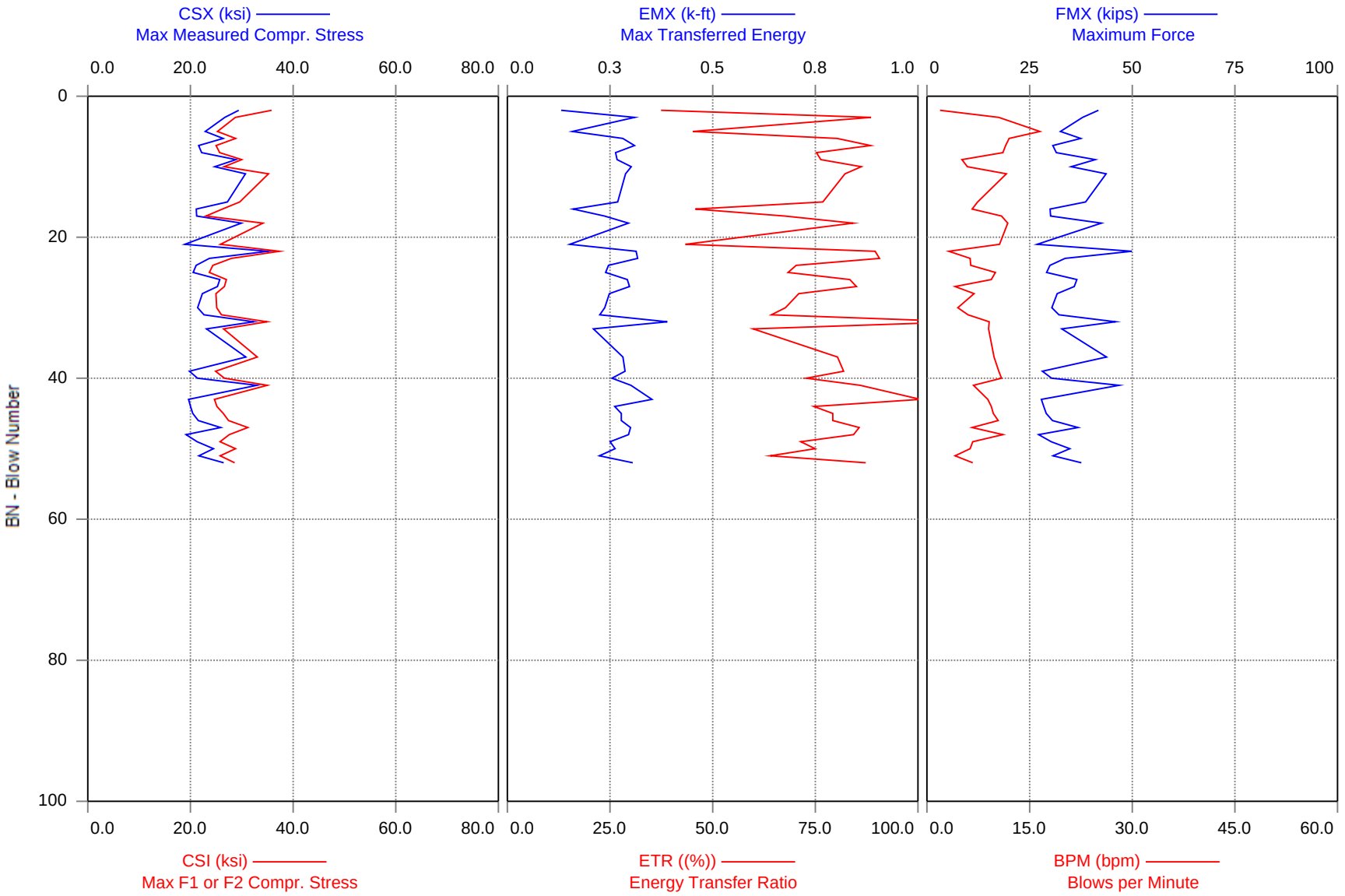
Time Summary

Drive 9 minutes 53 seconds 4:12 AM - 4:22 AM BN 1 - 105

GRL Engineers, Inc. - Seminar - PDIPLOT2 Ver 2015.1.50.1 - Case Method & iCAP® Results

Printed: 18-November-2015 Test started: 18-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 118.12-ft (36m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 118.12-ft (36m)
OP: AF

MB06 - 118.12-ft (36m)
Date: 18-September-2015

AR: 1.42 in²
LE: 190.47 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
2	118.13	91	29.4	35.8	0.131	37.4	41.8	1.9	15.1	121.8	980
3	118.14	91	26.7	28.8	0.310	88.6	37.9	10.5	13.5	107.8	890
5	118.16	91	22.9	25.3	0.158	45.2	32.5	16.5	13.3	110.4	763
6	118.17	91	26.4	28.8	0.281	80.3	37.4	12.0	12.0	109.2	879
7	118.17	91	21.6	25.0	0.309	88.4	30.6	11.5	12.4	115.8	719
8	118.18	91	22.2	25.7	0.263	75.3	31.5	11.1	13.2	115.9	739
9	118.19	91	28.9	30.0	0.267	76.3	41.0	5.1	14.4	103.9	963
10	118.20	91	24.7	26.5	0.302	86.2	35.1	5.9	13.0	107.3	824
11	118.21	91	30.7	35.2	0.288	82.2	43.6	11.6	16.8	114.6	1,024
15	118.25	91	27.2	29.6	0.269	76.8	38.6	7.4	15.3	108.9	906
16	118.26	91	21.1	26.2	0.160	45.8	30.0	6.6	13.0	124.2	704
17	118.26	91	21.2	23.0	0.236	67.5	30.1	10.9	12.4	108.6	707
18	118.27	91	29.9	34.1	0.295	84.2	42.5	11.8	16.8	114.0	997
21	118.30	91	18.9	25.8	0.152	43.4	26.8	10.6	12.4	136.8	630
22	118.31	91	35.1	37.3	0.313	89.6	49.9	3.2	17.5	106.3	1,171
23	118.32	91	23.7	28.0	0.317	90.6	33.6	6.3	14.7	118.1	789
24	118.33	91	21.1	24.4	0.246	70.3	30.0	6.4	13.5	115.5	703
25	118.34	91	20.5	23.7	0.239	68.4	29.1	10.0	12.7	115.5	684
26	118.35	91	25.7	27.0	0.292	83.4	36.5	9.4	13.3	105.0	857
27	118.35	91	25.3	26.6	0.298	85.0	35.9	4.1	13.1	105.3	842
28	118.36	91	22.3	25.0	0.248	71.0	31.7	6.9	13.1	111.8	744
30	118.38	91	21.4	25.1	0.237	67.7	30.4	4.5	13.4	117.3	714
31	118.39	91	22.6	26.0	0.225	64.3	32.1	6.0	13.2	115.0	755
32	118.40	91	32.3	34.9	0.389	111.2	45.9	9.1	15.4	108.0	1,078
33	118.41	91	23.1	26.4	0.210	59.9	32.8	9.0	13.9	114.3	771
37	118.44	91	30.8	33.0	0.281	80.4	43.7	9.8	15.2	107.2	1,026
39	118.46	91	19.8	24.9	0.287	81.9	28.1	10.5	14.1	125.8	660
40	118.47	91	21.4	26.6	0.255	72.8	30.3	10.9	15.5	124.6	712
41	118.48	91	33.0	35.0	0.301	85.9	46.8	6.8	17.2	106.1	1,099
43	118.50	91	19.6	24.7	0.352	100.6	27.9	8.9	15.6	125.8	654
44	118.51	91	20.0	25.2	0.261	74.7	28.4	9.4	14.4	125.7	667
45	118.52	91	20.5	26.4	0.277	79.3	29.1	9.7	15.6	129.0	682
46	118.53	91	21.5	27.4	0.277	79.2	30.6	10.4	14.2	127.4	717
47	118.53	91	25.9	31.2	0.300	85.7	36.8	6.6	16.5	120.4	863
48	118.54	91	19.2	27.6	0.295	84.3	27.2	11.1	14.9	144.0	638
49	118.55	91	21.3	25.8	0.250	71.4	30.3	6.7	14.1	121.0	710
50	118.56	91	24.5	28.8	0.262	74.9	34.8	6.3	14.4	117.5	816
51	118.57	91	21.6	25.8	0.224	64.0	30.7	4.1	14.7	119.2	721
52	118.58	91	26.5	28.6	0.306	87.3	37.6	6.7	13.8	108.1	882
		Average	24.4	28.1	0.266	75.9	34.6	8.4	14.3	116.2	812
		Std. Dev.	4.2	3.7	0.052	14.9	6.0	2.9	1.4	9.0	140

Total number of blows analyzed: 39

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 118.12-ft (36m)
MB06 - 118.12-ft (36m)
OP: AF
Date: 18-September-2015

BL# Sensors

1-1 F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)
2-52 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

Time Summary

Drive 8 minutes 6 seconds 7:13 AM - 7:21 AM BN 1 - 52

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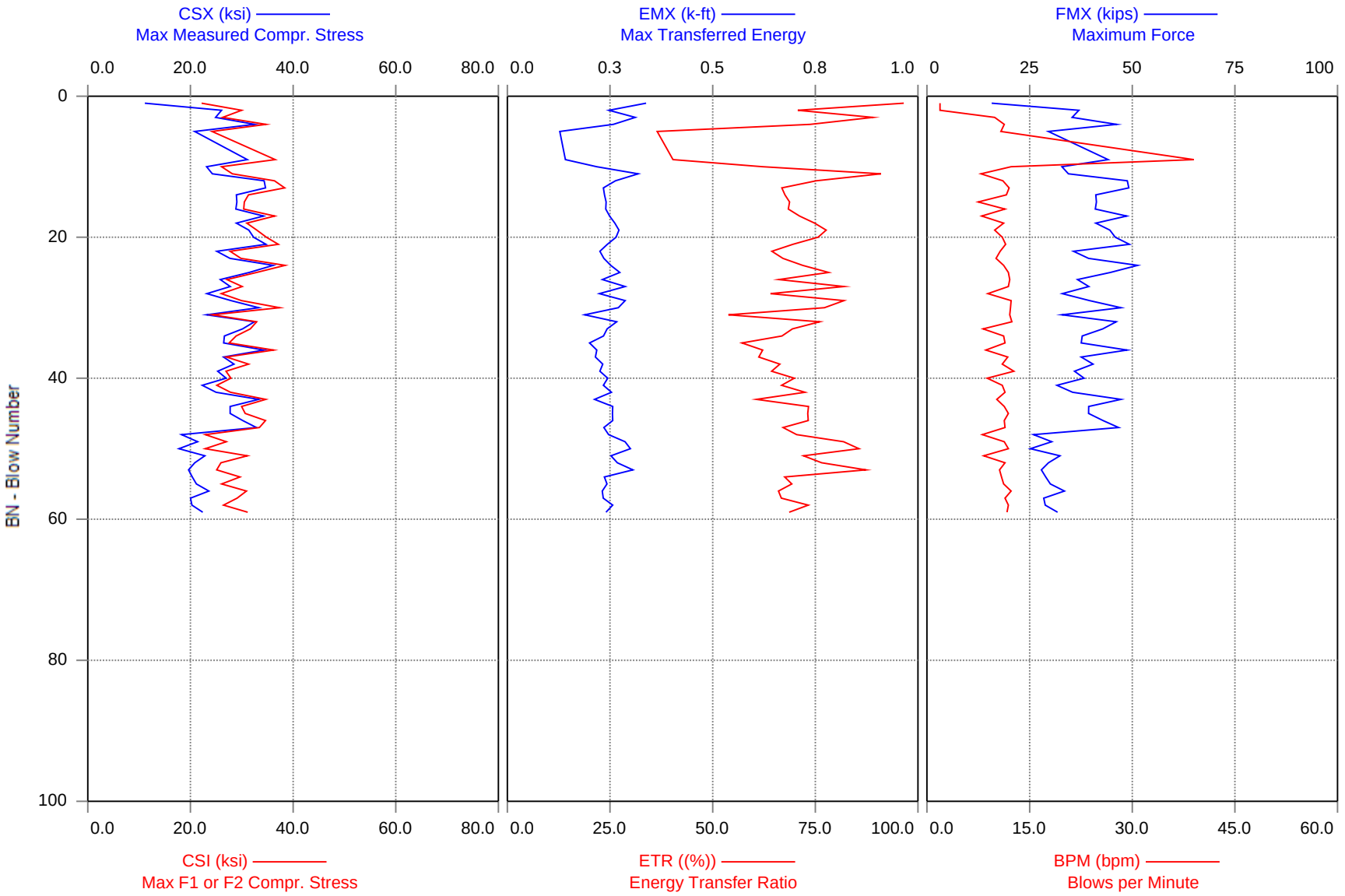
Printed: 18-November-2015 Test started: 18-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 137.8-ft (42m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 137.8-ft (42m)
OP: AF

MB06 - 137.8-ft (42m)
Date: 18-September-2015

AR: 1.42 in²
LE: 210.15 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
1	137.80	6,424	11.1	22.2	0.338	96.5	15.8	1.9	4.2	199.7	370
2	137.80	6,424	26.1	30.0	0.248	70.7	37.0	1.9	13.0	115.0	869
3	137.80	6,424	24.9	26.3	0.312	89.0	35.3	9.9	11.9	105.6	830
4	137.80	6,424	32.5	34.7	0.258	73.8	46.2	11.3	13.8	106.8	1,084
5	137.80	6,424	20.8	24.2	0.128	36.5	29.6	10.8	12.7	116.3	694
9	137.80	6,424	31.1	36.5	0.141	40.3	44.1	39.0	14.9	117.5	1,036
10	137.80	6,424	23.1	26.1	0.218	62.1	32.9	12.3	11.6	112.5	772
11	137.80	6,424	24.3	28.2	0.318	91.0	34.5	7.9	13.0	116.1	809
12	137.80	6,424	34.4	36.4	0.263	75.2	48.8	11.1	14.6	105.9	1,145
13	137.80	6,424	34.6	38.4	0.234	66.8	49.2	12.0	15.8	110.8	1,154
14	137.80	6,424	28.9	31.3	0.237	67.6	41.1	11.6	14.0	108.1	965
15	137.80	6,424	29.1	30.5	0.241	68.7	41.3	7.5	13.2	104.9	968
16	137.80	6,424	28.9	30.4	0.239	68.4	41.0	11.4	13.1	105.2	962
17	137.80	6,424	34.2	36.4	0.249	71.1	48.6	8.0	15.7	106.4	1,141
18	137.80	6,424	28.9	31.0	0.262	74.8	41.1	11.2	13.0	107.1	965
19	137.80	6,424	31.4	32.9	0.272	77.7	44.5	9.9	15.6	105.0	1,045
20	137.80	6,424	32.3	34.8	0.265	75.7	45.9	11.0	15.3	107.7	1,076
21	137.80	6,424	34.7	37.1	0.243	69.5	49.3	11.5	14.6	106.9	1,158
22	137.80	6,424	25.1	27.7	0.225	64.4	35.7	10.7	12.7	110.3	838
23	137.80	6,424	27.7	29.9	0.235	67.1	39.4	10.1	13.4	107.7	924
24	137.80	6,424	36.1	38.4	0.252	71.9	51.3	11.2	15.0	106.4	1,205
25	137.80	6,424	31.5	32.9	0.274	78.3	44.7	11.9	15.3	104.5	1,048
26	137.80	6,424	25.8	27.1	0.231	66.1	36.7	12.1	12.8	105.0	861
27	137.80	6,424	27.8	30.1	0.287	82.0	39.4	11.9	13.2	108.3	925
28	137.80	6,424	23.2	26.0	0.224	64.1	33.0	8.9	11.7	112.0	774
29	137.80	6,424	27.9	29.9	0.287	82.0	39.6	12.3	13.6	107.3	930
30	137.80	6,424	33.3	37.4	0.270	77.2	47.3	12.2	14.8	112.2	1,109
31	137.80	6,424	23.2	24.3	0.188	53.8	32.9	12.1	11.8	105.0	772
32	137.80	6,424	32.5	32.9	0.266	76.1	46.1	12.4	15.4	101.4	1,082
33	137.80	6,424	30.1	31.7	0.243	69.4	42.8	8.2	14.1	105.1	1,005
34	137.80	6,424	26.6	28.9	0.234	66.9	37.8	11.2	13.1	108.6	887
35	137.80	6,424	26.5	27.5	0.200	57.1	37.6	11.4	12.6	104.1	882
36	137.80	6,424	34.3	36.2	0.218	62.2	48.7	8.6	15.2	105.5	1,144
37	137.80	6,424	26.5	27.0	0.214	61.2	37.6	11.8	12.8	102.1	882
38	137.80	6,424	28.5	31.3	0.232	66.4	40.5	11.0	13.6	110.0	950
39	137.86	15	25.3	26.9	0.225	64.4	35.9	12.7	12.8	106.5	844
40	137.91	15	26.9	27.9	0.245	69.9	38.3	8.8	12.6	103.5	898
41	137.97	15	22.3	25.1	0.234	66.8	31.7	11.0	11.8	112.7	743
42	138.02	15	25.0	27.8	0.254	72.5	35.5	11.4	13.8	111.3	833
43	138.08	15	33.3	34.7	0.212	60.7	47.3	10.2	15.7	104.2	1,109
44	138.13	15	27.7	30.0	0.257	73.3	39.4	11.3	15.0	108.1	925
45	138.19	15	27.7	30.7	0.256	73.2	39.4	11.9	15.0	110.7	924
46	138.24	15	30.2	34.6	0.256	73.3	42.9	11.3	15.6	114.7	1,006
47	138.30	15	32.9	33.4	0.235	67.1	46.7	11.4	13.5	101.7	1,095
48	138.30	328	18.3	22.9	0.247	70.5	26.0	8.1	12.5	125.3	609

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Case Method & iCAP® Results PDIPLOT2 2015.1.50.1 - Printed 18-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO2-MB06 - 137.8-ft (42m) MB06 - 137.8-ft (42m)
OP: AF Date: 18-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
49	138.31	328	21.4	27.0	0.287	81.9	30.4	11.3	16.0	126.1	713
50	138.31	328	17.7	22.9	0.300	85.6	25.2	11.9	13.5	128.9	592
51	138.31	328	22.8	31.1	0.252	72.1	32.4	8.3	14.9	136.3	760
52	138.31	328	20.8	25.9	0.268	76.5	29.6	11.4	12.6	124.4	695
53	138.32	328	19.6	25.1	0.306	87.3	27.9	10.6	14.9	128.0	654
54	138.32	328	20.4	29.6	0.236	67.5	28.9	10.9	15.7	145.6	679
55	138.32	328	21.2	26.1	0.242	69.3	30.1	11.2	13.2	123.2	706
56	138.32	328	23.6	30.9	0.231	66.0	33.5	12.3	14.8	131.1	786
57	138.33	328	20.0	29.1	0.234	66.7	28.4	11.4	14.1	145.3	667
58	138.33	328	20.3	26.5	0.256	73.3	28.8	11.9	13.0	130.4	676
59	138.33	328	22.4	31.2	0.240	68.6	31.8	11.7	14.8	139.1	746
		Average	26.7	30.1	0.247	70.5	38.0	11.1	13.7	114.8	891
		Std. Dev.	5.3	4.2	0.036	10.2	7.5	4.3	1.8	15.9	175

Total number of blows analyzed: 56

BL# Sensors

1-1 F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)
2-59 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

Time Summary

Drive 5 minutes 20 seconds 11:47 AM - 11:52 AM BN 1 - 59

ATTACHMENT 3

Field Notes, and Plots and Tables of PDA Data
Skate 3 Jack-up Drilling Platform, Drill Rig Comacchio Model MC1200
Borehole MB-18, Hammer SPT-09

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Ph: (713) 369-5400 F (713) 369-5518

Project #	04.10140334
Project Name	Alaska LNG Project
SPT Tester	J. Greenwald / A. Fee
Rig(s)	Skate 3A / Comacchio MC120
Rig Operator(s)	Fugro Seacore
Test Date(s)	9/19/15 ~ 9/21/15

SPT ENERGY CALIBRATION

Rig and Hammer Description

Rig Model / Serial #	Skate 3A / Comacchio MC120
Hammer Model / Serial #	SPT-09

Notes on Operational Performance

DS1: 12" Casing to 0.5 m, 7" Casing to 6 m, DTM = 20.7 m, Test from 6.00-6.42m.
DS2: 12" Casing to 0.5 m, 7" Casing to 12 m, DTM = 20.7 m, Test from 12 - 12.45m.
DS3: 12" Casing to 0.5 m, 7" Casing to 17.7m, Geobor to 19.4m, DTM = 20.7m, Test from 19.4-19.85m
* Cored through large boulder & performed SPT (DS3) at 19.4m
DS4: 12" Casing to 0.5 m, 7" Casing to 17.7 m, Geobor to 25.4 m, DTM = 20.7 m, Test from 25.4 - 26.8m
DS5: 12" casing to 0.5m, 7" casing to 17.7m; Geobor to 31.4m, DTM = 20.7m, Test from 31.40 to 31.78 m
DS6: 12" Casing to 0.5m, 7" Casing to 17.7m; Geobor to 36.7m; DTM = 20.7 m; Test from 36.7 - 36.89m

Instrumentation

Name:	333NWJ	Area = 1.42 in^2 = 9.16 cm^2
Strains*:	F1 / (F3) 333NWJ-1	Gage Factor = 214 με/V
	F2 / (F4) 333NWJ-2	Gage Factor = 213.44 με/V
Accelerometers*:	A1 / (A3) K1481	Gage Factor = 360 (mV/G x 5000)
	A2 / (A4) K1799	Gage Factor = 345 (mV/G x 5000)

*Circle utilized channel

Data Set 1 **Data File Name:** SKATE3A-SPT09-MB18-6M **Location:** MB-18 **Rig:** Skate 3A **Date & Time:** 9/19/15 2333

Starting depth of sample = "LP"	6.00m
List of rod sections from sampler to ~~instrument~~ hammer	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (9x3m + 1x0.75m) + 0.254 = 28.804 m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731 m
Blows observed (uncorrected)	6-39-50/12cm (BN from PDA: 96)

Offsets**: F1 / (F3) = -0.26 V F2 / (F4) = -0.30 V A1 / (A3) = -0.01 V A2 / (A4) = 0.01 V

**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799

Data Set 2 **Data File Name:** SKATE3A-SPT09-MB18-12M **Location:** MB-18 **Rig:** SKATE 3 **Date & Time:** 9/20/15 08:05

Starting depth of sample = "LP"	12.00m
List of rod sections from sampler to ~~instrument~~ hammer	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (11x3m + 1x0.75m) + 0.254 = 34.804m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731m
Blows observed (uncorrected)	12-29-50 (BN from PDA: 92)

Offsets**: F1 / (F3) = -0.26 V F2 / (F4) = -0.30 V A1 / (A3) = -0.01 V A2 / (A4) = 0.01 V

**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Ph: (713) 369-5400 F (713) 369-5518

Project #	04.10140334
Project Name	Alaska LNG Project
SPT Tester	J. Greenwald / A. Fee
Rig(s)	Skate 3A / Comacchio MC1200
Rig Operator(s)	Fugro Seacore
Test Date(s)	9/19/15 - 9/21/15

SPT-09

SPT ENERGY CALIBRATION

Data Set 3 **Data File Name:** SKATE3A-SPT09-MB18-19.4M **Location:** MB-18 **Rig:** Skate3A **Date & Time:** 9/20/15 14:55

Starting depth of sample = "LP"	19.4 meters
List of rod sections from sampler to ~~instrument~~ hammer	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (13x3m + 1x1.5m) + 0.254 = 41.554 m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731 m
Blows observed (uncorrected)	16-33-44 (BN from PDA = 94)
Offsets**: F1 / F3 = -0.26V F2 / F4 = -0.30V A1 / A3 = -0.01V A2 / A4 = 0.01V	

**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799

SKATE3A-SPT-09-MB18-25.4M

Data Set 4 **Data File Name:** **Location:** MB-18 **Rig:** Skate3A **Date & Time:** 9/20/15 22:15

Starting depth of sample = "LP"	25.4M
List of rod sections from sampler to ~~instrument~~ hammer	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (15x3m + 1.5m + 0.75m) + 0.254 = 48.304 m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731m
Blows observed (uncorrected)	8-16-22-25 (BN from PDA = 72)
Offsets**: F1 / F3 = -0.26V F2 / F4 = -0.30V A1 / A3 = -0.01V A2 / A4 = 0.01V	

**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799

SKATE3A-SPT09-MB18-31.4M

Data Set 5 **Data File Name:** **Location:** MB-18 **Rig:** SKATE3A **Date & Time:** 9/21/15 01:45

Starting depth of sample = "LP"	31.4 M
List of rod sections from sampler to ~~instrument~~ hammer	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (17x3m + 1.5m + 0.75m) + 0.254 = 54.304m
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731m
Blows observed (uncorrected)	20-41-39 (BN from PDA = 101)
Offsets**: F1 / F3 = -0.26V F2 / F4 = -0.30V A1 / A3 = -0.01V A2 / A4 = 0.01V	

**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799

Data Set 6 **Data File Name:** SKATE3A-SPT09-MB18-36.7M **Location:** MB-18 **Rig:** SKATE3A **Date & Time:** 9/21/15 08:15

Starting depth of sample = "LP"	36.7M
List of rod sections from sampler to ~~instrument~~ hammer	Sampler + Rods + Instrument + Adapter + Anvil
Length from tip of sampler to Gage Location = "LE"	0.80 + (19x3m + 1.5m) + 0.254 = 59.554
Length from impact surface to gages	0.356 + 0.093 + 0.282 = 0.731m
Blows observed (uncorrected)	31-50/4cm (BN from PDA = 82)
Offsets**: F1 / F3 = -0.26V F2 / F4 = -0.30V A1 / A3 = -0.01V A2 / A4 = 0.01V	

**Add instrument names 333NWJ-1 333NWJ-2 K1481 K1799

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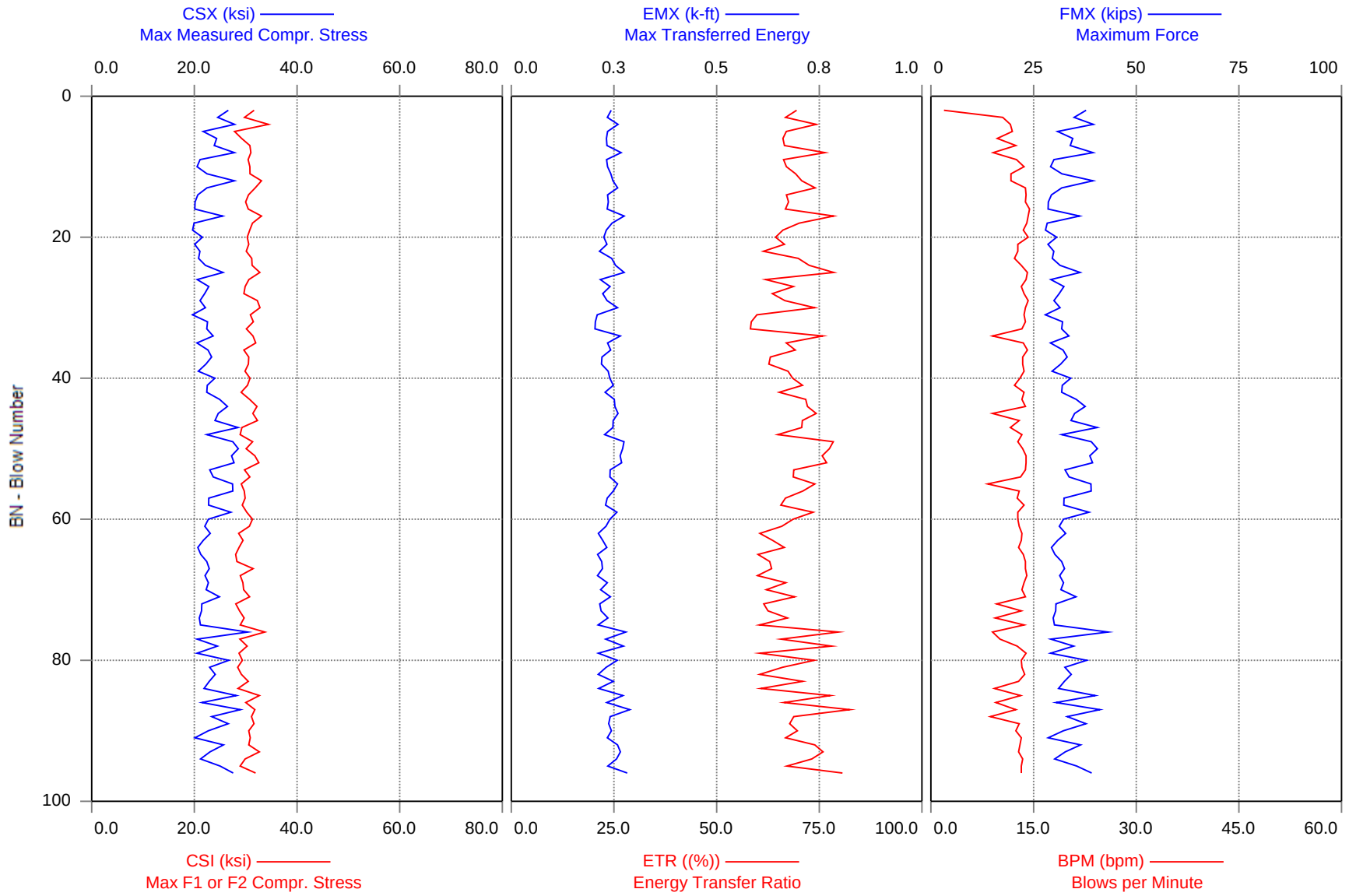
Printed: 19-November-2015 Test started: 20-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 19.69-ft (6m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 19.69-ft (6m)
OP: AF

MB18 - 19.69-ft (6m)
Date: 20-September-2015

AR: 1.42 in²
LE: 94.50 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
2	19.77	10	26.6	31.6	0.243	69.5	37.8	1.9	14.8	118.9	887
3	19.85	10	24.6	29.8	0.234	66.8	34.9	10.5	14.4	121.3	819
4	19.94	10	27.8	34.4	0.260	74.2	39.5	11.6	16.9	123.7	928
5	20.02	10	21.7	27.8	0.234	67.0	30.8	11.9	14.8	128.3	724
6	20.11	10	24.3	29.2	0.232	66.2	34.5	9.7	14.7	120.1	811
7	20.19	10	23.9	30.8	0.233	66.5	33.9	12.4	15.3	129.0	796
8	20.20	66	27.8	31.0	0.267	76.4	39.5	9.1	15.7	111.5	927
9	20.22	66	21.1	30.5	0.232	66.3	30.0	12.5	14.8	144.4	704
10	20.23	66	20.5	30.8	0.235	67.0	29.1	13.6	15.4	150.2	684
11	20.24	66	22.5	30.9	0.242	69.3	31.9	11.7	15.0	137.3	749
12	20.25	66	27.8	33.1	0.248	70.7	39.5	11.7	17.4	119.0	927
13	20.27	66	22.4	31.9	0.259	74.0	31.9	13.8	15.9	141.9	748
14	20.28	66	20.7	30.5	0.234	67.0	29.3	13.9	15.3	147.8	689
15	20.29	66	20.1	30.0	0.236	67.5	28.6	13.8	15.2	149.0	671
16	20.30	66	20.1	30.5	0.234	66.8	28.5	14.4	15.2	151.8	670
17	20.32	66	25.5	33.1	0.275	78.5	36.2	14.2	16.0	129.8	850
18	20.33	66	19.9	31.3	0.245	70.1	28.3	14.0	15.4	157.1	665
19	20.34	66	19.7	30.8	0.231	66.1	27.9	13.5	14.6	156.7	655
20	20.35	66	21.6	30.3	0.225	64.4	30.6	14.2	15.0	140.5	719
21	20.37	66	20.1	30.6	0.233	66.5	28.5	12.7	15.1	152.5	669
22	20.38	66	21.1	30.1	0.215	61.4	29.9	12.7	14.6	142.9	703
23	20.39	66	20.8	31.2	0.245	69.9	29.6	12.2	15.2	149.7	694
24	20.40	66	22.1	31.3	0.254	72.5	31.4	13.2	15.8	141.1	738
25	20.42	66	25.6	32.7	0.275	78.5	36.3	14.1	16.7	128.1	852
26	20.43	66	20.6	30.6	0.217	61.9	29.2	13.9	14.9	148.9	685
27	20.44	66	22.8	29.9	0.240	68.7	32.4	13.2	15.4	131.1	760
28	20.45	66	22.0	29.6	0.222	63.6	31.2	13.6	14.5	134.8	733
29	20.47	66	21.1	32.3	0.233	66.6	30.0	14.2	15.2	153.0	703
30	20.48	66	22.1	32.8	0.259	73.9	31.4	13.8	15.9	148.1	738
31	20.49	66	19.6	30.9	0.209	59.8	27.9	13.6	14.5	157.5	654
32	20.50	66	22.6	31.5	0.205	58.4	32.1	13.8	15.3	139.6	752
33	20.52	66	22.4	30.1	0.204	58.2	31.8	13.3	15.4	134.4	747
34	20.53	66	23.7	31.4	0.265	75.8	33.6	9.0	16.5	132.8	789
35	20.54	66	20.5	31.9	0.234	67.0	29.1	13.5	15.8	155.8	684
36	20.55	66	22.7	29.6	0.242	69.1	32.2	14.1	15.2	130.8	755
37	20.57	66	23.4	30.6	0.221	63.1	33.2	13.4	15.3	131.0	779
38	20.58	66	22.2	30.5	0.219	62.7	31.6	13.4	15.6	137.3	741
39	20.59	66	20.8	29.9	0.236	67.4	29.5	13.6	15.4	143.8	693
40	20.60	66	24.0	30.8	0.240	68.5	34.1	13.0	15.4	128.5	800
41	20.62	66	22.5	30.3	0.248	70.9	32.0	12.2	15.8	134.7	751
42	20.63	66	22.4	29.1	0.228	65.2	31.8	13.6	15.1	129.8	747
43	20.64	66	24.9	30.8	0.251	71.7	35.4	13.3	16.3	123.5	831
44	20.65	66	26.5	32.2	0.252	72.1	37.6	13.8	15.3	121.7	882
45	20.67	66	24.7	31.4	0.260	74.2	35.0	9.0	16.1	127.4	822
46	20.68	66	24.0	32.3	0.248	70.9	34.1	12.9	17.3	134.5	800

GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 19.69-ft (6m)
OP: AF

MB18 - 19.69-ft (6m)
Date: 20-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
47	20.69	66	28.5	29.3	0.248	70.7	40.5	11.6	16.9	102.7	950
48	20.70	103	22.4	28.9	0.227	64.9	31.8	13.3	15.4	129.0	747
49	20.71	103	27.5	31.4	0.274	78.4	39.1	12.7	17.0	114.0	917
50	20.71	103	28.6	30.1	0.271	77.5	40.6	13.4	16.6	105.3	952
51	20.72	103	27.2	31.8	0.265	75.7	38.7	13.9	17.1	116.6	908
52	20.73	103	27.7	32.6	0.269	76.8	39.4	13.9	16.7	117.5	924
53	20.74	103	23.0	29.8	0.241	68.8	32.7	13.8	15.2	129.4	767
54	20.75	103	23.7	30.8	0.240	68.7	33.6	13.1	16.1	130.0	790
55	20.75	103	27.4	29.1	0.259	73.9	39.0	8.3	16.7	106.2	915
56	20.76	103	27.5	29.7	0.248	71.0	39.0	12.9	16.6	108.1	916
57	20.77	103	22.8	29.9	0.234	66.8	32.4	12.6	15.5	131.0	761
58	20.78	103	22.8	29.3	0.230	65.6	32.3	13.6	16.5	128.8	759
59	20.79	103	27.1	30.2	0.257	73.5	38.5	12.7	16.8	111.5	903
60	20.79	103	22.7	31.3	0.240	68.6	32.3	12.7	16.2	137.7	758
61	20.80	103	22.0	30.7	0.231	65.9	31.3	12.9	16.7	139.5	734
62	20.81	103	23.1	28.6	0.212	60.5	32.8	13.3	15.2	123.9	770
63	20.82	103	21.7	29.5	0.223	63.6	30.9	13.2	15.1	135.6	725
64	20.83	103	20.7	28.7	0.233	66.5	29.3	12.8	15.5	138.9	689
65	20.83	103	21.3	28.1	0.210	60.1	30.2	13.5	15.4	132.0	709
66	20.84	103	22.4	28.3	0.220	62.9	31.8	13.8	15.6	126.2	747
67	20.85	103	22.9	31.5	0.222	63.4	32.5	13.8	16.6	137.4	763
68	20.86	103	22.1	28.9	0.210	60.0	31.3	14.0	15.5	131.1	736
69	20.87	103	22.7	29.5	0.234	66.8	32.3	13.6	15.5	129.6	758
70	20.87	103	22.3	29.6	0.217	62.1	31.7	13.3	15.6	132.8	743
71	20.88	103	24.9	30.8	0.241	69.0	35.3	13.8	15.5	123.7	829
72	20.89	103	21.4	28.1	0.215	61.5	30.4	9.6	15.5	130.9	715
73	20.90	103	21.4	28.8	0.219	62.5	30.4	13.2	15.7	134.6	713
74	20.90	103	21.0	29.7	0.235	67.2	29.8	9.4	16.5	141.6	699
75	20.91	103	21.2	28.9	0.211	60.4	30.1	13.6	15.8	136.6	706
76	20.92	103	30.4	33.7	0.279	79.6	43.1	9.0	18.1	111.0	1,012
77	20.93	103	20.6	28.9	0.230	65.7	29.2	10.1	15.6	140.4	685
78	20.94	103	24.5	30.3	0.273	78.0	34.8	12.6	18.0	123.7	816
79	20.94	103	20.5	28.7	0.212	60.5	29.1	13.9	16.0	139.9	684
80	20.95	103	26.7	29.4	0.258	73.8	37.9	13.2	16.7	110.0	890
81	20.96	103	23.0	28.4	0.231	66.1	32.6	13.3	16.0	123.8	766
82	20.97	103	24.1	29.2	0.212	60.5	34.2	13.7	16.3	121.2	802
83	20.98	103	22.9	30.5	0.248	70.9	32.5	12.8	16.5	133.2	763
84	20.98	103	21.9	28.5	0.213	60.8	31.1	9.3	15.7	130.3	730
85	20.99	103	28.2	32.6	0.272	77.7	40.0	13.1	17.5	115.9	939
86	21.00	103	21.5	30.0	0.233	66.5	30.5	9.5	15.5	139.7	716
87	21.01	103	28.9	31.8	0.288	82.4	41.1	12.4	18.0	109.8	965
88	21.02	103	23.4	31.1	0.241	68.8	33.2	8.7	16.8	133.1	779
89	21.02	103	26.6	31.6	0.237	67.8	37.8	12.9	17.9	118.9	886
90	21.03	103	22.7	30.6	0.244	69.7	32.2	12.4	17.4	134.8	757
91	21.04	103	20.1	30.9	0.234	66.8	28.6	13.2	16.7	153.5	671
92	21.05	103	25.7	30.6	0.259	73.9	36.4	13.0	15.6	119.2	855
93	21.06	103	23.0	32.7	0.266	75.9	32.7	12.8	17.7	141.8	768
94	21.06	103	21.2	29.9	0.256	73.2	30.1	13.4	16.6	140.9	707
95	21.07	103	25.0	28.9	0.235	67.1	35.5	13.2	16.8	115.6	834
96	21.08	103	27.6	31.9	0.282	80.6	39.1	13.2	17.3	115.9	919
		Average	23.4	30.5	0.240	68.6	33.2	12.6	15.9	131.6	780
		Std. Dev.	2.6	1.3	0.019	5.5	3.7	1.8	0.9	12.9	86

Total number of blows analyzed: 95

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 19.69-ft (6m)
MB18 - 19.69-ft (6m)
OP: AF
Date: 20-September-2015

BL# Sensors

1-1 F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)
2-96 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

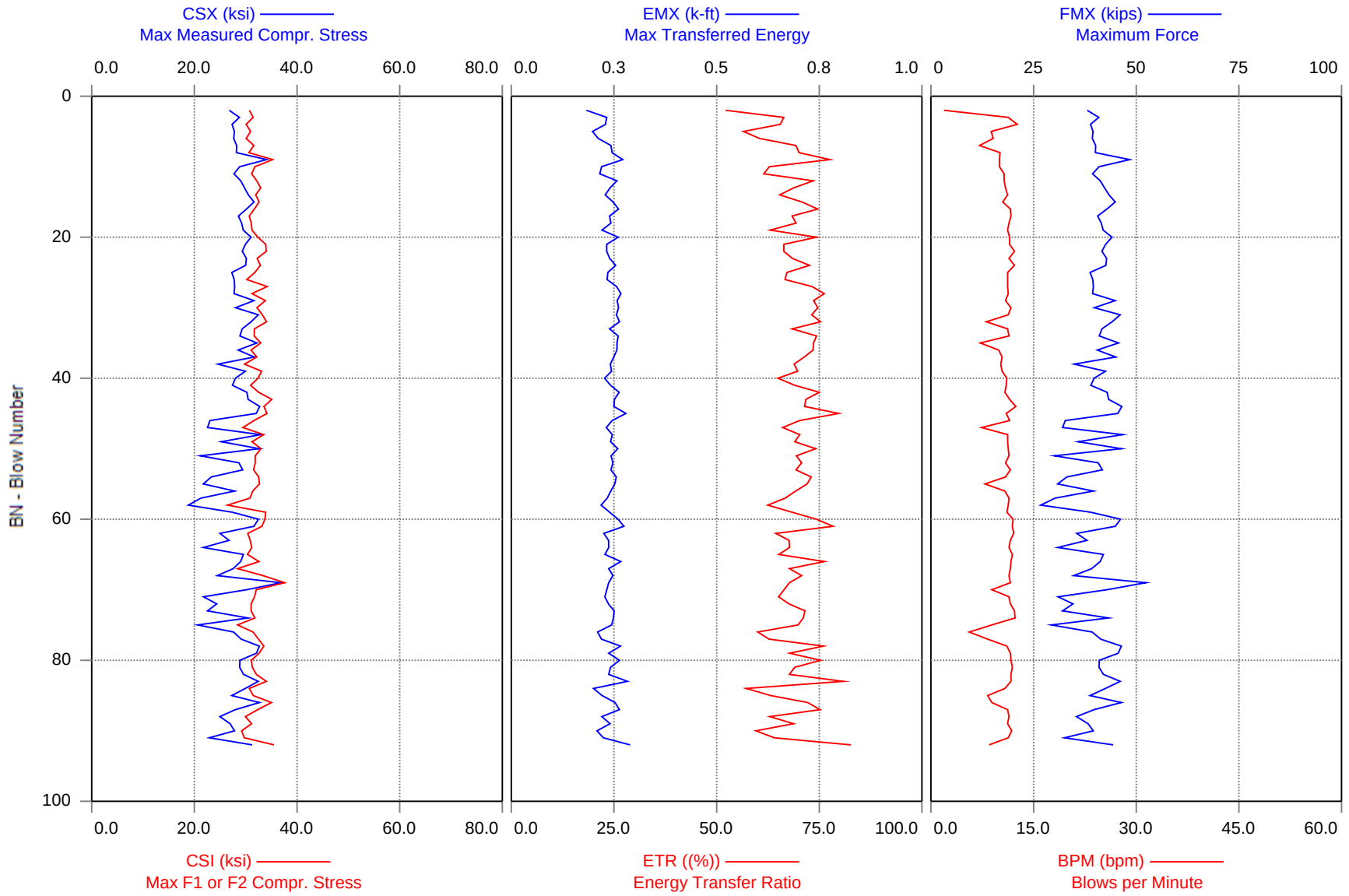
Time Summary

Drive 7 minutes 40 seconds 2:28 AM - 2:36 AM BN 1 - 96

GRL Engineers, Inc. - Seminar - PDIPLOT2 Ver 2015.1.50.1 - Case Method & iCAP® Results

Printed: 19-November-2015 Test started: 20-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 39.37-ft (12m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 39.37-ft (12m)
OP: JG

MB18 - 39.37-ft (12m)
Date: 20-September-2015

AR: 1.42 in²
LE: 114.19 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
2	39.37	20	26.8	30.7	0.183	52.2	38.0	1.9	14.3	114.7	893
3	39.37	20	28.8	31.4	0.232	66.4	40.9	11.3	16.3	109.2	960
4	39.37	20	27.4	30.1	0.229	65.5	38.8	12.6	16.0	110.0	912
5	39.37	20	27.8	31.0	0.198	56.5	39.5	8.8	16.4	111.4	927
6	39.37	20	27.7	30.1	0.212	60.5	39.3	9.1	16.3	108.8	922
7	39.37	20	28.3	31.6	0.243	69.3	40.1	7.1	16.2	111.9	942
8	39.37	20	28.2	30.6	0.245	70.1	40.0	10.1	16.0	108.6	940
9	39.37	20	34.1	35.2	0.272	77.6	48.4	10.0	18.1	103.4	1,136
10	39.37	20	28.8	31.8	0.220	62.8	40.9	10.0	17.0	110.2	961
11	39.37	20	27.7	31.1	0.215	61.5	39.4	10.7	16.7	112.4	924
12	39.37	20	29.0	32.1	0.257	73.5	41.2	10.7	17.1	110.7	968
13	39.87	48	29.8	32.9	0.241	68.7	42.3	10.9	17.4	110.6	992
14	39.87	48	30.5	32.0	0.229	65.4	43.4	11.2	16.5	104.7	1,018
15	39.87	48	31.6	32.6	0.248	70.8	44.9	10.5	16.7	103.2	1,054
16	39.87	48	30.2	31.7	0.261	74.6	42.8	11.6	17.4	105.0	1,005
17	39.87	48	28.6	30.7	0.239	68.4	40.6	11.7	16.2	107.4	953
18	39.87	48	29.2	31.1	0.243	69.3	41.5	11.4	17.1	106.4	973
19	39.87	48	29.5	31.2	0.221	63.0	41.9	11.2	16.5	105.7	984
20	39.87	48	31.0	32.4	0.260	74.3	44.1	11.5	17.5	104.3	1,035
21	39.87	48	30.0	33.9	0.232	66.4	42.5	11.5	17.5	113.2	998
22	39.87	48	29.3	34.0	0.232	66.4	41.6	12.2	17.3	116.0	978
23	39.87	48	30.1	32.2	0.239	68.4	42.8	11.4	17.6	107.0	1,004
24	39.87	48	30.0	32.8	0.254	72.6	42.6	12.2	17.0	109.5	1,000
25	39.87	48	27.3	31.8	0.235	67.1	38.8	11.2	16.8	116.4	910
26	39.87	48	27.8	30.2	0.233	66.7	39.4	11.2	16.6	108.8	926
27	39.87	48	27.9	34.2	0.256	73.2	39.6	11.2	17.7	122.7	929
28	39.87	48	27.7	31.2	0.267	76.2	39.4	11.3	17.2	112.7	924
29	39.87	48	31.6	33.8	0.258	73.6	44.9	10.9	18.0	107.0	1,053
30	39.87	48	28.0	32.2	0.261	74.6	39.8	11.7	17.4	114.9	934
31	39.87	48	32.5	33.2	0.256	73.1	46.1	11.3	16.8	102.4	1,082
32	39.87	48	31.1	34.1	0.264	75.3	44.1	8.1	18.4	109.7	1,036
33	39.87	48	29.3	31.7	0.239	68.4	41.6	11.2	16.9	108.1	977
34	39.87	48	28.9	31.7	0.260	74.3	41.0	11.4	16.4	109.7	962
35	39.87	48	32.2	32.9	0.258	73.6	45.7	7.2	17.0	102.4	1,072
36	39.87	48	28.5	31.1	0.257	73.5	40.5	9.9	16.5	108.9	951
37	39.87	48	31.7	32.1	0.250	71.3	45.0	10.4	16.8	101.5	1,055
38	39.87	48	24.6	29.8	0.241	68.9	34.9	10.2	16.3	121.2	819
39	39.87	48	29.9	33.1	0.244	69.7	42.5	10.4	18.0	110.6	998
40	39.87	48	28.0	32.4	0.227	64.9	39.8	11.1	17.3	115.8	933
41	39.87	48	27.4	31.0	0.242	69.0	38.9	11.0	16.5	112.9	914
42	40.37	83	30.2	32.5	0.263	75.0	42.9	10.8	17.7	107.6	1,007
43	40.37	83	30.5	35.1	0.251	71.7	43.3	11.5	18.1	115.1	1,016
44	40.37	83	32.7	33.5	0.250	71.4	46.5	12.4	17.5	102.5	1,091
45	40.37	83	32.1	34.1	0.279	79.7	45.5	11.0	17.9	106.5	1,069
46	40.37	83	23.0	31.6	0.246	70.2	32.7	11.5	18.1	137.3	768

GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 39.37-ft (12m)
OP: JG

MB18 - 39.37-ft (12m)
Date: 20-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
47	40.37	83	22.6	29.5	0.231	66.1	32.0	7.4	16.3	130.5	752
48	40.37	83	32.9	33.5	0.246	70.2	46.7	11.2	17.6	101.9	1,096
49	40.37	83	25.3	31.2	0.242	69.0	35.9	11.2	17.1	123.6	842
50	40.37	83	32.7	33.0	0.259	74.1	46.4	11.3	17.1	100.9	1,089
51	40.37	83	21.2	31.9	0.243	69.4	30.1	11.4	16.0	150.4	706
52	40.37	83	28.7	31.9	0.247	70.7	40.7	10.9	17.5	111.2	956
53	40.37	83	29.4	31.5	0.243	69.3	41.7	11.6	15.9	107.3	980
54	40.37	83	23.3	32.5	0.256	73.0	33.1	10.9	18.1	139.7	777
55	40.37	83	21.7	32.7	0.252	72.0	30.9	7.9	17.9	150.3	725
56	40.37	83	27.9	31.4	0.242	69.2	39.6	10.8	16.1	112.6	929
57	40.37	83	21.3	30.8	0.233	66.7	30.2	11.4	16.8	144.9	709
58	40.37	83	18.8	26.5	0.219	62.4	26.7	11.3	15.2	140.7	628
59	40.37	83	27.4	33.9	0.239	68.4	38.9	11.1	18.3	123.7	914
60	40.37	83	32.5	33.8	0.260	74.3	46.1	12.0	18.0	103.9	1,083
61	40.37	83	31.6	33.2	0.274	78.3	44.9	11.9	18.1	104.9	1,054
62	40.37	83	25.0	30.4	0.225	64.4	35.5	12.1	16.5	121.6	833
63	40.37	83	26.8	30.9	0.237	67.6	38.0	11.6	15.7	115.4	892
64	40.37	83	21.8	31.2	0.237	67.8	30.9	11.4	17.1	143.2	725
65	40.37	83	29.6	30.4	0.228	65.1	42.0	11.9	16.5	102.7	985
66	40.37	83	29.0	32.6	0.267	76.2	41.2	11.7	17.6	112.3	967
67	40.37	83	27.6	28.4	0.237	67.8	39.2	11.6	15.9	103.2	919
68	40.37	83	24.5	33.4	0.247	70.7	34.8	11.4	16.6	136.4	816
69	40.37	83	36.9	37.6	0.237	67.7	52.3	11.6	17.4	102.0	1,229
70	40.37	83	30.2	32.0	0.232	66.4	42.9	8.9	17.2	106.1	1,007
71	40.37	83	21.8	31.7	0.228	65.1	31.0	11.4	17.2	145.5	727
72	40.37	83	24.4	31.1	0.237	67.6	34.6	11.6	16.1	127.4	812
73	40.37	83	22.6	31.1	0.250	71.5	32.0	12.2	16.9	137.6	752
74	40.37	83	30.4	31.8	0.249	71.1	43.2	12.3	16.4	104.4	1,015
75	40.37	83	20.7	28.4	0.244	69.8	29.3	8.9	16.4	137.6	689
76	40.37	83	27.6	31.4	0.210	60.0	39.3	5.6	16.9	113.8	921
77	40.37	83	29.1	32.5	0.220	62.8	41.3	8.3	16.7	111.6	970
78	40.37	83	32.7	33.5	0.266	76.0	46.4	11.1	16.9	102.7	1,088
79	40.37	83	32.1	32.6	0.237	67.8	45.6	11.6	17.4	101.5	1,070
80	40.37	83	28.9	31.1	0.264	75.3	41.0	11.7	17.3	107.7	963
81	40.37	83	28.8	31.3	0.242	69.0	40.9	11.9	16.9	108.6	961
82	40.37	83	29.6	32.1	0.237	67.7	42.0	11.7	16.9	108.5	986
83	40.37	83	32.5	34.0	0.283	80.8	46.1	11.7	17.4	104.9	1,082
84	40.37	83	29.9	30.7	0.200	57.2	42.5	10.8	16.9	102.6	997
85	40.37	83	27.3	31.5	0.221	63.2	38.7	8.3	17.1	115.3	910
86	40.37	83	32.7	35.0	0.253	72.2	46.4	8.9	17.7	107.2	1,089
87	40.37	83	28.0	32.3	0.263	75.2	39.7	11.2	18.0	115.6	933
88	40.37	83	25.0	29.9	0.220	63.0	35.5	11.4	16.8	119.9	832
89	40.37	83	27.0	31.2	0.241	68.7	38.3	11.2	17.6	115.6	898
90	40.37	83	27.8	29.2	0.209	59.6	39.5	11.8	16.1	105.0	928
91	40.37	83	22.9	29.7	0.224	64.0	32.5	11.3	16.6	129.7	764
92	40.87	83	31.3	35.5	0.289	82.7	44.4	8.5	18.8	113.6	1,042
		Average	28.3	32.0	0.242	69.3	40.2	10.7	17.0	114.1	944
		Std. Dev.	3.4	1.7	0.019	5.3	4.8	1.6	0.7	12.3	112

Total number of blows analyzed: 91

BL# Sensors

1-1 F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 39.37-ft (12m) MB18 - 39.37-ft (12m)
OP: JG Date: 20-September-2015

2-92 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

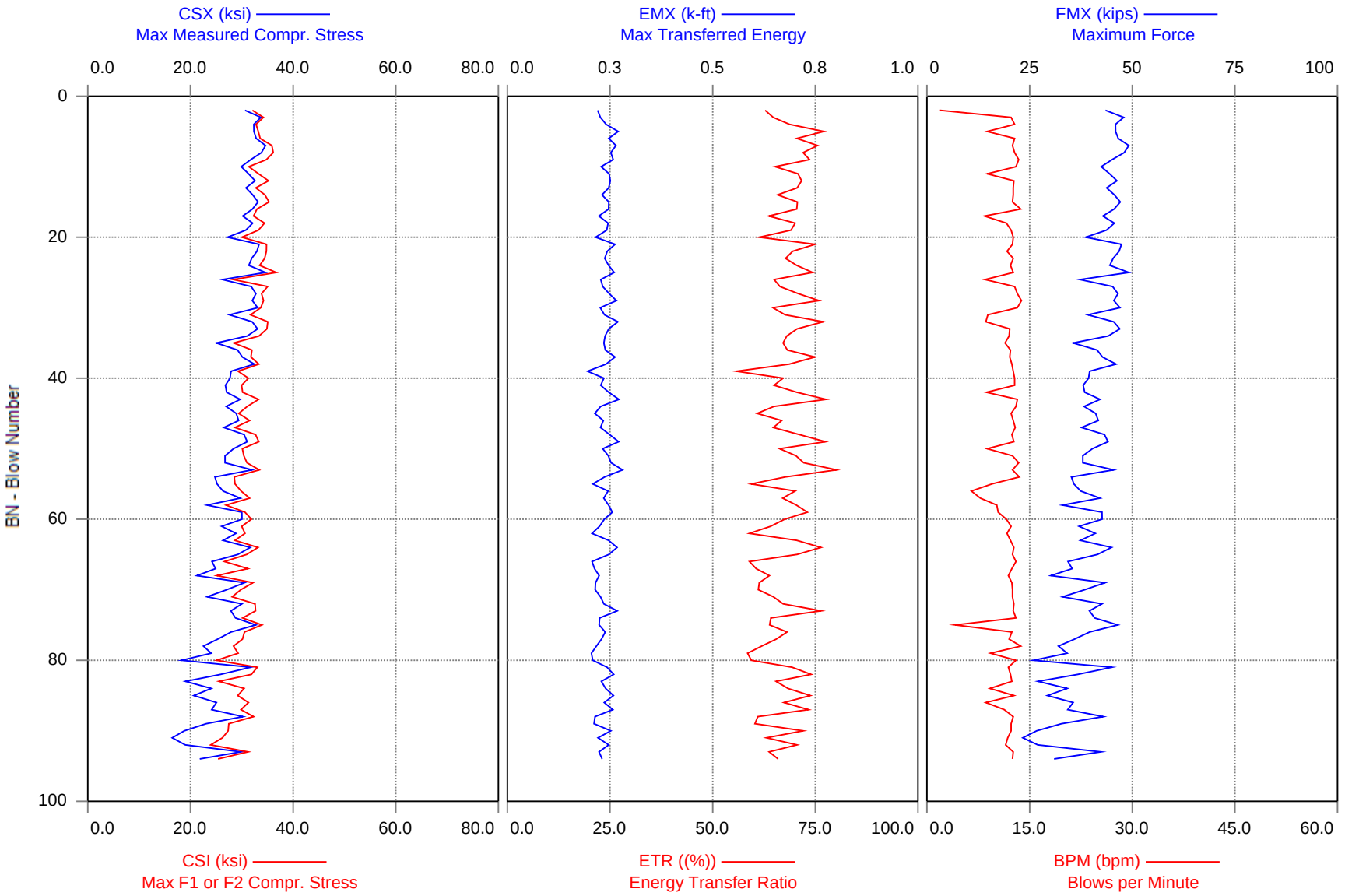
Time Summary

Drive 8 minutes 38 seconds 10:52 AM - 11:01 AM BN 1 - 92

GRL Engineers, Inc. - Seminar - PDIPLOT2 Ver 2015.1.50.1 - Case Method & iCAP® Results

Printed: 19-November-2015 Test started: 20-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 63.65-ft (19.4m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 63.65-ft (19.4m)
OP: JG

MB18 - 63.65-ft (19.4m)
Date: 20-September-2015

AR: 1.42 in²
LE: 136.33 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
2	63.68	26	30.6	32.1	0.220	62.8	43.5	1.9	15.8	104.7	1,021
3	63.71	26	33.7	34.2	0.227	64.8	47.9	12.3	17.3	101.4	1,124
4	63.74	26	32.3	32.8	0.240	68.7	45.9	12.8	16.9	101.4	1,078
5	63.77	26	32.4	33.2	0.270	77.1	45.9	8.8	17.0	102.7	1,079
6	63.81	26	32.8	33.6	0.247	70.5	46.6	12.8	17.4	102.4	1,093
7	63.84	26	34.6	35.9	0.264	75.5	49.2	12.5	18.4	103.6	1,154
8	63.87	26	33.8	36.1	0.252	72.0	48.0	12.8	17.9	106.9	1,127
9	63.90	26	31.8	34.8	0.258	73.6	45.1	13.4	17.5	109.6	1,059
10	63.93	26	29.9	31.4	0.228	65.2	42.4	13.0	17.3	104.9	996
11	63.96	26	31.3	33.3	0.248	70.8	44.5	8.8	17.1	106.2	1,044
12	63.99	26	32.6	35.2	0.251	71.7	46.3	12.7	17.8	108.1	1,086
13	64.02	26	30.8	32.7	0.247	70.6	43.8	12.6	16.7	106.2	1,027
14	64.06	26	32.1	34.5	0.230	65.8	45.6	12.6	17.6	107.4	1,071
15	64.09	26	33.2	35.3	0.247	70.6	47.1	12.5	18.1	106.5	1,106
16	64.12	26	32.1	32.9	0.247	70.5	45.6	13.7	17.5	102.7	1,070
17	64.15	26	30.2	32.3	0.223	63.6	42.9	8.4	17.1	107.0	1,006
18	64.17	54	32.1	34.4	0.245	70.1	45.6	11.6	17.5	107.1	1,071
19	64.18	54	30.8	33.2	0.242	69.1	43.7	12.3	17.4	107.9	1,026
20	64.20	54	27.2	30.0	0.215	61.4	38.7	12.6	15.8	110.3	908
21	64.21	54	33.4	34.8	0.262	74.9	47.4	12.5	17.5	104.4	1,112
22	64.23	54	33.0	34.8	0.243	69.5	46.8	11.7	18.2	105.6	1,099
23	64.24	54	31.9	34.5	0.237	67.7	45.3	12.6	16.9	107.9	1,064
24	64.26	54	31.4	33.5	0.247	70.4	44.6	12.2	16.8	106.7	1,046
25	64.27	54	34.6	36.7	0.260	74.3	49.1	12.6	19.5	106.1	1,154
26	64.29	54	26.3	28.4	0.227	65.0	37.3	8.5	16.7	108.0	875
27	64.30	54	31.8	35.0	0.232	66.4	45.2	12.8	17.5	110.1	1,061
28	64.32	54	32.8	33.8	0.248	70.9	46.5	13.2	17.8	103.3	1,092
29	64.33	54	32.1	34.2	0.266	75.9	45.5	13.8	18.3	106.8	1,068
30	64.35	54	33.1	33.7	0.226	64.7	47.0	13.2	18.0	101.8	1,104
31	64.36	54	27.6	31.7	0.237	67.6	39.2	8.9	16.9	114.8	921
32	64.38	54	32.0	35.1	0.269	76.9	45.5	8.6	17.6	109.5	1,068
33	64.39	54	33.1	34.9	0.247	70.6	47.0	12.1	17.8	105.5	1,103
34	64.41	54	31.1	33.4	0.238	68.0	44.2	12.0	17.3	107.3	1,036
35	64.42	54	25.1	28.4	0.235	67.1	35.6	11.4	14.5	113.5	835
36	64.44	54	29.2	32.0	0.239	68.2	41.4	12.2	15.5	109.5	973
37	64.45	54	30.1	31.8	0.262	74.9	42.8	12.1	17.2	105.5	1,004
38	64.47	54	32.4	33.3	0.240	68.6	46.1	12.4	18.6	102.7	1,081
39	64.48	54	27.9	29.3	0.195	55.8	39.6	12.6	16.3	105.0	930
40	64.50	54	27.7	31.3	0.235	67.1	39.4	12.8	15.8	112.9	924
41	64.51	54	26.8	30.0	0.227	64.9	38.1	12.8	17.5	111.8	894
42	64.53	54	27.1	30.2	0.247	70.5	38.4	8.7	15.3	111.5	902
43	64.54	54	29.7	33.3	0.272	77.6	42.2	13.2	17.8	112.1	989
44	64.56	54	27.0	31.1	0.227	64.9	38.3	13.0	14.9	115.2	898
45	64.57	54	28.9	29.4	0.213	60.8	41.1	12.3	16.4	101.6	964
46	64.59	54	29.4	31.5	0.234	66.8	41.7	12.6	15.9	107.2	979

GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 63.65-ft (19.4m)
OP: JG

MB18 - 63.65-ft (19.4m)
Date: 20-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
47	64.60	54	26.5	28.7	0.227	64.8	37.7	12.9	15.7	108.1	884
48	64.62	54	30.5	32.7	0.249	71.1	43.2	12.4	16.6	107.3	1,015
49	64.63	54	31.0	33.3	0.271	77.4	44.1	12.7	18.0	107.3	1,035
50	64.65	54	28.4	30.1	0.232	66.3	40.3	8.8	15.7	106.1	946
51	64.66	72	26.7	30.4	0.246	70.3	38.0	12.5	15.4	113.7	891
52	64.67	72	26.7	31.0	0.253	72.2	38.0	13.4	16.4	116.0	891
53	64.68	72	32.0	33.4	0.281	80.1	45.4	12.5	17.8	104.4	1,067
54	64.70	72	24.8	28.5	0.237	67.7	35.2	13.5	14.1	115.2	826
55	64.71	72	25.2	28.7	0.208	59.4	35.8	9.5	15.4	113.9	840
56	64.72	72	26.4	29.9	0.245	70.1	37.4	6.5	16.5	113.3	879
57	64.73	72	29.7	31.5	0.235	67.0	42.2	7.8	16.6	106.2	990
58	64.74	72	23.2	26.9	0.246	70.4	33.0	10.2	14.5	115.9	775
59	64.75	72	30.0	30.6	0.256	73.1	42.6	10.4	17.1	102.0	1,001
60	64.76	72	30.0	31.9	0.236	67.5	42.7	11.6	15.5	106.1	1,001
61	64.78	72	26.1	30.0	0.224	64.1	37.1	12.3	15.5	115.0	870
62	64.79	72	28.9	30.6	0.206	58.9	41.0	11.7	15.1	106.1	962
63	64.80	72	26.3	28.7	0.247	70.5	37.4	12.2	15.0	108.8	878
64	64.81	72	31.6	33.2	0.267	76.4	44.9	12.7	18.1	104.8	1,055
65	64.82	72	29.2	31.0	0.247	70.6	41.5	12.5	16.2	105.9	975
66	64.83	72	24.2	26.6	0.206	58.9	34.4	13.0	15.5	110.1	807
67	64.84	72	24.9	31.2	0.212	60.6	35.4	12.4	17.3	125.2	830
68	64.85	72	21.3	25.2	0.223	63.8	30.2	11.9	14.3	118.3	709
69	64.87	72	30.5	32.2	0.215	61.4	43.3	12.4	16.0	105.4	1,018
70	64.88	72	27.1	29.8	0.214	61.1	38.5	12.5	17.2	110.1	903
71	64.89	72	23.3	28.1	0.227	64.8	33.0	12.5	15.6	120.9	776
72	64.90	72	30.0	32.6	0.235	67.2	42.6	12.7	16.6	108.6	1,000
73	64.91	72	27.9	32.7	0.268	76.4	39.6	12.6	19.2	117.3	929
74	64.92	72	28.8	30.2	0.225	64.2	40.9	13.0	15.5	104.8	959
75	64.93	72	32.7	33.9	0.224	63.9	46.5	4.1	16.7	103.6	1,091
76	64.95	72	27.9	30.5	0.238	68.1	39.6	12.4	18.2	109.4	930
77	64.96	72	25.3	30.1	0.229	65.5	35.9	12.0	16.8	119.1	843
78	64.97	72	22.6	28.4	0.217	61.9	32.0	13.7	16.0	125.9	752
79	64.98	72	24.0	29.3	0.205	58.5	34.1	9.3	16.8	121.8	801
80	64.99	72	18.3	25.1	0.208	59.4	25.9	13.0	15.1	137.4	609
81	65.00	72	31.7	33.0	0.243	69.4	45.0	11.9	16.9	104.2	1,057
82	65.01	72	25.9	31.9	0.259	74.0	36.8	12.2	18.9	123.1	863
83	65.03	72	19.1	25.6	0.229	65.4	27.1	12.4	15.1	134.2	635
84	65.04	72	24.0	30.5	0.239	68.3	34.1	9.2	18.0	126.7	801
85	65.05	72	20.7	29.2	0.258	73.8	29.4	12.7	16.9	141.4	689
86	65.06	72	25.1	31.3	0.236	67.4	35.6	8.6	18.7	124.8	836
87	65.07	72	24.1	29.9	0.257	73.3	34.3	11.3	16.9	123.6	805
88	65.08	72	30.2	32.3	0.213	61.0	42.9	12.6	16.0	106.8	1,008
89	65.09	72	23.1	27.5	0.211	60.3	32.7	12.3	16.7	119.1	769
90	65.10	72	18.8	27.4	0.252	72.0	26.7	12.3	15.9	145.5	627
91	65.12	72	16.4	26.2	0.221	63.1	23.3	11.8	15.2	159.6	548
92	65.13	72	19.0	23.9	0.247	70.6	27.0	11.5	14.2	126.0	633
93	65.14	72	29.9	31.2	0.223	63.7	42.4	12.6	16.1	104.6	995
94	65.15	72	21.8	25.4	0.231	65.9	31.0	12.5	16.5	116.3	727
		Average	28.4	31.4	0.238	68.0	40.3	11.7	16.7	111.6	947
		Std. Dev.	4.1	2.8	0.018	5.1	5.8	2.0	1.2	10.1	137

Total number of blows analyzed: 93

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 63.65-ft (19.4m) MB18 - 63.65-ft (19.4m)
OP: JG Date: 20-September-2015

BL#	Sensors
1-1	F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)
2-94	F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

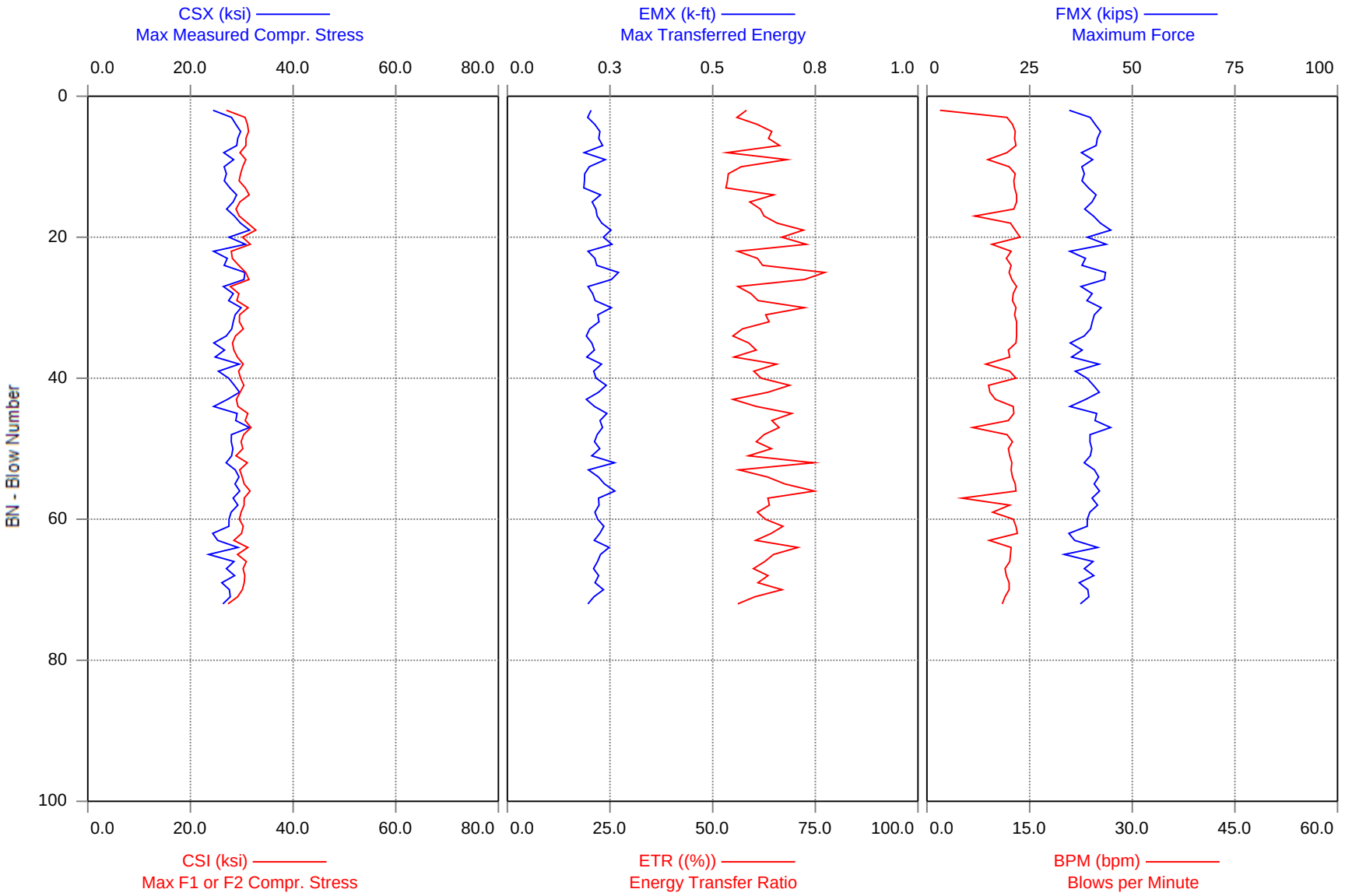
Time Summary

Drive 8 minutes 19 seconds 5:48 PM - 5:57 PM BN 1 - 94

GRL Engineers, Inc. - Seminar - PDIPLOT2 Ver 2015.1.50.1 - Case Method & iCAP® Results

Printed: 19-November-2015 Test started: 21-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 83.34-ft (25.4m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 83.34-ft (25.4m)
OP: AF

MB18 - 83.34-ft (25.4m)
Date: 21-September-2015

AR: 1.42 in²
LE: 158.48 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
2	83.33	13	24.4	27.0	0.204	58.2	34.6	1.9	15.5	110.7	813
3	83.33	13	28.0	30.6	0.196	55.9	39.7	11.7	16.3	109.5	933
4	83.33	13	28.9	31.1	0.213	60.8	41.0	12.5	17.0	107.8	962
5	83.33	13	29.8	31.3	0.225	64.4	42.3	12.9	17.2	105.2	992
6	83.33	13	29.2	30.8	0.223	63.6	41.5	12.8	17.0	105.5	973
7	83.33	13	29.0	30.8	0.232	66.3	41.2	13.0	16.8	106.2	967
8	83.33	13	26.5	29.7	0.187	53.5	37.6	11.7	16.6	111.9	884
9	83.33	13	28.4	30.8	0.238	68.1	40.4	8.9	17.4	108.4	947
10	83.83	27	26.6	30.2	0.199	57.0	37.7	12.0	17.2	113.6	885
11	83.83	27	27.0	29.8	0.188	53.8	38.3	12.9	16.8	110.2	900
12	83.83	27	26.6	29.5	0.188	53.6	37.7	12.7	16.9	110.9	886
13	83.83	27	27.7	30.7	0.186	53.2	39.3	12.8	17.4	110.8	923
14	83.83	27	29.0	31.5	0.227	64.8	41.2	13.1	18.0	108.5	967
15	83.83	27	28.3	29.6	0.207	59.0	40.2	13.1	17.1	104.7	944
16	83.83	27	27.0	28.9	0.216	61.6	38.4	12.7	17.3	106.7	901
17	83.83	27	28.6	29.5	0.219	62.5	40.5	7.0	17.0	103.4	952
18	83.83	27	29.7	31.2	0.230	65.7	42.2	12.2	17.1	104.7	992
19	83.83	27	31.5	32.7	0.252	72.1	44.8	12.9	17.6	103.9	1,051
20	83.83	27	27.5	30.2	0.234	66.8	39.1	13.6	17.3	109.6	917
21	83.83	27	30.7	31.7	0.255	72.8	43.6	9.5	17.6	103.1	1,024
22	83.83	27	24.5	27.9	0.196	56.1	34.8	12.3	16.5	114.0	817
23	83.83	27	27.2	28.2	0.213	60.9	38.6	11.6	17.2	103.6	906
24	83.83	27	26.6	29.4	0.218	62.2	37.7	12.3	16.1	110.7	886
25	83.83	27	30.6	30.8	0.271	77.3	43.5	12.0	18.2	100.4	1,021
26	84.33	37	30.4	31.4	0.253	72.3	43.2	12.4	17.6	103.2	1,015
27	84.33	37	26.4	27.8	0.197	56.1	37.5	13.1	17.1	105.2	881
28	84.33	37	28.3	29.4	0.208	59.3	40.2	12.6	17.4	103.9	945
29	84.33	37	27.4	29.1	0.214	61.1	39.0	12.5	17.3	105.9	914
30	84.33	37	29.9	31.2	0.253	72.3	42.4	13.0	18.3	104.5	996
31	84.33	37	28.7	29.6	0.220	62.9	40.7	12.8	17.6	103.1	956
32	84.33	37	28.3	29.5	0.223	63.8	40.3	13.1	17.8	104.2	945
33	84.33	37	28.1	30.3	0.200	57.2	39.8	13.1	16.6	108.1	935
34	84.33	37	27.0	28.8	0.192	54.9	38.3	13.1	16.7	106.7	899
35	84.33	37	24.6	28.2	0.206	58.8	34.9	13.0	16.9	114.7	819
36	84.33	37	26.6	28.5	0.212	60.6	37.8	11.9	17.0	106.8	888
37	84.33	37	24.8	29.1	0.193	55.2	35.2	12.1	17.5	117.4	827
38	84.33	37	29.5	30.3	0.229	65.5	41.9	8.6	17.7	102.7	983
39	84.33	37	25.5	29.4	0.210	60.0	36.2	12.1	17.6	115.4	849
40	84.33	37	27.4	29.8	0.216	61.8	39.0	13.0	17.5	108.5	915
41	84.33	37	28.6	30.4	0.241	68.8	40.5	9.0	17.8	106.5	952
42	84.33	37	29.6	29.7	0.222	63.5	42.0	9.2	17.2	100.4	985
43	84.33	37	27.2	28.9	0.192	54.9	38.7	10.0	16.9	106.3	908
44	84.33	37	24.5	29.3	0.212	60.7	34.8	12.6	17.0	119.3	817
45	84.33	37	29.1	31.2	0.242	69.3	41.3	12.7	18.3	107.2	970
46	84.33	37	28.8	30.7	0.225	64.4	40.9	11.9	17.7	106.4	961

GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 83.34-ft (25.4m)
OP: AF

MB18 - 83.34-ft (25.4m)
Date: 21-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
47	84.33	37	31.5	31.8	0.232	66.2	44.7	6.7	18.0	100.9	1,050
48	84.33	37	28.0	30.4	0.219	62.5	39.7	11.7	17.6	108.6	933
49	84.83	42	28.0	29.9	0.212	60.6	39.7	12.5	17.6	106.9	932
50	84.83	42	28.3	30.2	0.225	64.3	40.2	11.9	17.6	106.8	943
51	84.83	42	28.0	28.9	0.206	58.7	39.8	12.1	16.8	103.1	934
52	84.83	42	27.0	31.1	0.261	74.5	38.3	12.4	17.6	115.3	899
53	84.83	42	28.7	29.6	0.197	56.4	40.8	12.3	17.4	103.0	958
54	84.83	42	29.4	30.1	0.222	63.3	41.8	12.5	17.1	102.1	981
55	84.83	42	28.7	30.5	0.236	67.6	40.7	12.9	17.7	106.3	956
56	84.83	42	29.6	31.6	0.262	74.8	42.0	13.0	18.1	106.8	987
57	84.83	42	28.3	30.5	0.222	63.4	40.2	5.1	17.7	107.7	944
58	84.83	42	29.2	30.5	0.223	63.8	41.5	12.1	17.7	104.1	975
59	84.83	42	27.9	29.9	0.213	60.9	39.7	9.6	18.0	107.0	931
60	84.83	42	27.5	29.5	0.220	62.8	39.1	12.6	17.5	107.3	917
61	84.83	42	27.5	30.3	0.235	67.1	39.0	13.0	18.2	110.2	916
62	84.83	42	24.3	30.0	0.225	64.3	34.6	13.2	17.1	123.1	811
63	84.83	42	25.3	28.5	0.212	60.5	35.9	9.1	17.3	112.5	844
64	84.83	42	29.3	31.2	0.248	70.7	41.6	12.3	18.7	106.5	976
65	84.83	42	23.6	29.2	0.227	64.8	33.5	12.2	16.5	123.8	785
66	84.83	42	28.5	30.9	0.219	62.7	40.4	12.1	17.5	108.4	949
67	84.83	42	27.0	30.3	0.210	59.9	38.3	11.4	17.5	112.1	900
68	84.83	42	28.6	30.6	0.222	63.5	40.6	11.6	17.7	107.0	954
69	84.83	42	26.1	30.5	0.214	61.0	37.1	12.0	16.7	116.7	870
70	84.83	42	27.6	30.1	0.234	66.9	39.2	12.0	15.5	109.1	920
71	84.83	42	27.8	29.2	0.211	60.3	39.4	11.4	16.9	105.2	925
72	85.33	42	26.3	27.3	0.196	56.1	37.4	11.0	15.6	103.8	877
		Average	27.8	30.0	0.219	62.7	39.5	11.7	17.3	107.9	928
		Std. Dev.	1.7	1.1	0.019	5.5	2.4	2.0	0.6	4.8	57

Total number of blows analyzed: 71

BL# Sensors

1-1 F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)
2-72 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

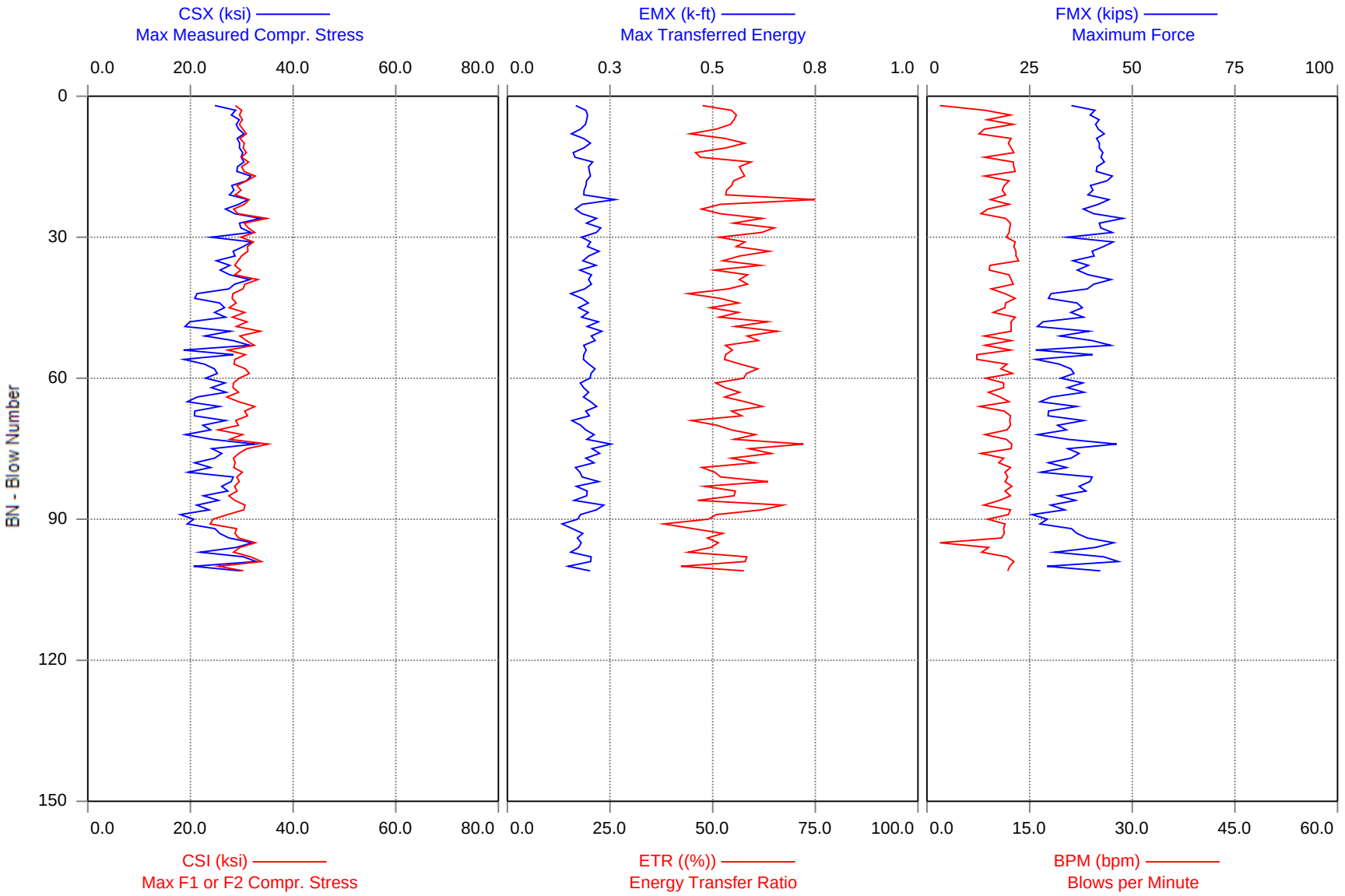
Time Summary

Drive 6 minutes 16 seconds 1:14 AM - 1:20 AM BN 1 - 72

GRL Engineers, Inc. - Seminar - PDIPLOT2 Ver 2015.1.50.1 - Case Method & iCAP® Results

Printed: 19-November-2015 Test started: 21-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 103.02-ft (31.4m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 103.02-ft (31.4m)
OP: AF

MB18 - 103.02-ft (31.4m)
Date: 21-September-2015

AR: 1.42 in²
LE: 178.16 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
3	103.07	33	28.8	30.0	0.191	54.6	40.9	8.5	15.9	104.1	960
5	103.12	33	29.5	30.1	0.193	55.2	41.9	8.8	16.1	102.1	984
7	103.17	33	29.4	30.2	0.178	50.9	41.7	8.4	16.2	102.8	980
9	103.22	33	29.1	29.7	0.185	53.0	41.3	12.3	16.0	102.0	969
11	103.26	33	29.6	30.3	0.186	53.2	42.0	12.3	16.2	102.4	985
13	103.31	33	29.9	29.9	0.165	47.0	42.4	8.4	17.1	100.3	995
15	103.36	33	29.2	30.0	0.198	56.5	41.4	12.7	17.3	102.8	972
17	103.41	33	31.8	32.6	0.202	57.8	45.1	8.4	16.8	102.5	1,060
19	103.46	33	28.0	29.1	0.191	54.6	39.8	11.3	16.2	103.7	935
21	103.51	33	27.6	28.7	0.186	53.2	39.2	11.5	16.2	104.1	921
23	103.53	67	29.4	30.5	0.182	51.9	41.7	12.0	16.6	103.9	980
25	103.56	67	28.6	29.2	0.181	51.8	40.6	7.9	16.3	102.3	953
27	103.58	67	29.6	30.5	0.193	55.1	42.0	12.2	17.2	103.1	985
29	103.61	67	31.8	32.5	0.217	61.9	45.1	12.0	17.5	102.4	1,059
31	103.63	67	31.9	32.2	0.202	57.8	45.3	12.9	17.4	101.0	1,064
33	103.66	67	28.3	31.2	0.223	63.8	40.2	13.0	18.0	110.2	944
35	103.68	67	25.0	29.3	0.184	52.5	35.6	13.4	16.6	117.0	835
37	103.71	67	25.8	29.8	0.176	50.4	36.6	9.1	17.4	115.5	860
39	103.73	67	31.6	33.2	0.198	56.5	44.9	12.3	19.0	105.0	1,053
41	103.75	67	27.5	30.2	0.188	53.8	39.1	9.4	17.8	109.9	917
43	103.78	67	20.8	28.1	0.181	51.8	29.6	12.9	17.6	135.0	694
45	103.80	67	26.6	27.6	0.173	49.4	37.8	11.4	16.8	103.5	888
47	103.83	67	26.8	28.2	0.181	51.6	38.1	12.9	16.6	105.1	894
49	103.85	67	18.9	29.0	0.194	55.5	26.9	12.3	17.2	152.9	631
51	103.88	67	22.8	29.6	0.204	58.4	32.4	8.4	17.0	129.8	761
53	103.90	67	31.5	32.4	0.186	53.1	44.7	8.5	16.8	102.9	1,050
55	103.92	67	28.4	30.7	0.186	53.2	40.3	7.3	17.4	108.1	947
57	103.95	67	22.7	28.5	0.198	56.7	32.2	11.7	18.0	125.6	757
59	103.97	67	25.2	31.5	0.204	58.3	35.8	12.5	18.4	124.8	841
61	104.00	67	26.7	28.4	0.178	50.7	38.0	11.2	16.8	106.2	891
63	104.02	64	27.0	29.4	0.198	56.5	38.3	9.0	18.0	109.0	898
65	104.05	64	19.4	29.4	0.203	57.9	27.6	12.0	17.5	151.4	647
67	104.07	64	20.8	30.6	0.191	54.6	29.6	11.3	17.8	146.6	695
69	104.10	64	26.9	28.8	0.157	44.9	38.1	12.1	17.1	107.4	895
71	104.13	64	23.9	25.4	0.191	54.5	34.0	11.7	15.8	106.1	797
73	104.15	64	24.2	27.7	0.193	55.3	34.3	11.6	16.7	114.5	806
75	104.18	64	24.2	31.0	0.206	58.9	34.3	12.3	18.2	128.1	806
77	104.20	64	24.7	28.4	0.191	54.6	35.1	11.2	17.2	114.8	824
79	104.23	64	23.9	28.4	0.166	47.4	34.0	12.2	18.0	118.9	797
81	104.25	64	28.3	29.0	0.182	52.0	40.3	11.8	17.7	102.4	945
83	104.28	64	26.1	28.6	0.168	48.0	37.0	12.4	16.7	109.6	870
85	104.30	64	22.5	27.5	0.193	55.2	32.0	12.2	17.5	121.9	752
87	104.33	64	21.2	30.6	0.235	67.1	30.1	8.3	18.1	144.4	707
89	104.36	64	18.0	27.2	0.178	50.9	25.6	11.9	16.7	151.0	601
91	104.38	64	19.4	23.9	0.133	38.1	27.5	11.4	15.4	123.1	646

GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 103.02-ft (31.4m)
OP: AF

MB18 - 103.02-ft (31.4m)
Date: 21-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
93	104.41	64	25.7	28.7	0.184	52.5	36.5	11.3	17.2	111.5	857
95	104.43	64	32.1	32.7	0.180	51.4	45.5	1.9	16.5	101.9	1,068
97	104.46	64	22.0	28.4	0.154	44.1	31.2	8.0	17.1	129.3	732
99	104.48	64	32.8	33.8	0.203	57.9	46.6	12.7	18.7	103.1	1,094
101	104.51	64	29.7	30.3	0.202	57.6	42.2	11.8	17.2	102.0	991
		Average	26.3	29.8	0.192	54.9	37.3	10.9	17.1	115.5	876
		Std. Dev.	3.9	1.9	0.021	6.1	5.5	2.1	0.8	15.8	130

Total number of blows analyzed: 100

BL#	Sensors
1-1	F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)
2-101	F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

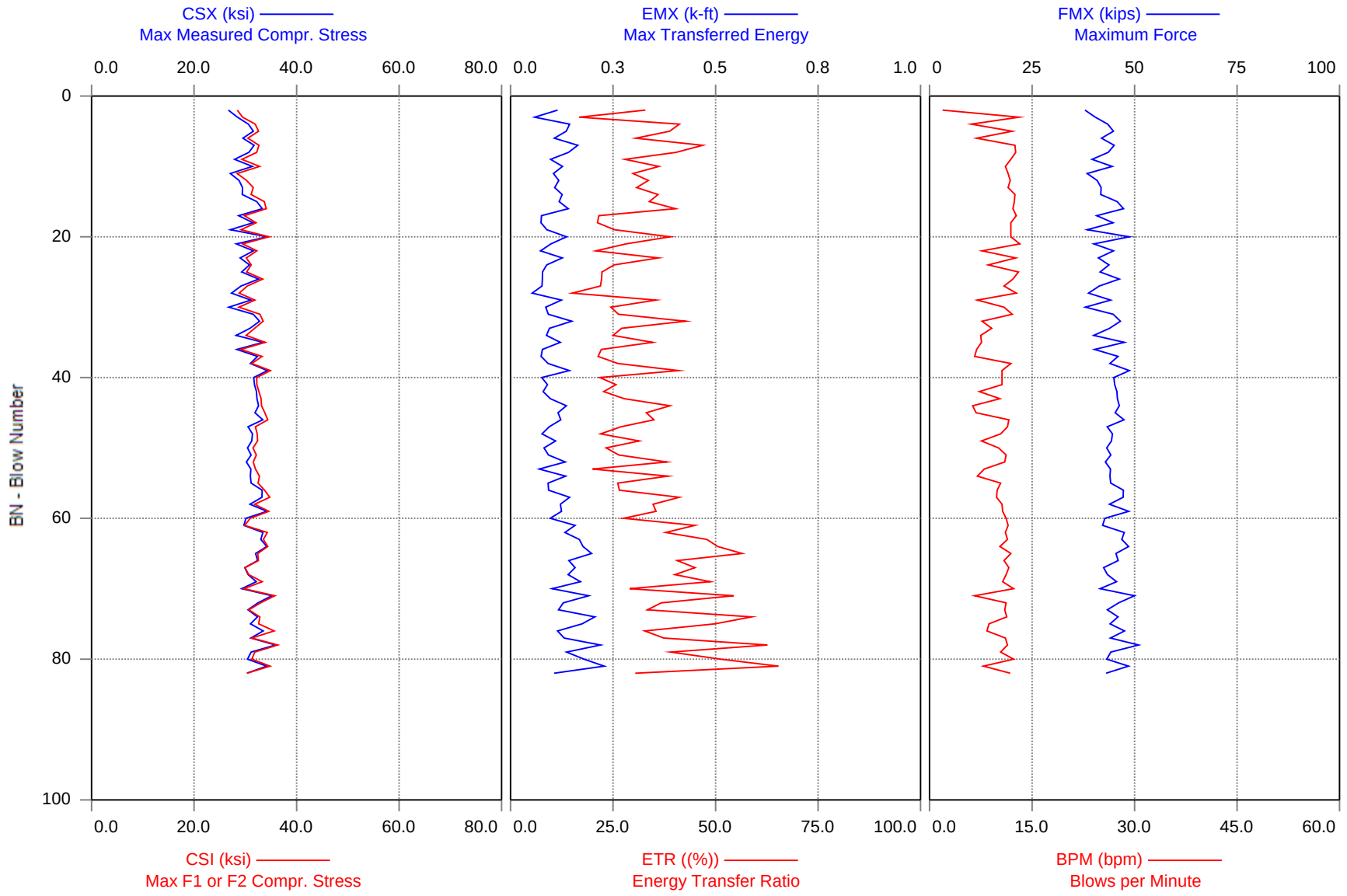
Time Summary

Drive 9 minutes 48 seconds 4:49 AM - 4:58 AM BN 1 - 101

GRL Engineers, Inc. - Seminar - PDIPLOT2 Ver 2015.1.50.1 - Case Method & iCAP® Results

Printed: 19-November-2015 Test started: 21-September-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 120.41-ft (36.7m)



GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 120.41-ft (36.7m)
OP: JG

MB18 - 120.41-ft (36.7m)
Date: 21-September-2015

AR: 1.42 in²
LE: 195.39 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.00 []

CSX: Max Measured Compr. Stress
CSI: Max F1 or F2 Compr. Stress
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio
FMX: Maximum Force

BPM: Blows per Minute
VMX: Maximum Velocity
RIX: CSI/CSX
MEX: Maximum Strain

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
2	120.42	51	26.7	28.4	0.115	32.9	37.9	1.9	12.8	106.6	890
3	120.44	51	28.5	29.5	0.059	16.8	40.4	13.1	14.6	103.5	948
4	120.46	51	30.6	31.9	0.144	41.2	43.5	6.1	15.7	104.4	1,020
5	120.47	51	31.6	32.6	0.136	38.8	44.8	12.1	15.9	103.2	1,052
6	120.49	51	29.5	30.5	0.107	30.5	41.9	6.9	15.3	103.3	985
7	120.50	51	31.7	32.7	0.164	46.9	45.0	12.5	15.6	103.0	1,057
8	120.52	51	30.7	32.2	0.141	40.4	43.6	12.6	16.0	105.0	1,023
9	120.54	51	27.9	29.3	0.098	27.9	39.6	11.9	15.0	105.1	931
10	120.55	51	31.4	32.8	0.127	36.2	44.5	11.1	15.5	104.5	1,045
11	120.57	51	27.1	28.4	0.105	29.9	38.4	11.5	14.9	104.9	902
12	120.59	51	28.8	30.3	0.118	33.6	40.9	11.8	15.7	105.1	959
13	120.60	51	29.5	31.5	0.108	30.8	41.8	11.5	16.1	107.1	982
14	120.62	51	29.4	31.1	0.126	36.0	41.7	12.5	15.6	105.9	980
15	120.63	51	32.2	33.7	0.118	33.8	45.8	12.4	16.2	104.5	1,074
16	120.65	51	33.3	34.1	0.141	40.2	47.3	12.2	16.9	102.3	1,111
17	120.67	51	28.7	29.8	0.075	21.5	40.8	12.7	15.8	103.8	957
18	120.68	51	31.5	32.1	0.074	21.2	44.7	11.9	15.8	101.9	1,050
19	120.70	51	27.1	29.2	0.089	25.3	38.5	11.9	15.6	107.6	904
20	120.72	51	34.3	34.6	0.136	38.9	48.7	11.9	17.3	100.9	1,143
21	120.73	51	28.2	29.5	0.099	28.2	40.1	13.2	16.1	104.4	941
22	120.75	51	31.6	32.2	0.073	20.8	44.8	7.7	15.3	102.1	1,052
23	120.76	51	29.0	30.2	0.126	36.1	41.2	12.6	16.3	104.1	967
24	120.78	51	30.8	31.1	0.088	25.2	43.8	8.6	16.2	101.1	1,027
25	120.80	51	29.3	30.3	0.078	22.3	41.6	13.0	16.1	103.3	976
26	120.81	51	32.6	33.4	0.078	22.2	46.3	12.2	16.6	102.5	1,086
27	120.83	51	29.2	30.4	0.077	21.9	41.4	10.9	15.5	104.2	972
28	120.85	51	27.3	28.8	0.053	15.0	38.8	12.7	15.7	105.5	910
29	120.86	51	31.1	31.9	0.124	35.5	44.2	7.0	16.3	102.5	1,036
30	120.88	51	26.8	28.8	0.086	24.5	38.0	10.9	15.5	107.4	893
31	120.89	51	31.5	32.9	0.092	26.3	44.8	12.1	15.4	104.2	1,051
32	120.91	51	32.8	33.5	0.149	42.6	46.6	7.7	15.4	102.2	1,093
33	120.91	315	30.9	31.8	0.095	27.1	43.9	9.1	15.7	102.9	1,031
34	120.92	315	28.2	30.2	0.087	25.0	40.1	7.5	15.6	107.0	940
35	120.92	315	33.4	33.9	0.121	34.6	47.5	7.6	15.7	101.4	1,115
36	120.92	315	28.4	29.1	0.078	22.1	40.3	6.9	15.9	102.7	945
37	120.92	315	32.4	33.3	0.075	21.3	46.0	6.6	15.5	102.8	1,079
38	120.93	315	31.0	31.3	0.092	26.2	44.0	11.9	16.1	100.9	1,033
39	120.93	315	34.3	34.9	0.143	40.9	48.7	10.6	16.2	101.7	1,144
40	120.93	315	31.7	32.2	0.076	21.8	44.9	10.6	16.1	101.8	1,055
41	120.93	315	31.8	32.3	0.090	25.7	45.2	10.6	16.6	101.4	1,060
42	120.94	315	32.2	32.7	0.080	22.7	45.7	7.3	15.8	101.5	1,072
43	120.94	315	32.3	33.1	0.097	27.7	45.8	10.3	16.1	102.5	1,076
44	120.94	315	32.6	33.2	0.136	38.9	46.3	6.3	15.5	101.8	1,086
45	120.94	315	31.9	33.8	0.116	33.1	45.3	6.8	16.1	106.1	1,062
46	120.95	315	33.4	34.4	0.122	35.0	47.4	11.6	15.4	102.9	1,114

GRL Engineers, Inc. - Seminar
Case Method & iCAP® Results

PDIPLOT2 2015.1.50.1 - Printed 19-November-2015

ALASKA LNG 2015 - SKATE3A-SPTO9-MB18 - 120.41-ft (36.7m)
OP: JG

MB18 - 120.41-ft (36.7m)
Date: 21-September-2015

BL#	Depth ft	BLC bl/.25m	CSX ksi	CSI ksi	EMX k-ft	ETR (%)	FMX kips	BPM bpm	VMX f/s	RIX (%)	MEX µE
47	120.95	315	30.5	32.0	0.094	26.9	43.3	11.4	15.1	104.7	1,017
48	120.95	315	31.4	32.3	0.077	21.9	44.6	10.4	15.3	102.9	1,047
49	120.95	315	31.2	32.4	0.110	31.4	44.4	7.6	15.6	103.6	1,042
50	120.96	315	30.4	31.5	0.082	23.3	43.2	10.1	15.2	103.5	1,015
51	120.96	315	31.1	32.1	0.092	26.4	44.2	11.2	15.8	103.2	1,038
52	120.96	315	30.2	31.6	0.133	38.1	42.9	11.0	15.0	104.5	1,007
53	120.96	315	31.1	32.0	0.070	20.0	44.1	8.0	15.0	102.9	1,036
54	120.97	315	31.0	32.8	0.134	38.4	44.0	7.0	14.9	105.8	1,033
55	120.97	315	31.1	32.5	0.092	26.2	44.2	10.4	14.4	104.4	1,037
56	120.97	315	33.3	33.7	0.093	26.5	47.3	9.9	14.9	101.3	1,110
57	120.98	315	33.2	34.8	0.144	41.1	47.2	9.8	15.1	104.6	1,108
58	120.98	315	30.9	31.8	0.122	34.8	43.9	10.6	14.9	102.9	1,030
59	120.98	315	34.2	34.6	0.124	35.5	48.6	10.7	15.7	101.1	1,140
60	120.98	315	30.1	31.0	0.097	27.6	42.7	11.2	14.8	102.9	1,003
61	120.99	315	29.7	29.9	0.157	44.9	42.2	11.5	14.6	100.5	991
62	120.99	315	33.4	34.3	0.132	37.9	47.5	11.1	15.7	102.5	1,115
63	120.99	315	33.0	33.5	0.168	47.9	46.9	11.4	15.7	101.6	1,101
64	120.99	315	34.2	34.4	0.177	50.5	48.5	10.3	16.1	100.6	1,140
65	121.00	315	32.0	32.4	0.198	56.5	45.5	11.9	15.8	101.3	1,067
66	121.00	315	32.4	32.6	0.142	40.7	46.0	10.9	15.2	100.5	1,080
67	121.00	315	29.9	29.9	0.157	45.0	42.4	11.6	15.0	100.2	996
68	121.00	315	30.6	30.7	0.140	40.1	43.4	11.2	14.9	100.3	1,019
69	121.01	315	32.1	33.3	0.170	48.7	45.6	10.7	15.6	103.6	1,071
70	121.01	315	29.3	29.7	0.102	29.1	41.6	12.3	14.4	101.4	977
71	121.01	315	35.2	35.8	0.190	54.4	50.0	6.6	16.8	101.6	1,173
72	121.01	315	32.5	33.0	0.129	36.8	46.1	11.2	15.1	101.5	1,083
73	121.02	315	30.5	30.7	0.117	33.4	43.4	11.0	14.9	100.5	1,018
74	121.02	315	32.4	32.8	0.206	58.8	46.0	11.3	16.1	101.4	1,079
75	121.02	315	31.0	32.6	0.174	49.8	44.0	8.7	14.6	105.2	1,033
76	121.02	315	33.5	35.6	0.115	32.8	47.5	8.4	15.9	106.4	1,116
77	121.03	315	31.1	31.3	0.131	37.4	44.1	11.1	15.1	100.6	1,036
78	121.03	315	35.9	36.3	0.219	62.6	51.0	11.4	17.5	101.2	1,196
79	121.03	315	31.1	31.8	0.137	39.1	44.2	10.4	14.7	102.2	1,038
80	121.03	315	30.4	31.3	0.179	51.2	43.2	12.3	16.1	102.8	1,014
81	121.04	315	34.2	34.8	0.228	65.3	48.5	7.9	15.7	101.9	1,139
82	121.04	315	30.3	30.3	0.106	30.4	43.0	11.8	15.0	100.1	1,010
		Average	31.1	32.0	0.119	34.0	44.2	10.3	15.6	103.1	1,037
		Std. Dev.	2.0	1.8	0.037	10.6	2.8	2.2	0.7	1.9	66

Total number of blows analyzed: 81

BL# Sensors

1-1 F3: [ST CAL] 147.5 (1.00); F4: [ST CAL] 147.5 (1.00); A3: [PR CAL] 1000.0 (1.00); A4: [PR CAL] 1000.0 (1.00)
2-82 F3: [333NWJ1] 214.0 (1.00); F4: [333NWJ2] 213.4 (1.00); A3: [K1481] 360.0 (1.00); A4: [K1799] 345.0 (1.00)

Time Summary

Drive 8 minutes 14 seconds 11:06 AM - 11:14 AM BN 1 - 82

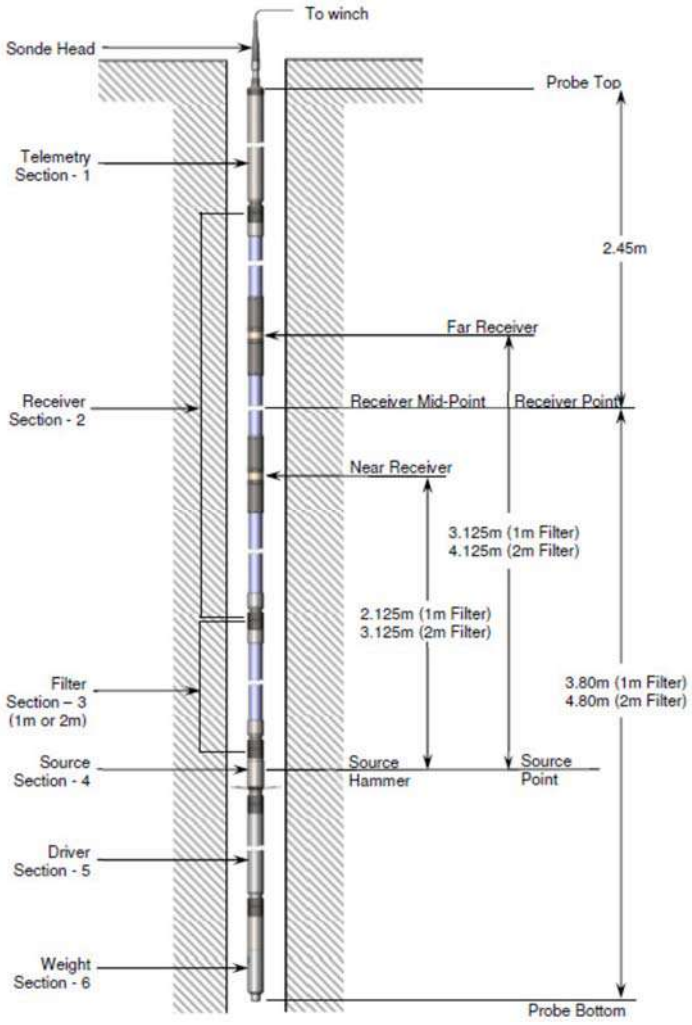
APPENDIX D

PS Logging Equipment Specifications and Results

DIGITAL P-S SUSPENSION PROBE

The Digital P-S suspension probe is a low-frequency acoustic sonde designed to measure compressional and shear-wave velocities (slowness) in soils and soft-rock formations. It operates using indirect-excitation rather than mode conversion as in a conventional sonic. It is capable of acquiring high-resolution P and S wave data in borehole depths of up to 1000m.

The P-S suspension probe contains a unique-design of powerful hammer source and two receivers, separated by acoustic damping tubes. To acquire data, the probe is stopped at the required depth and the source is fired under surface command. Firing causes a solenoid-operated shuttle aligned across the borehole axis to strike plates on opposite sides of the probe in turn, setting up a pressure doublet in the surrounding fluid. The resultant fluid motion produces a tube wave at the borehole wall with velocity close to the shear velocity of the formation together with a compressional wave. As the waves propagate parallel to the borehole axis, they set up corresponding fluid movements that are detected by the two neutral-buoyancy 3D hydrophone receivers, allowing the wave velocity to be directly measured. The facility to stack multiple shots and filter the data as in normal seismic data acquisition is included in the operating software.



Features:

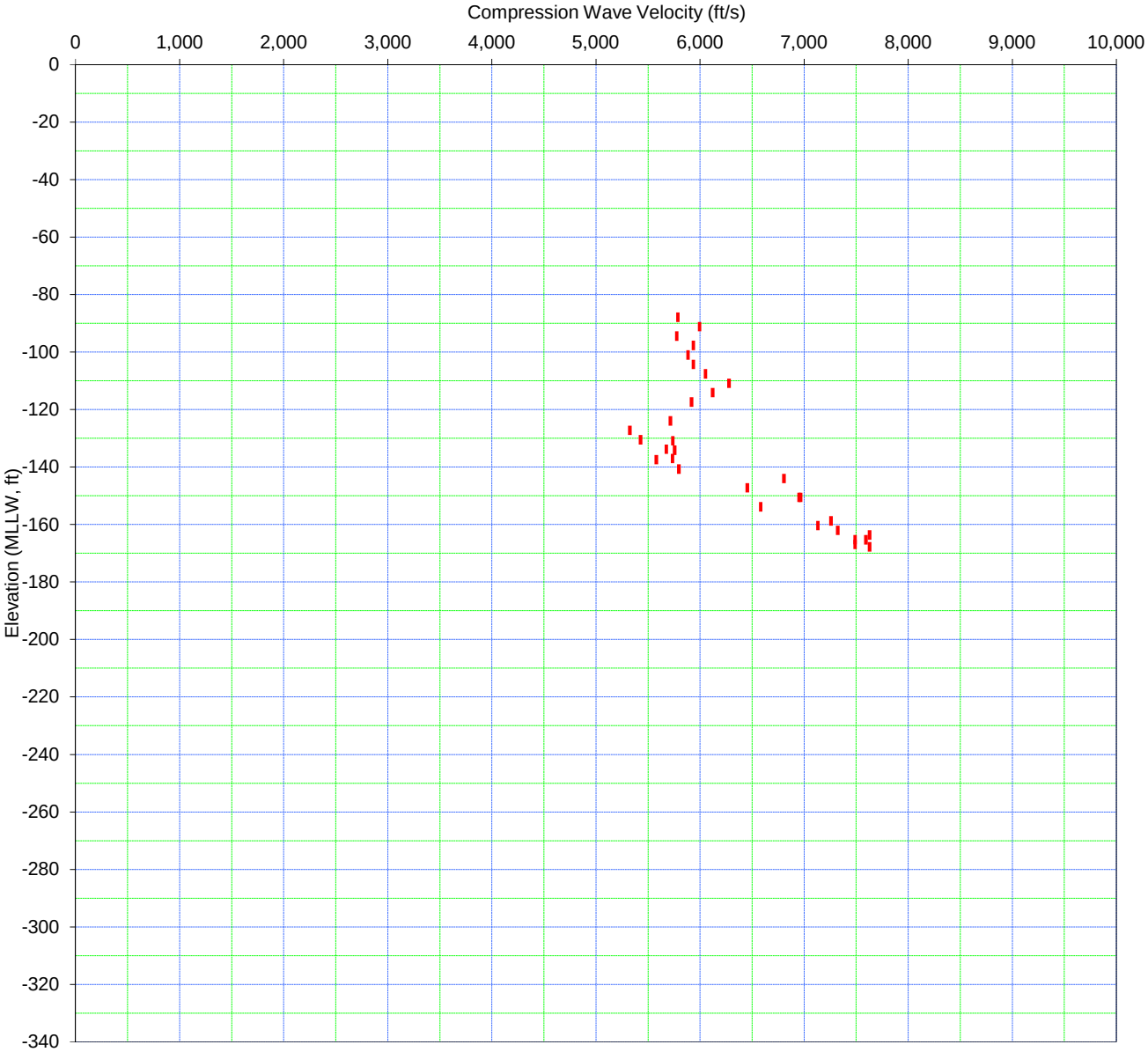
- High energy shear-wave source, typically 20x power of conventional sonic probes;
- Low frequency measurement, more representative of engineering situations;
- Stacking of multiple shots to increase signal to noise ratio;
- Real-time wavelet (wiggle) display.
- Weight: 5.9 kg (13.0 lbs)
- Pressure Rating: 200 Bar (3000 PSI), Operating Temperature: 70°C (122°F)
- Caliper measurements: 38 to 430 mm (1.5” to 17”) or 50 to 730mm (2” to 29”);

Specifications:

- Diameter: 54 mm;
- Length: 6.25 – 7.25 m (assembled);
- Weight: 38 kg;
- Max. temperature: 70 °C;
- Max. pressure: 20 MPa
- Transducer type: solenoid and hammer
- Receiver type: 3D hydrophones

Field Applications:

- Formation compression (P-) wave velocity or slowness
- Formation shear (S-) wave velocity or slowness



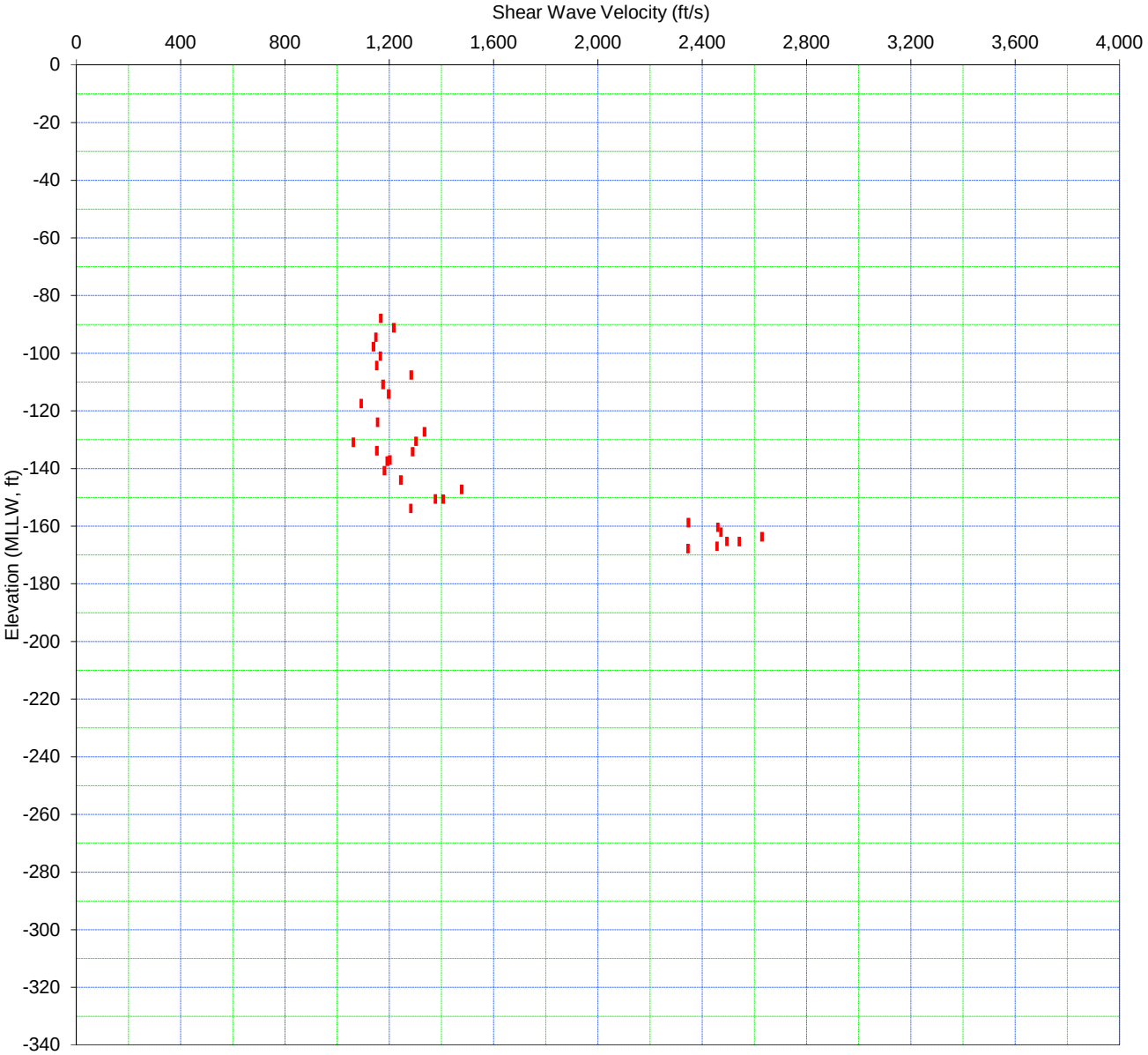
MEASURED P-WAVE VELOCITIES - BORING MB-03

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D2-1



MEASURED S-WAVE VELOCITIES - BORING MB-03

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D2-2

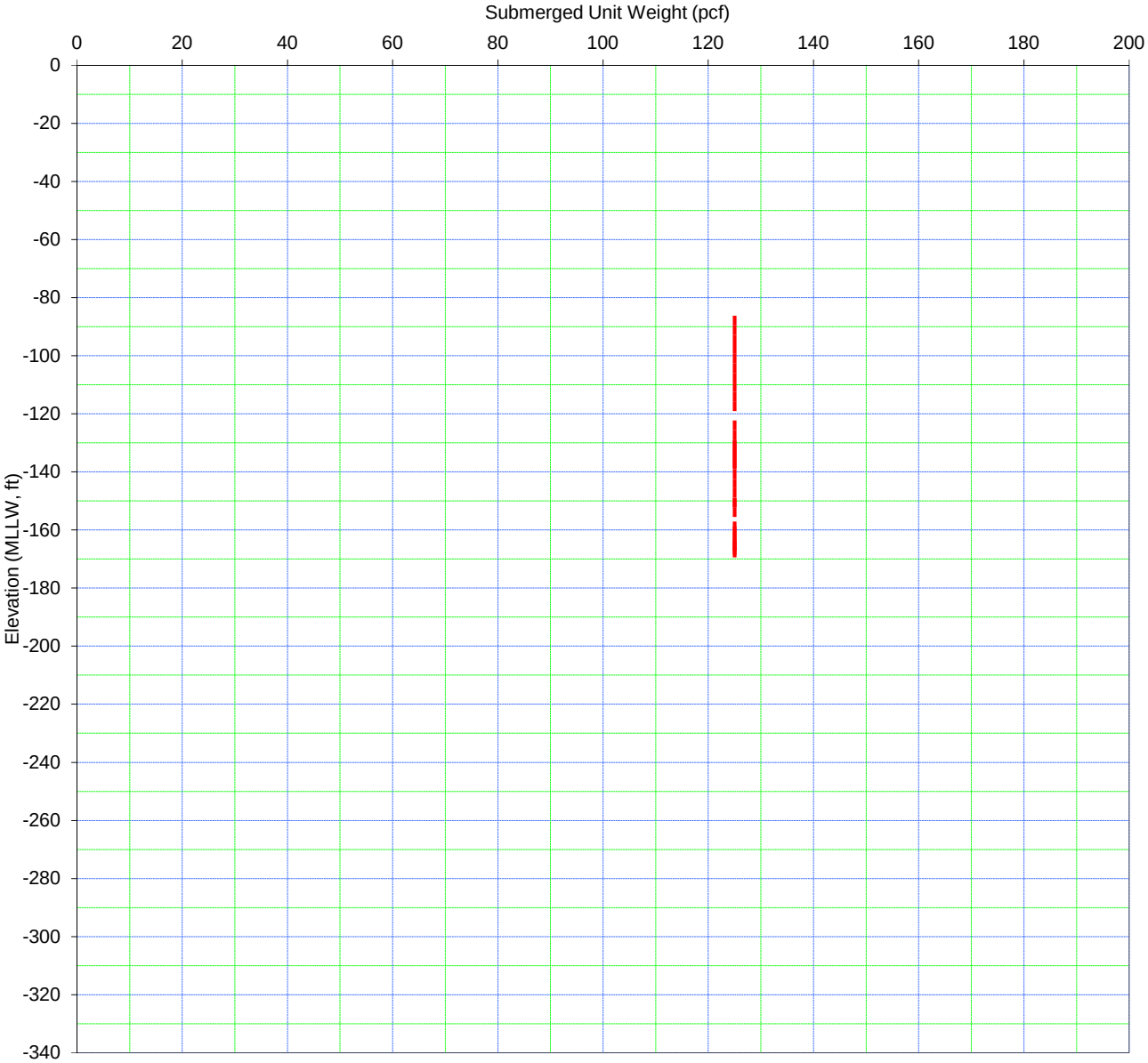
CALCULATED POISSON'S RATIO - BORING MB-03

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D2-3



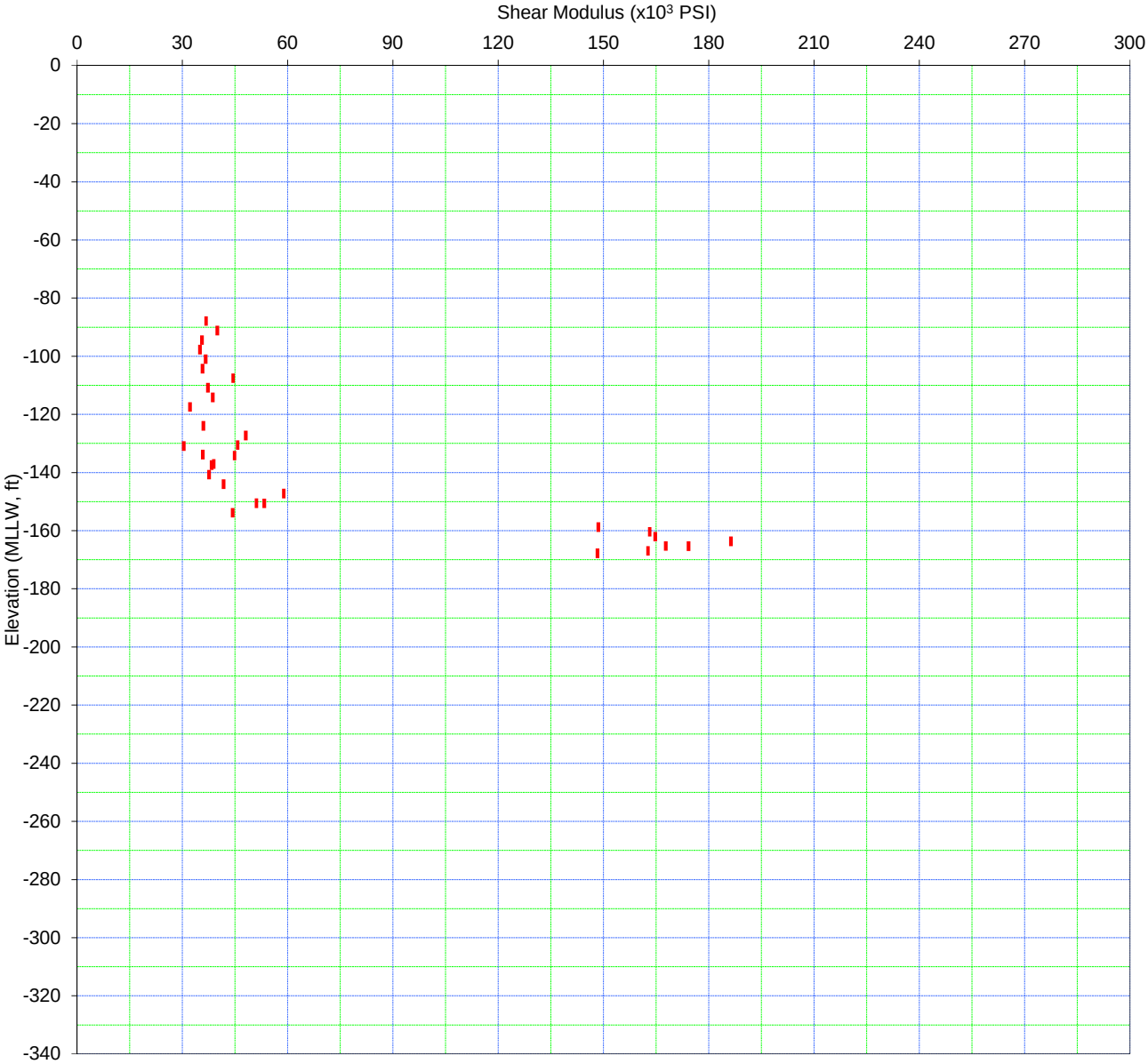
ASSUMED SUBMERGED UNIT WEIGHT - BORING MB-03

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D2-4



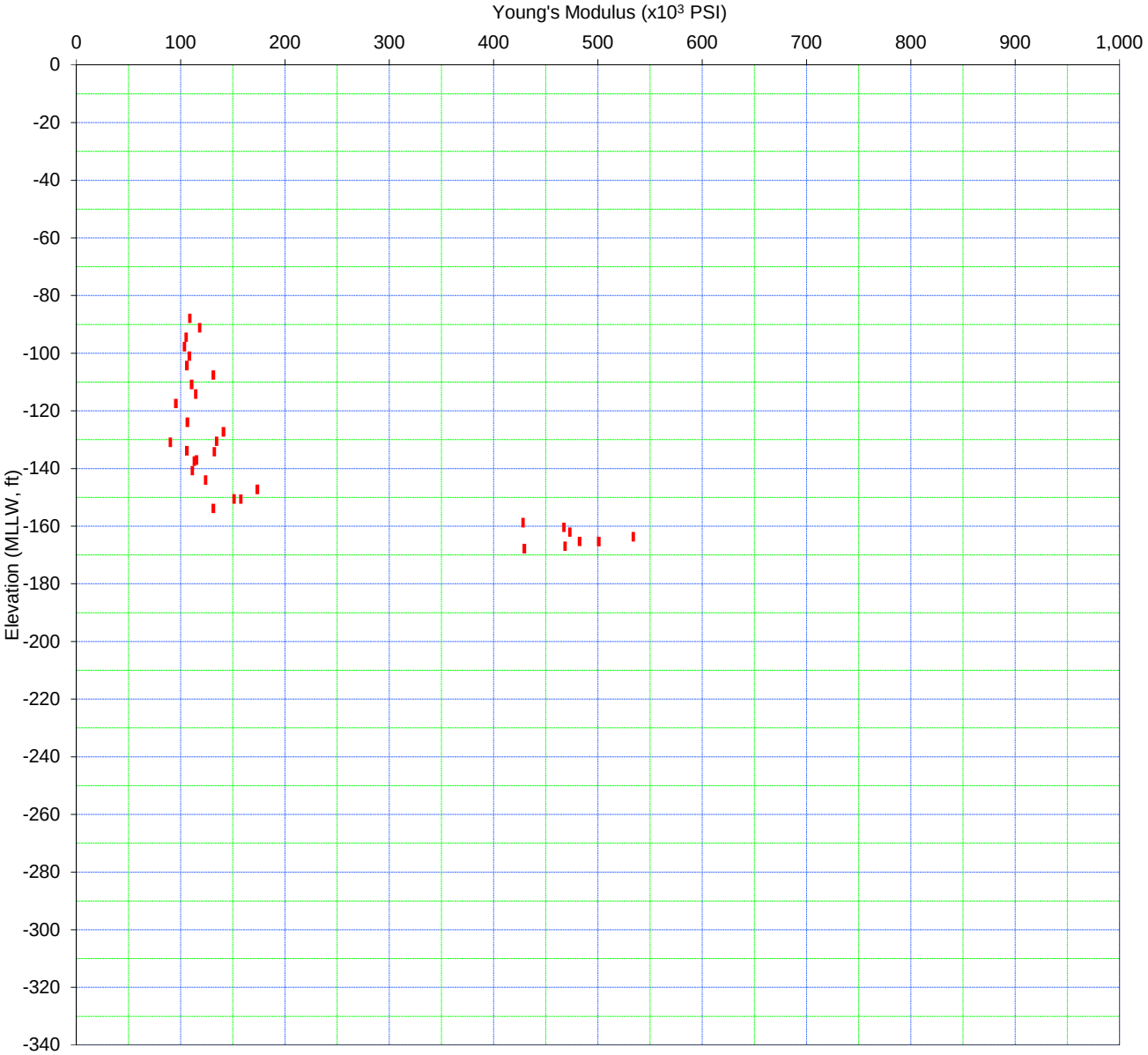
CALCULATED SHEAR MODULUS - BORING MB-03

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D2-5



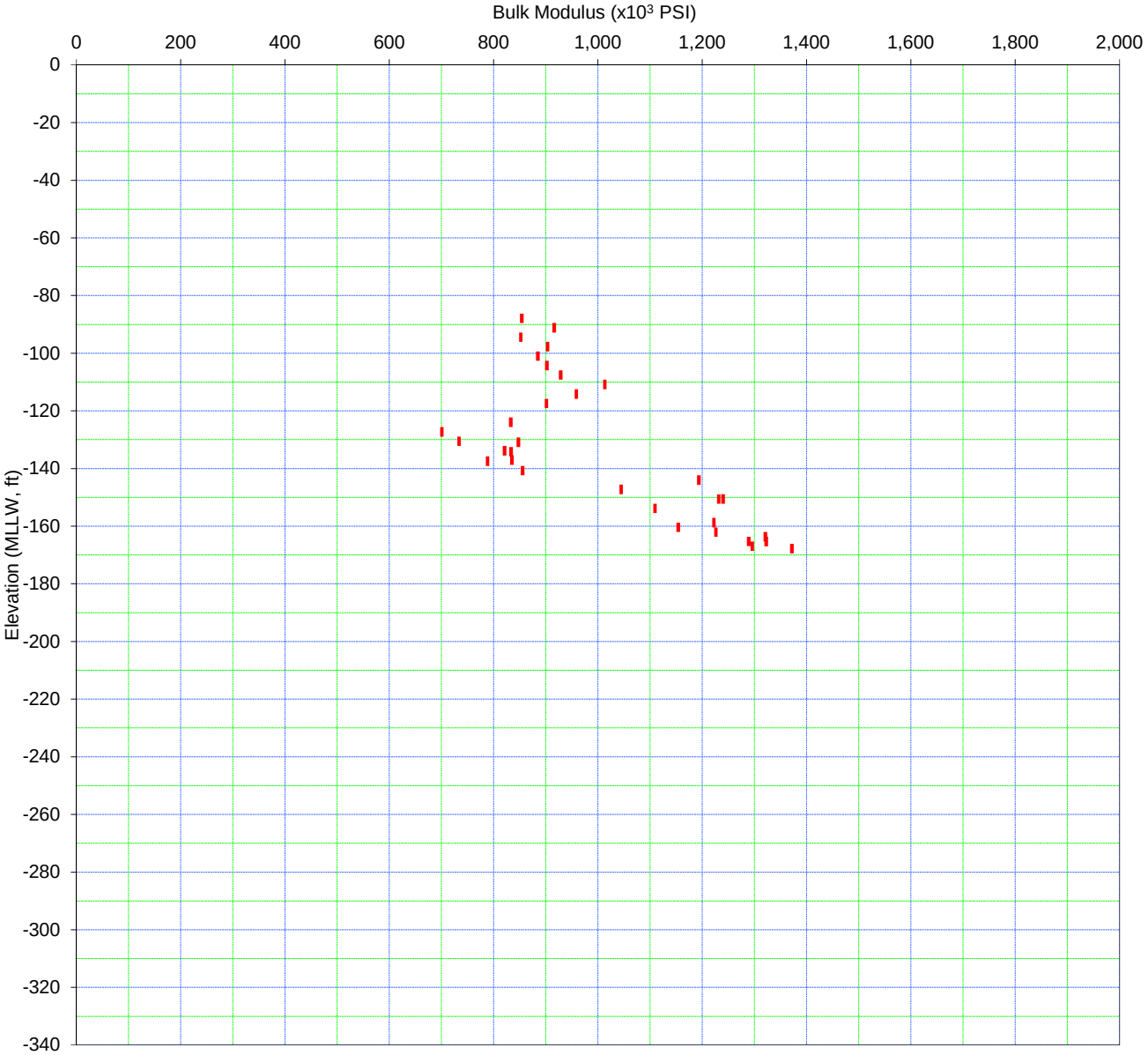
CALCULATED YOUNG'S MODULUS - BORING MB-03

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D2-6



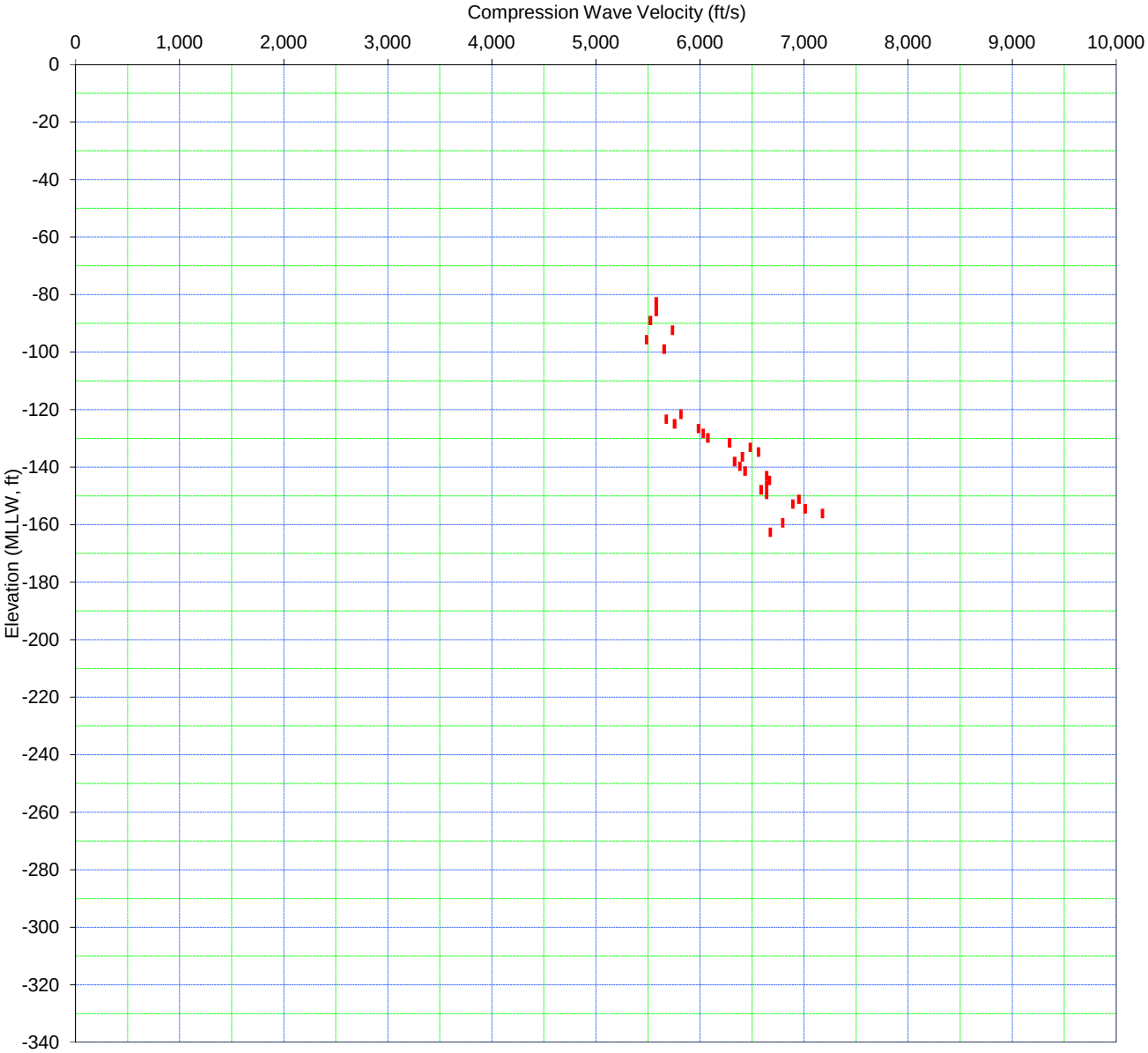
CALCULATED BULK MODULUS - BORING MB-03

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D2-7



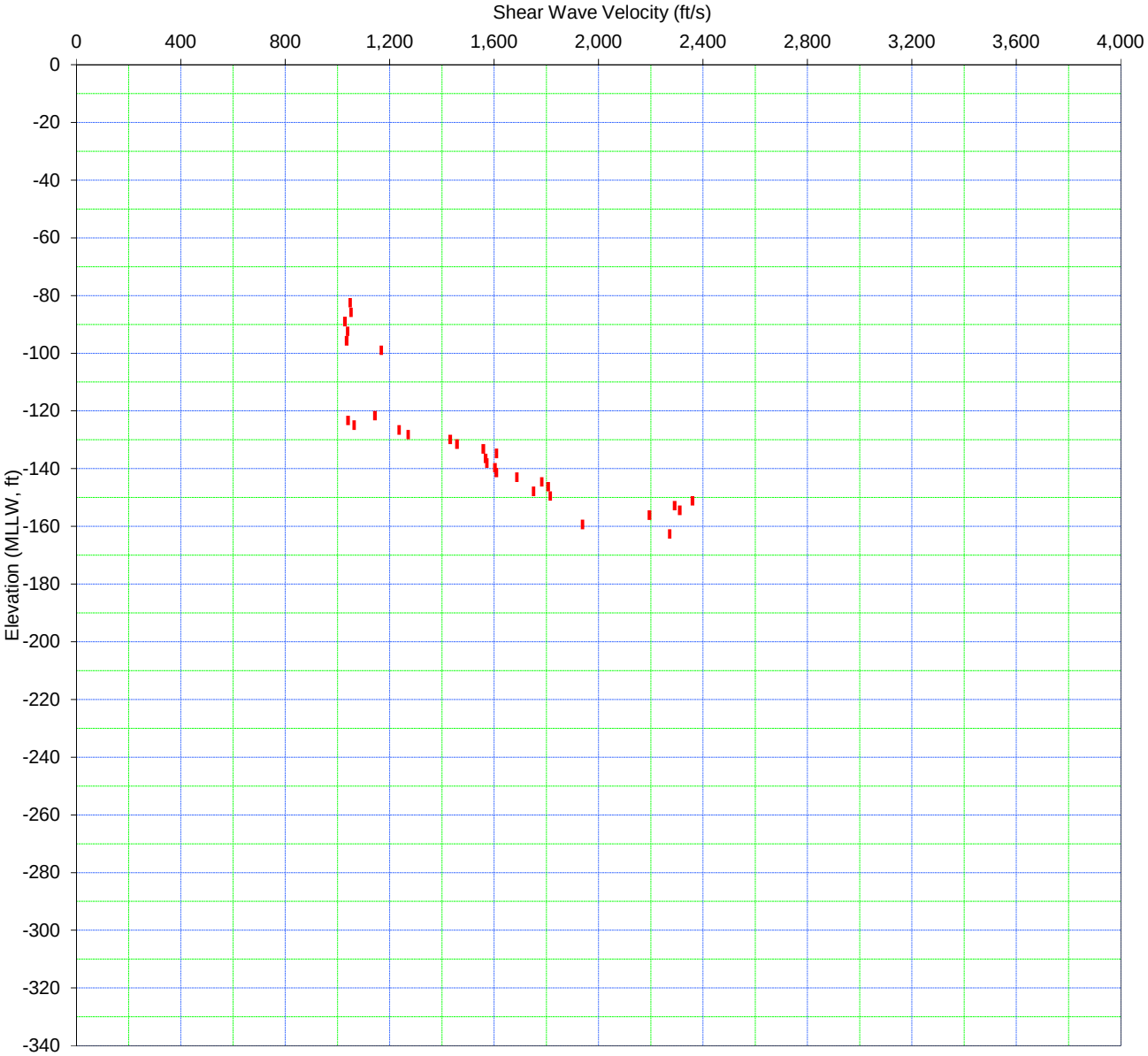
MEASURED P-WAVE VELOCITIES - BORING MB-06

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D3-1



MEASURED S-WAVE VELOCITIES - BORING MB-06

MARINE LNG FACILITIES

ALASKA LNG PROJECT

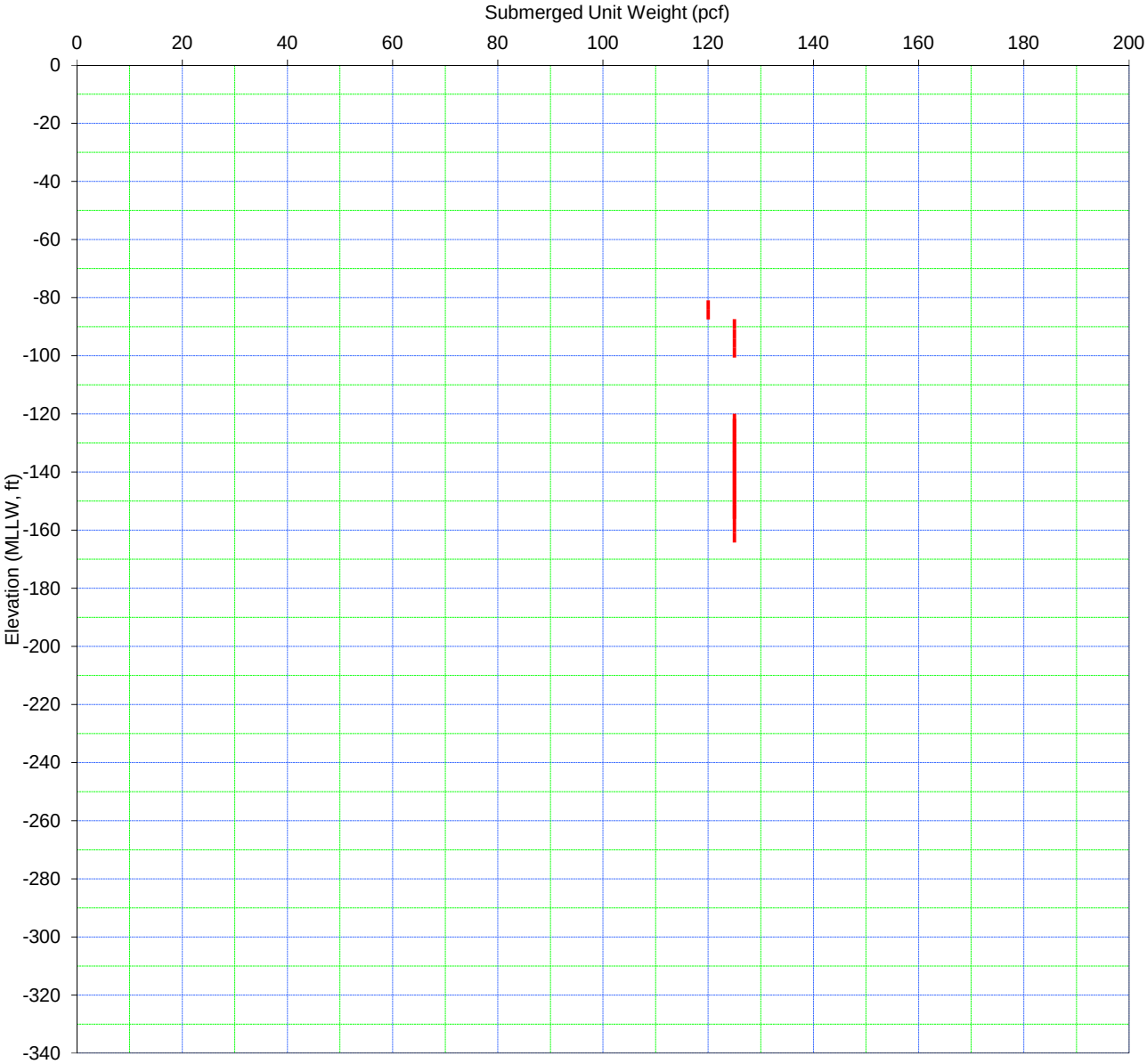
NIKISIKI, ALASKA

PLATE D3-2

CALCULATED POISSON'S RATIO - BORING MB-06

MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISIKI, ALASKA

PLATE D3-3



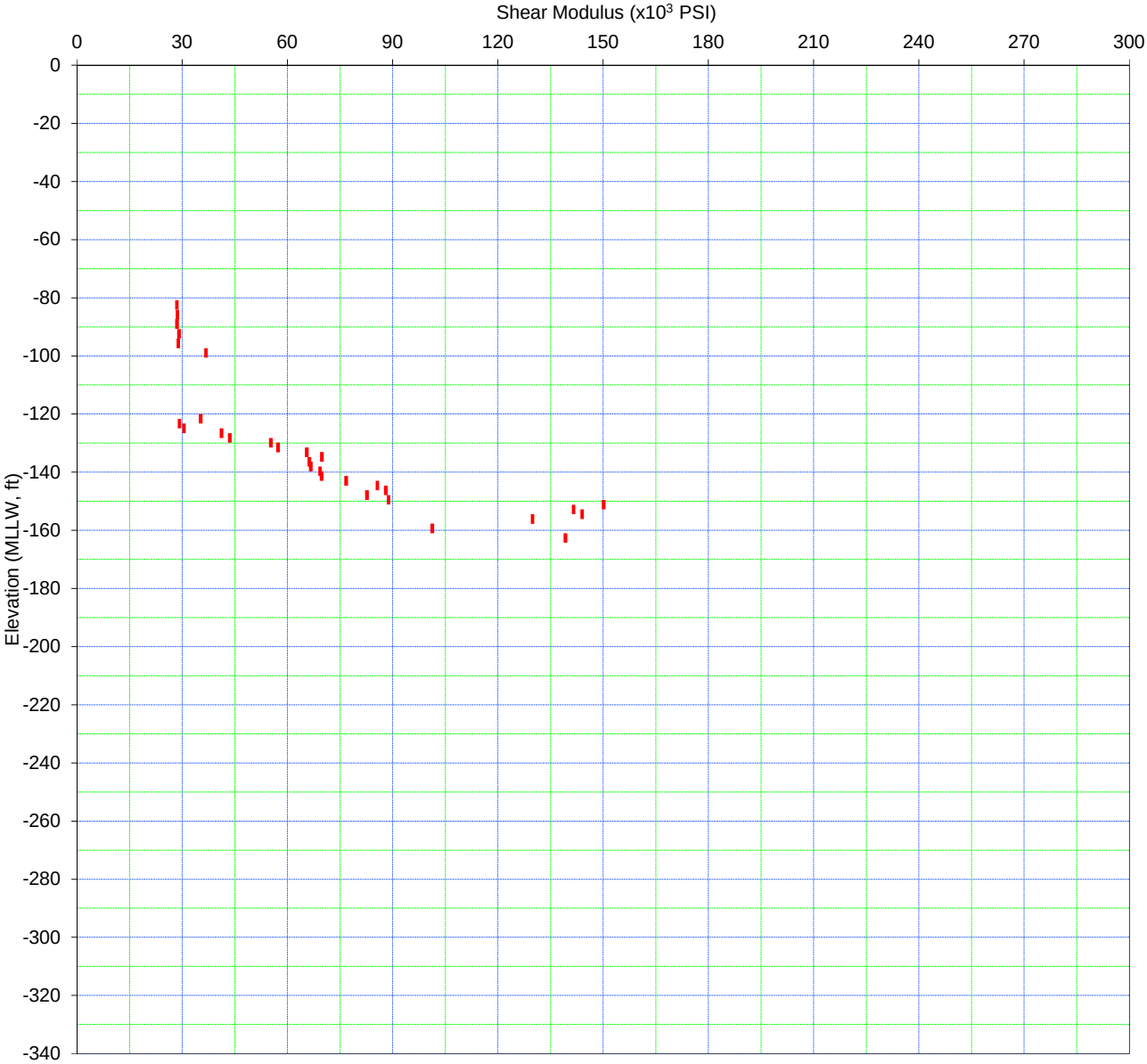
ASSUMED SUBMERGED UNIT WEIGHT - BORING MB-06

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D3-4



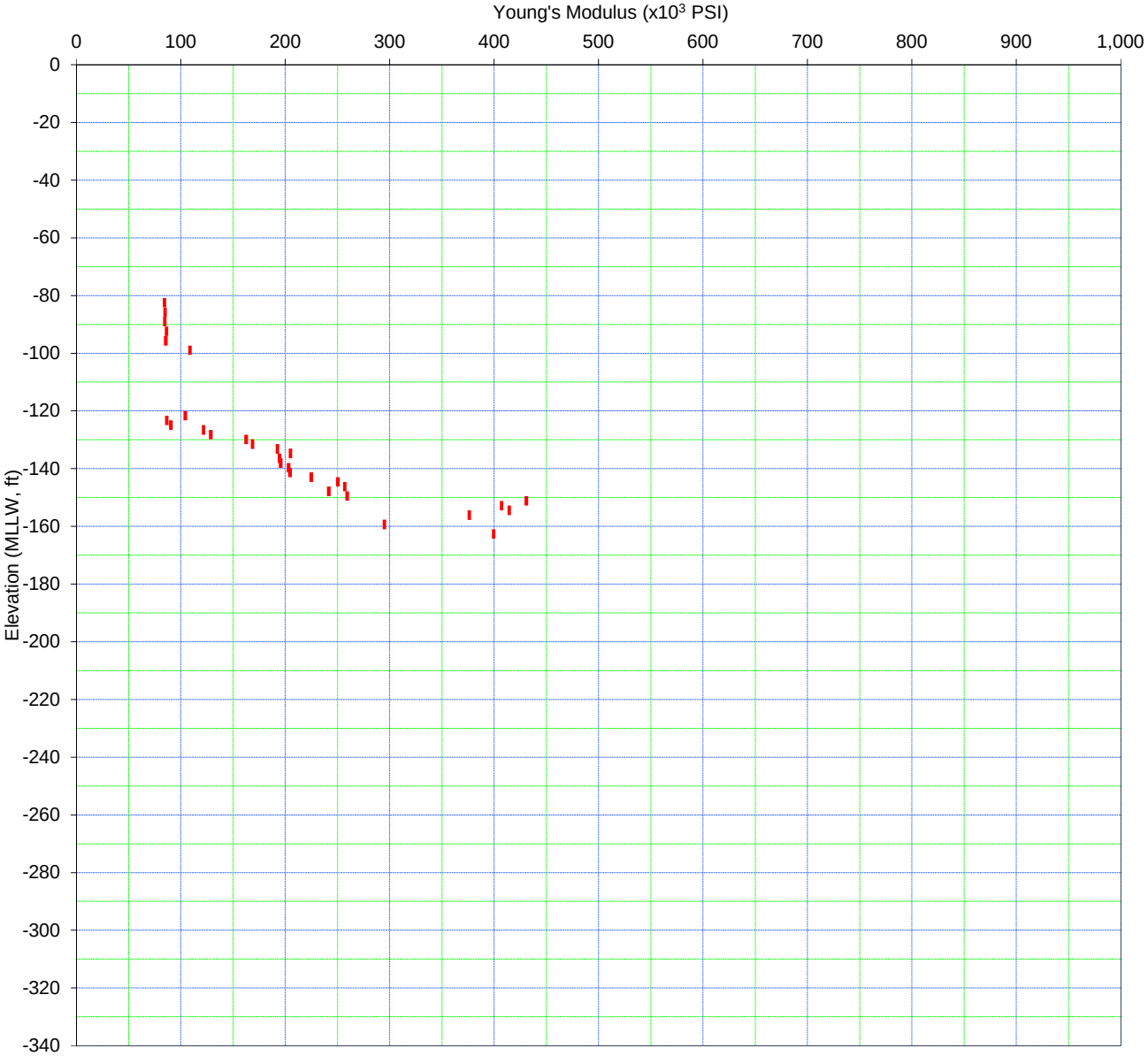
CALCULATED SHEAR MODULUS - BORING MB-06

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D3-5



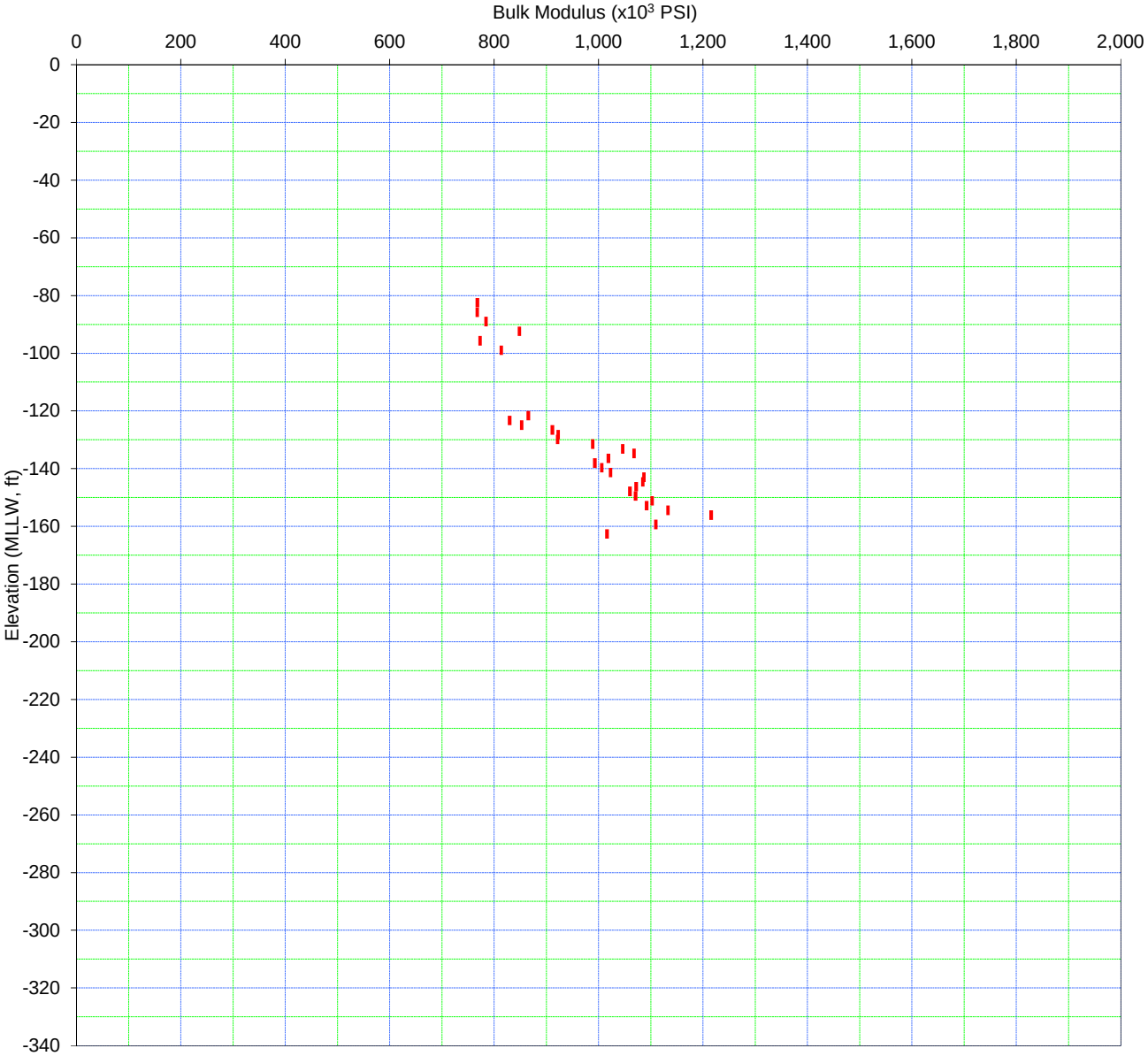
CALCULATED YOUNG'S MODULUS - BORING MB-06

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D3-6



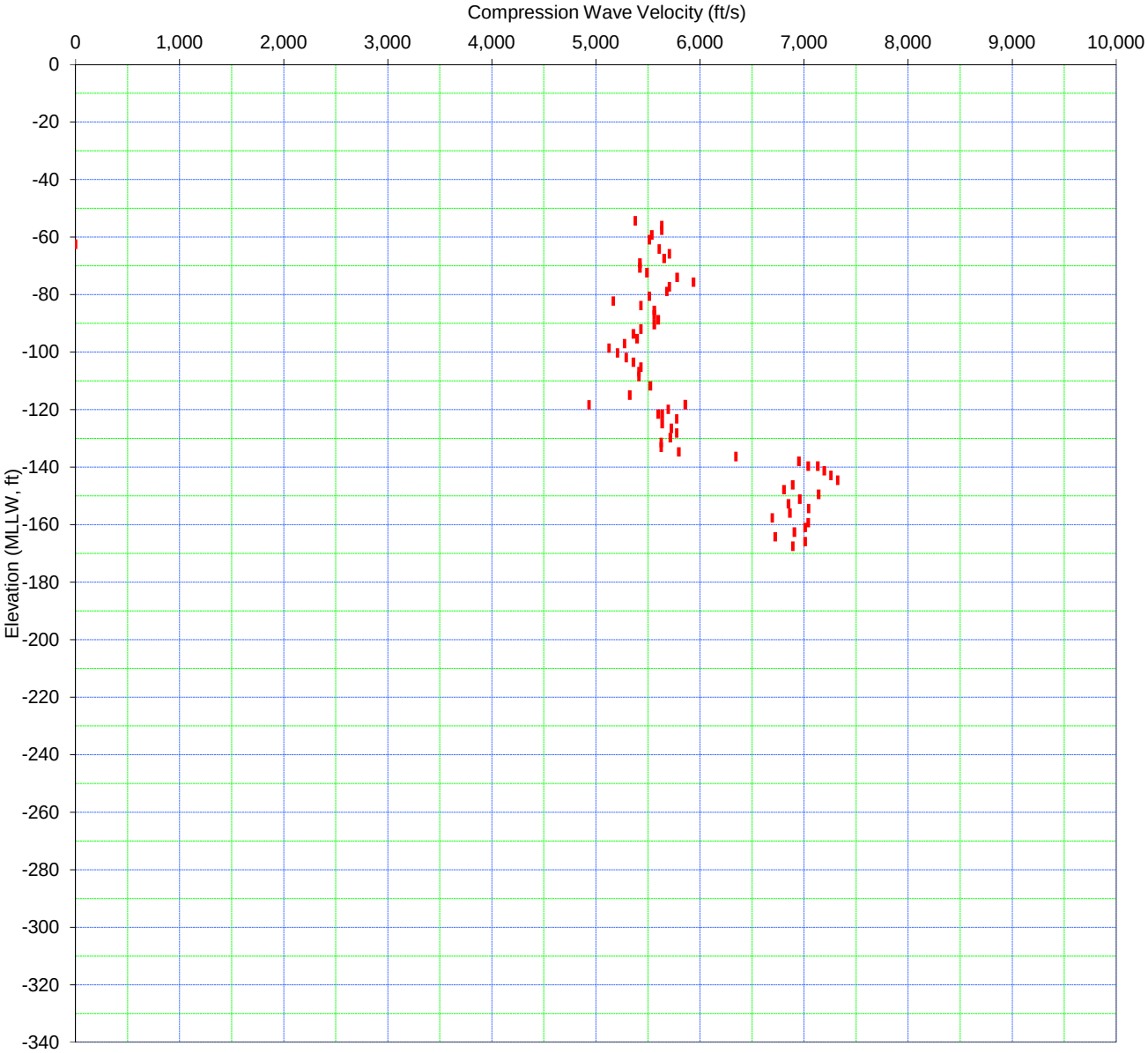
CALCULATED BULK MODULUS - BORING MB-06

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D3-7



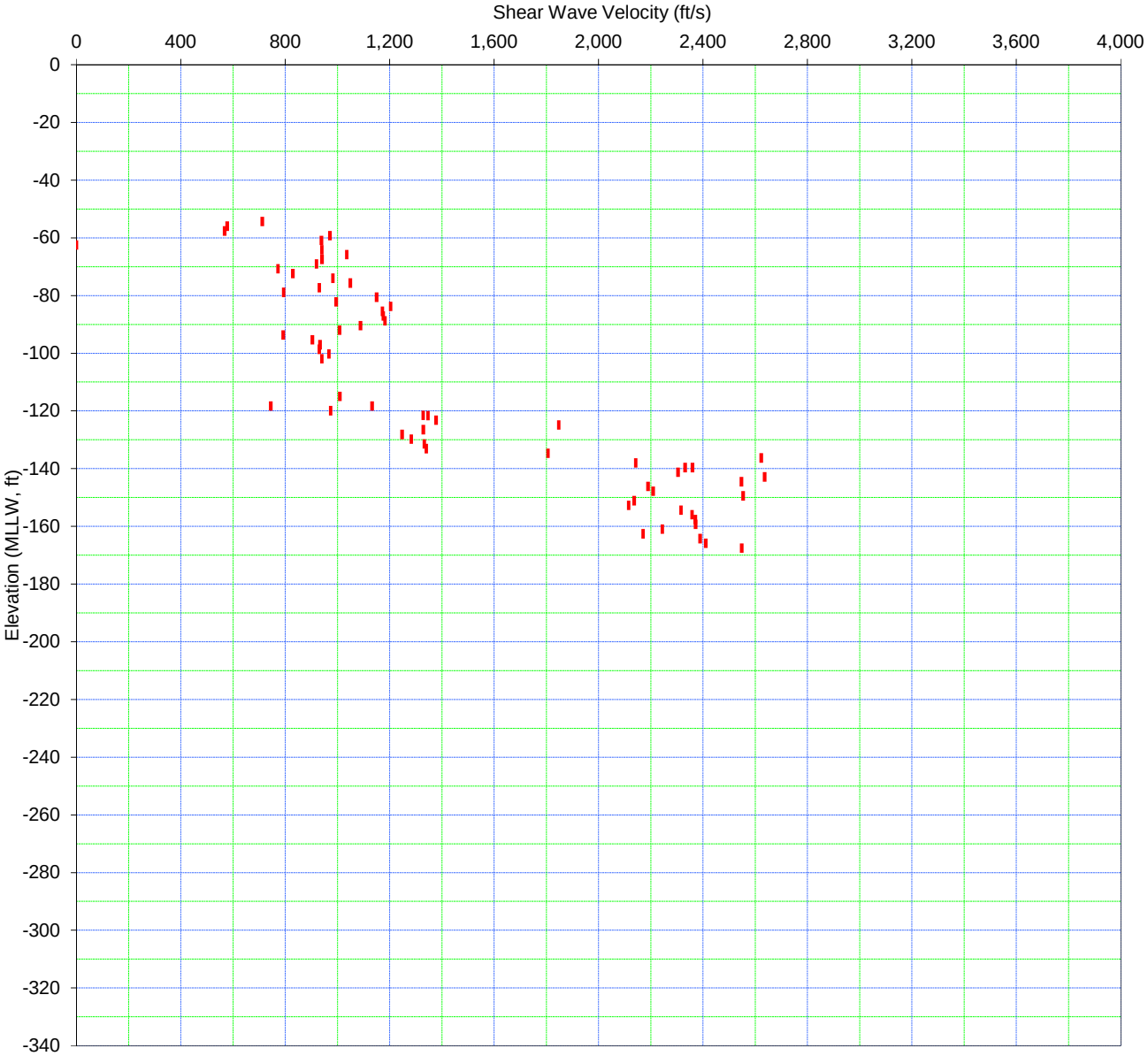
MEASURED P-WAVE VELOCITIES - BORING MB-13

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D4-1



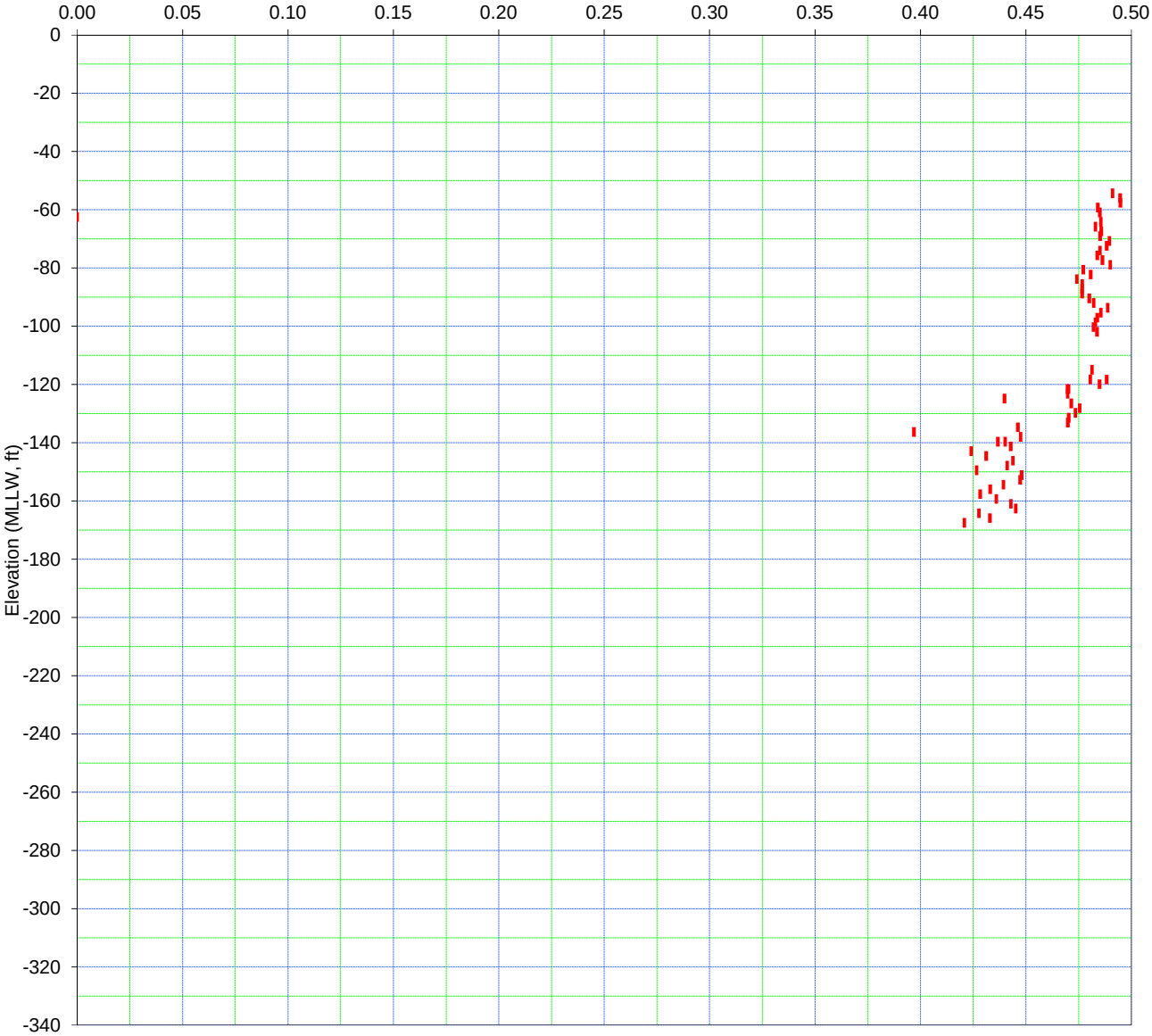
MEASURED S-WAVE VELOCITIES - BORING MB-13

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

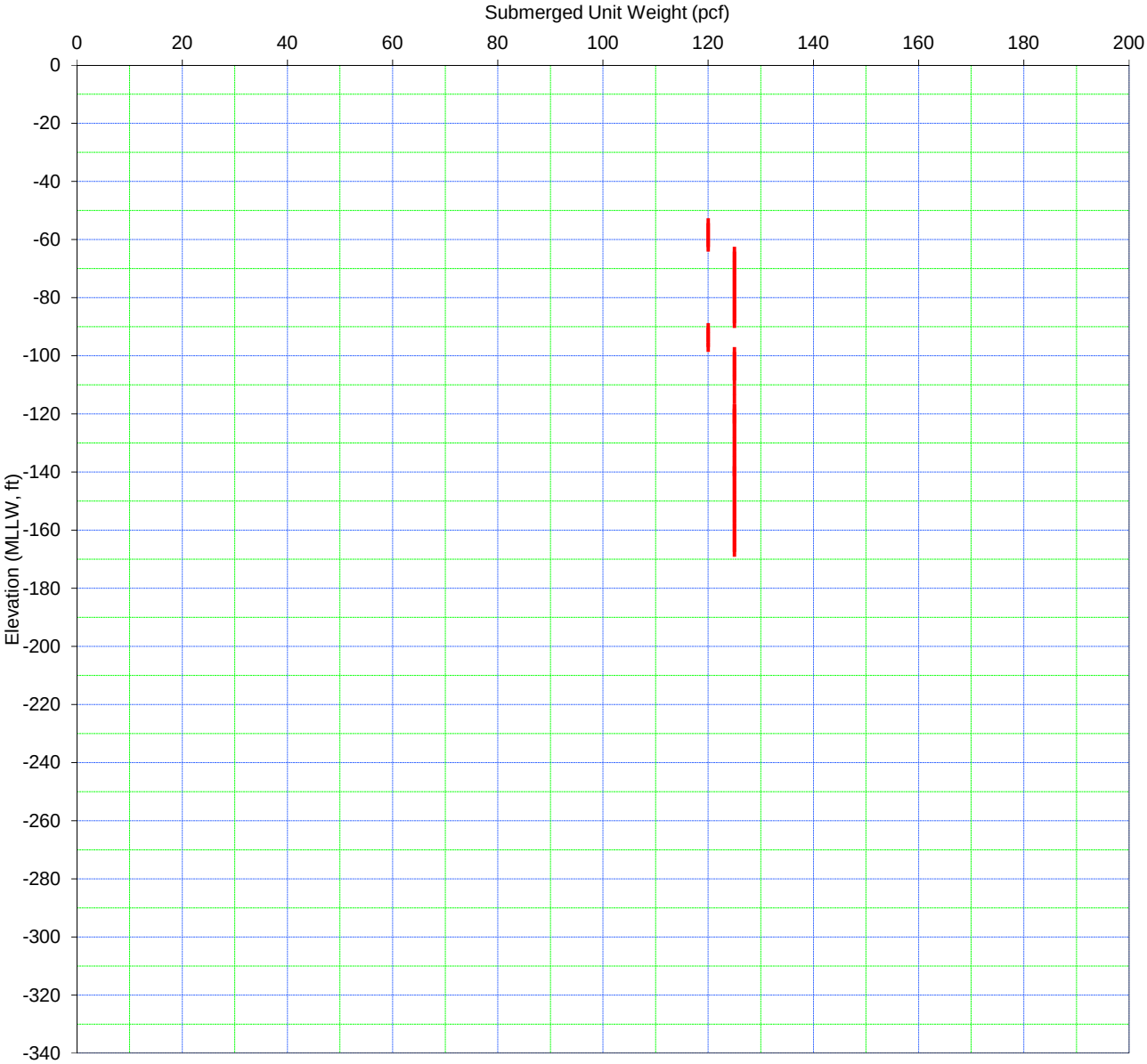
PLATE D4-2



CALCULATED POISSON'S RATIO - BORING MB-13

MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISIKI, ALASKA

PLATE D4-3



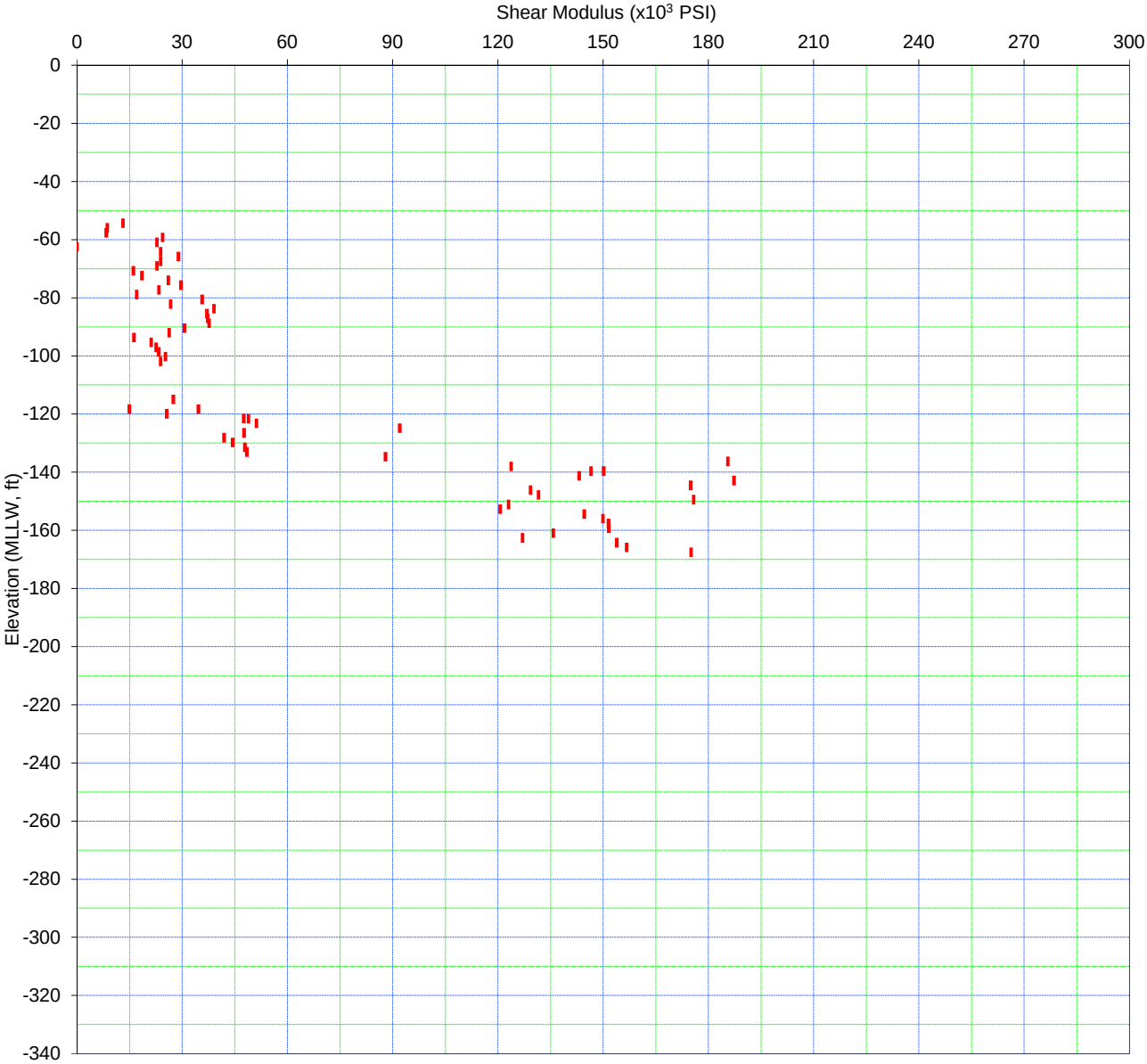
ASSUMED SUBMERGED UNIT WEIGHT - BORING MB-13

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D4-4



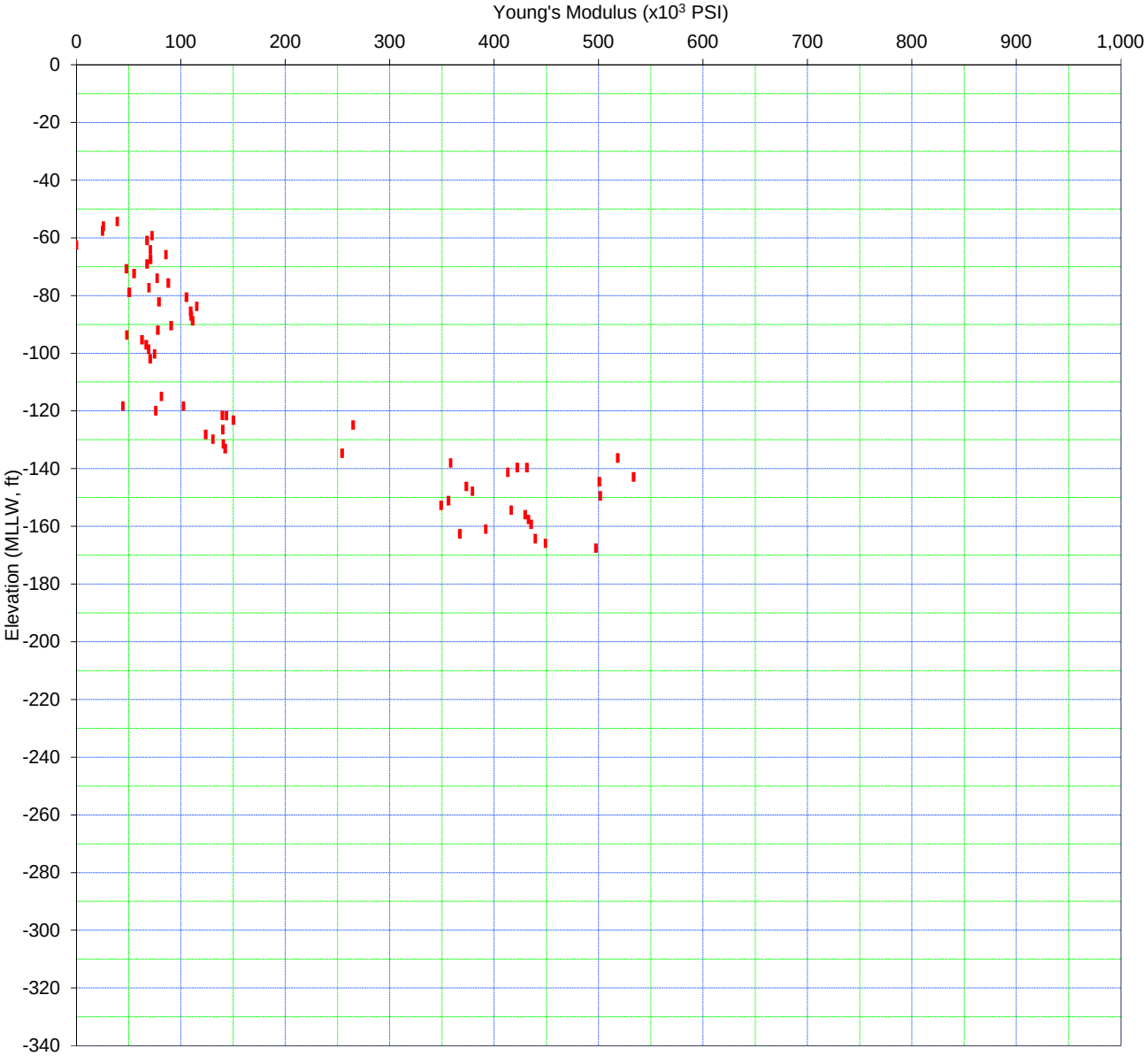
CALCULATED SHEAR MODULUS - BORING MB-13

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D4-5



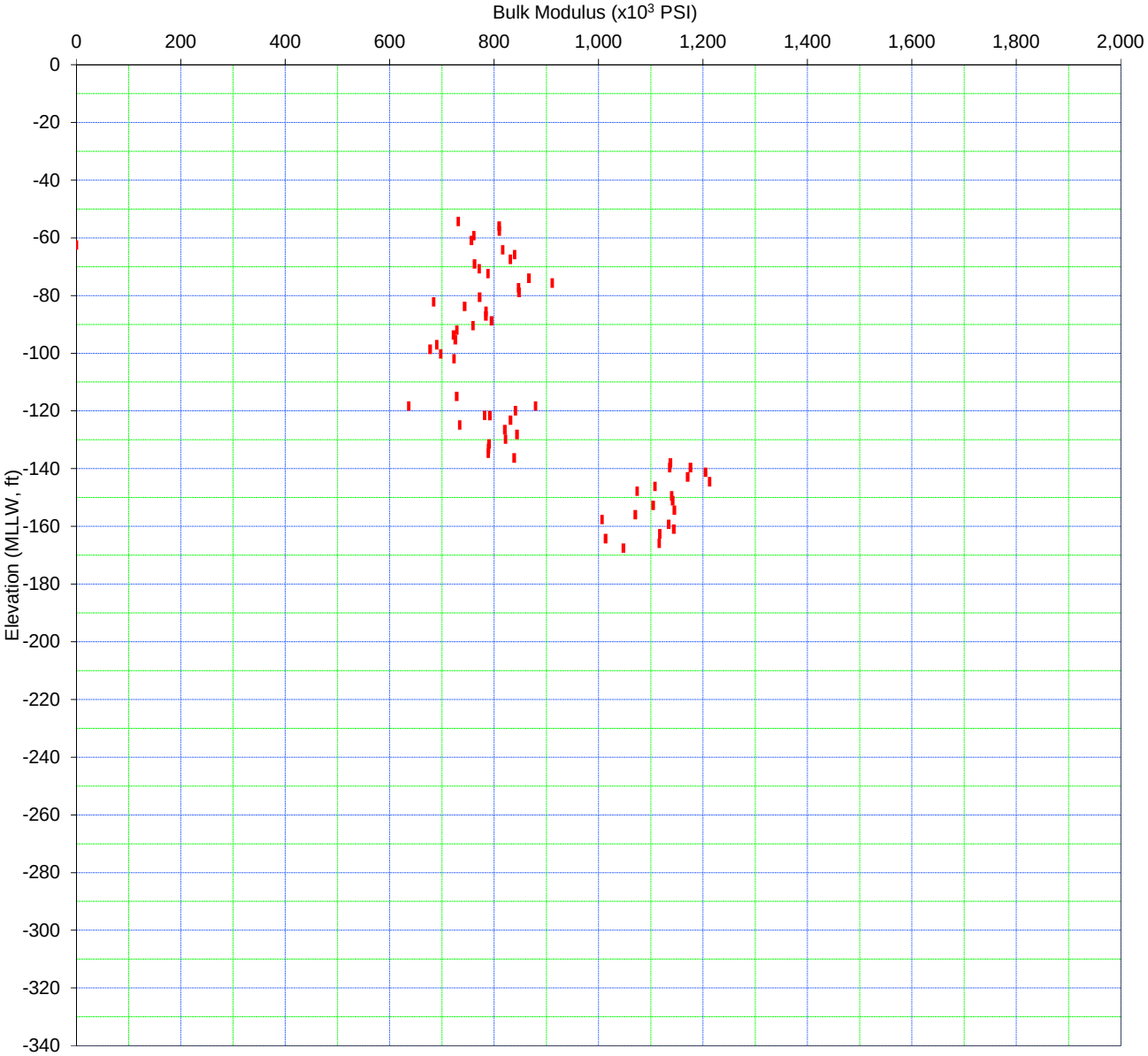
CALCULATED YOUNG'S MODULUS - BORING MB-13

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D4-6



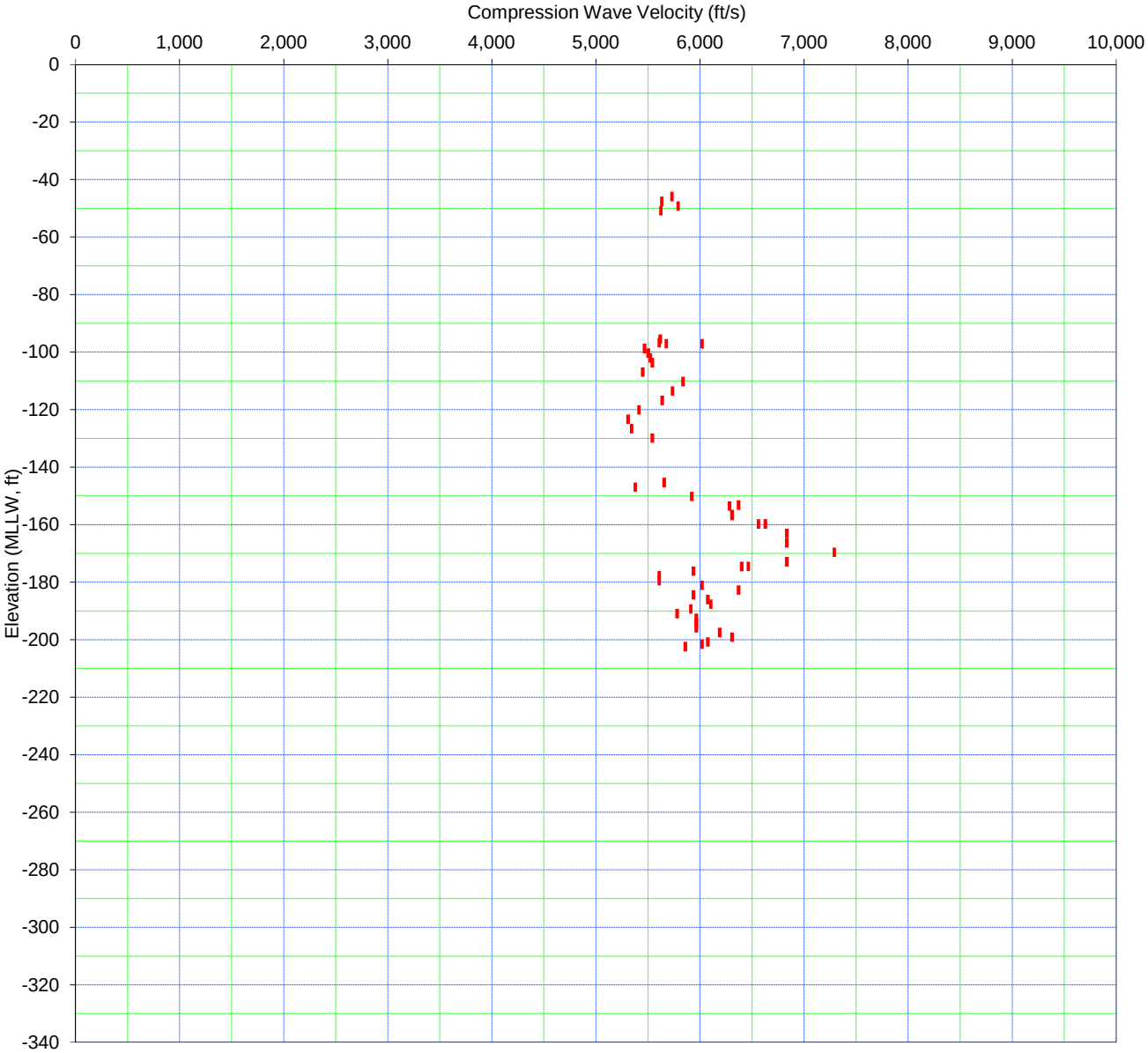
CALCULATED BULK MODULUS - BORING MB-13

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D4-7



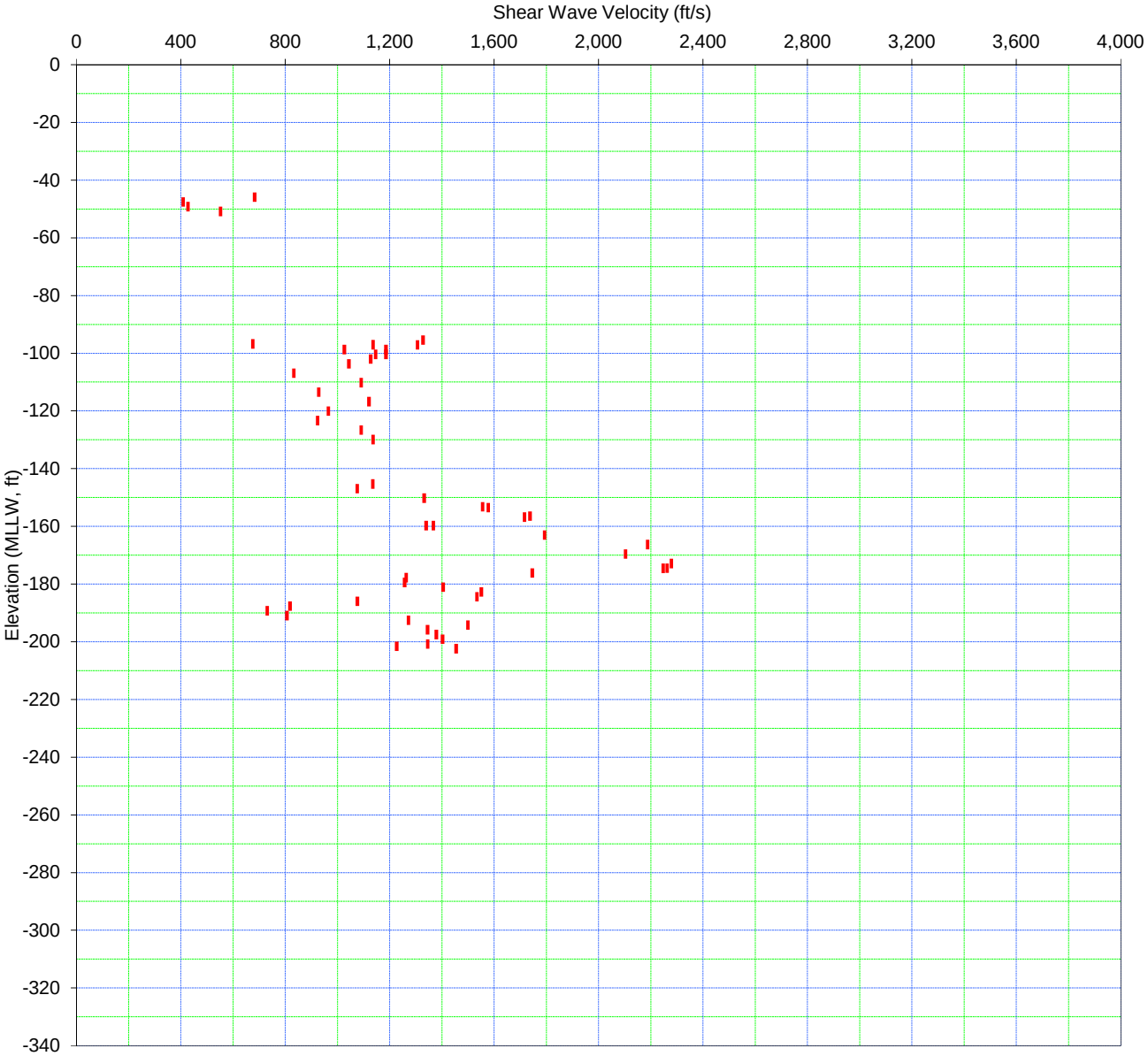
MEASURED P-WAVE VELOCITIES - BORING MB-17

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D5-1



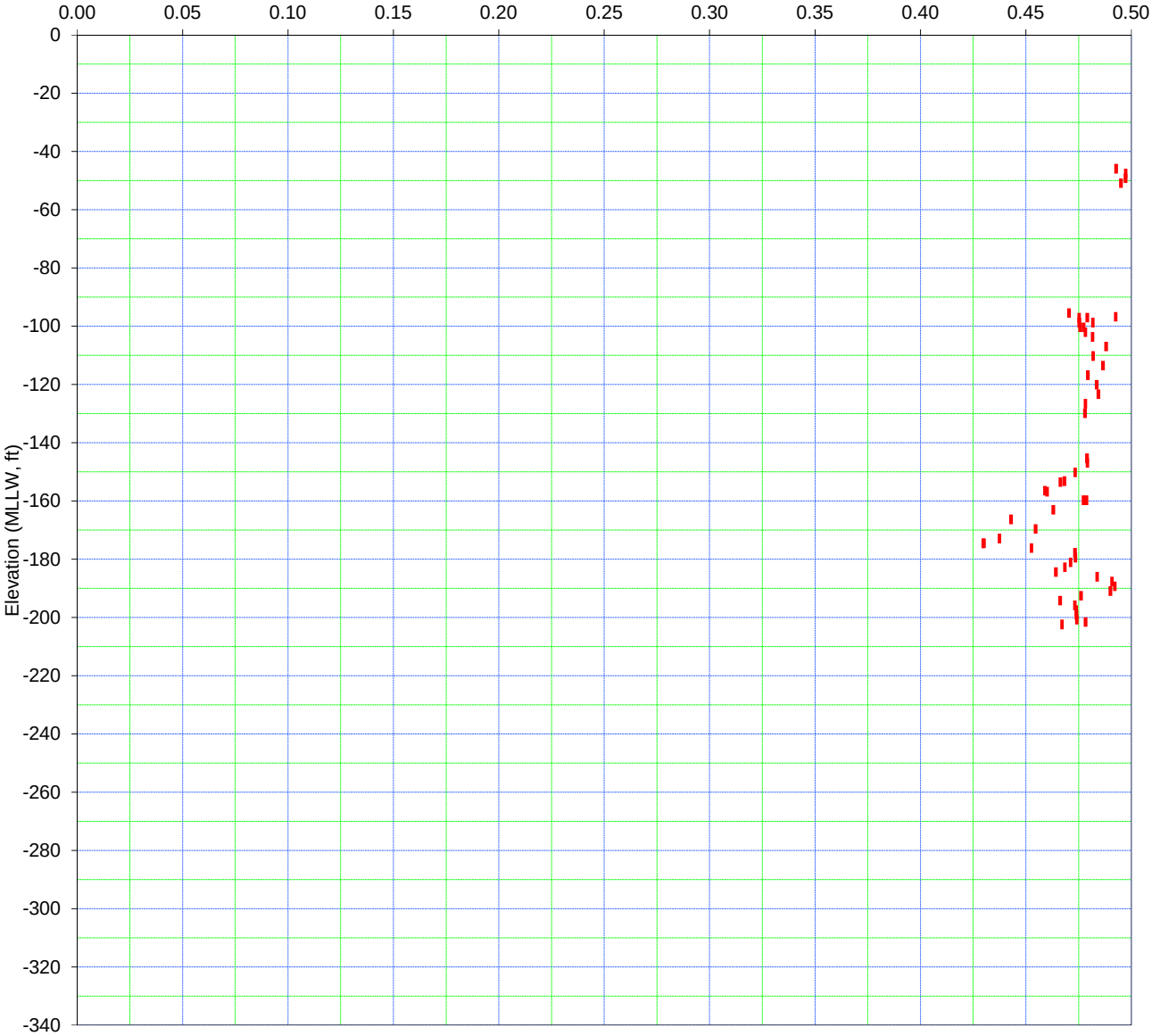
MEASURED S-WAVE VELOCITIES - BORING MB-17

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D5-2



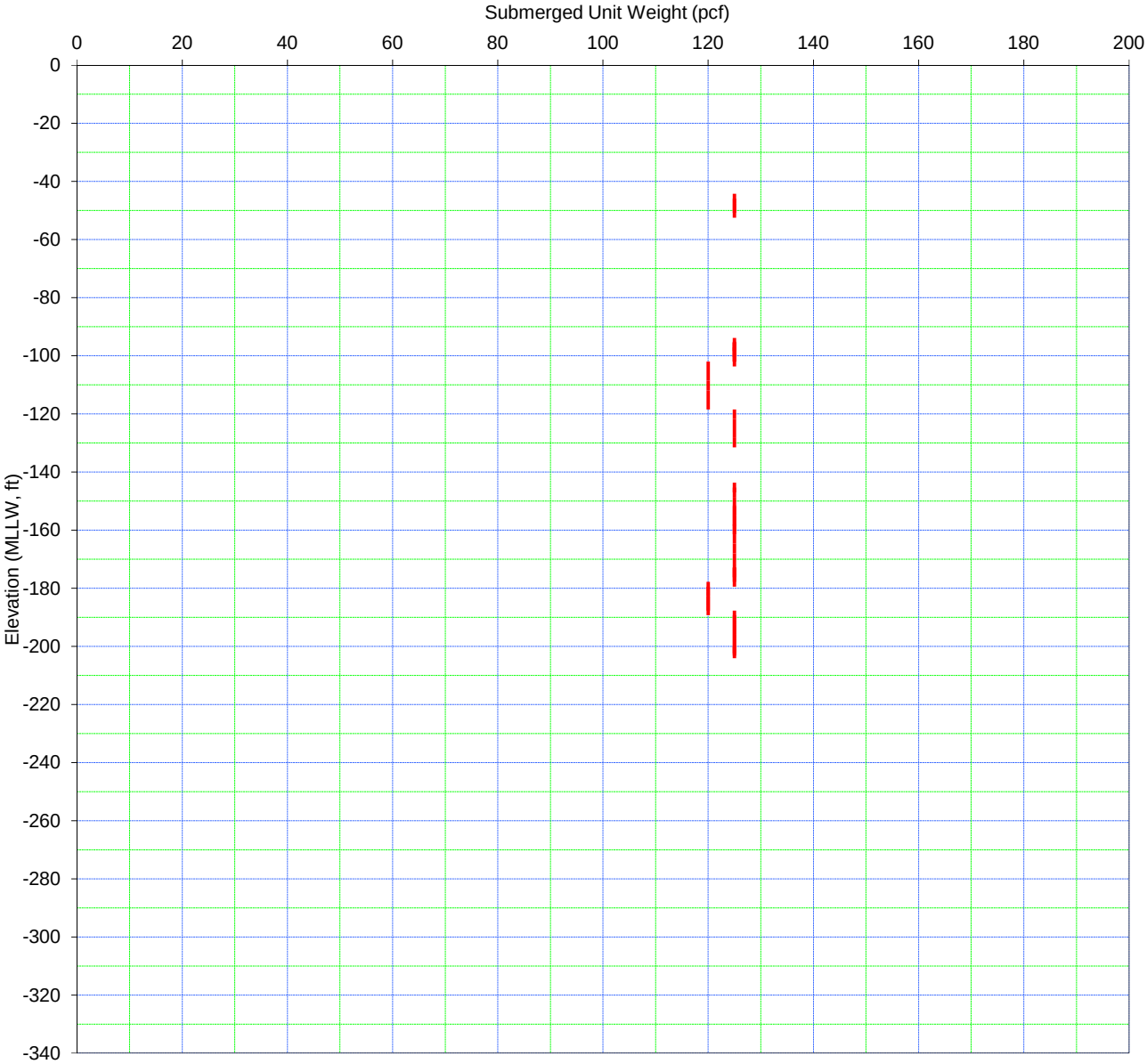
CALCULATED POISSON'S RATIO - BORING MB-17

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D5-3



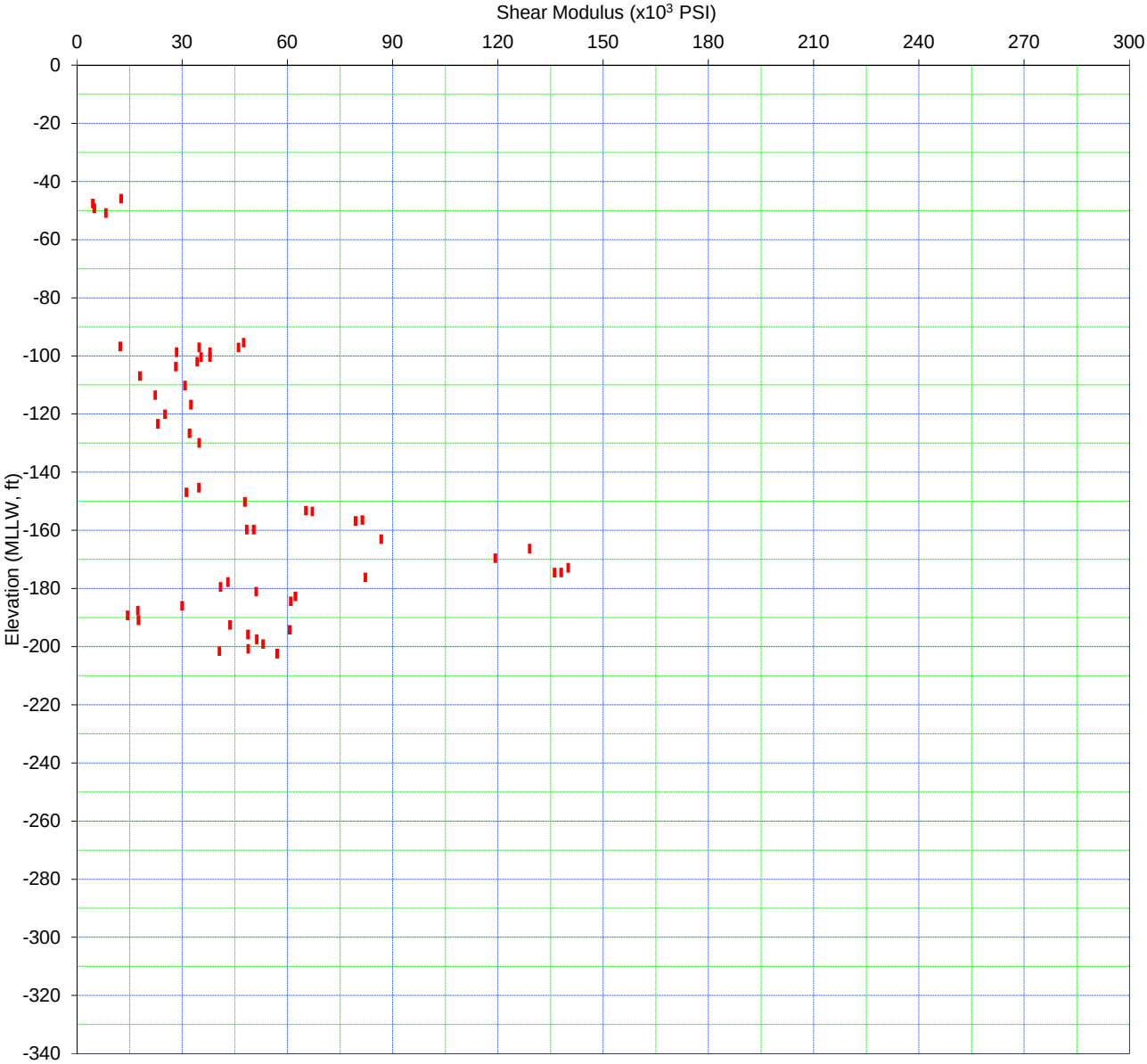
ASSUMED SUBMERGED UNIT WEIGHT - BORING MB-17

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D5-4



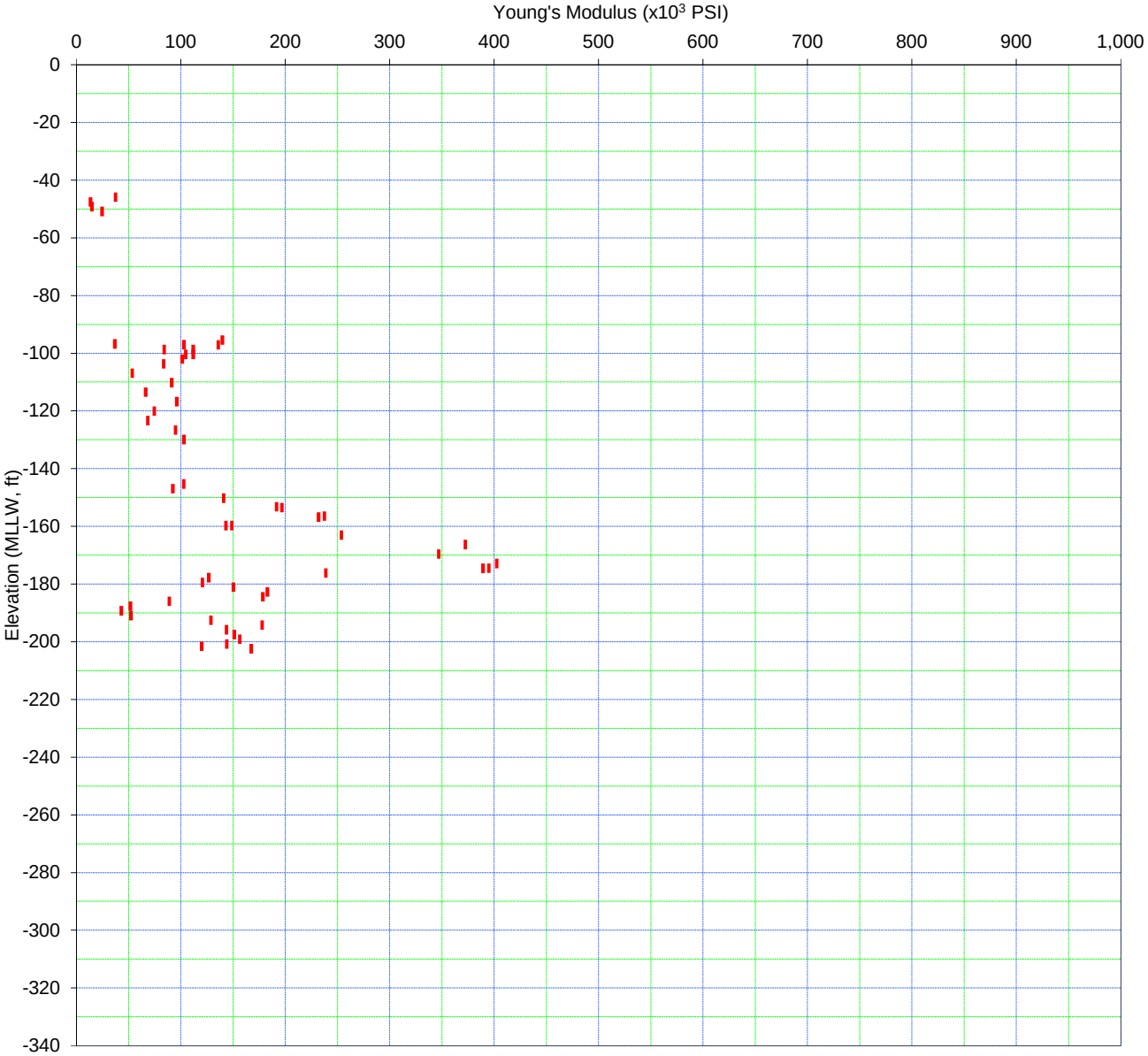
CALCULATED SHEAR MODULUS - BORING MB-17

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D5-5



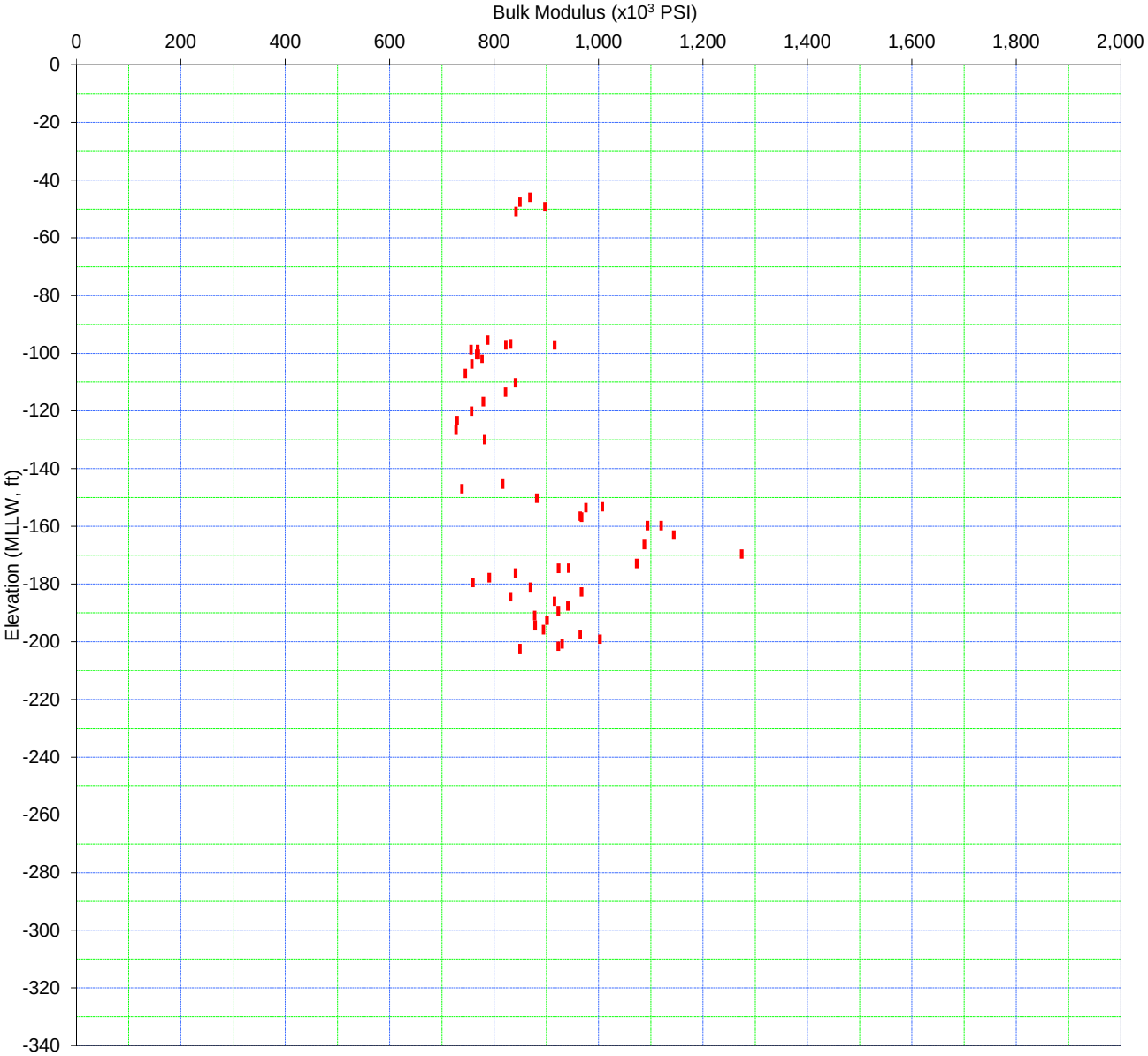
CALCULATED YOUNG'S MODULUS - BORING MB-17

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D5-6



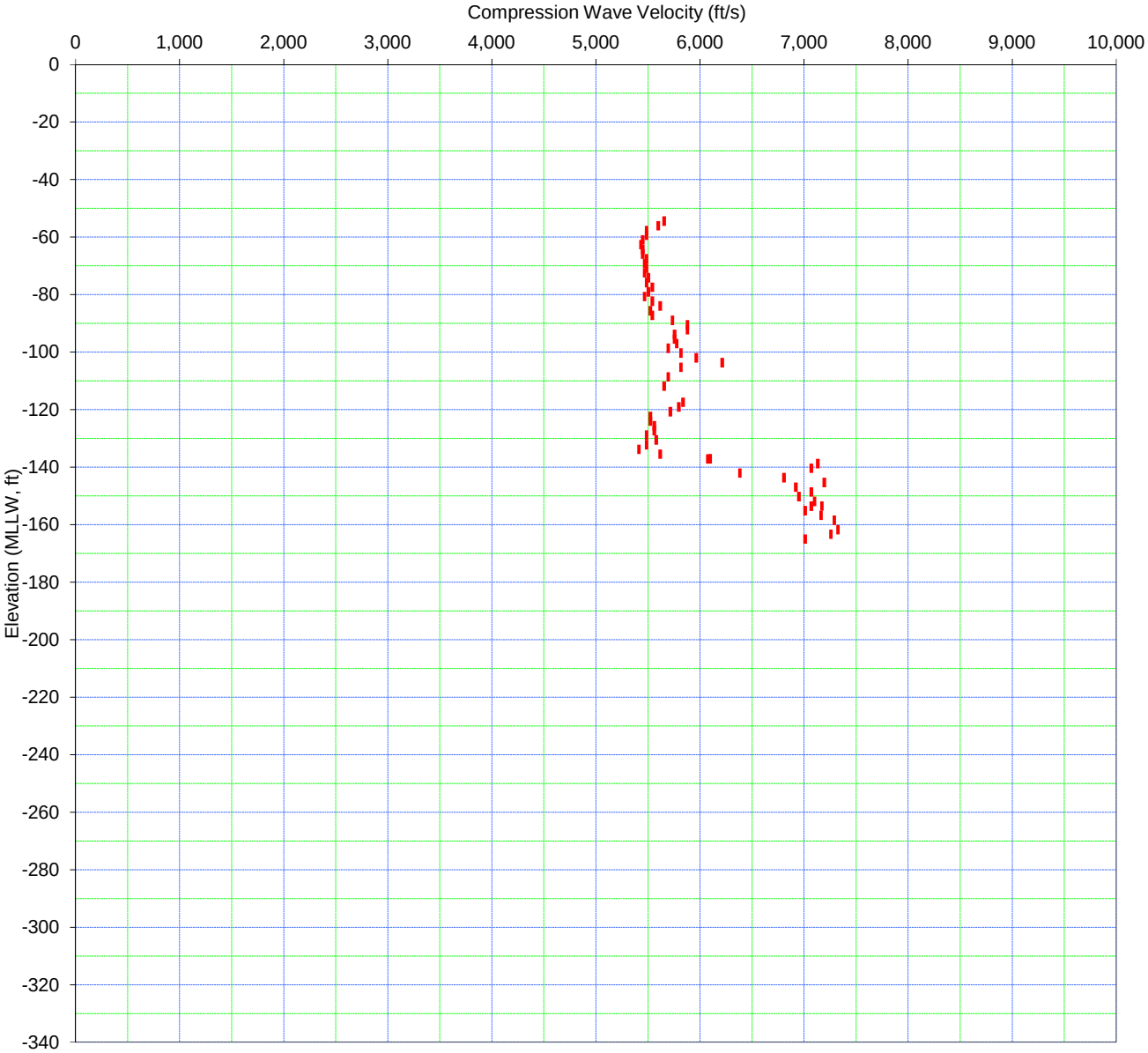
CALCULATED BULK MODULUS - BORING MB-17

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D5-7



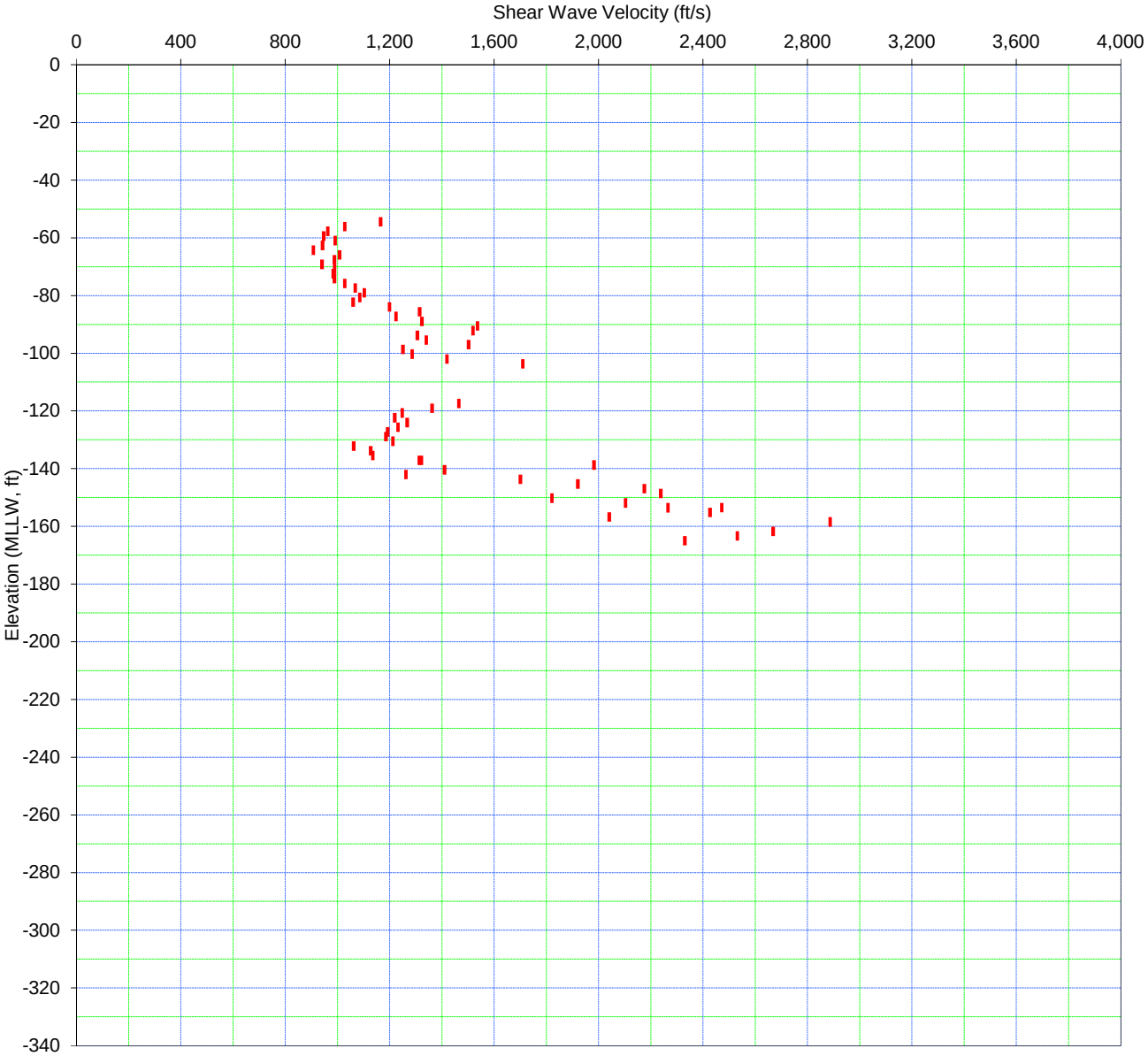
MEASURED P-WAVE VELOCITIES - BORING MB-19

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D6-1



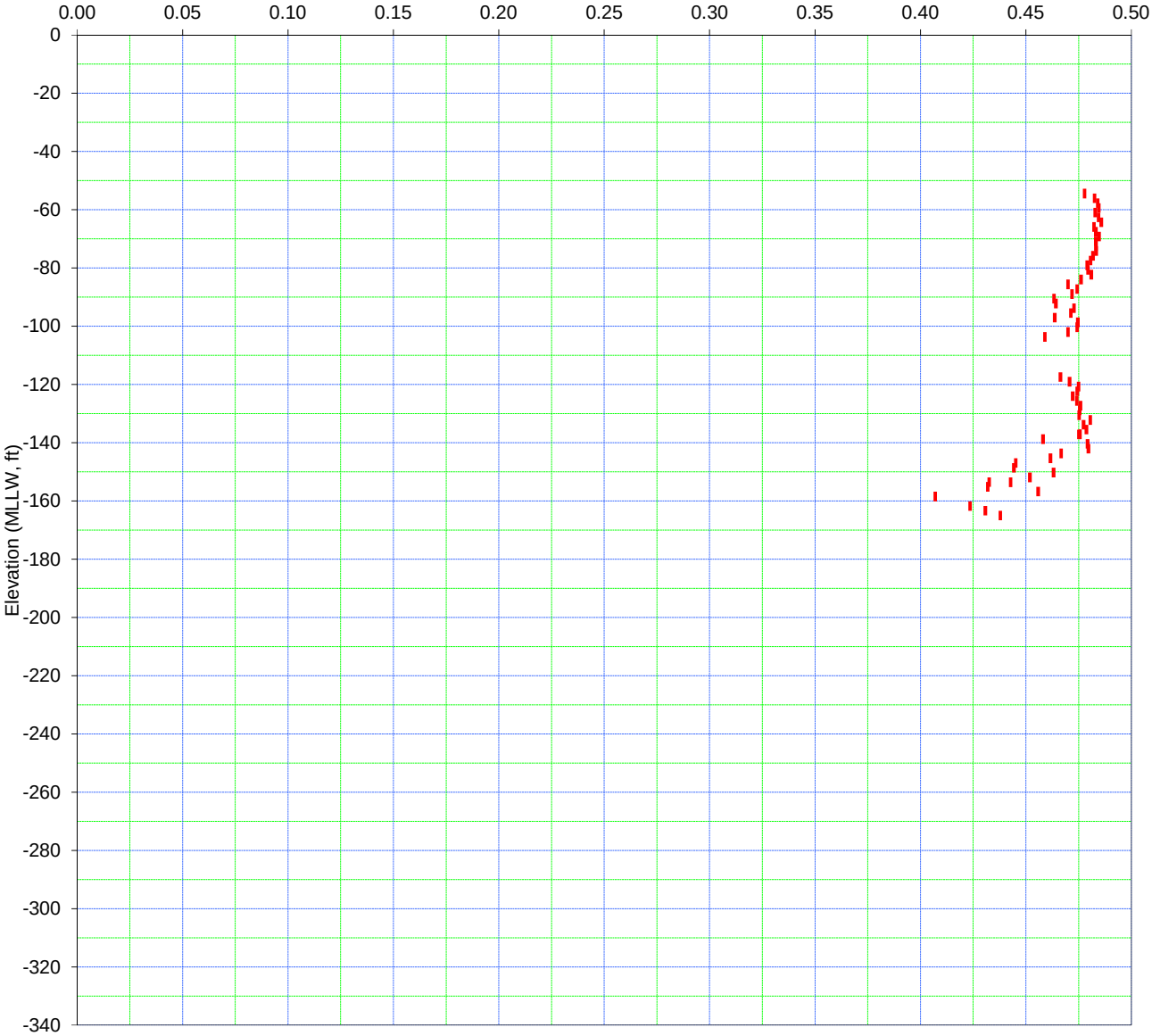
MEASURED S-WAVE VELOCITIES - BORING MB-19

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D6-2



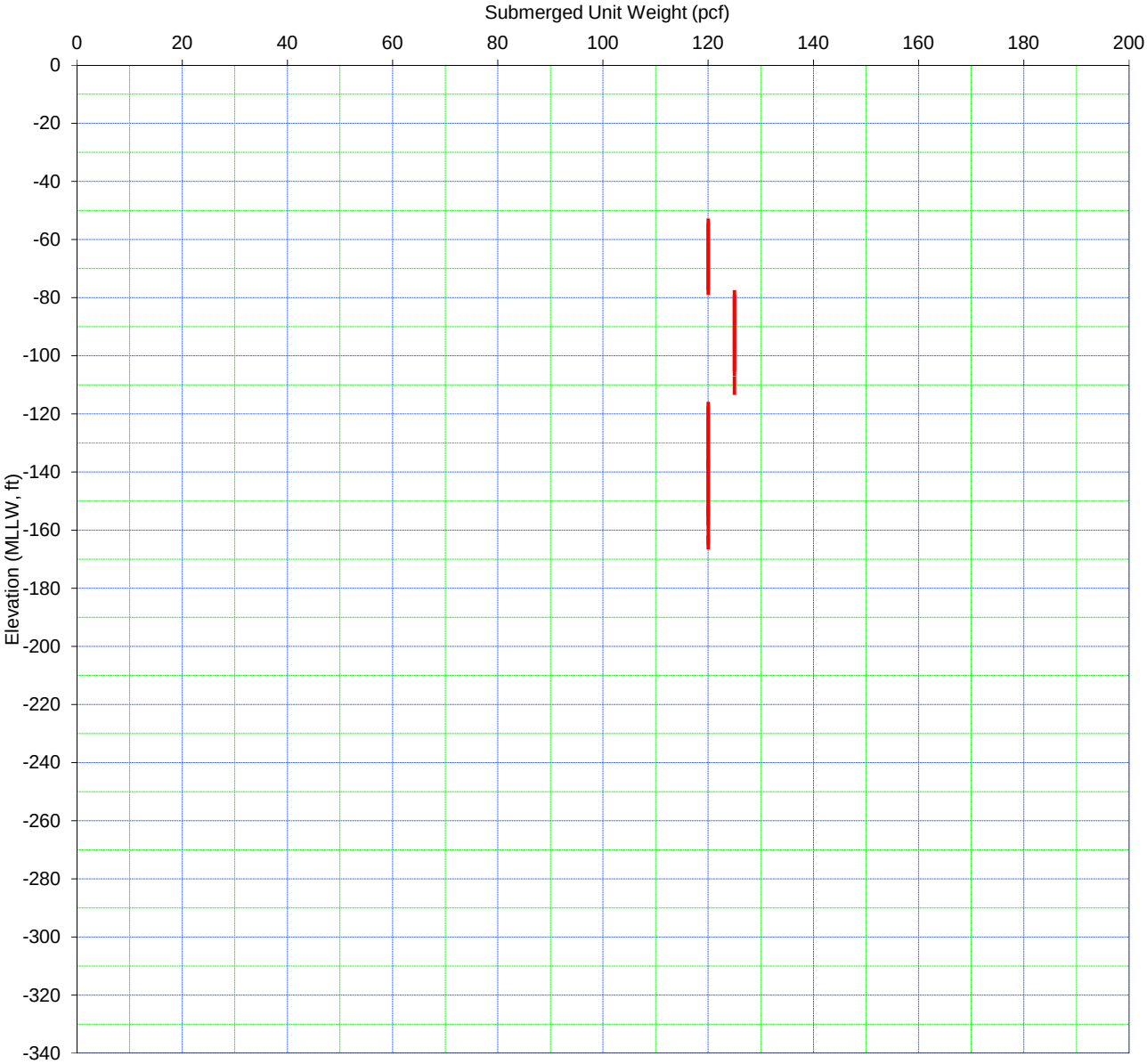
CALCULATED POISSON'S RATIO - BORING MB-19

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D6-3



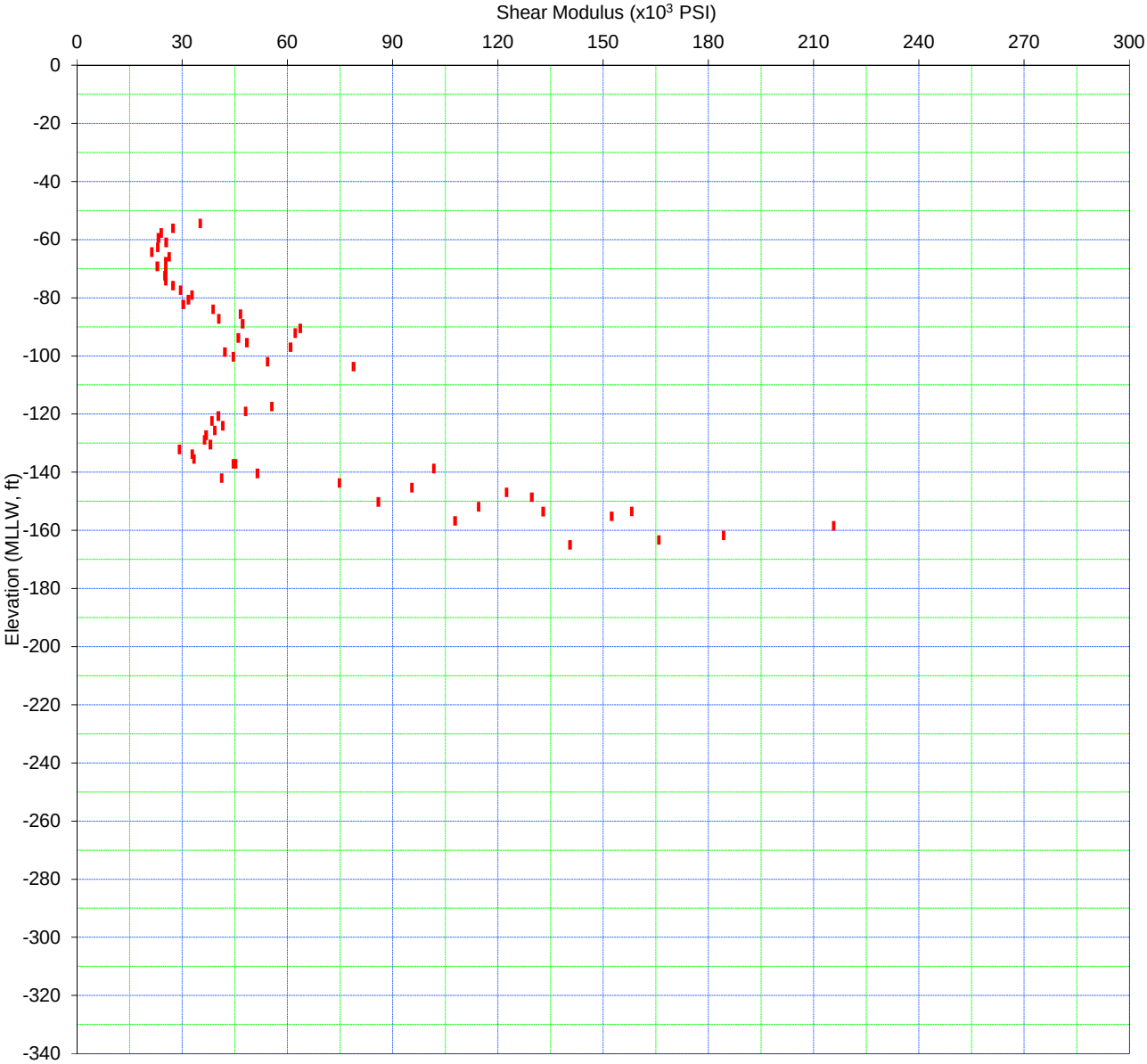
ASSUMED SUBMERGED UNIT WEIGHT - BORING MB-19

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D6-4



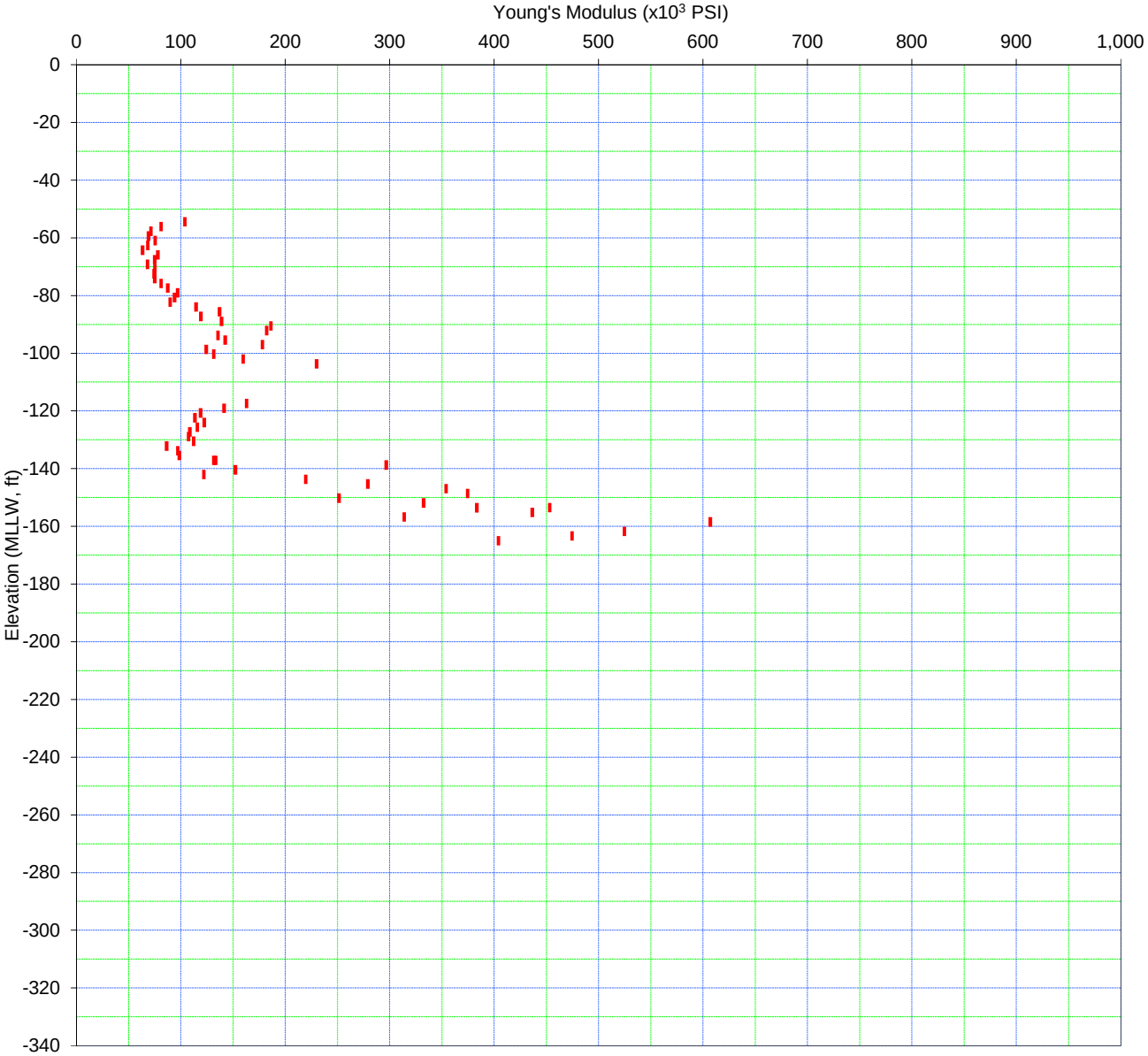
CALCULATED SHEAR MODULUS - BORING MB-19

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D6-5



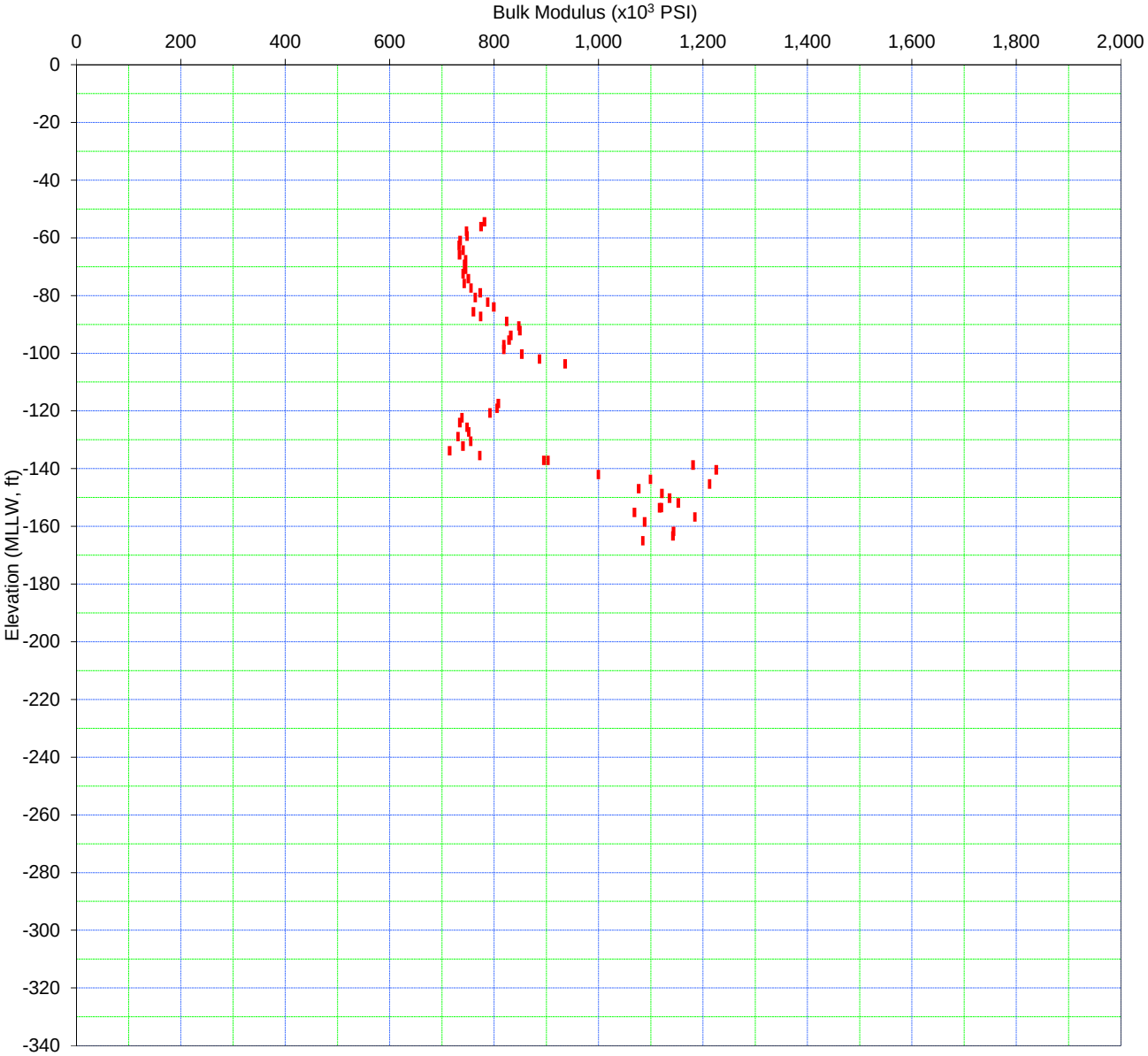
CALCULATED YOUNG'S MODULUS - BORING MB-19

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D6-6



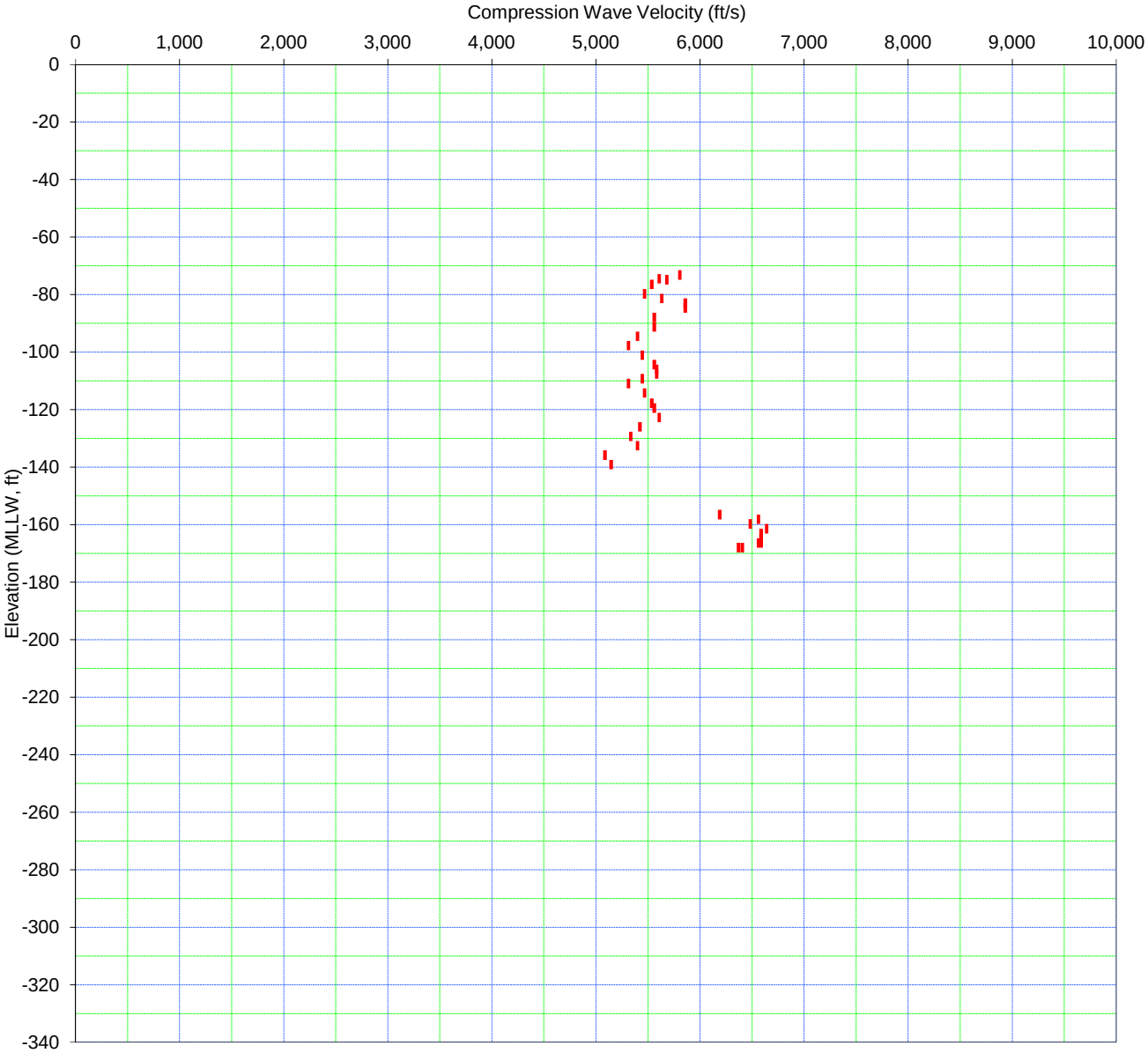
CALCULATED BULK MODULUS - BORING MB-19

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D6-7



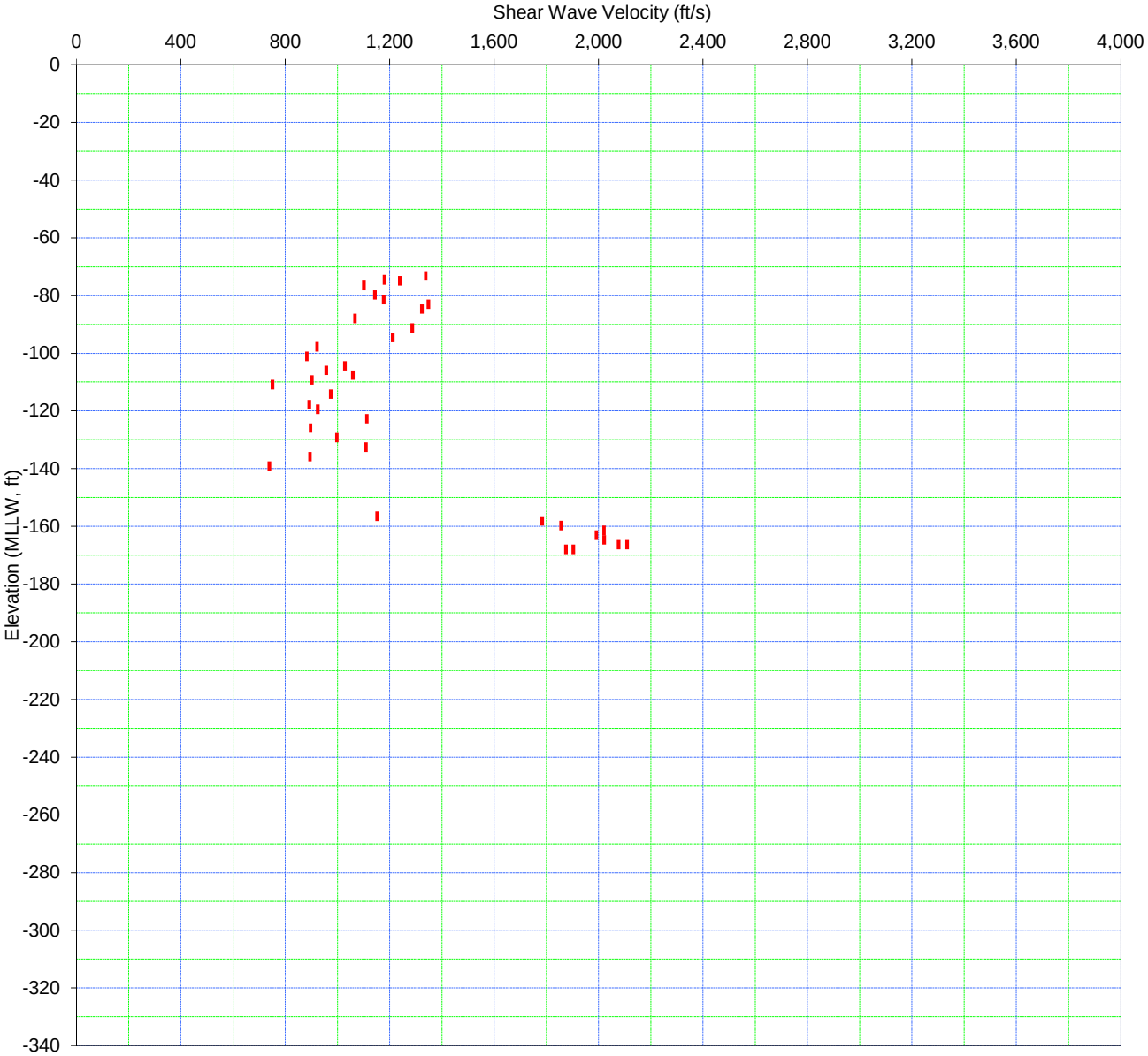
MEASURED P-WAVE VELOCITIES - BORING MB-21

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D7-1



MEASURED S-WAVE VELOCITIES - BORING MB-21

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D7-2

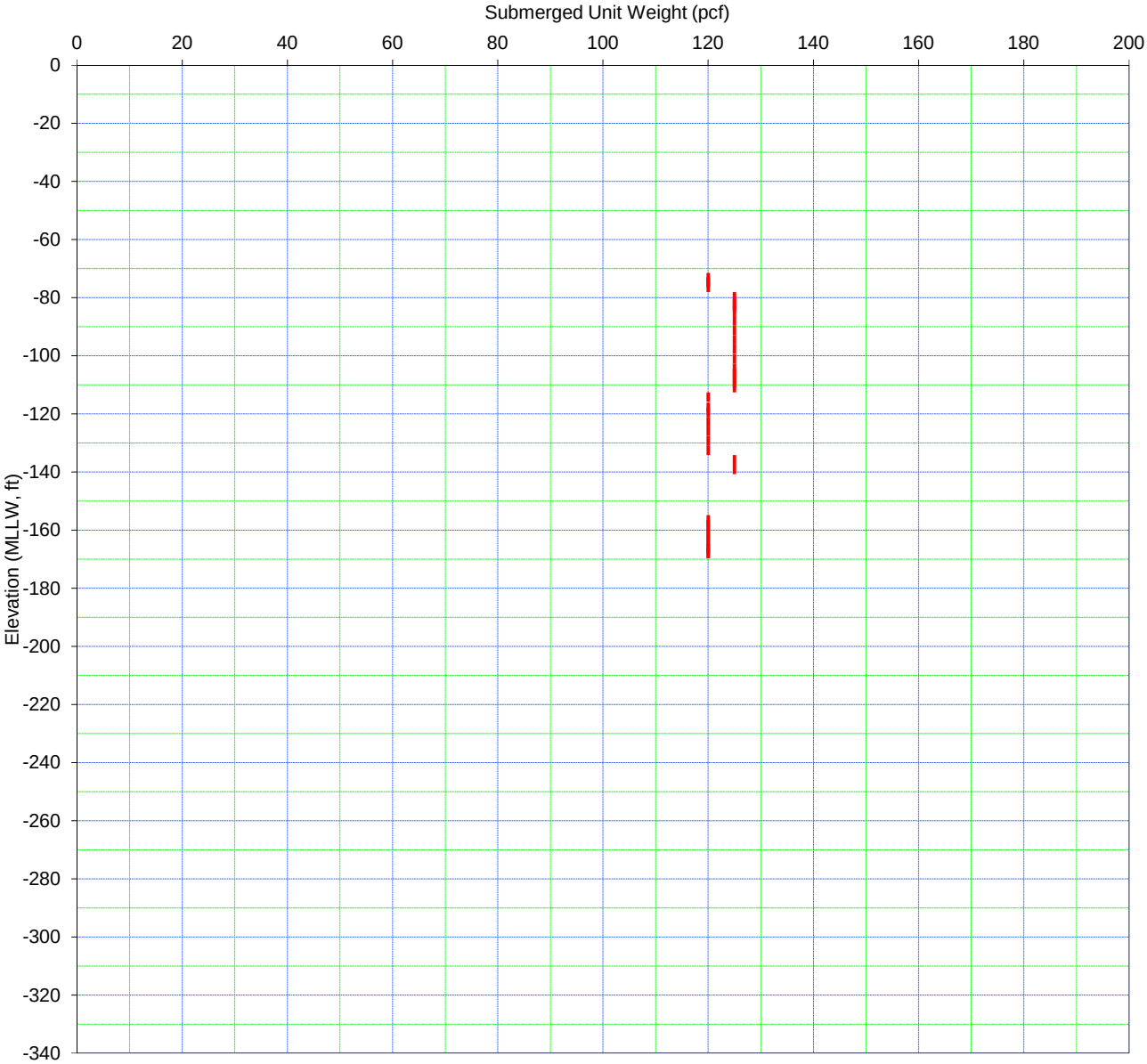
CALCULATED POISSON'S RATIO - BORING MB-21

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D7-3



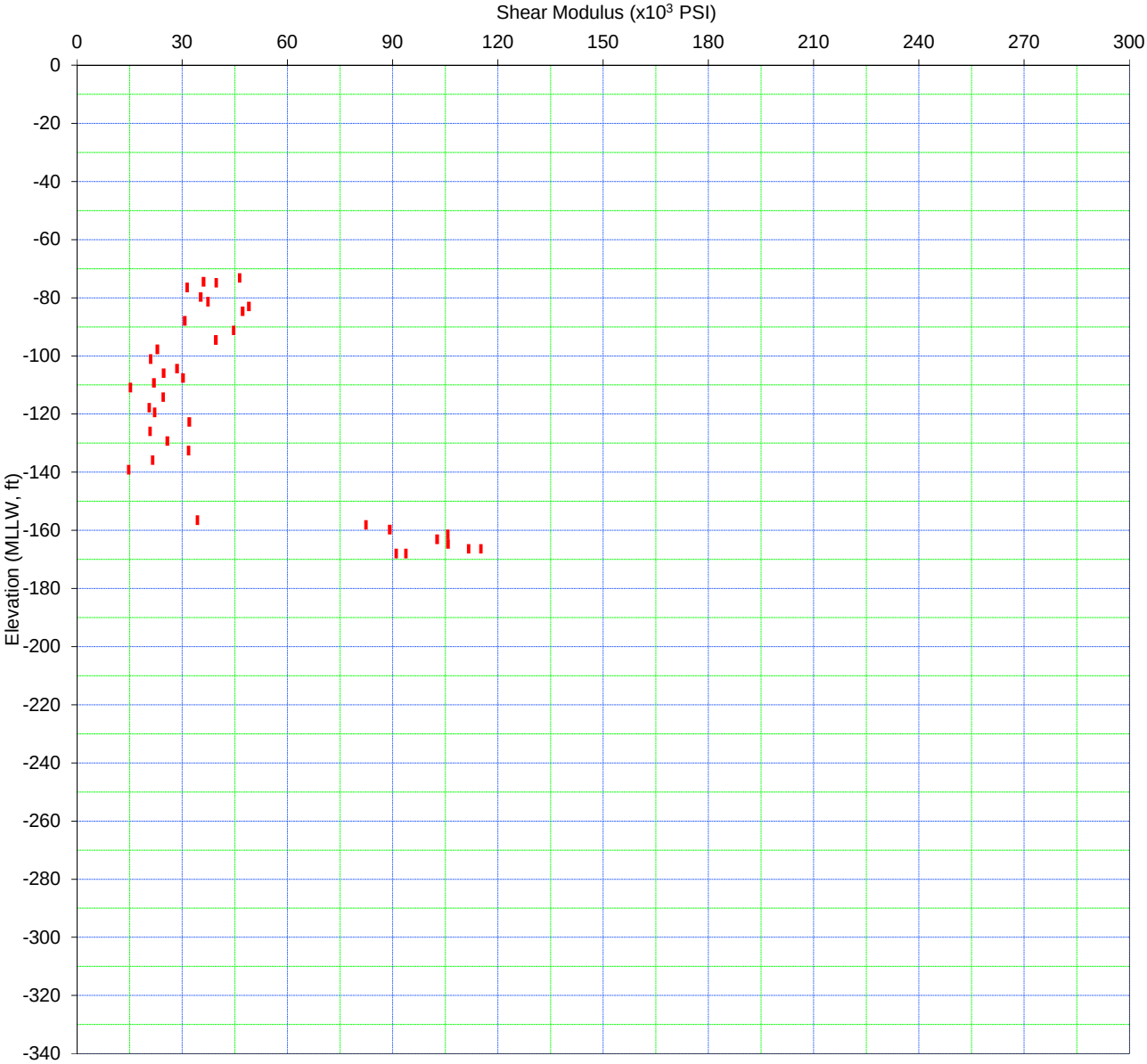
ASSUMED SUBMERGED UNIT WEIGHT - BORING MB-21

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D7-4



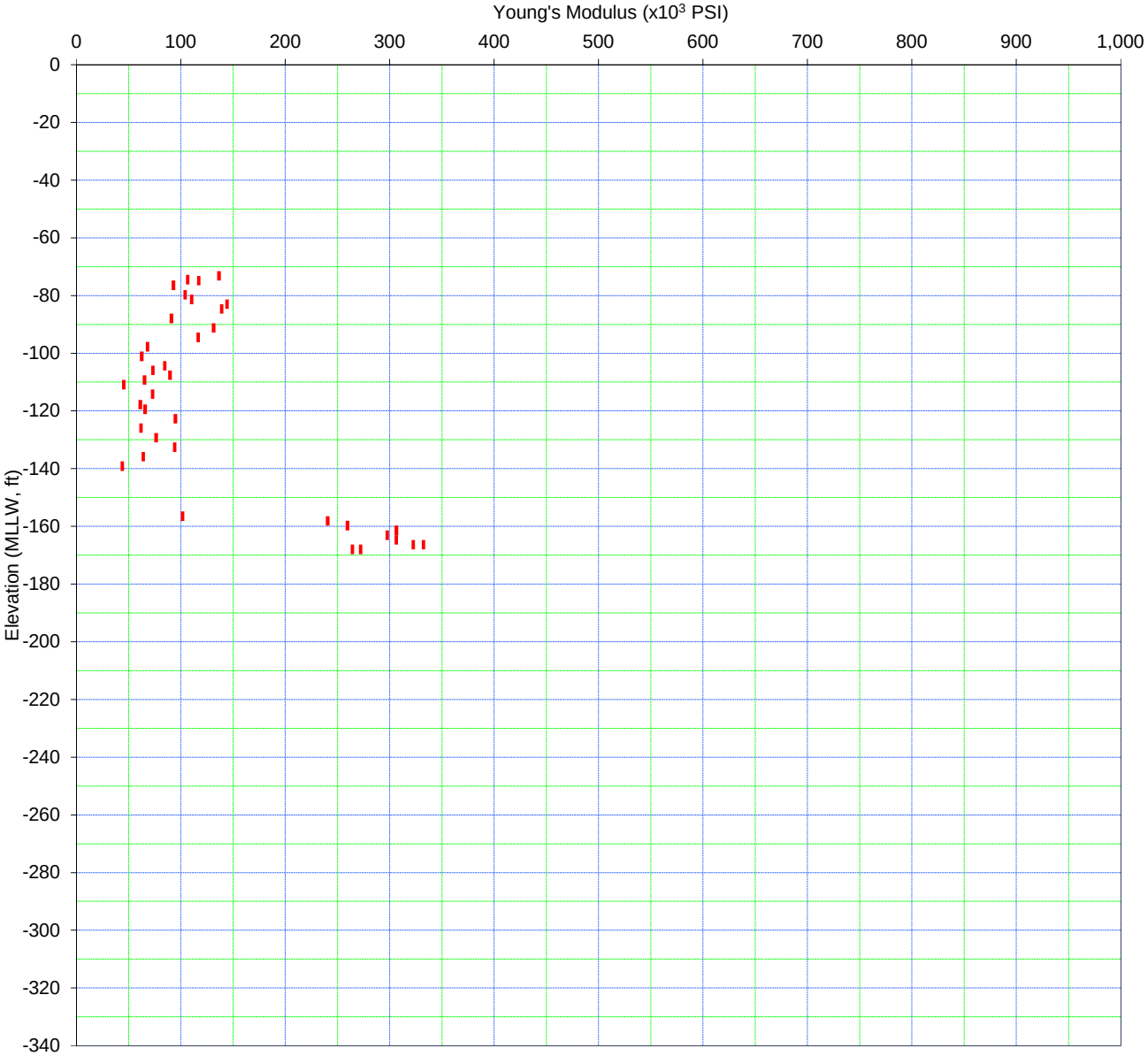
CALCULATED SHEAR MODULUS - BORING MB-21

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D7-5



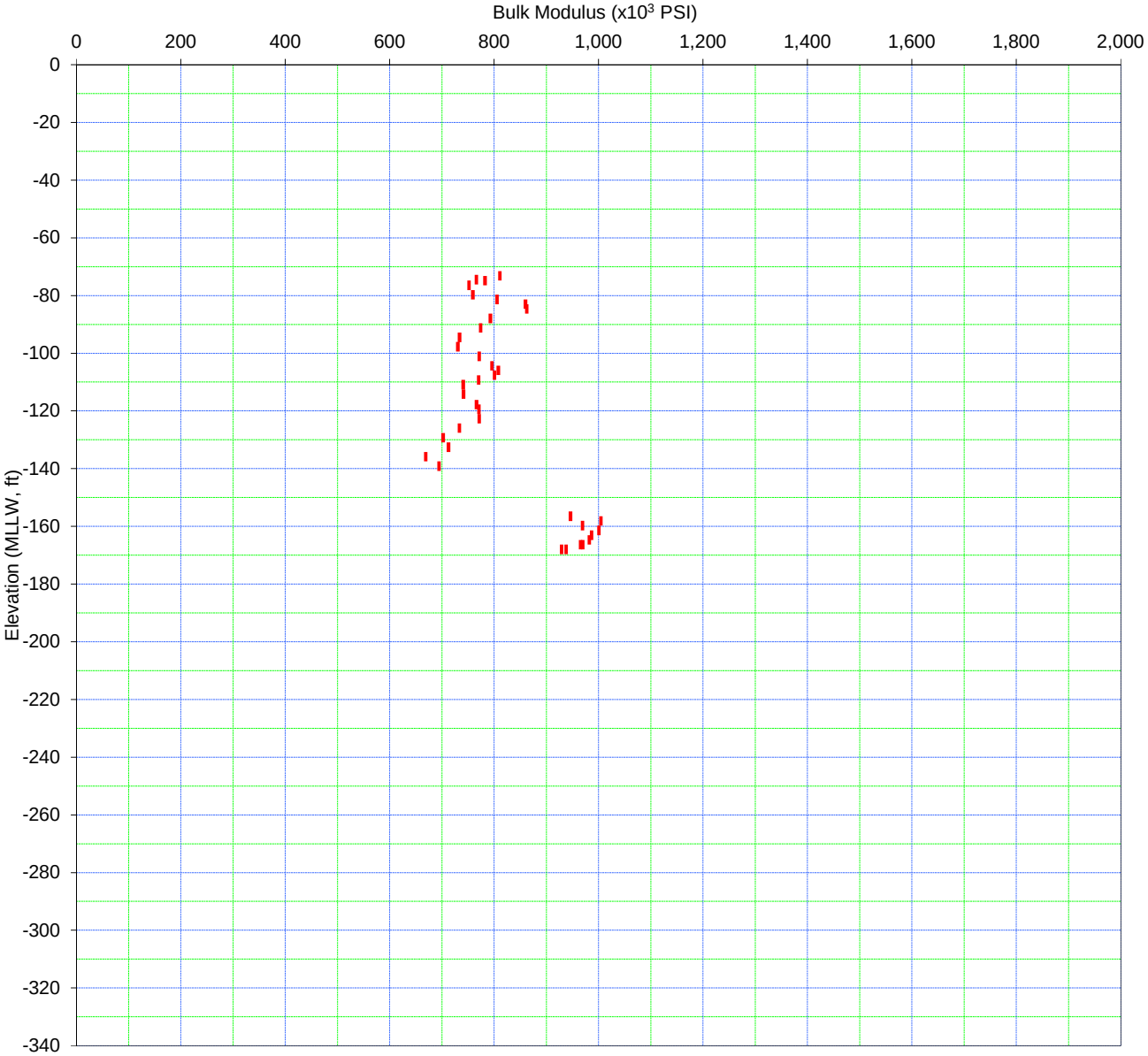
CALCULATED YOUNG'S MODULUS - BORING MB-21

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D7-6



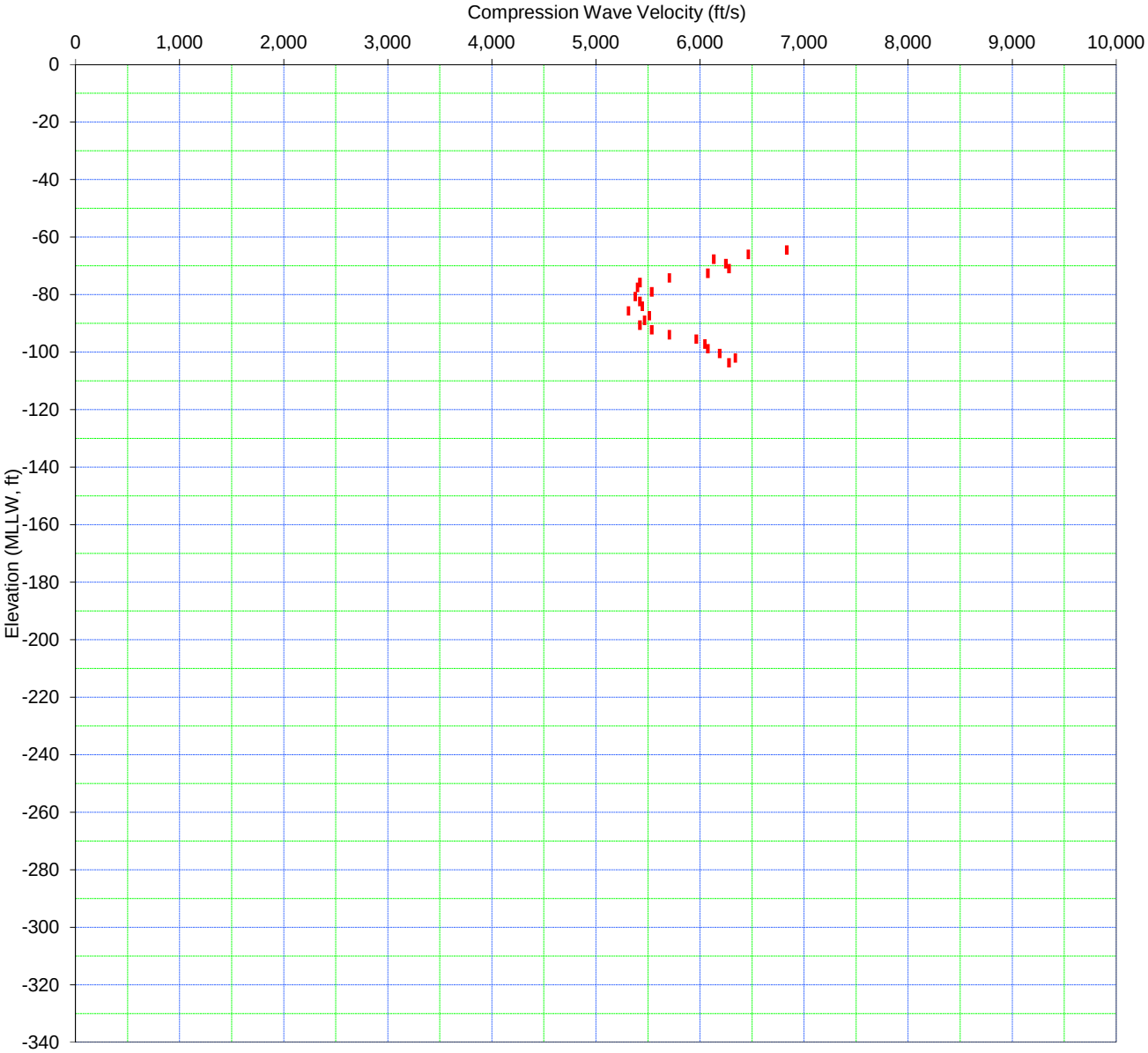
CALCULATED BULK MODULUS - BORING MB-21

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D7-7



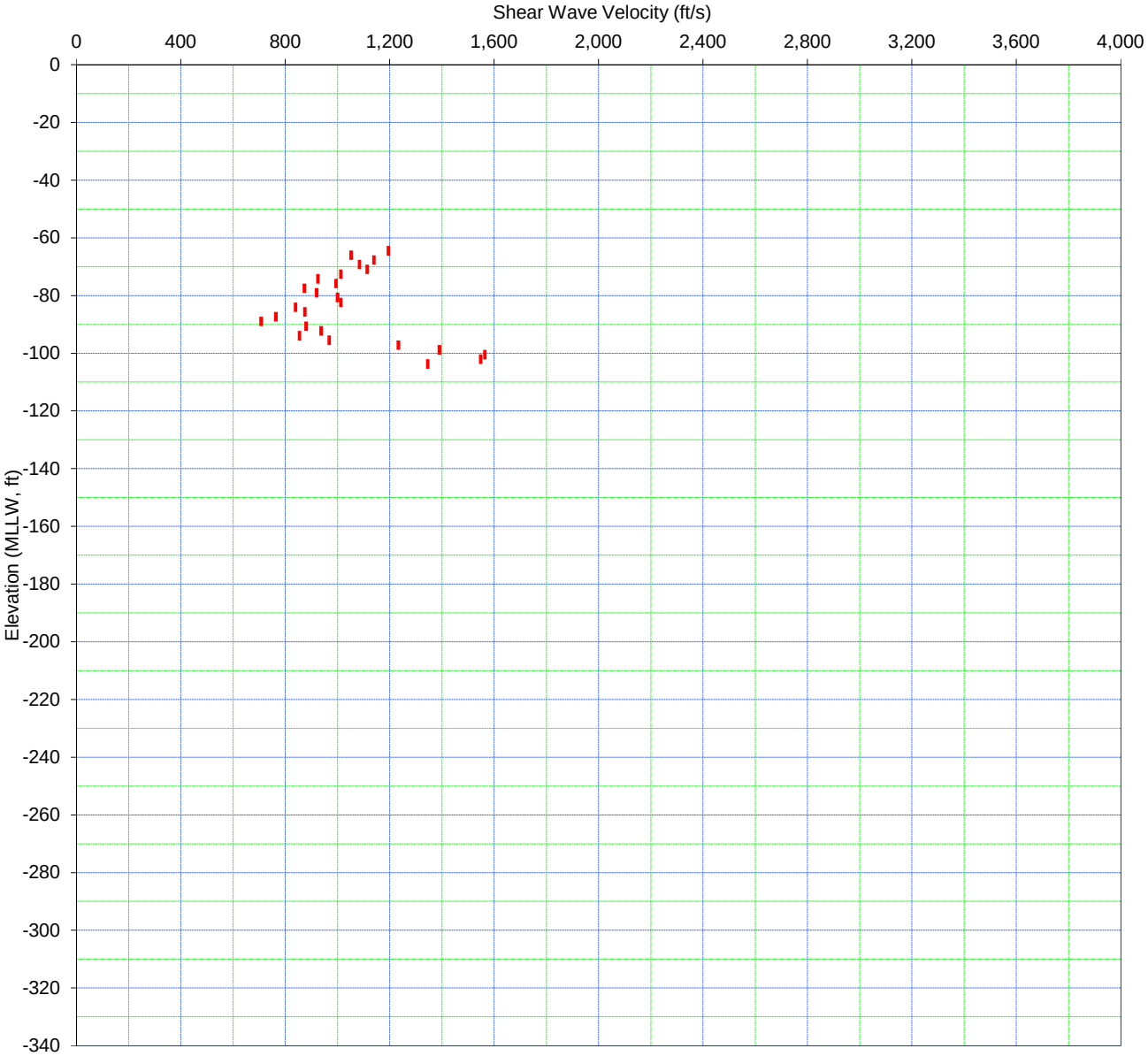
MEASURED P-WAVE VELOCITIES - BORING MB-22

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D8-1



MEASURED S-WAVE VELOCITIES - BORING MB-22

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D8-2

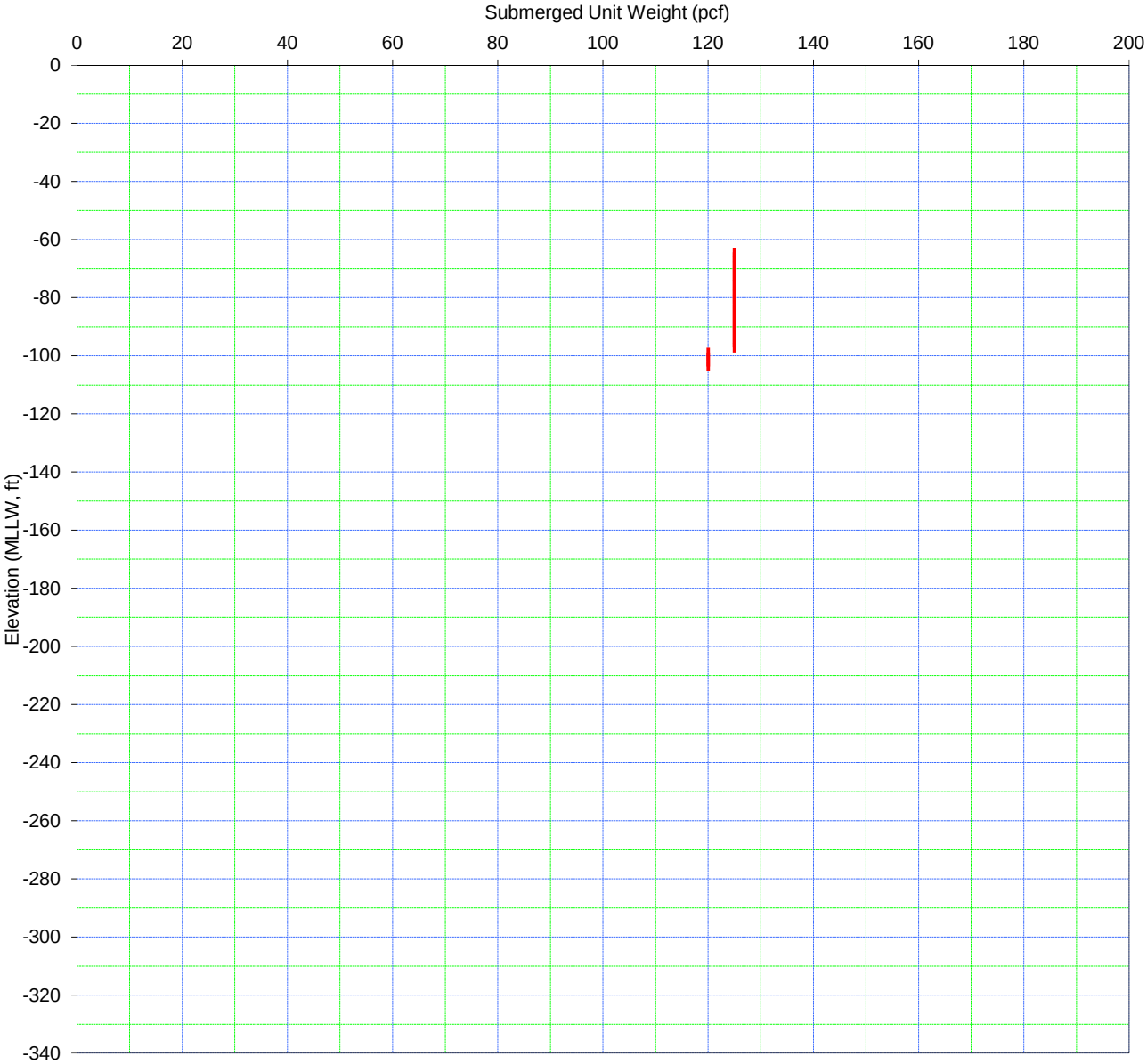
CALCULATED POISSON'S RATIO - BORING MB-22

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D8-3



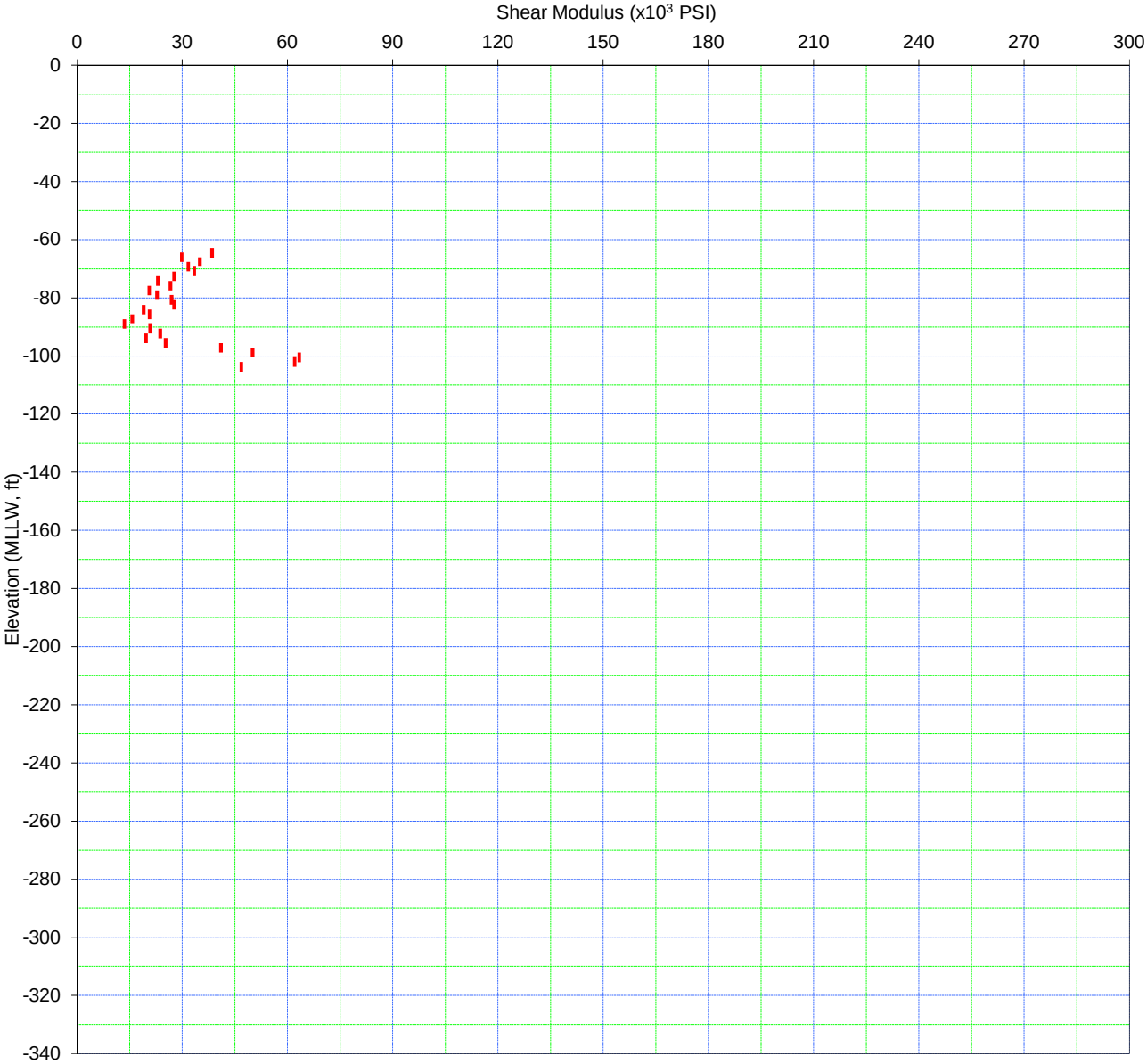
ASSUMED SUBMERGED UNIT WEIGHT - BORING MB-22

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D8-4



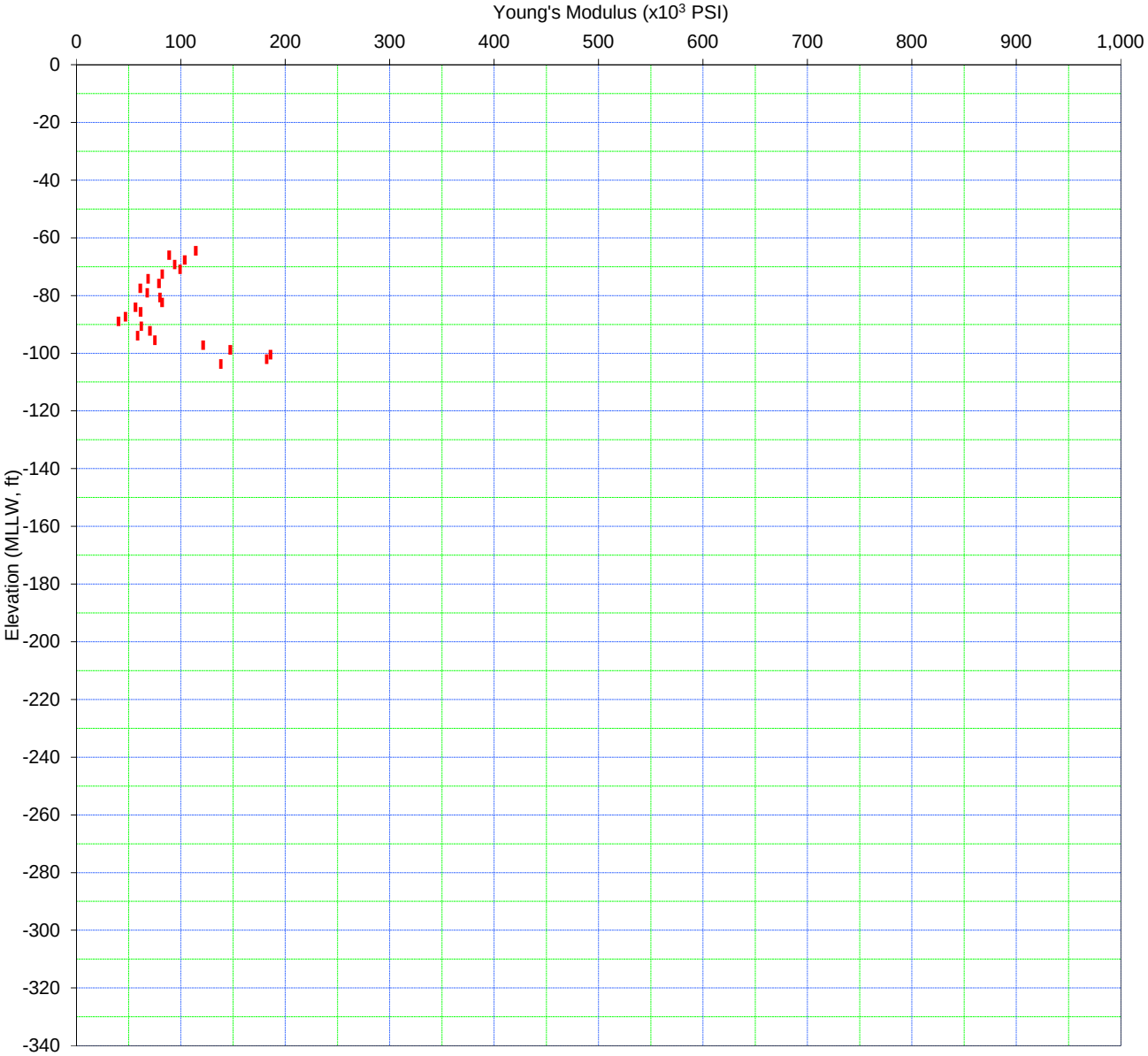
CALCULATED SHEAR MODULUS - BORING MB-22

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D8-5



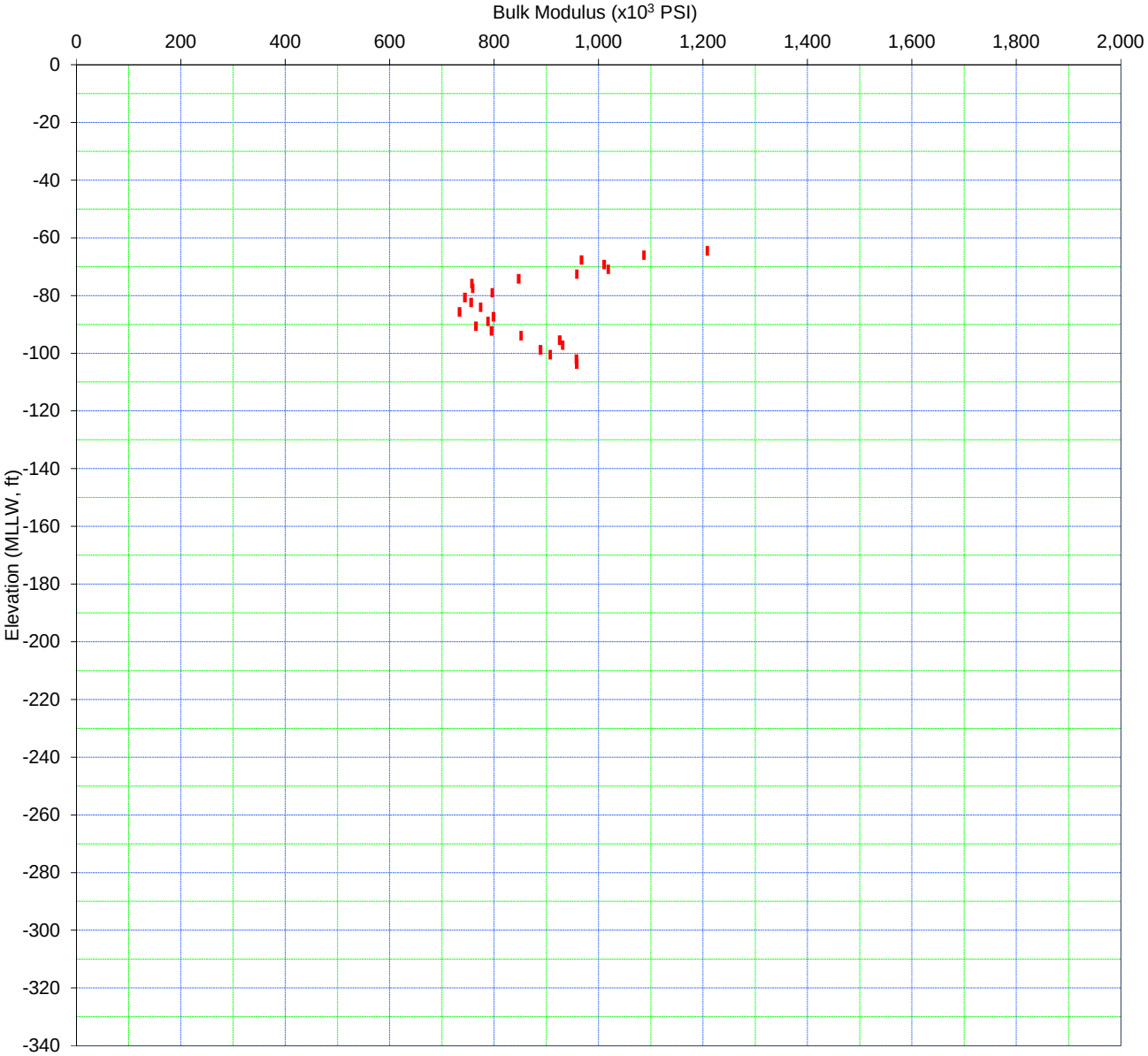
CALCULATED YOUNG'S MODULUS - BORING MB-22

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D8-6



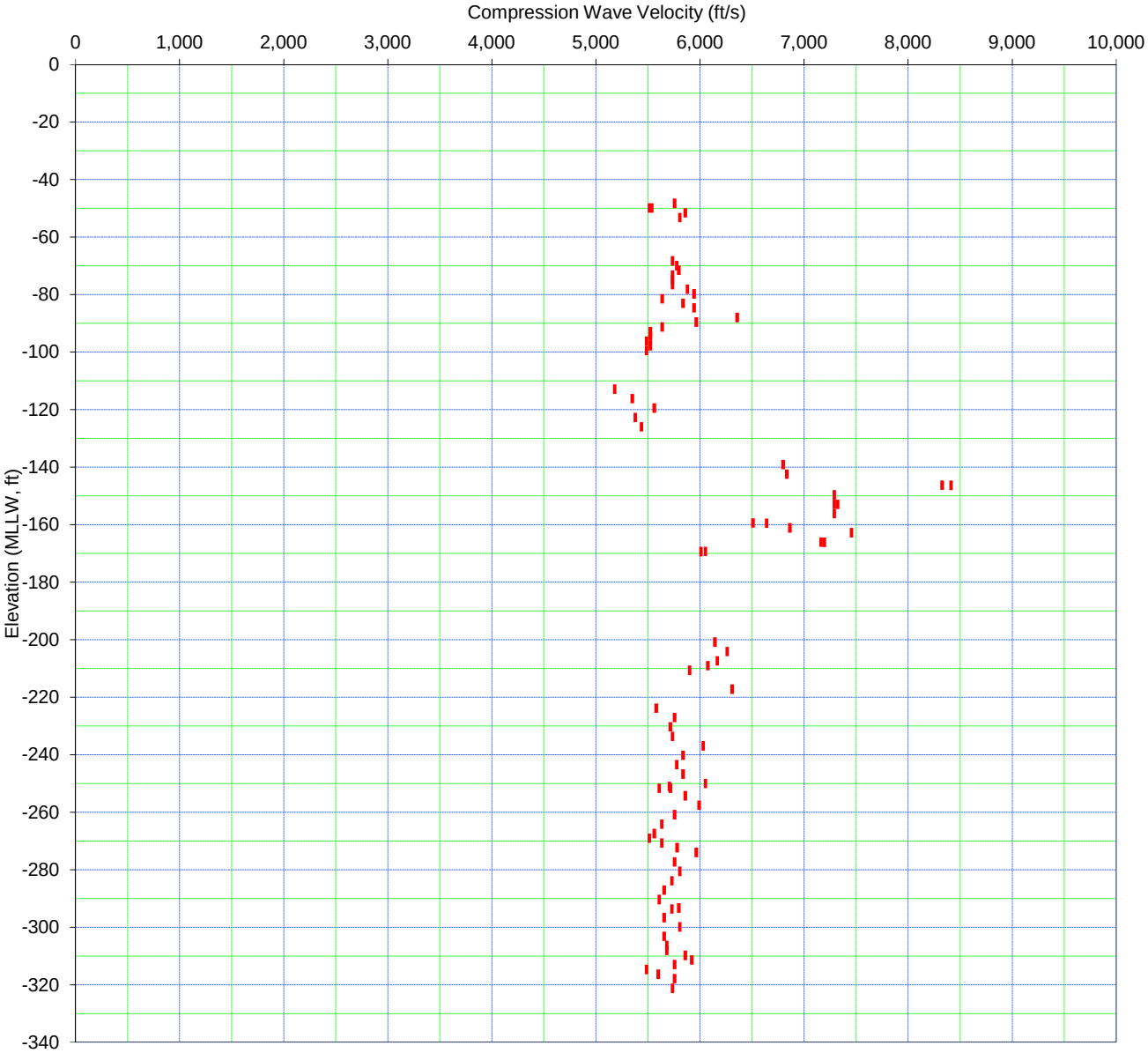
CALCULATED BULK MODULUS - BORING MB-22

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D8-7



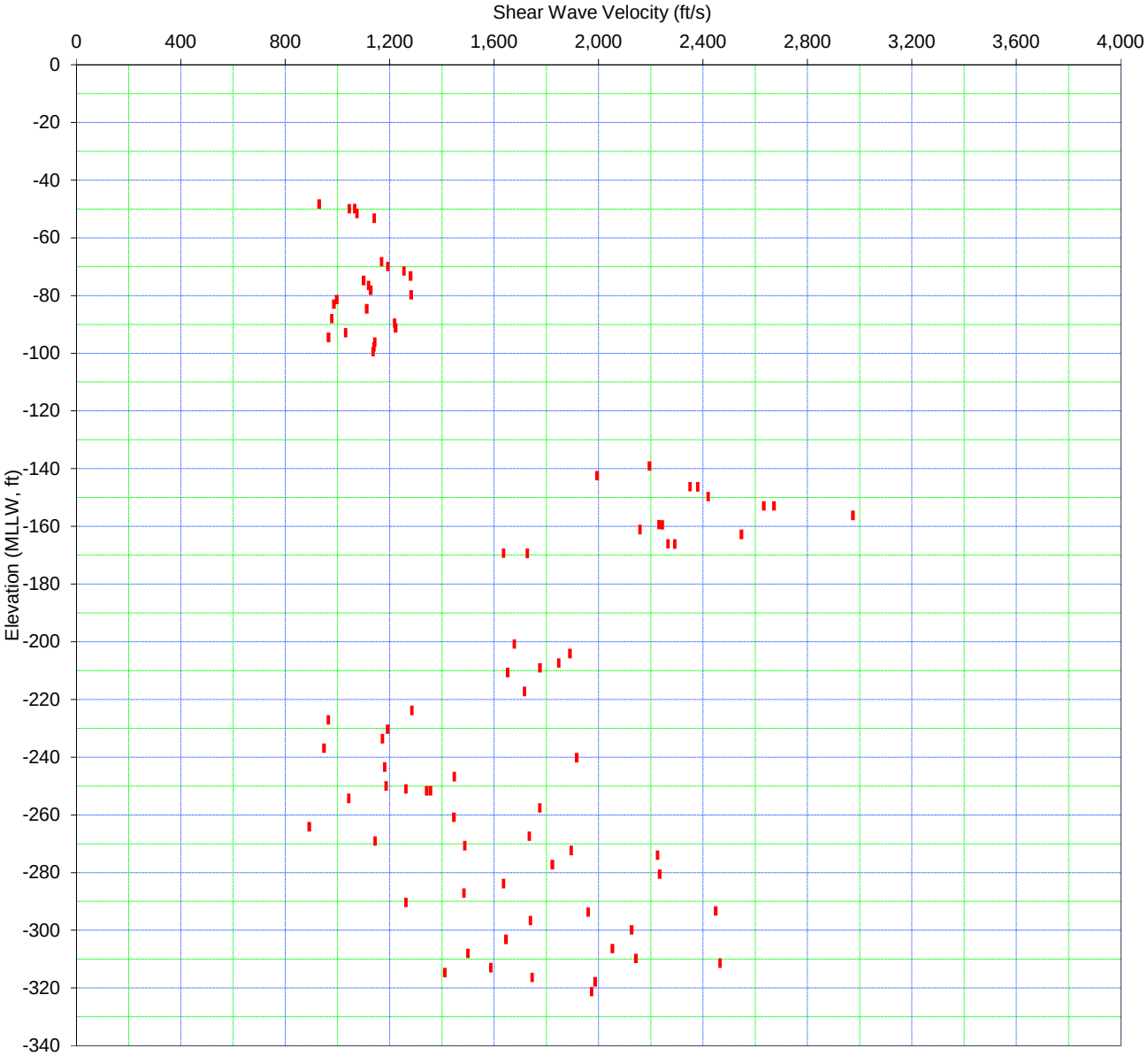
MEASURED P-WAVE VELOCITIES - BORING MB-23

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D9-1



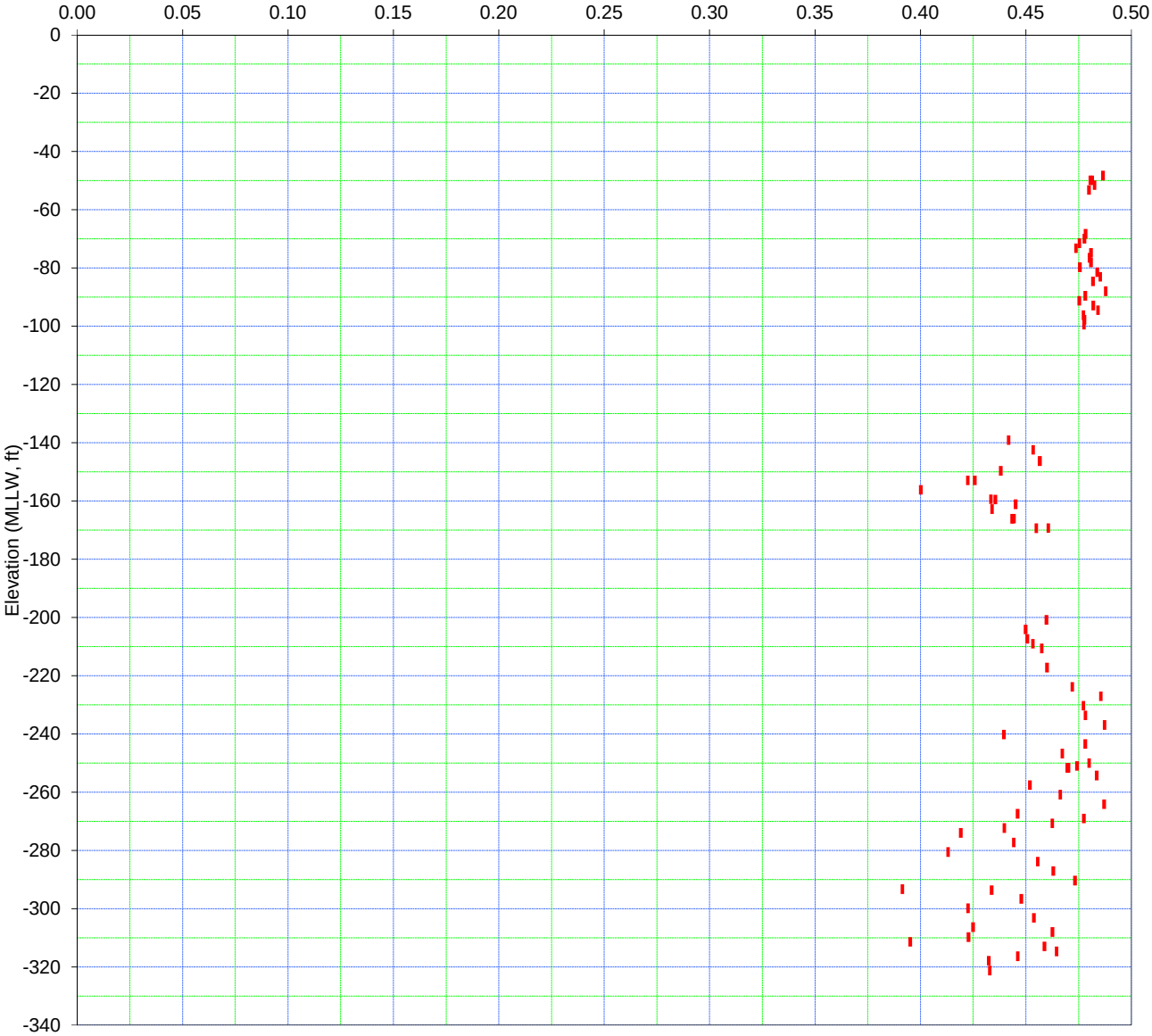
MEASURED S-WAVE VELOCITIES - BORING MB-23

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D9-2



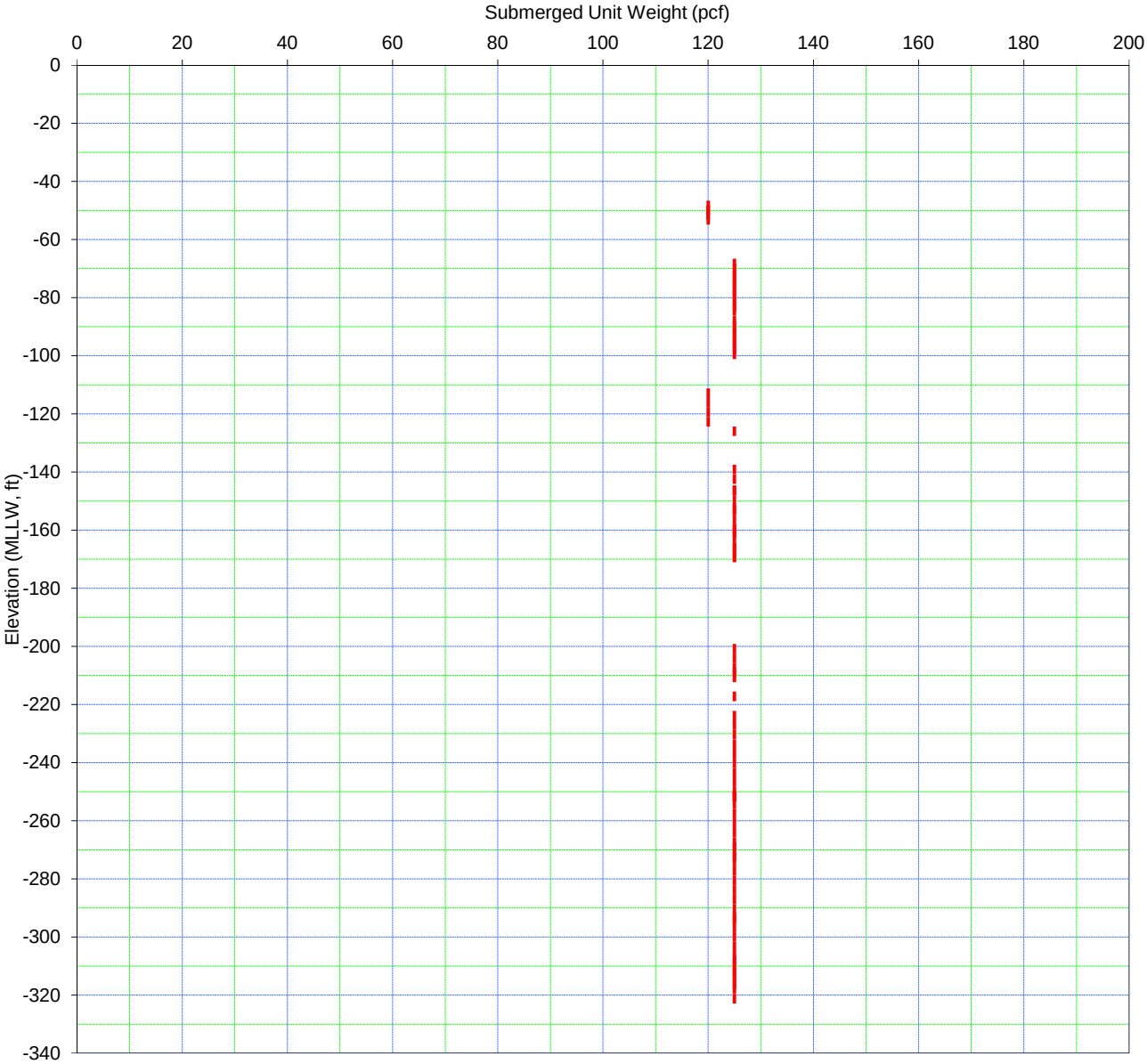
CALCULATED POISSON'S RATIO - BORING MB-23

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D9-3



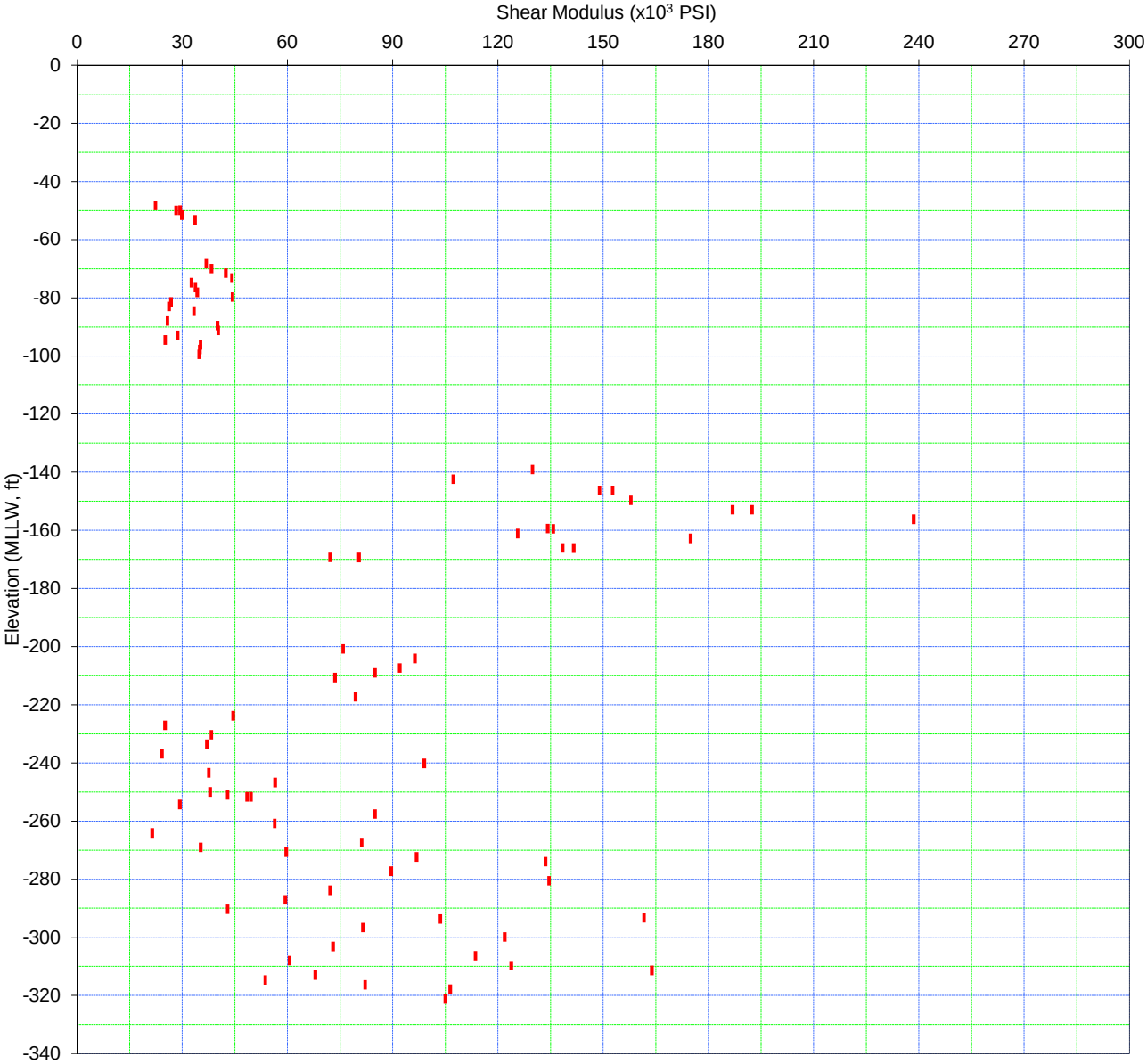
ASSUMED SUBMERGED UNIT WEIGHT - BORING MB-23

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D9-4



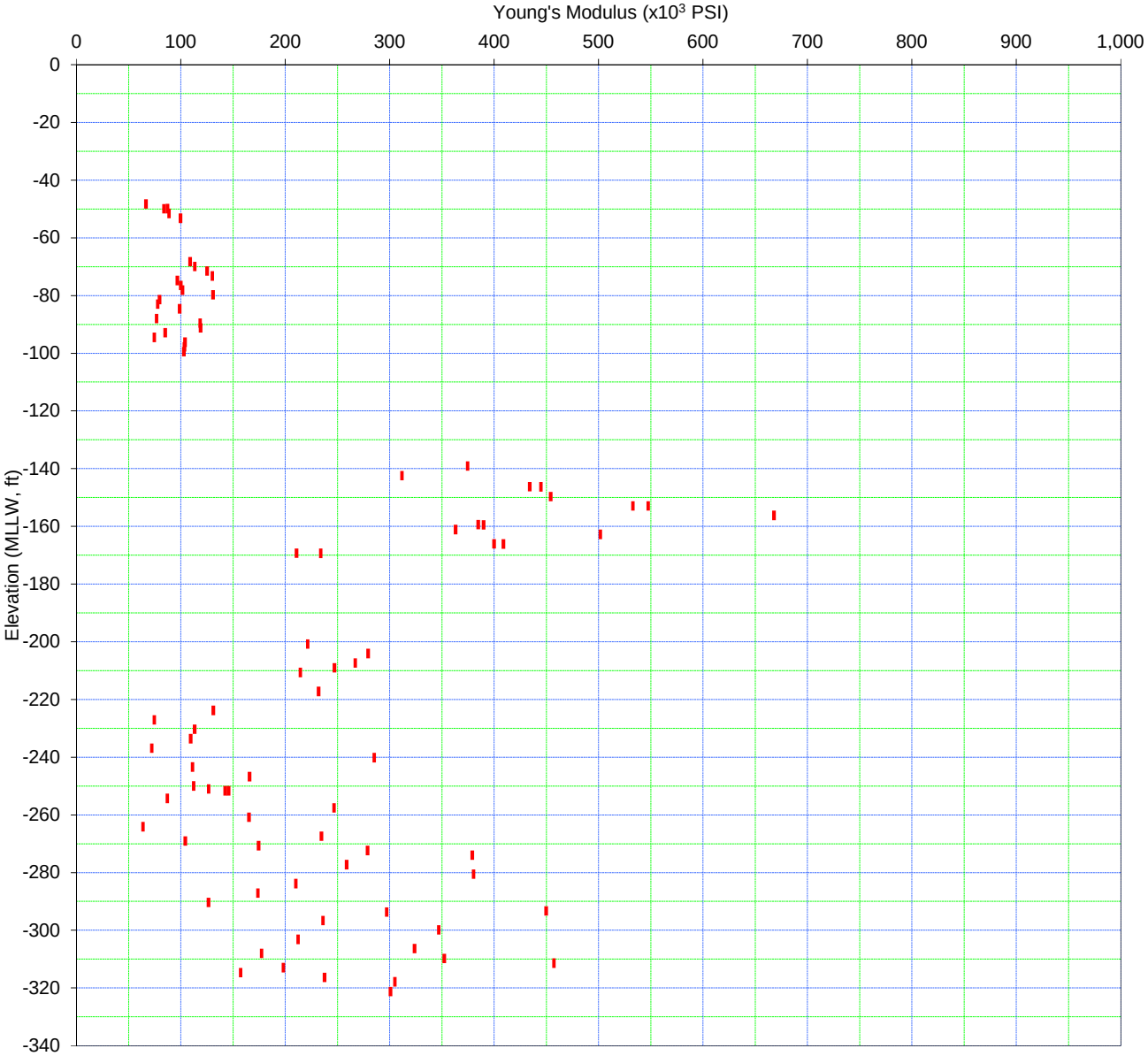
CALCULATED SHEAR MODULUS - BORING MB-23

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D9-5



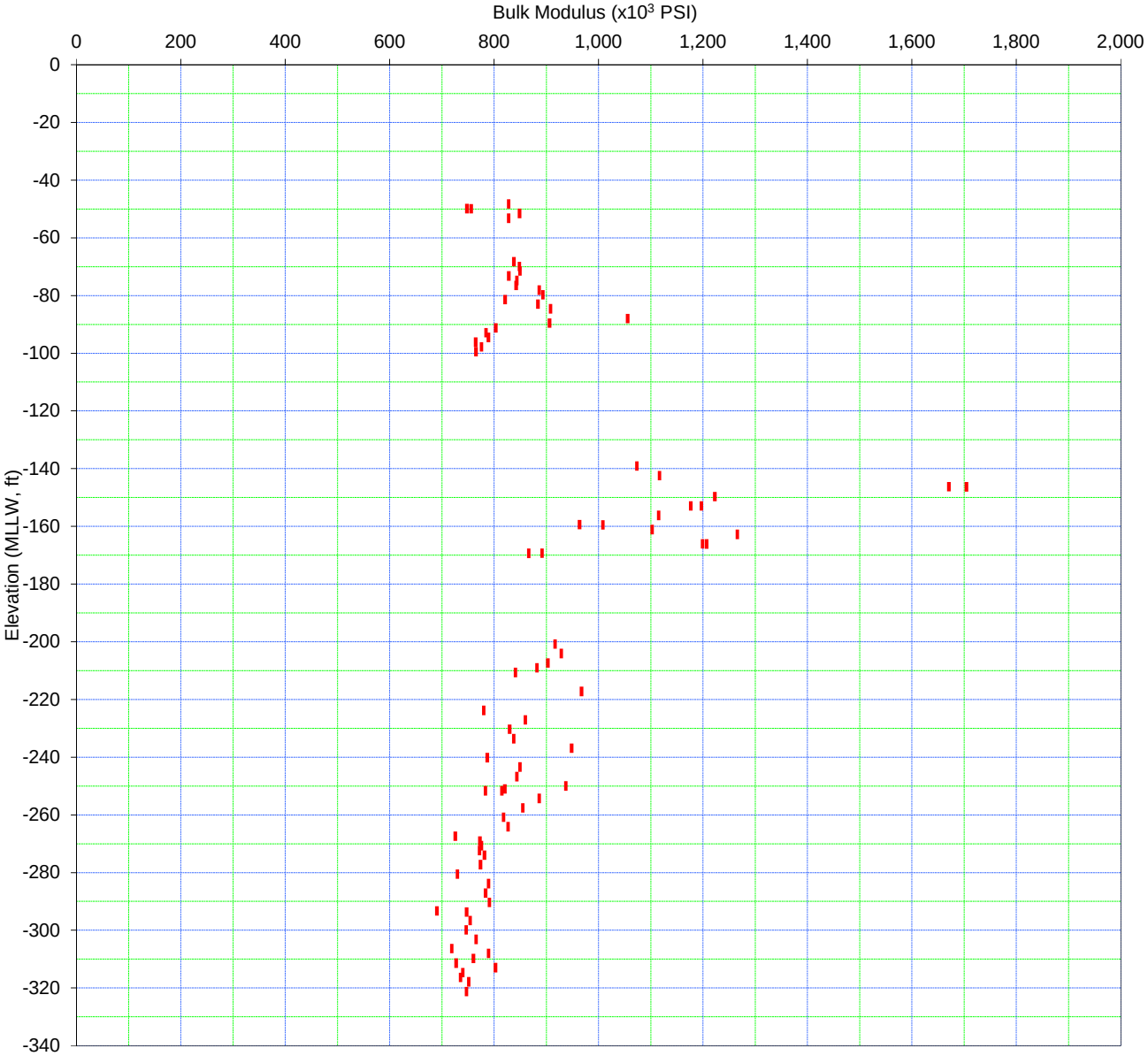
CALCULATED YOUNG'S MODULUS - BORING MB-23

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D9-6



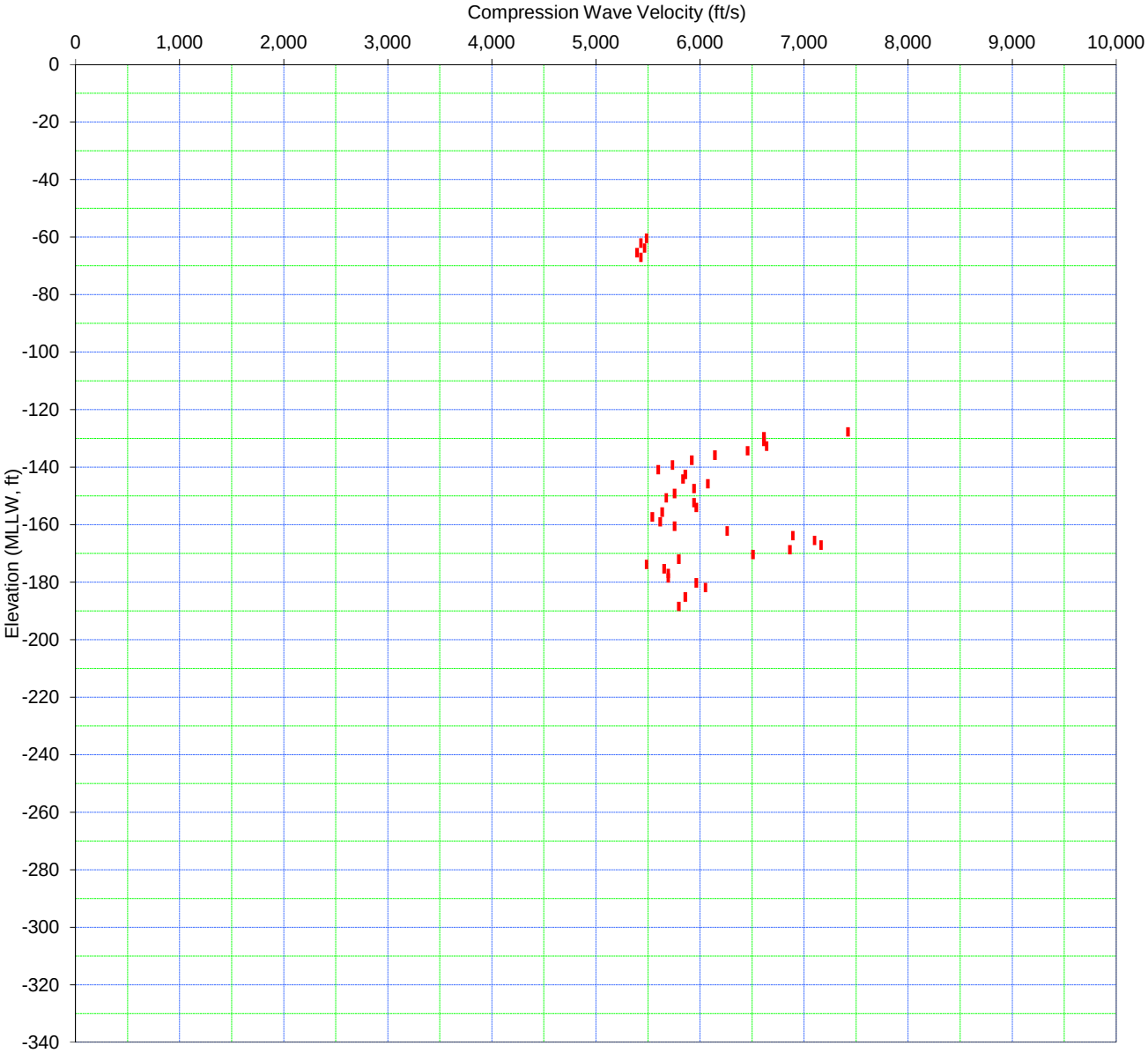
CALCULATED BULK MODULUS - BORING MB-23

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D9-7



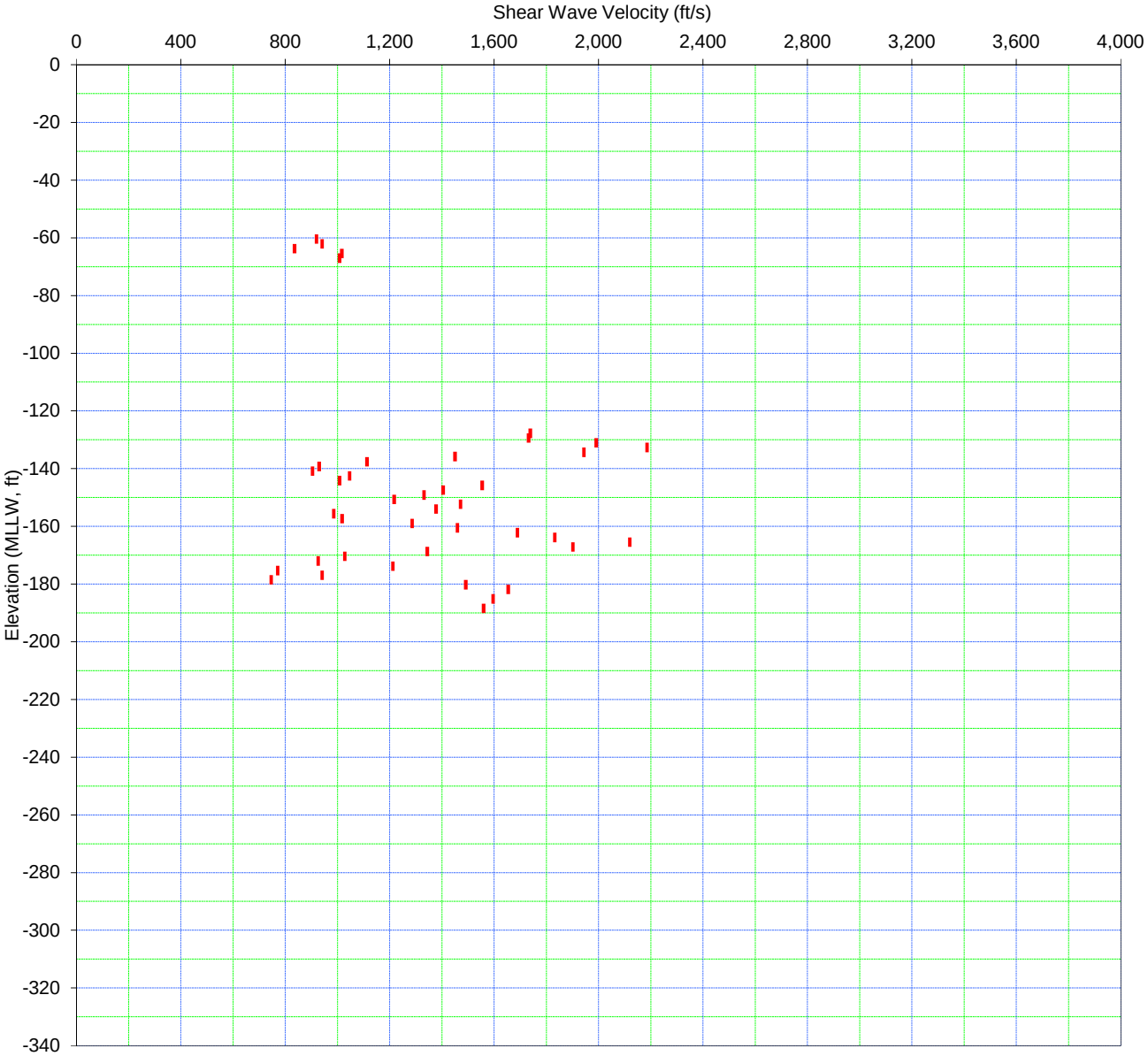
MEASURED P-WAVE VELOCITIES - BORING MB-27

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D10-1



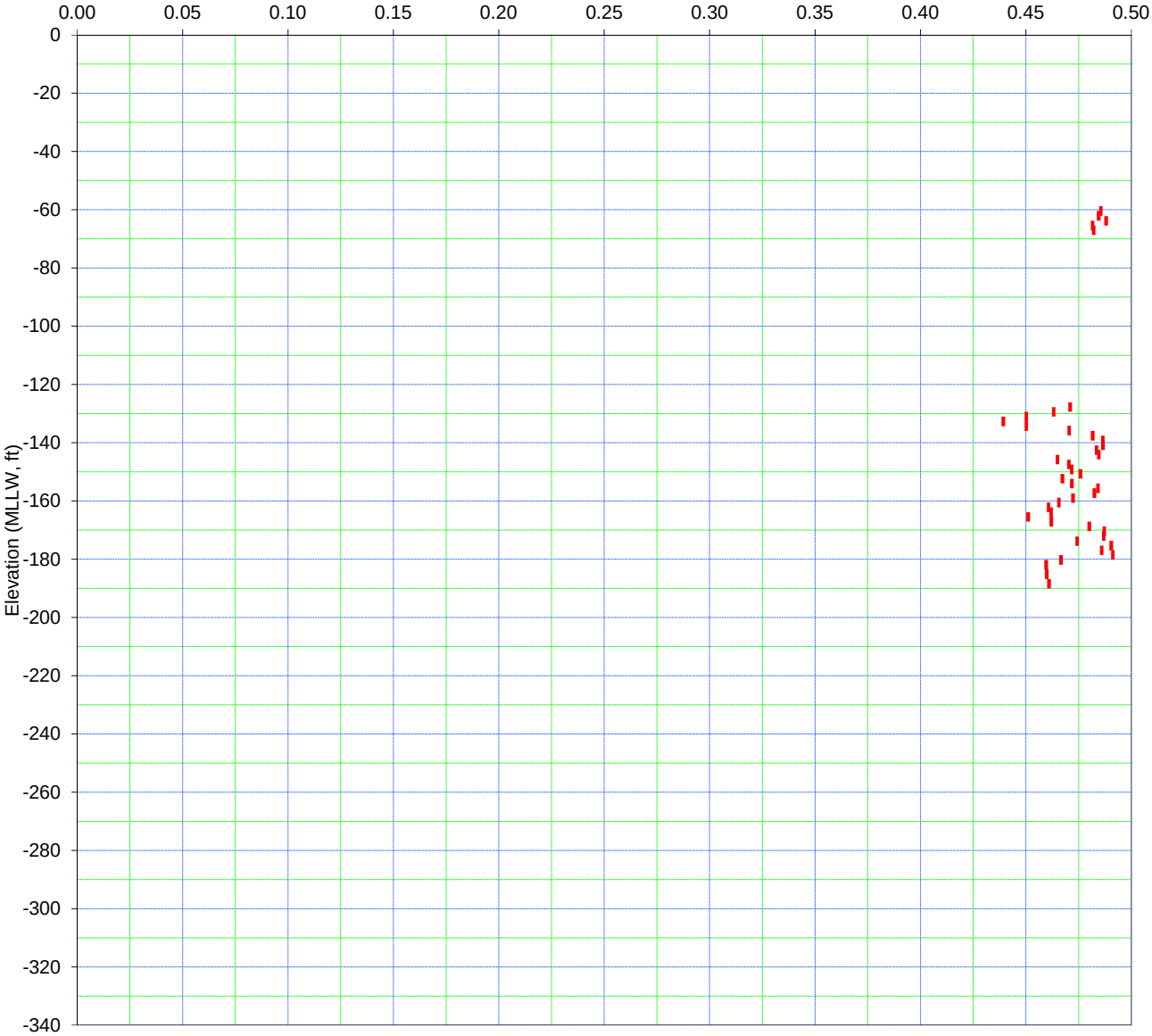
MEASURED S-WAVE VELOCITIES - BORING MB-27

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

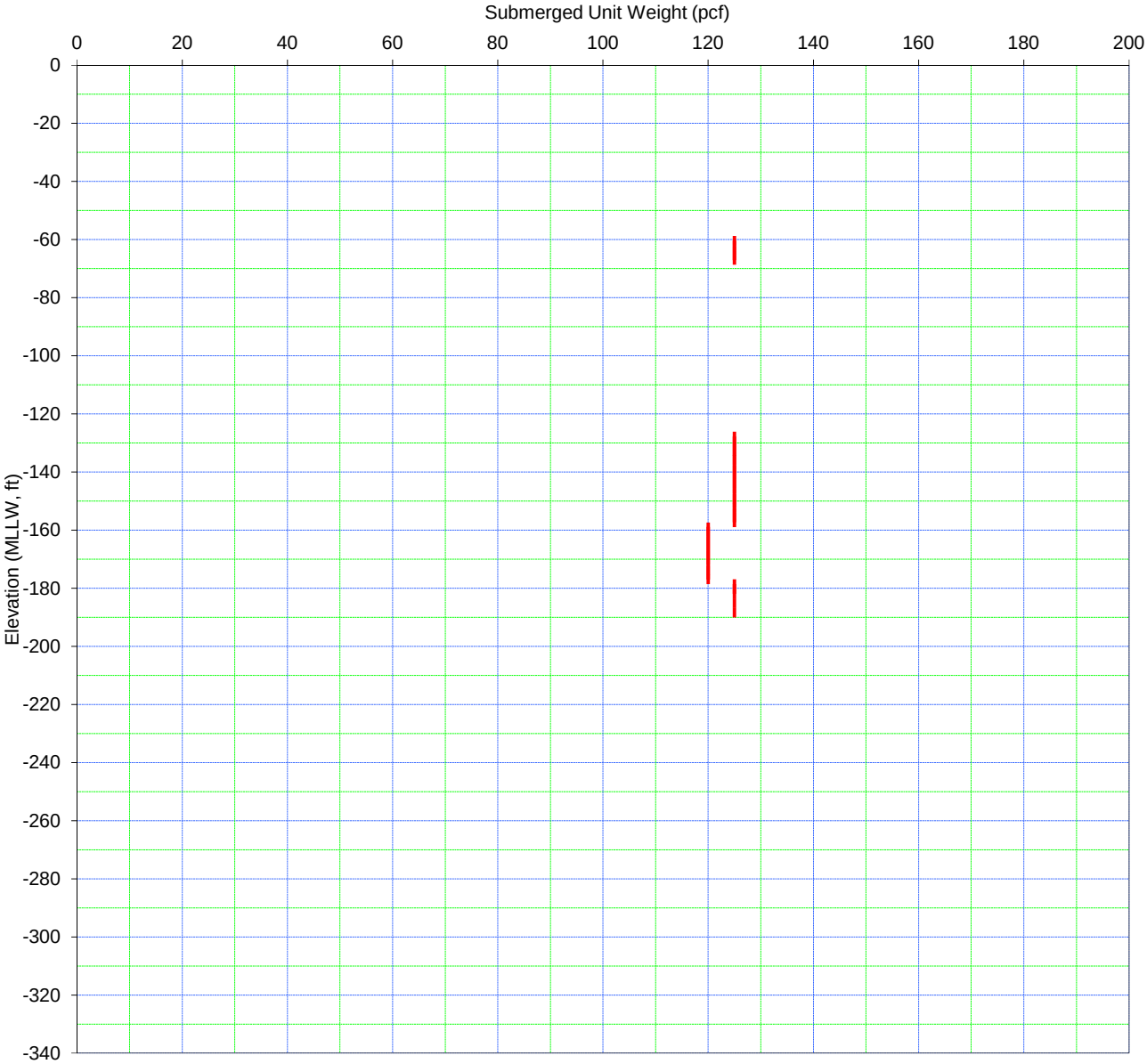
PLATE D10-2



CALCULATED POISSON'S RATIO - BORING MB-27

MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISIKI, ALASKA

PLATE D10-3



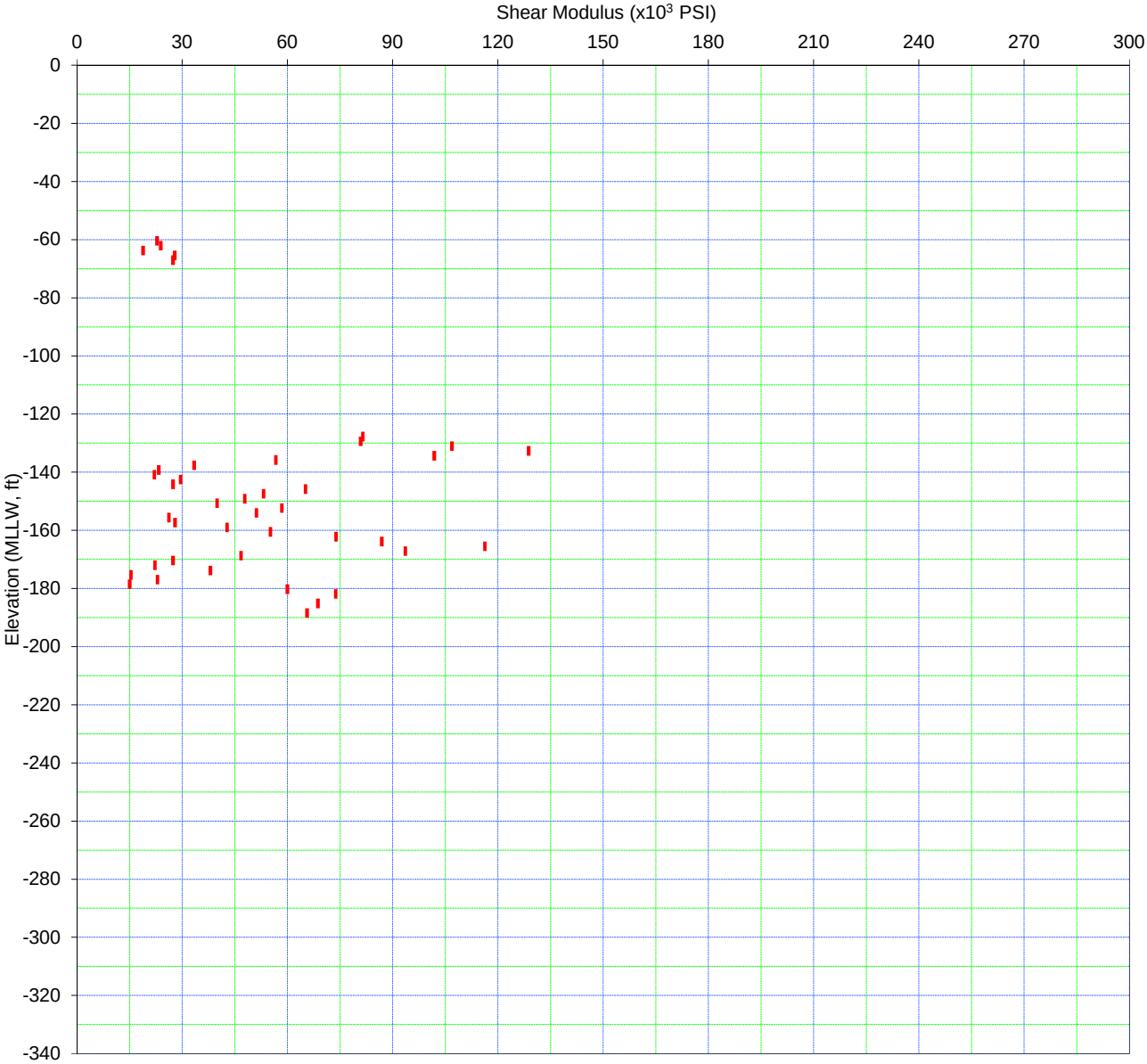
ASSUMED SUBMERGED UNIT WEIGHT - BORING MB-27

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D10-4



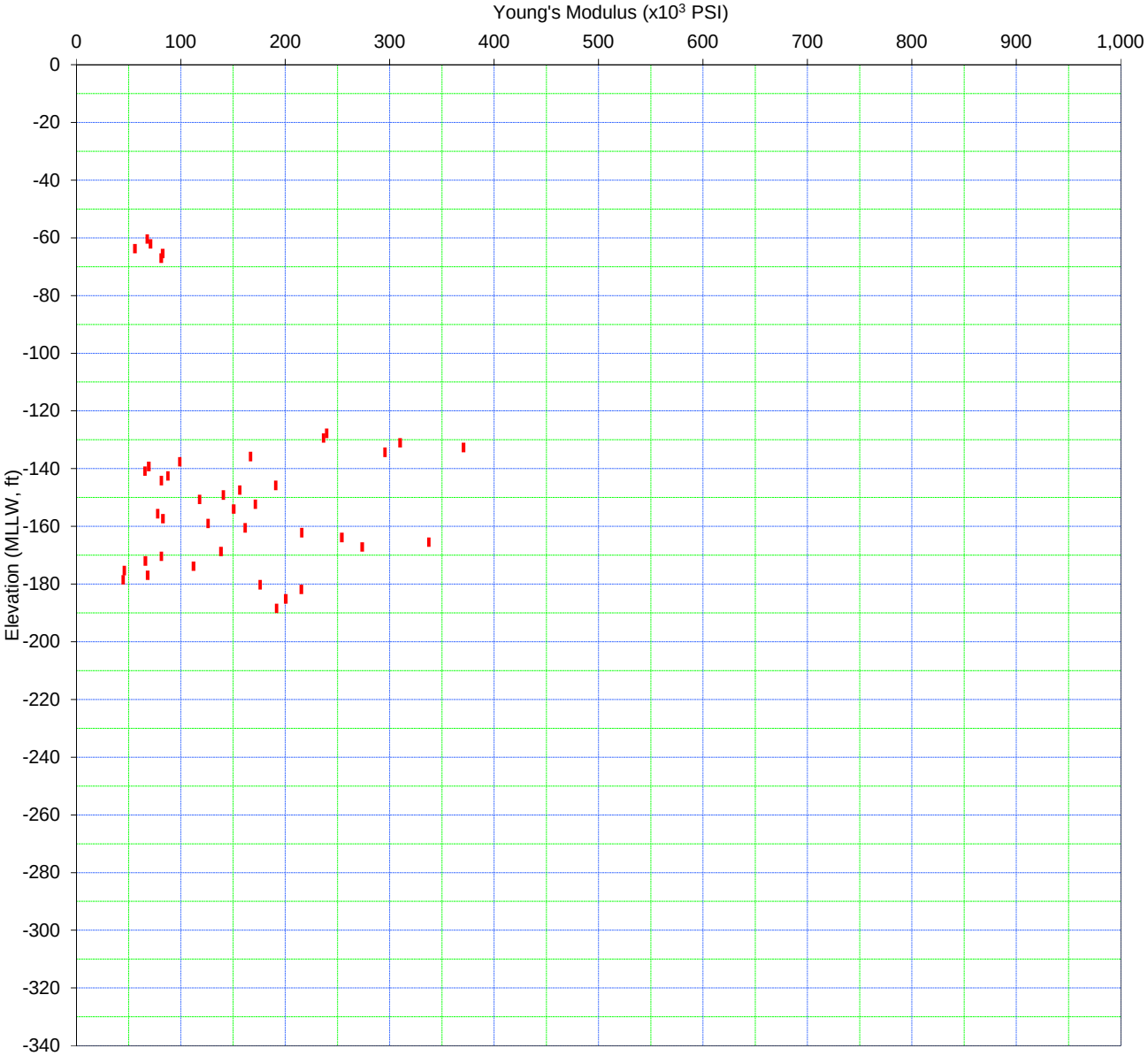
CALCULATED SHEAR MODULUS - BORING MB-27

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D10-5



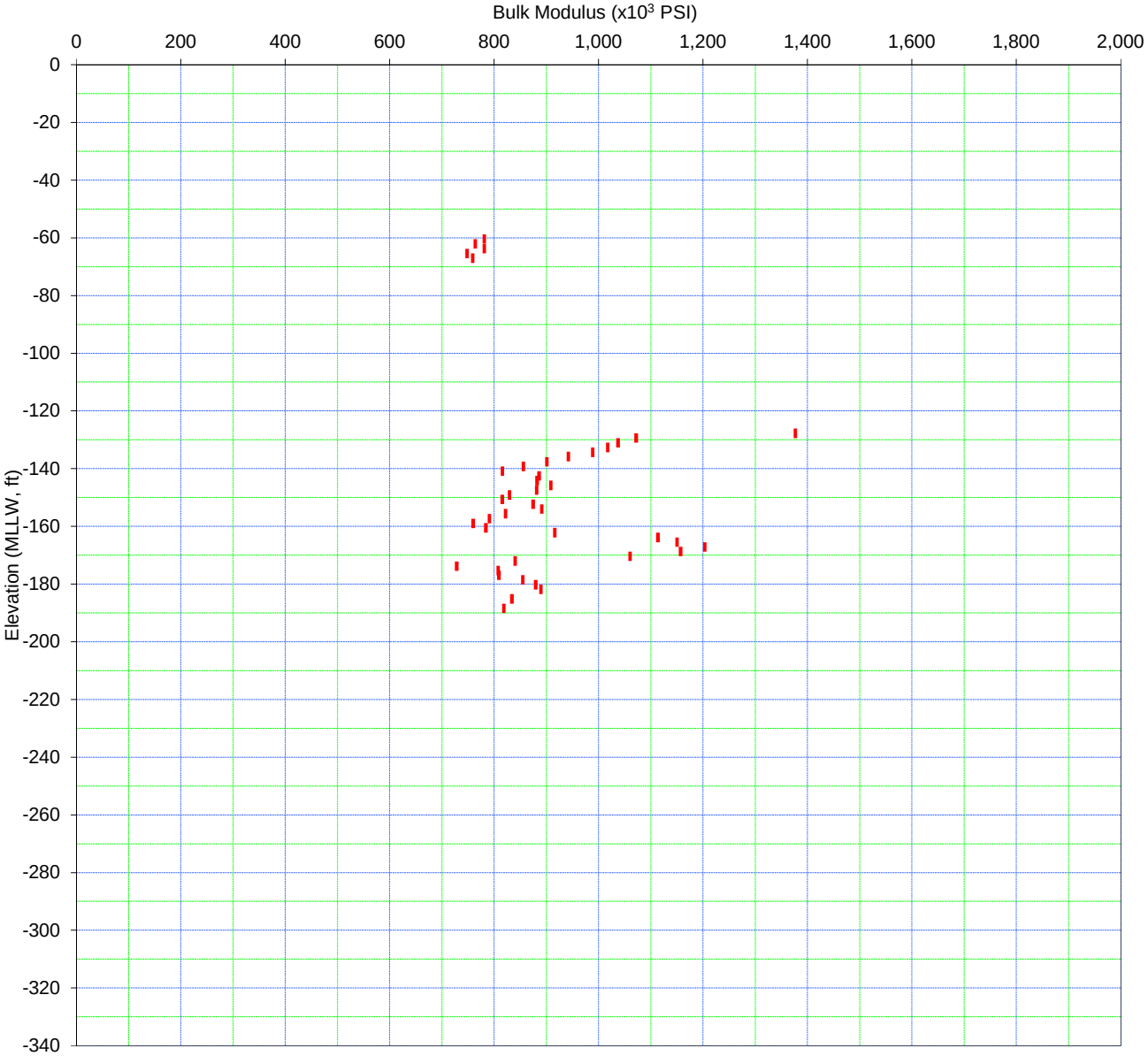
CALCULATED YOUNG'S MODULUS - BORING MB-27

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D10-6



CALCULATED BULK MODULUS - BORING MB-27

MARINE LNG FACILITIES

ALASKA LNG PROJECT

NIKISIKI, ALASKA

PLATE D10-7

APPENDIX E

Laboratory Test Results

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
DS-4A	0.5	23[a]																									M
DS-4A	0.6	32[a]																									M
DS-4B	1.3	22[a]																									M
DS-4B	13.5	21[a]																									M
DS-4B	13.9	20[a]																									M
DS-4B	16.6	23[a]																									M
DS-5A	4.5	26[a]																									M
DS-5A	9.4	24[a]																									M
DS-5A	11.3	22[a]																									M
DS-5A	14.3	22[a]																									M
DS-5A	16.1	23[a]																									M
DS-5A	16.7	22[a]																									M
DS-5A	19.2	29[a]																									M
DS-5A	19.2	23[a]																									M
DS-5B	6.1	32[a]																									M
DS-5B	16.1	23[a]																									M
DS-5B	18.4	23[a]																									M
MB-02	4.4	25																									M
MB-02	4.4					10																					S
MB-02	6.9					19																					S
MB-02	6.9	19																									M
MB-02	11.8	28																									M
MB-02	11.8					67	34	18																			A, FC
MB-02	18.6	20																									M
MB-02	18.6					22																					S
MB-02	21.7					63	25	10																			A, S
MB-02	21.7	19																									M
MB-02	26.6	19				67	30	16																			M, A, FC
MB-02	30.0						NP	NP																			A
MB-02	32.3	18	134.5	113.7		69						1.5															M, T, FC, Ur

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-1

Report No. 04.10140334-9

Confidential
LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16

Alaska LNG

FUGRO

LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R	pH	Cl^-	SO_4^{2-}	S^{2-}				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	ohm-cm		ppm	ppm	ppm				
MB-02	34.8					92	25	10																			A, FC
MB-02	34.8	18																									M
MB-02	39.7	18				48																					M, S
MB-02	42.2					64	23	9																			A, FC
MB-02	42.2	17																									M
MB-02	47.1					70	24	9																			A, FC
MB-02	47.1	18																									M
MB-03	2.0	26[a]				14[a]																					M, S
MB-03	4.4	24[a]																									M
MB-03	6.9	25[a]				42	NP	NP																			M, A, FC
MB-03	9.4	26[a]																									M
MB-03	11.3	26[a]				23[a]																					M, S, H
MB-03	14.3	26[a]				17[a]																					M, S
MB-03	16.4	25[a]																									M
MB-03	19.1	26[a]				21[a]	NP	NP																			M, A, S
MB-03	21.1	28[a]																									M
MB-03	24.1	26[a]				26[a]																					M, S, H
MB-03	26.4	29[a]																									M
MB-03	28.7	37[a]				15[a]																					M, S
MB-03	31.0	25[a]																									M
MB-03	33.4	25[a]																									M
MB-03	35.4	23[a]																									M
MB-03	38.4	24[a]																									M
MB-03	40.7	21[a]				49	20	5																			M, A, FC
MB-03	46.0	19[a]				62	27	12																			M, A, FC
MB-03	50.2	23[a]				63	24	9																			M, A, FC
MB-03	55.8	20[a]																									M
MB-03	61.5	17	132.4	112.9		73	28	14			5.8																M, T, A, FC, U
MB-03	61.5	17	135.5	115.7								3.5															M, T, Ur
MB-03	61.7	20[a]							4.5																		M, p

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-2

Report No. 04.10140334-9

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-03	66.6								4.5																		p
MB-03	66.9	17[a]																									M
MB-03	71.7								4.5																		p
MB-03	71.9	18[a]																									M
MB-03	75.7	16	132.6	114.0		66	20	6					0.6	32.6													M, T, A, FC
MB-03	76.1	17	134.2	115.1		66	20	6																			M, T, A, C, XR, FC
MB-03	76.4								4.5																		p
MB-03	76.6	16	133.0	114.5							5.9																M, T, U
MB-03	76.6	15	135.2	117.2		65	21	8				3.4															M, T, A, FC, Ur
MB-03	76.8	16[a]																									M
MB-03	81.5								4.5																		p
MB-03	81.7	16[a]																									M
MB-03	86.5								4.5																		p
MB-03	86.6	17[a]																									M
MB-03	91.4	16	137.8	119.1		62	19	6	4.5		7.4																M, T, A, FC, p, U
MB-03	91.4	15	136.2	118.1								3.6															M, T, Ur
MB-03	91.5	16[a]																									M
MB-03	95.1	14[a]				50	15	3																			M, A, FC
MB-03	101.2								4.5																		p
MB-03	101.4	17[a]																									M
MB-03	104.7								4.5																		p
MB-03	105.0	17[a]																									M
MB-03	107.6	19[a]							4.5																		M, p
MB-03	116.0	21	131.2	108.2		97	31	15	4.5		6.3																M, T, A, FC, p, U
MB-03	116.0	21	131.9	108.9								4.0															M, T, Ur
MB-03	116.1	23[a]																									M
MB-03	117.5	23[a]							4.5																		M, p
MB-03	122.1	20[a]																									M
MB-03	122.4	14[a]																									M
MB-03	123.0								4.5																		p

Classification Tests
LL = Liquid Limit
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*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

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S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
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DSS = Direct Simple Shear

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R = Resistivity
Cl^- = Chloride
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

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Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
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SG = Specific Gravity
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-3

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_F415MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-03	124.9	12[a]							4.5																		M, p
MB-03	125.7					45[a]	25	12																			A, S
MB-03	125.7	14																									M
MB-03	133.1	9[a]																									M
MB-03	133.8					69																					FC
MB-03	140.8					66[a]	30	14																			A, S
MB-03	140.8	10																									M
MB-03	142.7								4.5																		p
MB-03	143.1	10[a]							4.5																		M, p
MB-03	145.3					42[a]	27	13																			A, S
MB-03	149.9					43[a]																					S
MB-03	154.2								4.5																		p
MB-04	3.0	26				55	34	17																			M, A, S
MB-04	5.3																		172	8.1	2549	464					Co
MB-04	7.2	26				23																					M, S
MB-04	12.5					18																					FC
MB-04	15.1	27				33																					M, S
MB-04	19.5					19																					S, H
MB-04	22.0					30	NP	NP																			A, FC
MB-04	23.8	21				85	37	22																			M, A, FC
MB-04	26.7	23				26																					M, S
MB-04	30.9	20																									M
MB-04	39.1	24				91	31	16																			M, A, FC
MB-04	41.0	20				34	NP	NP																			M, A, S
MB-04	42.2	18				73	31	16																			M, A, FC
MB-04	45.1	25	120.6	96.7		37	21	7			3.9																M, T, A, FC, U
MB-04	45.1	22	130.0	106.6								2.0															M, T, Ur
MB-04	45.3					54	20	3																			A, FC
MB-04	49.5					57																					FC
MB-04	54.5	19				79	26	12																			M, A, S

Classification Tests
LL = Liquid Limit
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*Oven-Dried Specimen

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Cl^- = Chloride
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-4

Report No. 04.10140334-9

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R	pH	Cl^-	SO_4^{2-}	S^{2-}				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	ohm-cm		ppm	ppm	ppm				
MB-04	64.3	18				68	22	8																			M, A, FC
MB-04	72.2								4.0																		p
MB-04	75.3	16	135.7	116.7		72	24	10			10.4																M, T, A, FC, U
MB-04	75.3	16	135.0	116.0								4.3															M, T, Ur
MB-04	80.2	16				77	23	9																			M, A, FC
MB-04	90.1	23	127.4	103.7		91	48	31			3.1																M, T, A, FC, U
MB-04	90.2								4.5																		p
MB-04	95.1								4.5																		p
MB-04	97.8	22	124.9	102.3							3.3																M, T, U
MB-04	97.8	20	130.1	108.0								4.6															M, T, Ur
MB-04	99.9					88	39	22																			A, FC
MB-04	100.0	21																									M
MB-04	100.1								4.5																		p
MB-04	104.9								4.5																		p
MB-04	105.0	18				53	18	5																			M, A, FC
MB-04	108.1								4.5																		p
MB-04	108.4	22	132.1	108.7			33	16			15.7																M, T, A, U
MB-04	120.9	9	143.1	131.4							22.3																M, T, U
MB-04	121.8	10				61	19	4																			M, A, FC
MB-04	129.3	12				61	28	13																			M, A, FC
MB-04	134.2					49	25	12																			A, FC
MB-04	136.8	32				88	29	3																			M, A, FC
MB-04	142.0	26				39																					M, S
MB-04	151.8	21				22																					M, S
MB-05	1.2	24				92	29	12																			M, A, FC
MB-05	4.6	27	120.5	94.9		99	55	35					0.8	19.6													M, T, A, FC
MB-05	4.7	22	125.1	102.6		98	27	10																			M, T, A, C, XR, FC
MB-05	5.2	24	126.5	101.9		95	30	12			1.9																M, T, A, S, H, U
MB-05	10.2					71																					S, H
MB-05	12.6	29				88																					M, S

Classification Tests
LL = Liquid Limit
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*Oven-Dried Specimen

Drained Strength
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PP = Pocket Penetrometer
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Strength Tests
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R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

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Cb = Percent Carbonate
CDSS = Cyclic DSS
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-5

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Alaska LNG

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LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-05	14.4																		140	8.3	240	100					Co
MB-05	17.6	22				41																					M, S, H
MB-05	20.0					91																					S, H
MB-05	24.8	25				82	21	4																			M, A, S
MB-05	29.8					13	NP	NP																			A, FC
MB-05	31.7					9																					S, H
MB-05	34.1	22				25																					M, S
MB-05	36.6					20										42.0											DSS, S
MB-05	41.7					22	NP	NP																			A, FC
MB-05	46.5	21				9																					M, FC
MB-05	54.3	19	129.8	108.8		85	29	15					1.0	27.7													M, T, A, C, XR, FC
MB-05	54.3	19	131.7	110.6		80	30	15																			M, T, A, FC
MB-05	55.0	19	133.5	112.4		82	33	18			4.5																M, T, A, FC, U
MB-05	55.0	20	131.8	110.1								2.3															M, T, Ur
MB-05	55.0	22	126.9	103.7																							M, T, C
MB-05	55.3								4.0																		p
MB-05	58.6								4.5																		p
MB-05	63.2	20				77	26	12																			M, A, FC
MB-05	63.5								2.0																		p
MB-05	68.2	37	117.4	85.4		95	43	26			0.3																M, T, A, FC, U
MB-05	68.2	36	120.8	89.1								0.5															M, T, Ur
MB-05	68.4								2.3																		p
MB-05	70.6	22	125.8	103.0		36																					M, T, C, FC
MB-05	71.3	25	125.2	100.1			NP	NP																			M, T, A, C
MB-05	71.3	23	123.3	99.9		21					4.5																M, T, XR, FC, U
MB-05	75.8	20				63	26	12																			M, A, S
MB-05	78.0	18				71	25	11																			M, A, FC
MB-05	85.6					68																					FC
MB-05	90.6	18				80	26	11																			M, A, FC
MB-05	100.4					67																					FC

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SUMMARY OF TEST RESULTS
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MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-6

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-05	110.2	19				89	32	17																			M, A, FC
MB-05	125.0	14				58	24	10																			M, A, FC
MB-05	128.0	15				63																					M, S
MB-05	132.4	19					34	16																			M, A
MB-05	134.5	13				62																					M, S
MB-05	139.1					66																					FC
MB-05	145.0	13	142.8	126.2		73	31	16			33.7																M, T, A, XR, S, U
MB-05	145.0					100																					FC
MB-05	148.3					40																					FC
MB-06	2.0					94	28	7																			A, S
MB-06	2.0	26																									M
MB-06	6.9					41																					S
MB-06	6.9	24																									M
MB-06	11.8					38																					S, H
MB-06	15.9	24																									M
MB-06	15.9					37																					S
MB-06	23.6					50																					S
MB-06	31.3	23																									M
MB-06	31.3					31																					S
MB-06	41.3	22																									M
MB-06	41.3					70	25	9																			A, FC
MB-06	46.3					95	30	14																			A, FC
MB-06	46.3	22																									M
MB-06	50.2	24	129.1	104.2							2.6																M, T, U
MB-06	50.2	23	128.1	104.5								1.3															M, T, Ur
MB-06	50.7					87	28	13																			A, FC
MB-06	50.7	22	129.5	106.4							2.3																M, T, U
MB-06	50.9								4.5																		p
MB-06	57.1								4.5																		p
MB-06	61.0	20																									M

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-7

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-06	61.0					85	34	19																			A, FC
MB-06	66.5	19	132.5	111.4							5.4																M, T, U
MB-06	66.5	19	128.7	108.1								2.2															M, T, Ur
MB-06	66.8					87	30	15																			A, FC
MB-06	66.8	19	131.0	109.7								2.4															M, T, Ur
MB-06	66.9								4.5																		p
MB-06	71.9								4.5																		p
MB-06	76.3	17	132.5	113.6							8.3																M, T, U
MB-06	76.3	16	124.2	106.7								2.2															M, T, Ur
MB-06	76.6	18	126.1	107.0								3.6															M, T, Ur
MB-06	76.6					81	26	11	4.5																		A, FC, p
MB-06	79.7	26																									M
MB-06	79.7					28																					S
MB-06	82.0								4.5																		p
MB-06	84.7	22	125.5	102.8							4.4																M, T, U
MB-06	84.7	22	124.7	102.6								4.1															M, T, Ur
MB-06	85.0					44	19	4																			A, FC
MB-06	85.0	24	120.5	97.1								2.0															M, T, Ur
MB-06	86.0					65	21	7	4.5																		A, FC, p
MB-06	86.0	18																									M
MB-06	91.9								4.5																		p
MB-06	96.5					82	36	19																			A, FC
MB-06	96.5	19	135.3	114.0								2.1															M, T, Ur
MB-06	107.0					68	29	14																			A, FC
MB-06	107.0					62	27	13																			A, FC
MB-06	107.0	15																									M
MB-06	107.1	14	133.5	117.1							8.4																M, T, U
MB-06	124.7					53	23	10																			A, FC
MB-06	124.7	9																									M
MB-06	128.8					88	33	18																			A, FC

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
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Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
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Test Listing Abbreviations
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CU = CU Triaxial
OC = Organic Content
MM = Min/Max
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SG = Specific Gravity
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-8

LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R	pH	Cl^-	SO_4^{2-}	S^{2-}				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	ohm-cm		ppm	ppm	ppm				
MB-06	128.8	14																									M
MB-06	133.5	17	135.9	116.6							18.4																M, T, U
MB-06	133.5					89	36	18																			A, FC
MB-06	138.3					30	23	10																			A, FC
MB-06	138.3	12																									M
MB-06	139.3					37																					FC
MB-06	139.3	11																									M
MB-06	149.3					10																					FC
MB-06	149.3	16																									M
MB-08	3.3	23				48																					M, S
MB-08	6.9					80																					S, H
MB-08	7.9	22				58																					M, S
MB-08	14.3	21				93																					M, S
MB-08	18.9					88	25	9																			A, XR, FC
MB-08	19.4	26	126.9	100.5							2.6																M, T, U
MB-08	19.7	21	128.0	105.4			25	10																			M, T, A, C
MB-08	19.7	26				99			3.8																		M, FC, p
MB-08	19.7					96																					FC, H
MB-08	22.5	22				84																					M, S
MB-08	25.9	23				92	30	15																			M, A, FC
MB-08	32.3	21				25																					M, S
MB-08	37.2					9										42.0											DSS, S
MB-08	46.9	21				85	34	19																			M, A, FC
MB-08	57.5	26	123.0	97.5		83	33	18																			M, T, A, C, FC
MB-08	58.1	21	128.1	105.7		60	29	14	4.5																		M, T, A, XR, FC, p
MB-08	58.1	22	128.1	104.8																							M, T, C
MB-08	62.5	21	128.6	106.3																							M, T, RC
MB-08	63.0	23	126.7	102.8		71	20	3			2.8																M, T, A, XR, FC, U
MB-08	66.3	20				82	30	15																			M, A, FC
MB-08	68.9								4.5																		p

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

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SO_4^{2-} = Sulfate
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-9

Report No. 04.10140334-9

Confidential
LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16

Alaska LNG

FUGRO

LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-08	72.5	26				39																					M, S
MB-08	76.3	20	129.0	107.2		84	30	15																			M, T, A, C, FC
MB-08	76.8	20	129.1	107.5		87	30	16					1.8	23.9													M, T, A, FC
MB-08	77.3	21	130.4	107.4		86	32	18	4.5		6.1																M, T, A, XR, FC, p, U
MB-08	82.2								4.5																		p
MB-08	87.1	38	152.2	109.9		82	27	12	4.5		6.4																M, T, A, FC, p, U
MB-08	92.0								4.5																		p
MB-08	97.0	23	126.3	102.5		90	33	17	4.5		3.9																M, T, A, FC, p, U
MB-08	101.9					96	39	21	4.5																		A, FC, p
MB-08	111.7	23	127.2	103.8		93	39	21	4.5		4.9																M, T, A, FC, p, U
MB-08	120.7	20	129.1	107.5		92	31	16					2.0	27.9													M, T, A, FC
MB-08	120.9	19	129.2	108.3		94	27	11																			M, T, A, C, FC
MB-08	121.4								4.5																		XR, p
MB-08	121.6	20				94	32	14																			M, A, S
MB-08	123.2	14				49	29	15																			M, A, S
MB-08	126.2	21				60	21	9																			M, A, S
MB-08	129.3	12				70	26	11																			M, A, FC
MB-08	131.7	12	138.9	124.4		68	29	14			12.7																M, T, A, S, U
MB-08	139.1	11				65	31	17																			M, A, S
MB-08	149.1	11				62	33	18																			M, A, S
MB-08	153.9	10	139.0	126.4							15.5																M, T, U
MB-08	159.5	9				7																					M, S
MB-08	166.9	11				6																					M, S
MB-08	185.7	19				6																					M, S
MB-08	206.2	21				6																					M, S
MB-09	0.4																		688	7.9	2919	470					Co
MB-09	1.1	23				90	42	24																			M, A, FC
MB-09	4.9	25	125.8	100.7		100	44	26																			M, T, A, C, FC
MB-09	5.4	18	133.0	112.6																							M, T, C
MB-09	5.6	20	133.0	111.0		96	27	10			1.6																M, T, A, XR, FC, U

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
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p = Pocket Penetrometer
t = Torvane
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-10

Report No. 04.10140334-9

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LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
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Alaska LNG

FUGRO

LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-09	5.7					87																					S, H
MB-09	7.7	21				94	37	22																			M, A, FC
MB-09	11.3					69	26	9			2.3																A, FC, U
MB-09	15.9					86																					S, H
MB-09	18.4	23				50																					M, S
MB-09	22.3	24				65	28	12																			M, A, FC
MB-09	27.5	19				59																					M, S
MB-09	33.1	20				91	33	17																			M, A, FC
MB-09	36.4	25	123.7	99.0		66							0.5	35.5													M, T, XR, FC
MB-09	42.2					87	25	10	4.5		6.5																A, FC, p, U
MB-09	47.1								3.8																		p
MB-09	50.7	20	127.1	106.2																							M, T, CDSS
MB-09	50.9	19	129.4	108.6																							M, T, CDSS
MB-09	51.0	19	129.4	109.1																							M, T, CDSS
MB-09	51.7	21	126.6	104.5																							M, T, RC
MB-09	52.0	20				78	20	3	4.5																		M, A, XR, FC, p
MB-09	52.1	20	131.6	110.0		88	27	12				1.9															M, T, A, FC, Ur
MB-09	61.8										4.7																U
MB-09	66.6	22	127.3	104.0		90	38	22																			M, T, A, C, FC
MB-09	66.8	21	128.2	105.9					3.8																		M, T, XR, p
MB-09	66.8	23	128.2	104.3																							M, T, C
MB-09	66.9	23				90	37	20																			M, A, FC
MB-09	71.7								4.3																		p
MB-09	76.6								4.3																		p
MB-09	79.6	23	127.8	103.5																							M, T, RC
MB-09	80.1	22	126.9	104.4																							M, T, CDSS
MB-09	80.2	19	128.3	107.6																							M, T, CDSS
MB-09	81.5	22	130.3	106.9								1.5															M, T, Ur
MB-09	81.5	19				87	29	14	4.3																		M, A, XR, FC, p
MB-09	81.5					92	35	19																			A, FC

Classification Tests
LL = Liquid Limit
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NP = Non-Plastic
*Oven-Dried Specimen

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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-11

Report No. 04.10140334-9

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USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16

Alaska LNG

FUGRO

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R	pH	Cl^-	SO_4^{2-}	S^{2-}				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	ohm-cm		ppm	ppm	ppm				
MB-09	96.3						40	21	4.0		5.2																A, p, U
MB-09	101.4								4.3																		p
MB-09	108.3	18				64																					M, S
MB-09	118.9	1																									M
MB-09	118.9					56																					S
MB-09	125.7	8							4.5																		M, p
MB-09	128.4					17																					S
MB-09	132.9	11				65	31	16																			M, A, S
MB-09	132.9						31	16																			A
MB-09	134.7	10																									M
MB-09	145.0	22	131.4	107.8		99	38	19	4.5		13.4																M, T, A, S, p, U
MB-09	149.3	1																									M
MB-12	2.0	18				91	44	27																			M, A, FC
MB-12	6.9	17				25																					M, S
MB-12	21.7	24				4																					M, S
MB-12	28.9	23	128.0	103.9		65	41	24			0.5																M, T, A, S, U
MB-12	36.4	24				87	40	23																			M, A, FC
MB-12	41.7	11	140.3	125.9		79	19	5	4.5																		M, T, A, XR, S, p
MB-12	41.7	12	140.2	125.0																							M, T, C
MB-12	51.4								2.8																		XR, p
MB-12	55.4	24				69																					M, S
MB-12	56.1								4.0																		p
MB-12	58.1								2.0																		p
MB-12	61.5	20	130.7	109.1		85	28	13			3.3																M, T, A, FC, U
MB-12	61.7								4.5																		p
MB-12	65.5	19				91			4.5																		M, S, p
MB-12	67.3								4.5																		p
MB-12	72.0								4.5																		p
MB-12	75.6	18	130.7	110.7							6.6																M, T, U
MB-12	80.5	18				21	26	12	4.5																		M, A, FC, p

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-12

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R	pH	Cl^-	SO_4^{2-}	S^{2-}				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	ohm-cm		ppm	ppm	ppm				
MB-12	85.6								4.5																		p
MB-12	91.7	24				97	35	17	4.5																		M, A, FC, p
MB-12	96.0	21	132.2	109.1					4.5		7.2																M, T, p, U
MB-12	99.9								4.5																		p
MB-12	100.2	20	133.2	111.2		94	35	18			7.5																M, T, A, FC, U
MB-12	108.3	18					48	30																			M, A
MB-12	119.9	7				6																					M, S
MB-12	125.3	15	135.9	118.4							7.1																M, T, U
MB-12	128.9	15				16																					M, S
MB-12	138.1	8				51	20	6																			M, A, FC
MB-12	148.1	16				66																					M, FC
MB-12	149.7	12	141.0	126.3							23.4																M, T, U
MB-13	1.1	64[a]																									M
MB-13	1.2					19																					FC
MB-13	1.2					19[a]																					FC
MB-13	1.5	21[a]				89	47	30																			M, A, FC
MB-13	4.8					89	45	27																			A, FC
MB-13	4.8					92	45	28																			A, FC
MB-13	4.8	21	132.1	109.6							5.1																M, T, XR, U
MB-13	4.9	23[a]							4.5																		M, p
MB-13	7.7	23[a]				26[a]																					M, S
MB-13	10.2	23[a]																									M
MB-13	12.6					15																					FC, H
MB-13	12.6					19[a]																					FC
MB-13	17.2	20[a]				41[a]																					M, S
MB-13	20.0	23[a]																									M
MB-13	20.0					61	26	11																			A, FC
MB-13	22.1	20	128.6	106.7																							M, T, CDSS
MB-13	22.4	22	127.5	104.1																							M, T, CDSS
MB-13	22.9						46	28																			A

Classification Tests
LL = Liquid Limit
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NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Direct

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

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CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-13

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf									
MB-13	23.3	22	127.9	104.4		89			4.5																		M, T, RC, XR, FC, p
MB-13	23.3	21	131.6	108.5							3.9																M, T, U
MB-13	29.0	22[a]																									M
MB-13	29.0					60	27	15																			A, FC
MB-13	29.1					63[a]																					FC
MB-13	31.5	30[a]				17																					M, FC, H
MB-13	31.5					18[a]																					FC
MB-13	34.0	17[a]				58																					M, FC, H
MB-13	36.4	20[a]					40	23																			M, A
MB-13	39.7	23	129.4	105.2		84	39	21	4.5		2.5																M, T, A, XR, FC, p, U
MB-13	43.0					91	31	16	4.5																		A, FC, p
MB-13	43.0	22																									M
MB-13	47.9								4.5																		p
MB-13	48.1					89	35	20																			A, FC
MB-13	48.1					89[a]																					FC
MB-13	52.8	19	131.7	110.8							5.9																M, T, XR, U
MB-13	52.8					90	32	16	4.5																		A, FC, p
MB-13	56.6					91	29	14																			A, FC
MB-13	56.6	21	132.5	109.9							4.6																M, T, XR, U
MB-13	56.8					91	38	22	4.5																		A, FC, p
MB-13	62.8								4.5																		p
MB-13	67.2					68																					FC
MB-13	67.6					82	34	18																			A, FC
MB-13	67.6	25	123.8	99.1							2.6																M, T, XR, U
MB-13	70.4	28[a]				80	26	11																			M, A, FC
MB-13	71.4					92	36	21																			A, FC
MB-13	71.4	24[a]																									M
MB-13	77.4	28	125.2	98.1							4.4																M, T, XR, U
MB-13	77.4					97	45	28	4.5																		A, FC, p
MB-13	82.4								4.5																		p

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
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Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
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Test Listing Abbreviations
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C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
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p = Pocket Penetrometer
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m = Miniature Vane

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-14

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R	pH	Cl^-	SO_4^{2-}	S^{2-}				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	ohm-cm		ppm	ppm	ppm				
MB-13	87.3					95	35	19	4.5																		A, FC, p
MB-13	87.3	22	128.4	105.2							4.9																M, T, XR, U
MB-13	87.4	21[a]																									M
MB-13	90.6					48			4.5																		FC, p
MB-13	90.6					55[a]																					FC
MB-13	96.2	17[a]																									M
MB-13	96.3					10[a]																					S
MB-13	101.2	27[a]																									M
MB-13	101.2					94	46	28																			A, FC
MB-13	101.2					89[a]																					FC
MB-13	101.5					54[a]			4.5																		S, p
MB-13	106.6								4.5																		p
MB-13	107.0	24[a]				70[a]	46	29																			M, A, S
MB-13	108.3	28[a]				96[a]																					M, S
MB-13	111.9					100	42	24	4.5																		A, FC, p
MB-13	111.9	24	124.4	100.4							4.1																M, T, XR, U
MB-13	112.0	26[a]																									M
MB-13	113.0	25[a]				60[a]	36	18	4.5																		M, A, S, p
MB-13	115.5	11[a]				54[a]																					M, S
MB-13	117.5								4.5																		p
MB-13	120.1	12[a]																									M
MB-13	120.1					56	26	13																			A, S
MB-13	122.7	11[a]				59[a]																					M, S
MB-13	123.0								4.5																		p
MB-13	126.0					64[a]																					S
MB-13	126.6	12[a]					32	17	4.5																		M, A, p
MB-13	130.1						36	22																			A
MB-13	130.1	13[a]																									M
MB-13	131.9								4.5																		p
MB-13	132.0	12[a]				70[a]																					M, S

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
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C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
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XR = X-Ray Radiography
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-15

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LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16

Report No. 04.10140334-9

Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-13	134.5								4.5																		p
MB-13	136.3	13[a]																									M
MB-13	139.9	15[a]				75	34	19																			M, A, FC
MB-13	139.9					78[a]																					FC
MB-13	141.7	11[a]																									M
MB-13	147.2	13[a]				61[a]	33	18																			M, A, S
MB-13	149.2	14[a]																									M
MB-13	150.3						22	8																			A
MB-13	150.3	12																									M
MB-14	4.1	25[a]				11																					M, S
MB-14	6.7	21[a]				38	NP	NP																			M, A, FC
MB-14	6.9	16[a]																									M
MB-14	12.6	21[a]																									M
MB-14	13.3	18[a]				83	31	18																			M, A, FC
MB-14	16.7	21[a]				52	22	7																			M, A, S
MB-14	19.2	20[a]																									M
MB-14	20.5	23[a]							4.5																		M, p
MB-14	24.1	20[a]																									M
MB-14	26.6	20[a]																									M
MB-14	30.0	25	129.3	103.5								0.7															M, T, Ur
MB-14	30.0	24[a]				92	43	26	3.0																		M, A, FC, p
MB-14	32.3	25[a]																									M
MB-14	34.8	22[a]																									M
MB-14	37.2	23[a]				92	36	21																			M, A, FC
MB-14	39.7	19[a]																									M
MB-14	42.2	18[a]																									M
MB-14	47.1	20[a]																									M
MB-14	52.0	25[a]				86																					M, FC
MB-14	56.9	23[a]																									M
MB-14	62.7	22	129.7	105.9		90	34	18			4.2																M, T, A, FC, U

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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-16

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Alaska LNG

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LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R	pH	Cl^-	SO_4^{2-}	S^{2-}				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	ohm-cm		ppm	ppm	ppm				
MB-14	62.8	28[a]							4.5																		M, p
MB-14	67.8	30[a]							4.5																		M, p
MB-14	72.1	22[a]																									M
MB-14	72.5	23	129.8	105.6		93	52	33	4.5		6.2																M, T, A, FC, p, U
MB-14	75.5	23	129.2	105.2								3.5															M, T, Ur
MB-14	77.4								4.5																		p
MB-14	77.6	19[a]																									M
MB-14	81.5	22[a]				88	48	30																			M, A, FC
MB-14	85.1	26[a]							4.5																		M, p
MB-14	87.3	20[a]				94	49	31	4.5																		M, A, FC, p
MB-14	87.3	20	131.9	109.7							11.8																M, T, U
MB-14	90.5	15[a]																									M
MB-14	91.7								4.5																		p
MB-14	93.2	17[a]				58	34	19	4.5																		M, A, S, p
MB-14	94.3	21[a]							4.5																		M, p
MB-14	94.5	17[a]																									M
MB-14	94.8								4.5																		p
MB-14	97.6	21				17																					M, S
MB-14	99.3	20[a]							4.5																		M, p
MB-14	100.6	21[a]																									M
MB-14	109.7	12[a]																									M
MB-14	114.0	12[a]																									M
MB-14	116.1	10[a]	127.7	116.5		59	32	17				10.0															M, T, A, FC, Ur
MB-14	116.2	11																									M
MB-14	119.4	13[a]																									M
MB-14	121.7	9	127.6	117.3		61	34	19				10.3															M, T, A, FC, Ur
MB-14	129.5	15[a]																									M
MB-14	130.6					11																					S
MB-14	137.1	14	142.2	124.2		48	20	8				2.2															M, T, A, FC, Ur
MB-14	140.6	35[a]				16																					M, S

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-17

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LNG Facilities Marine Geotechnical Data Report
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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-15	6.2	29				92	54	34																			M, A, FC
MB-15	6.9	6				2																					M, S
MB-15	16.4	10				16																					M, S
MB-15	23.8	16				35																					M, S
MB-15	33.8	19				38																					M, S
MB-15	38.3	17				42	NP	NP																			M, A, FC
MB-15	45.2	19				77	32	17																			M, A, FC
MB-15	61.8	22	129.7	106.2		89	32	15	3.3		2.8																M, T, A, FC, p, U
MB-15	66.8								3.5																		p
MB-15	71.7								4.5																		p
MB-15	76.6	23	127.1	103.7		89	37	20	4.5																		M, T, A, C, XR, FC, p
MB-15	81.1	20	130.4	108.6		42					6.5																M, T, S, U
MB-15	86.6	22				93	35	18																			M, A, FC
MB-15	88.6								4.5																		p
MB-15	91.4								4.3																		p
MB-15	96.3								4.3																		p
MB-15	100.2	21	131.0	108.5		92	38	20	4.5		6.6																M, T, A, FC, p, U
MB-15	105.0								4.5																		p
MB-15	110.2	16				82	42	23																			M, A, FC
MB-15	118.9	13	136.5	121.1		79	31	17																			M, T, A, C, FC
MB-15	119.1	13	137.4	121.8			28	13	4.5																		M, T, A, XR, p
MB-15	119.1	12	137.4	122.7																							M, T, C
MB-15	128.9	9	142.6	130.3		76	17	4			13.5																M, T, A, S, U
MB-15	134.5	9				54	25	11																			M, A, FC
MB-15	140.4	12				60	25	11																			M, A, S
MB-15	151.6	12				69	35	20																			M, A, FC
MB-16	4.4	21				20																					M, S
MB-16	13.6	22				32																					M, S
MB-16	18.0								3.8																		p
MB-16	19.2	16				71	34	19																			M, A, FC

Classification Tests
LL = Liquid Limit
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-18

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-16	22.3								3.8																		p
MB-16	24.6								4.0																		p
MB-16	26.9								4.5																		p
MB-16	29.4	18	131.5	111.0			39	22																			M, T, A, C
MB-16	30.5	20	130.1	108.0		89					2.3																M, T, XR, FC, U
MB-16	31.3								4.5																		p
MB-16	36.7	20				42																					M, S
MB-16	44.6	22				15																					M, S
MB-16	52.8	26				95	52	34	4.5																		M, A, XR, FC, p
MB-16	57.3	22				60	19	2																			M, A, FC
MB-16	66.9	24				23																					M, S
MB-16	77.4	22	130.8	107.3		91	36	19	4.5		3.9																M, T, A, S, p, U
MB-16	82.4	23				90	33	16	3.8																		M, A, FC, p
MB-16	87.3	22	129.7	106.4					2.8		3.4																M, T, p, U
MB-16	88.1								3.8																		p
MB-16	91.4	17				57	19	8																			M, A, FC
MB-16	100.9	13				35	14	4																			M, A, FC
MB-16	103.2	18	133.8	113.7							4.8																M, T, U
MB-16	104.2								4.5																		p
MB-16	107.3								4.5																		p
MB-16	110.4	15				87	43	27																			M, A, FC
MB-16	114.8								4.5																		p
MB-16	120.4	17				75	30	13																			M, A, FC
MB-16	134.0	11				69	33	18																			M, A, FC
MB-16	149.8	15	135.1	117.3			28	12																			M, T, A, C
MB-16	150.4	19	135.7	114.0		97					10.4																M, T, XR, FC, U
MB-17	4.4	25[a]				14	NP	NP																			M, A, S
MB-17	6.9	26[a]				9													308	8.3	2587	515					M, S, Co
MB-17	8.6	16[a]																									M
MB-17	10.6	22[a]																									M

Classification Tests
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*Oven-Dried Specimen

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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-19

Report No. 04.10140334-9

Confidential
LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16

Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R	pH	Cl^-	SO_4^{2-}	S^{2-}				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	ohm-cm		ppm	ppm	ppm				
MB-17	11.2	13[a]																									M
MB-17	16.7	14[a]				71	36	19																			M, A, FC
MB-17	19.2					84	41	24																			A, FC
MB-17	19.2	19	134.4	113.0								2.3															M, T, Ur
MB-17	19.4								4.0																		p
MB-17	21.2	22[a]																									M
MB-17	21.4	18[a]																									M
MB-17	24.3	17[a]																									M
MB-17	27.2	19	122.3	102.7		52	24	6			4.6																M, T, A, FC, U
MB-17	30.5	25[a]																									M
MB-17	32.5	24[a]				19	NP	NP																			M, A, FC
MB-17	35.0	24[a]																									M
MB-17	38.1	25[a]				24										47.0											M, DSS, S
MB-17	38.1					26																					S
MB-17	39.9	23[a]																									M
MB-17	42.3	22[a]				45	NP	NP																			M, A, FC
MB-17	46.6	15[a]				71	30	16																			M, A, FC
MB-17	47.2	21[a]																									M
MB-17	52.8	22[a]				81	44	27																			M, A, FC
MB-17	58.7								4.2																		p
MB-17	63.5	23	129.0	105.2		91	38	20			3.4																M, T, A, FC, U
MB-17	63.5	22	130.3	106.9								1.5															M, T, Ur
MB-17	63.7								4.5																		p
MB-17	68.6								4.5																		p
MB-17	72.7	19	131.7	110.4		95	47	28			6.1																M, T, A, FC, U
MB-17	72.8								4.5																		p
MB-17	78.7	16[a]				72	43	26																			M, A, FC
MB-17	84.0	22[a]																									M
MB-17	89.7	25	129.7	103.8		98	38	21	4.5		3.7																M, T, A, FC, p, U
MB-17	89.7	22	129.2	105.8								3.0															M, T, Ur

Classification Tests
LL = Liquid Limit
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R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-20

Report No. 04.10140334-9

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-17	93.8	24[a]																									M
MB-17	98.4								4.5																		p
MB-17	101.1	23[a]																									M
MB-17	104.5	20	132.2	109.9		80	NP	NP	4.5		7.6																M, T, A, FC, p, U
MB-17	105.6	21[a]				73			4.5																		M, FC, p
MB-17	109.6	17[a]																									M
MB-17	112.5								4.5																		p
MB-17	112.7	12[a]																									M
MB-17	112.8	12[a]																									M
MB-17	114.8					69	21	3																			A, FC
MB-17	121.2								4.5																		p
MB-17	123.0	13[a]							4.5																		M, p
MB-17	126.0					60	23	8	4.5																		A, FC, p
MB-17	126.0	13[a]	142.2	125.9								3.5															M, T, Ur
MB-17	126.1	12																									M
MB-17	129.9	25																									M
MB-17	129.9					16																					S
MB-17	131.2								4.5																		p
MB-17	133.2	13[a]				68	30	15																			M, A, FC
MB-17	135.2					28																					S
MB-17	135.2	6																									M
MB-17	136.2								4.5																		p
MB-17	138.5					93	36	16																			A, FC
MB-17	138.5	17																									M
MB-17	141.1								4.5																		p
MB-17	141.8	22[a]																									M
MB-17	142.0					2	NP	NP																			A, FC
MB-17	142.3	20[a]																									M
MB-17	147.3	30[a]				5																					M, S
MB-17	151.4	20[a]																									M

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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-21

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Alaska LNG

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LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-17	157.2					9																					S
MB-17	162.4	22[a]																									M
MB-17	171.0	16[a]				8																					M, FC
MB-17	183.7	18																									M
MB-17	183.7					4																					S
MB-17	190.7					5																					FC
MB-17	201.1	21[a]																									M
MB-18	0.2	30																									M
MB-18	0.2					90	33	16																			A, FC
MB-18	0.5					58																					S
MB-18	0.5	20																									M
MB-18	2.0																		320	8.2	2349	564					Co
MB-18	4.3	20	132.3	110.6		89	50	32	4.5		5.1																M, T, A, S, p, U
MB-18	6.9					83	40	23																			A, FC
MB-18	6.9	19																									M
MB-18	9.9						28	14																			A
MB-18	10.1	17	134.8	115.2		83	31	16																			M, T, A, C, FC
MB-18	10.2					88			4.5																		FC, p
MB-18	10.2	20	136.5	114.2							5.0																M, T, XR, U
MB-18	10.2	17	133.9	114.2																							M, T, C
MB-18	13.5	21	130.6	107.8		91	49	31	4.5		3.9																M, T, A, S, p, U
MB-18	15.9	21																									M
MB-18	15.9					90																					FC
MB-18	19.2	19	134.9	113.1		90	42	24	4.5			3.1															M, T, A, FC, p, Ur
MB-18	21.1					50																					S
MB-18	21.1	24																									M
MB-18	26.0					60	24	5																			A, FC
MB-18	26.0	23																									M
MB-18	28.2	24																									M
MB-18	28.2					52																					S

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

Test Listing Abbreviations

M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-22

Alaska LNG
FUGRO

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-18	35.9	20																									M
MB-18	35.9					51	NP	NP																			A, S
MB-18	40.9					37																					FC
MB-18	46.3					88	43	25																			A, FC
MB-18	46.3	21																									M
MB-18	52.0	22	130.2	107.0		96	41	23	4.5		4.8																M, T, A, FC, p, U
MB-18	52.0	22	131.4	107.9								2.6															M, T, Ur
MB-18	56.9								4.5																		p
MB-18	65.1	19																									M
MB-18	65.1					90	43	26																			A, FC
MB-18	66.3								4.5																		p
MB-18	71.9					83	37	23																			A, FC
MB-18	71.9	17																									M
MB-18	72.2								4.5																		p
MB-18	75.0					85	44	26																			A, FC
MB-18	75.0	20																									M
MB-18	81.2	29	123.0	95.5		97	55	37	4.5		3.7																M, T, A, FC, p, U
MB-18	81.2	28	123.2	95.9								1.9															M, T, Ur
MB-18	91.0	27	125.1	98.3		98	39	22	4.0		2.9																M, T, A, FC, p, U
MB-18	96.0	25	125.7	100.2		96	39	21	3.5		4.3																M, T, A, S, p, U
MB-18	99.1					89	22	6																			A, FC
MB-18	99.1	20																									M
MB-18	108.9	13																									M
MB-18	108.9					54	33	18																			A, S
MB-18	111.2	12																									M
MB-18	111.2					58	33	18																			A, S
MB-18	121.0	12																									M
MB-18	121.0					71	36	21																			A, S
MB-18	132.2	17																									M
MB-18	132.2					70	42	25																			A, FC

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
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Cl^- = Chloride
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CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
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MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-23

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG_R:\04\00\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_06\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-19	0.4	22[a]				26	NP	NP																			M, A, FC
MB-19	2.9	36[a]																									M
MB-19	6.9	25[a]				15	NP	NP											292	8.4	3223	503					M, A, S, Co
MB-19	14.2	25[a]																									M
MB-19	14.3					25	NP	NP																			A, S
MB-19	16.7																		281	8.5	2829	584					Co
MB-19	19.4	21[a]																									M
MB-19	20.8					92	42	26																			A, FC
MB-19	21.7	23[a]																									M
MB-19	26.5	22[a]				90																					M, FC
MB-19	33.1	23[a]																									M
MB-19	36.4	22	131.6	108.1		90	38	20			4.0																M, T, A, FC, U
MB-19	36.4	22	130.4	107.3								1.7															M, T, Ur
MB-19	36.6	23[a]							4.5																		M, p
MB-19	39.9	21[a]							4.5																		M, p
MB-19	43.0								4.5																		p
MB-19	43.1	23[a]																									M
MB-19	48.1	26	127.9	101.2		90	41	24			0.9																M, T, A, FC, U
MB-19	52.0	23[a]																									M
MB-19	57.7								4.5																		p
MB-19	62.7	19	132.5	111.3		87	39	22	4.5		6.6																M, T, A, FC, p, U
MB-19	62.7	19	135.6	114.3								3.9															M, T, Ur
MB-19	65.7								4.5																		p
MB-19	67.6	20[a]							4.5																		M, p
MB-19	72.8	20[a]																									M
MB-19	74.3	21[a]				50	47	29																			M, A, S
MB-19	77.4	18	135.6	115.3		88	39	23			13.0																M, T, A, FC, U
MB-19	78.7	20[a]							4.5																		M, p
MB-19	92.2	30	123.0	94.3		99	41	23	4.5		3.0																M, T, A, FC, p, U
MB-19	92.2	30	122.7	94.6								1.6															M, T, Ur

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
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Strength Tests
S_u = Undrained Shear Strength
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R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
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Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-24

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R	pH	Cl^-	SO_4^{2-}	S^{2-}				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	ohm-cm		ppm	ppm	ppm				
MB-19	92.4	28[a]																									M
MB-19	97.1								4.5																		p
MB-19	97.9	25[a]				95	37	21	2.8																		M, A, FC, p
MB-19	97.9	23																									M
MB-19	98.8								3.5																		p
MB-19	102.0	21	130.6	107.7		99	50	31			9.6																M, T, A, FC, U
MB-19	102.2	23[a]																									M
MB-19	109.1								4.5																		p
MB-19	110.4	15[a]							4.5																		M, p
MB-19	113.4								4.5																		p
MB-19	114.0	13[a]				62	26	13																			M, A, S
MB-19	115.7								4.5																		p
MB-19	119.9	10	136.0	123.3		56	29	16				8.7															M, T, A, FC, Ur
MB-19	119.9	11																									M
MB-19	127.0					65	34	19																			A, S
MB-19	127.0	12																									M
MB-19	129.2	11[a]																									M
MB-19	132.4	12	125.1	111.4		73	33	18				9.8															M, T, A, FC, Ur
MB-19	137.6	16																									M
MB-19	137.6					93																					S
MB-20	3.9	13				5																					M, S
MB-20	9.2	12																									M
MB-20	10.7	14					30	15																			M, A
MB-20	14.3	17				81	43	26																			M, A, FC
MB-20	24.0	20				36	NP	NP																			M, A, S
MB-20	30.1	20	129.4	107.5			39	24																			M, T, A, C
MB-20	31.3	22	129.4	106.2		85			4.5																		M, T, XR, FC, p
MB-20	39.1	19	133.1	111.4		89	42	24			5.3																M, T, A, FC, U
MB-20	39.1	19	134.1	112.3								3.4															M, T, Ur
MB-20	39.7								4.5																		XR, p

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
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Test Listing Abbreviations
M = Moisture Content
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Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-25

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-20	39.9	22					42	24																			M, A
MB-20	46.3	18	128.9	109.3		26	NP	NP			5.2																M, T, A, S, U
MB-20	55.3								4.5																		p
MB-20	60.2	21	131.9	109.3		88	34	17	4.5		5.4																M, T, A, FC, p, U
MB-20	65.1								4.0																		p
MB-20	69.4	18				36	NP	NP																			M, A, S
MB-20	75.1								3.5																		p
MB-20	81.0								3.3																		p
MB-20	84.8										3.4																U
MB-20	84.8	22	128.3	105.3			33	16																			M, T, A
MB-20	85.0								3.5																		p
MB-20	89.7								3.5																		p
MB-20	94.7								3.8																		p
MB-20	96.3								4.3																		p
MB-20	102.7	21	131.7	108.5		92	32	15																			M, T, A, FC
MB-20	102.7										3.1																U
MB-20	108.3								4.5																		p
MB-20	112.5	18				48	15	3																			M, A, FC
MB-20	120.1								4.5																		p
MB-20	128.9	7				2	NP	NP																			M, A, FC
MB-20	131.2								4.5																		p
MB-20	134.5								4.5																		p
MB-20	143.7	14				51	32	17																			M, A, FC
MB-20	149.9								4.5																		p
MB-20	152.6	11				65	19	7																			M, A, FC
MB-21	2.0					10	NP	NP																			A, FC
MB-21	2.0	23																									M
MB-21	4.4	26[a]																	263	8.3	2859	520					M, Co
MB-21	6.1	16[a]																									M
MB-21	9.4	20[a]				68	32	17																			M, A, FC

Classification Tests
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*Oven-Dried Specimen

Drained Strength
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Cl^- = Chloride
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-26

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV									R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf									
MB-21	11.5	24[a]				36	NP	NP																			M, A, FC
MB-21	13.0					64	26	12																			A, FC
MB-21	13.6	22[a]					28	13																			M, A
MB-21	16.7	29[a]																									M
MB-21	20.0	21				69	35	20																			M, A, XR, FC
MB-21	20.2								4.5																		p
MB-21	22.5	19[a]																									M
MB-21	31.5	20[a]				49	23	5																			M, A, FC
MB-21	36.1					52	21	7																			A, S
MB-21	36.1	19																									M
MB-21	38.9	18[a]																									M
MB-21	45.9	18																									M
MB-21	45.9					61	20	5																			A, FC
MB-21	52.8	20[a]				50																					M, S
MB-21	58.7								4.5																		p
MB-21	63.5					89	35	18																			A, FC
MB-21	63.5	21	130.0	107.2							4.2																M, T, XR, U
MB-21	63.7								4.5																		p
MB-21	68.4								4.5																		p
MB-21	68.9	27																									M
MB-21	73.3								4.5																		p
MB-21	78.2	22	129.9	106.5							3.1																M, T, XR, U
MB-21	78.3					88	33	17	4.5																		A, FC, p
MB-21	83.2								4.5																		p
MB-21	88.1								4.5																		p
MB-21	92.2					87	30	15																			A, FC
MB-21	92.2	18																									M
MB-21	97.3					92	31	14	4.5																		A, FC, p
MB-21	97.3	20	129.0	107.1							3.8																M, T, XR, U
MB-21	100.7	25[a]																									M

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-27

Report No. 04.10140334-9

Confidential
LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16

Alaska LNG

FUGRO

LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-21	108.9	27[a]				98	46	26	4.5																		M, A, FC, p
MB-21	112.2								4.5																		p
MB-21	117.6	30	122.4	93.9							3.2																M, T, XR, U
MB-21	117.6					100	42	22	4.5																		A, FC, p
MB-21	123.4	32[a]																									M
MB-21	124.0	16																									M
MB-21	124.0					71	23	9																			A, FC
MB-21	126.6	16[a]																									M
MB-21	136.5					57	29	14																			A, FC
MB-21	148.6	14[a]				63	30	15																			M, A, FC
MB-21	149.3								4.5																		p
MB-21	153.5	15	132.7	115.3								5.9															M, T, Ur
MB-21	154.2								4.5																		p
MB-22	1.9	17[a]																									M
MB-22	2.1								4.5																		p
MB-22	4.4	21[a]																									M
MB-22	4.4						46	27	4.5																		A, p
MB-22	6.2	18	131.5	111.0		92	31	16			3.0																M, T, A, FC, U
MB-22	6.3								4.5																		p
MB-22	11.8	17[a]																									M
MB-22	11.8						26	11																			A
MB-22	14.1	18	130.3	110.6		71	29	14	4.5		3.8																M, T, A, FC, p, U
MB-22	14.3	19[a]																									M
MB-22	17.4								4.5																		p
MB-22	17.6	22[a]																									M
MB-22	20.7	18	134.4	113.8		94	45	27	4.5		9.0																M, T, A, FC, p, U
MB-22	20.7	18	131.5	111.6								5.5															M, T, Ur
MB-22	20.8	19[a]																									M
MB-22	23.0								4.5																		p
MB-22	23.2	19[a]																									M

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-28

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-22	24.8	19[a]																									M
MB-22	27.9					95	47	30																			A, FC
MB-22	27.9	19[a]																									M
MB-22	31.5	24	126.4	102.3		78	42	24			0.3																M, T, A, FC, U
MB-22	31.7	23[a]							4.5																		M, p
MB-22	33.8	21[a]																									M
MB-22	40.5	25[a]																									M
MB-22	40.5					74	43	26																			A, FC
MB-22	46.3	21	130.5	107.7		93	38	20			3.4																M, T, A, FC, U
MB-22	46.3	21	132.9	109.8								1.9															M, T, Ur
MB-22	46.4	22[a]							4.5																		M, p
MB-22	51.4								4.5																		p
MB-22	51.5	23[a]																									M
MB-22	56.1	21	130.3	107.6		93	38	20			4.0																M, T, A, FC, U
MB-22	56.3	22[a]							4.5																		M, p
MB-22	59.1	19[a]																									M
MB-22	65.8	16[a]				83	41	24																			M, A, FC
MB-22	68.2	20[a]				78	39	22																			M, A, S
MB-22	71.9	23[a]																									M
MB-22	72.0	20																									M
MB-22	73.5	24[a]				99	48	28																			M, A, FC
MB-22	77.1	15[a]				5																					M, S
MB-22	110.9	12[a]																									M
MB-22	117.5					63	40	23																			A, S
MB-22	119.4	13[a]																									M
MB-22	121.0	15[a]																									M
MB-22	124.0	19[a]				95	38	21																			M, A, FC
MB-22	129.3	17[a]																									M
MB-22	132.9					16																					S
MB-22	132.9	36[a]																									M

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-29

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-22	141.1	27[a]																									M
MB-22	141.1					3																					S
MB-22	151.2	23[a]																									M
MB-22	151.3	22				9																					M, S
MB-23	2.0	17[a]																									M
MB-23	4.4					35	NP	NP																			A, S
MB-23	9.4	21[a]																									M
MB-23	11.8	22[a]				81	41	25																			M, A, FC
MB-23	16.8	16[a]																									M
MB-23	19.7	14[a]																									M
MB-23	23.3	19	130.7	109.5		85	41	24			5.4																M, T, A, FC, U
MB-23	23.3	20	129.6	108.3								3.1															M, T, Ur
MB-23	23.5	19[a]							4.5																		M, p
MB-23	25.9								4.5																		p
MB-23	31.2	20[a]				83	46	28																			M, A, FC
MB-23	34.9					91	42	24																			A, FC
MB-23	35.0					91	44	26																			A, FC
MB-23	38.2	21[a]																									M
MB-23	43.0								4.5																		XR, p
MB-23	43.0	20	131.1	109.4																							M, T, RC
MB-23	44.0								4.5																		p
MB-23	44.6	20[a]																									M
MB-23	47.9								4.5																		p
MB-23	49.2								4.5																		p
MB-23	51.0	21	132.3	109.2		95	42	25	4.5		7.3																M, T, A, FC, p, U
MB-23	51.0	20	133.3	111.3								4.4															M, T, Ur
MB-23	55.0	19[a]							4.5																		M, p
MB-23	58.1					75	29	15	4.5																		A, S, p
MB-23	58.1	16																									M
MB-23	61.4	20[a]				97	45	26																			M, A, FC

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-30

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-23	61.4								2.8																		p
MB-23	63.7								4.5																		p
MB-23	66.4	19[a]				92	40	23	4.5																		M, A, FC, p
MB-23	75.9					87	40	22																			A, FC
MB-23	76.9	18[a]																									M
MB-23	80.9	17[a]																									M
MB-23	81.5					83	46	27																			A, FC
MB-23	83.4	23[a]																									M
MB-23	86.9					19																					S
MB-23	88.9	21[a]				7	NP	NP																			M, A, S
MB-23	93.2					14										37.0											DSS, S
MB-23	98.6					11	NP	NP																			A, S
MB-23	98.6	21																									M
MB-23	102.5					55	23	9																			A, FC
MB-23	102.7	12[a]																									M
MB-23	111.6					87	30	15																			A, FC
MB-23	111.9	17[a]							4.5																		M, p
MB-23	114.2					97	19	8	4.5																		A, FC, p
MB-23	114.2	4																									M
MB-23	120.7	11																									M
MB-23	120.7					62	29	14																			A, S
MB-23	121.4	14[a]																									M
MB-23	121.8								4.5																		p
MB-23	124.0	10[a]				67	29	14	4.5																		M, A, S, p
MB-23	128.0								4.5																		p
MB-23	128.6	16	134.3	116.0		91	38	20			14.2																M, T, A, FC, U
MB-23	128.6	14	110.0	96.7								7.5															M, T, Ur
MB-23	131.2					69	33	17																			A, FC
MB-23	133.9	9[a]				76	25	9	4.5																		M, A, S, p
MB-23	136.5					57	17	2																			A, S

Classification Tests
LL = Liquid Limit
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*Oven-Dried Specimen

Drained Strength
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Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
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Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
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Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

Report No. 04.10140334-9
Confidential
LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16
Alaska LNG
FUGRO

LAB SUMMARY TABLE ALASKA LNG _R:\04\00\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-23	136.5	18																									M
MB-23	138.5								4.5																		p
MB-23	143.0	49[a]				77	24	10	4.5																		M, A, S, p
MB-23	148.3					17																					S
MB-23	148.3	19																									M
MB-23	173.6					51	14	1																			A, FC
MB-23	174.2	20																									M
MB-23	174.2					7																					S
MB-23	192.9					4																					S
MB-23	219.2					6																					S
MB-23	219.2	15																									M
MB-23	232.3					6																					S
MB-23	241.5	27[a]				99	NP	NP																			M, A, FC
MB-23	241.5					99	27	5																			A, S
MB-23	244.4								4.5																		p
MB-23	244.8								4.5																		p
MB-23	250.0	25				65	NP	NP																			M, A, FC
MB-23	259.8	21																									M
MB-23	259.8					26																					S
MB-23	263.8					64	24	3	4.5																		A, FC, p
MB-23	263.8	22																									M
MB-23	266.4	25				96	40	15																			M, A, FC
MB-23	266.5						NP	NP																			A
MB-23	271.0	30	122.5	94.1							27.2																M, T, U
MB-23	271.0	29	116.0	90.2								16.5															M, T, Ur
MB-23	273.6	24[a]				90	NP	NP																			M, A, FC
MB-23	281.5	27[a]				96																					M, FC
MB-23	281.5	24	134.4	108.0							31.0																M, T, U
MB-23	281.5	28	114.5	89.4								14.3															M, T, Ur
MB-23	287.4	27[a]				89	30	4																			M, A, FC

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LL = Liquid Limit
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Drained Strength
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Strength Estimate
PP = Pocket Penetrometer
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S_u = Undrained Shear Strength
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DS = Direct Shear
DSS = Direct Simple Shear
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Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
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SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-32

Report No. 04.10140334-9

Confidential
LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16

Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG_R:\04\00\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-23	287.5						NP	NP																			A
MB-23	296.9	29[a]				99	38	13																			M, A, FC
MB-24	0.3	20[a]																									M
MB-24	1.5	13[a]				81	25	8																			M, A, FC
MB-24	3.8	6[a]																									M
MB-24	5.4	15[a]																									M
MB-24	5.9	18[a]				43																					M, S
MB-24	9.4	18[a]				84	28	13																			M, A, FC
MB-24	10.2	21[a]					NP	NP																			M, A
MB-24	11.4	17[a]																									M
MB-24	13.6	14[a]				82	33	18																			M, A, FC
MB-24	16.7	20[a]																									M
MB-24	18.5	22[a]				10	17	3																			M, A, S
MB-24	20.5	25[a]																									M
MB-24	23.6	21[a]				31																					M, S
MB-24	25.0	28[a]																									M
MB-24	27.7	27[a]																									M
MB-24	30.2					11																					FC
MB-24	30.3	23[a]																									M
MB-24	33.3	26[a]				11																					M, S
MB-24	35.4	19[a]				63	32	17																			M, A, FC
MB-24	38.4	23[a]																									M
MB-24	40.3	27[a]				17	NP	NP																			M, A, S
MB-24	45.0	24[a]																									M
MB-24	50.5	23[a]				7																					M, S
MB-24	55.1	25[a]																									M
MB-24	60.2	25[a]																									M
MB-24	65.9	22[a]				89	47	29																			M, A, FC
MB-24	71.7								4.5																		p
MB-24	71.9	21[a]																									M

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-33

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20-Jun-16

Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-24	76.6	20	137.8	115.2							6.9																M, T, XR, U
MB-24	76.6					92	40	22	4.5																		A, FC, p
MB-24	76.8	39[a]							4.5																		M, p
MB-24	80.0	14[a]																									M
MB-24	85.6						45	28																			A
MB-25	1.1					68	37	22																			A, S
MB-25	1.1	18																									M
MB-25	1.4					70																					FC
MB-25	6.9					73	32	17											420	8.0	2175	367					A, FC, Co
MB-25	6.9	15																									M
MB-25	11.8	19																									M
MB-25	11.8					14																					S
MB-25	19.2					8																					S
MB-25	19.2	21																									M
MB-25	24.1	24																									M
MB-25	24.1					32																					S
MB-25	25.8	21																									M
MB-25	25.8					29																					FC
MB-25	30.8					12																					FC
MB-25	30.8	22																									M
MB-25	33.6	23																									M
MB-25	33.6					18																					S
MB-25	38.7					20																					S
MB-25	38.7	39																									M
MB-25	51.2					92	40	23																			A, FC
MB-25	51.2	20																									M
MB-26	2.0					71	35	20											274	8.0	3374	803					A, S, Co
MB-26	2.0	19																									M
MB-26	4.0	16	128.1	110.5																							M, T
MB-26	4.3					50	35	20																			A, XR, S

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
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*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
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DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
M = Moisture Content
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Cb = Percent Carbonate
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-26	6.1					74	29	13																			A, FC
MB-26	6.1	14																									M
MB-26	6.6								4.5																		p
MB-26	9.4					73	36	21																			A, FC
MB-26	9.4	16																									M
MB-26	9.6	22	131.4	107.9							4.0																M, T, U
MB-26	13.6					17																					FC
MB-26	13.6					16																					FC, H
MB-26	14.3					66																					S
MB-26	14.3	14																									M
MB-26	16.7	20																									M
MB-26	16.7					86	36	20																			A, FC
MB-26	20.0	16	136.6	118.0							6.6																M, T, XR, U
MB-26	20.0					78	34	18	4.5																		A, FC, p
MB-26	23.3								4.5																		p
MB-26	25.6																										XR
MB-26	27.2	30																									M
MB-26	27.2					18																					FC, H
MB-26	31.5					92	43	25	4.5																		A, FC, p
MB-26	34.8					92	41	22	4.5																		A, FC, p
MB-26	34.8	23	129.8	105.8							3.7																M, T, XR, U
MB-26	40.5	20																									M
MB-26	40.5					88	38	21																			A, FC
MB-26	49.8					68																					S, H
MB-26	49.8	18																									M
MB-27	2.0					8	NP	NP																			A, FC
MB-27	2.0	23[a]																									M
MB-27	4.4	31[a]				1	NP	NP																			M, A, FC
MB-27	6.9	28[a]				12																					M, S
MB-27	9.4	26[a]																									M

Classification Tests
LL = Liquid Limit
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S_u = Undrained Shear Strength
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R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
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Test Listing Abbreviations
M = Moisture Content
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-35

Report No. 04.10140334-9

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-27	11.8	24[a]																									M
MB-27	11.8					45	NP	NP																			A, S
MB-27	14.3	20[a]				23																					M, S
MB-27	18.5	21[a]																									M
MB-27	18.5					62																					FC, H
MB-27	21.7					80	26	11																			A, FC
MB-27	21.7	19[a]																									M
MB-27	27.4					71	32	18																			A, FC
MB-27	29.9	19[a]																									M
MB-27	32.3	25[a]																									M
MB-27	32.3					89	41	23																			A, FC
MB-27	34.7	24[a]																									M
MB-27	36.8	21[a]																									M
MB-27	39.1	18[a]				66	26	13																			M, A, S
MB-27	42.0					93	44	26																			A, FC
MB-27	42.0	21[a]																									M
MB-27	47.1	21[a]				90	40	23	4.5																		M, A, FC, p
MB-27	52.0	20[a]							4.5																		M, p
MB-27	53.8					93	37	19																			A, FC
MB-27	56.9	19[a]																									M
MB-27	59.1								4.5																		p
MB-27	59.7					80	32	16																			A, S
MB-27	61.8	32[a]																									M
MB-27	61.8					71	33	17																			A, FC
MB-27	63.0					99	55	33																			A, S
MB-27	66.8	38[a]																									M
MB-27	67.6					55	25	11	4.5																		A, FC, p
MB-27	67.6	11																									M
MB-27	71.3					51	24	11																			A, FC
MB-27	71.3	34[a]																									M

Classification Tests
LL = Liquid Limit
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Drained Strength
C' = Cohesion
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Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
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Test Listing Abbreviations
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-36

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Alaska LNG

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LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-27	72.8					83	27	14																			A, S
MB-27	74.5								4.5																		p
MB-27	75.1	13[a]																									M
MB-27	77.4	22																									M
MB-27	77.4					98	32	15	4.5																		A, FC, p
MB-27	79.5	18[a]																									M
MB-27	80.9					75	25	11	4.5																		A, FC, p
MB-27	80.9	19																									M
MB-27	85.8	19[a]																									M
MB-27	86.6					23										39.5											DSS, S
MB-27	95.6	14[a]																									M
MB-27	97.1	14																									M
MB-27	97.1					84	36	20	4.5																		A, S, p
MB-27	99.9								4.5																		p
MB-27	100.1	17[a]																									M
MB-27	101.7	12																									M
MB-27	101.7					40																					S
MB-27	107.7	21[a]																									M
MB-27	113.9					97	40	21																			A, FC
MB-27	116.8								4.5																		p
MB-27	119.5					97	37	20																			A, FC
MB-27	119.5	19[a]																									M
MB-27	121.1					14																					S
MB-27	121.4					8										42.0											DSS, S
MB-27	121.4					6																					S
MB-27	127.5	12[a]																									M
MB-27	137.1	16[a]				13	NP	NP																			M, A, S
MB-27	148.3	22[a]																									M
MB-27	150.3					6																					S
MB-28	0.4	23[a]																									M

Classification Tests
LL = Liquid Limit
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Strength Estimate
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Cl^- = Chloride
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Test Listing Abbreviations

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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-37

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Alaska LNG

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LAB SUMMARY TABLE ALASKA LNG _R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-28	1.1	24[a]																									M
MB-28	1.4	25[a]																									M
MB-28	4.4	24[a]				28																					M, S
MB-28	6.7	27[a]																	303	8.2	3626	554					M, Co
MB-28	9.4	29[a]					NP	NP																			M, A
MB-28	11.8	27[a]				90																					M, S, H
MB-28	14.3	28[a]				76																					M, FC
MB-28	16.7	23[a]				89	29	14																			M, A, FC
MB-28	18.0	25	126.6	101.4																							M, T, CDSS
MB-28	18.3	27	112.9	88.7																							M, T, CDSS
MB-28	18.7	25	124.3	99.6																							M, T, RC, XR
MB-28	18.9	20[a]																									M
MB-28	22.4					81	32	16																			A, FC
MB-28	22.5	25[a]				63																					M, S
MB-28	24.9	20[a]				78	28	13																			M, A, FC
MB-28	28.4	22[a]							3.5																		M, XR, p
MB-28	31.5	22	126.0	103.7		83	28	13			3.5																M, T, A, XR, FC, U
MB-28	31.7	22[a]							4.0																		M, p
MB-28	32.0								4.0																		p
MB-28	34.9	20[a]																									M
MB-28	38.2	65[a]							4.0																		M, p
MB-28	38.6								4.0																		p
MB-28	41.3	24	125.8	101.7							3.7																M, T, XR, U
MB-28	41.3					22	20	6																			A, FC
MB-28	41.5	23[a]																									M
MB-28	45.4					82	27	13																			A, FC
MB-28	45.8	20[a]																									M
MB-28	50.4	28[a]				62	NP	NP																			M, A, S
MB-28	52.3	20[a]																									M
MB-31	4.4	24																									M

Classification Tests
LL = Liquid Limit
PI = Plasticity Index
NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-38

Report No. 04.10140334-9

Confidential
LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16

Alaska LNG

FUGRO

LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014 PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
MB-31	4.4					45													325	8.0	2999	564					C, S, Co
MB-31	13.8	24				93	36	19	4.5																		M, A, S, p, H
MB-31	15.9	23																									M
MB-31	15.9					86	32	15																			A, FC
MB-31	18.0								3.3																		p
MB-31	22.7	19				88																					M, S
MB-31	25.8					79	24	9																			A, FC
MB-31	25.8	17																									M
MB-31	28.2	17																									M
MB-31	28.2					82	24	9																			A, FC
MB-31	30.3	16																									M
MB-31	30.3					34																					FC
MB-31	36.4	22				82	35	18	4.3																		M, A, FC, p
MB-31	38.9					81	32	17																			A, FC
MB-31	38.9	20																									M
MB-31	39.7								2.0																		p
MB-31	46.6					83	31	16																			A, FC
MB-31	46.6	21																									M
MB-31	49.7								4.0																		p
MB-31	50.7					48																					FC
MB-31	50.7	18					27	13																			M, A
MB-31	51.8	21																									M
MB-31	51.8						39	22																			A

Classification Tests
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Drained Strength
C' = Cohesion
PHI' = Friction Angle

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R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
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[a] = Denotes results of the tests performed at the onsite laboratory in Nikiski, Alaska (see text).

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Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
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U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
p = Pocket Penetrometer
t = Torvane
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SUMMARY OF TEST RESULTS
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E1-39

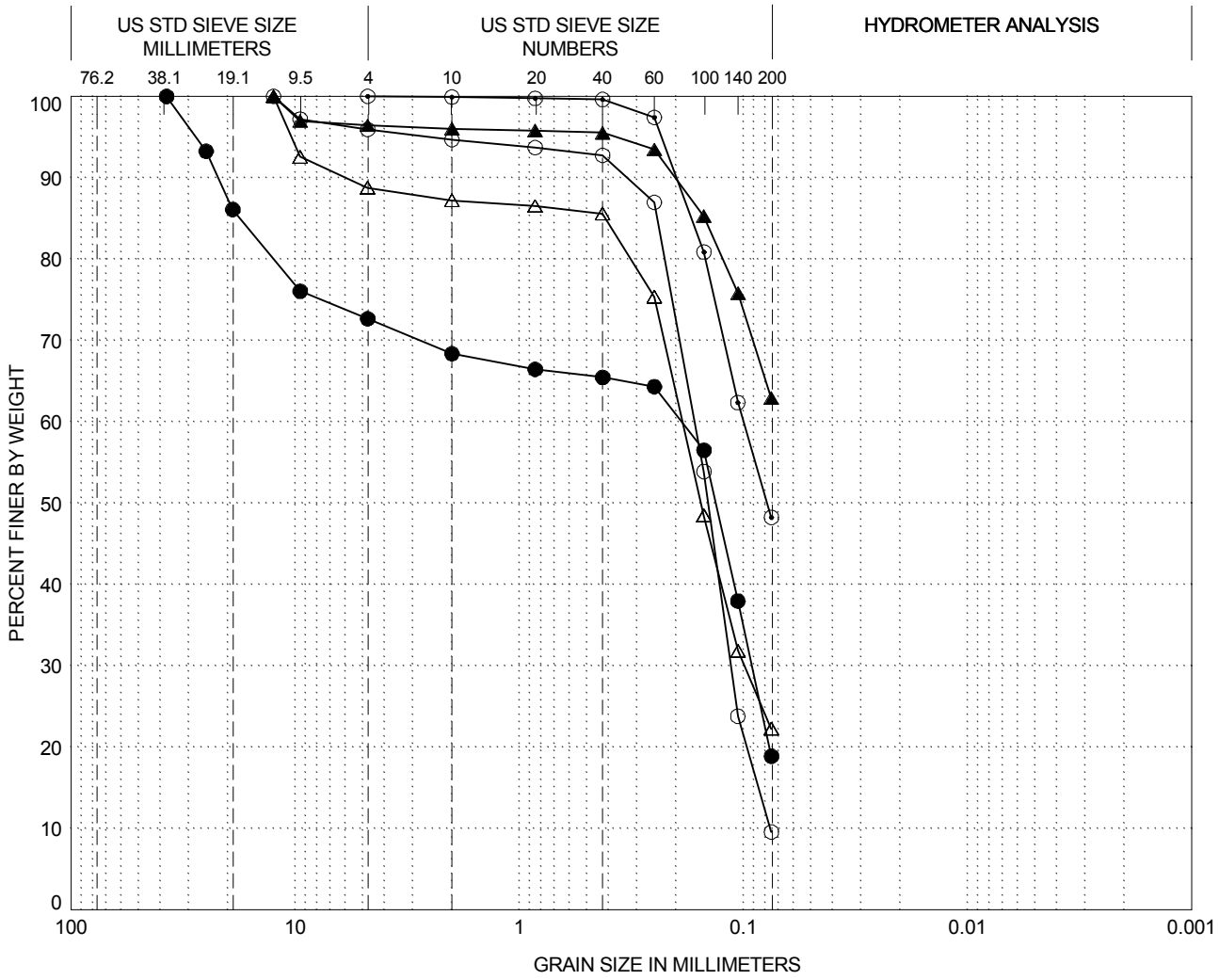
Report No. 04.10140334-9

Confidential
LNG Facilities Marine Geotechnical Data Report
USAL-FG-GRZZZ-00-002015-011 Rev.0
20-Jun-16

Alaska LNG

FUGRO

LAB SUMMARY TABLE ALASKA LNG_R:\04100\2014\PROJECTS\04.10140334 - PHASE 2 ALASKA LNG PROJECT\09_GIS\EXPLORATIONS\GINT\2015\TEMP FOR LAB GINT\2016_0610\04_10140334_AKLNG_FA15MB_NEW.GPJ_ 6/21/16 05:56 PM

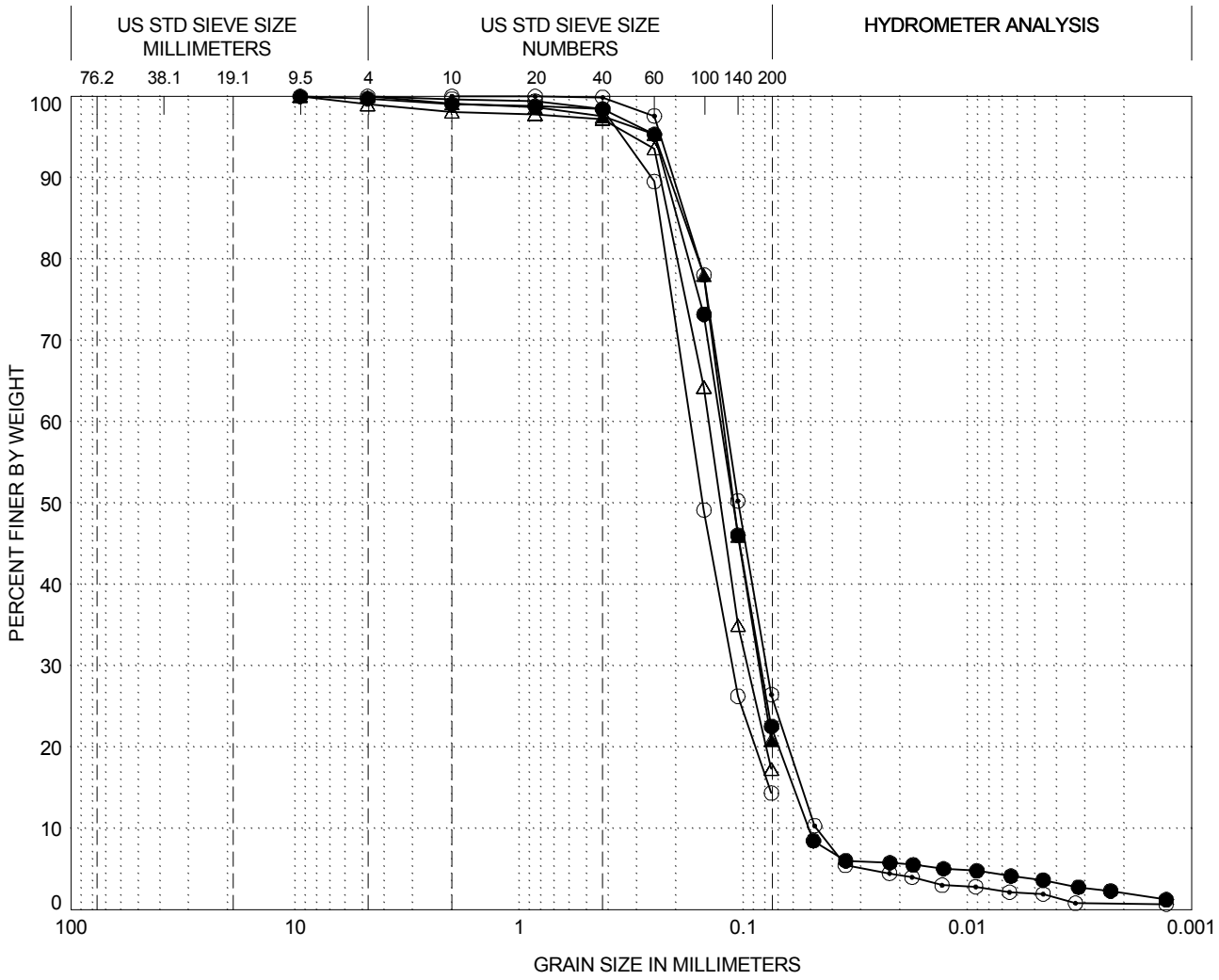


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-02	4.4	SAND with silt (SP-SM)	1.0	2.2	4	86	10
●	MB-02	6.9	Silty SAND with gravel (SM)			27	54	19
△	MB-02	18.6	Silty SAND (SM)			11	67	22
▲	MB-02	21.7	Sandy Lean CLAY (CL)			4	34	63
⊙	MB-02	39.7	Clayey SAND (SC)			0	52	48

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-1

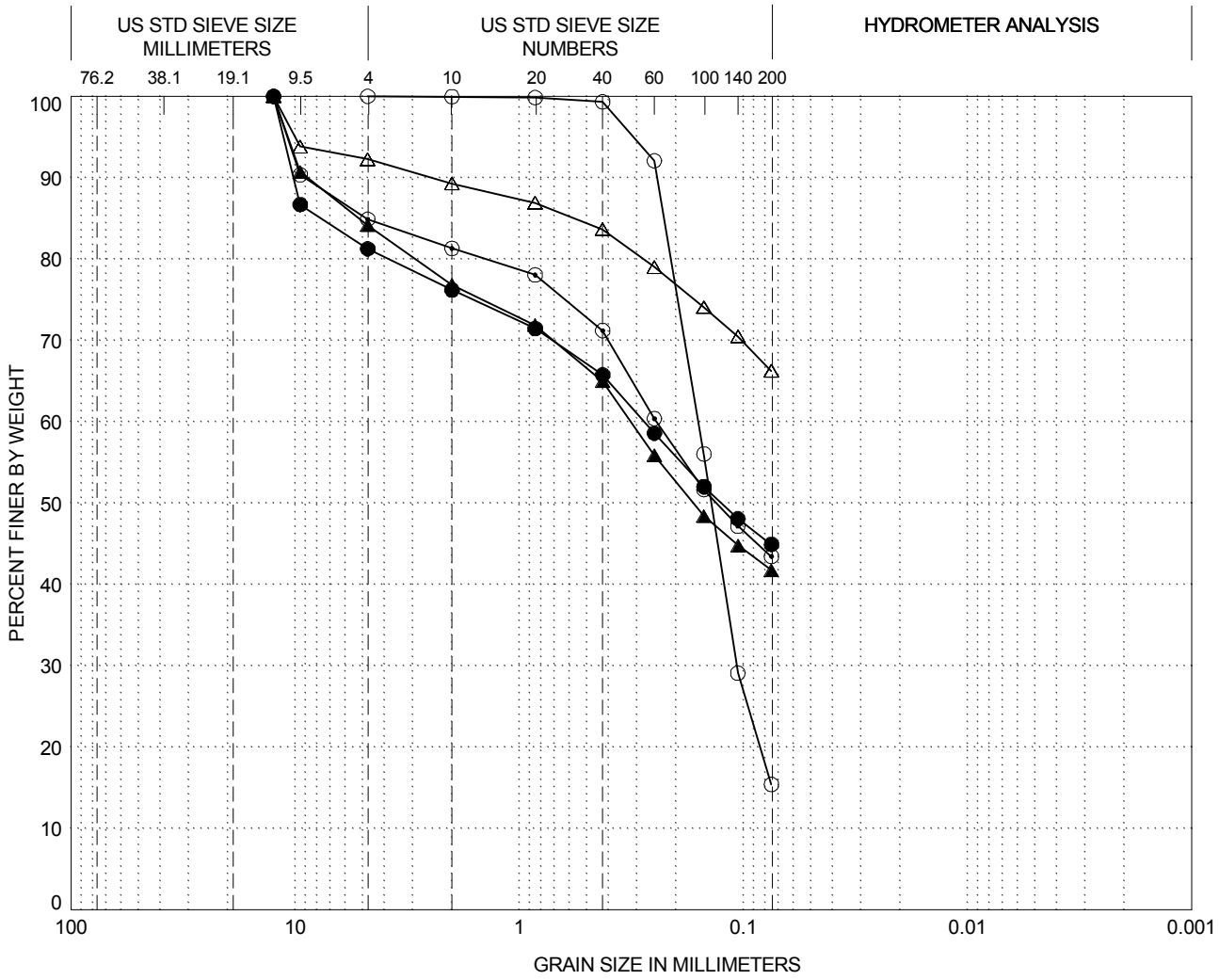


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-03	2.0	Silty SAND (SM)			0	86	14
●	MB-03	11.3	Silty SAND (SM)	1.1	2.5	0	77	23
△	MB-03	14.3	Silty SAND (SM)			1	82	17
▲	MB-03	19.1	Silty SAND (SM)			0	79	21
⊙	MB-03	24.1	Silty SAND (SM)	1.1	2.5	0	74	26

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-2

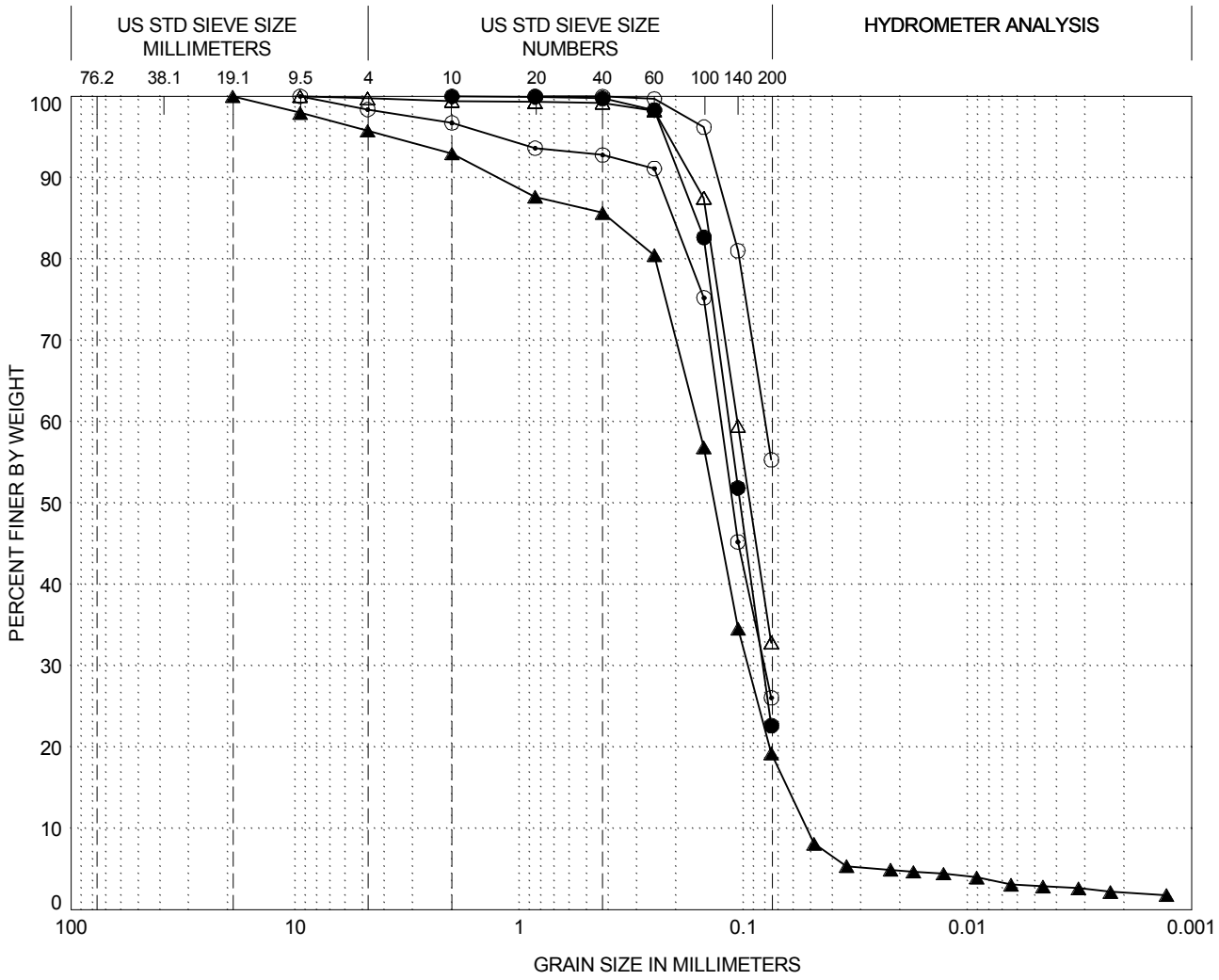


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-03	28.7	Silty SAND (SM)			0	85	15
●	MB-03	125.7	Clayey SAND with gravel (SC)			19	36	45
△	MB-03	140.8	Sandy Lean CLAY (CL)			8	26	66
▲	MB-03	145.3	Clayey SAND with gravel (SC)			16	42	42
⊙	MB-03	149.9	Clayey SAND with gravel (SC)			15	41	43

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-3

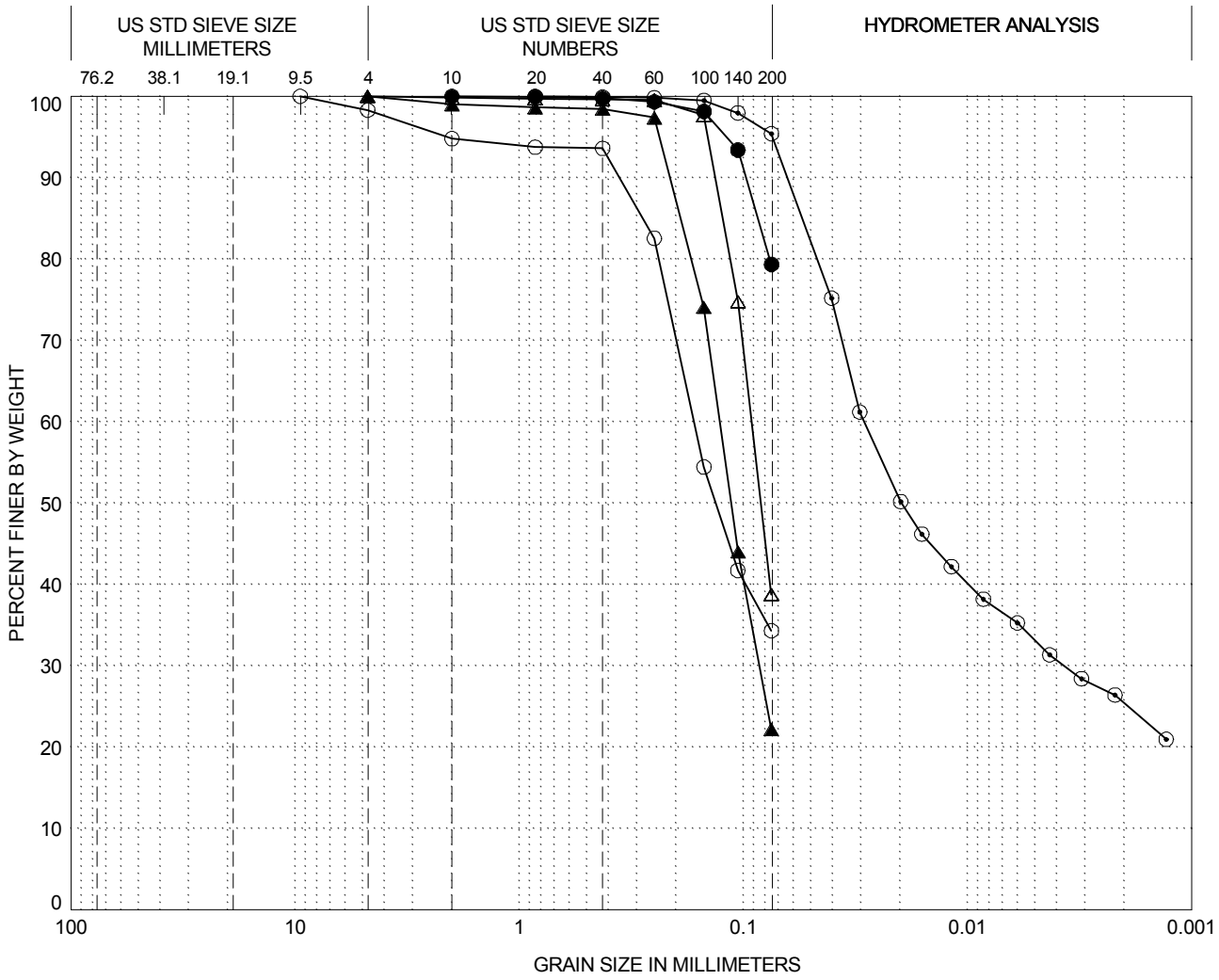


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-04	3.0	Sandy SILT (ML)			0	45	55
●	MB-04	7.2	Silty SAND (SM)			0	77	23
△	MB-04	15.1	Silty SAND (SM)			0	67	33
▲	MB-04	19.5	Silty SAND (SM)	1.1	3.1	4	77	19
⊙	MB-04	26.7	Silty SAND (SM)			2	72	26

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-4

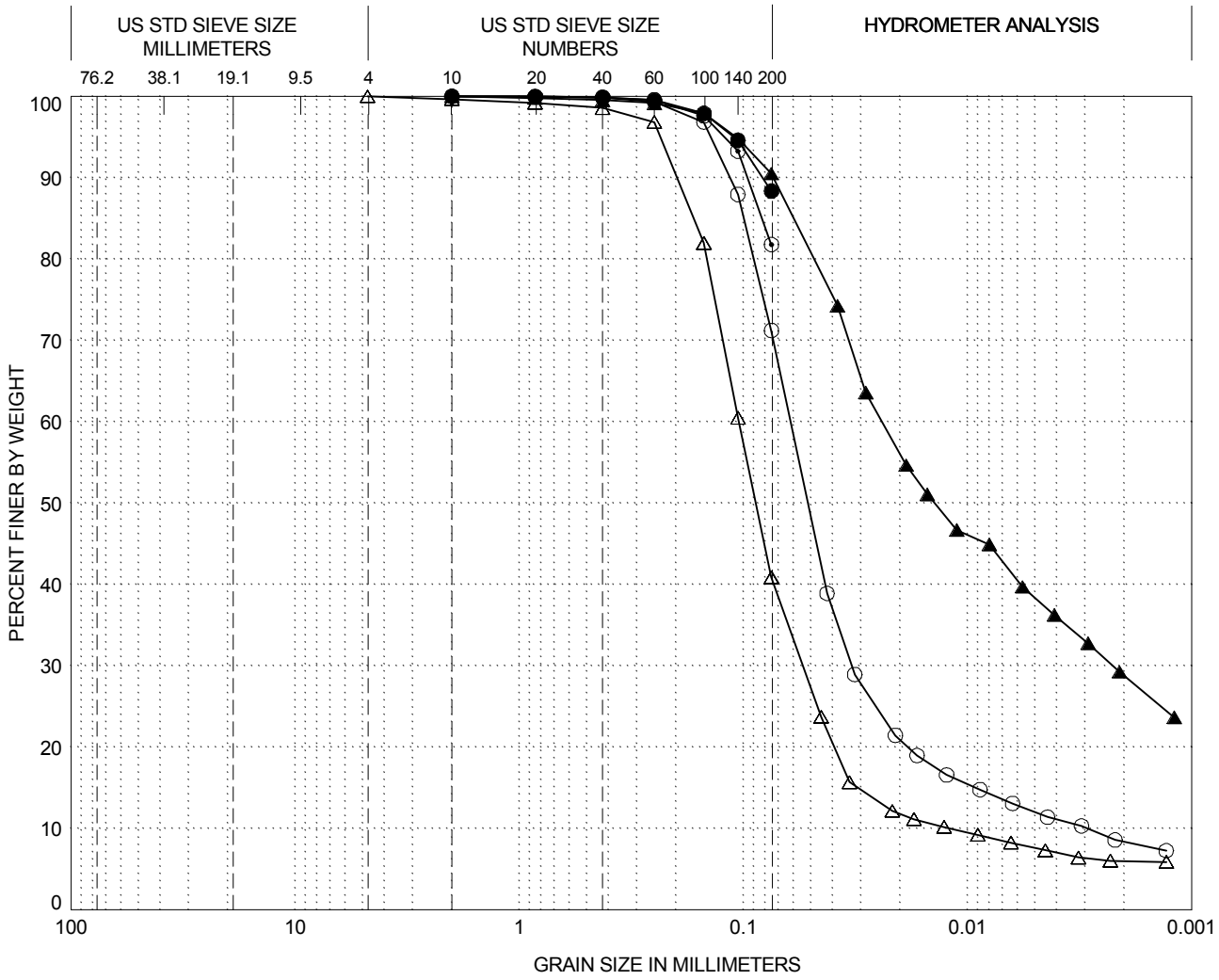


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-04	41.0	Silty SAND (SM)			2	64	34
●	MB-04	54.5	Lean CLAY with sand (CL)			0	21	79
△	MB-04	142.0	Silty SAND (SM)			0	61	39
▲	MB-04	151.8	Silty SAND (SM)			0	78	22
⊙	MB-05	5.2	Lean CLAY (CL)			0	5	95

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-5

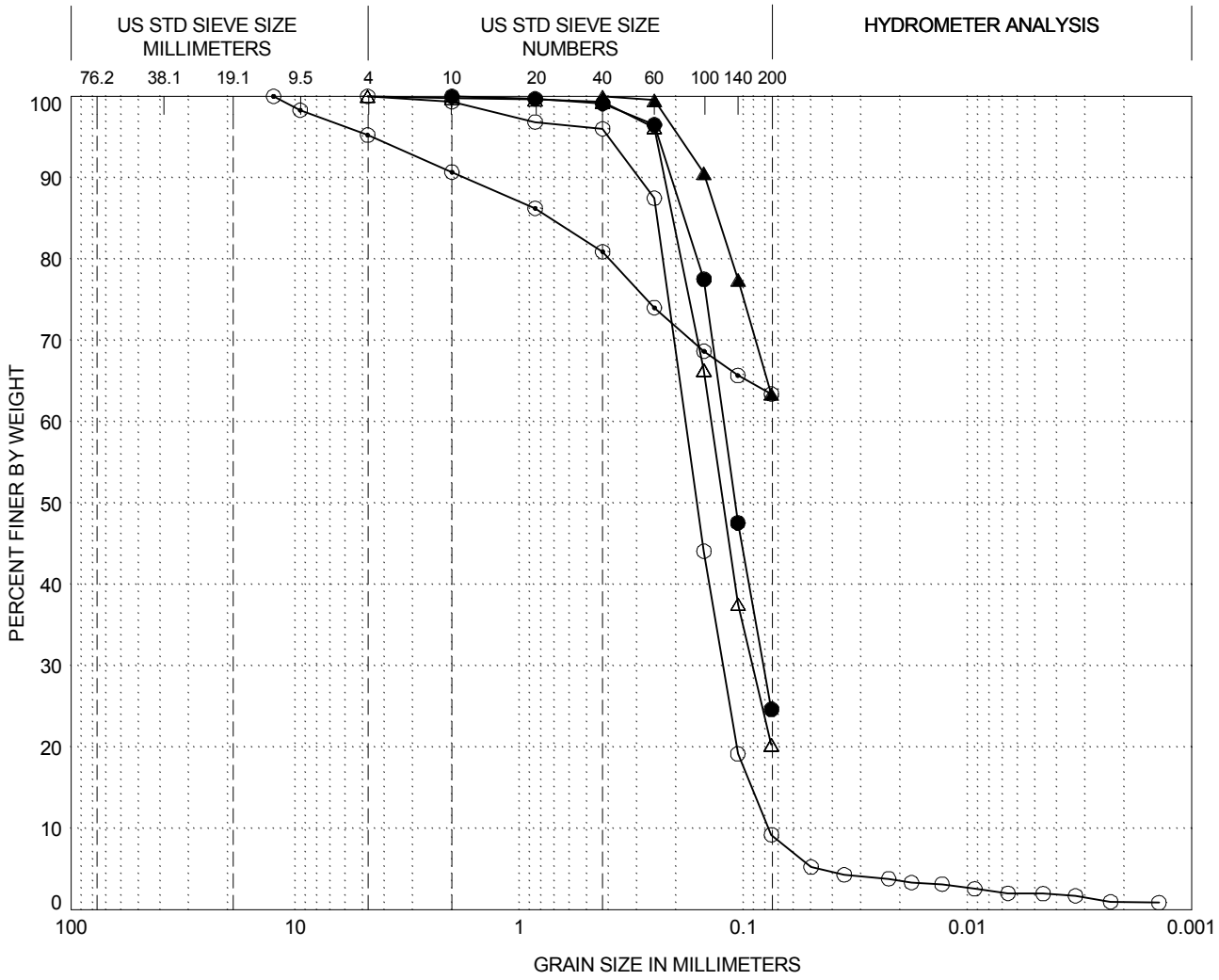


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-05	10.2	Lean CLAY with sand (CL)	6.0	21.1	0	29	71
●	MB-05	12.6	Lean CLAY (CL)			0	12	88
△	MB-05	17.6	Silty SAND (SM)	2.4	8.8	0	59	41
▲	MB-05	20.0	Silty CLAY (CL-ML)			0	9	91
⊙	MB-05	24.8	Silty CLAY with sand (CL-ML)			0	18	82

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-6

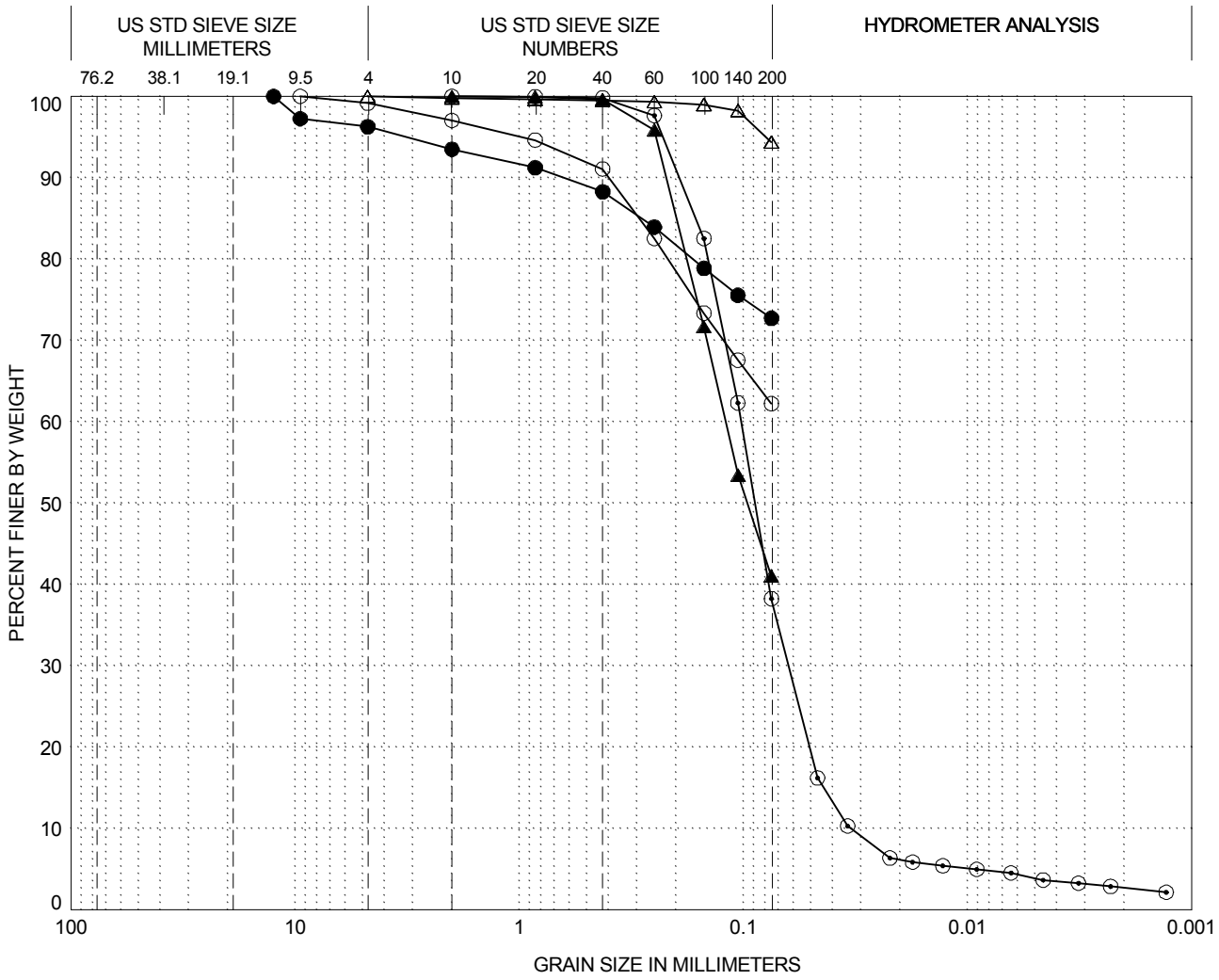


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-05	31.7	SAND with silt (SP-SM)	1.1	2.3	0	91	9
●	MB-05	34.1	Silty SAND (SM)			0	75	25
△	MB-05	36.6	Silty SAND (SM)			0	80	20
▲	MB-05	75.8	Sandy Lean CLAY (CL)			0	37	63
⊙	MB-05	128.0	Sandy Lean CLAY (CL)			5	32	63

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-7

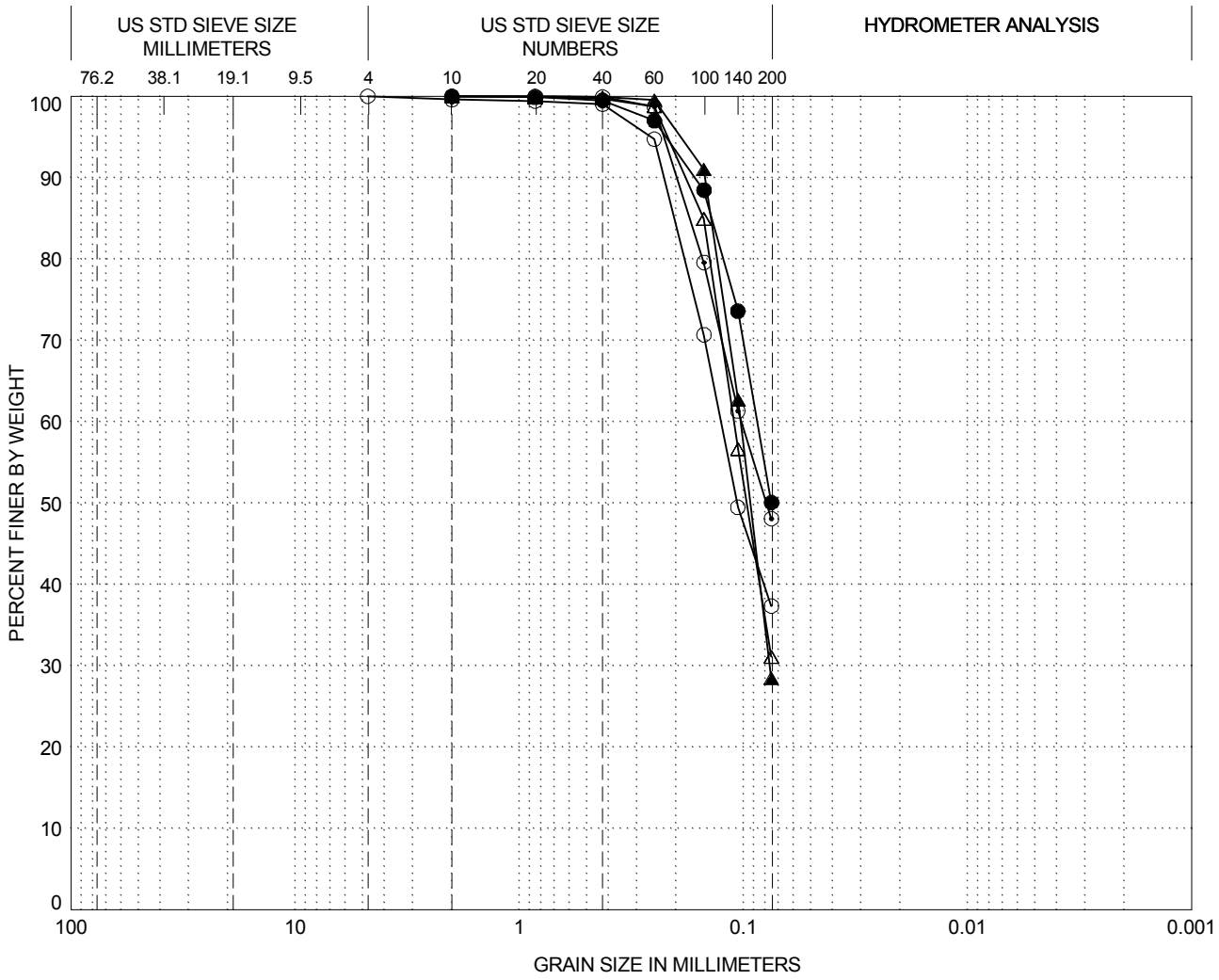


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-05	134.5	Sandy Lean CLAY (CL)			1	37	62
●	MB-05	145.0	Lean CLAY with sand (CL)			4	24	73
△	MB-06	2.0	Silty CLAY (CL-ML)			0	6	94
▲	MB-06	6.9	Silty, Clayey SAND (SC-SM)			0	59	41
⊙	MB-06	11.8	Silty, Clayey SAND (SC-SM)	1.2	3.1	0	62	38

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-8

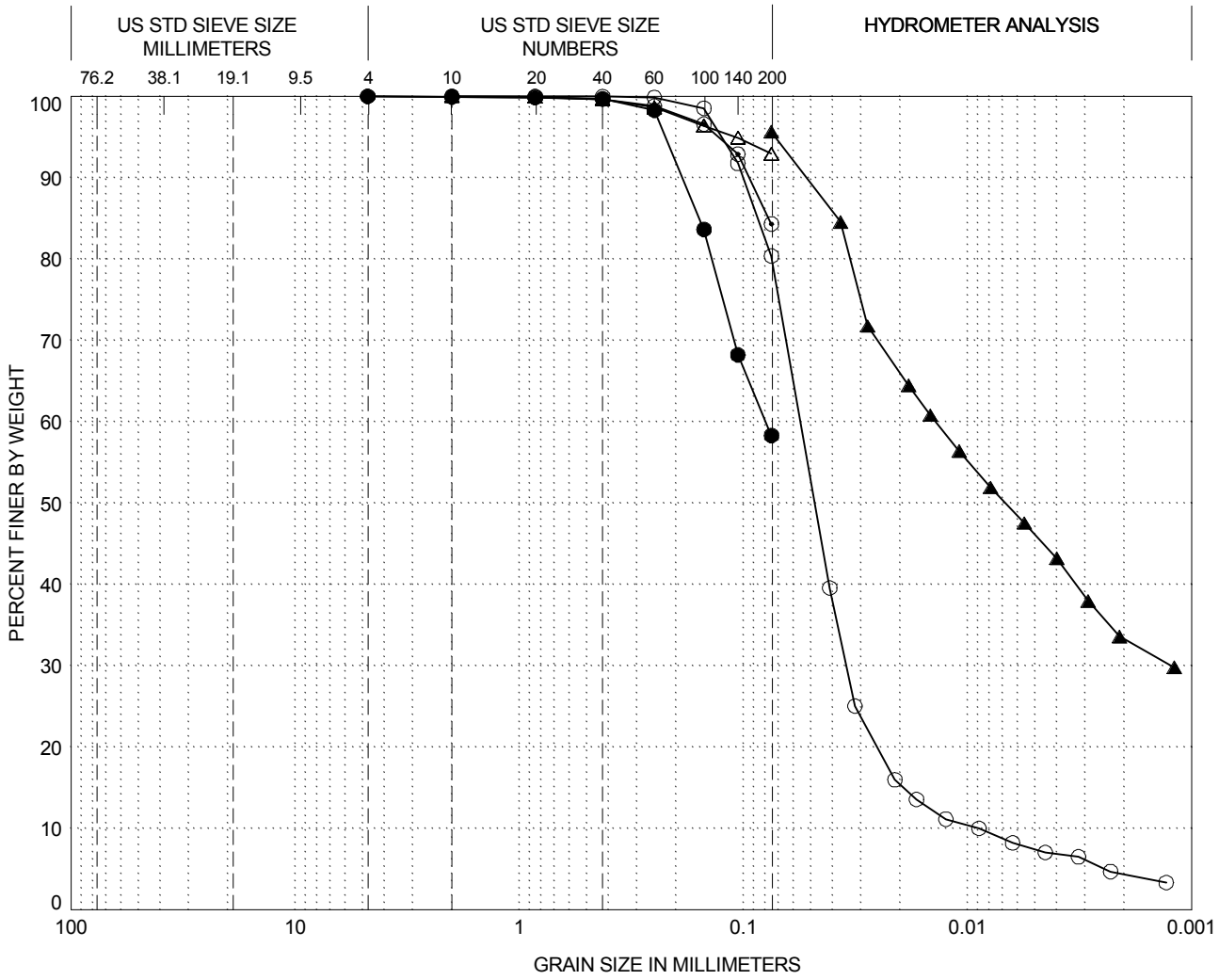


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-06	15.9	Silty, Clayey SAND (SC-SM)			0	63	37
●	MB-06	23.6	Sandy, Silty CLAY (CL-ML)			0	50	50
△	MB-06	31.3	Silty, Clayey SAND (SC-SM)			0	69	31
▲	MB-06	79.7	Clayey SAND (SC)			0	72	28
⊙	MB-08	3.3	Silty SAND (SM)			0	52	48

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-9

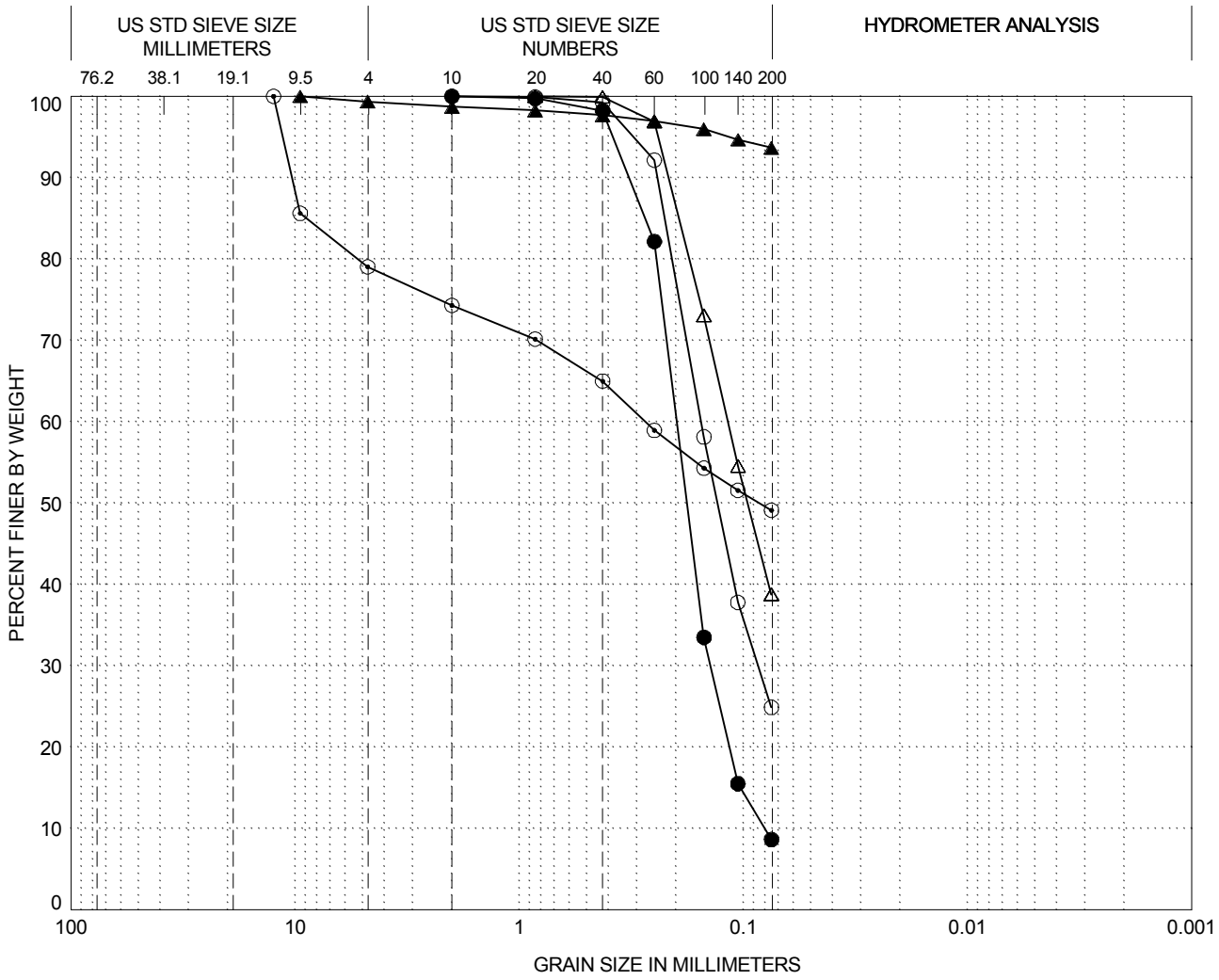


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-08	6.9	SILT with sand (ML)	2.4	6.2	0	20	80
●	MB-08	7.9	Sandy SILT (ML)			0	42	58
△	MB-08	14.3	SILT (ML)			0	7	93
▲	MB-08	19.7	Lean CLAY (CL)			0	0	96
⊙	MB-08	22.5	Lean CLAY with sand (CL)			0	16	84

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-10

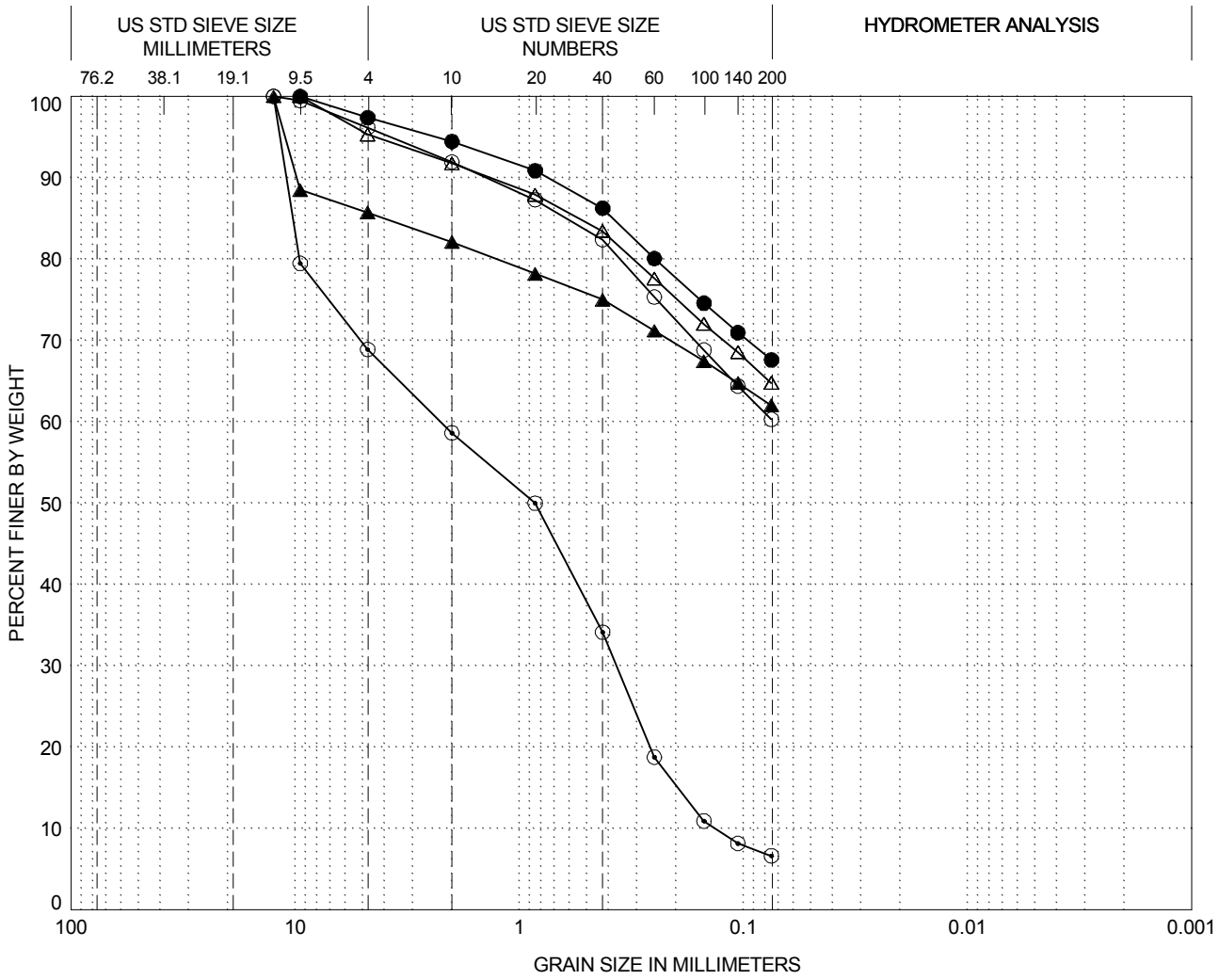


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-08	32.3	Silty SAND (SM)			0	75	25
●	MB-08	37.2	SAND with silt (SP-SM)	1.2	2.5	0	91	9
△	MB-08	72.5	Silty, Clayey SAND (SC-SM)			0	61	39
▲	MB-08	121.6	Lean CLAY (CL)			1	6	94
⊙	MB-08	123.2	Clayey SAND with gravel (SC)			21	30	49

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-11

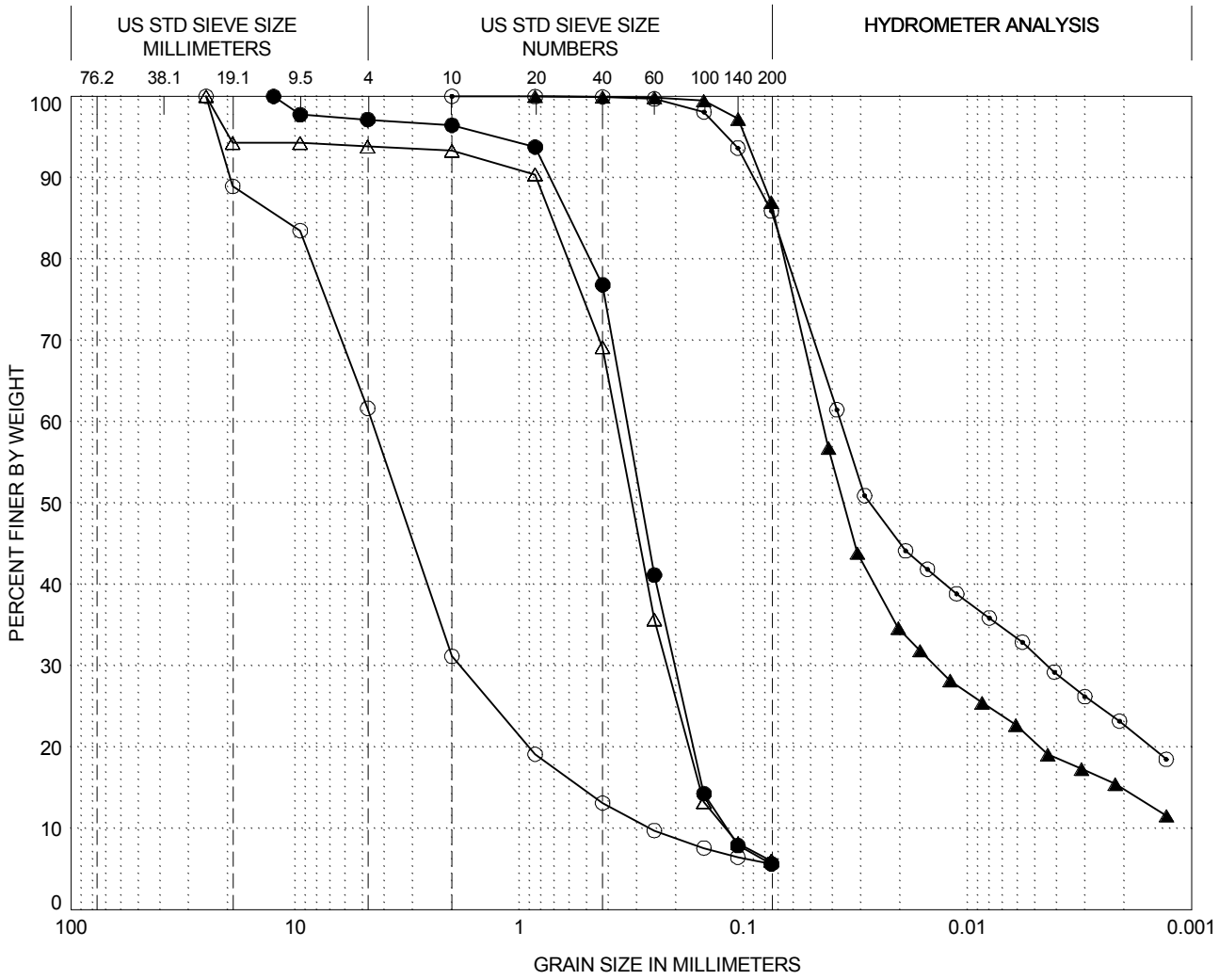


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-08	126.2	Sandy Lean CLAY (CL)			4	36	60
●	MB-08	131.7	Sandy Lean CLAY (CL)			3	30	68
△	MB-08	139.1	Sandy Lean CLAY (CL)			5	31	65
▲	MB-08	149.1	Sandy Lean CLAY (CL)			14	24	62
⊙	MB-08	159.5	SAND with clay and gravel (SW-SC)	0.5	16.8	31	62	7

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-12

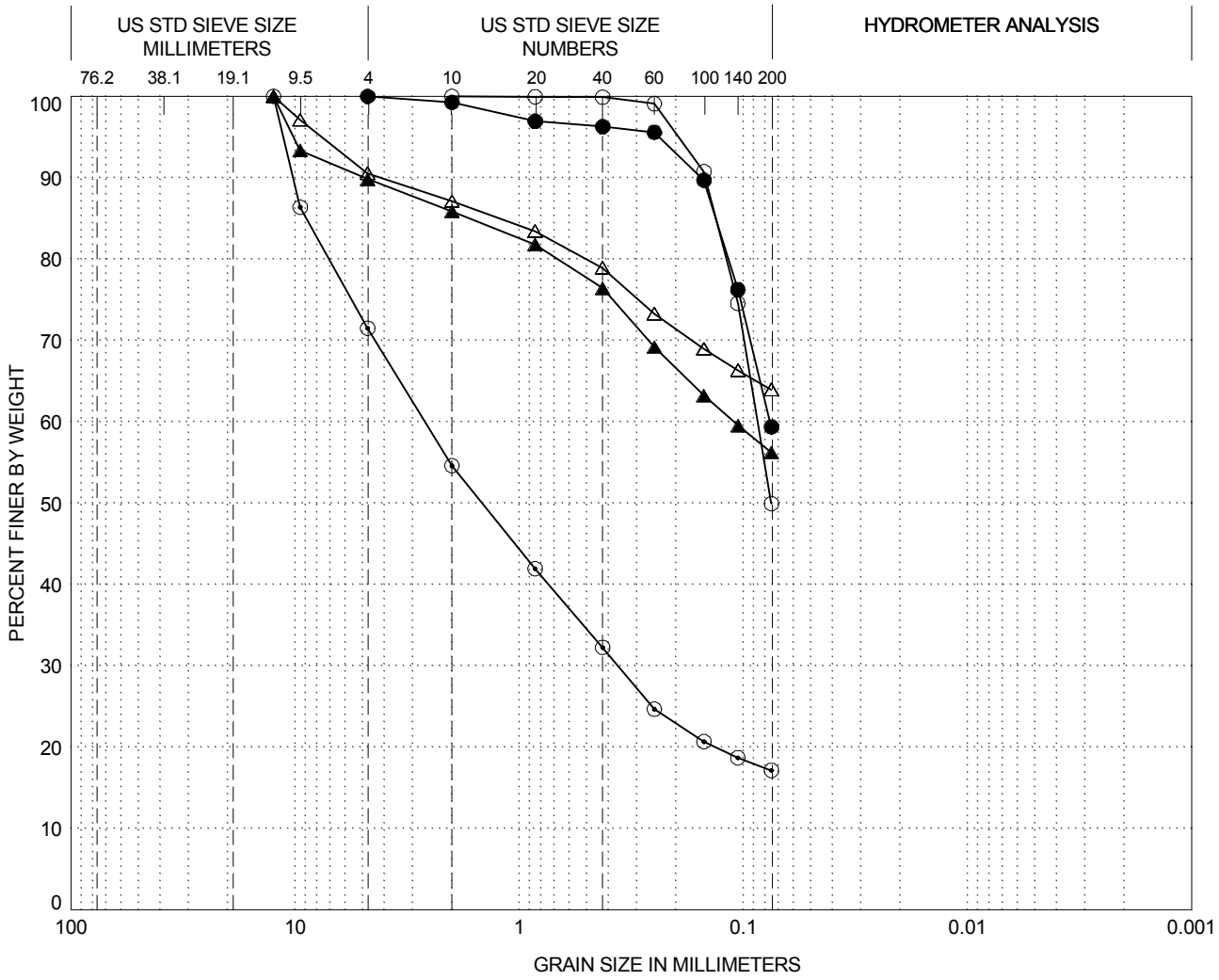


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-08	166.9	SAND with clay and gravel (SW-SC)	2.9	17.4	38	56	6
●	MB-08	185.7	SAND with clay (SP-SC)	1.0	2.8	3	91	6
△	MB-08	206.2	SAND with clay (SP-SC)	1.1	3.1	6	88	6
▲	MB-09	5.7	Lean CLAY (CL)			0	13	87
⊙	MB-09	15.9	Lean CLAY (CL)			0	14	86

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-13

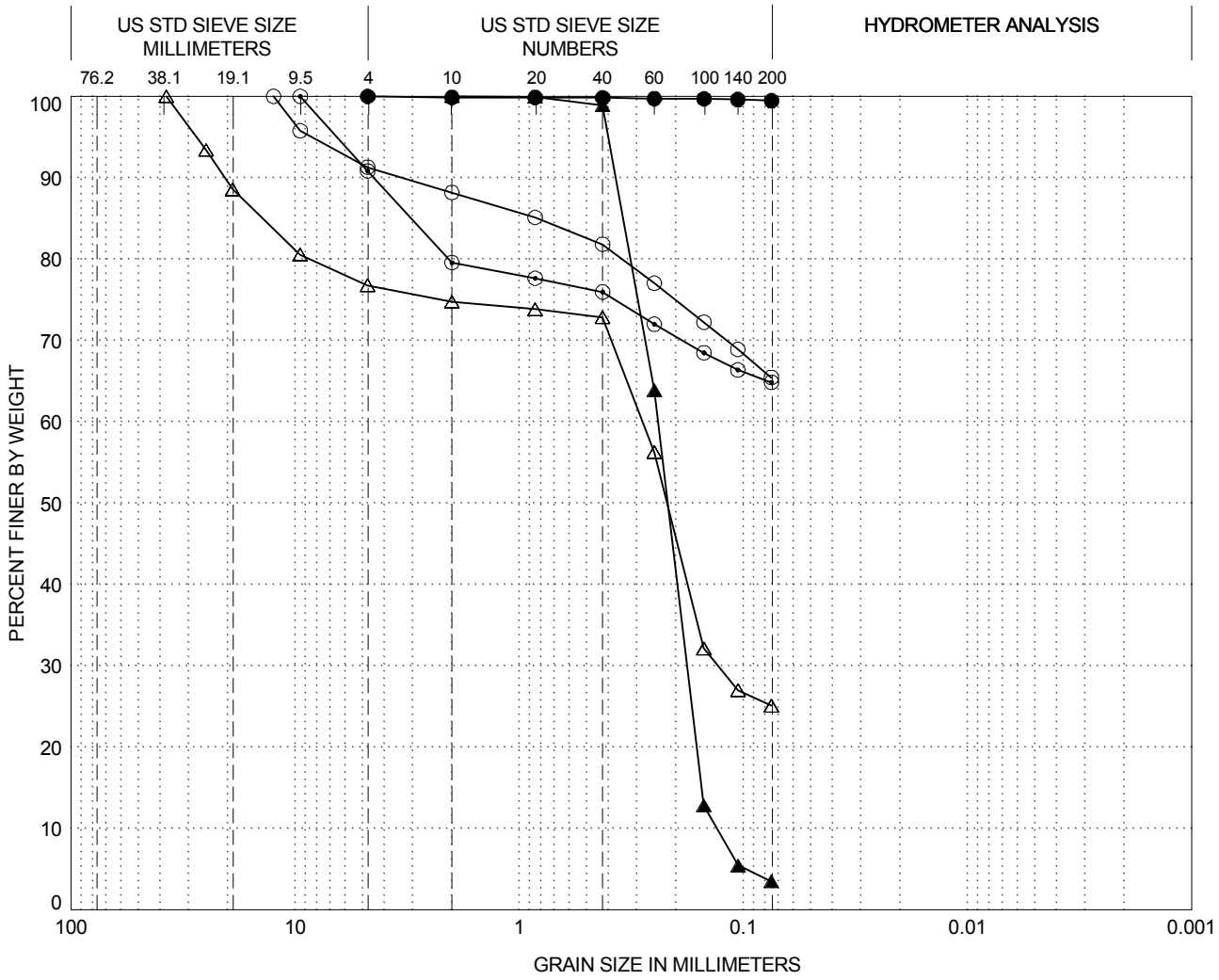


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-09	18.4	Sandy Lean CLAY (CL)			0	50	50
●	MB-09	27.5	Sandy Lean CLAY (CL)			0	41	59
△	MB-09	108.3	Sandy SILT (ML)			9	27	64
▲	MB-09	118.9	Sandy SILT (ML)			10	34	56
⊙	MB-09	128.4	Clayey SAND with gravel (SC)			29	54	17

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-14

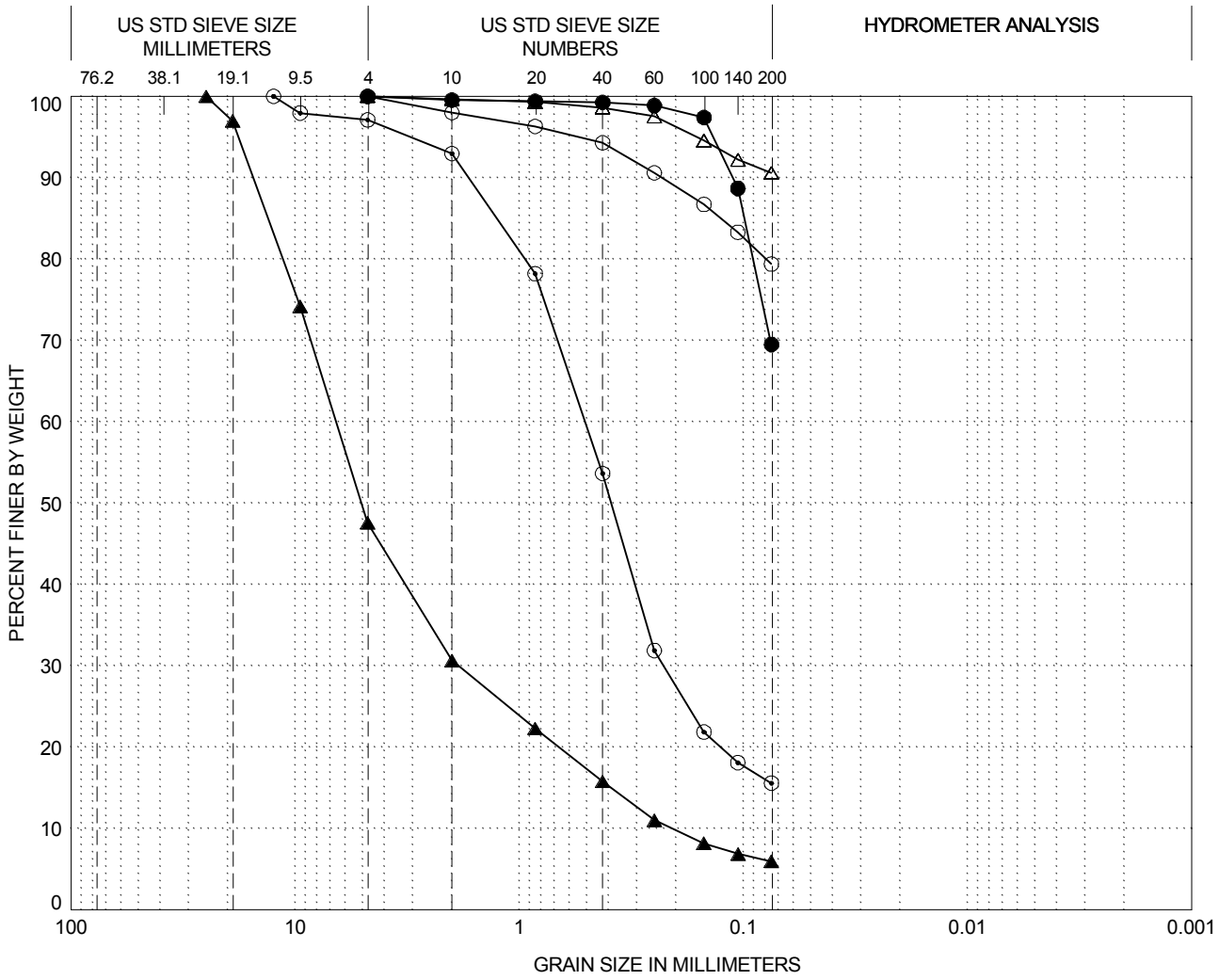


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-09	132.9	Sandy Lean CLAY (CL)			9	26	65
●	MB-09	145.0	Lean CLAY (CL)			0	1	99
△	MB-12	6.9	Clayey SAND with gravel (SC)			23	52	25
▲	MB-12	21.7	SAND (SP)	1.0	1.8	0	96	4
⊙	MB-12	28.9	Sandy Lean CLAY (CL)			9	26	65

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-15

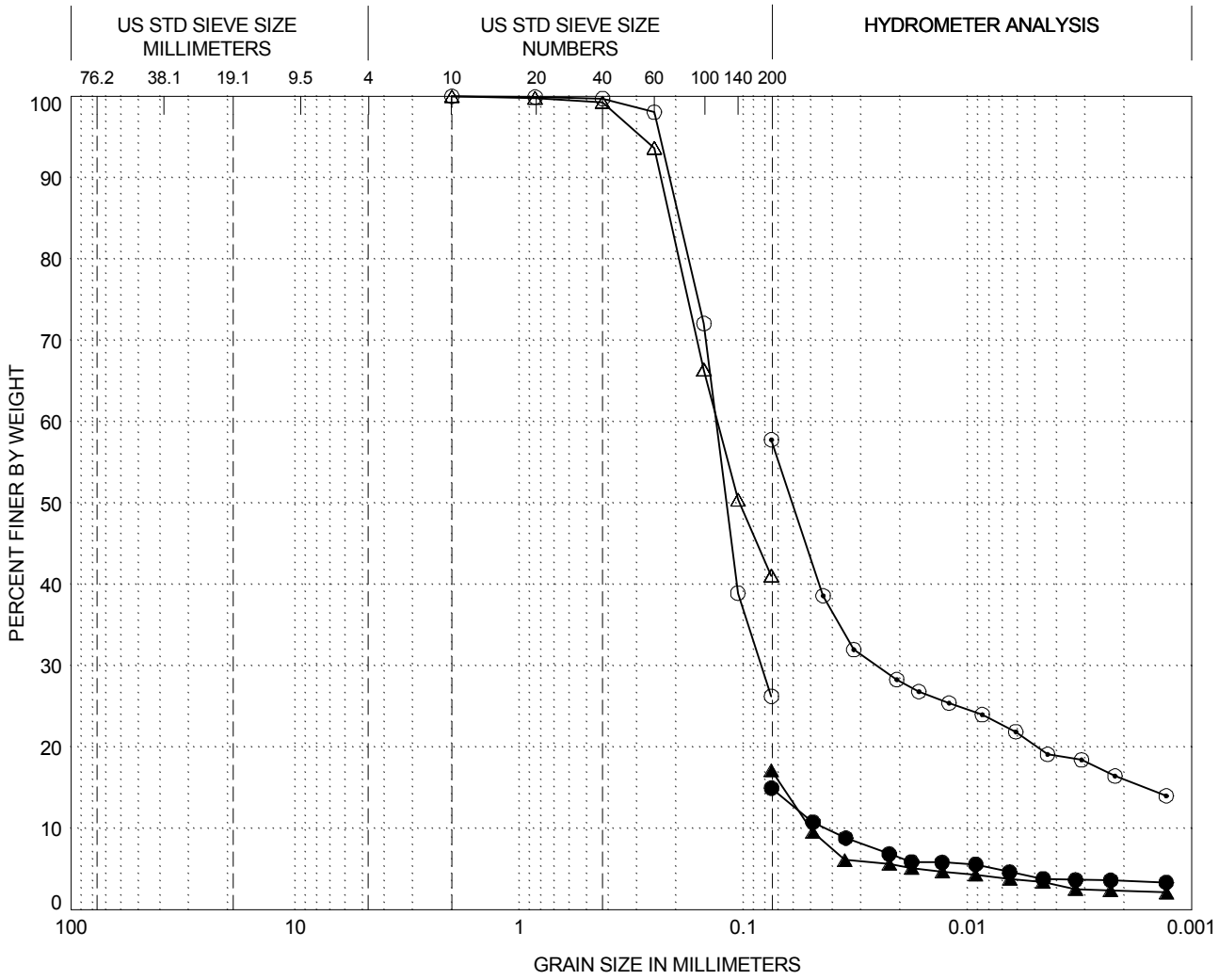


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-12	41.7	Silty CLAY with sand (CL-ML)			0	21	79
●	MB-12	55.4	Sandy Lean CLAY (CL)			0	31	69
△	MB-12	65.5	Lean CLAY (CL)			0	9	91
▲	MB-12	119.9	GRAVEL with silt and sand (GW-GM)	2.6	31.5	52	42	6
⊙	MB-12	128.9	Silty SAND (SM)			3	82	16

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-16

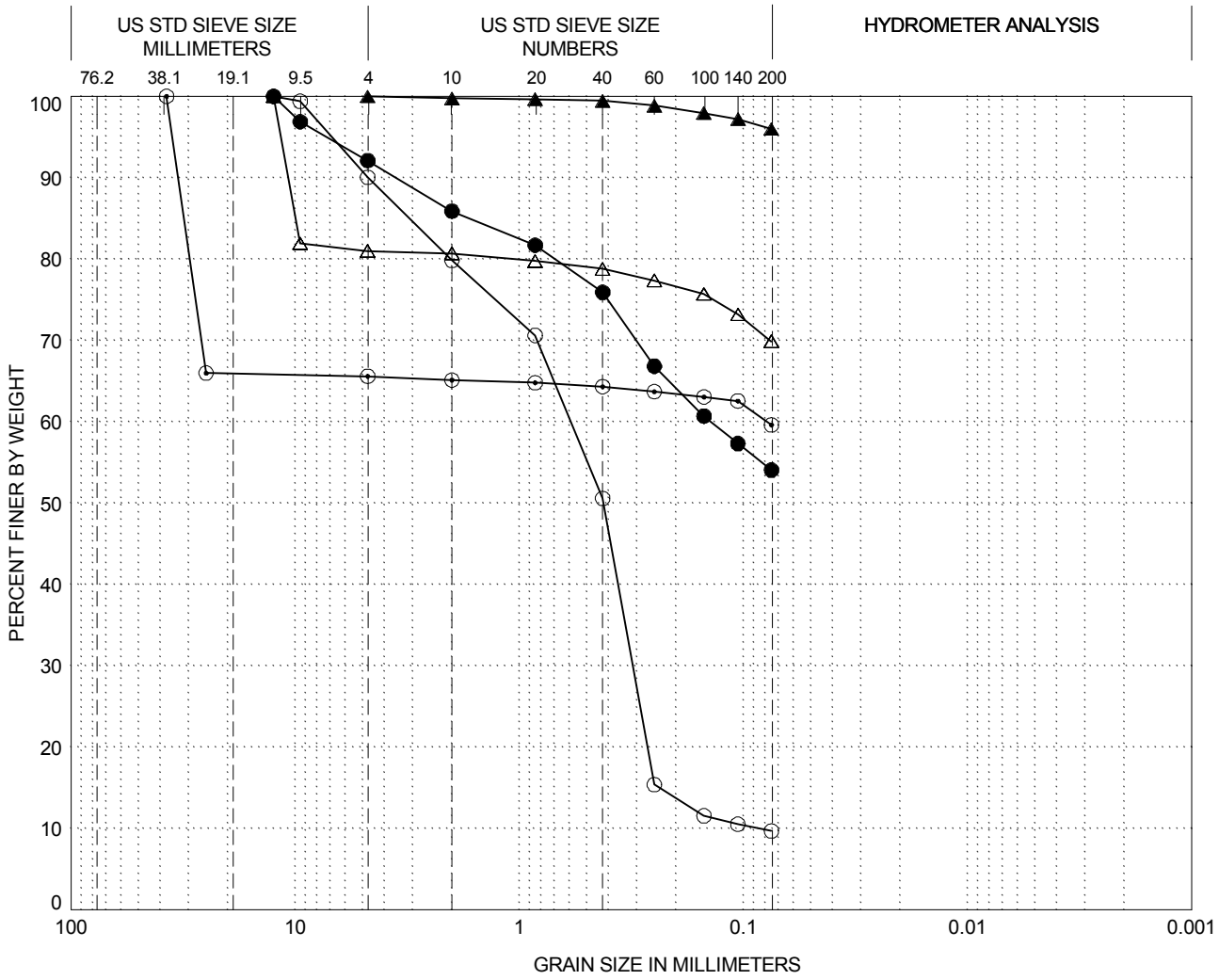


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-13	7.7	Silty SAND (SM)			0	74	26
●	MB-13	12.6	Silty SAND (SM)			0	0	15
△	MB-13	17.2	Silty SAND (SM)			0	59	41
▲	MB-13	31.5	Silty SAND (SM)			0	0	17
⊙	MB-13	34.0	Sandy Lean CLAY (CL)			0	0	58

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-17

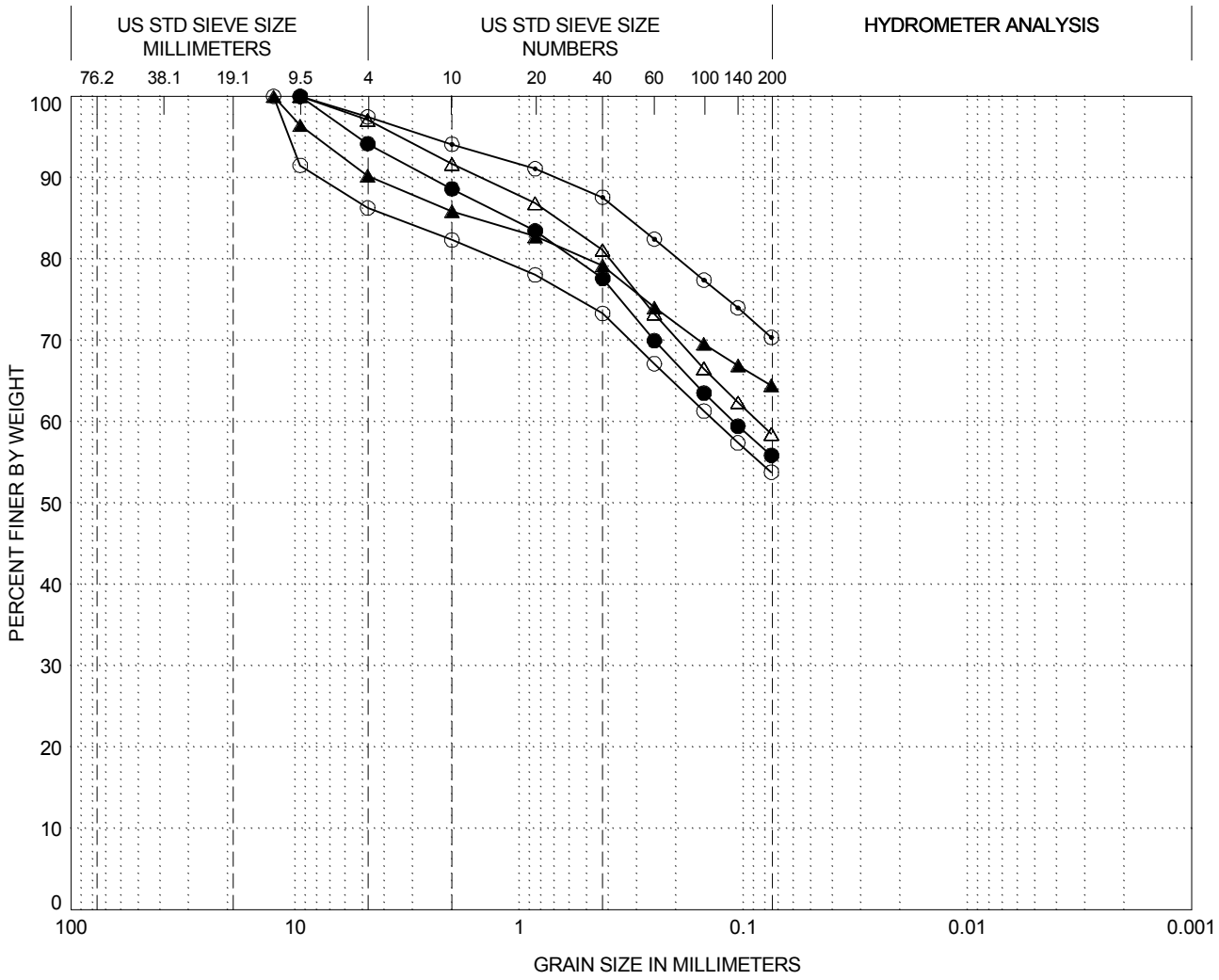


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-13	96.3	SAND with clay (SW-SC)	1.9	6.9	10	80	10
●	MB-13	101.5	Sandy Lean CLAY (CL)			8	38	54
△	MB-13	107.0	Gravelly Lean CLAY (CL)			19	11	70
▲	MB-13	108.3	Lean CLAY (CL)			0	4	96
⊙	MB-13	113.0	Gravelly Lean CLAY (CL)			34	6	60

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-18

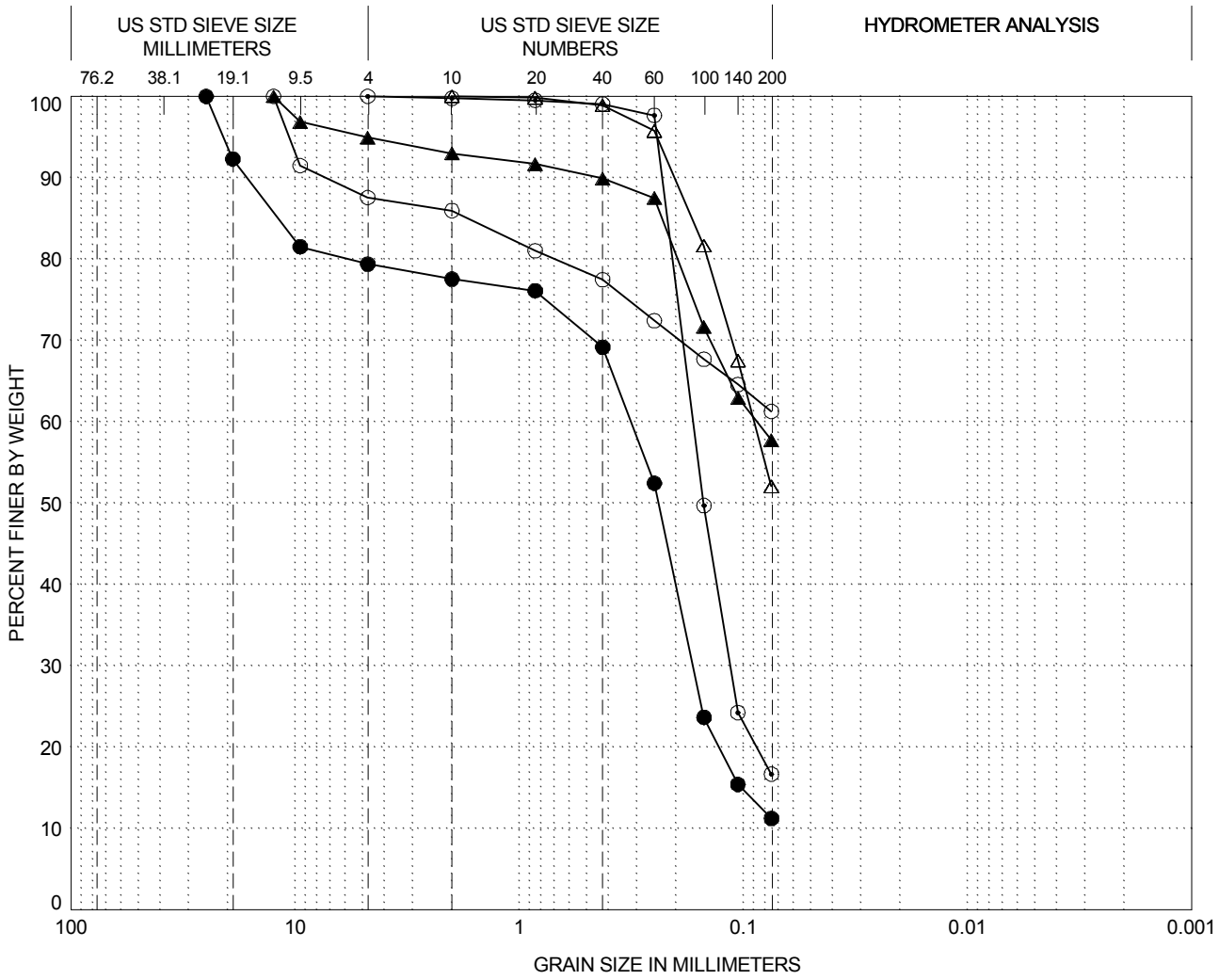


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-13	115.5	Sandy Lean CLAY (CL)			14	32	54
●	MB-13	120.1	Sandy Lean CLAY (CL)			6	38	56
△	MB-13	122.7	Sandy Lean CLAY (CL)			3	39	59
▲	MB-13	126.0	Sandy Lean CLAY (CL)			10	26	64
⊙	MB-13	132.0	Sandy Lean CLAY (CL)			3	27	70

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-19

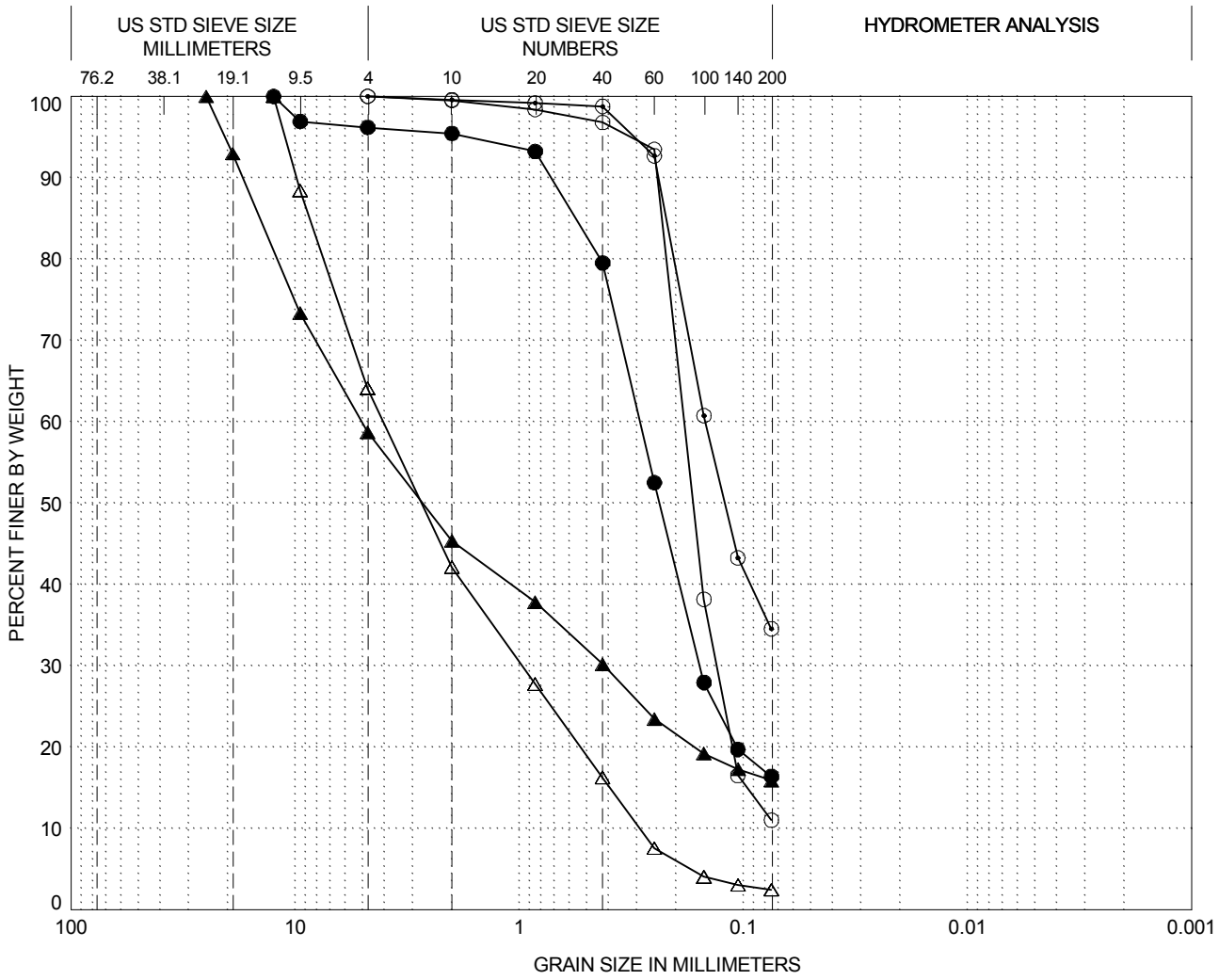


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-13	147.2	Sandy Lean CLAY (CL)			12	26	61
●	MB-14	4.1	SAND with clay and gravel (SP-SC)	1.3	4.7	21	68	11
△	MB-14	16.7	Sandy, Silty CLAY (CL-ML)			0	48	52
▲	MB-14	93.2	Sandy Lean CLAY (CL)			5	37	58
⊙	MB-14	97.6	Clayey SAND (SC)			0	83	17

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-20

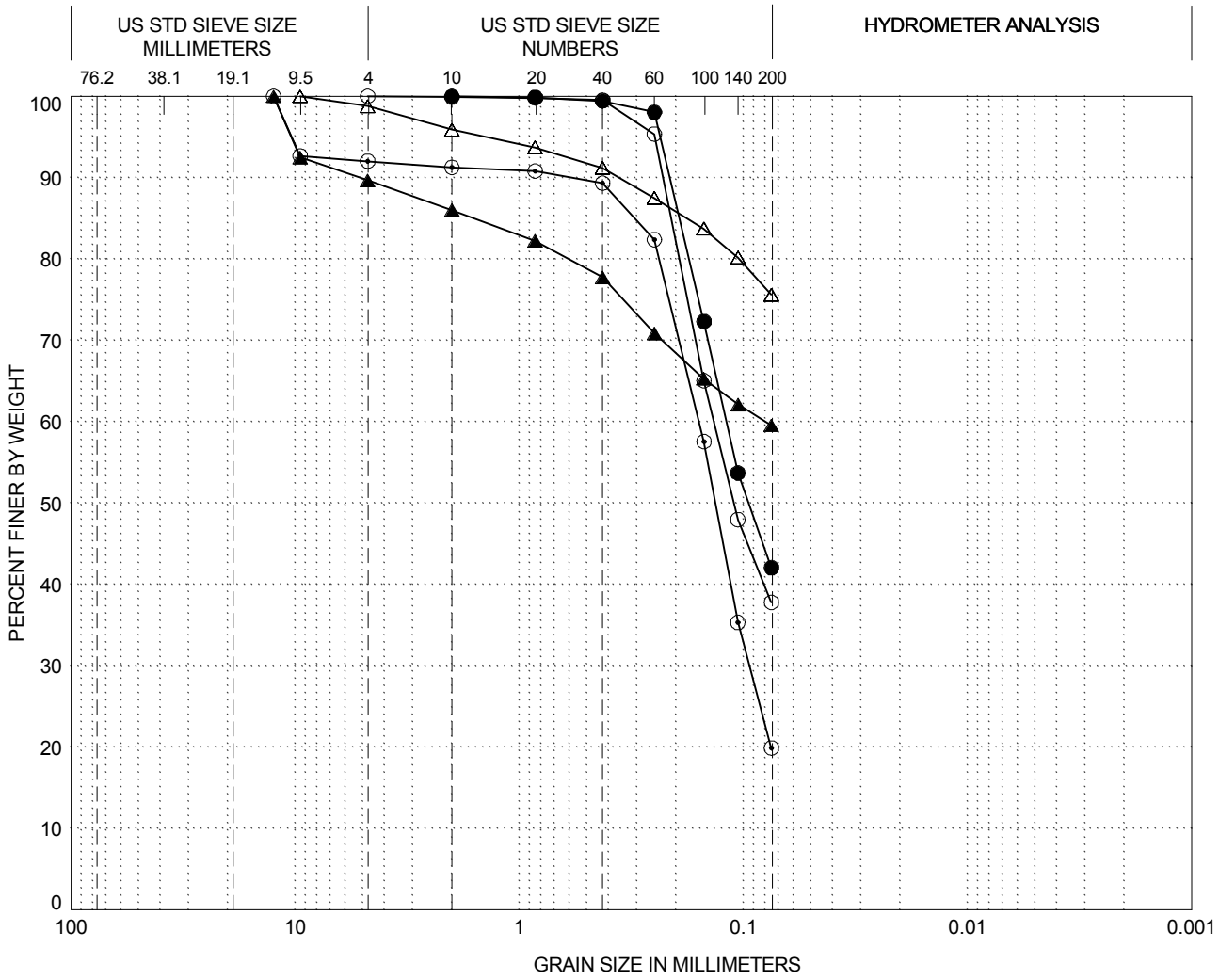


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-14	130.6	SAND with clay (SP-SC)	1.3	2.6	0	89	11
●	MB-14	140.6	Clayey SAND (SC)			4	80	16
△	MB-15	6.9	SAND with gravel (SW)	0.8	13.9	36	62	2
▲	MB-15	16.4	Clayey SAND with gravel (SC)			41	43	16
⊙	MB-15	23.8	Silty SAND (SM)			0	65	35

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-21

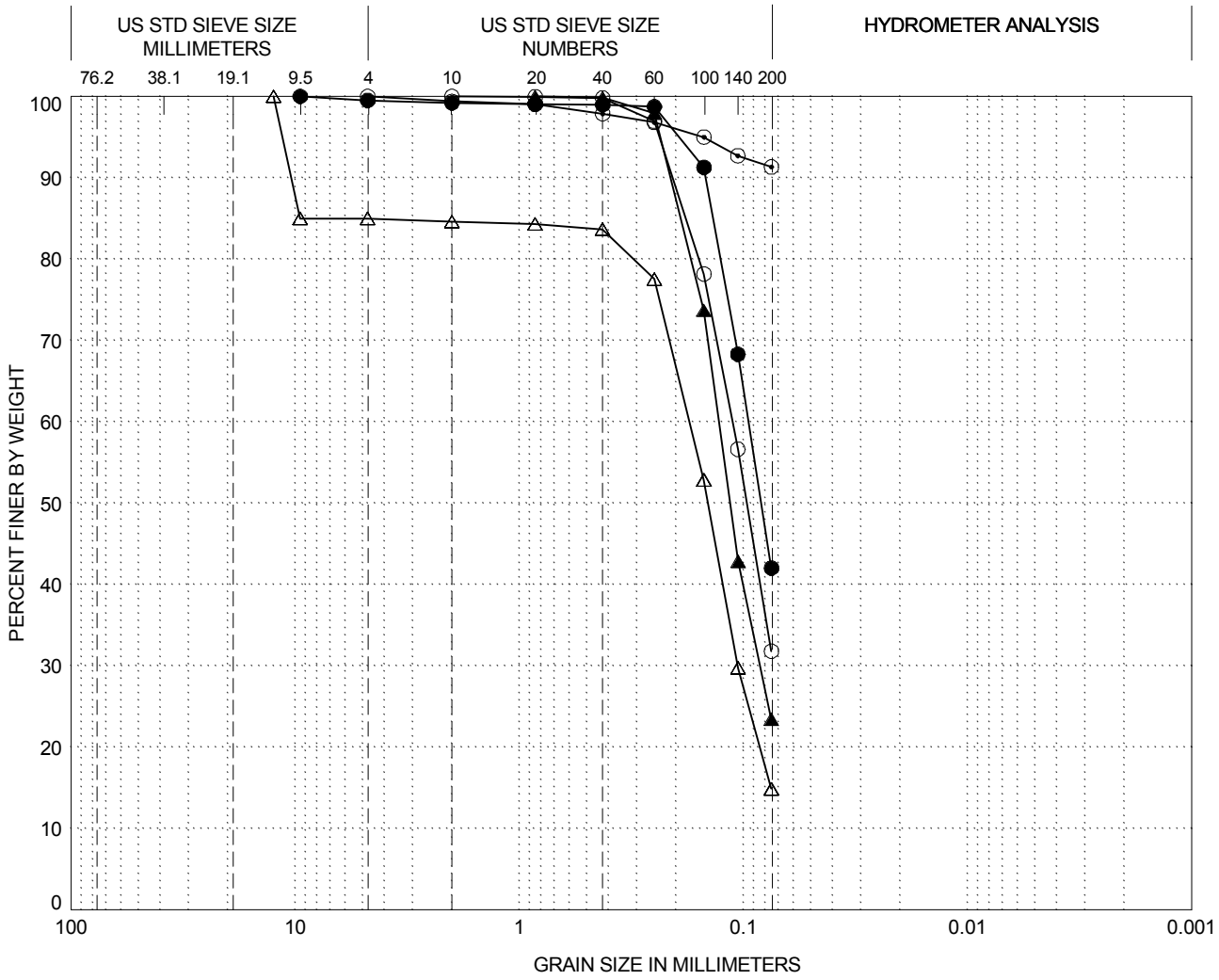


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-15	33.8	Silty SAND (SM)			0	62	38
●	MB-15	81.1	Clayey SAND (SC)			0	58	42
△	MB-15	128.9	Silty CLAY with sand (CL-ML)			1	23	76
▲	MB-15	140.4	Sandy Lean CLAY with gravel (CL)			10	30	60
⊙	MB-16	4.4	Silty SAND (SM)			8	72	20

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-22

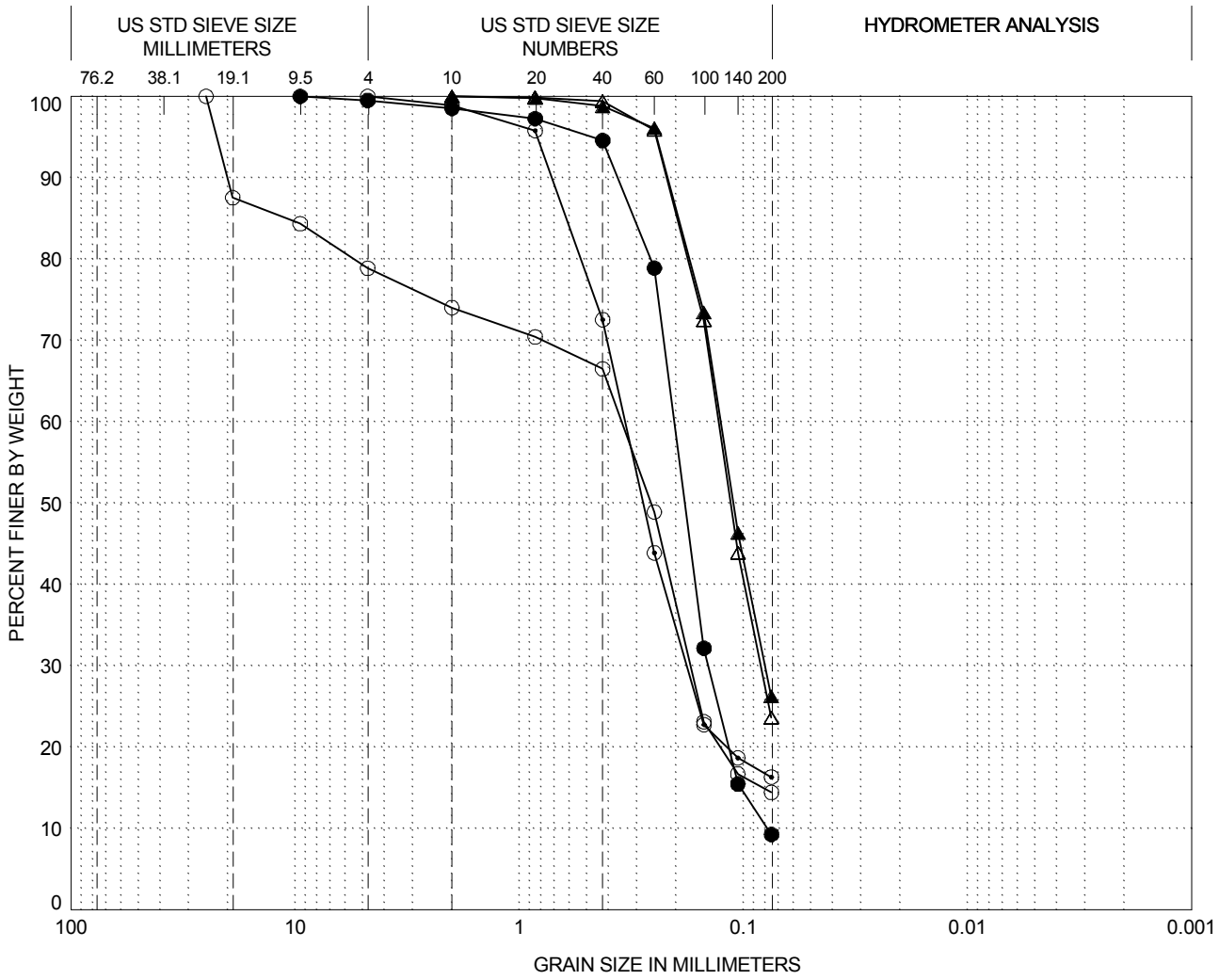


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-16	13.6	Silty SAND (SM)			0	68	32
●	MB-16	36.7	Silty SAND (SM)			0	57	42
△	MB-16	44.6	Silty SAND with gravel (SM)			15	70	15
▲	MB-16	66.9	Silty SAND (SM)			0	77	23
⊙	MB-16	77.4	Lean CLAY (CL)			0	9	91

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-23

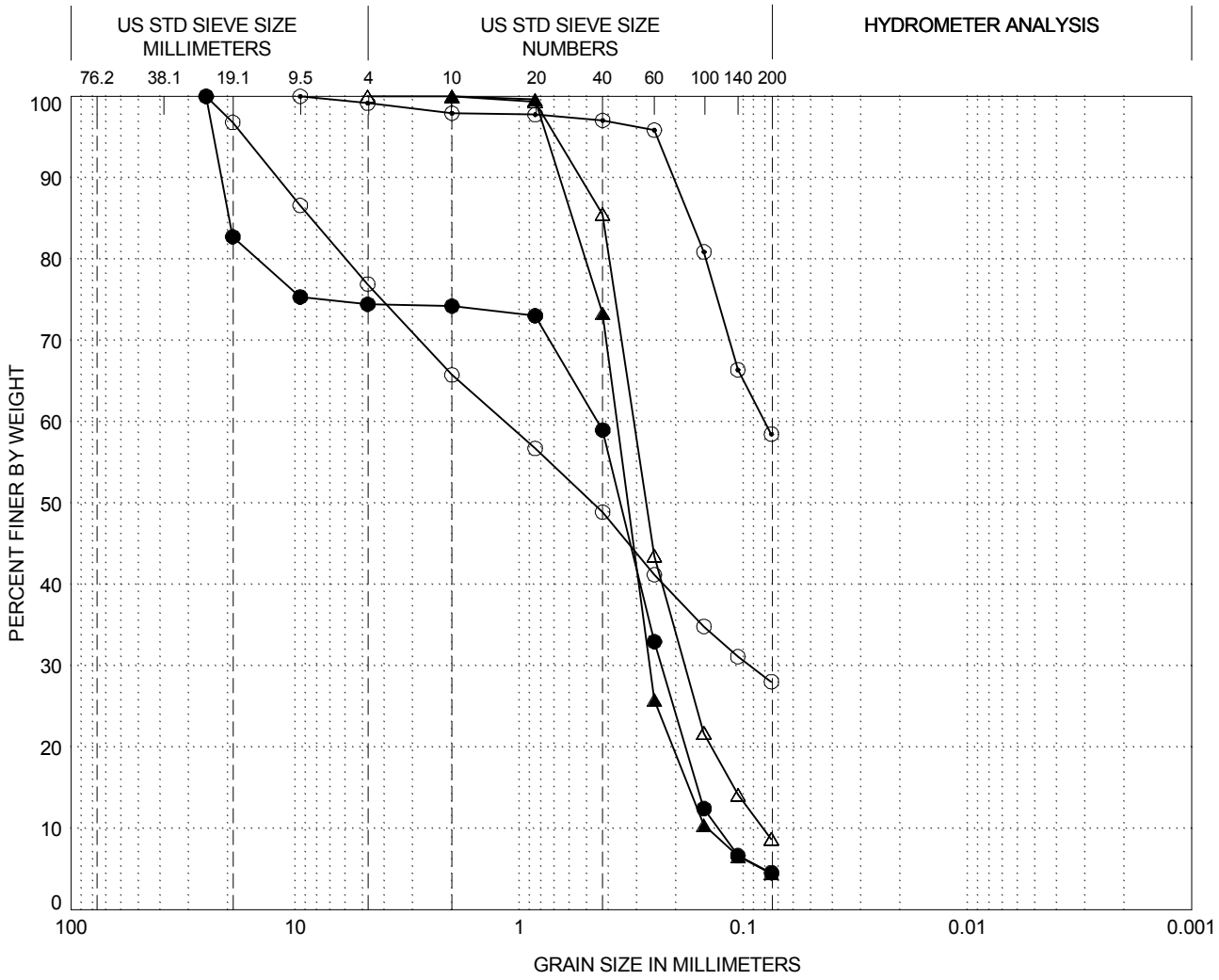


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-17	4.4	Clayey SAND with gravel (SC)			21	64	14
●	MB-17	6.9	SAND with clay (SP-SC)	1.3	2.6	0	90	9
△	MB-17	38.1	Silty SAND (SM)			0	76	24
▲	MB-17	38.1	Silty SAND (SM)			0	74	26
⊙	MB-17	129.9	Clayey SAND (SC)			0	84	16

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-24

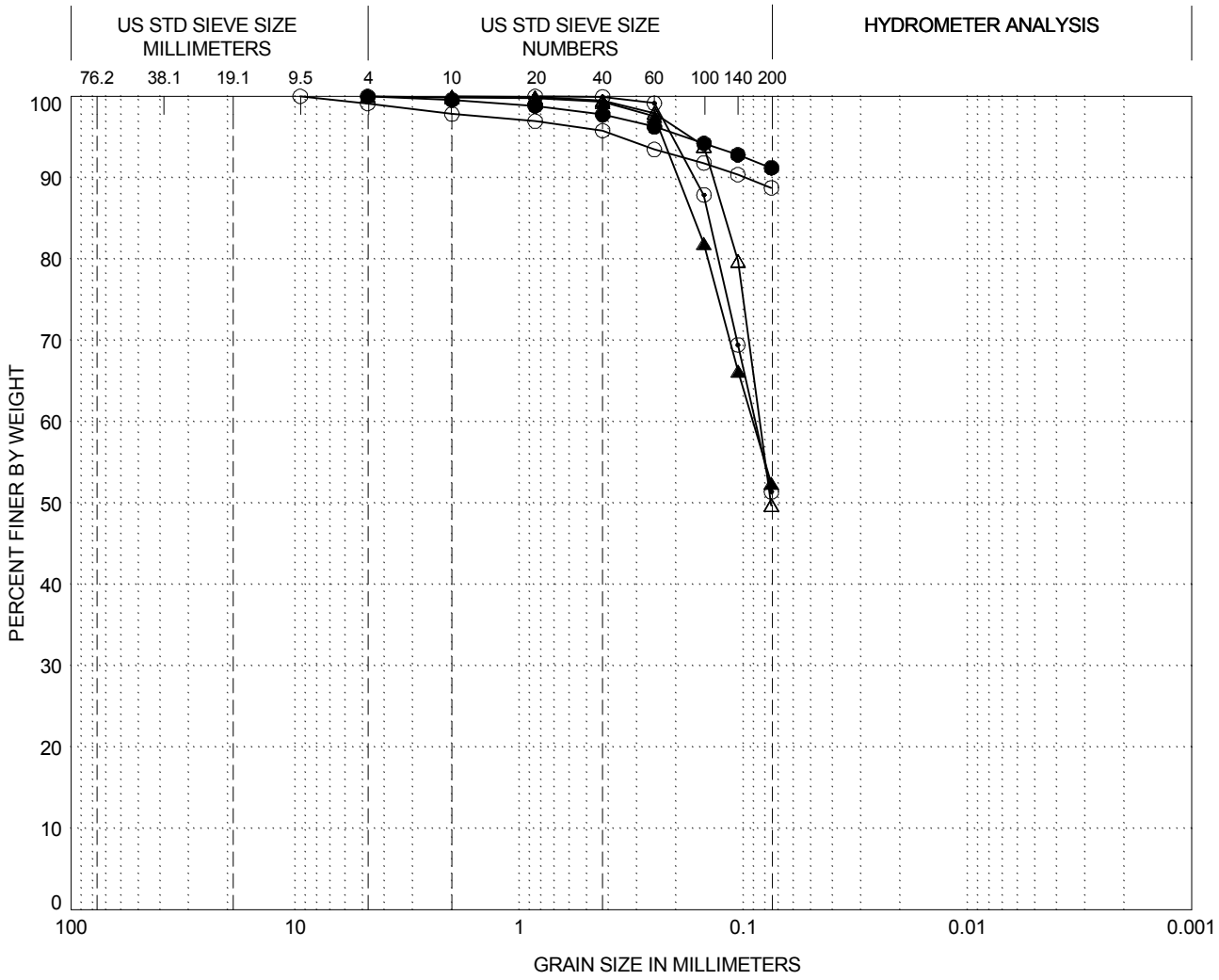


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-17	135.2	Clayey SAND with gravel (SC)			23	49	28
●	MB-17	147.3	SAND with clay and gravel (SP-SC)	0.9	3.4	26	70	5
△	MB-17	157.2	SAND with silt (SP-SM)	1.3	3.8	0	91	9
▲	MB-17	183.7	SAND (SP)	1.3	2.5	0	96	4
⊙	MB-18	0.5	Sandy SILT (ML)			1	41	58

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-25

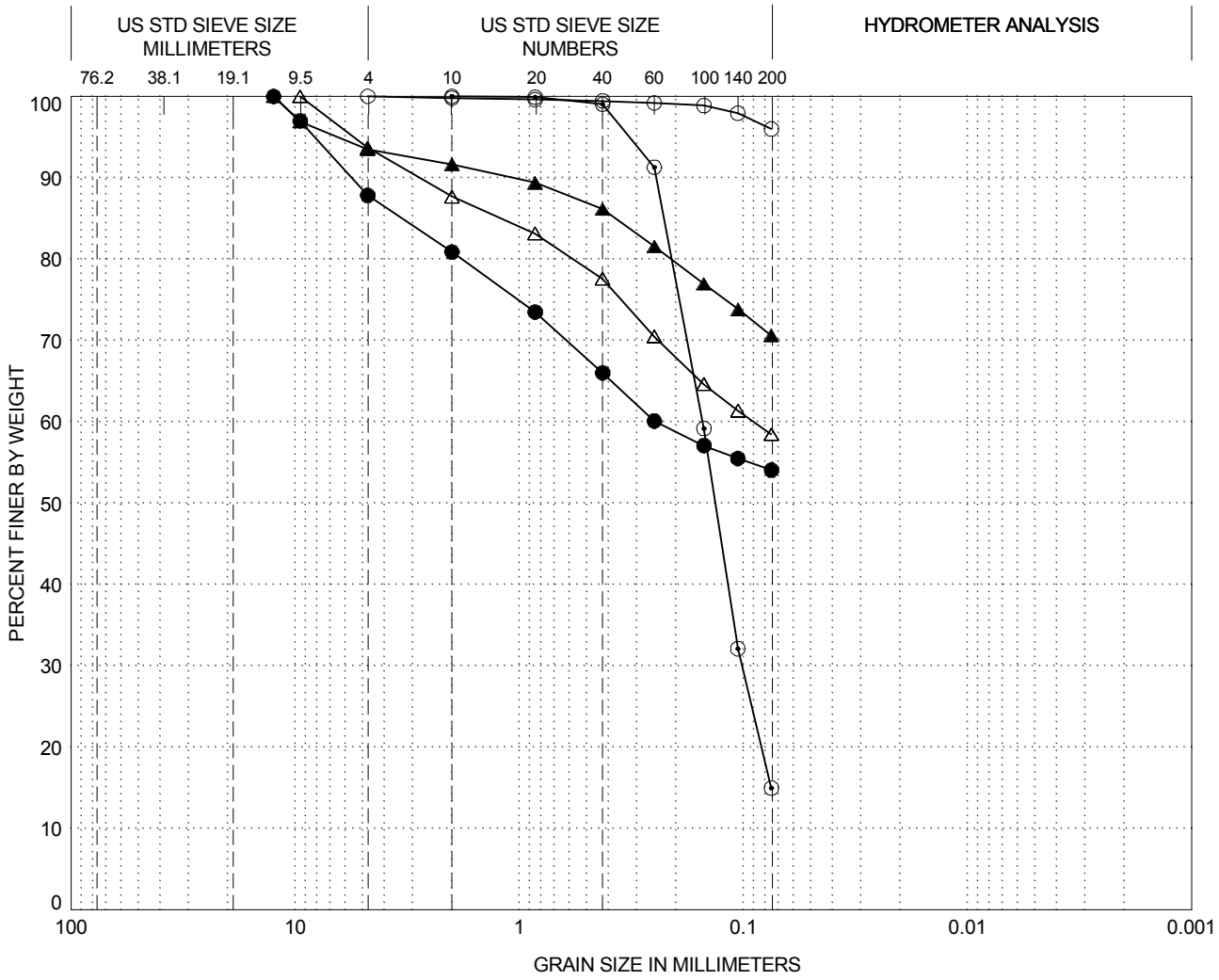


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-18	4.3	Lean CLAY (CL)			1	10	89
●	MB-18	13.5	Lean CLAY (CL)			0	9	91
△	MB-18	21.1	Sandy SILT (ML)			0	50	50
▲	MB-18	28.2	Sandy, Silty CLAY (CL-ML)			0	48	52
⊙	MB-18	35.9	Sandy SILT (ML)			0	49	51

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-26

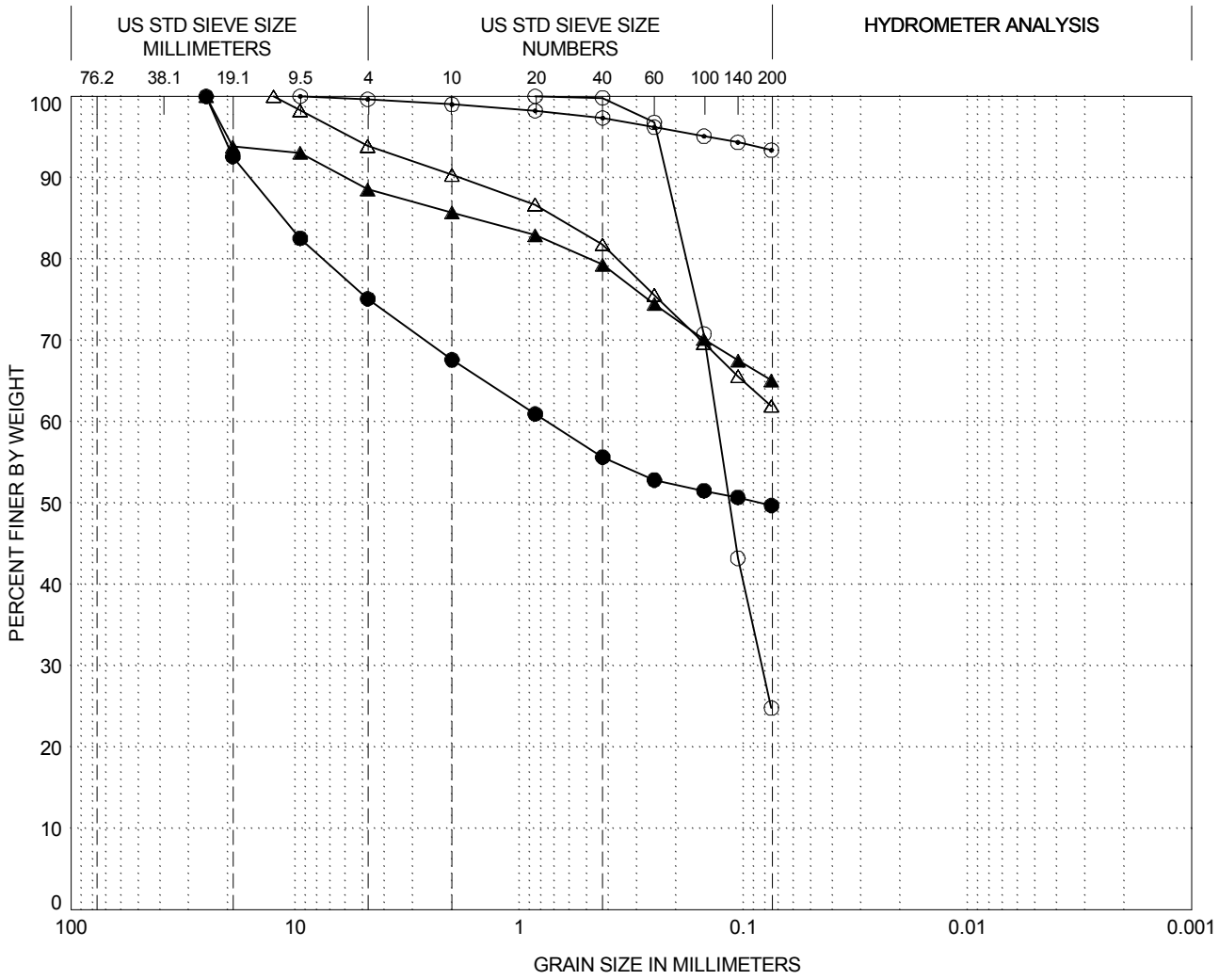


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-18	96.0	Lean CLAY (CL)			0	4	96
●	MB-18	108.9	Sandy Lean CLAY (CL)			12	34	54
△	MB-18	111.2	Sandy Lean CLAY (CL)			6	35	58
▲	MB-18	121.0	Lean CLAY with sand (CL)			6	23	71
⊙	MB-19	6.9	Silty SAND (SM)			0	85	15

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-27

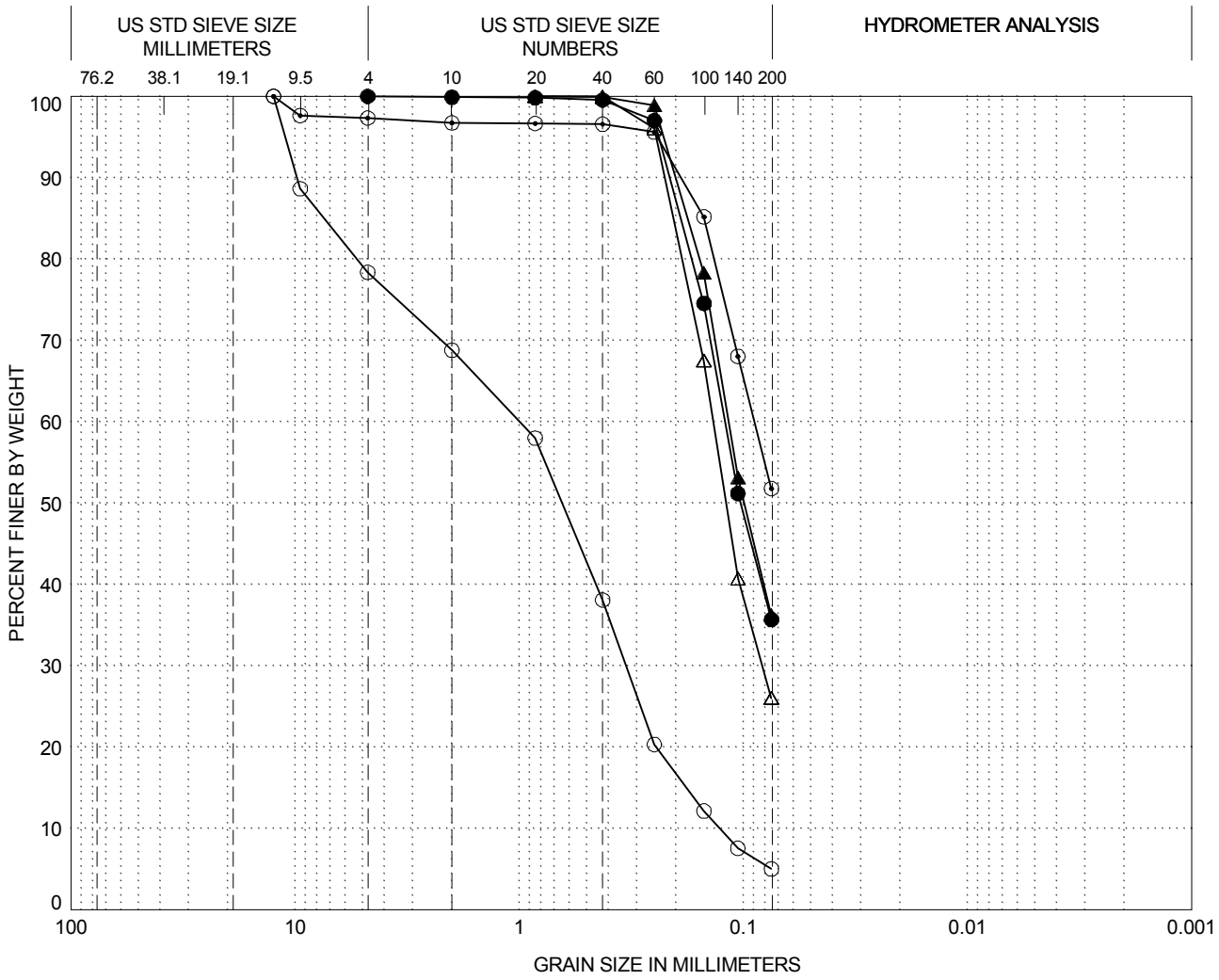


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-19	14.3	Silty SAND (SM)			0	75	25
●	MB-19	74.3	Gravelly Lean CLAY with sand (CL)			25	25	50
△	MB-19	114.0	Sandy Lean CLAY (CL)			6	32	62
▲	MB-19	127.0	Sandy Lean CLAY (CL)			11	23	65
⊙	MB-19	137.6	Lean CLAY (CL)			0	6	93

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-28

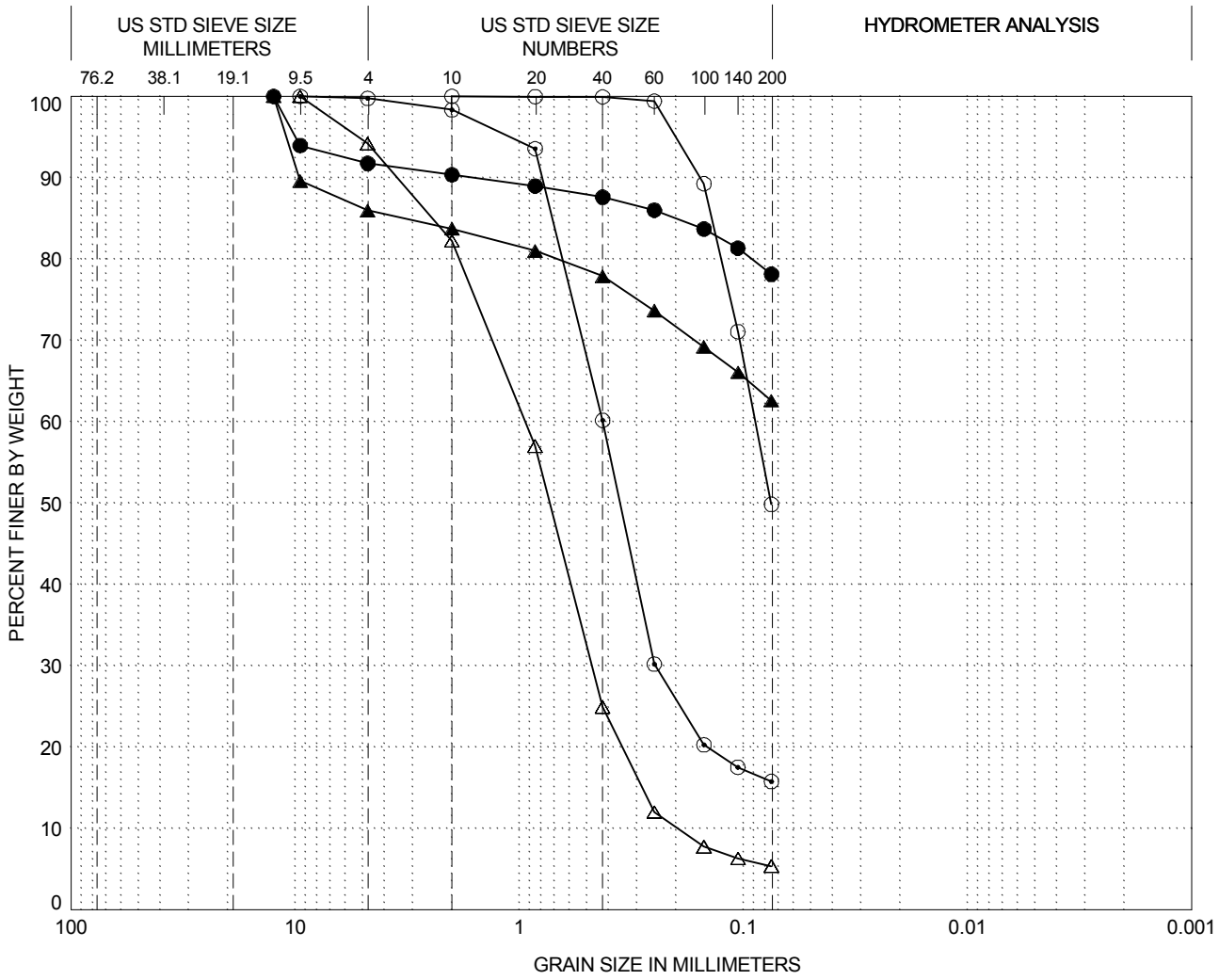


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-20	3.9	SAND with silt and gravel (SW-SM)	0.9	7.8	22	73	5
●	MB-20	24.0	Silty SAND (SM)			0	64	36
△	MB-20	46.3	Silty SAND (SM)			0	74	26
▲	MB-20	69.4	Silty SAND (SM)			0	64	36
⊙	MB-21	36.1	Sandy, Silty CLAY (CL-ML)			3	46	52

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-29

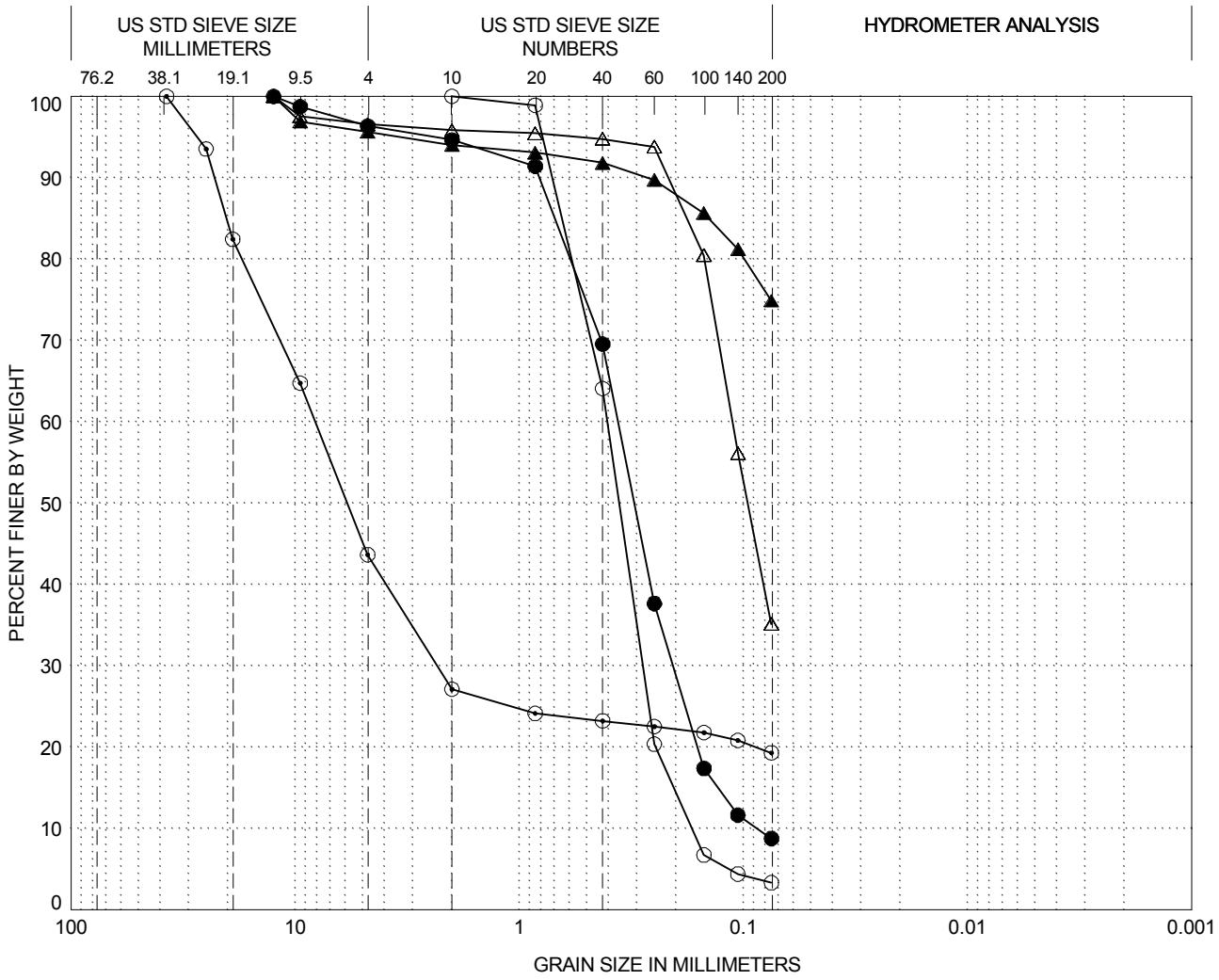


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-21	52.8	Sandy SILT (ML)			0	50	50
●	MB-22	68.2	Lean CLAY with sand (CL)			8	14	78
△	MB-22	77.1	SAND with silt (SP-SM)	1.2	4.8	6	89	5
▲	MB-22	117.5	Sandy Lean CLAY (CL)			14	23	63
⊙	MB-22	132.9	Clayey SAND (SC)			0	84	16

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-30

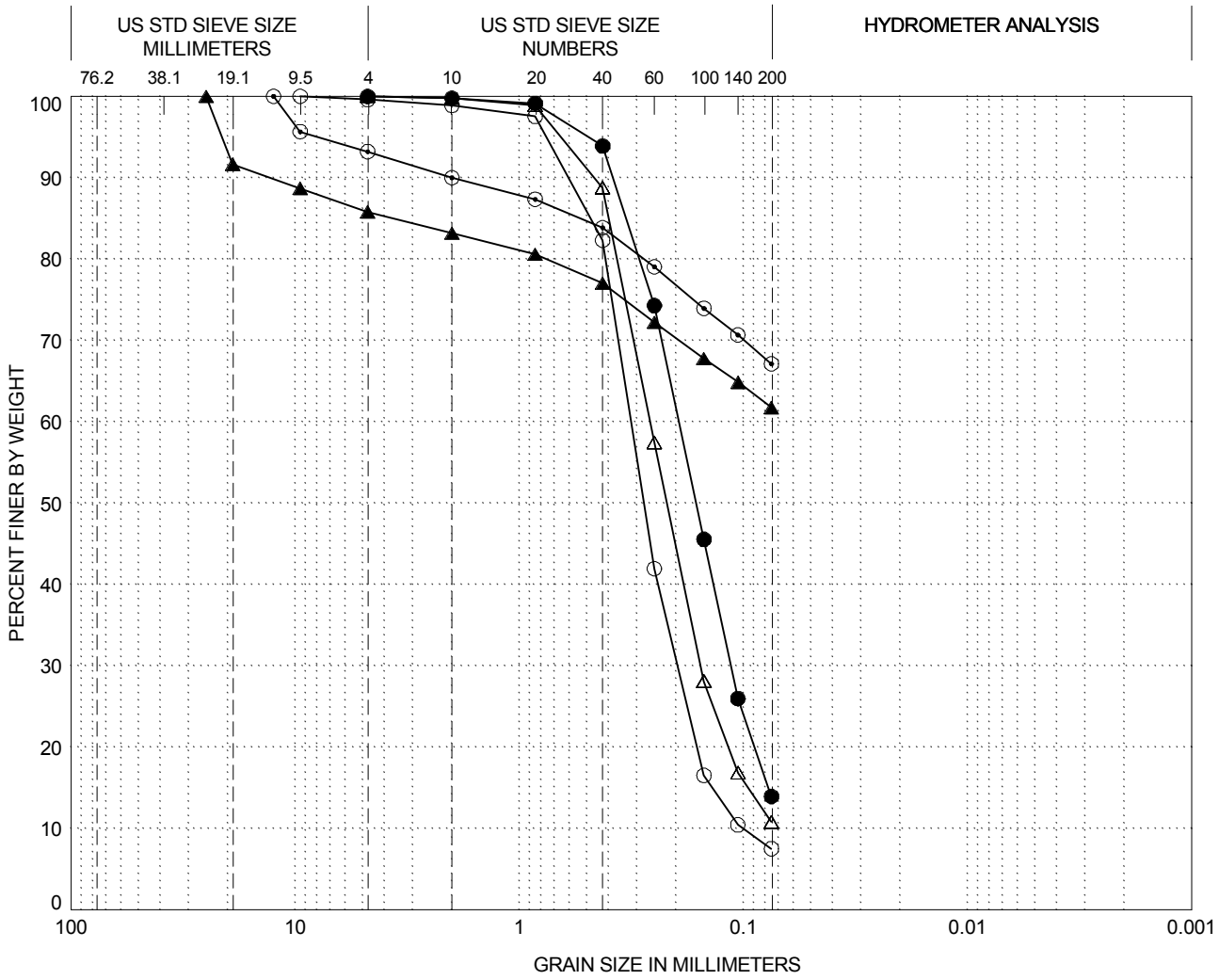


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-22	141.1	SAND (SP)	1.2	2.4	0	97	3
●	MB-22	151.3	SAND with clay (SP-SC)	1.3	4.2	4	88	9
△	MB-23	4.4	Silty SAND (SM)			3	61	35
▲	MB-23	58.1	Lean CLAY with sand (CL)			4	21	75
⊙	MB-23	86.9	Clayey GRAVEL with sand (GC)			56	24	19

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-31

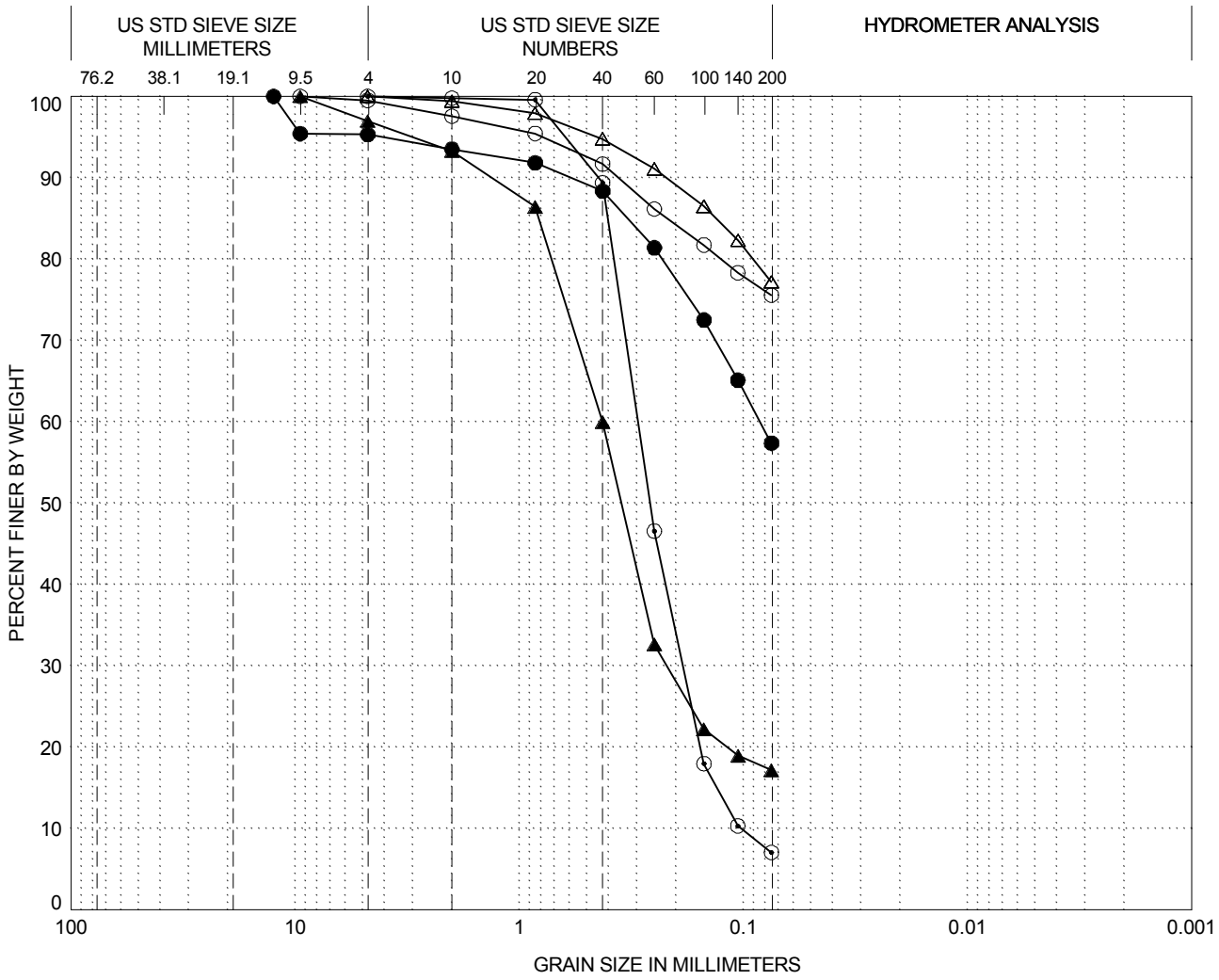


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-23	88.9	SAND with silt (SP-SM)	1.2	3.1	0	92	7
●	MB-23	93.2	SAND with silt (SP-SM)			0	86	14
△	MB-23	98.6	SAND with silt (SP-SM)	1.3	3.6	0	89	11
▲	MB-23	120.7	Sandy Lean CLAY (CL)			14	24	62
⊙	MB-23	124.0	Sandy Lean CLAY (CL)			7	26	67

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-32

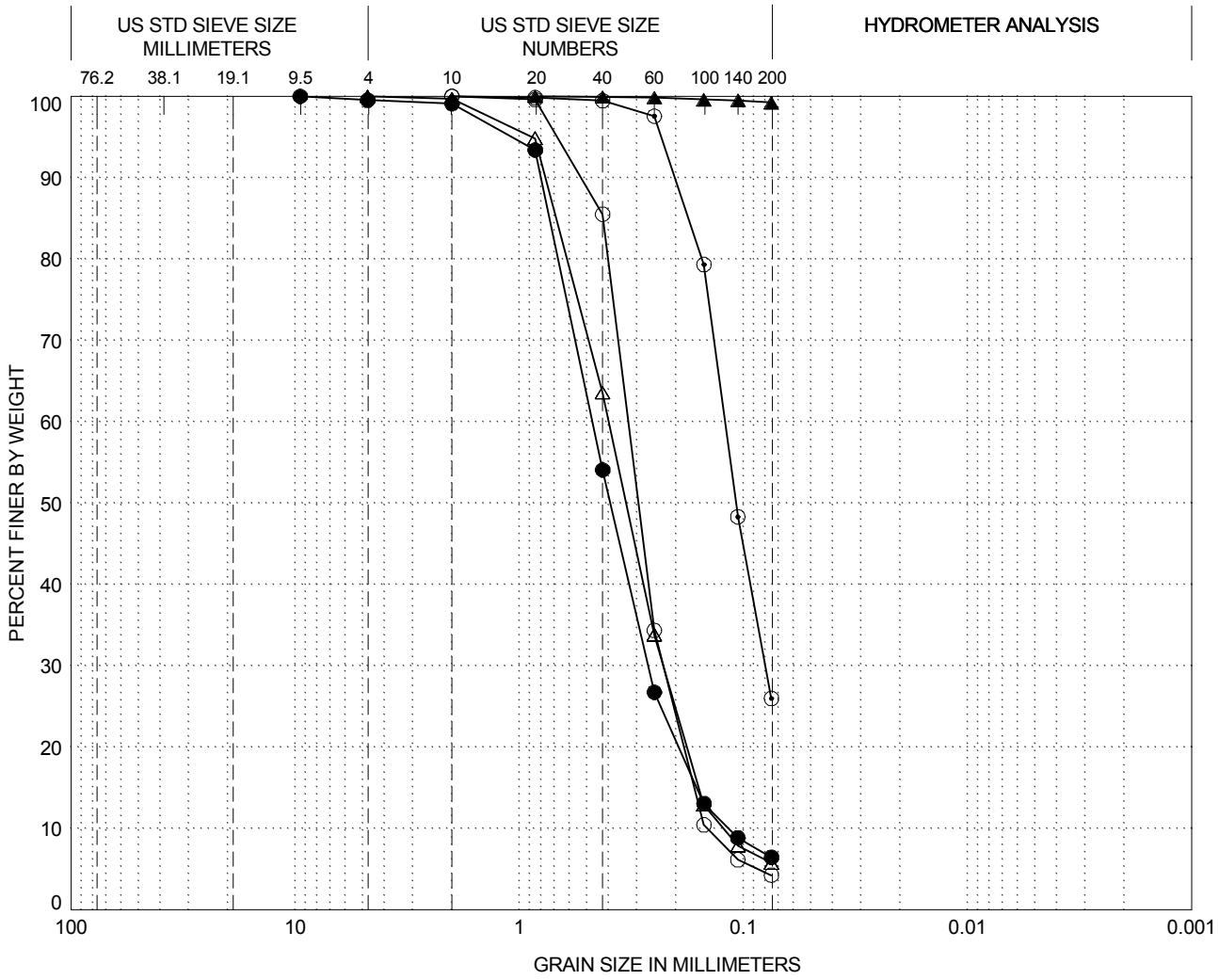


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-23	133.9	Lean CLAY with sand (CL)			0	24	76
●	MB-23	136.5	Sandy SILT (ML)			5	38	57
△	MB-23	143.0	Lean CLAY with sand (CL)			0	23	77
▲	MB-23	148.3	Clayey SAND (SC)			3	80	17
⊙	MB-23	174.2	SAND with silt (SP-SM)	1.1	2.9	0	93	7

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-33

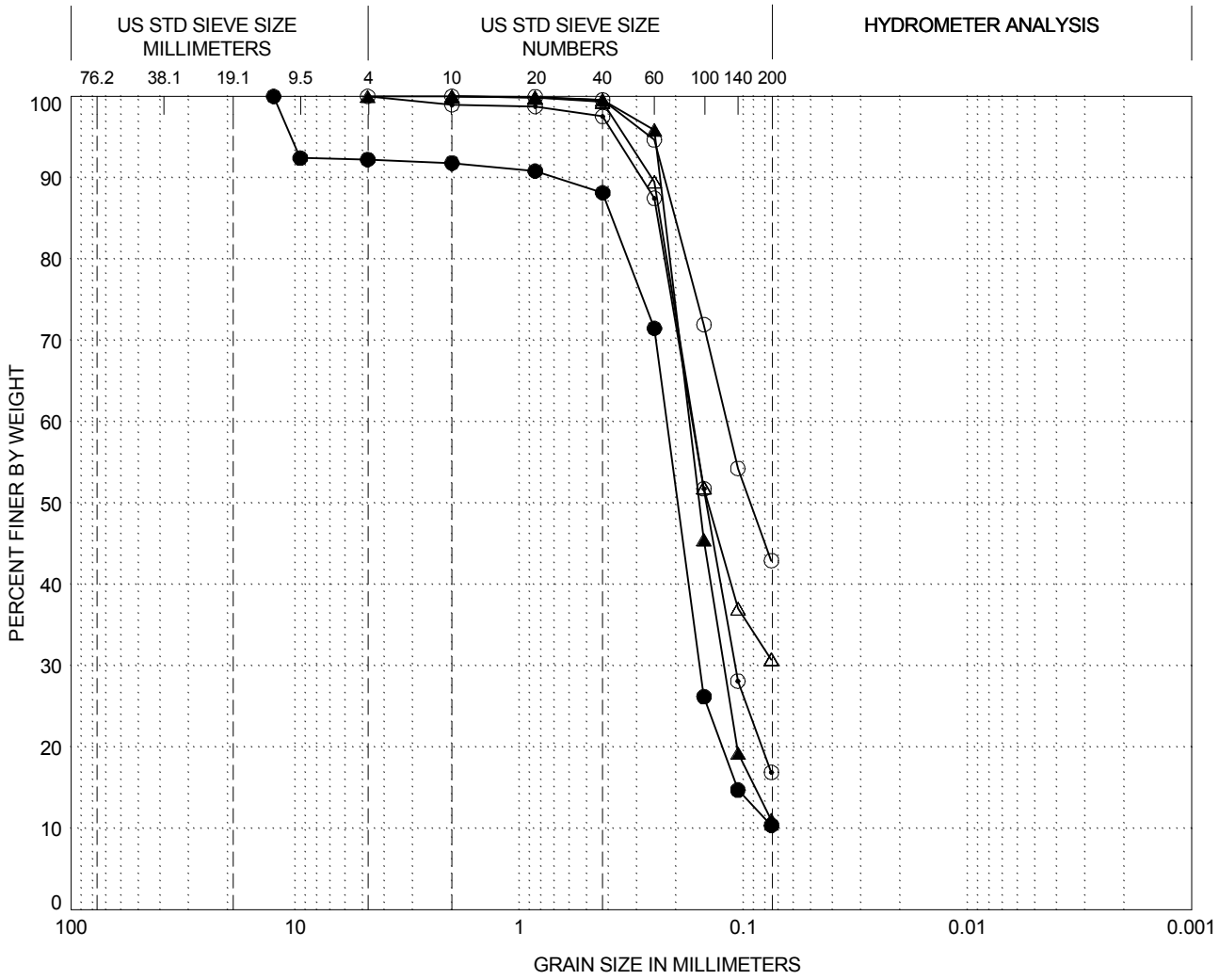


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-23	192.9	SAND (SP)	1.1	2.3	0	96	4
●	MB-23	219.2	SAND with silt (SP-SM)	1.3	4.0	0	93	6
△	MB-23	232.3	SAND with silt (SP-SM)	1.1	3.3	0	94	6
▲	MB-23	241.5	SILT (ML)			0	1	99
⊙	MB-23	259.8	Silty SAND (SM)			0	74	26

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-34

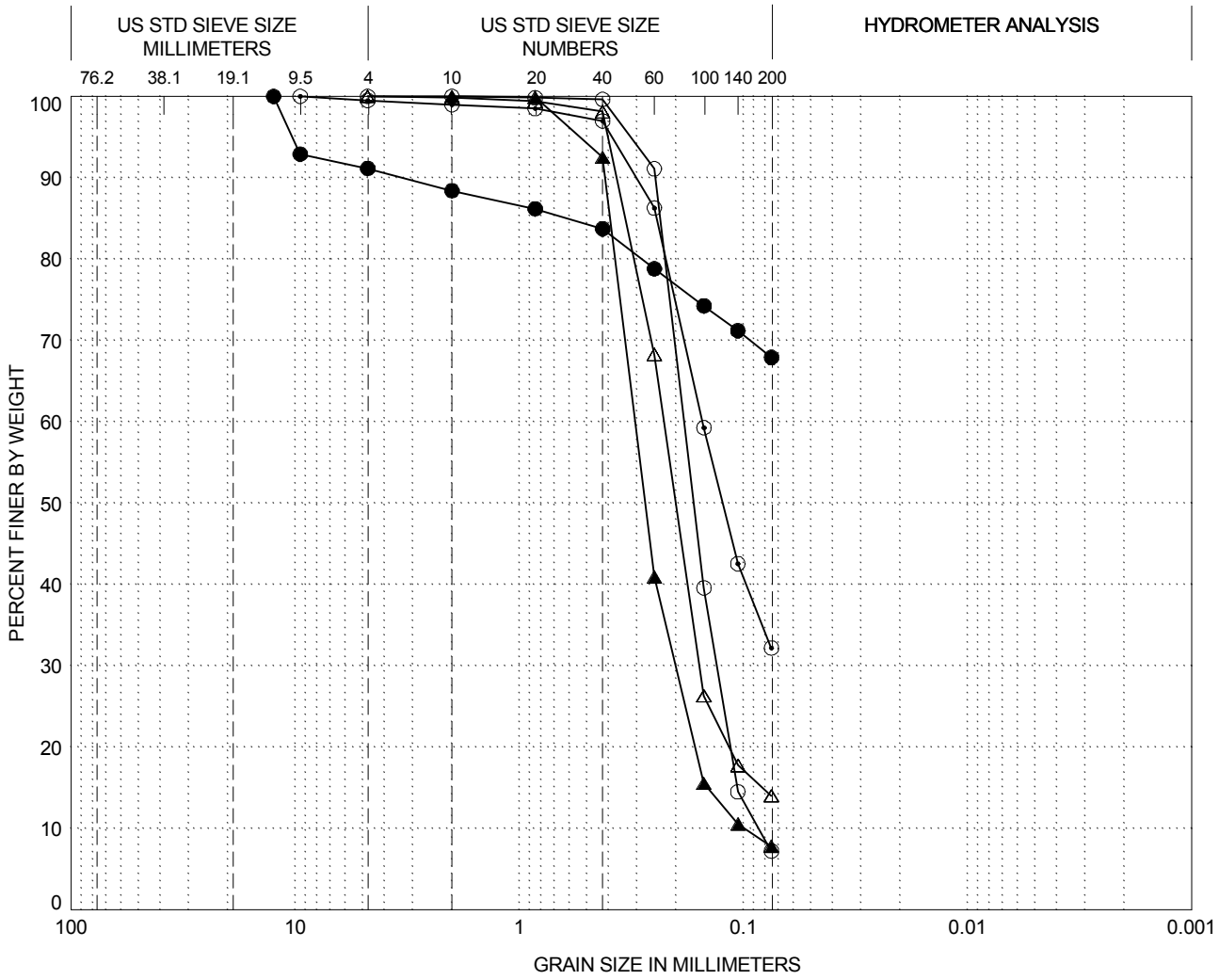


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-24	5.9	Clayey SAND (SC)			0	57	43
●	MB-24	18.5	SAND with silt (SP-SM)	1.5	3.0	8	82	10
△	MB-24	23.6	Silty SAND (SM)			0	69	31
▲	MB-24	33.3	SAND with silt (SP-SM)	1.2	2.4	0	89	11
⊙	MB-24	40.3	Silty SAND (SM)			0	83	17

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-35

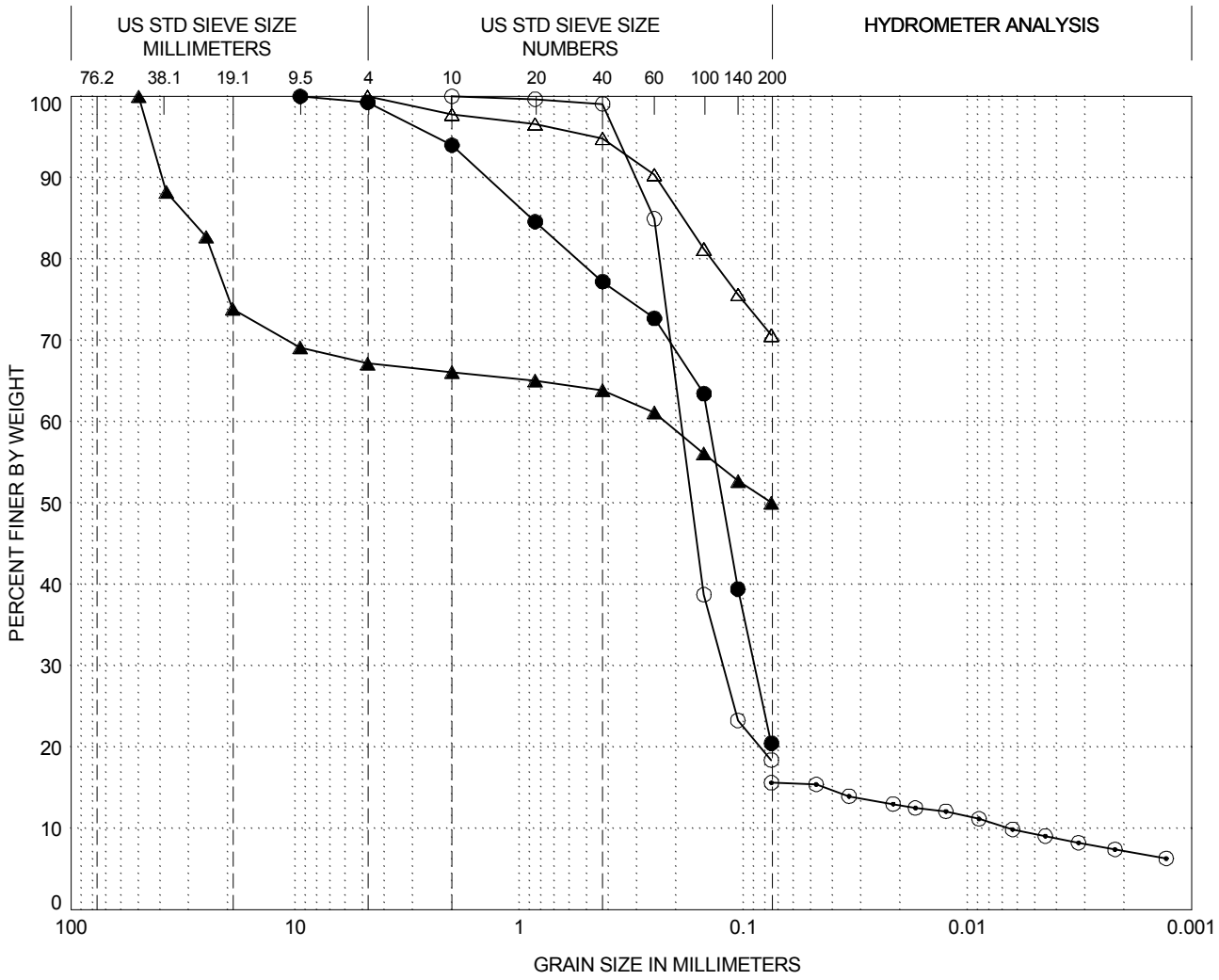


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-24	50.5	SAND with silt (SP-SM)	1.1	2.1	0	93	7
●	MB-25	1.1	Sandy Lean CLAY (CL)			9	23	68
△	MB-25	11.8	Silty, Clayey SAND (SC-SM)			0	86	14
▲	MB-25	19.2	SAND with silt (SP-SM)	1.3	3.1	0	92	8
⊙	MB-25	24.1	Clayey SAND (SC)			1	67	32

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-36

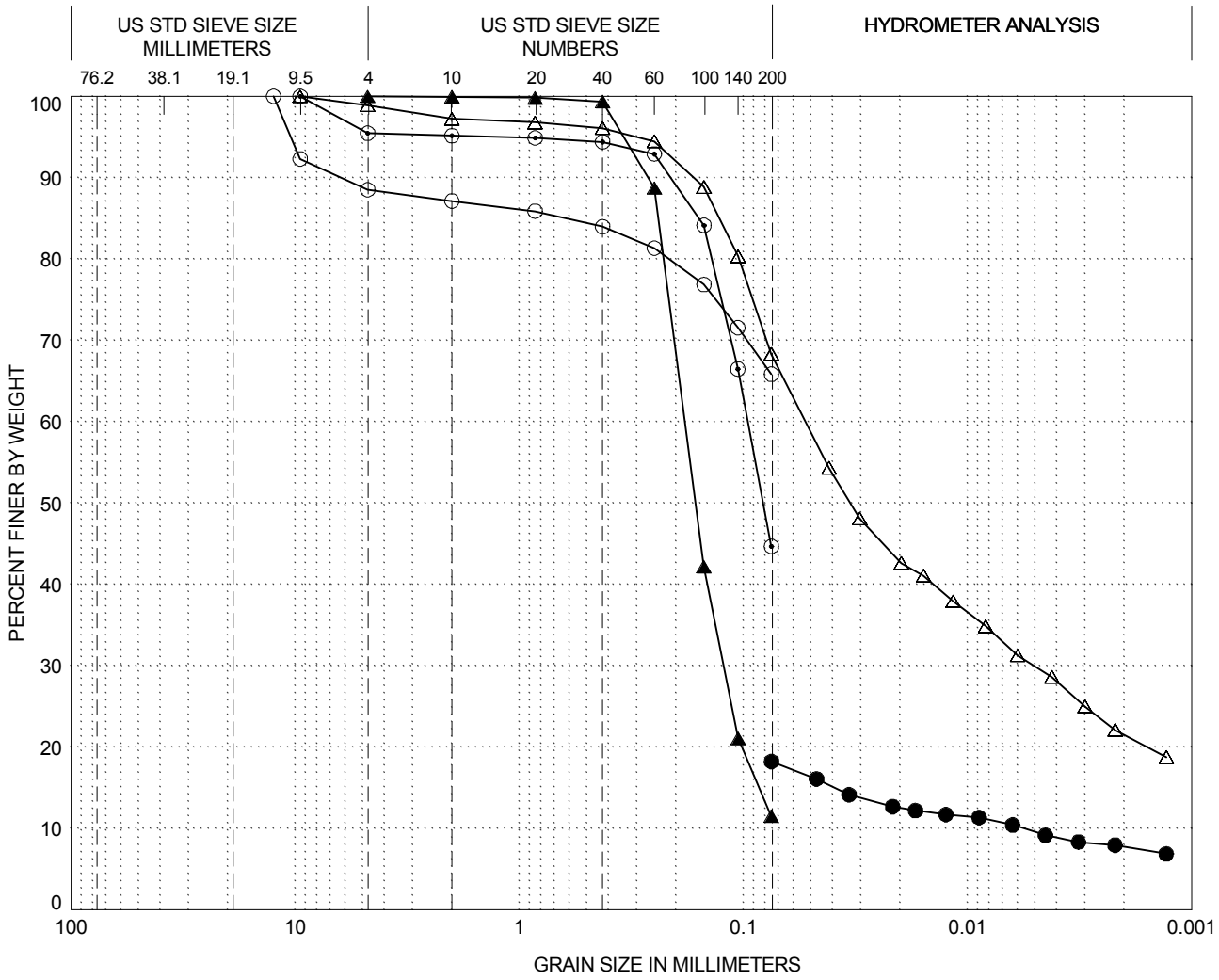


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-25	33.6	Clayey SAND (SC)			0	82	18
●	MB-25	38.7	Clayey SAND (SC)			1	79	20
△	MB-26	2.0	Lean CLAY with sand (CL)			0	29	71
▲	MB-26	4.3	Gravelly Lean CLAY with sand (CL)			33	17	50
⊙	MB-26	13.6	Clayey SAND (SC)			0	0	16

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-37

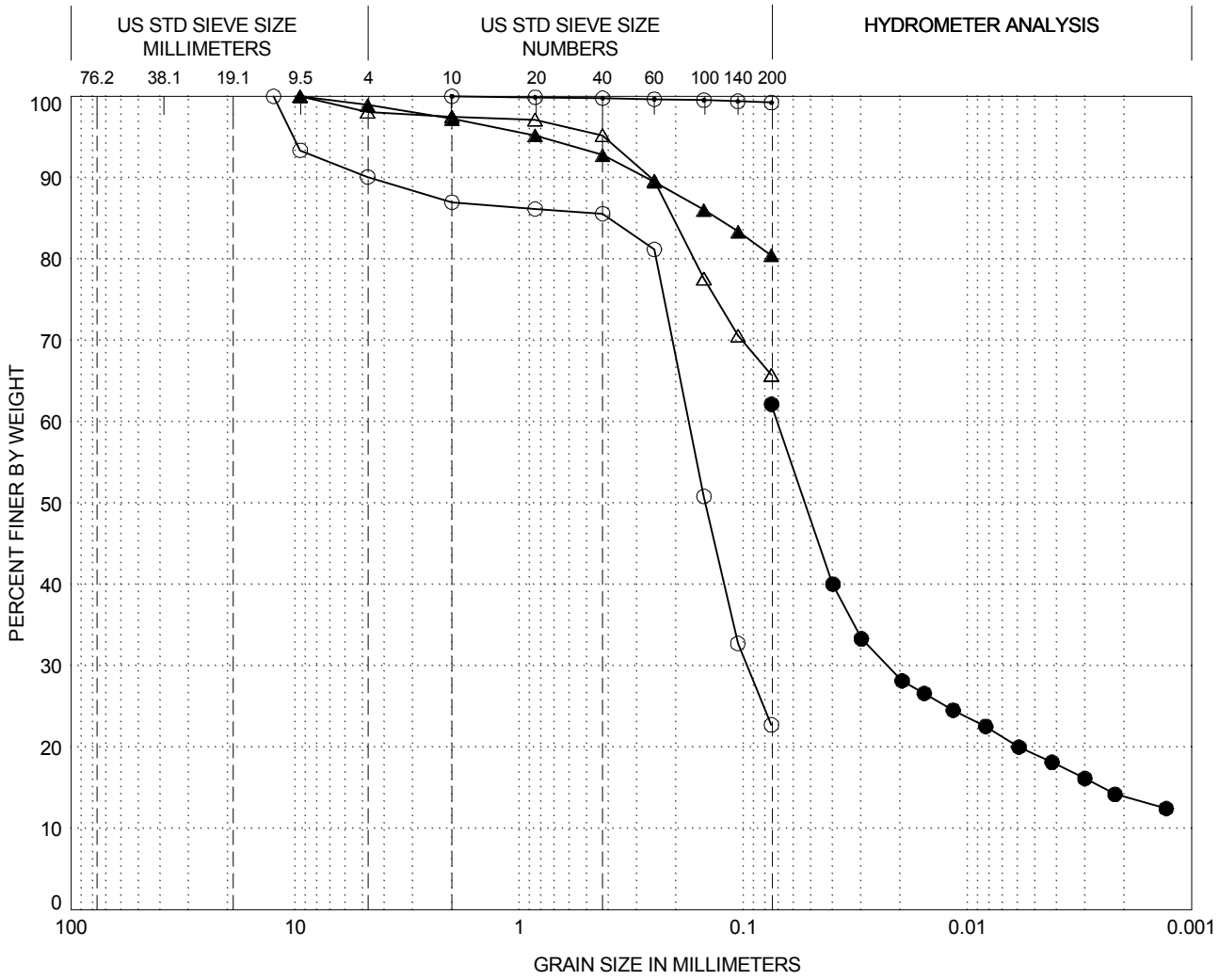


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-26	14.3	Sandy Lean CLAY (CL)			11	23	66
●	MB-26	27.2	Clayey SAND (SC)			0	0	18
△	MB-26	49.8	Sandy Lean CLAY (CL)			1	31	68
▲	MB-27	6.9	SAND with silt (SP-SM)	1.2	2.6	0	88	12
⊙	MB-27	11.8	Silty SAND (SM)			5	51	45

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-38

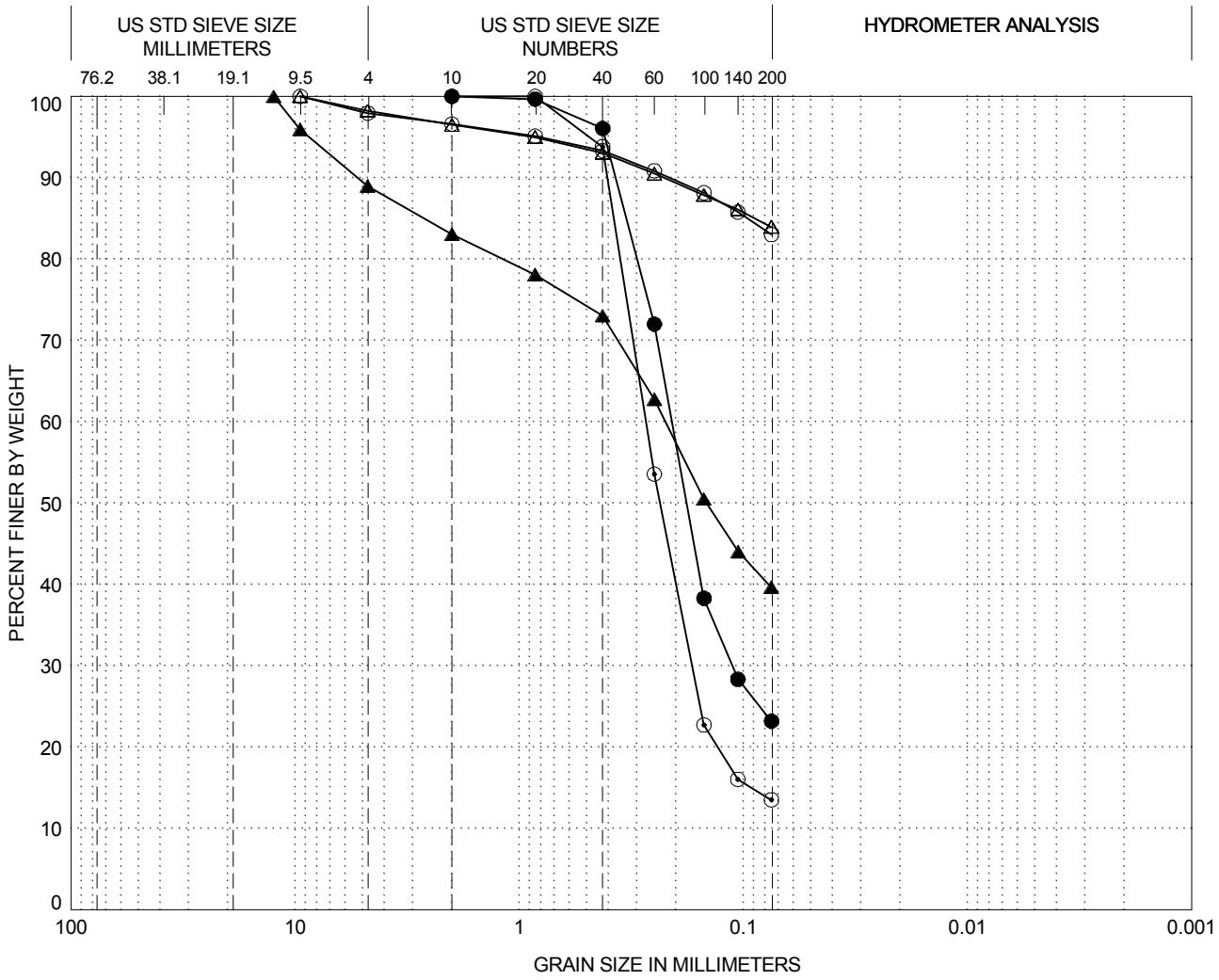


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-27	14.3	Silty SAND (SM)			10	67	23
●	MB-27	18.5	Sandy Lean CLAY (CL)			0	0	62
△	MB-27	39.1	Sandy Lean CLAY (CL)			2	32	66
▲	MB-27	59.7	Lean CLAY with gravel (CL)			1	18	80
⊙	MB-27	63.0	Fat CLAY (CH)			0	1	99

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-39

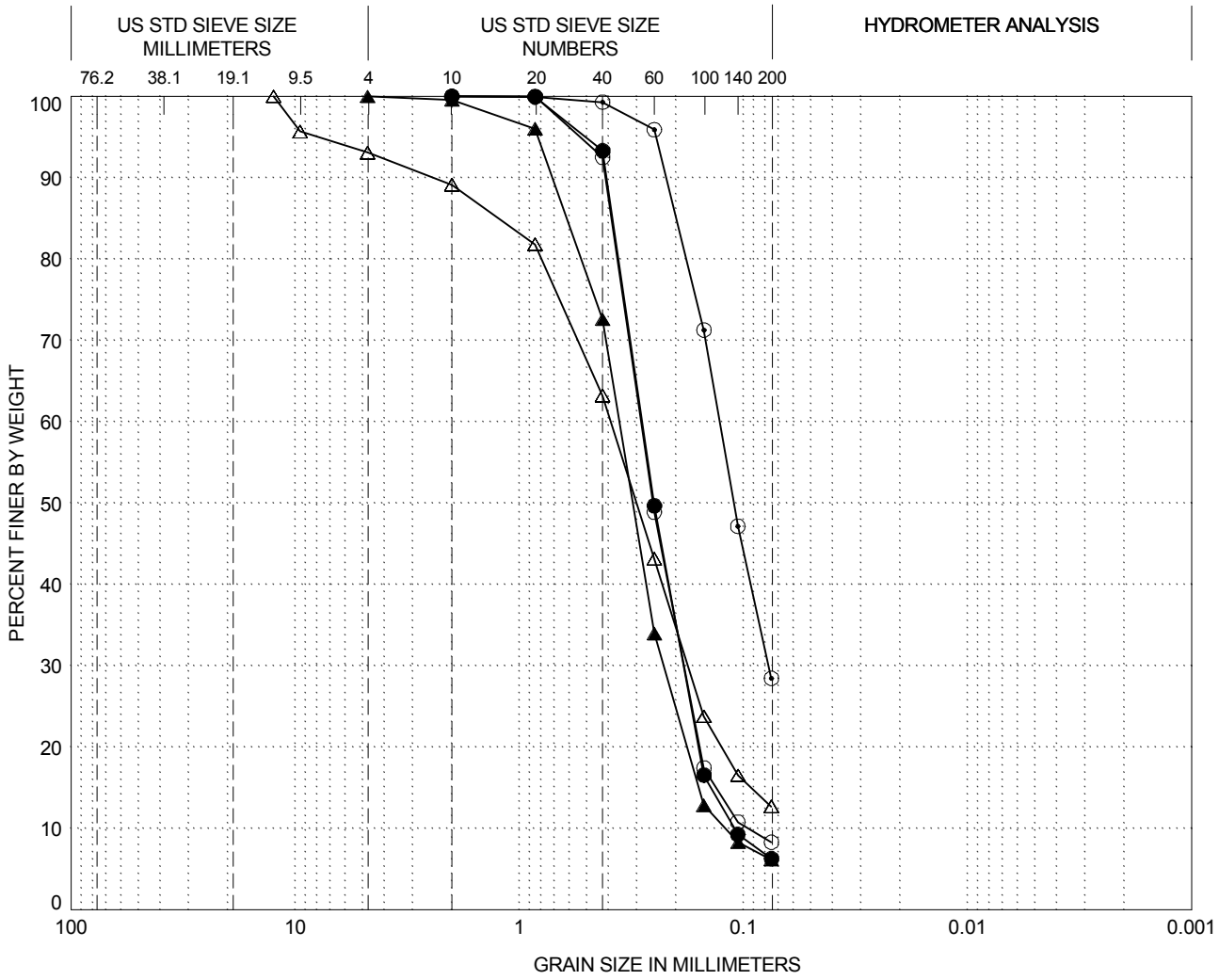


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-27	72.8	Lean CLAY with sand (CL)			2	15	83
●	MB-27	86.6	Clayey SAND (SC)			0	77	23
△	MB-27	97.1	Lean CLAY with sand (CL)			2	14	84
▲	MB-27	101.7	Clayey SAND (SC)			11	49	40
⊙	MB-27	121.1	Clayey SAND (SC)			0	86	14

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-40

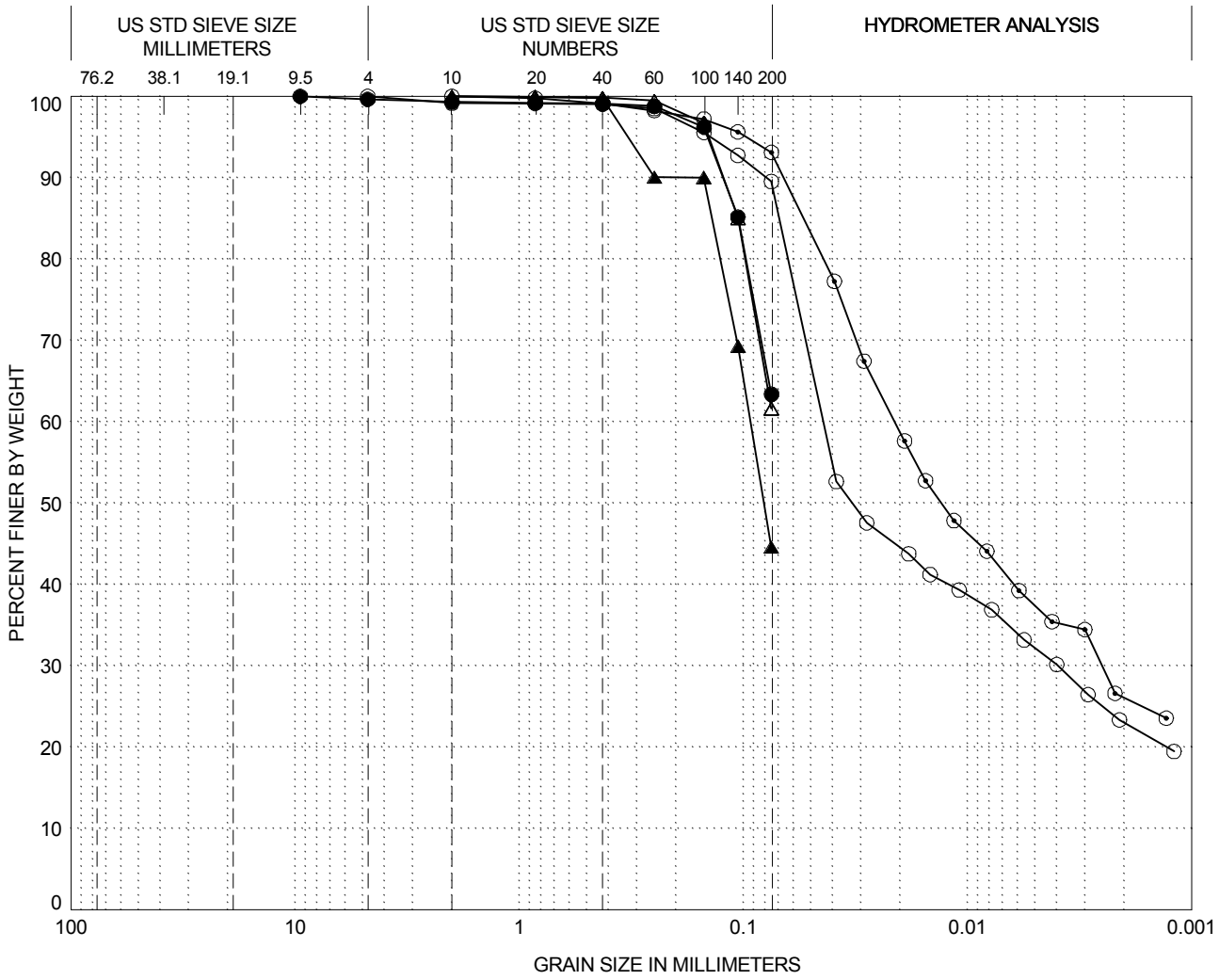


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-27	121.4	SAND with clay (SP-SC)	1.2	3.0	0	92	8
●	MB-27	121.4	SAND with clay (SP-SC)	1.1	2.6	0	94	6
△	MB-27	137.1	Clayey SAND (SC)			7	80	13
▲	MB-27	150.3	SAND with clay (SP-SC)	1.2	3.0	0	94	6
⊙	MB-28	4.4	Silty SAND (SM)			0	72	28

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-41

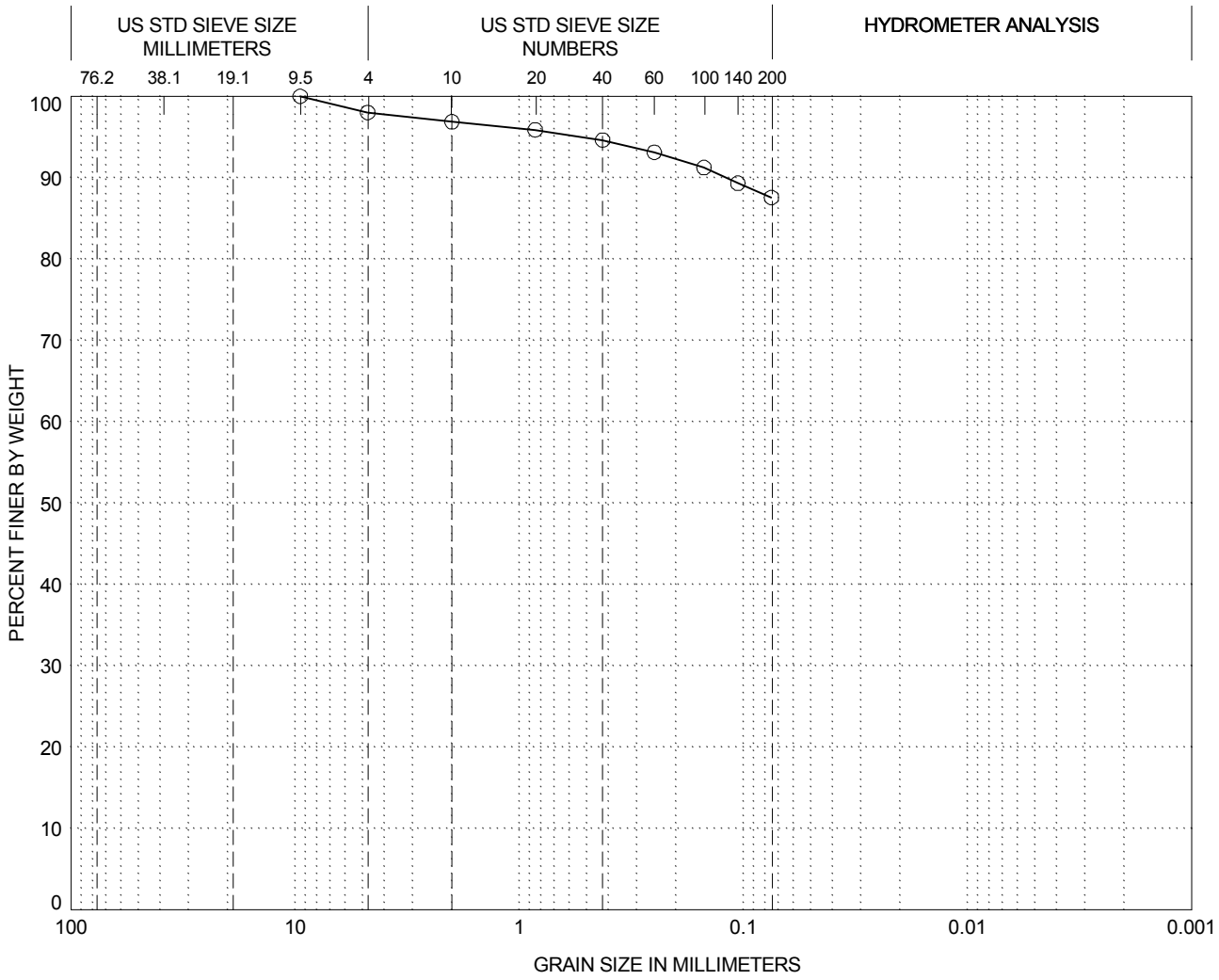


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-28	11.8	Lean CLAY (CL)			0	10	90
●	MB-28	22.5	Sandy Lean CLAY (CL)			0	36	63
△	MB-28	50.4	Sandy Lean CLAY (CL)			0	38	62
▲	MB-31	4.4	Silty SAND (SM)			0	55	45
⊙	MB-31	13.8	Lean CLAY (CL)			0	7	93

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-42

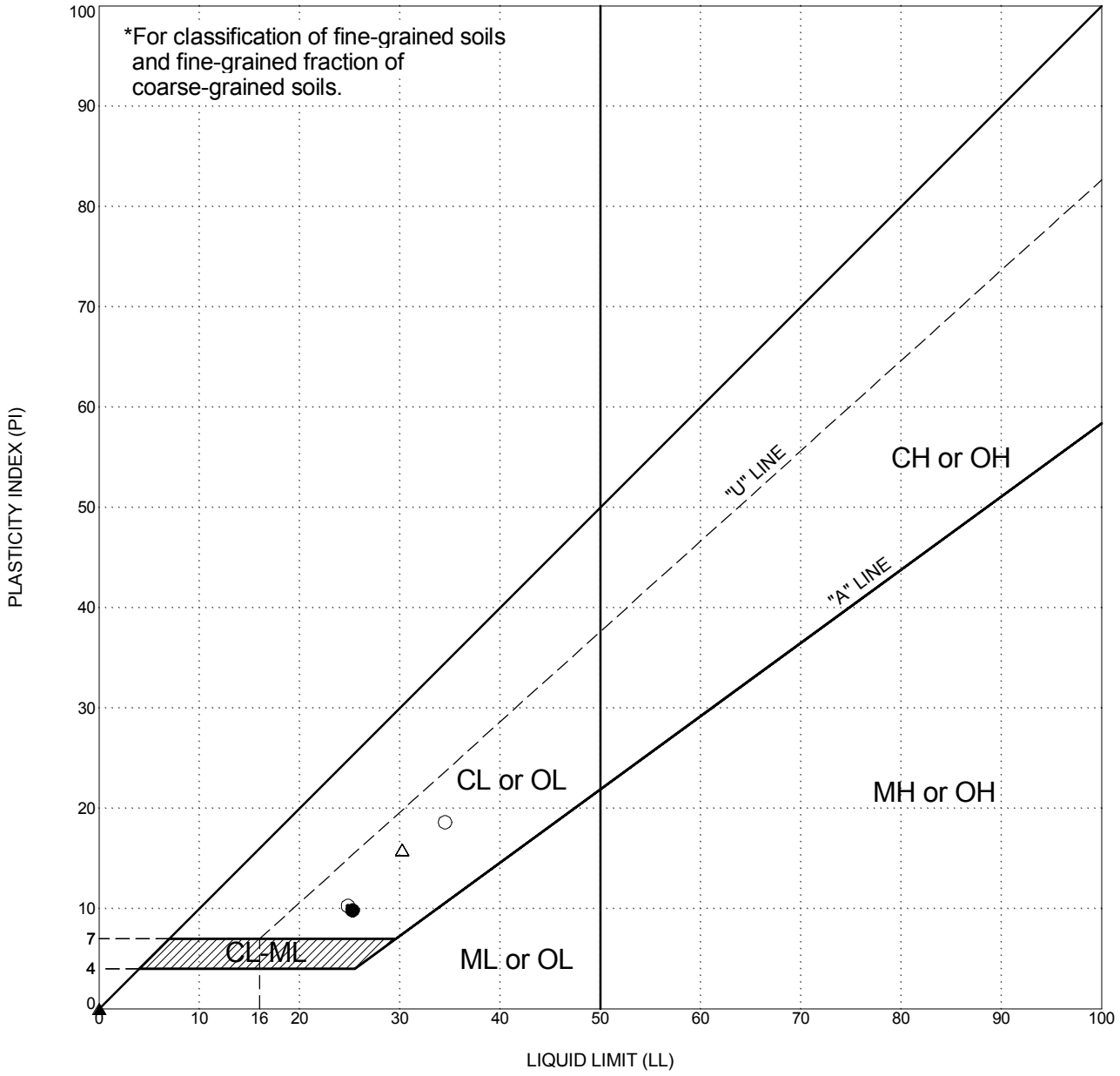


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	MB-31	22.7	Lean CLAY (CL)			2	10	88

GRAIN SIZE CURVES
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E2-43

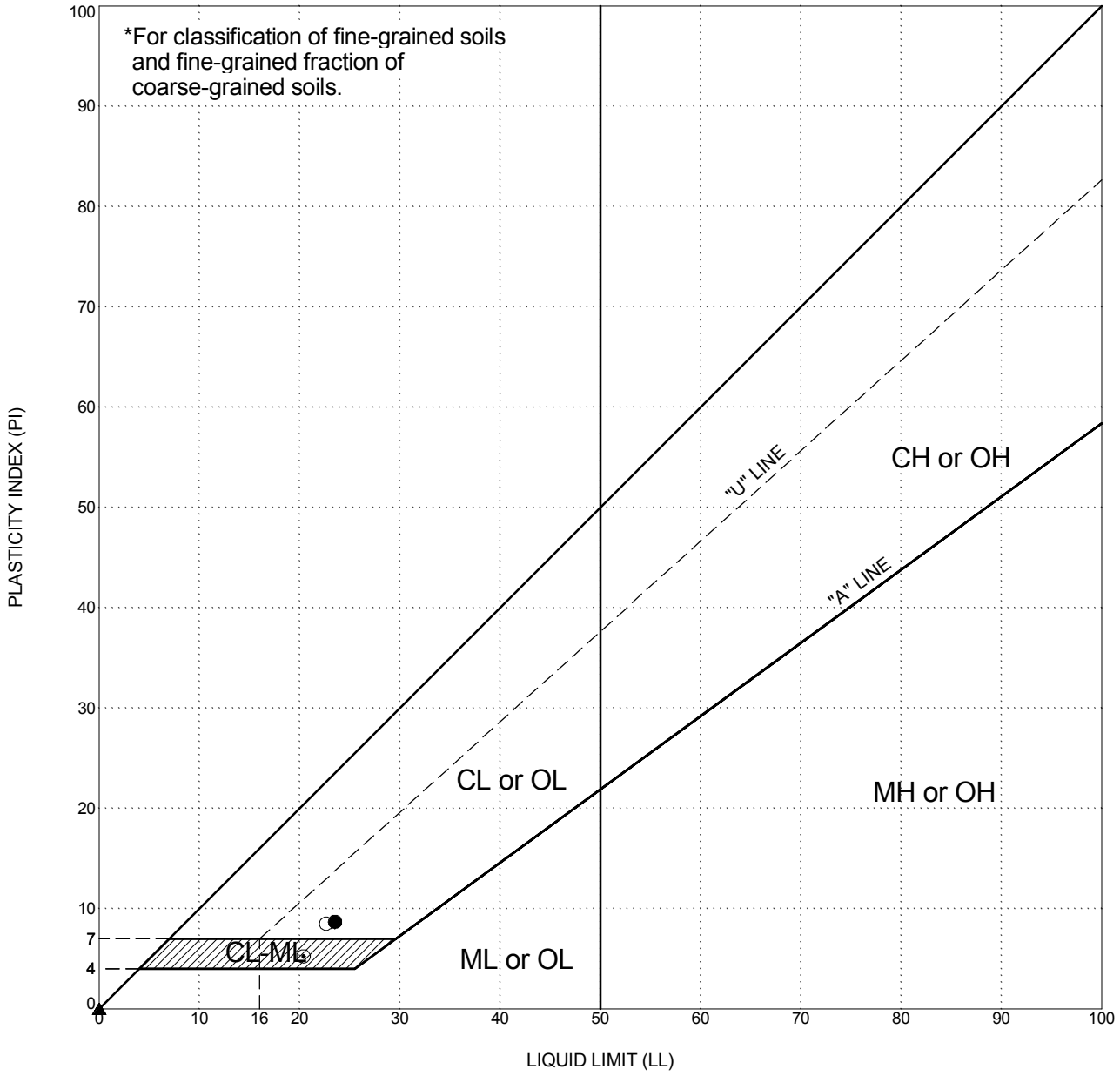


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-02	11.8	Sandy Lean CLAY (CL)	34	16	18	67
●	MB-02	21.7	Sandy Lean CLAY (CL)	25	15	10	63
△	MB-02	26.6	Sandy Lean CLAY (CL)	30	14	16	67
▲	MB-02	30.0	Sandy Lean CLAY (CL)	NP	NP	NP	
⊙	MB-02	34.8	Lean CLAY (CL)	25	15	10	92

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-1



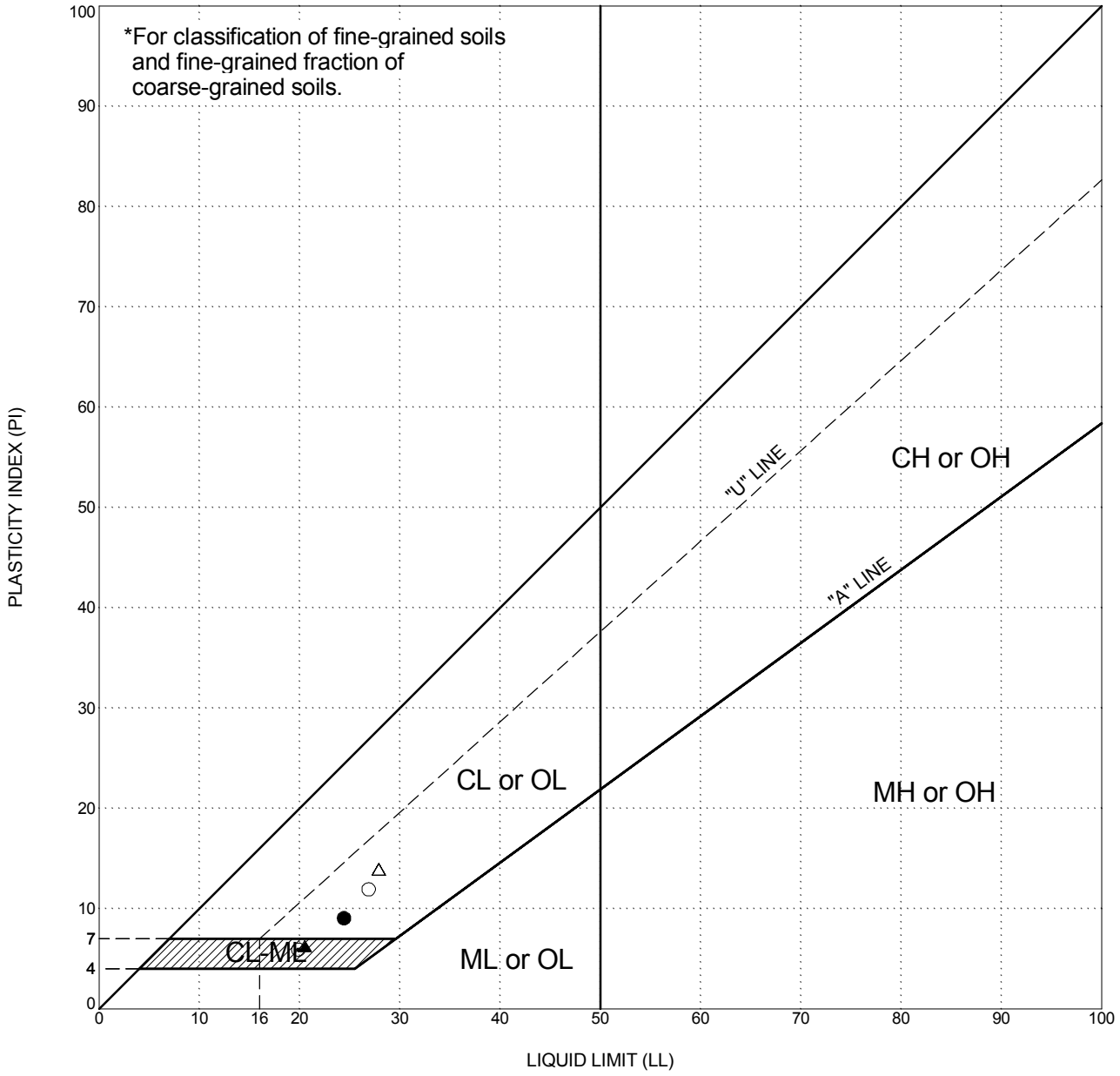
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-02	42.2	Sandy Lean CLAY (CL)	23	14	9	64
●	MB-02	47.1	Sandy Lean CLAY (CL)	24	15	9	70
△	MB-03	6.9	Silty SAND (SM)	NP	NP	NP	42
▲	MB-03	19.1	Silty SAND (SM)	NP	NP	NP	21
⊙	MB-03	40.7	Silty, Clayey SAND (SC-SM)	20	15	5	49

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-2



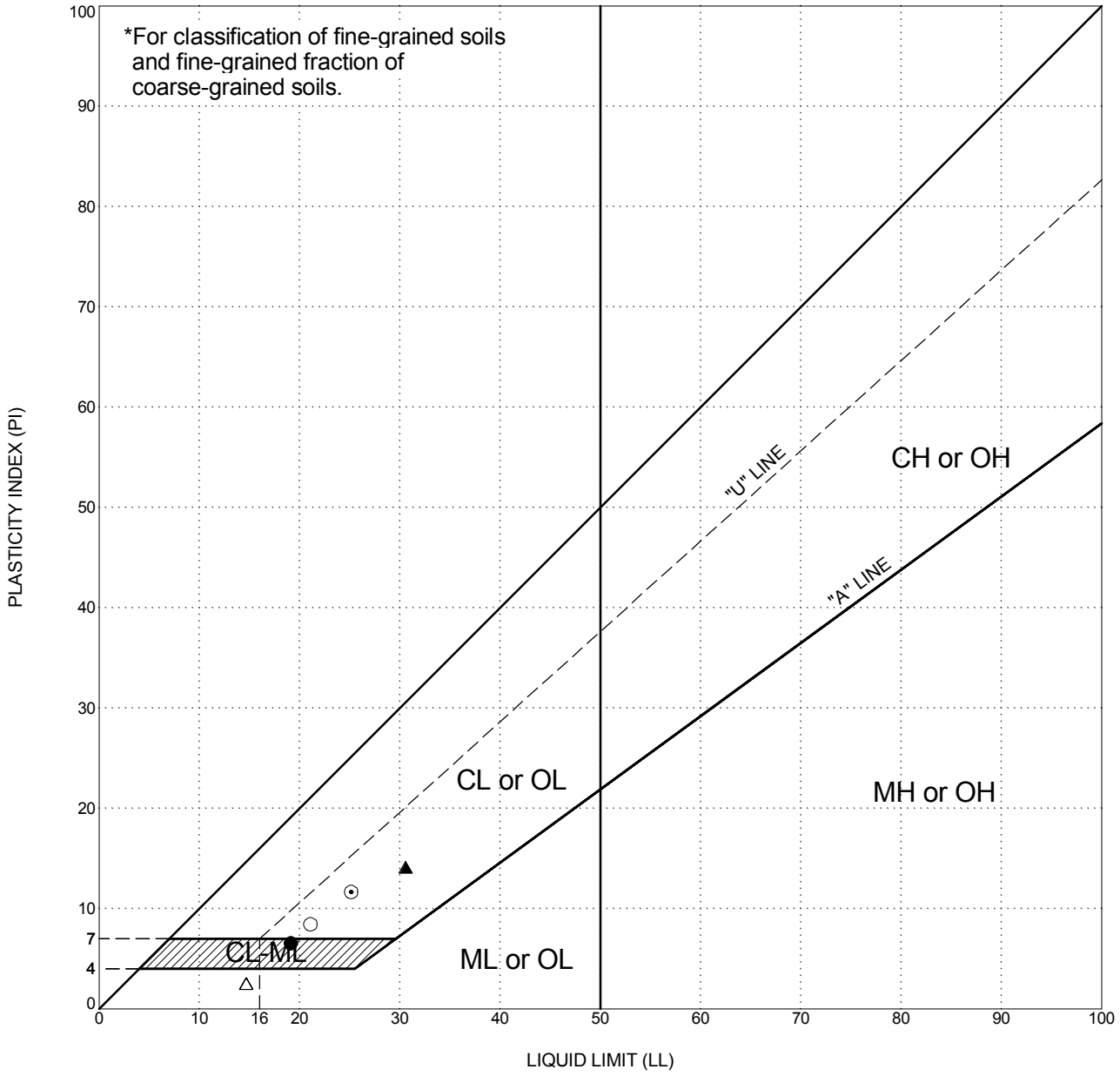
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-03	46.0	Sandy Lean CLAY (CL)	27	15	12	62
●	MB-03	50.2	Sandy Lean CLAY (CL)	24	15	9	63
△	MB-03	61.5	Lean CLAY with sand (CL)	28	14	14	73
▲	MB-03	75.7	Sandy Lean CLAY (CL)	20	14	6	66
⊙	MB-03	76.1	Sandy Lean CLAY (CL)	20	14	6	66

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-3

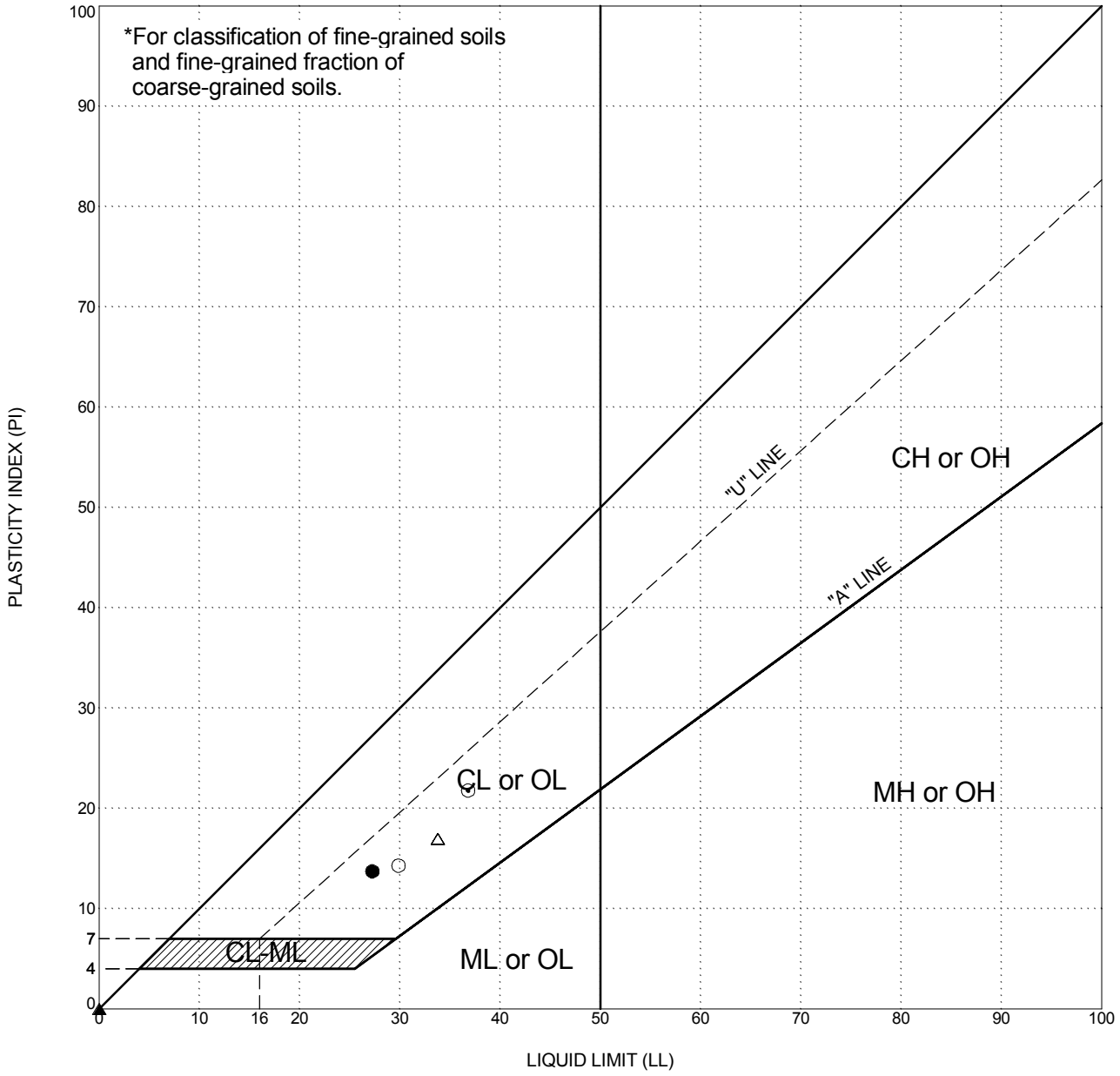


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-03	76.6	Sandy Lean CLAY (CL)	21	13	8	65
●	MB-03	91.4	Sandy, Silty CLAY (CL-ML)	19	13	6	62
△	MB-03	95.1	Sandy SILT (ML)	15	12	3	50
▲	MB-03	116.0	Lean CLAY (CL)	31	16	15	97
⊙	MB-03	125.7	Clayey SAND with gravel (SC)	25	13	12	45

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-4

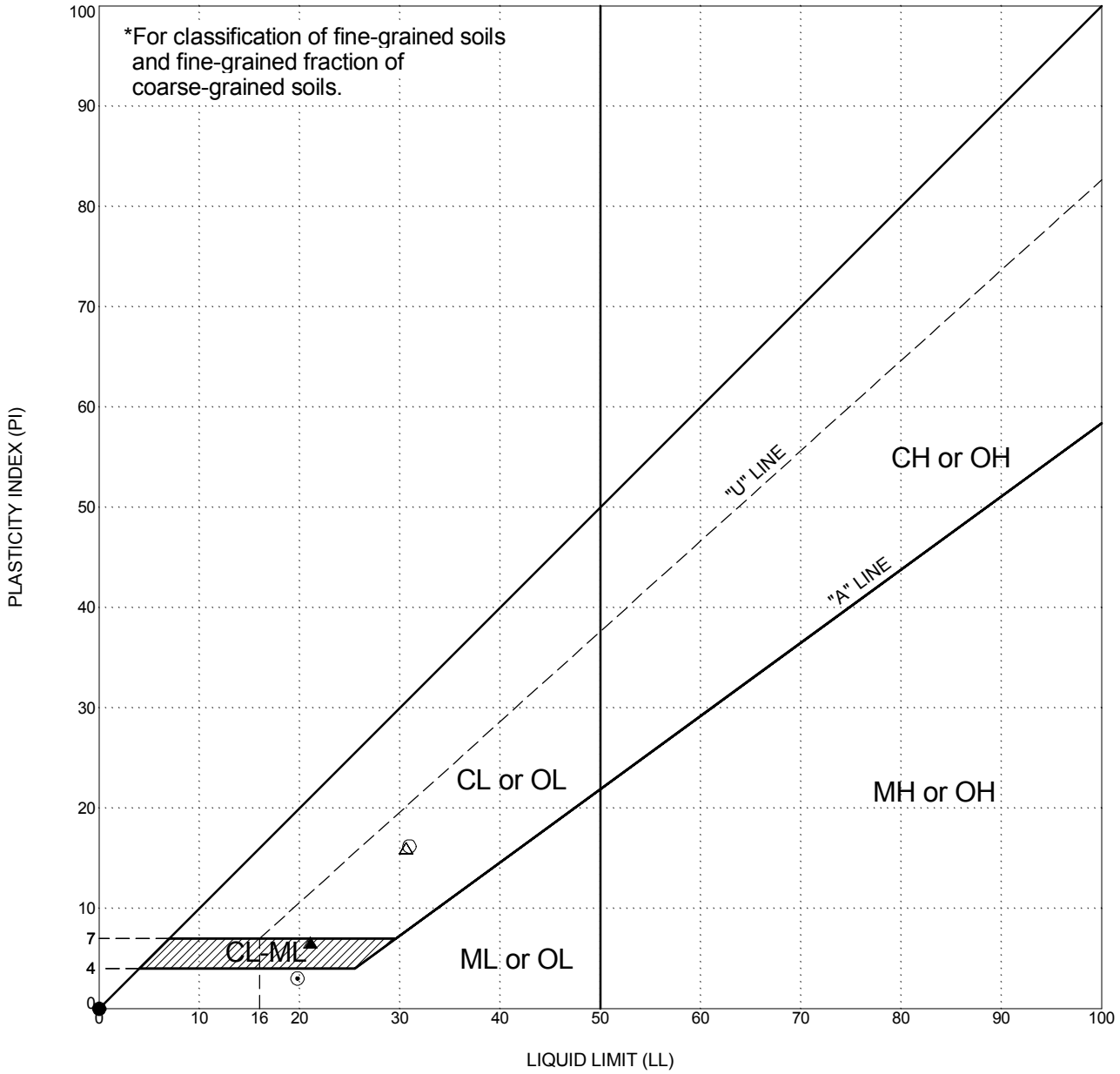


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-03	140.8	Sandy Lean CLAY (CL)	30	16	14	66
●	MB-03	145.3	Clayey SAND with gravel (SC)	27	14	13	42
△	MB-04	3.0	Sandy SILT (ML)	34	17	17	55
▲	MB-04	22.0	Silty SAND (SM)	NP	NP	NP	30
⊙	MB-04	23.8	Lean CLAY with sand (CL)	37	15	22	85

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-5

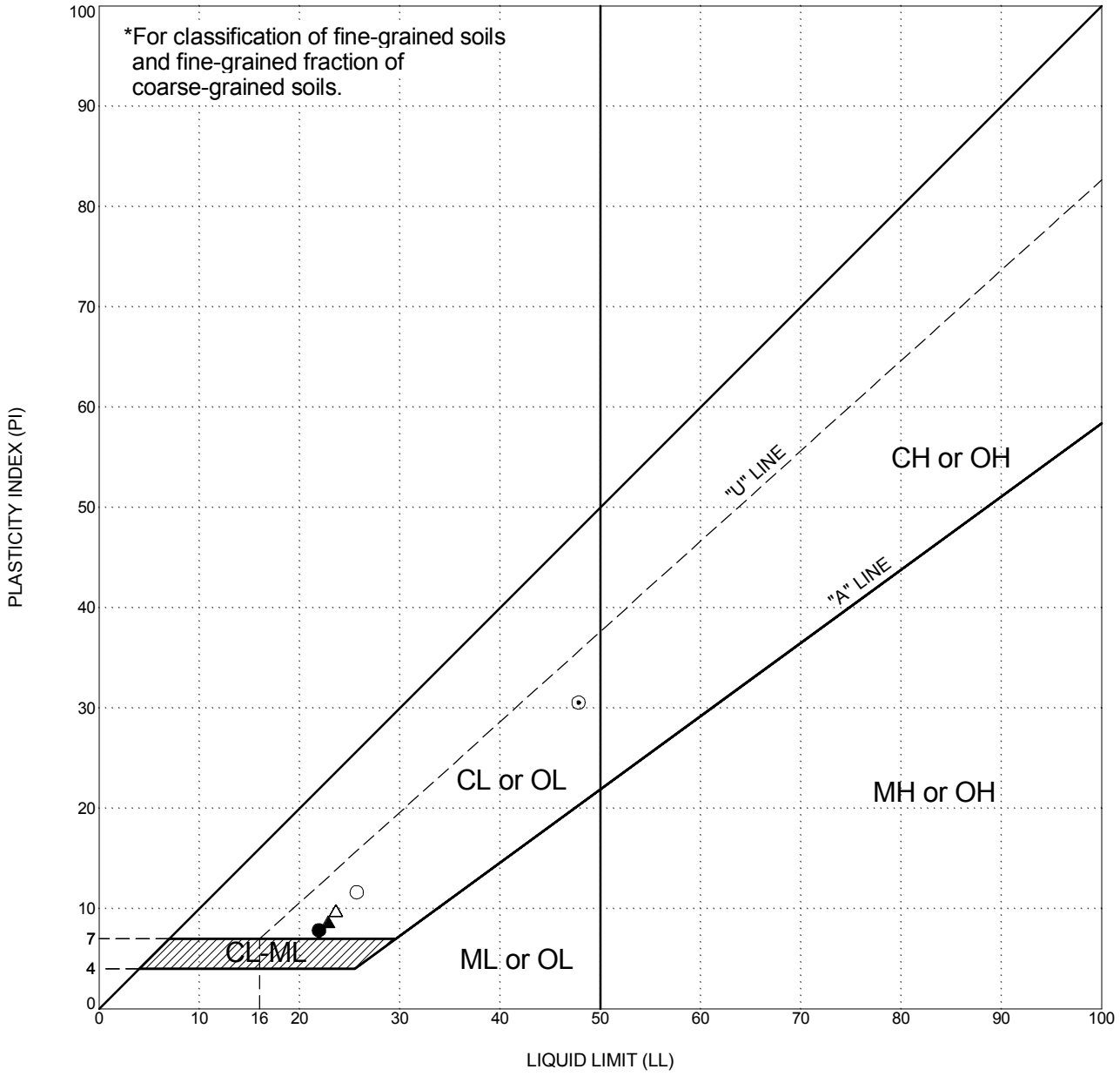


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-04	39.1	Lean CLAY (CL)	31	15	16	91
●	MB-04	41.0	Silty SAND (SM)	NP	NP	NP	34
△	MB-04	42.2	Lean CLAY with sand (CL)	31	15	16	73
▲	MB-04	45.1	Silty, Clayey SAND (SC-SM)	21	14	7	37
⊙	MB-04	45.3	Sandy SILT (ML)	20	17	3	54

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-6

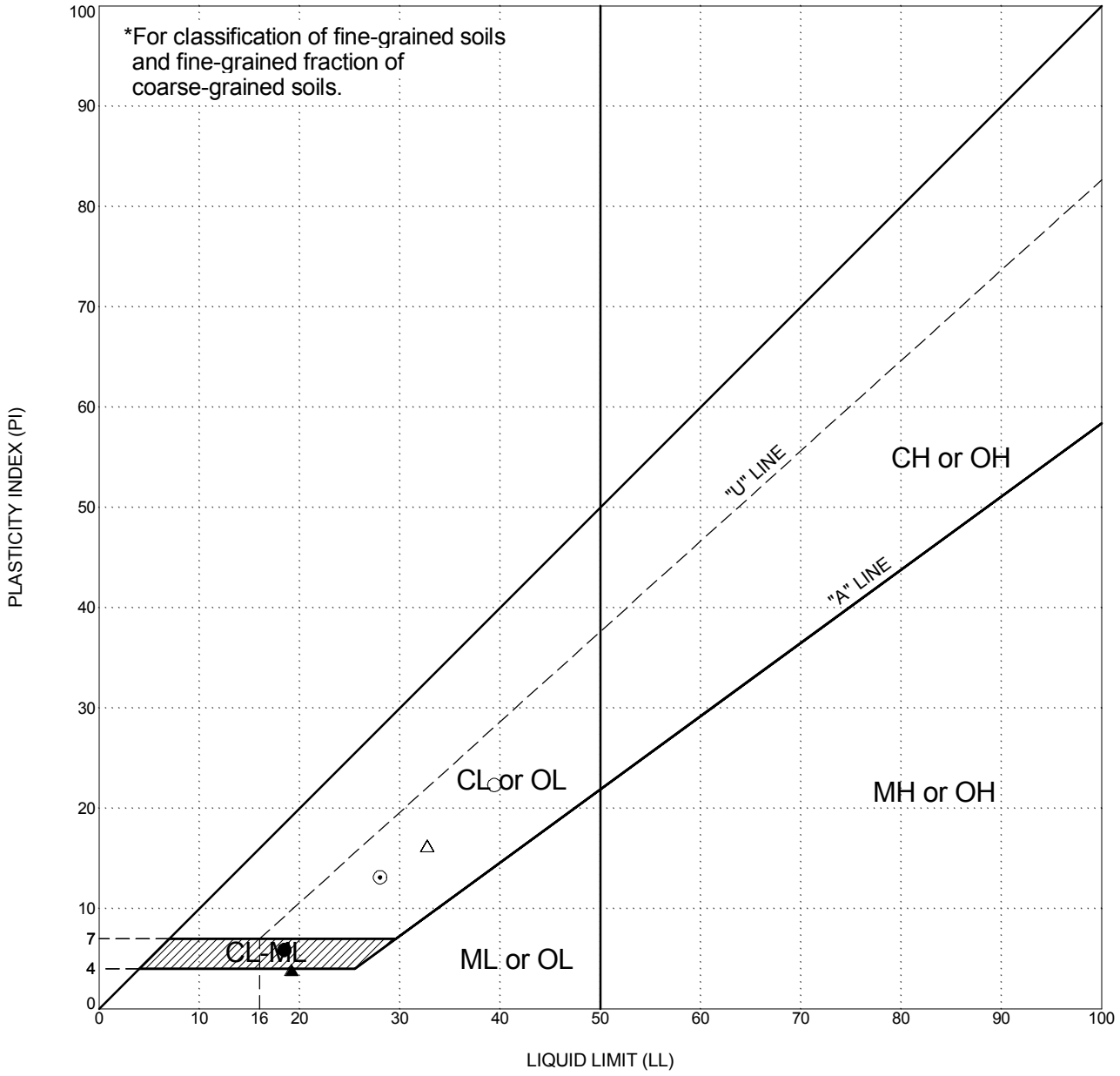


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-04	54.5	Lean CLAY with sand (CL)	26	14	12	79
●	MB-04	64.3	Sandy Lean CLAY (CL)	22	14	8	68
△	MB-04	75.3	Lean CLAY with sand (CL)	24	14	10	72
▲	MB-04	80.2	Lean CLAY with sand (CL)	23	14	9	77
⊙	MB-04	90.1	Lean CLAY (CL)	48	17	31	91

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-7



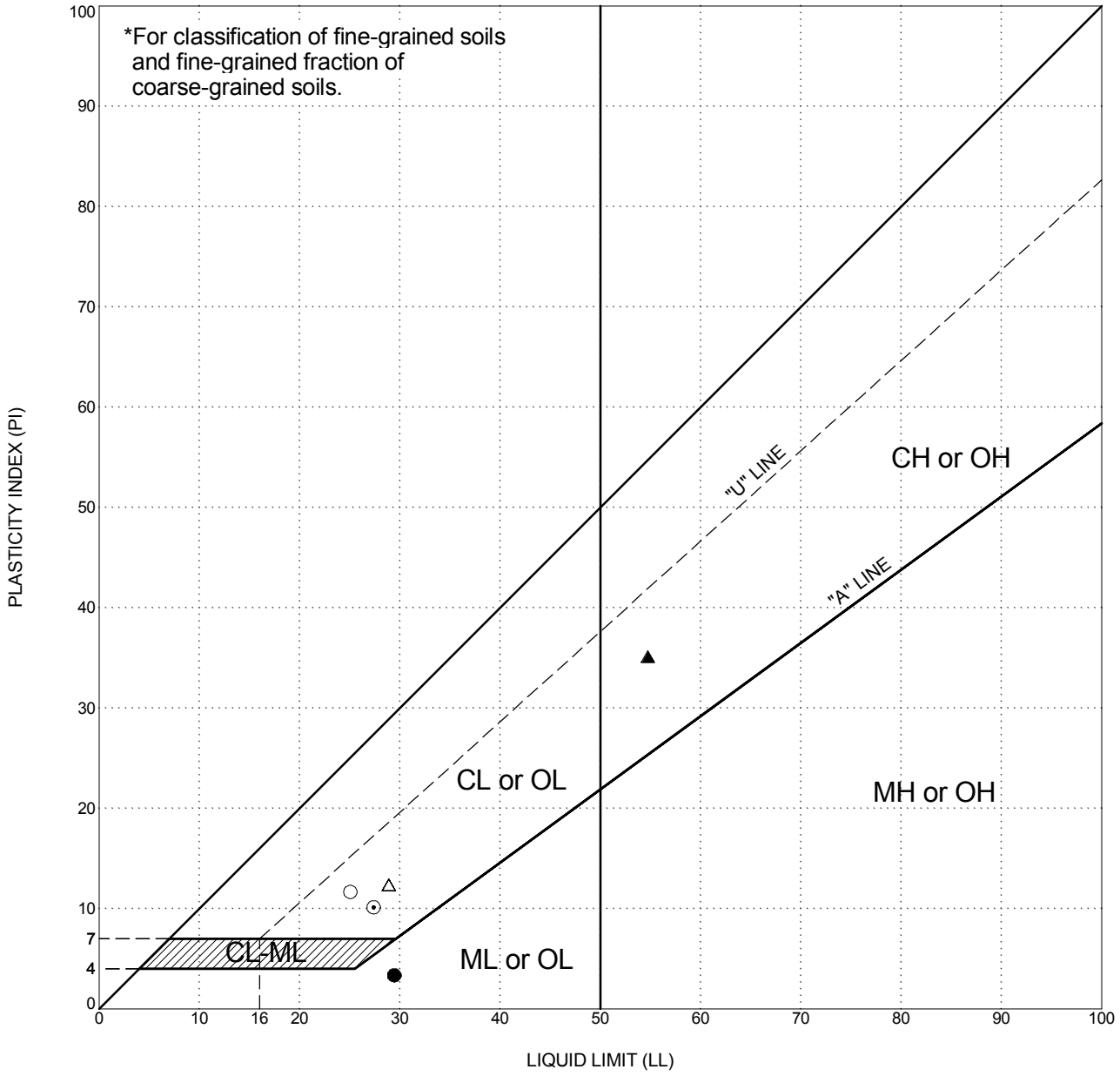
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-04	99.9	Lean CLAY (CL)	39	17	22	88
●	MB-04	105.0	Sandy, Silty CLAY (CL-ML)	18	13	5	53
△	MB-04	108.4	Lean CLAY (CL)	33	17	16	
▲	MB-04	121.8	Sandy, Silty CLAY (CL-ML)	19	15	4	61
⊙	MB-04	129.3	Gravelly Lean CLAY (CL)	28	15	13	61

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-8



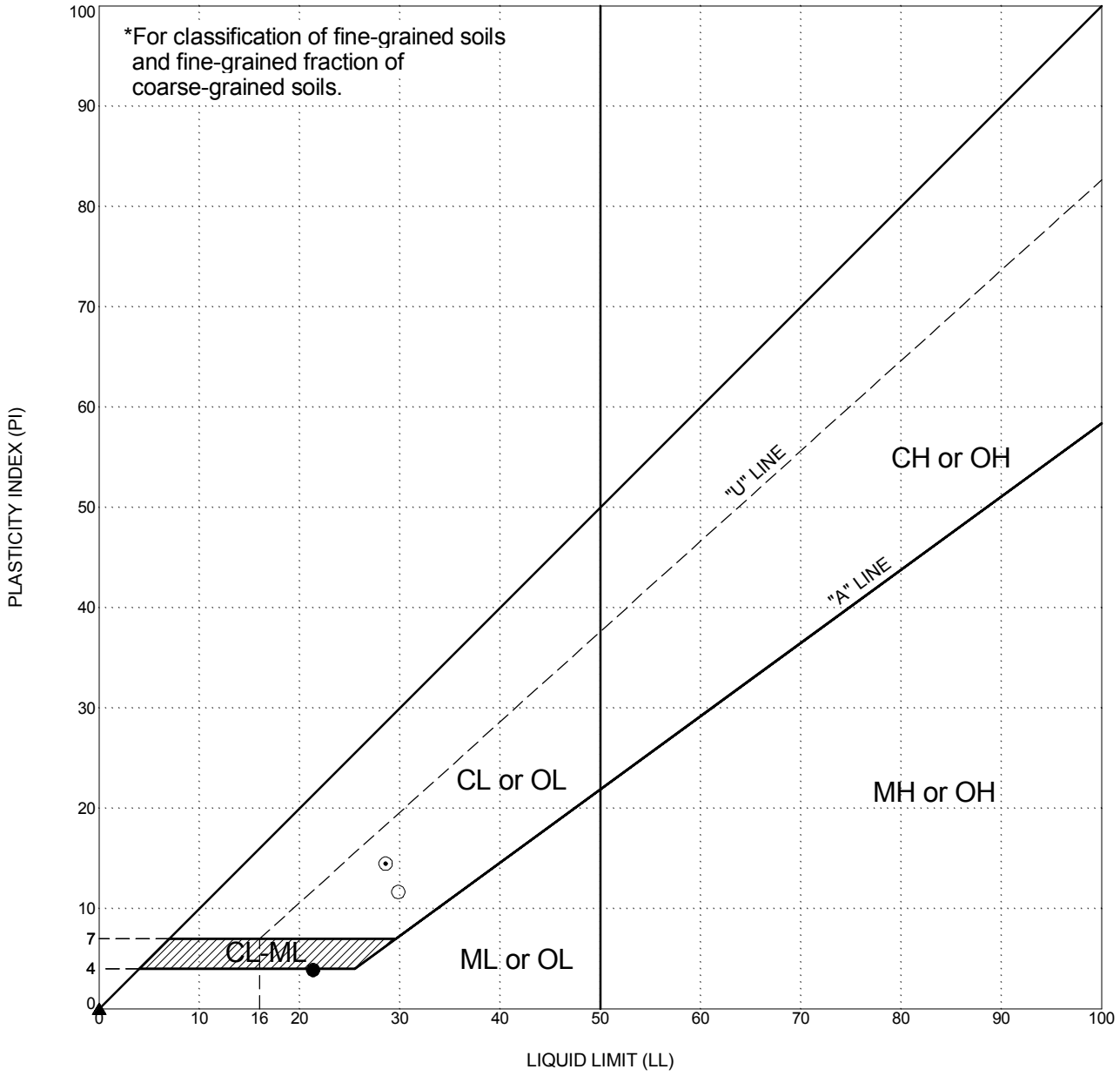
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-04	134.2	Clayey SAND (SC)	25	13	12	49
●	MB-04	136.8	SILT (ML)	29	26	3	88
△	MB-05	1.2	Lean CLAY (CL)	29	17	12	92
▲	MB-05	4.6	Lean CLAY (CL)	55	20	35	99
⊙	MB-05	4.7	Lean CLAY (CL)	27	17	10	98

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-9



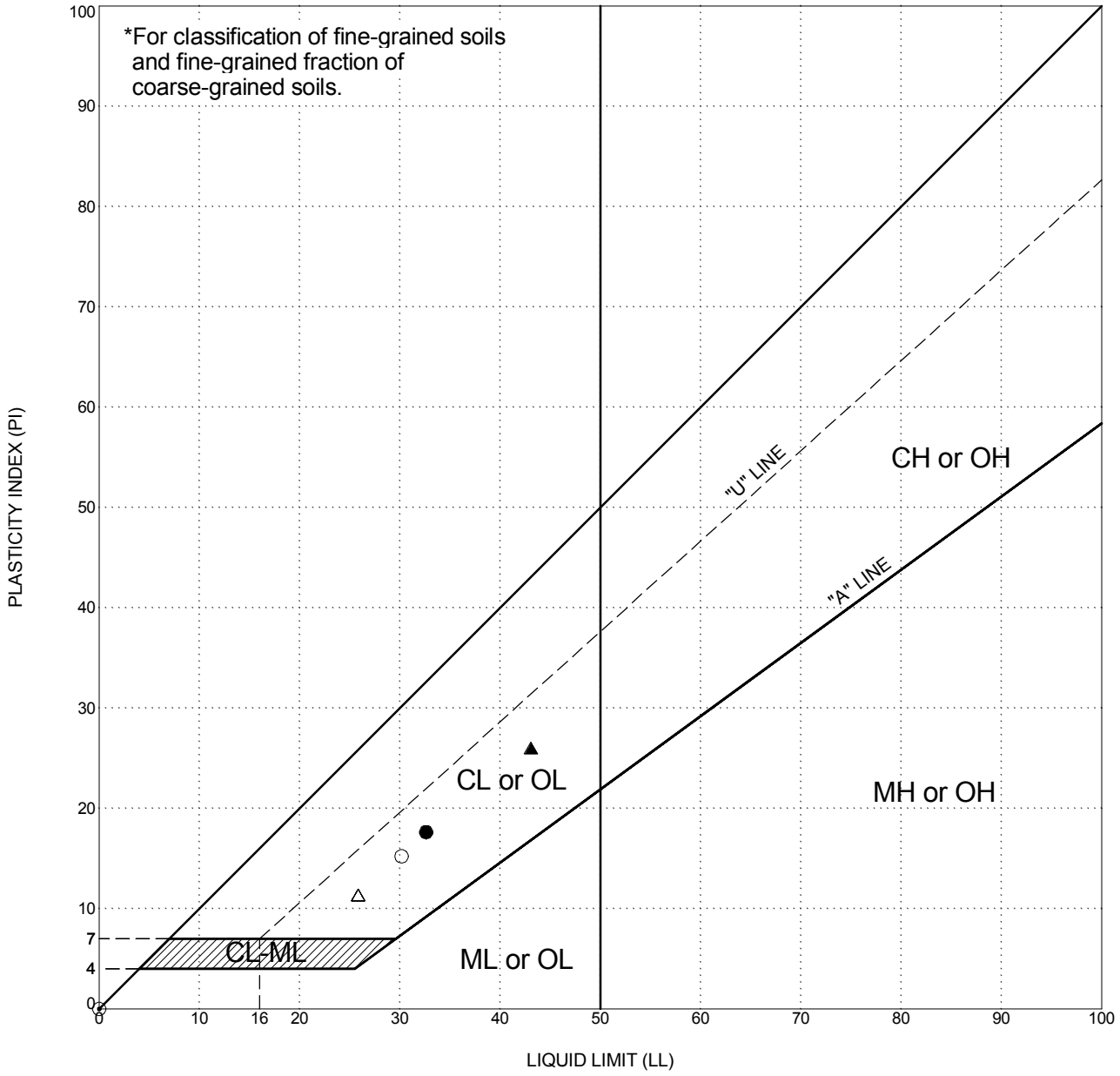
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-05	5.2	Lean CLAY (CL)	30	18	12	95
●	MB-05	24.8	Silty CLAY with sand (CL-ML)	21	17	4	82
△	MB-05	29.8	Silty SAND (SM)	NP	NP	NP	13
▲	MB-05	41.7	Silty SAND (SM)	NP	NP	NP	22
⊙	MB-05	54.3	Lean CLAY with sand (CL)	29	14	15	85

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-10



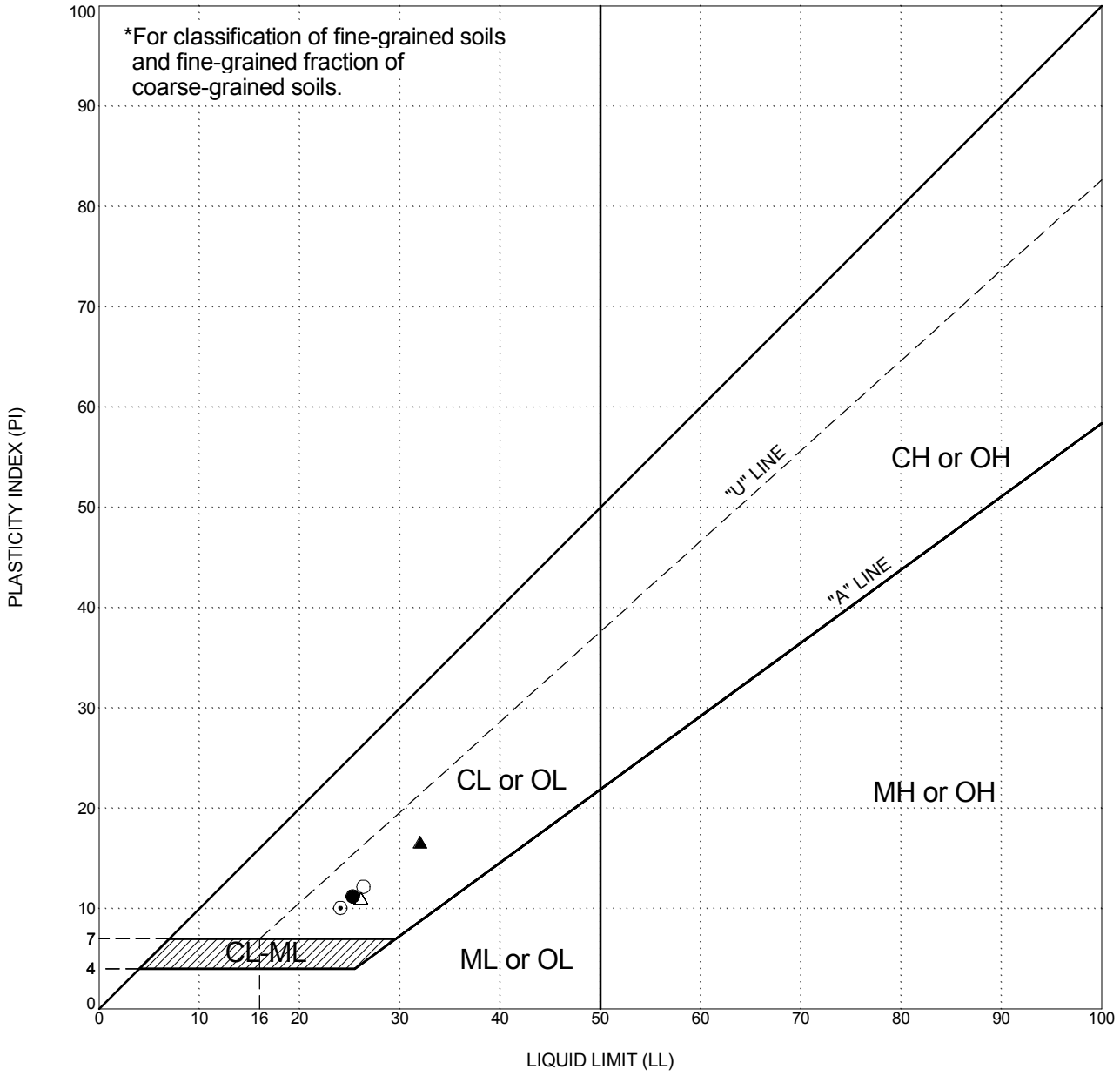
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-05	54.3	Lean CLAY with sand (CL)	30	15	15	80
●	MB-05	55.0	Lean CLAY with sand (CL)	33	15	18	82
△	MB-05	63.2	Lean CLAY with sand (CL)	26	14	12	77
▲	MB-05	68.2	Lean CLAY (CL)	43	17	26	95
⊙	MB-05	71.3	Silty SAND (SM)	NP	NP	NP	

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-11



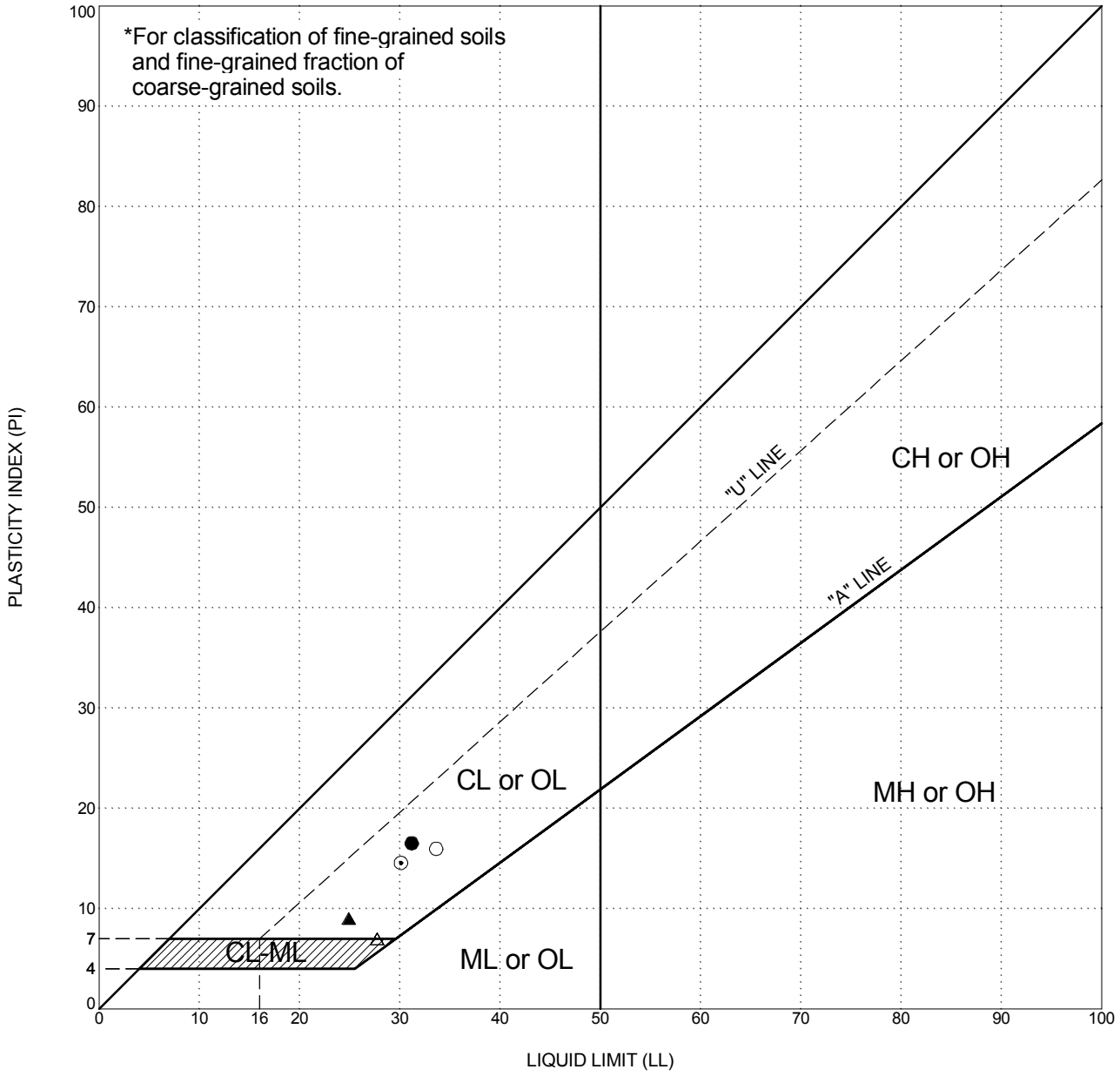
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-05	75.8	Sandy Lean CLAY (CL)	26	14	12	63
●	MB-05	78.0	Lean CLAY with sand (CL)	25	14	11	71
△	MB-05	90.6	Lean CLAY with sand (CL)	26	15	11	80
▲	MB-05	110.2	Lean CLAY (CL)	32	15	17	89
⊙	MB-05	125.0	Gravelly Lean CLAY (CL)	24	14	10	58

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-12



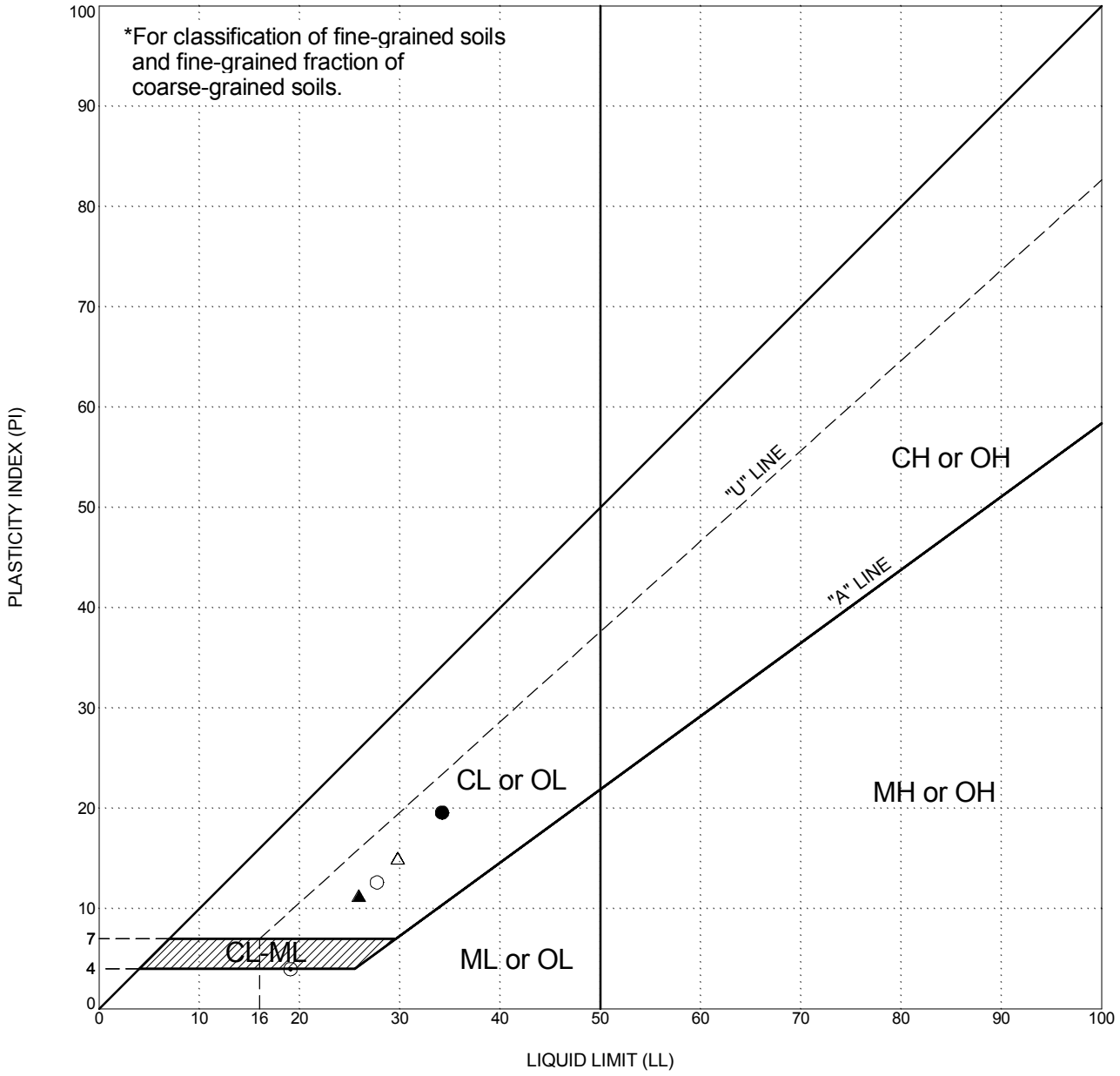
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-05	132.4	Sandy Lean CLAY (CL)	34	18	16	
●	MB-05	145.0	Lean CLAY with sand (CL)	31	15	16	73
△	MB-06	2.0	Silty CLAY (CL-ML)	28	21	7	94
▲	MB-06	41.3	Sandy Lean CLAY (CL)	25	16	9	70
⊙	MB-06	46.3	Lean CLAY (CL)	30	16	14	95

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-13



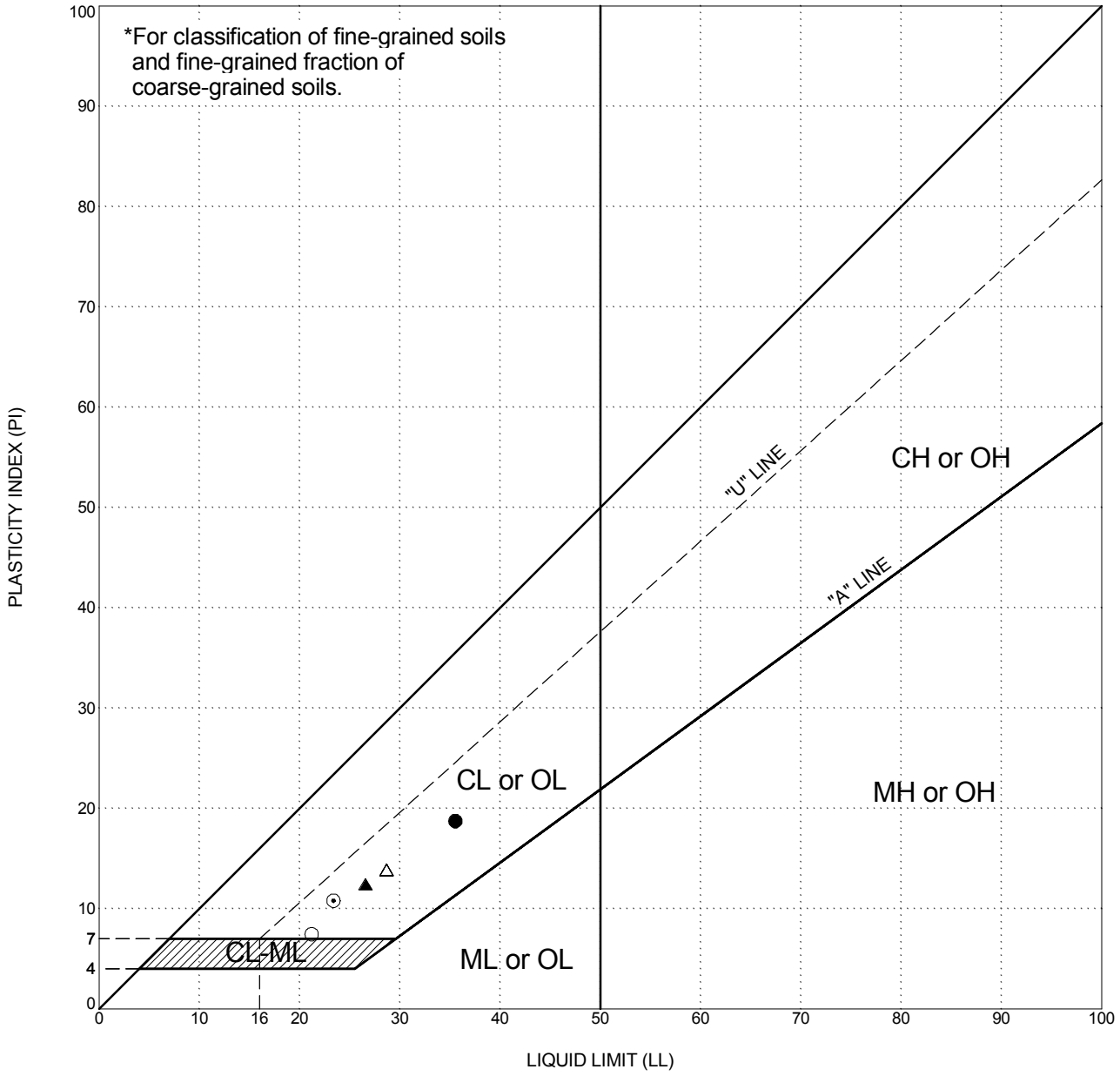
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-06	50.7	Lean CLAY (CL)	28	15	13	87
●	MB-06	61.0	Lean CLAY with sand (CL)	34	15	19	85
△	MB-06	66.8	Lean CLAY (CL)	30	15	15	87
▲	MB-06	76.6	Lean CLAY with sand (CL)	26	15	11	81
⊙	MB-06	85.0	Silty, Clayey SAND (SC-SM)	19	15	4	44

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-14



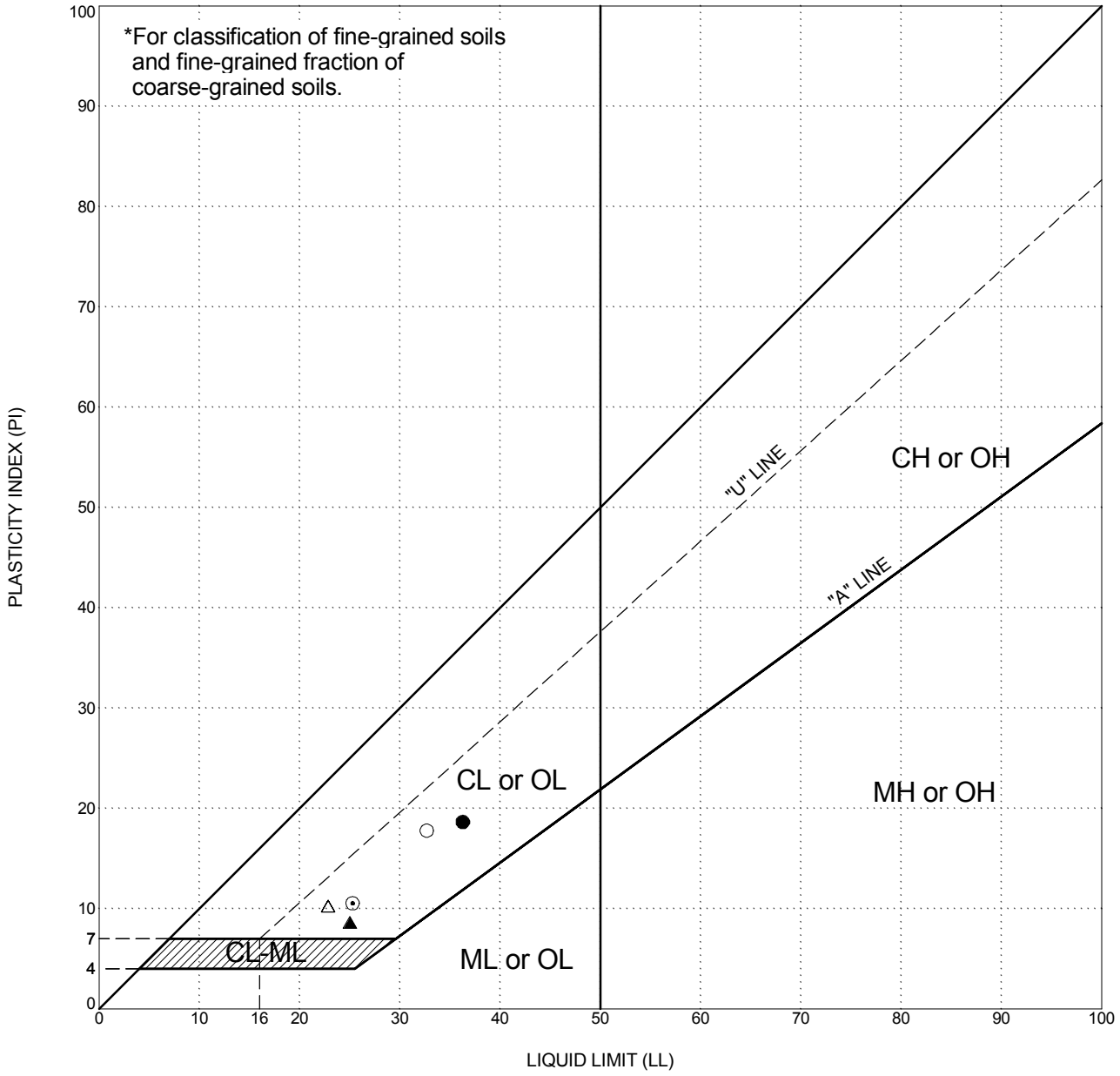
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-06	86.0	Sandy, Silty CLAY (CL-ML)	21	14	7	65
●	MB-06	96.5	Lean CLAY with sand (CL)	36	17	19	82
△	MB-06	107.0	Sandy Lean CLAY with gravel (CL)	29	15	14	68
▲	MB-06	107.0	Sandy Lean CLAY with gravel (CL)	27	14	13	62
⊙	MB-06	124.7	Sandy Lean CLAY with gravel (CL)	23	13	10	53

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-15



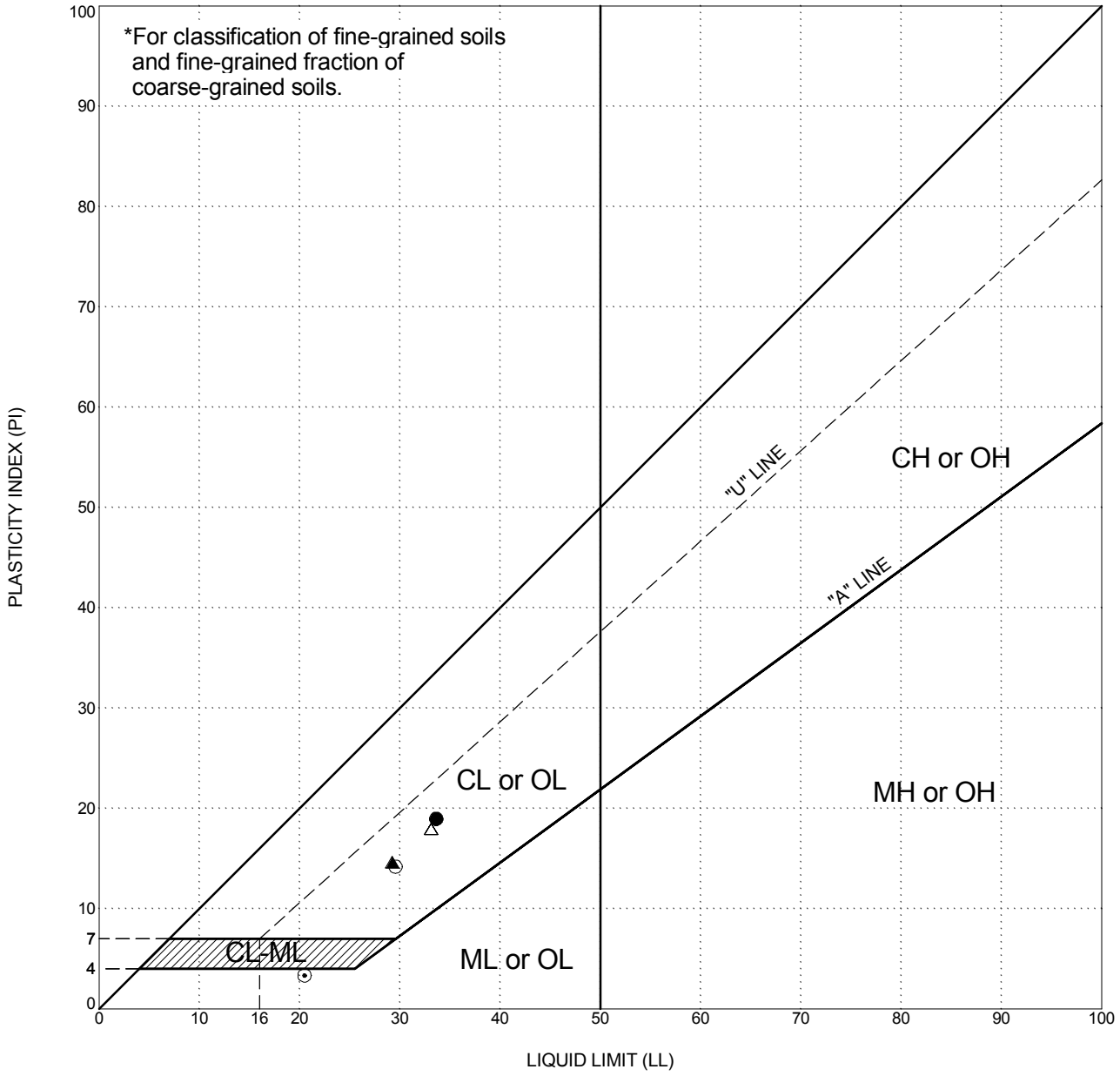
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-06	128.8	Lean CLAY (CL)	33	15	18	88
●	MB-06	133.5	Lean CLAY (CL)	36	18	18	89
△	MB-06	138.3	Clayey SAND with gravel (SC)	23	13	10	30
▲	MB-08	18.9	Lean CLAY (CL)	25	16	9	88
⊙	MB-08	19.7	Lean CLAY (CL)	25	15	10	

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-16



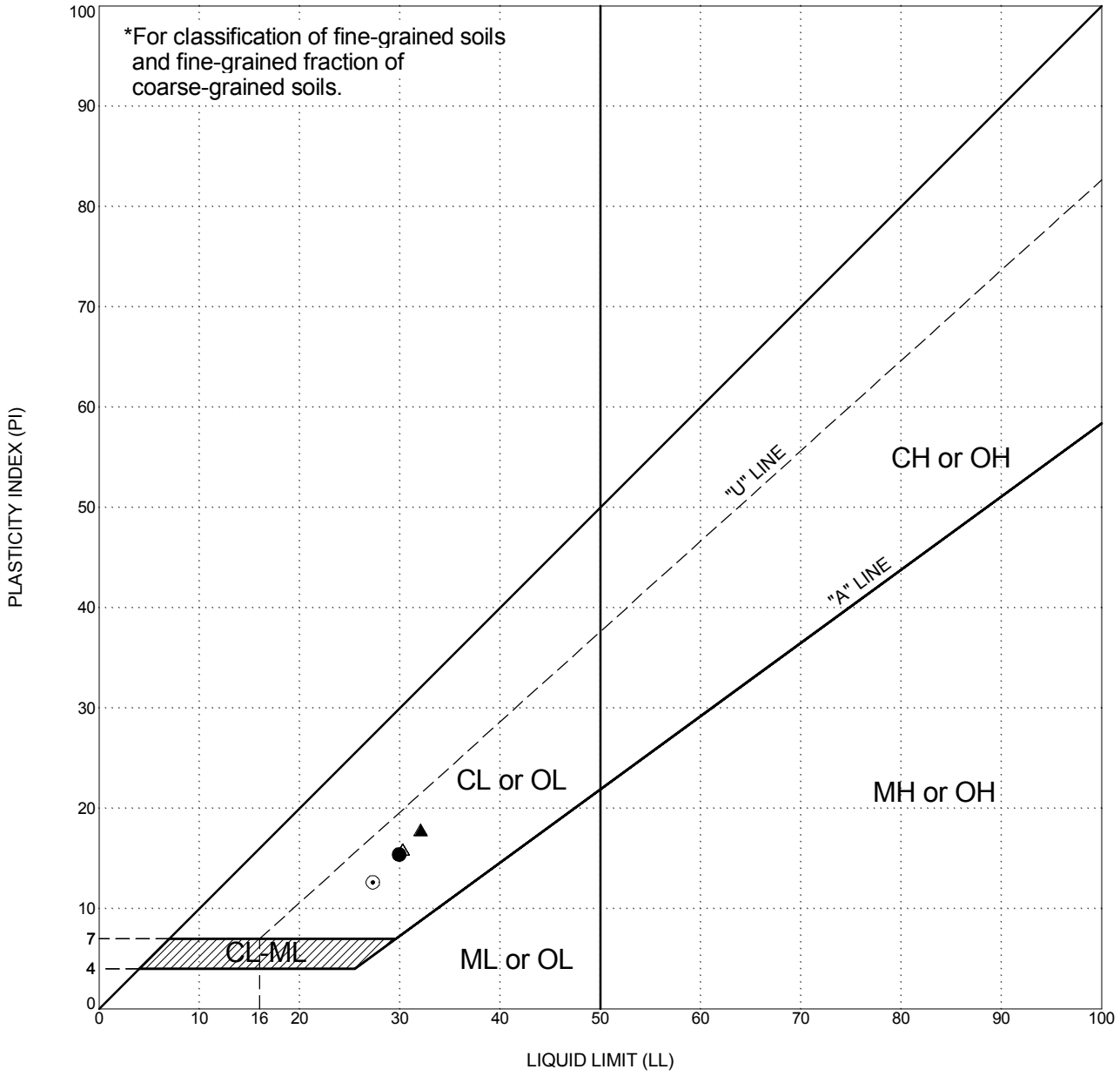
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-08	25.9	Lean CLAY (CL)	30	15	15	92
●	MB-08	46.9	Lean CLAY with sand (CL)	34	15	19	85
△	MB-08	57.5	Lean CLAY with sand (CL)	33	15	18	83
▲	MB-08	58.1	Sandy Lean CLAY (CL)	29	15	14	60
⊙	MB-08	63.0	SILT with sand (ML)	20	17	3	71

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-17



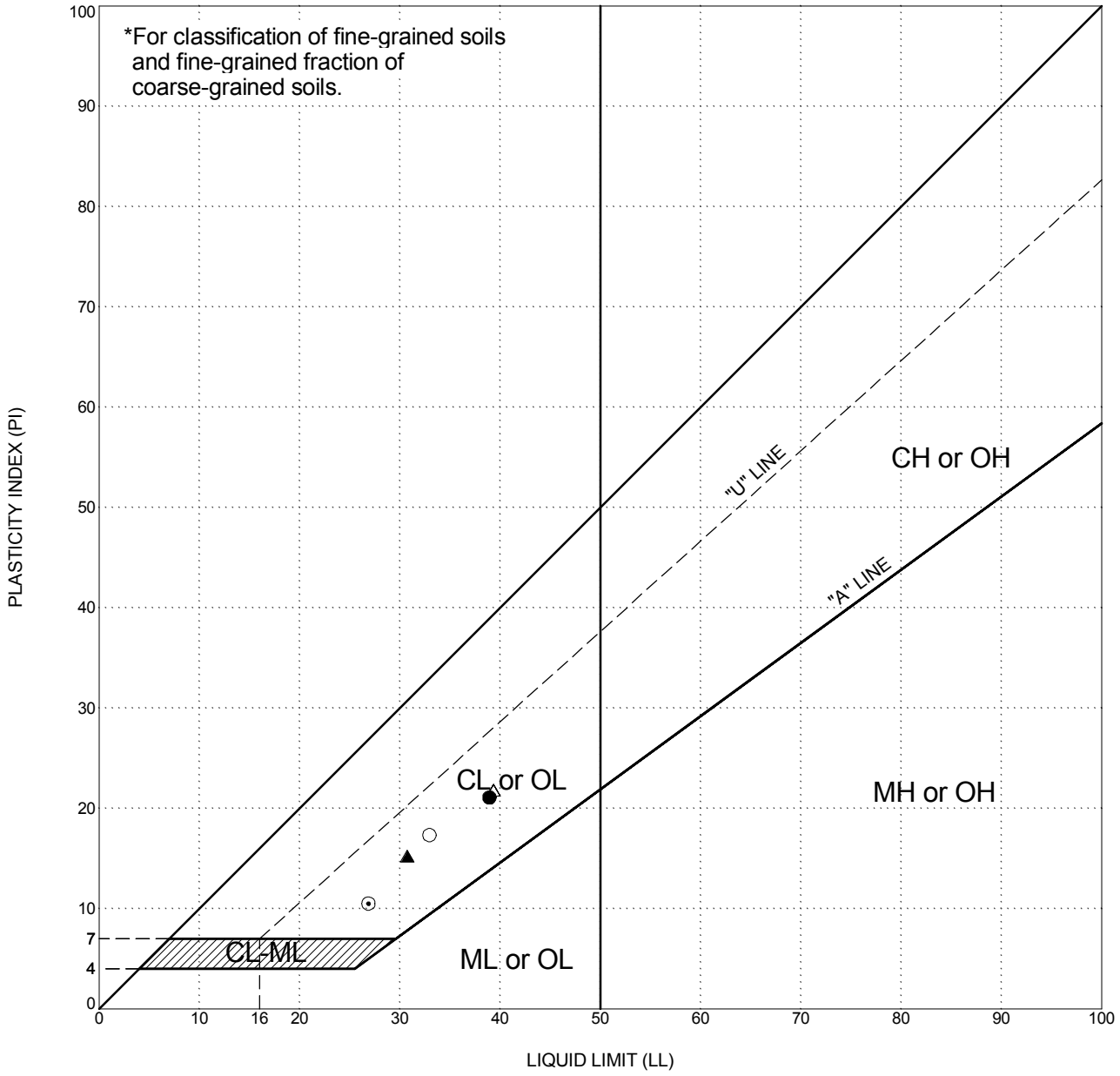
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-08	66.3	Lean CLAY with sand (CL)	30	15	15	82
●	MB-08	76.3	Lean CLAY with sand (CL)	30	15	15	84
△	MB-08	76.8	Lean CLAY (CL)	30	14	16	87
▲	MB-08	77.3	Lean CLAY (CL)	32	14	18	86
⊙	MB-08	87.1	Lean CLAY with sand (CL)	27	15	12	82

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-18



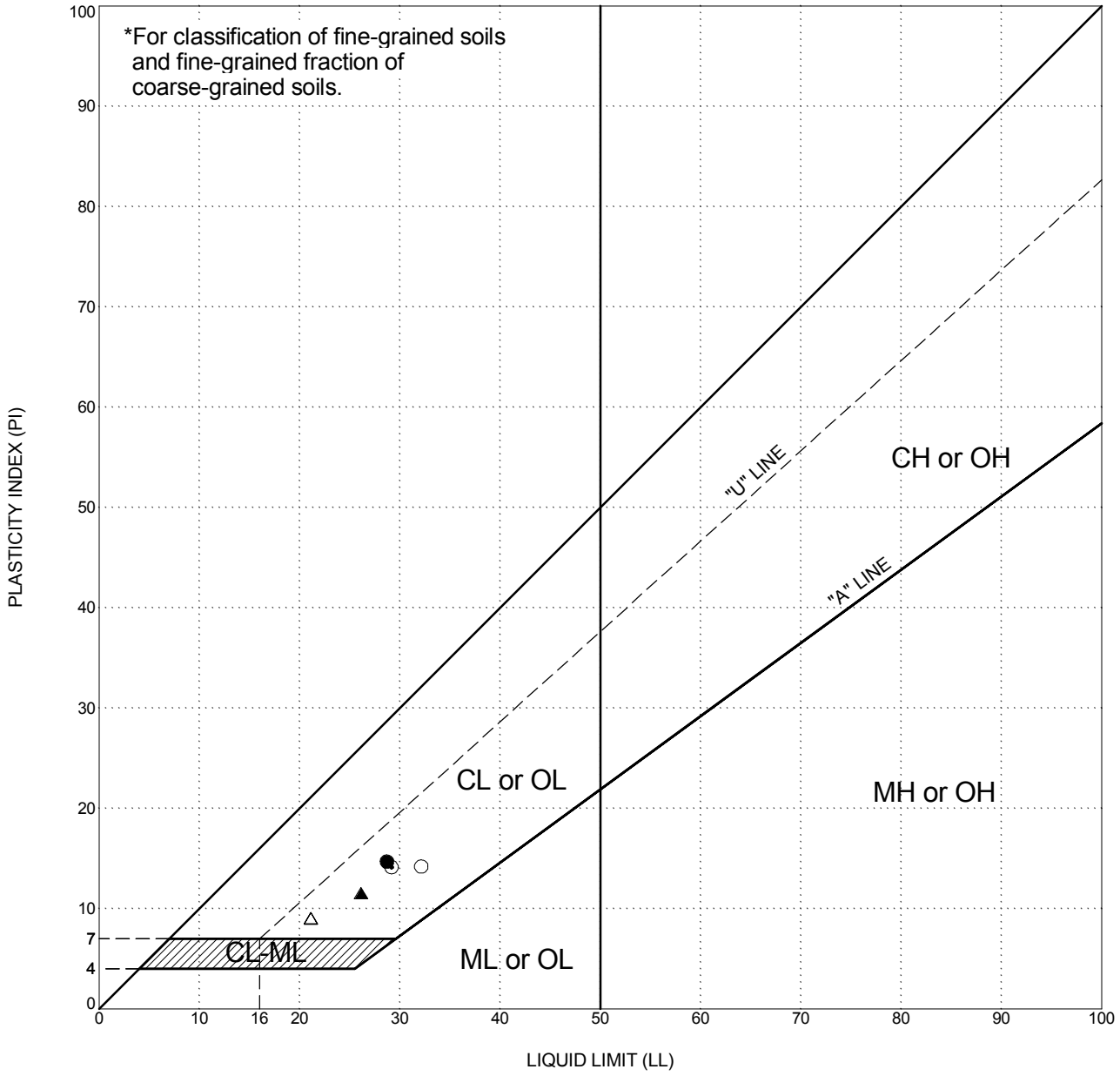
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-08	97.0	Lean CLAY (CL)	33	16	17	90
●	MB-08	101.9	Lean CLAY (CL)	39	18	21	96
△	MB-08	111.7	Lean CLAY (CL)	39	18	21	93
▲	MB-08	120.7	Lean CLAY (CL)	31	15	16	92
⊙	MB-08	120.9	Lean CLAY (CL)	27	16	11	94

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-19



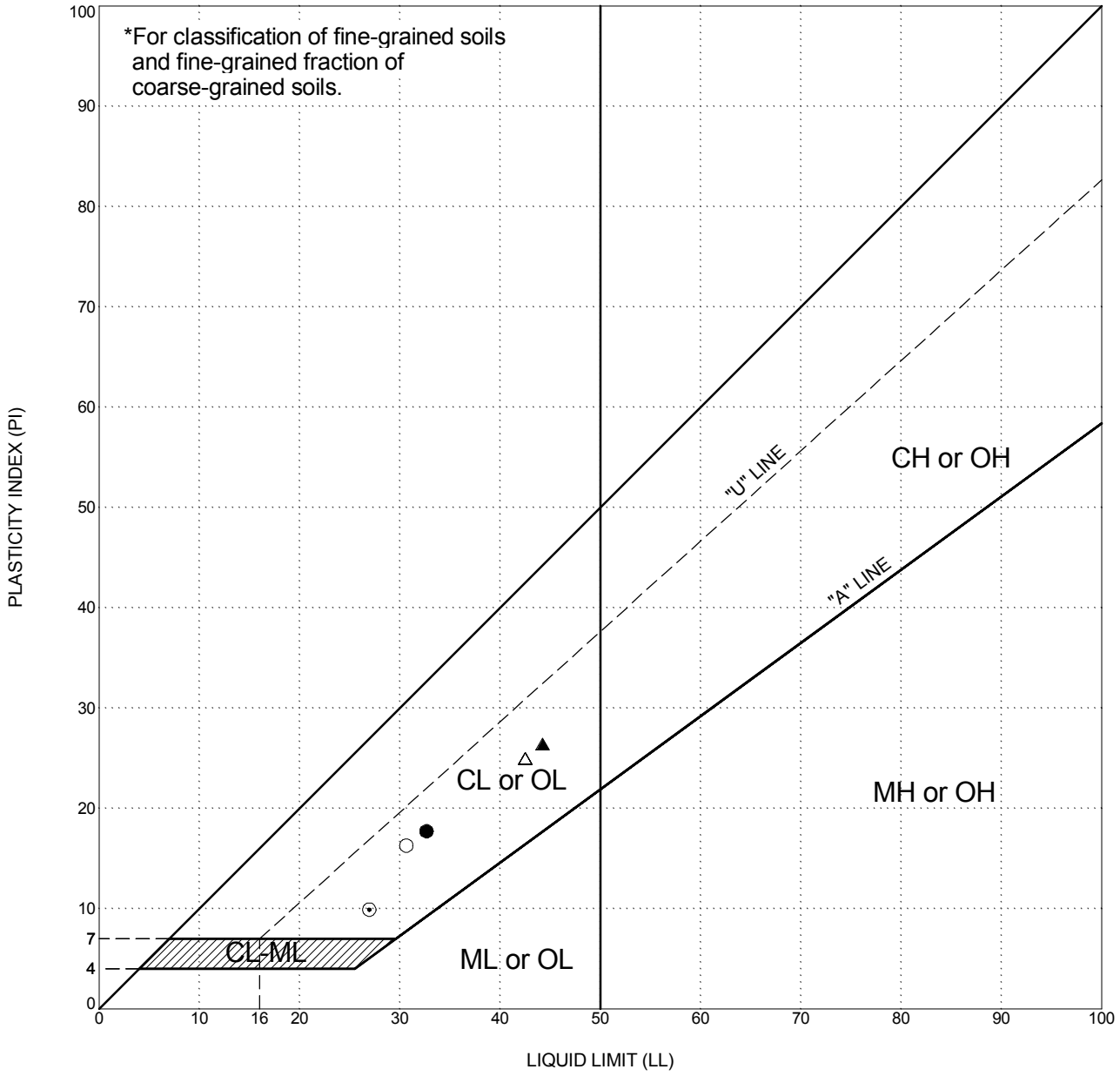
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-08	121.6	Lean CLAY (CL)	32	18	14	94
●	MB-08	123.2	Clayey SAND with gravel (SC)	29	14	15	49
△	MB-08	126.2	Sandy Lean CLAY (CL)	21	12	9	60
▲	MB-08	129.3	Sandy Lean CLAY (CL)	26	15	11	70
⊙	MB-08	131.7	Sandy Lean CLAY (CL)	29	15	14	68

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-20



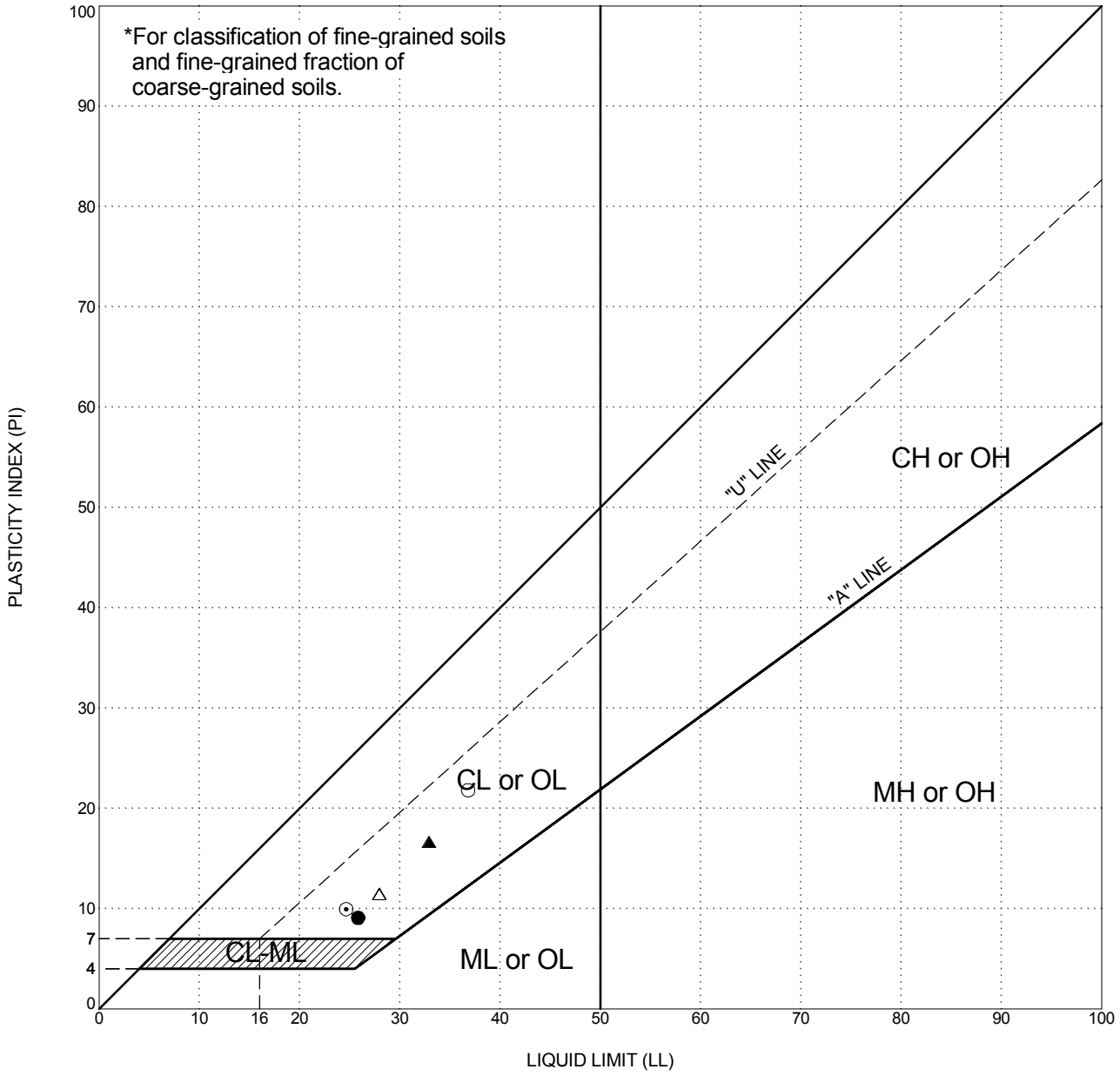
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-08	139.1	Sandy Lean CLAY (CL)	31	14	17	65
●	MB-08	149.1	Sandy Lean CLAY (CL)	33	15	18	62
△	MB-09	1.1	Lean CLAY (CL)	42	18	24	90
▲	MB-09	4.9	Lean CLAY (CL)	44	18	26	100
⊙	MB-09	5.6	Lean CLAY (CL)	27	17	10	96

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-21



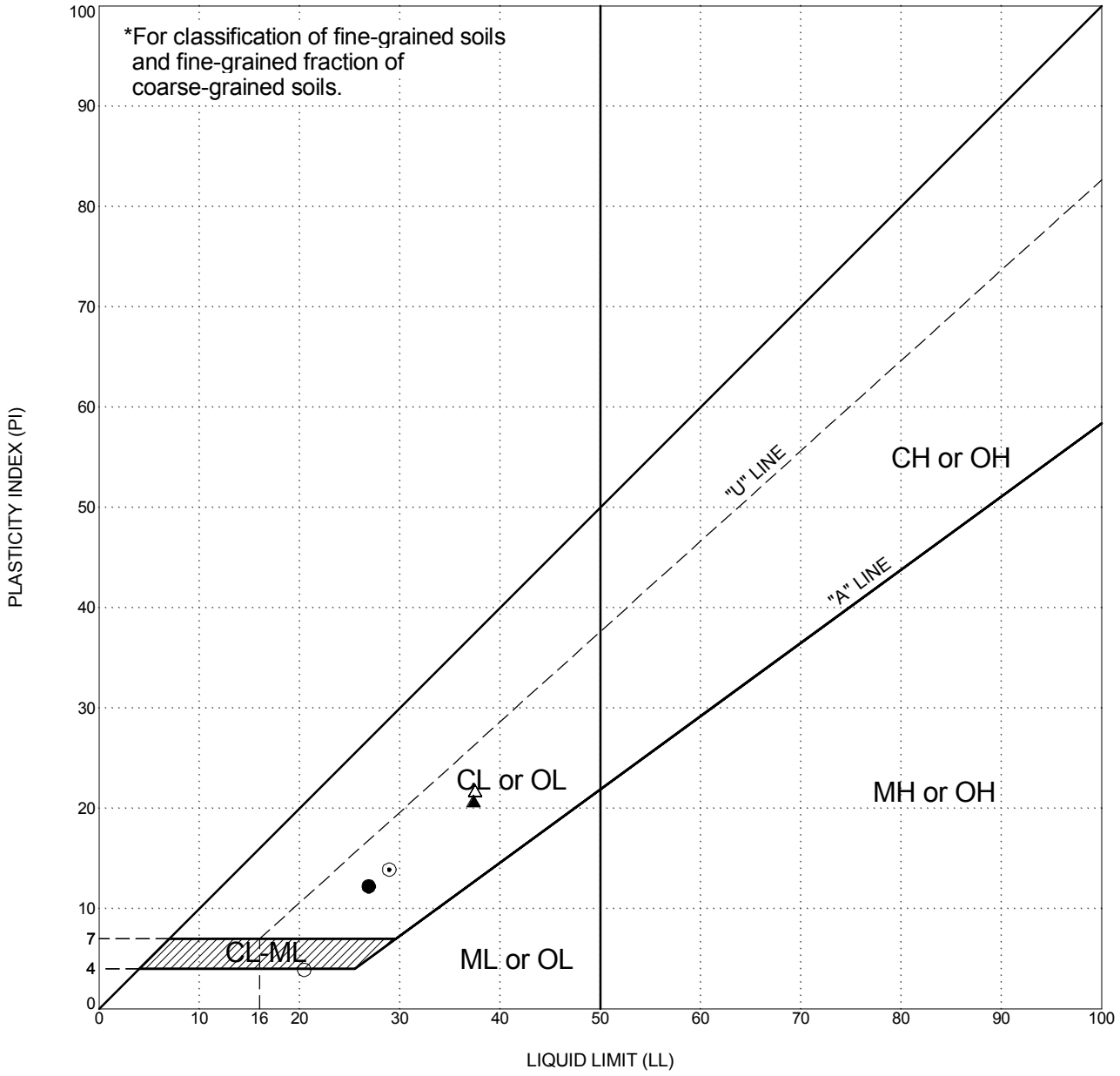
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-09	7.7	Lean CLAY (CL)	37	15	22	94
●	MB-09	11.3	Sandy Lean CLAY (CL)	26	17	9	69
△	MB-09	22.3	Sandy Lean CLAY (CL)	28	16	12	65
▲	MB-09	33.1	Lean CLAY (CL)	33	16	17	91
⊙	MB-09	42.2	Lean CLAY (CL)	25	15	10	87

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-22



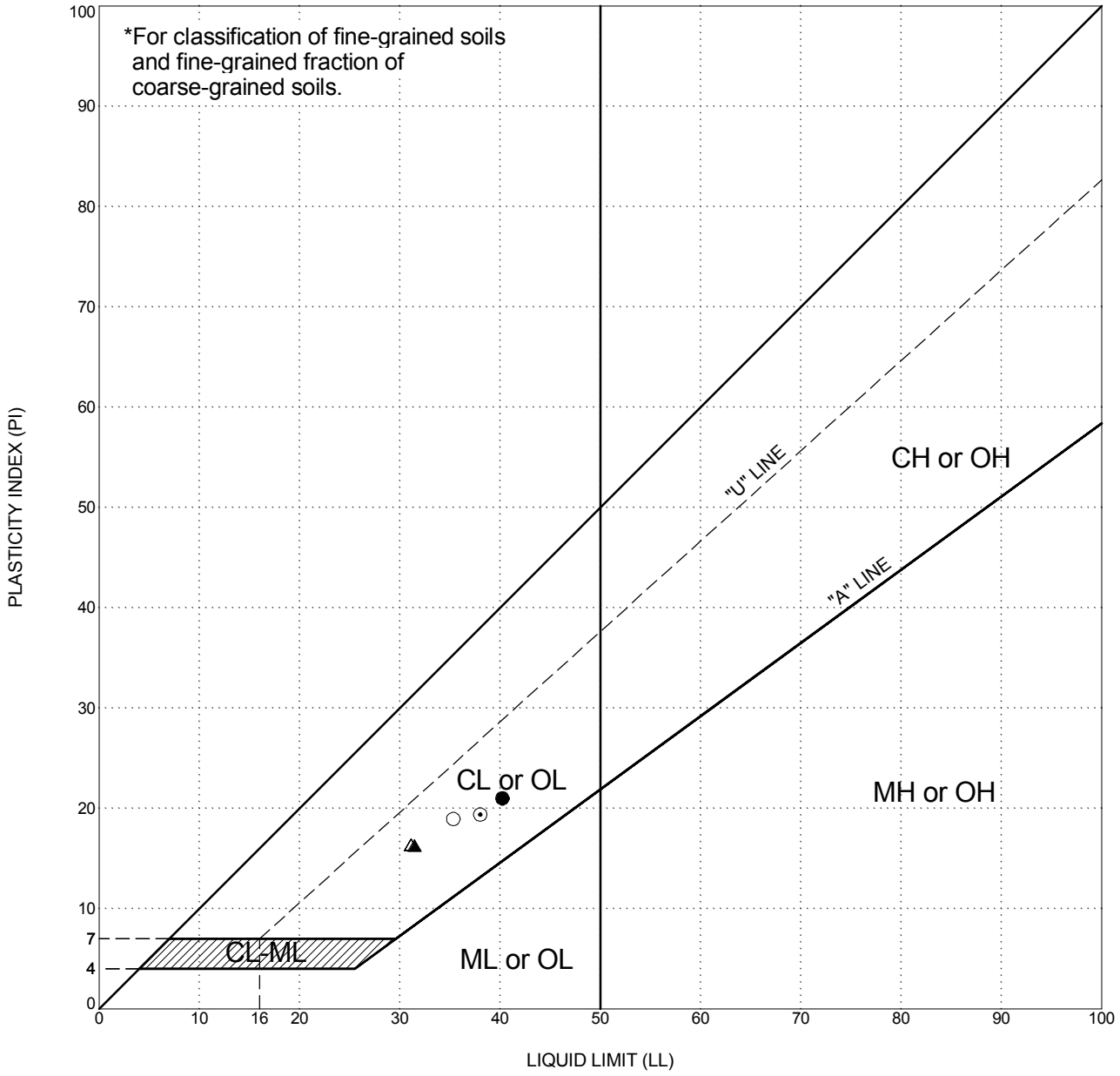
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-09	52.0	SILT with sand (ML)	20	17	3	78
●	MB-09	52.1	Lean CLAY (CL)	27	15	12	88
△	MB-09	66.6	Lean CLAY (CL)	38	16	22	90
▲	MB-09	66.9	Lean CLAY (CL)	37	17	20	90
⊙	MB-09	81.5	Lean CLAY (CL)	29	15	14	87

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-23



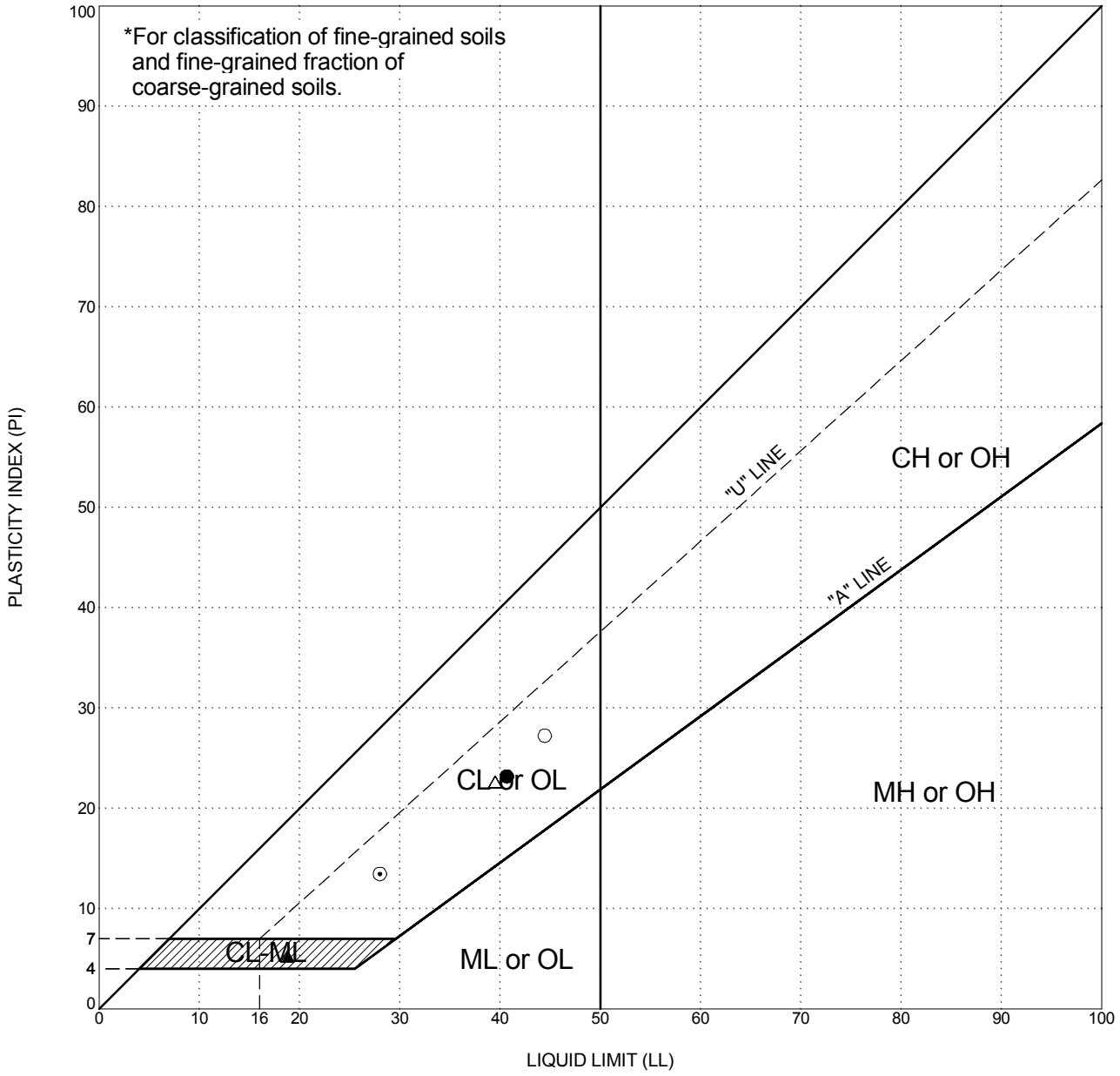
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-09	81.5	Lean CLAY (CL)	35	16	19	92
●	MB-09	96.3	Lean CLAY (CL)	40	19	21	
△	MB-09	132.9	Sandy Lean CLAY (CL)	31	15	16	65
▲	MB-09	132.9	Sandy Lean CLAY (CL)	31	15	16	
⊙	MB-09	145.0	Lean CLAY (CL)	38	19	19	99

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-24



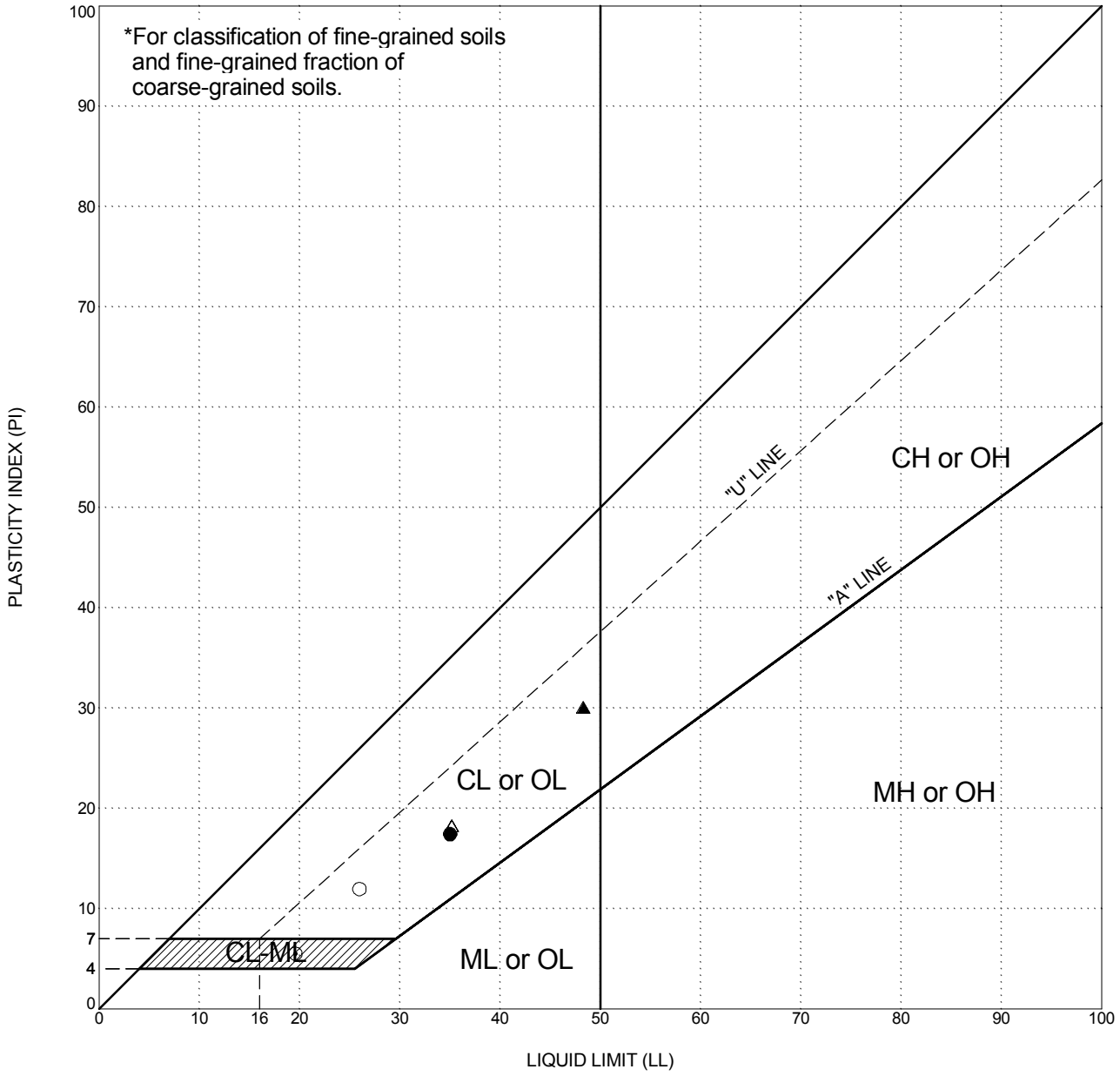
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-12	2.0	Lean CLAY (CL)	44	17	27	91
●	MB-12	28.9	Sandy Lean CLAY (CL)	41	17	24	65
△	MB-12	36.4	Lean CLAY (CL)	40	17	23	87
▲	MB-12	41.7	Silty CLAY with sand (CL-ML)	19	14	5	79
⊙	MB-12	61.5	Lean CLAY with sand (CL)	28	15	13	85

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-25



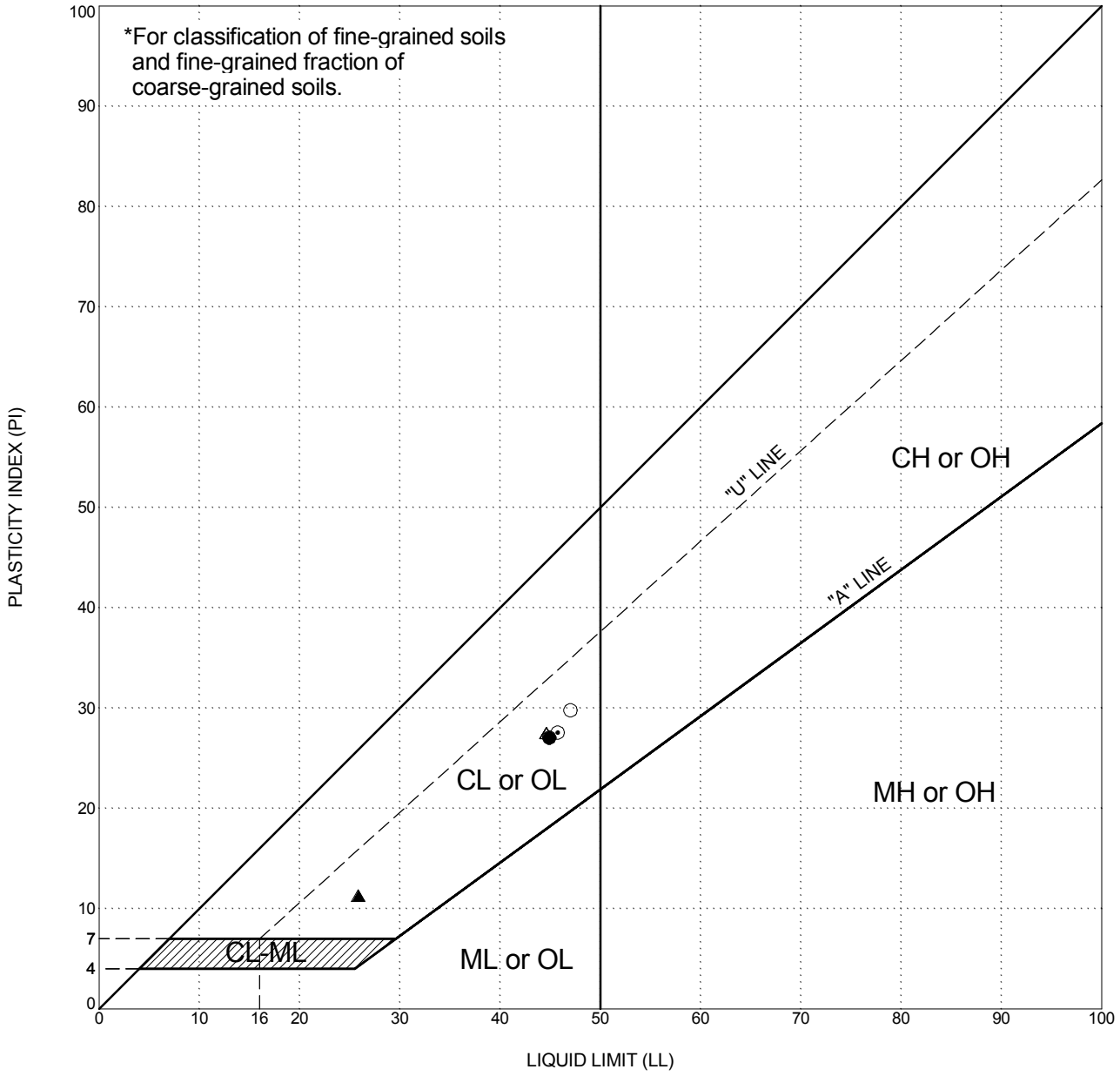
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-12	80.5	Clayey SAND (SC)	26	14	12	21
●	MB-12	91.7	Lean CLAY (CL)	35	18	17	97
△	MB-12	100.2	Lean CLAY (CL)	35	17	18	94
▲	MB-12	108.3	Lean CLAY (CL)	48	18	30	
⊙	MB-12	138.1	Gravelly, Silty CLAY (CL-ML)	20	14	6	51

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-26



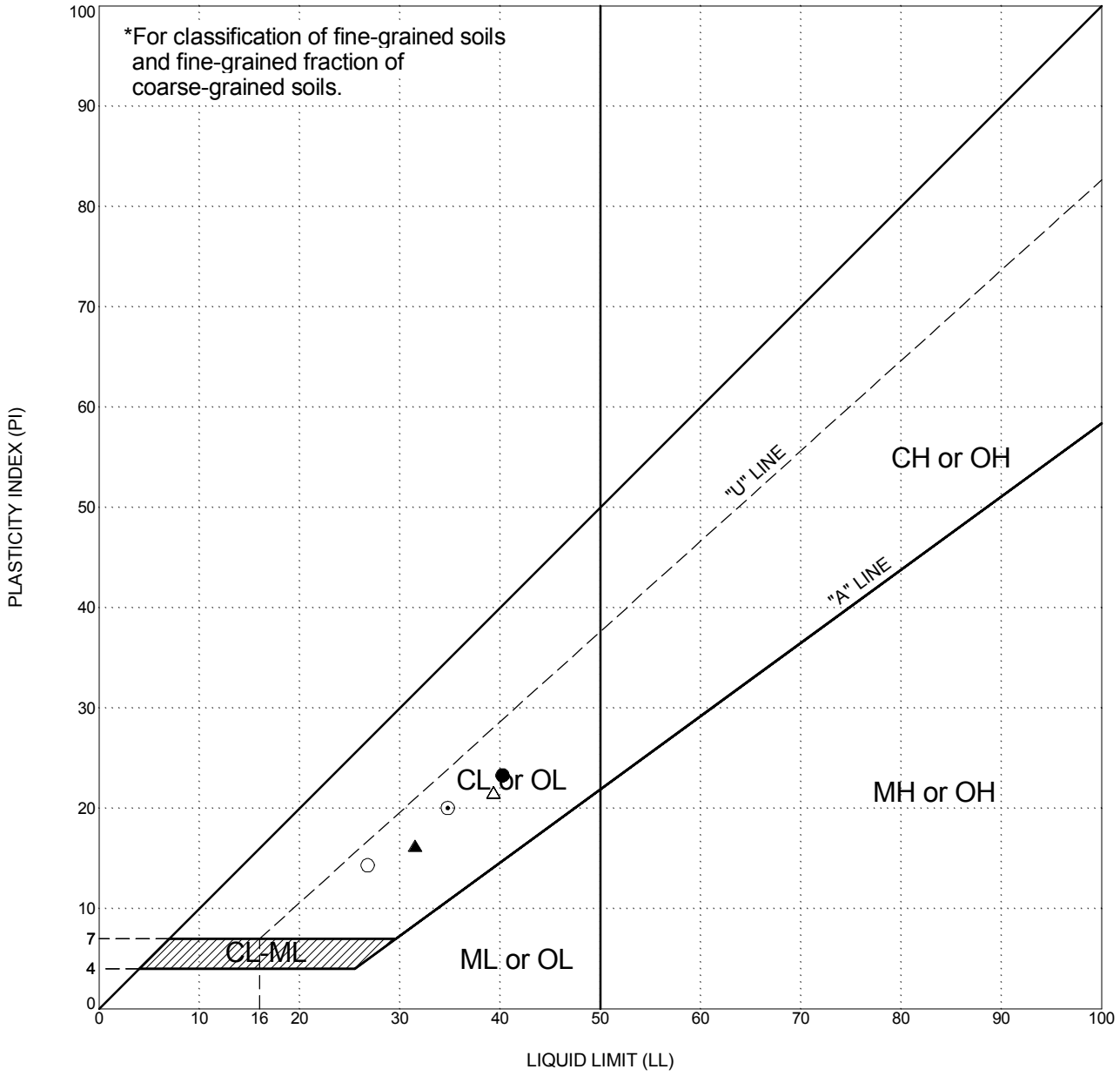
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-13	1.5	Lean CLAY (CL)	47	17	30	89
●	MB-13	4.8	Lean CLAY (CL)	45	18	27	89
△	MB-13	4.8	Lean CLAY (CL)	45	17	28	92
▲	MB-13	20.0	Sandy Lean CLAY (CL)	26	15	11	61
⊙	MB-13	22.9	Lean CLAY (CL)	46	18	28	

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-27



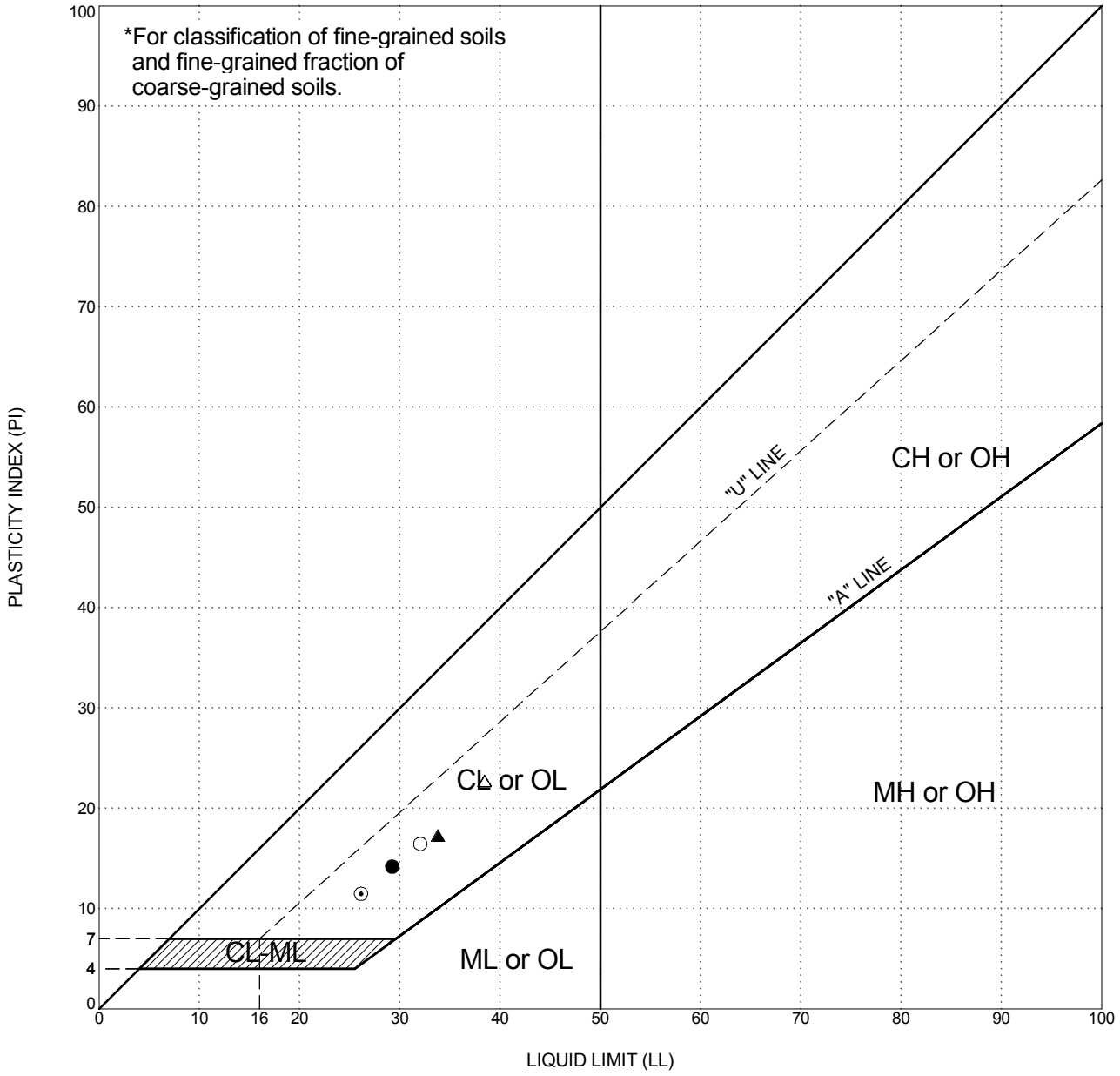
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-13	29.0	Sandy Lean CLAY (CL)	27	12	15	60
●	MB-13	36.4	Lean CLAY (CL)	40	17	23	
△	MB-13	39.7	Lean CLAY with sand (CL)	39	18	21	84
▲	MB-13	43.0	Lean CLAY (CL)	31	15	16	91
⊙	MB-13	48.1	Lean CLAY (CL)	35	15	20	89

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-28



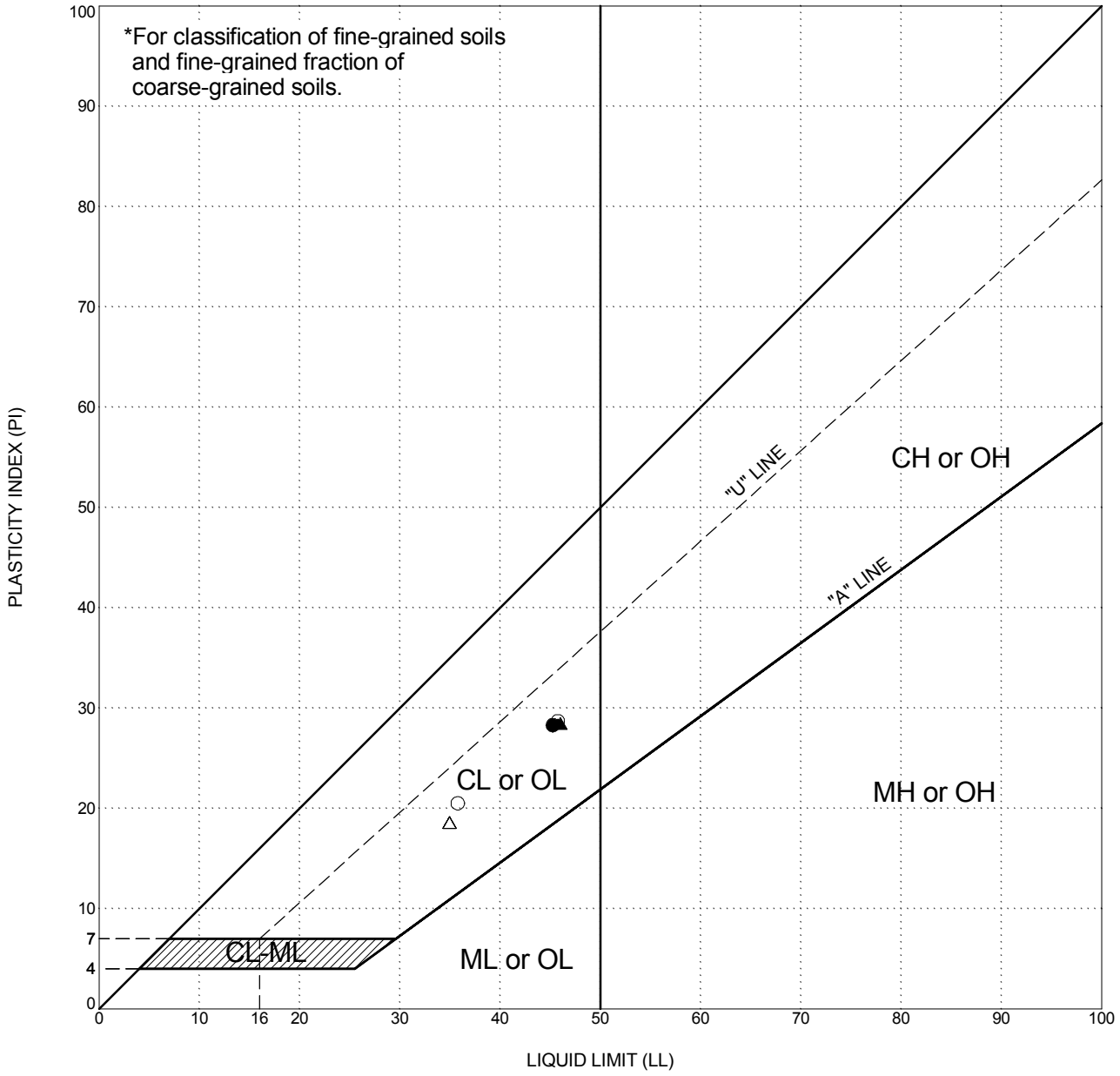
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-13	52.8	Lean CLAY (CL)	32	16	16	90
●	MB-13	56.6	Lean CLAY (CL)	29	15	14	91
△	MB-13	56.8	Lean CLAY (CL)	38	16	22	91
▲	MB-13	67.6	Lean CLAY with sand (CL)	34	16	18	82
⊙	MB-13	70.4	Lean CLAY with sand (CL)	26	15	11	80

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-29



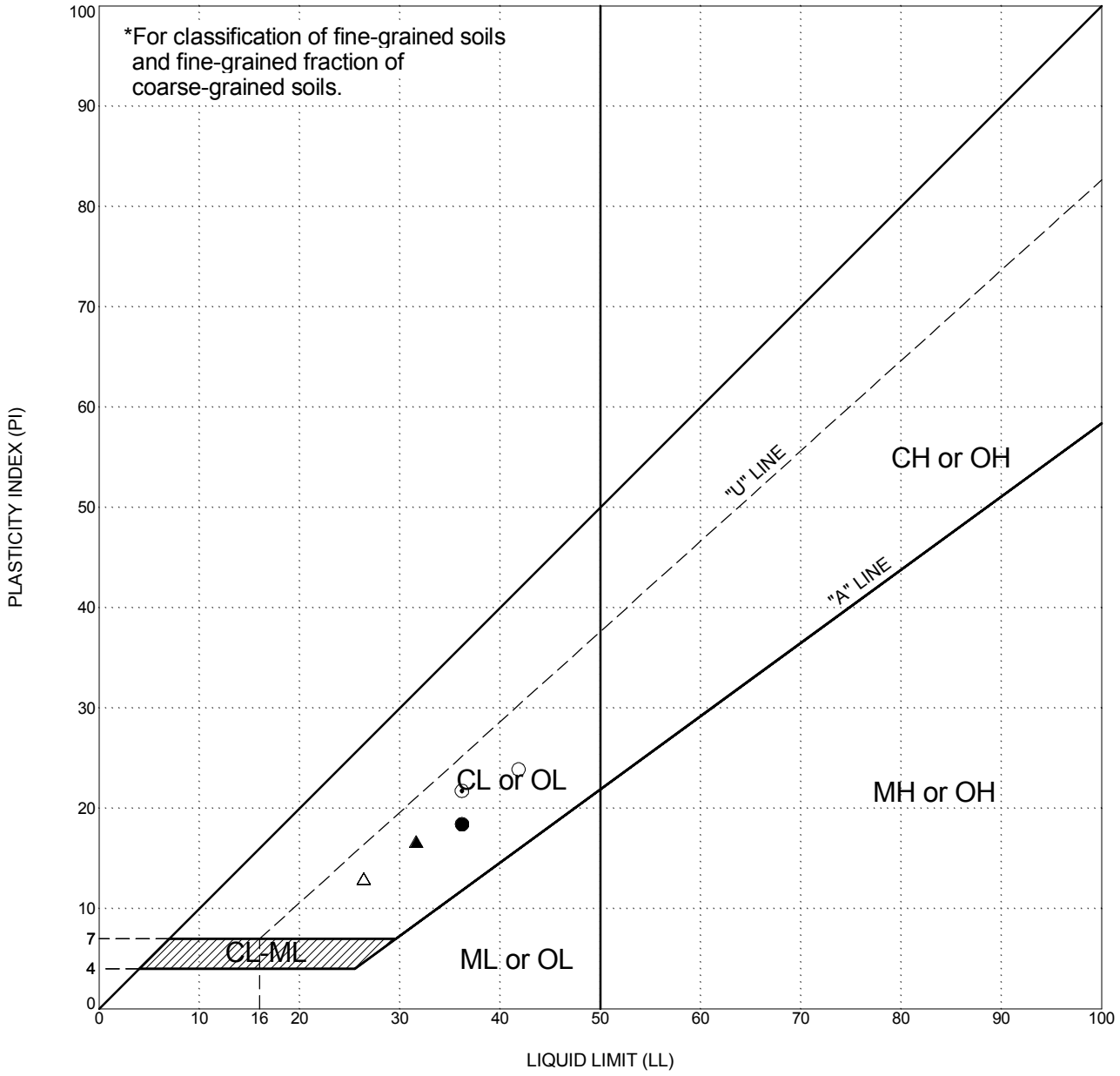
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-13	71.4	Lean CLAY (CL)	36	15	21	92
●	MB-13	77.4	Lean CLAY (CL)	45	17	28	97
△	MB-13	87.3	Lean CLAY (CL)	35	16	19	95
▲	MB-13	101.2	Lean CLAY (CL)	46	18	28	94
⊙	MB-13	107.0	Gravelly Lean CLAY (CL)	46	17	29	70

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-30



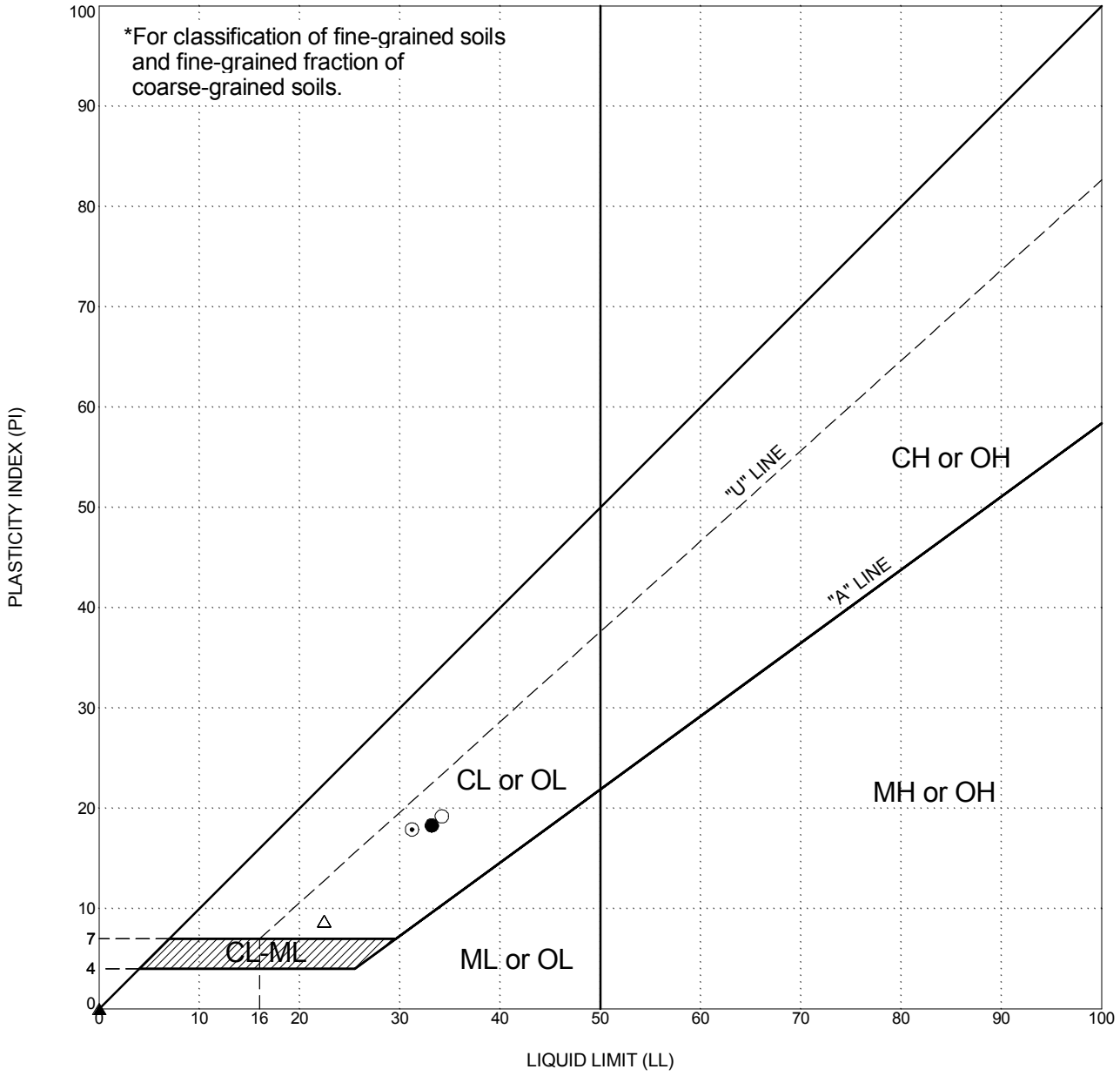
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-13	111.9	Lean CLAY (CL)	42	18	24	100
●	MB-13	113.0	Gravelly Lean CLAY (CL)	36	18	18	60
△	MB-13	120.1	Sandy Lean CLAY (CL)	26	13	13	56
▲	MB-13	126.6	Sandy Lean CLAY (CL)	32	15	17	
⊙	MB-13	130.1	Sandy Lean CLAY (CL)	36	14	22	

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-31

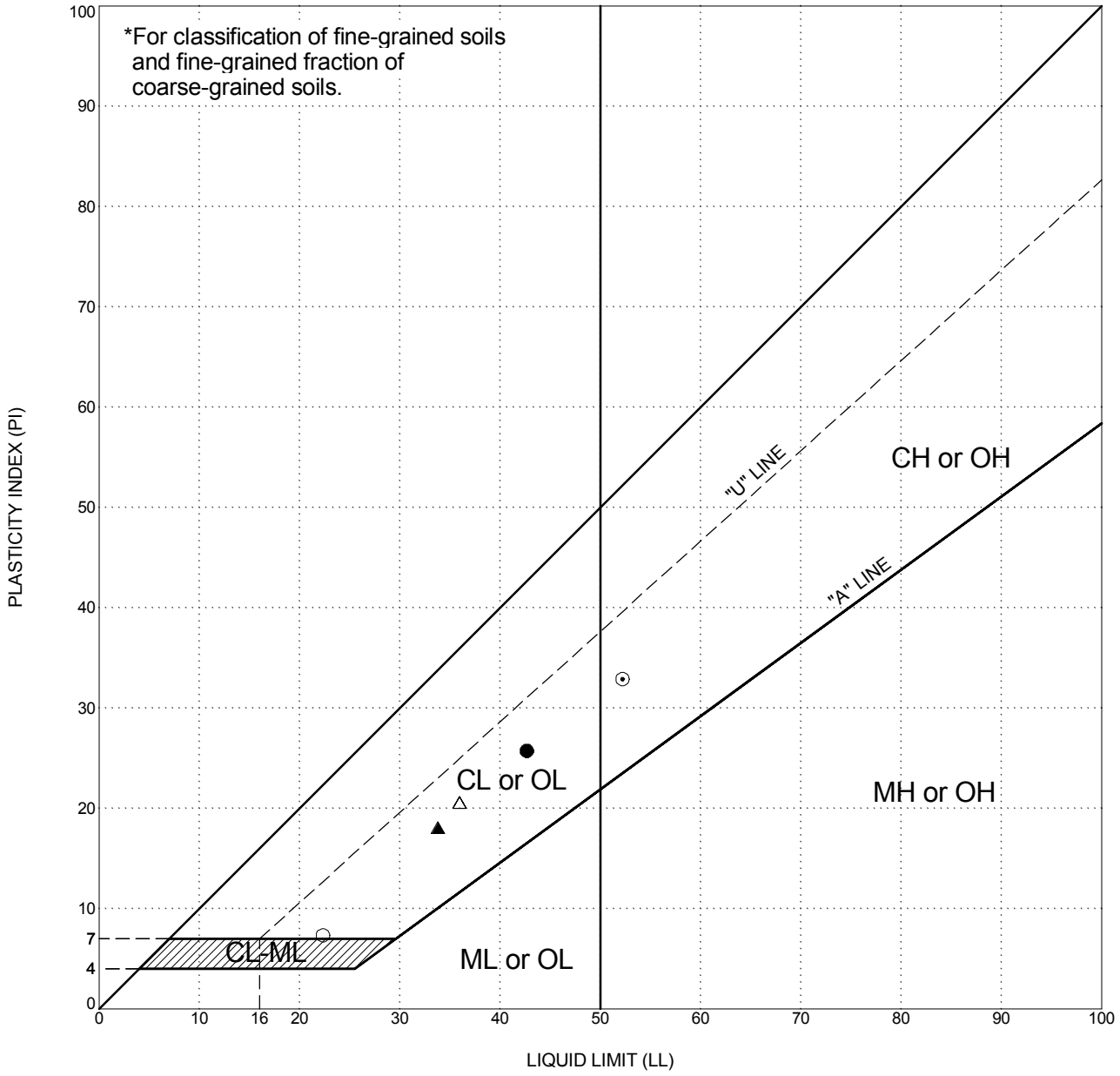


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-13	139.9	Lean CLAY with sand (CL)	34	15	19	75
●	MB-13	147.2	Sandy Lean CLAY (CL)	33	15	18	61
△	MB-13	150.3	GRAVEL with clay (GW-GC)	22	14	8	
▲	MB-14	6.7	Silty SAND (SM)	NP	NP	NP	38
⊙	MB-14	13.3	Lean CLAY with sand (CL)	31	13	18	83

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-32

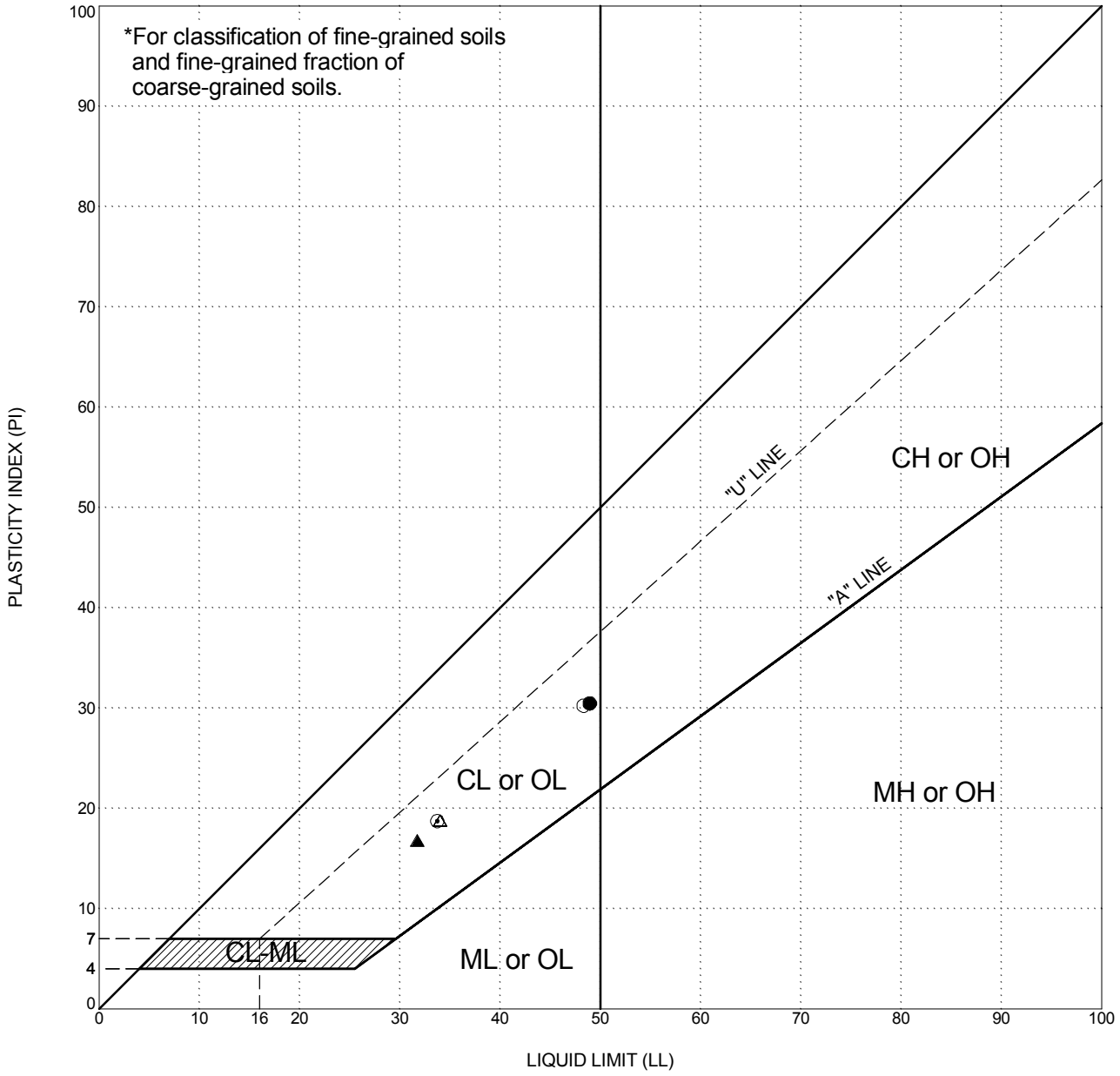


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-14	16.7	Sandy, Silty CLAY (CL-ML)	22	15	7	52
●	MB-14	30.0	Lean CLAY (CL)	43	17	26	92
△	MB-14	37.2	Lean CLAY (CL)	36	15	21	92
▲	MB-14	62.7	Lean CLAY (CL)	34	16	18	90
⊙	MB-14	72.5	Fat CLAY (CH)	52	19	33	93

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-33



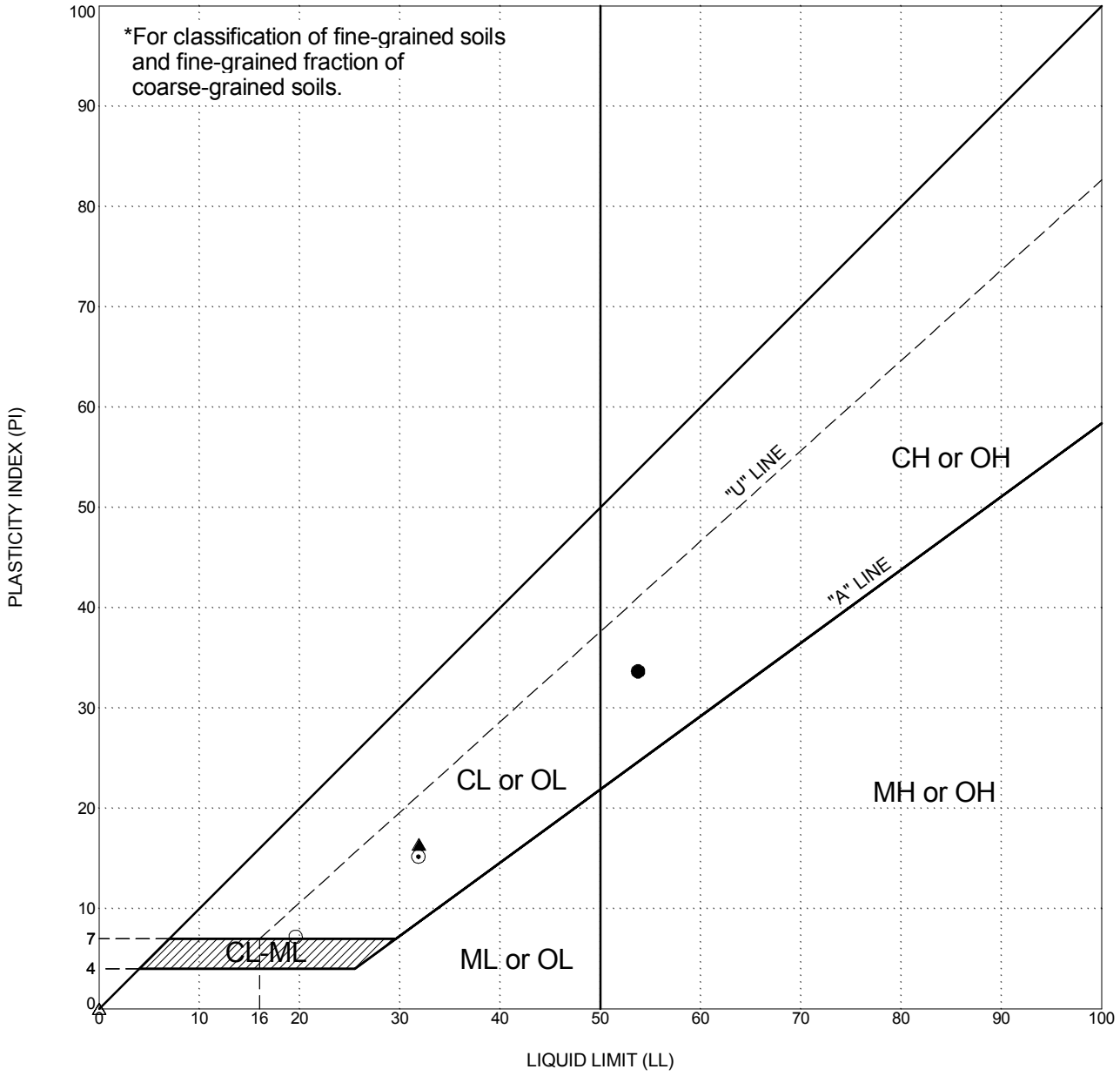
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-14	81.5	Lean CLAY (CL)	48	18	30	88
●	MB-14	87.3	Lean CLAY (CL)	49	18	31	94
△	MB-14	93.2	Sandy Lean CLAY (CL)	34	15	19	58
▲	MB-14	116.1	Gravelly Lean CLAY (CL)	32	15	17	59
⊙	MB-14	121.7	Gravelly Lean CLAY (CL)	34	15	19	61

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-34

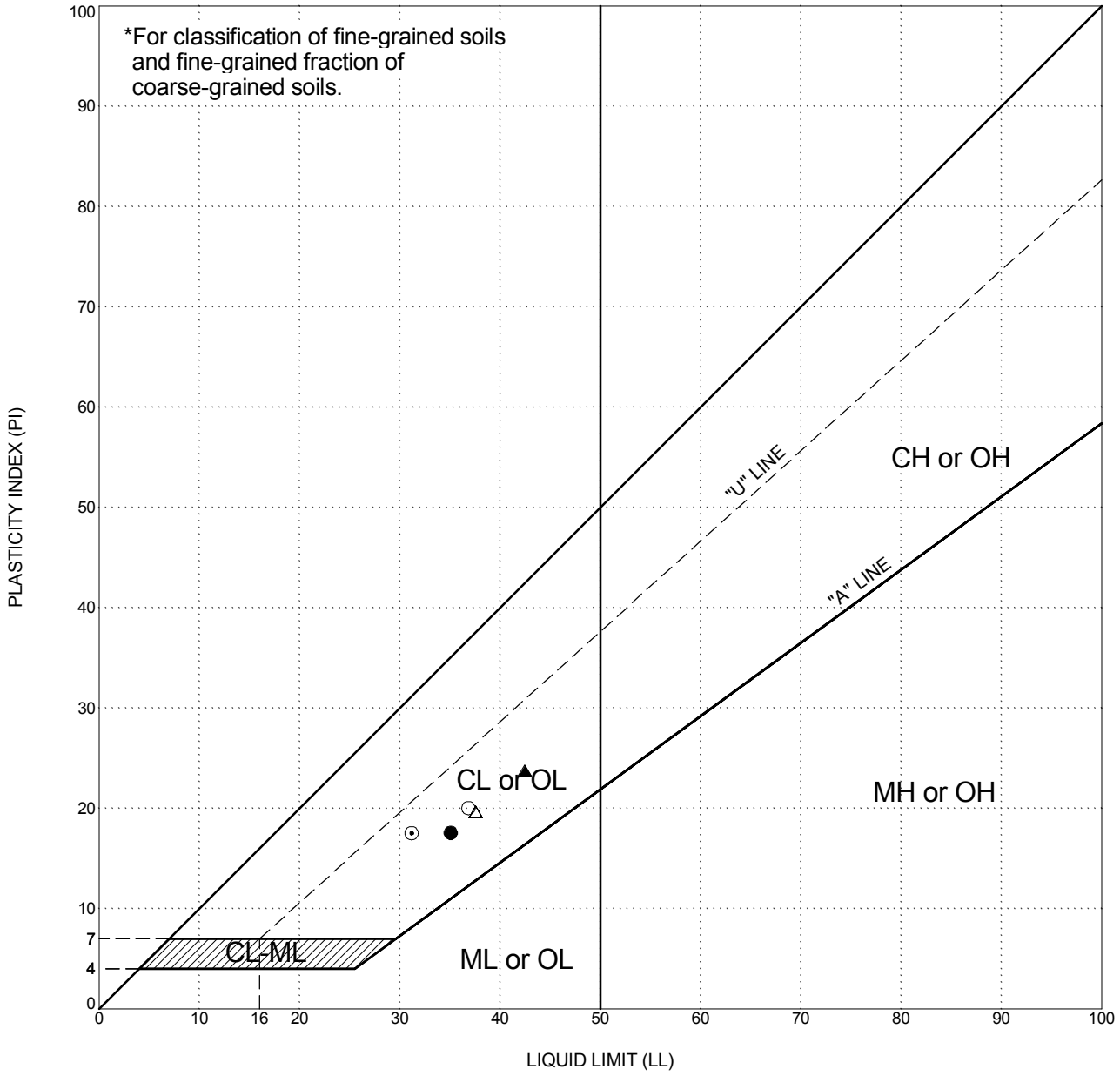


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-14	137.1	Clayey SAND with gravel (SC)	20	12	8	48
●	MB-15	6.2	Fat CLAY (CH)	54	20	34	92
△	MB-15	38.3	Silty SAND (SM)	NP	NP	NP	42
▲	MB-15	45.2	Lean CLAY with sand (CL)	32	15	17	77
⊙	MB-15	61.8	Lean CLAY (CL)	32	17	15	89

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-35



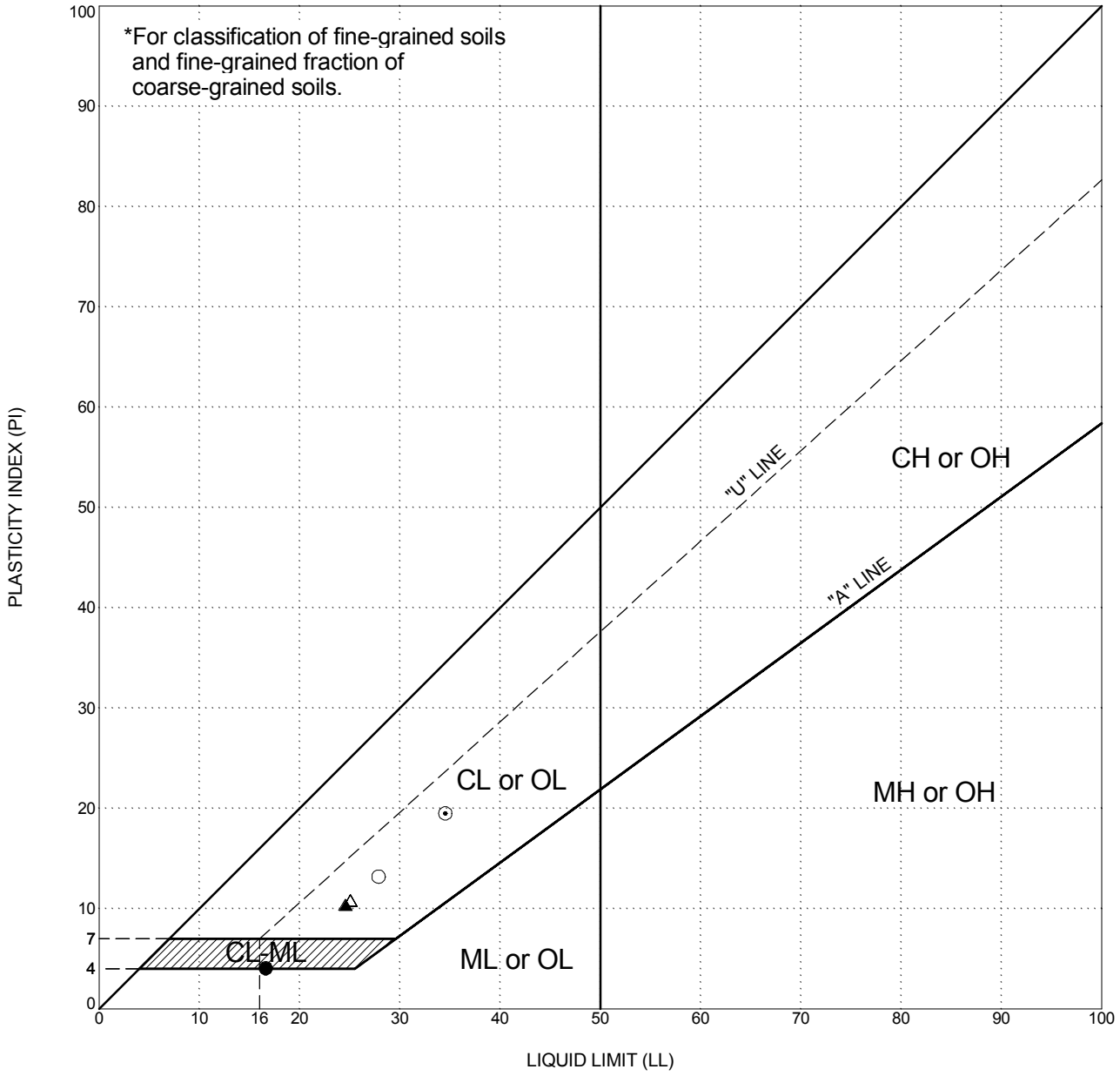
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-15	76.6	Lean CLAY (CL)	37	17	20	89
●	MB-15	86.6	Lean CLAY (CL)	35	17	18	93
△	MB-15	100.2	Lean CLAY (CL)	38	18	20	92
▲	MB-15	110.2	Lean CLAY with sand (CL)	42	19	23	82
⊙	MB-15	118.9	Lean CLAY with sand (CL)	31	14	17	79

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-36



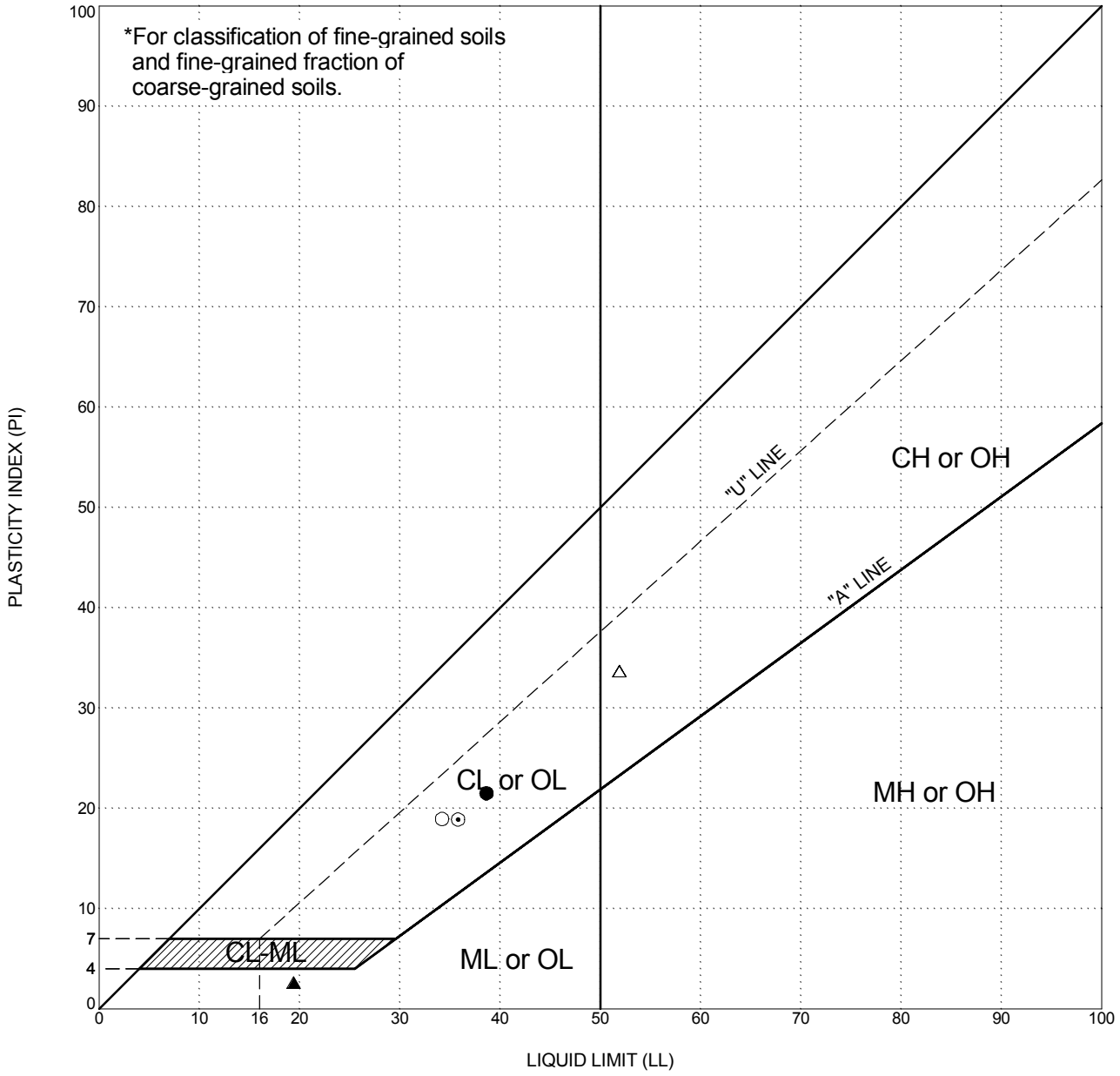
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-15	119.1	Lean CLAY with sand (CL)	28	15	13	
●	MB-15	128.9	Silty CLAY with sand (CL-ML)	17	13	4	76
△	MB-15	134.5	Sandy Lean CLAY with gravel (CL)	25	14	11	54
▲	MB-15	140.4	Sandy Lean CLAY with gravel (CL)	25	14	11	60
⊙	MB-15	151.6	Sandy Lean CLAY with gravel (CL)	35	15	20	69

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-37



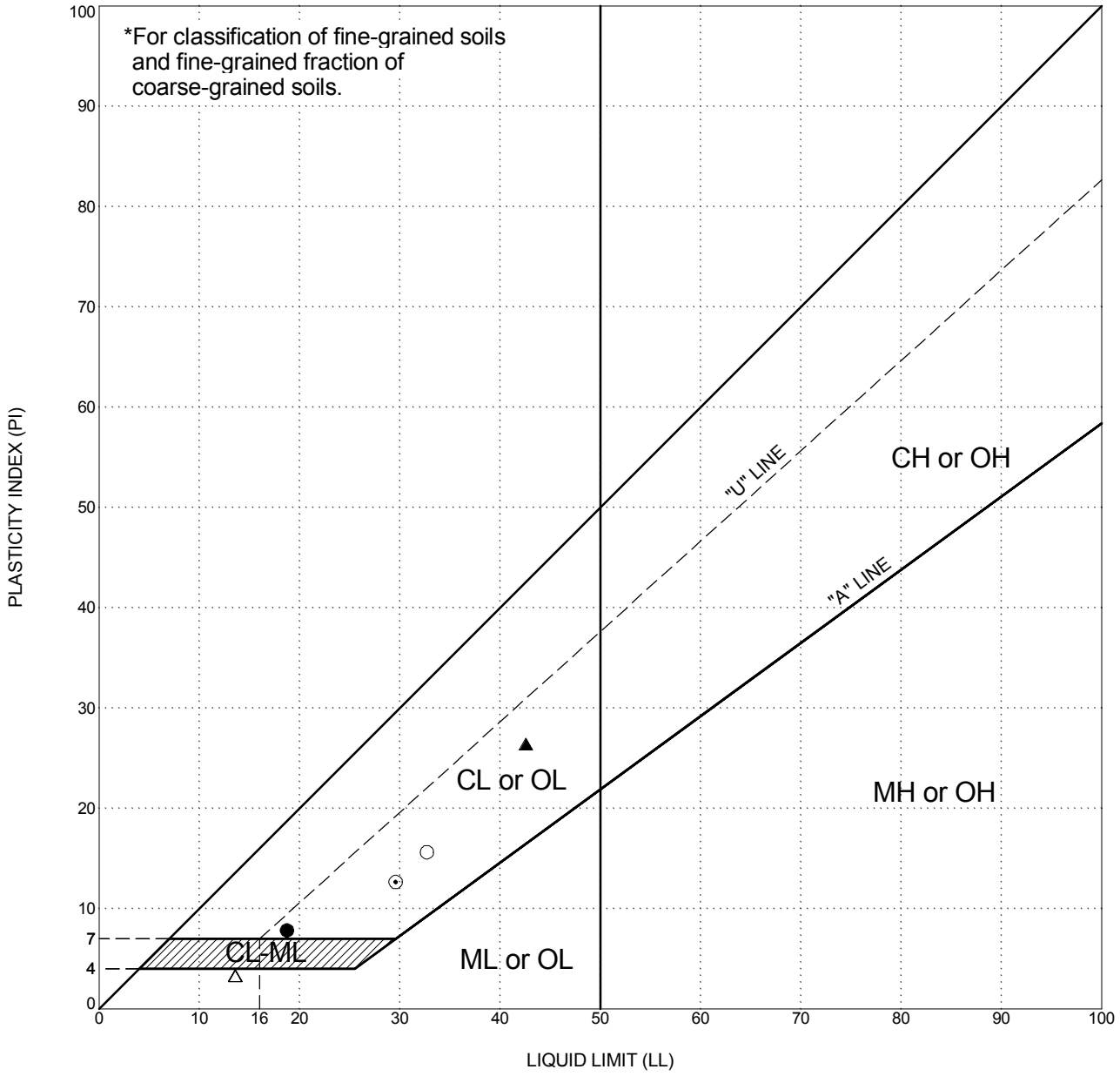
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-16	19.2	Lean CLAY with sand (CL)	34	15	19	71
●	MB-16	29.4	Lean CLAY (CL)	39	17	22	
△	MB-16	52.8	Lean CLAY (CL)	52	18	34	95
▲	MB-16	57.3	Sandy SILT (ML)	19	17	2	60
⊙	MB-16	77.4	Lean CLAY (CL)	36	17	19	91

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-38



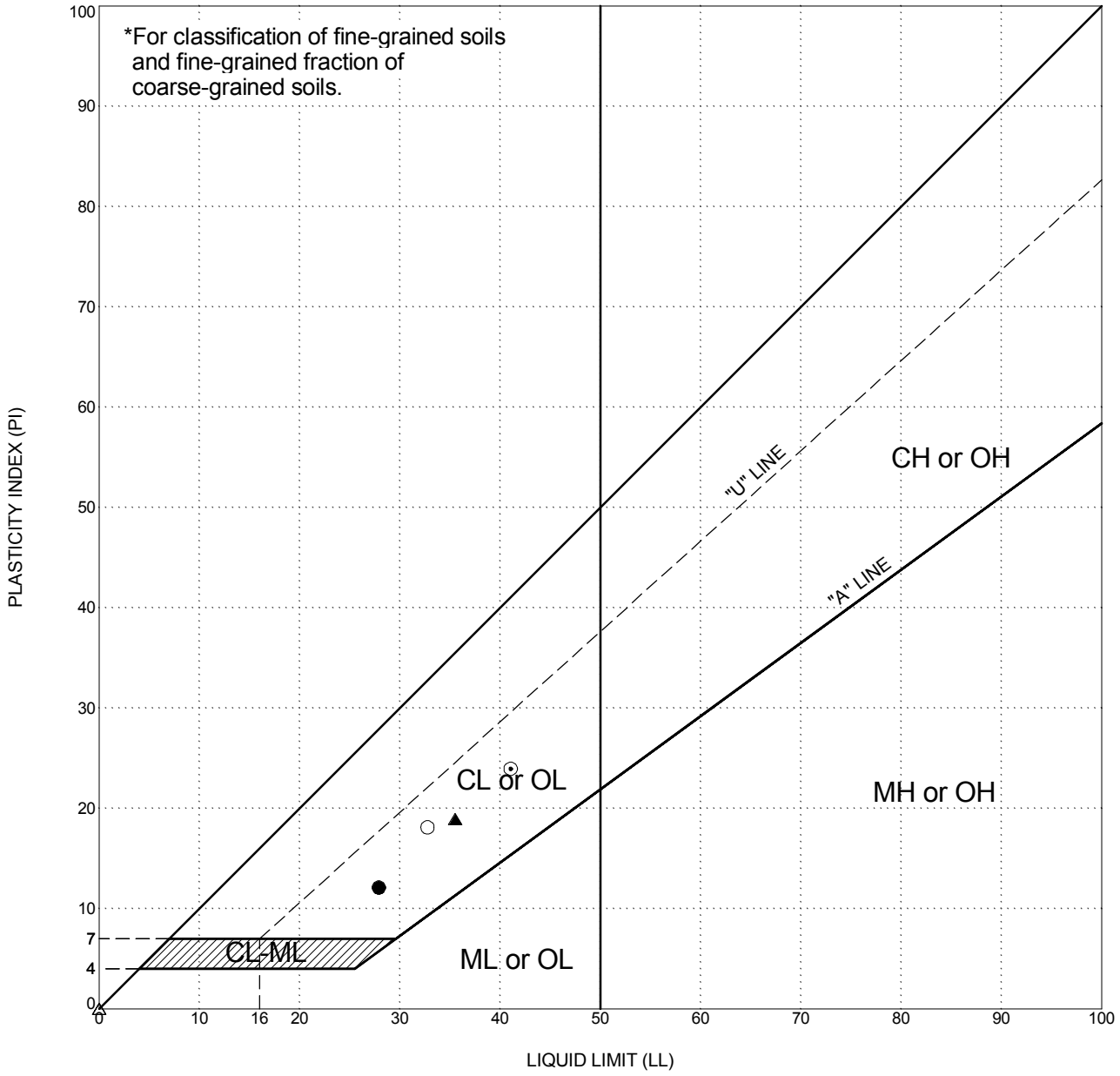
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-16	82.4	Lean CLAY (CL)	33	17	16	90
●	MB-16	91.4	Sandy Lean CLAY (CL)	19	11	8	57
△	MB-16	100.9	Silty, Clayey SAND (SC-SM)	14	10	4	35
▲	MB-16	110.4	Lean CLAY (CL)	43	16	27	87
⊙	MB-16	120.4	Lean CLAY with sand (CL)	30	17	13	75

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-39



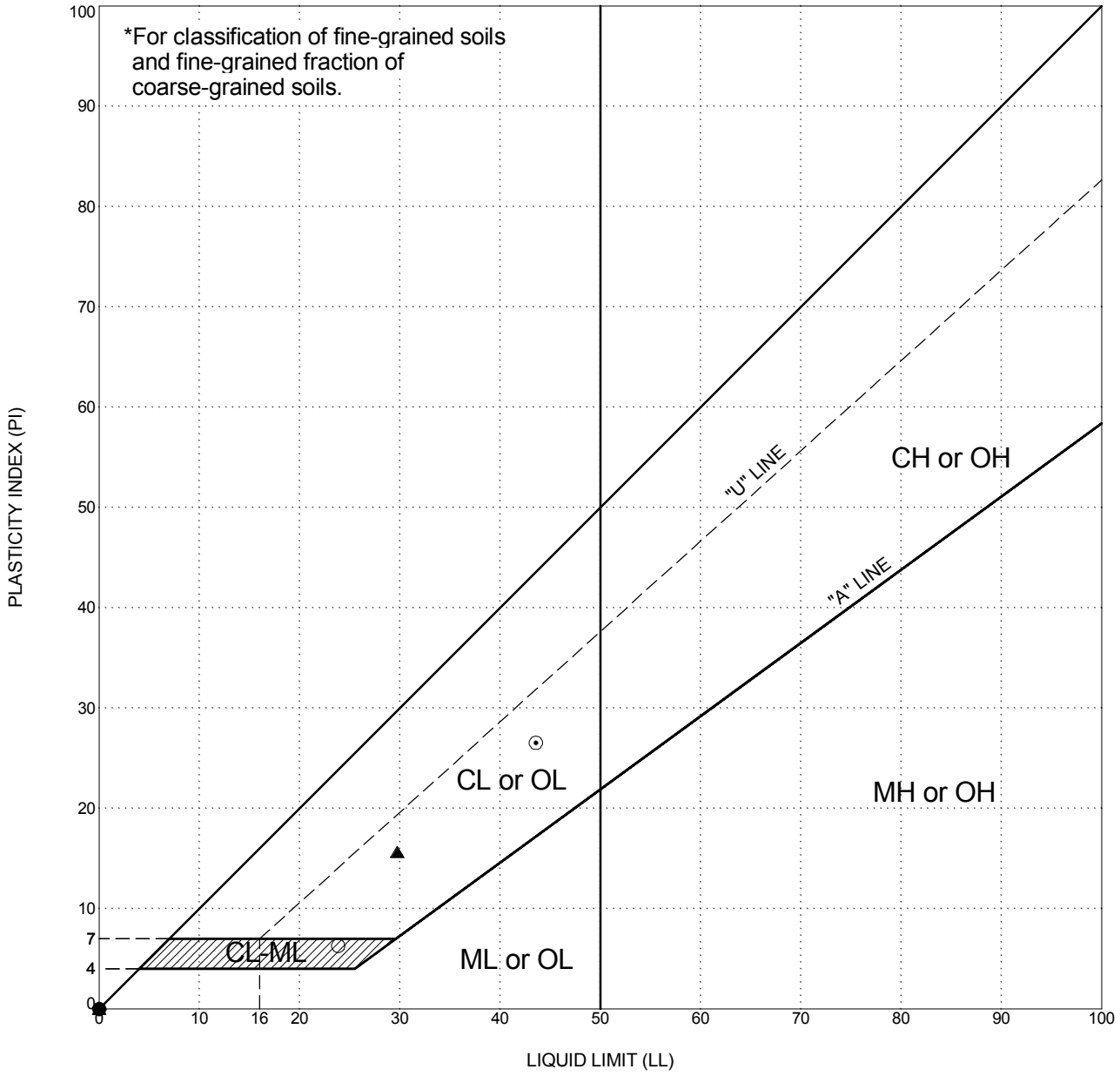
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-16	134.0	Sandy Lean CLAY (CL)	33	15	18	69
●	MB-16	149.8	Lean CLAY (CL)	28	16	12	
△	MB-17	4.4	Clayey SAND with gravel (SC)	NP	NP	NP	14
▲	MB-17	16.7	Lean CLAY with sand (CL)	36	17	19	71
⊙	MB-17	19.2	Lean CLAY with sand (CL)	41	17	24	84

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-40



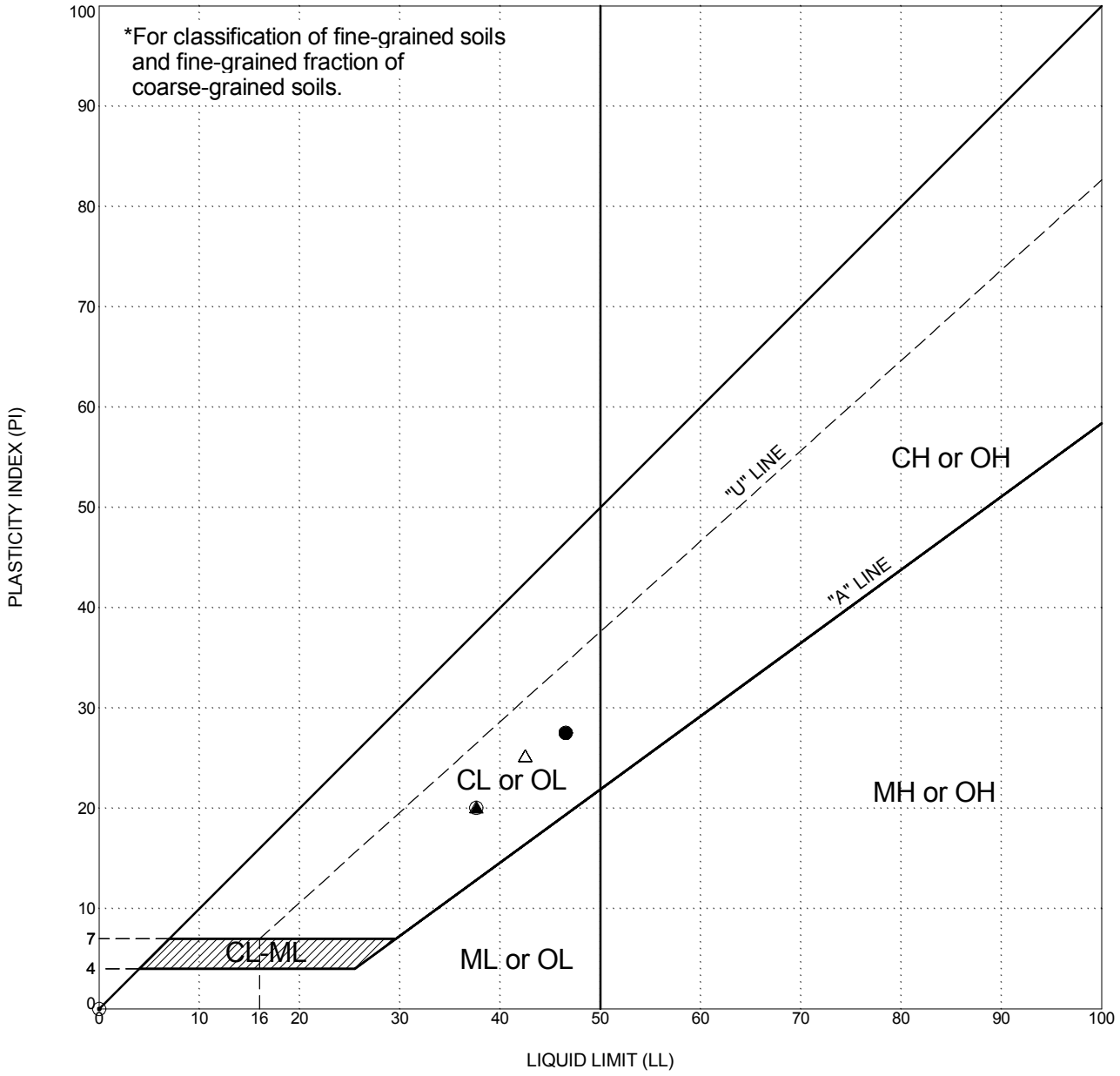
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-17	27.2	Sandy, Silty CLAY (CL-ML)	24	18	6	52
●	MB-17	32.5	Silty SAND (SM)	NP	NP	NP	19
△	MB-17	42.3	Silty SAND (SM)	NP	NP	NP	45
▲	MB-17	46.6	Lean CLAY with sand (CL)	30	14	16	71
⊙	MB-17	52.8	Lean CLAY with sand (CL)	44	17	27	81

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-41



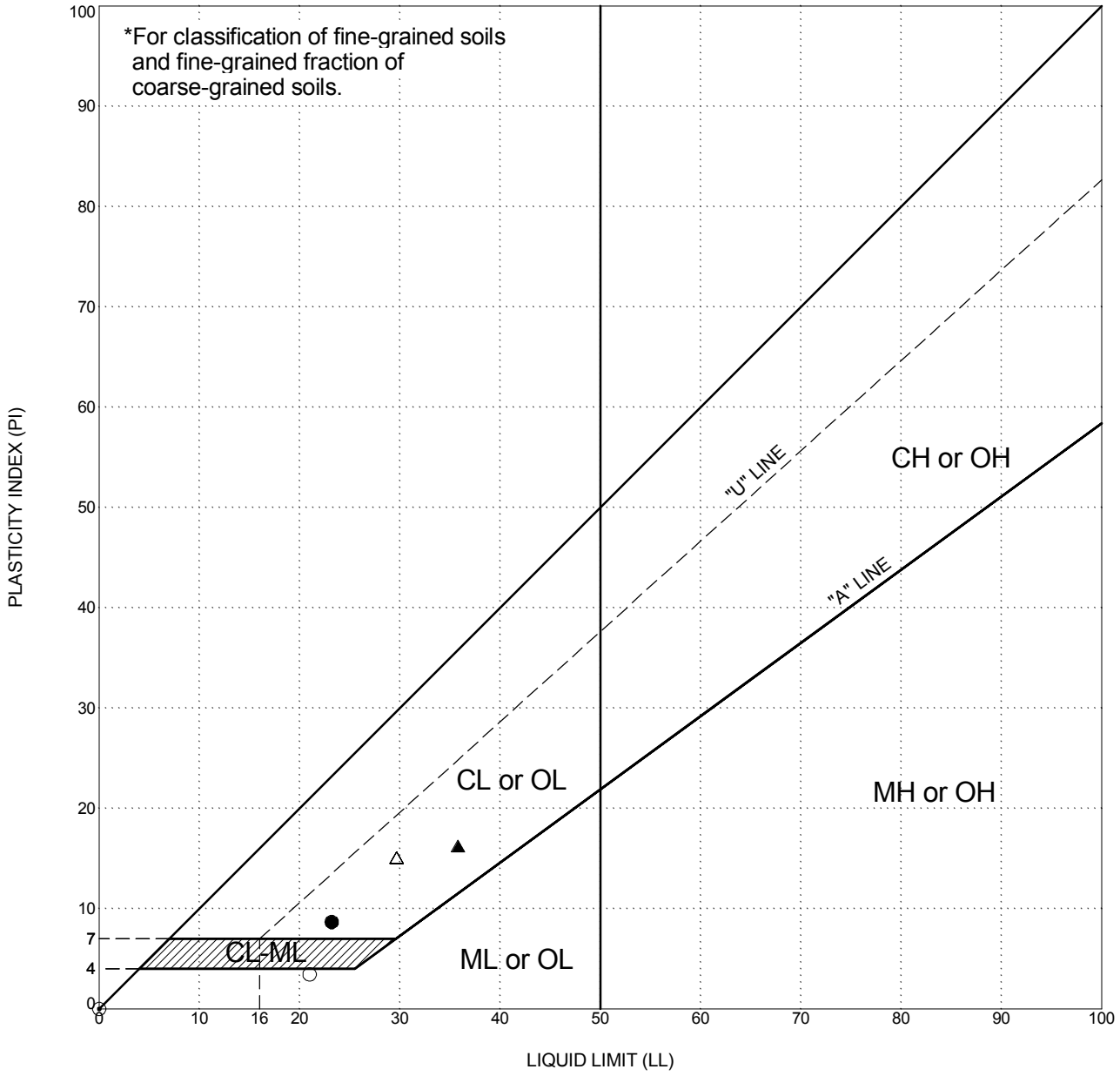
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-17	63.5	Lean CLAY (CL)	38	18	20	91
●	MB-17	72.7	Lean CLAY (CL)	47	19	28	95
△	MB-17	78.7	Lean CLAY with sand (CL)	43	17	26	72
▲	MB-17	89.7	Lean CLAY (CL)	38	17	21	98
⊙	MB-17	104.5	SILT with sand (ML)	NP	NP	NP	80

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-42



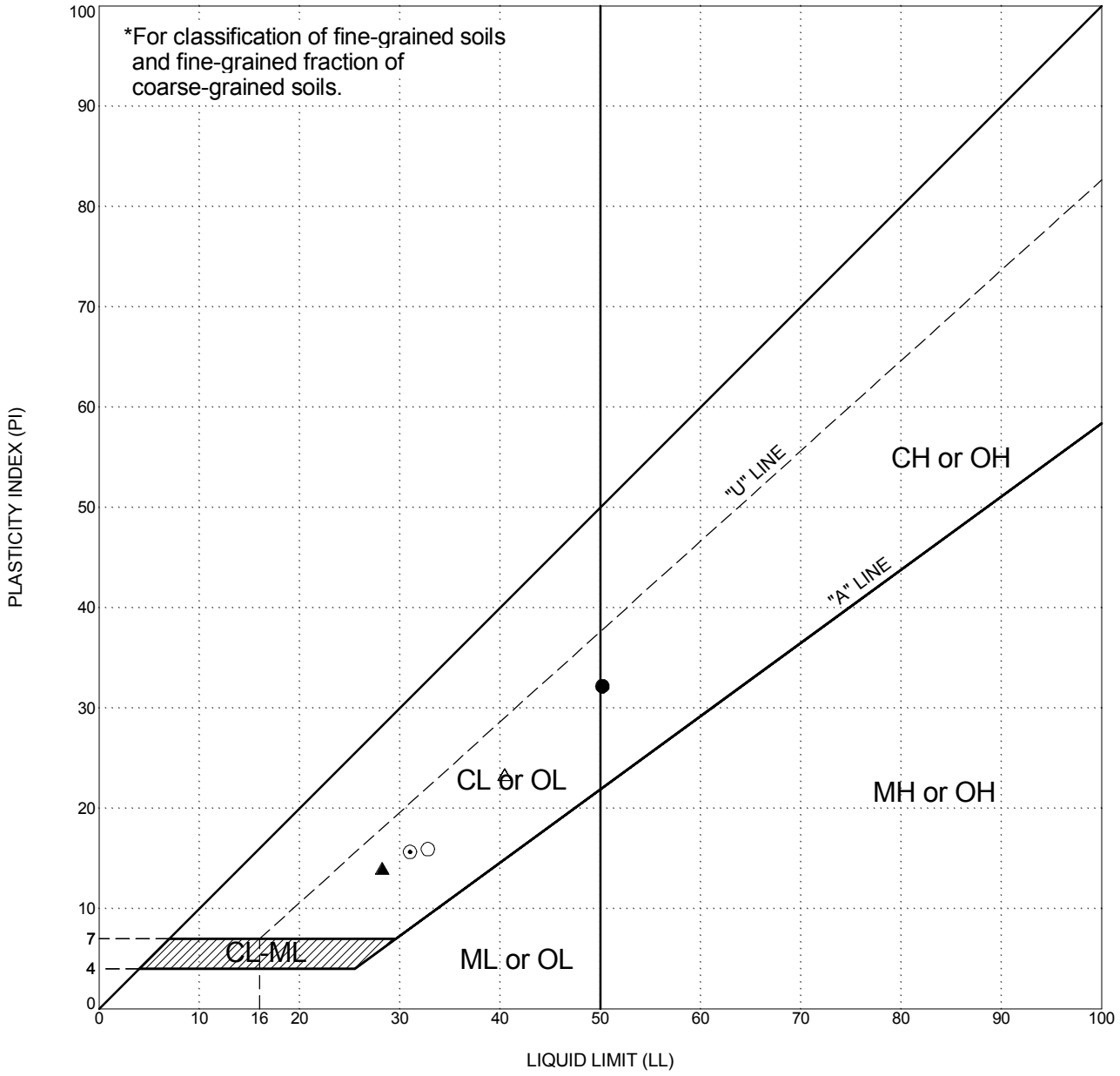
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-17	114.8	Sandy SILT (ML)	21	18	3	69
●	MB-17	126.0	Gravelly Lean CLAY (CL)	23	15	8	60
△	MB-17	133.2	Sandy Lean CLAY (CL)	30	15	15	68
▲	MB-17	138.5	Lean CLAY (CL)	36	20	16	93
⊙	MB-17	142.0	SAND (SP)	NP	NP	NP	2

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-43



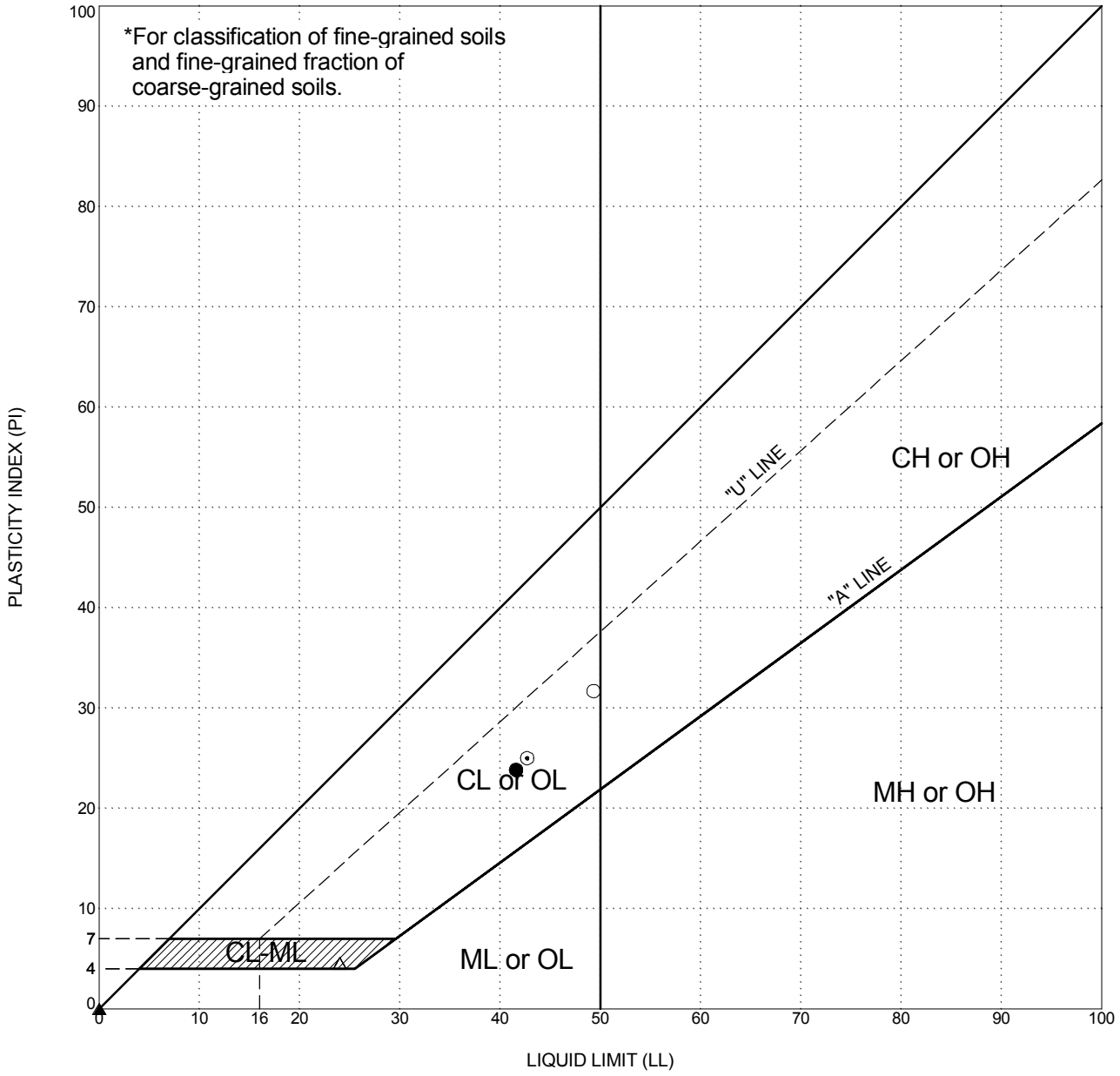
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-18	0.2	Lean CLAY (CL)	33	17	16	90
●	MB-18	4.3	Lean CLAY (CL)	50	18	32	89
△	MB-18	6.9	Lean CLAY with sand (CL)	40	17	23	83
▲	MB-18	9.9	Lean CLAY with sand (CL)	28	14	14	
⊙	MB-18	10.1	Lean CLAY with sand (CL)	31	15	16	83

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-44



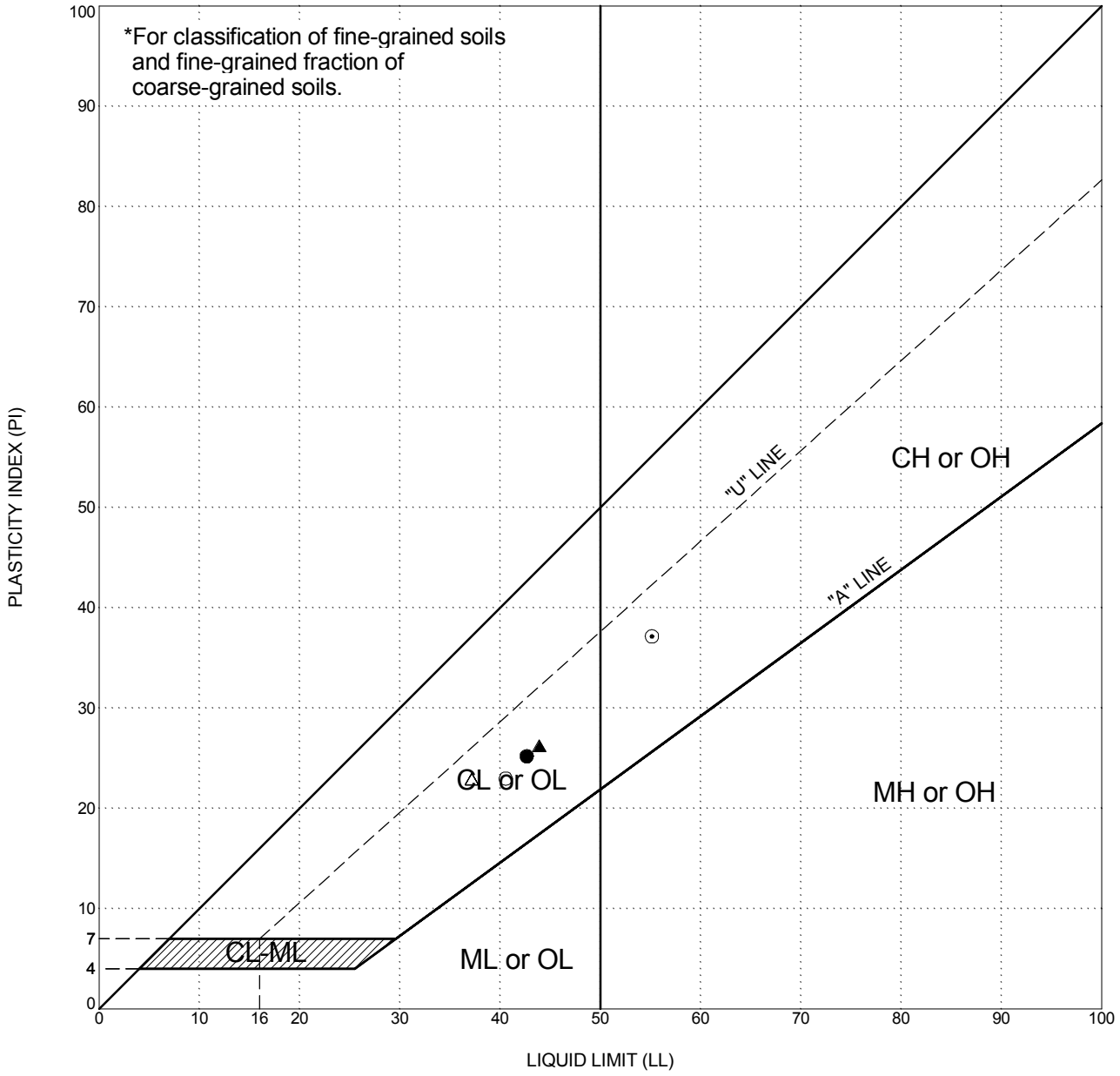
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-18	13.5	Lean CLAY (CL)	49	18	31	91
●	MB-18	19.2	Lean CLAY (CL)	42	18	24	90
△	MB-18	26.0	Sandy SILT (ML)	24	19	5	60
▲	MB-18	35.9	Sandy SILT (ML)	NP	NP	NP	51
⊙	MB-18	46.3	Lean CLAY (CL)	43	18	25	88

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-45



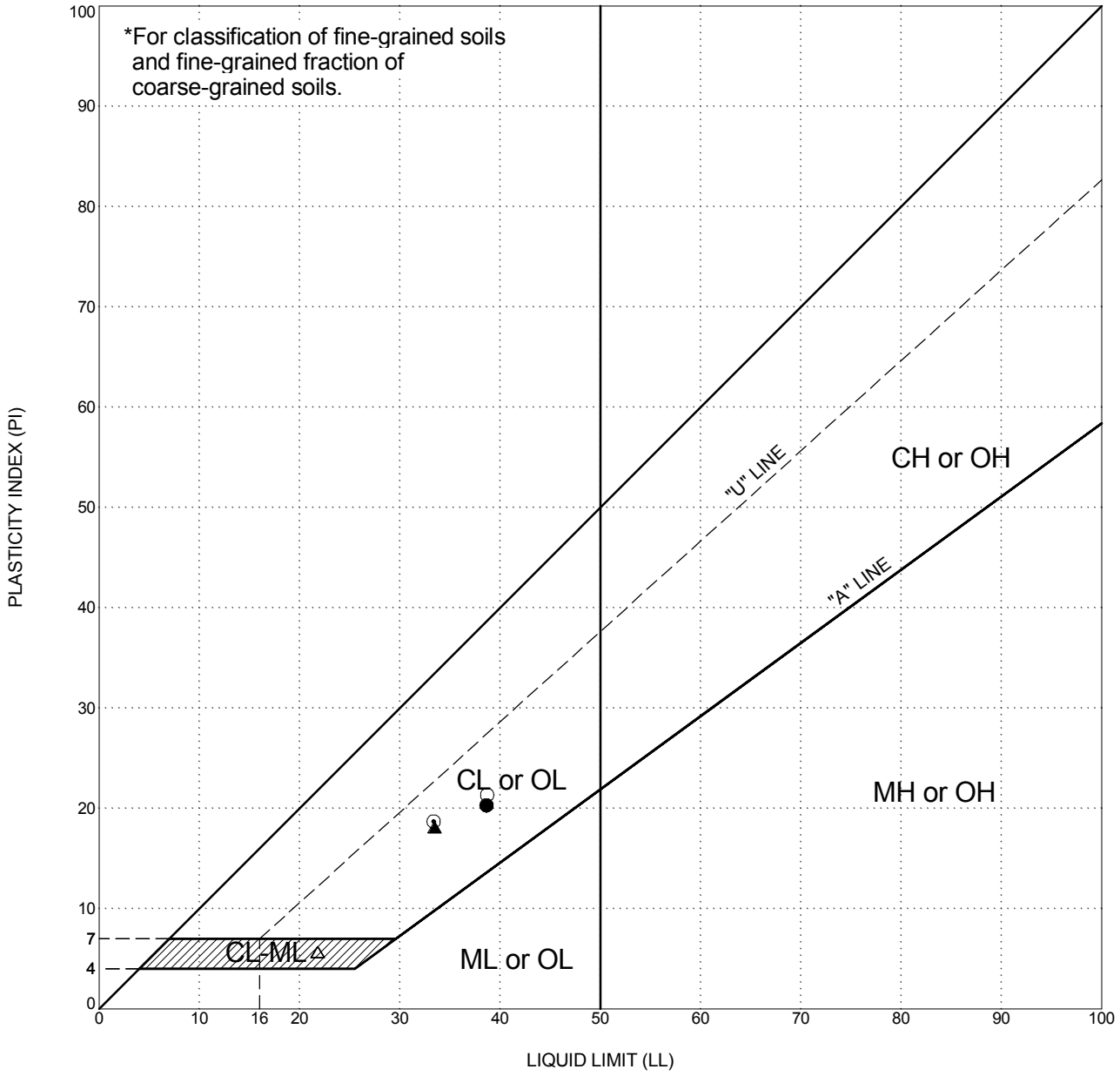
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-18	52.0	Lean CLAY (CL)	41	18	23	96
●	MB-18	65.1	Lean CLAY (CL)	43	17	26	90
△	MB-18	71.9	Lean CLAY with sand (CL)	37	14	23	83
▲	MB-18	75.0	Lean CLAY (CL)	44	18	26	85
⊙	MB-18	81.2	Lean CLAY (CL)	55	18	37	97

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-46



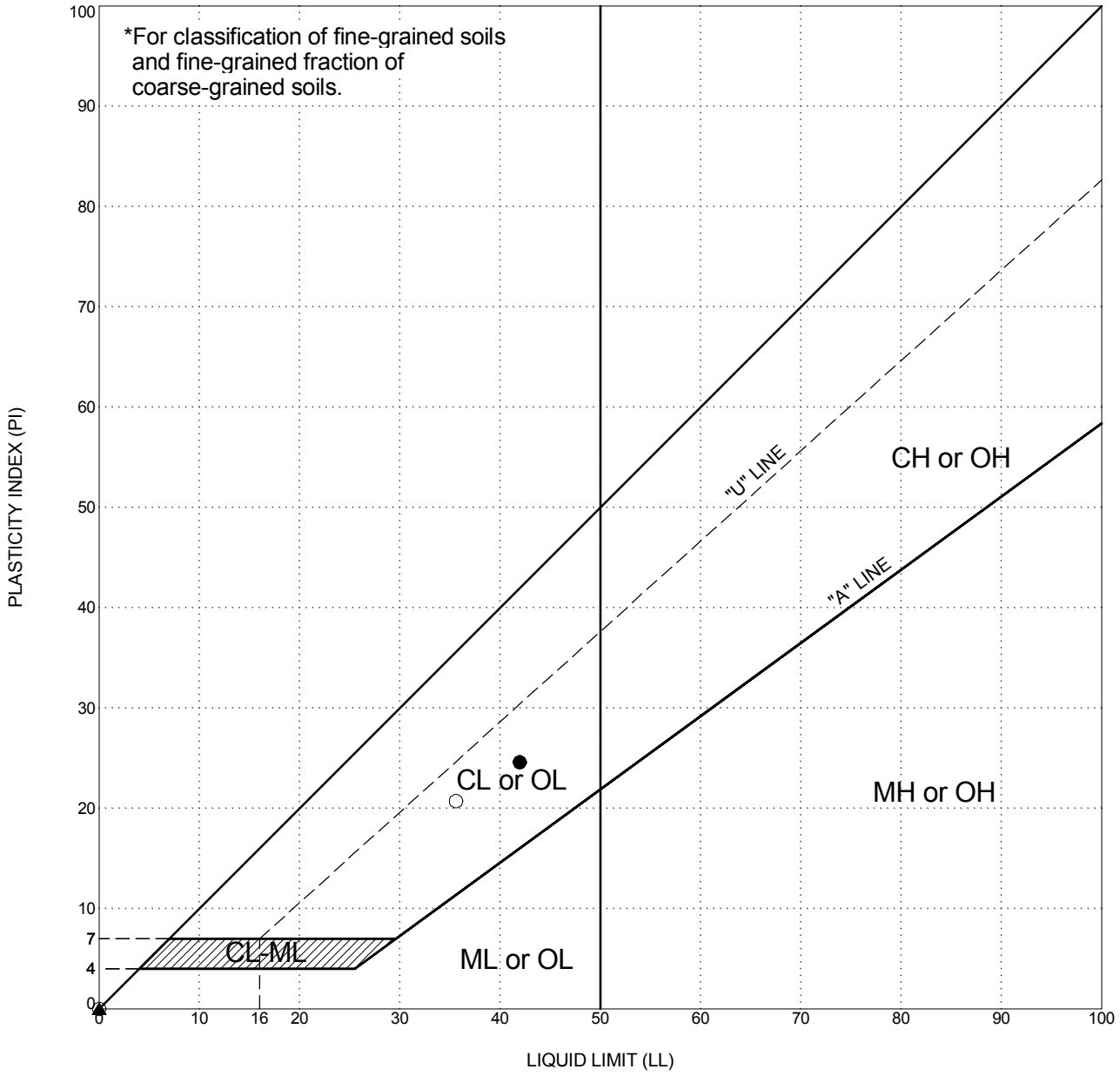
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-18	91.0	Lean CLAY (CL)	39	17	22	98
●	MB-18	96.0	Lean CLAY (CL)	39	18	21	96
△	MB-18	99.1	Silty CLAY (CL-ML)	22	16	6	89
▲	MB-18	108.9	Sandy Lean CLAY (CL)	33	15	18	54
⊙	MB-18	111.2	Sandy Lean CLAY (CL)	33	15	18	58

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-47



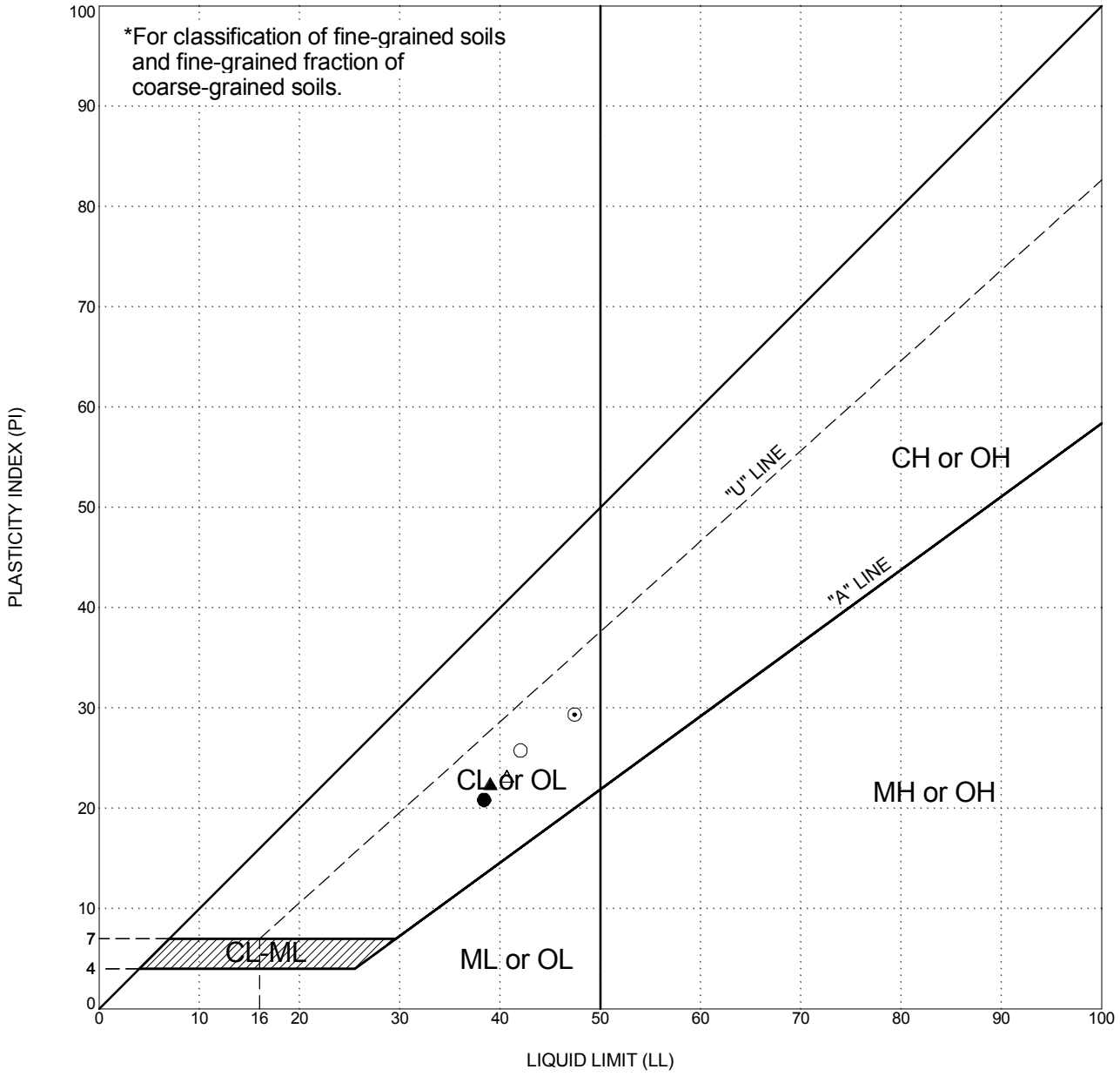
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-18	121.0	Lean CLAY with sand (CL)	36	15	21	71
●	MB-18	132.2	Sandy Lean CLAY (CL)	42	17	25	70
△	MB-19	0.4	Silty SAND (SM)	NP	NP	NP	26
▲	MB-19	6.9	Silty SAND (SM)	NP	NP	NP	15
⊙	MB-19	14.3	Silty SAND (SM)	NP	NP	NP	25

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-48



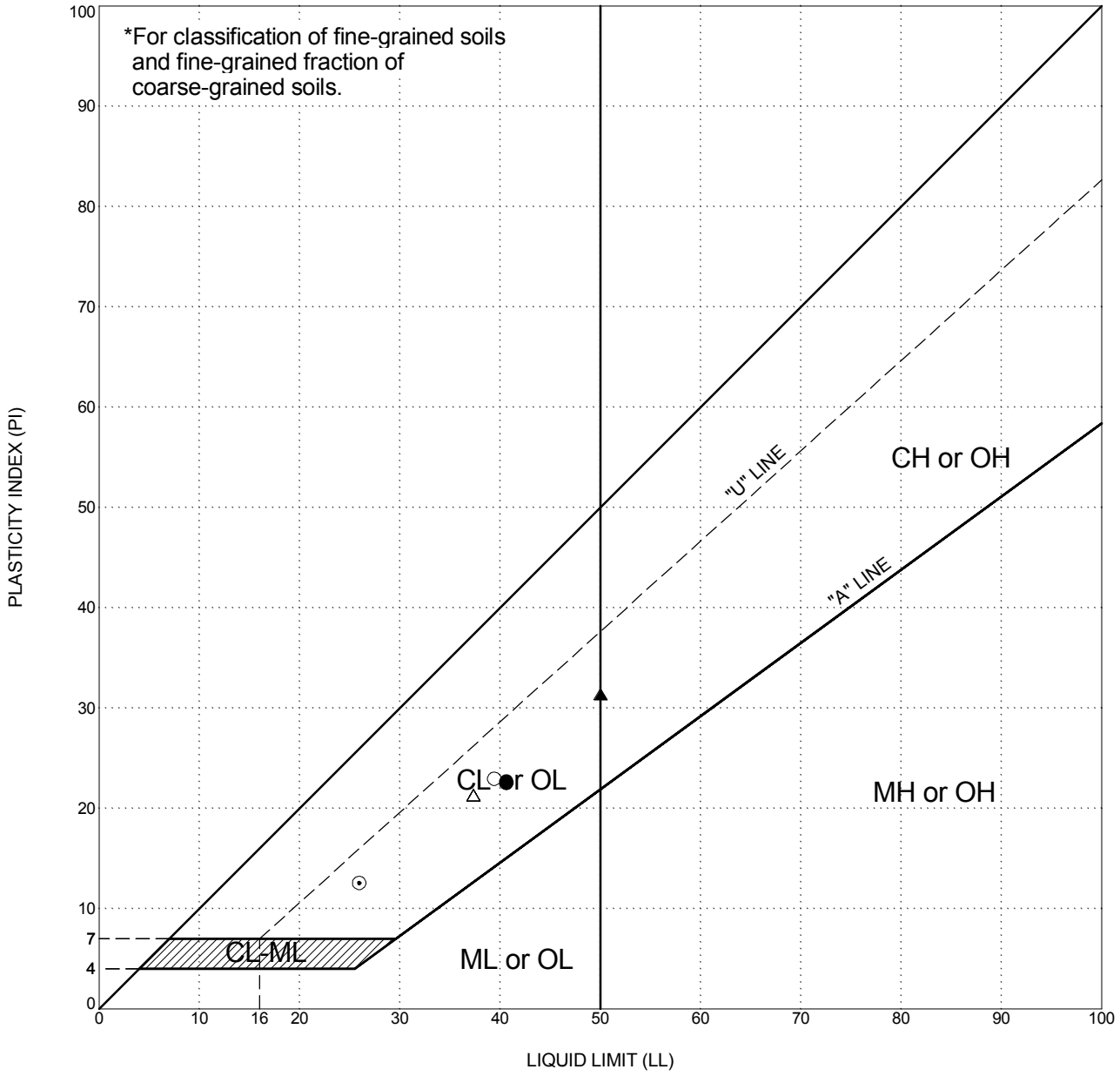
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-19	20.8	Lean CLAY (CL)	42	16	26	92
●	MB-19	36.4	Lean CLAY (CL)	38	18	20	90
△	MB-19	48.1	Lean CLAY (CL)	41	17	24	90
▲	MB-19	62.7	Lean CLAY (CL)	39	17	22	87
⊙	MB-19	74.3	Gravelly Lean CLAY with sand (CL)	47	18	29	50

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-49



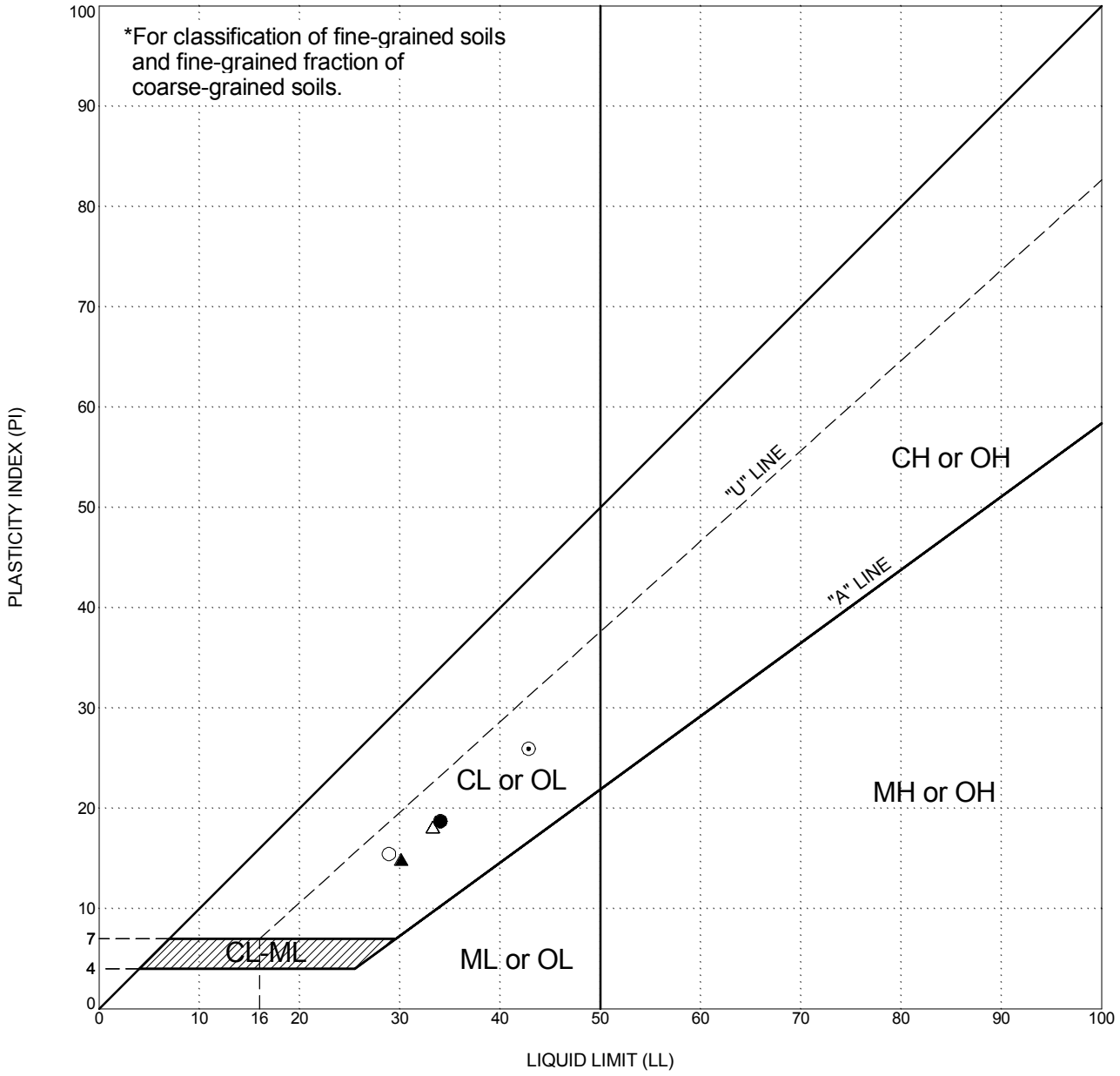
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-19	77.4	Lean CLAY (CL)	39	16	23	88
●	MB-19	92.2	Lean CLAY (CL)	41	18	23	99
△	MB-19	97.9	Lean CLAY (CL)	37	16	21	95
▲	MB-19	102.0	Lean CLAY (CL)	50	19	31	99
⊙	MB-19	114.0	Sandy Lean CLAY (CL)	26	13	13	62

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-50

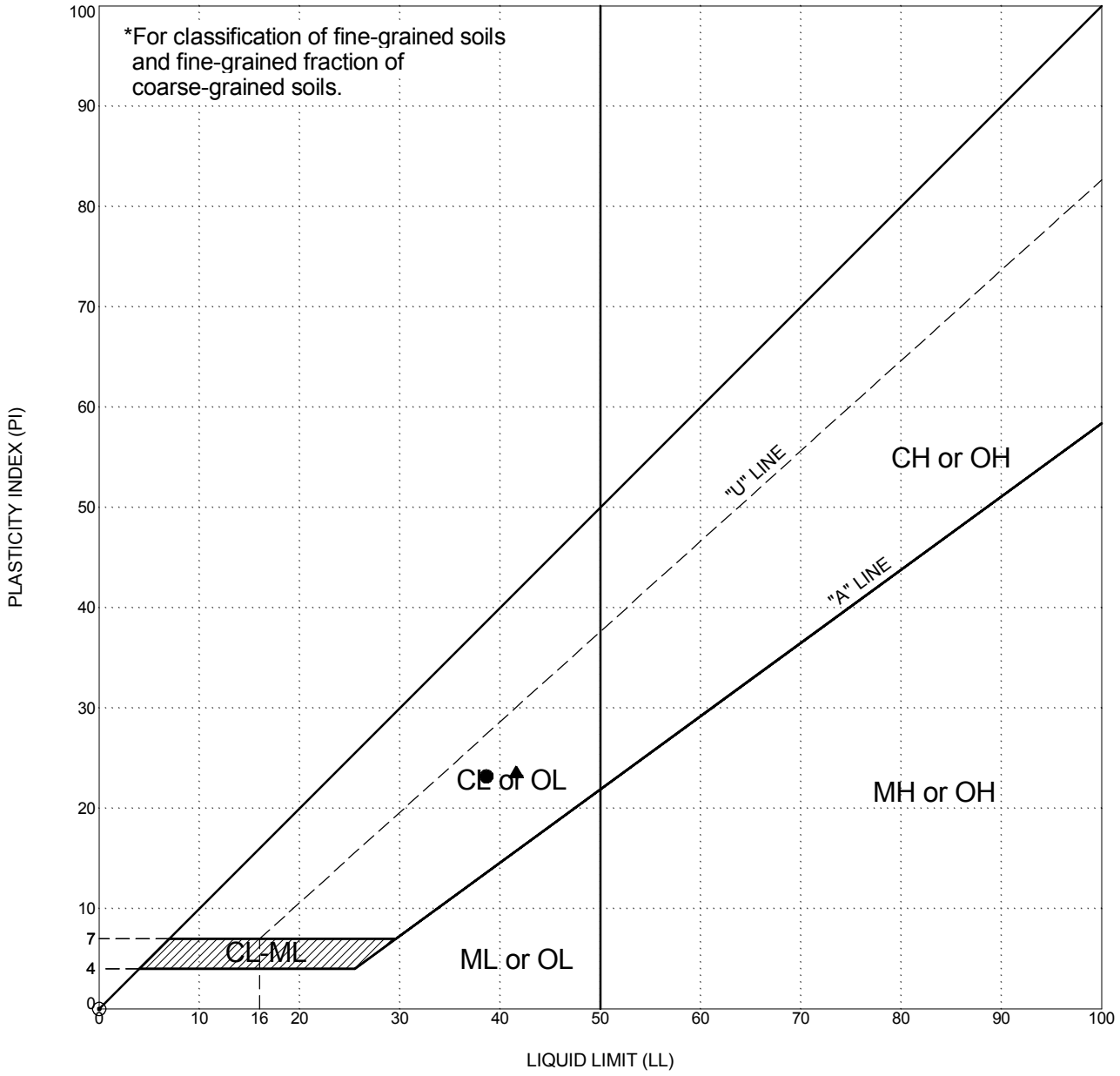


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-19	119.9	Sandy Lean CLAY (CL)	29	13	16	56
●	MB-19	127.0	Sandy Lean CLAY (CL)	34	15	19	65
△	MB-19	132.4	Gravelly Lean CLAY (CL)	33	15	18	73
▲	MB-20	10.7	Clayey GRAVEL with sand (GC)	30	15	15	
⊙	MB-20	14.3	Lean CLAY with sand (CL)	43	17	26	81

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-51



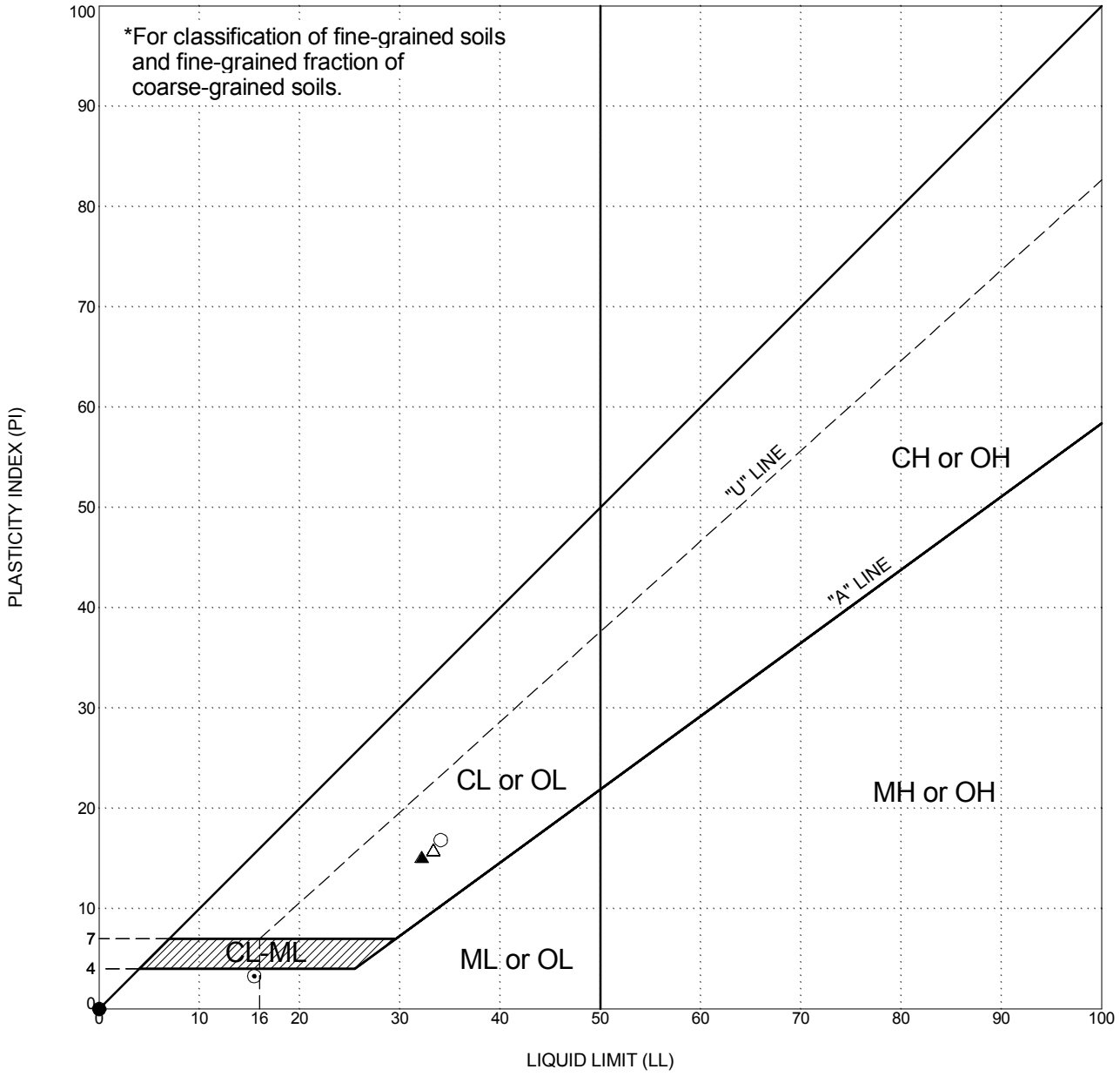
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-20	24.0	Silty SAND (SM)	NP	NP	NP	36
●	MB-20	30.1	Lean CLAY with sand (CL)	39	15	24	
△	MB-20	39.1	Lean CLAY (CL)	42	18	24	89
▲	MB-20	39.9	Lean CLAY (CL)	42	18	24	
⊙	MB-20	46.3	Silty SAND (SM)	NP	NP	NP	26

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-52

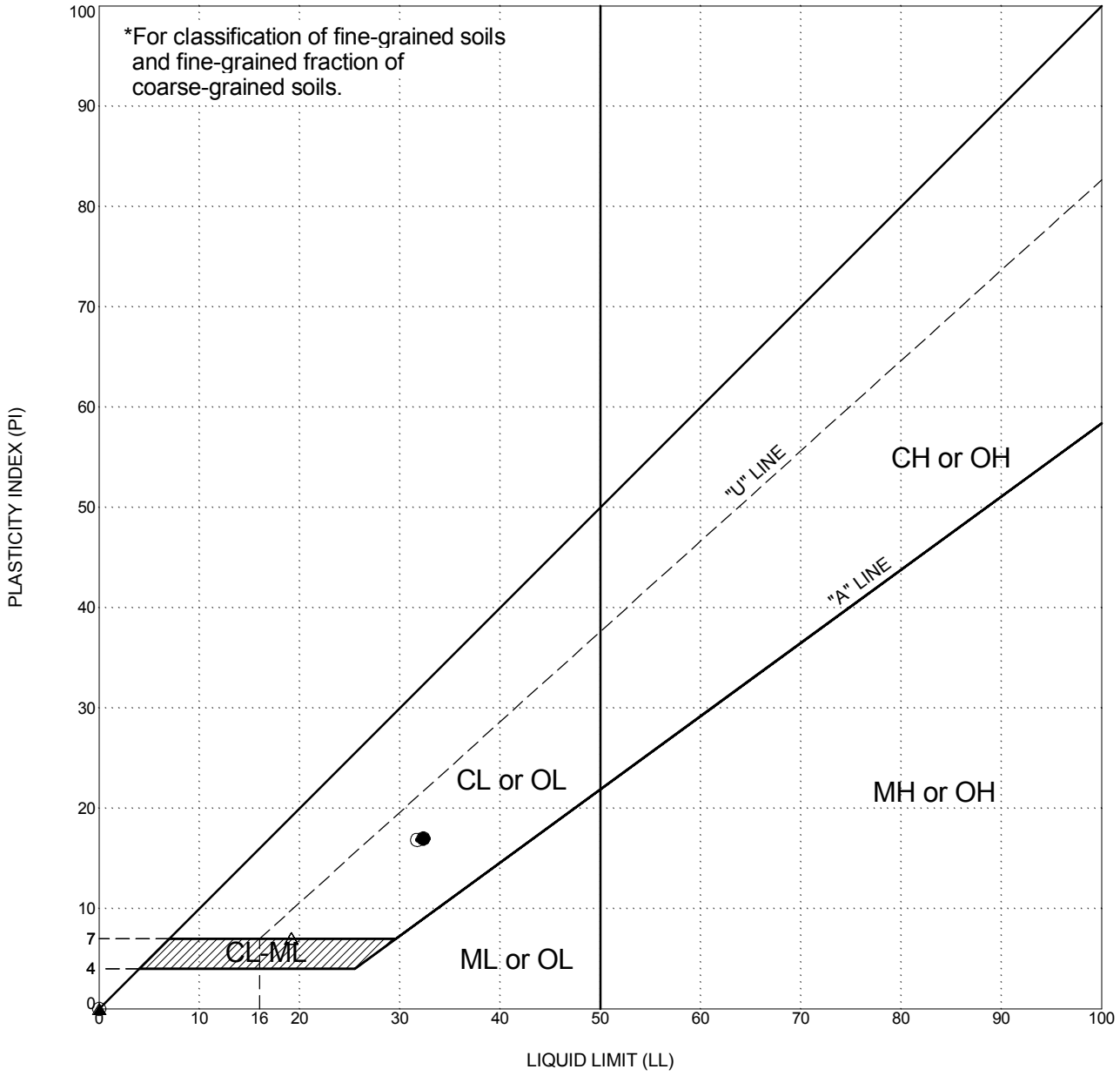


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-20	60.2	Lean CLAY (CL)	34	17	17	88
●	MB-20	69.4	Silty SAND (SM)	NP	NP	NP	36
△	MB-20	84.8	Lean CLAY (CL)	33	17	16	
▲	MB-20	102.7	Lean CLAY (CL)	32	17	15	92
⊙	MB-20	112.5	Silty SAND (SM)	15	12	3	48

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-53

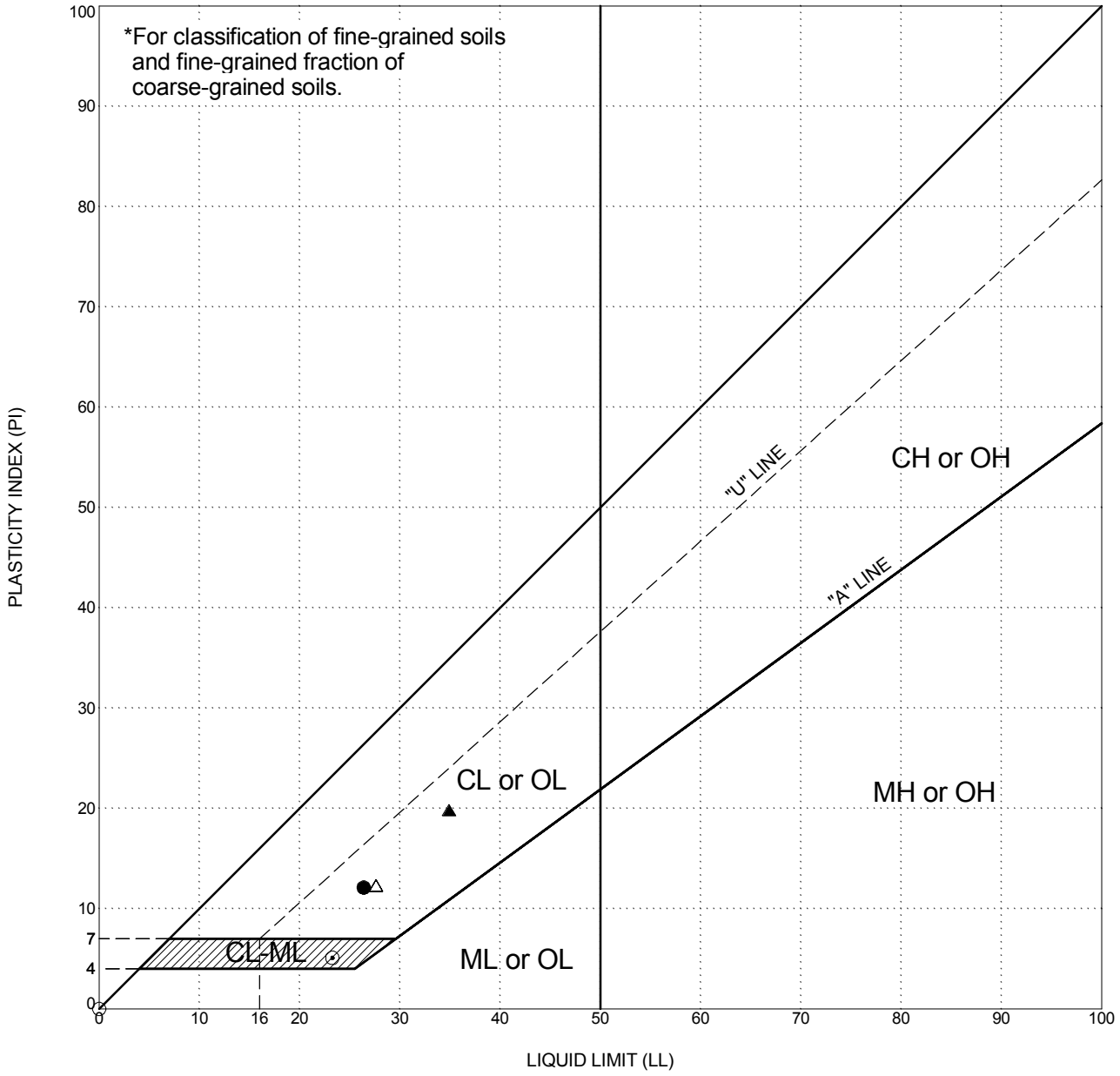


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-20	128.9	SAND (SW)	NP	NP	NP	2
●	MB-20	143.7	Sandy Lean CLAY with gravel (CL)	32	15	17	51
△	MB-20	152.6	Sandy, Silty CLAY with gravel (CL-ML)	19	12	7	65
▲	MB-21	2.0	SAND with silt (SP-SM)	NP	NP	NP	10
⊙	MB-21	9.4	Sandy Lean CLAY (CL)	32	15	17	68

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-54



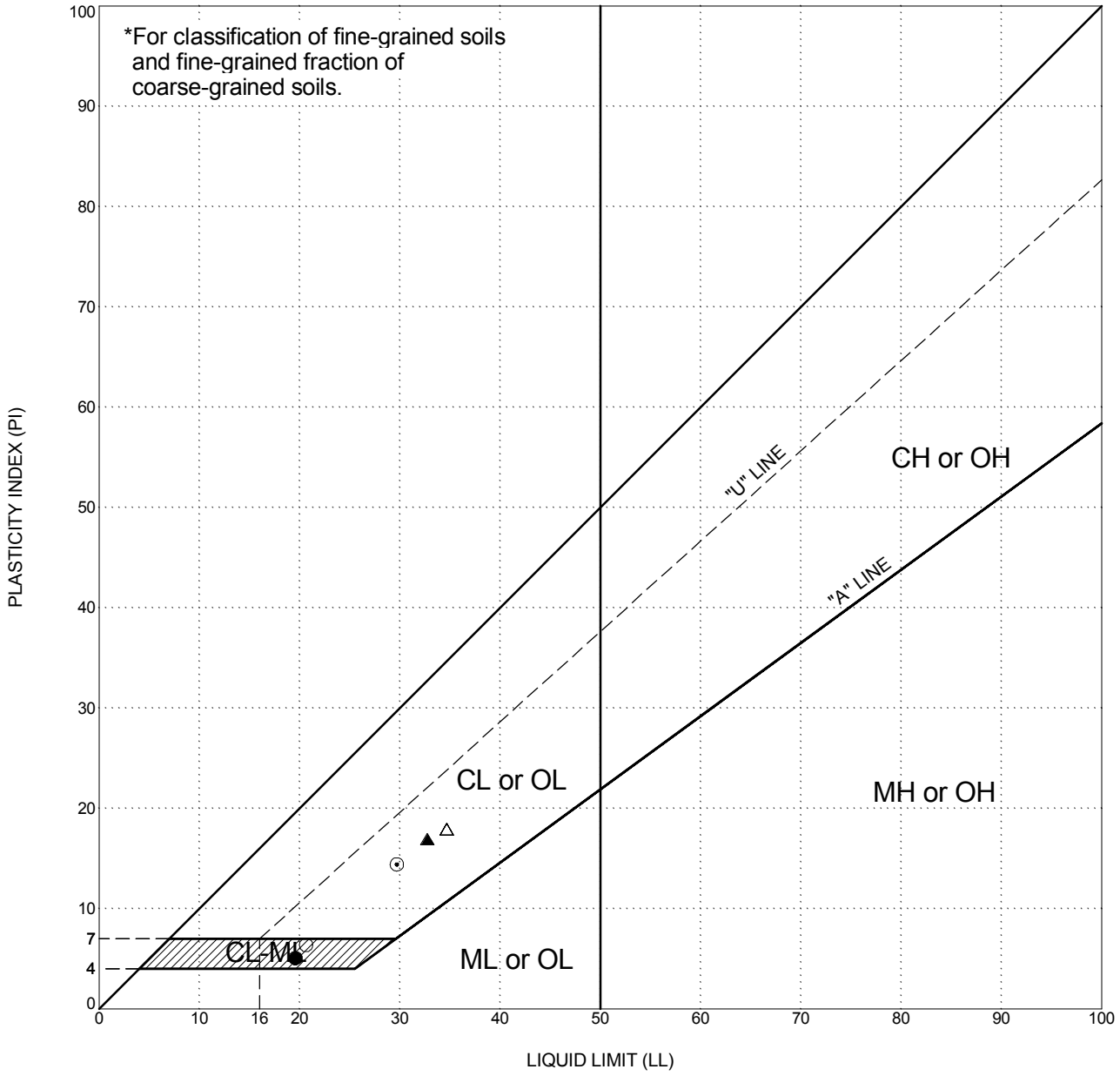
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-21	11.5	Silty SAND (SM)	NP	NP	NP	36
●	MB-21	13.0	Sandy Lean CLAY (CL)	26	14	12	64
△	MB-21	13.6	Sandy Lean CLAY (CL)	28	15	13	
▲	MB-21	20.0	Sandy Lean CLAY (CL)	35	15	20	69
⊙	MB-21	31.5	Silty, Clayey SAND (SC-SM)	23	18	5	49

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-55



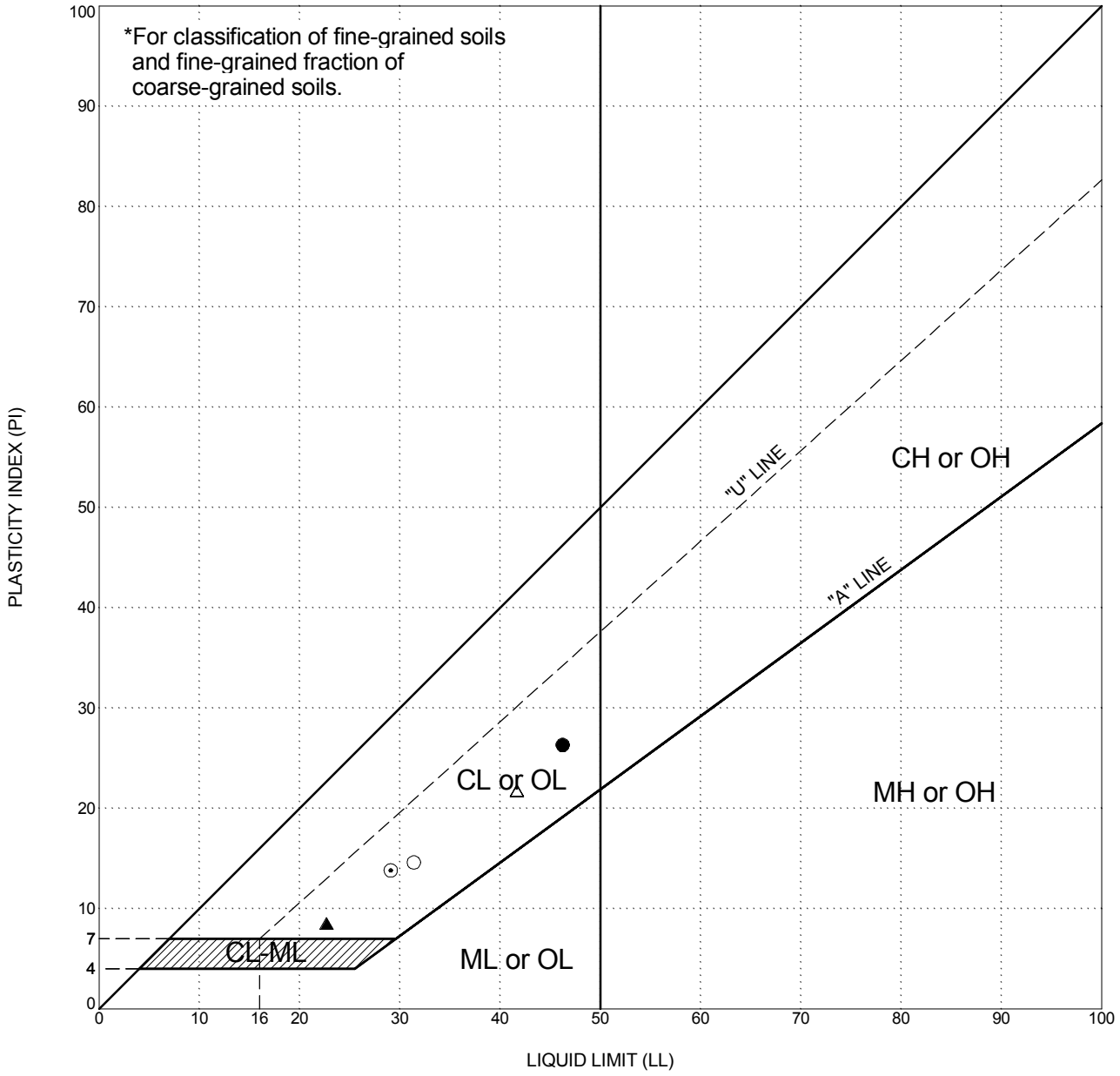
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-21	36.1	Sandy, Silty CLAY (CL-ML)	21	14	7	52
●	MB-21	45.9	Sandy, Silty CLAY (CL-ML)	20	15	5	61
△	MB-21	63.5	Lean CLAY (CL)	35	17	18	89
▲	MB-21	78.3	Lean CLAY (CL)	33	16	17	88
⊙	MB-21	92.2	Lean CLAY (CL)	30	15	15	87

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-56



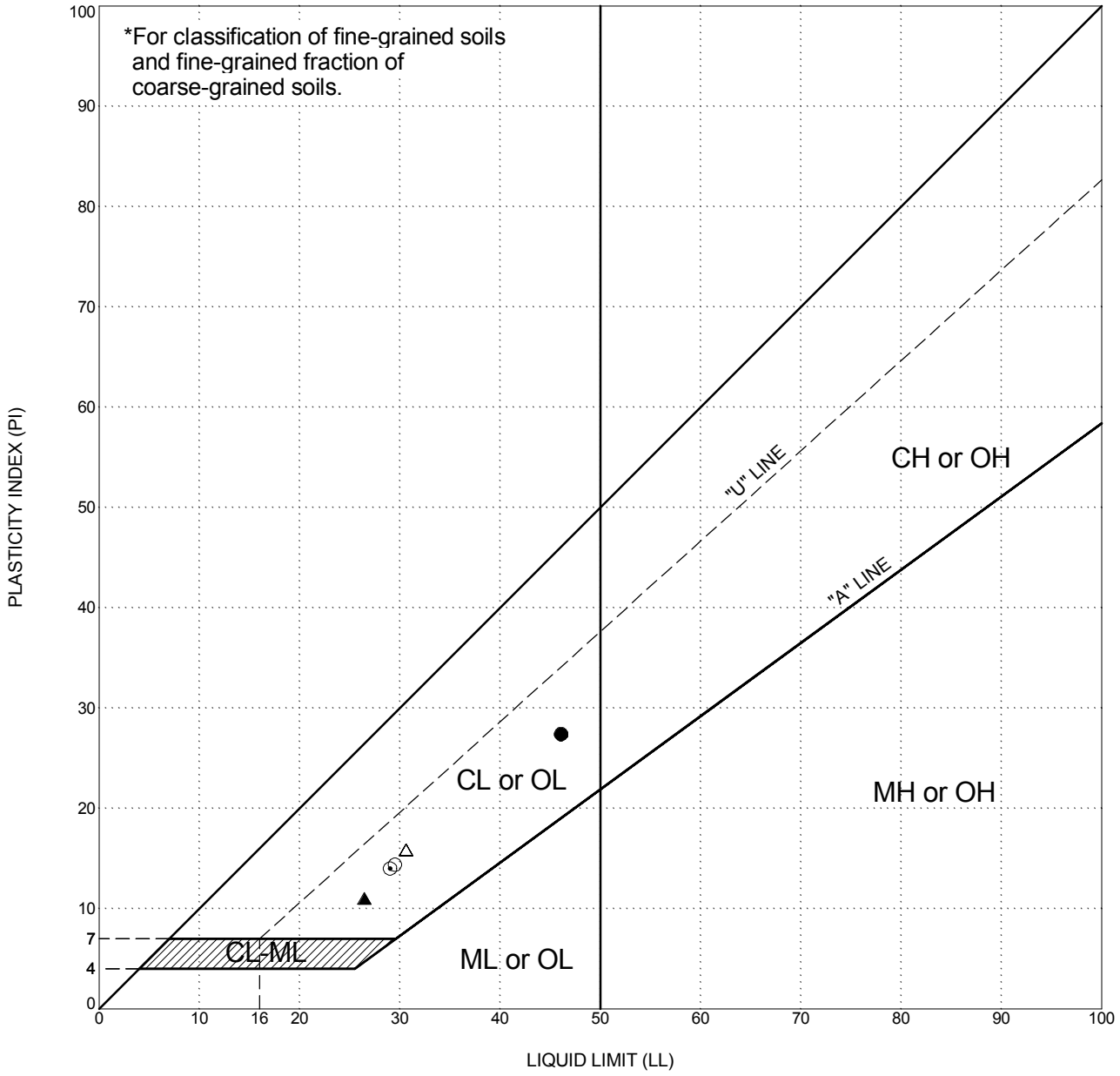
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-21	97.3	Lean CLAY (CL)	31	17	14	92
●	MB-21	108.9	Lean CLAY (CL)	46	20	26	98
△	MB-21	117.6		42	20	22	100
▲	MB-21	124.0	Lean CLAY with sand (CL)	23	14	9	71
⊙	MB-21	136.5	Sandy Lean CLAY (CL)	29	15	14	57

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-57

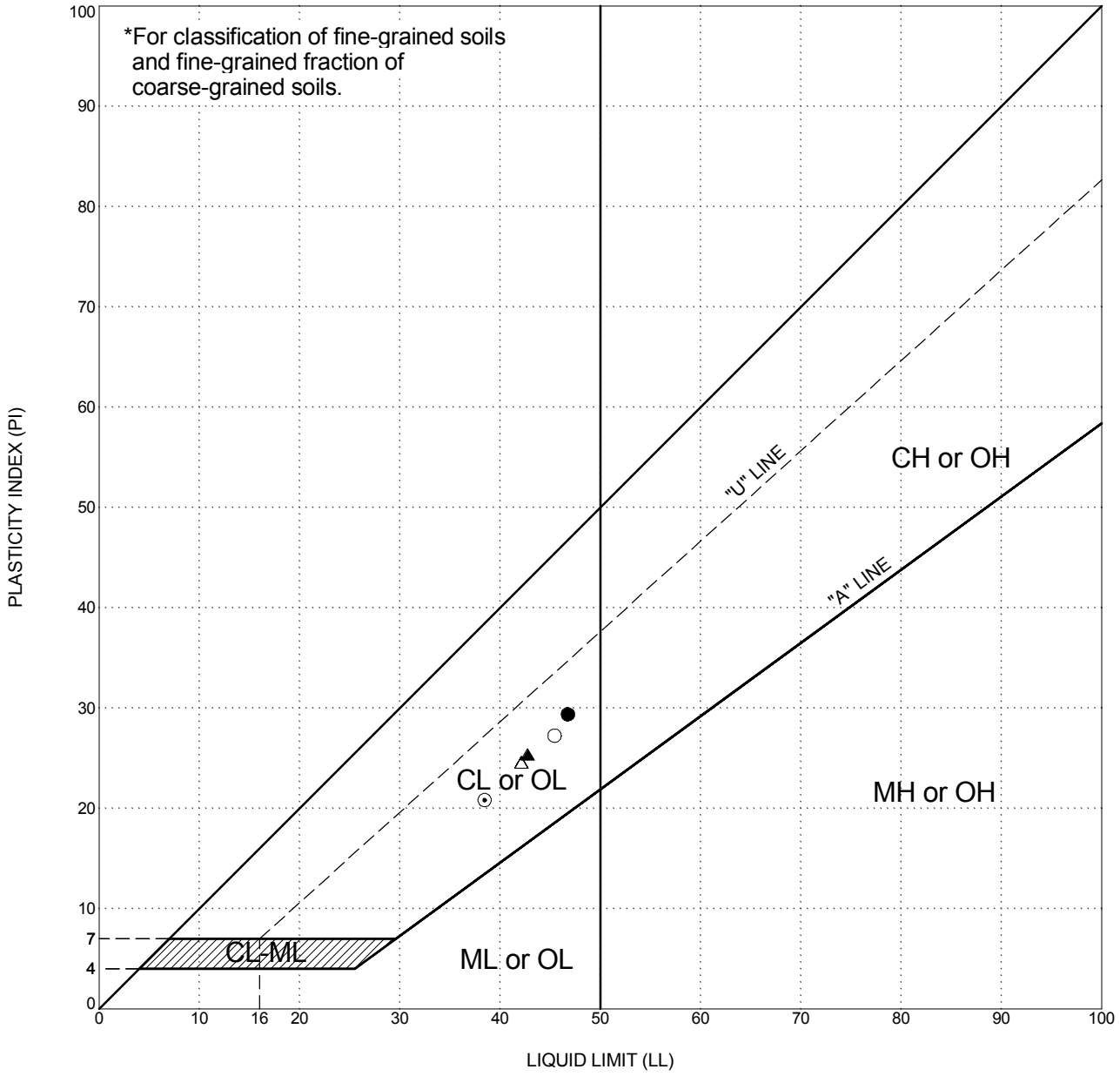


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-21	148.6	Sandy Lean CLAY (CL)	30	15	15	63
●	MB-22	4.4	Lean CLAY (CL)	46	19	27	
△	MB-22	6.2	Lean CLAY (CL)	31	15	16	92
▲	MB-22	11.8	Sandy Lean CLAY (CL)	26	15	11	
⊙	MB-22	14.1	Lean CLAY with sand (CL)	29	15	14	71

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-58



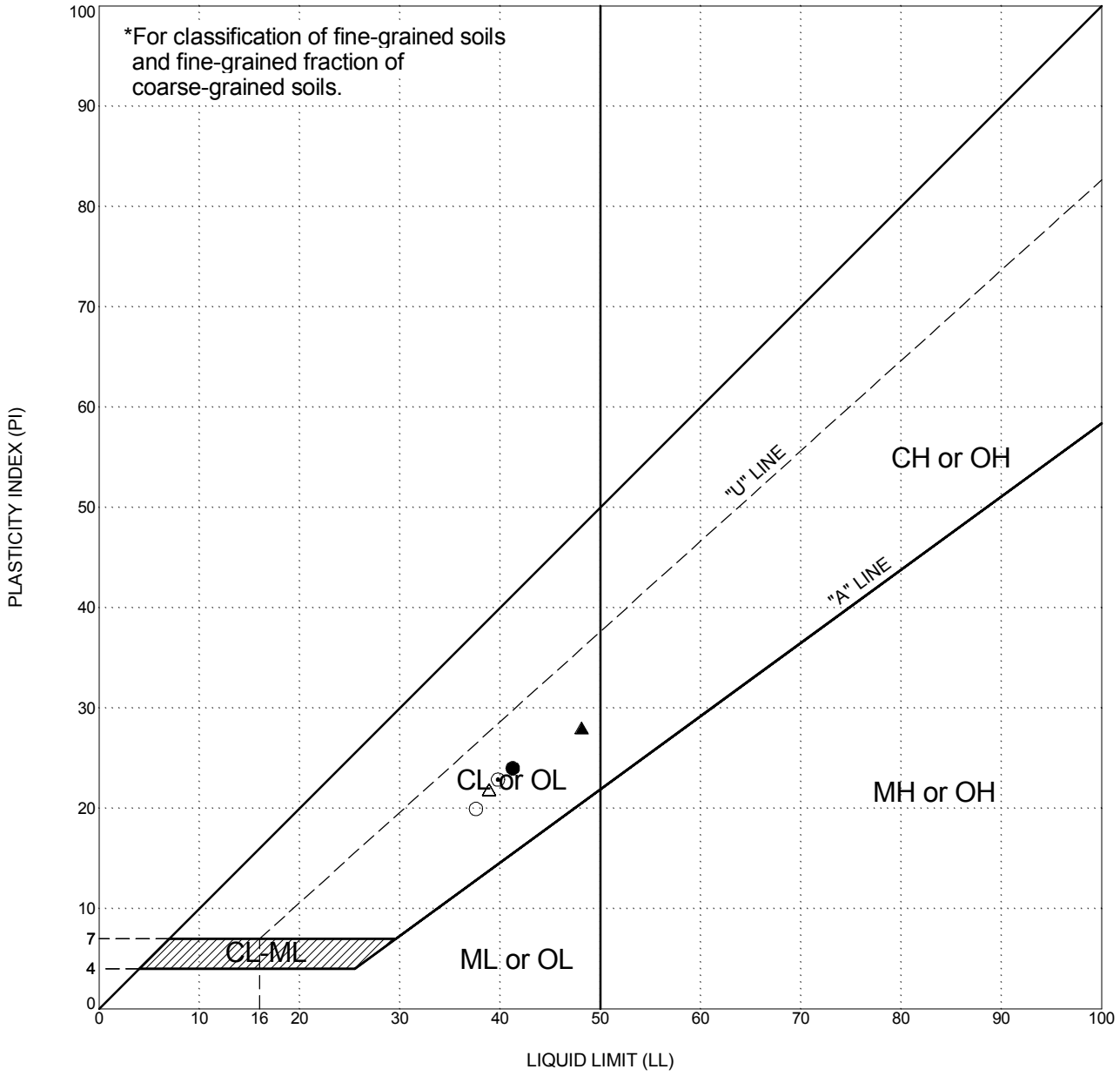
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-22	20.7	Lean CLAY (CL)	45	18	27	94
●	MB-22	27.9	Lean CLAY (CL)	47	17	30	95
△	MB-22	31.5	Lean CLAY with sand (CL)	42	18	24	78
▲	MB-22	40.5	Lean CLAY with sand (CL)	43	17	26	74
⊙	MB-22	46.3	Lean CLAY (CL)	38	18	20	93

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-59



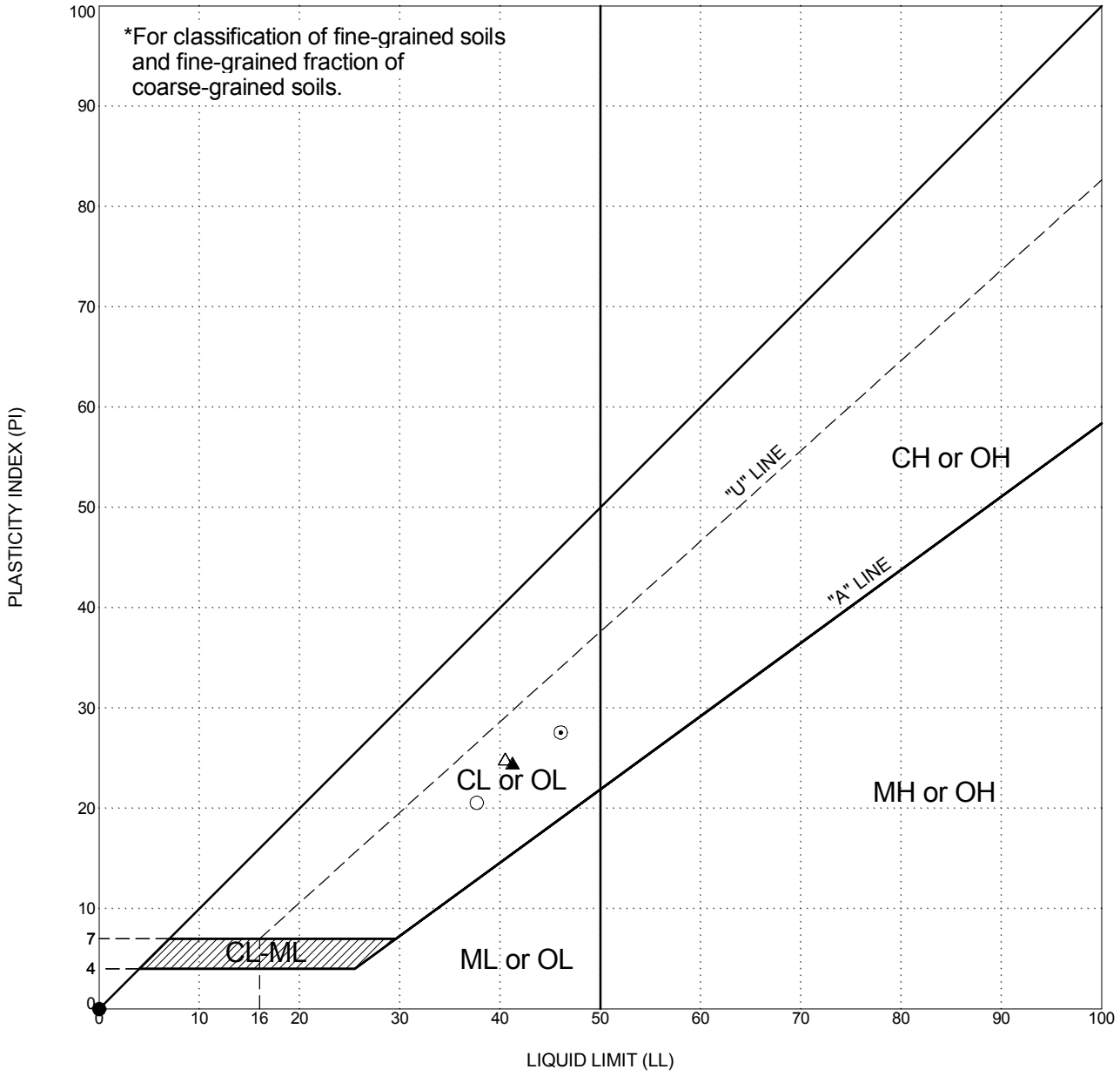
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-22	56.1	Lean CLAY (CL)	38	18	20	93
●	MB-22	65.8	Lean CLAY with sand (CL)	41	17	24	83
△	MB-22	68.2	Lean CLAY with sand (CL)	39	17	22	78
▲	MB-22	73.5	Lean CLAY (CL)	48	20	28	99
⊙	MB-22	117.5	Sandy Lean CLAY (CL)	40	17	23	63

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-60



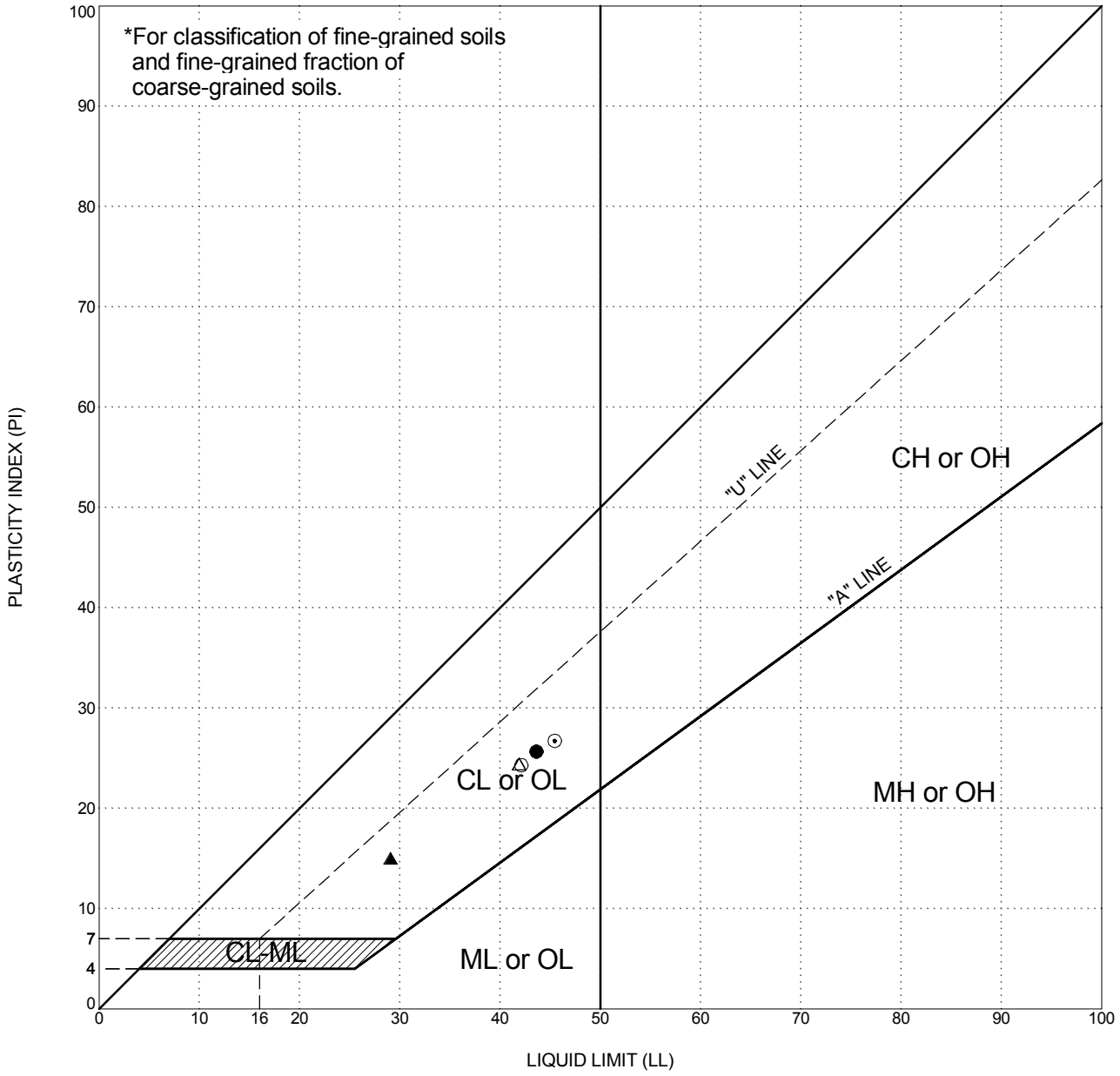
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-22	124.0	Lean CLAY (CL)	38	17	21	95
●	MB-23	4.4	Silty SAND (SM)	NP	NP	NP	35
△	MB-23	11.8	Lean CLAY with sand (CL)	41	16	25	81
▲	MB-23	23.3	Lean CLAY with sand (CL)	41	17	24	85
⊙	MB-23	31.2	Lean CLAY with sand (CL)	46	18	28	83

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-61



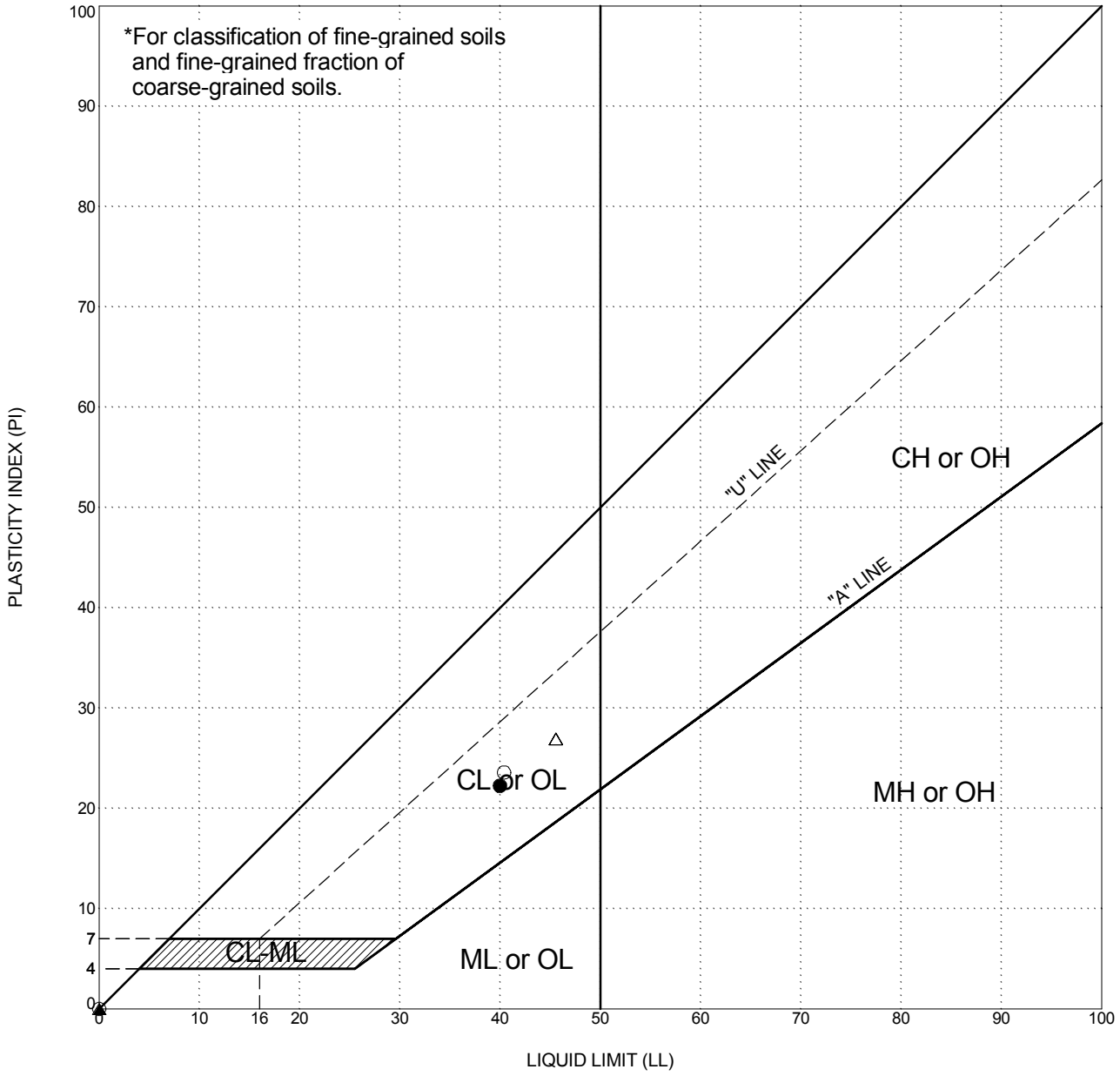
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-23	34.9	Lean CLAY (CL)	42	18	24	91
●	MB-23	35.0	Lean CLAY (CL)	44	18	26	91
△	MB-23	51.0	Lean CLAY (CL)	42	17	25	95
▲	MB-23	58.1	Lean CLAY with sand (CL)	29	14	15	75
⊙	MB-23	61.4	Lean CLAY (CL)	45	19	26	97

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-62



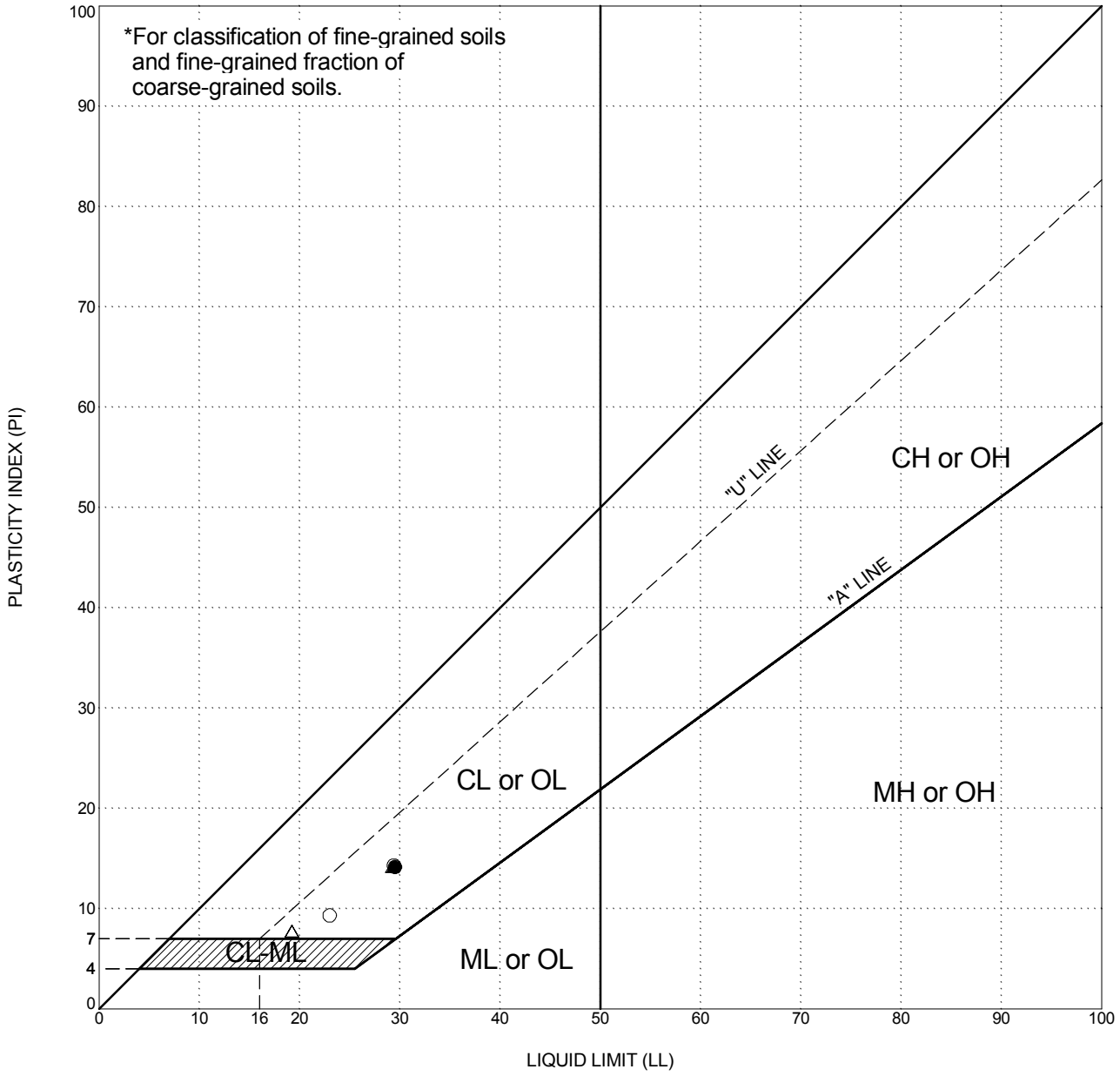
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-23	66.4	Lean CLAY (CL)	40	17	23	92
●	MB-23	75.9	Lean CLAY (CL)	40	18	22	87
△	MB-23	81.5	Lean CLAY with sand (CL)	46	19	27	83
▲	MB-23	88.9	SAND with silt (SP-SM)	NP	NP	NP	7
⊙	MB-23	98.6	SAND with silt (SP-SM)	NP	NP	NP	11

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-63



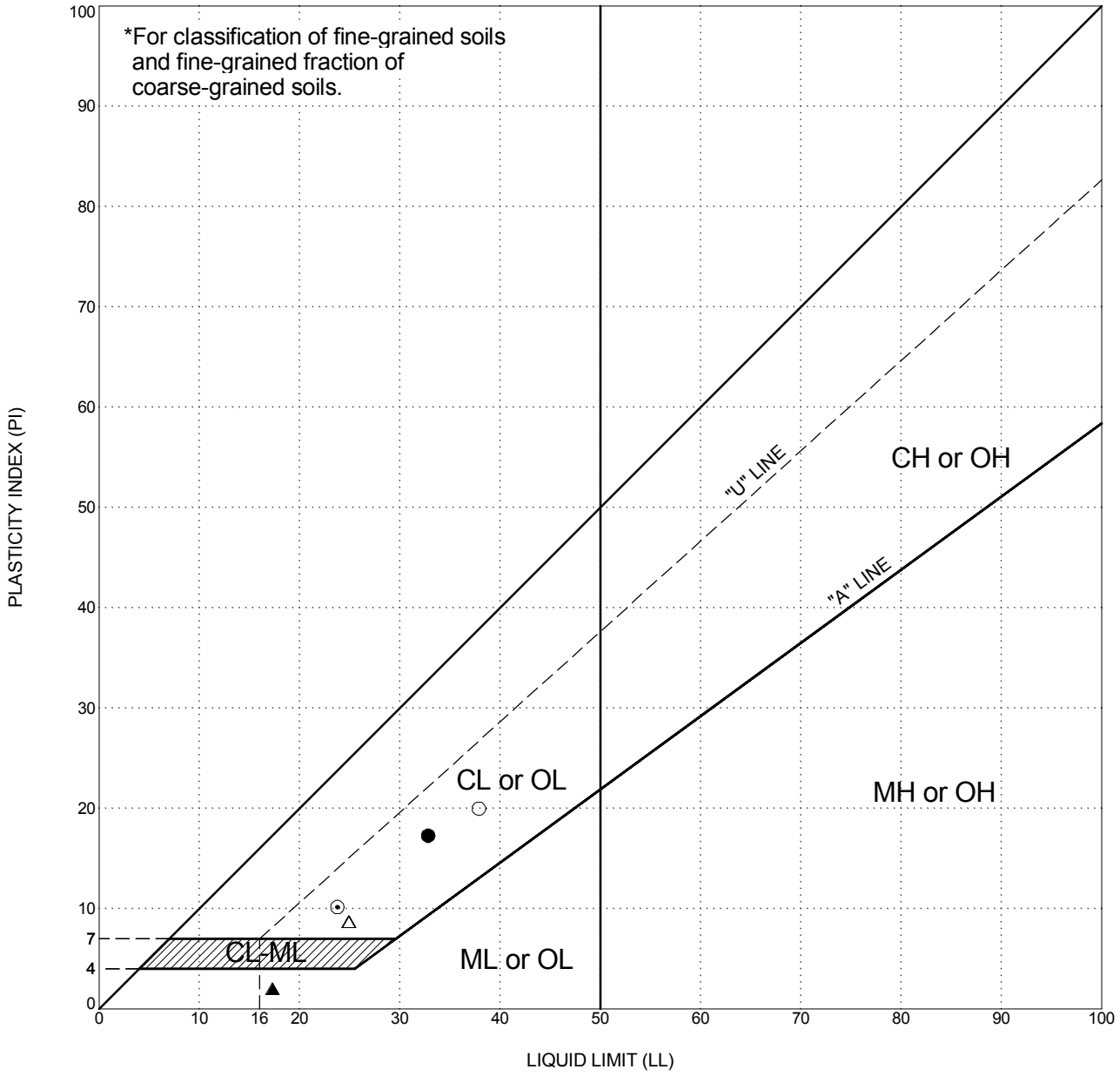
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-23	102.5	Sandy Lean CLAY (CL)	23	14	9	55
●	MB-23	111.6	Lean CLAY (CL)	30	15	15	87
△	MB-23	114.2	Gravelly Lean CLAY with sand (CL)	19	11	8	97
▲	MB-23	120.7	Sandy Lean CLAY (CL)	29	15	14	62
⊙	MB-23	124.0	Sandy Lean CLAY (CL)	29	15	14	67

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-64



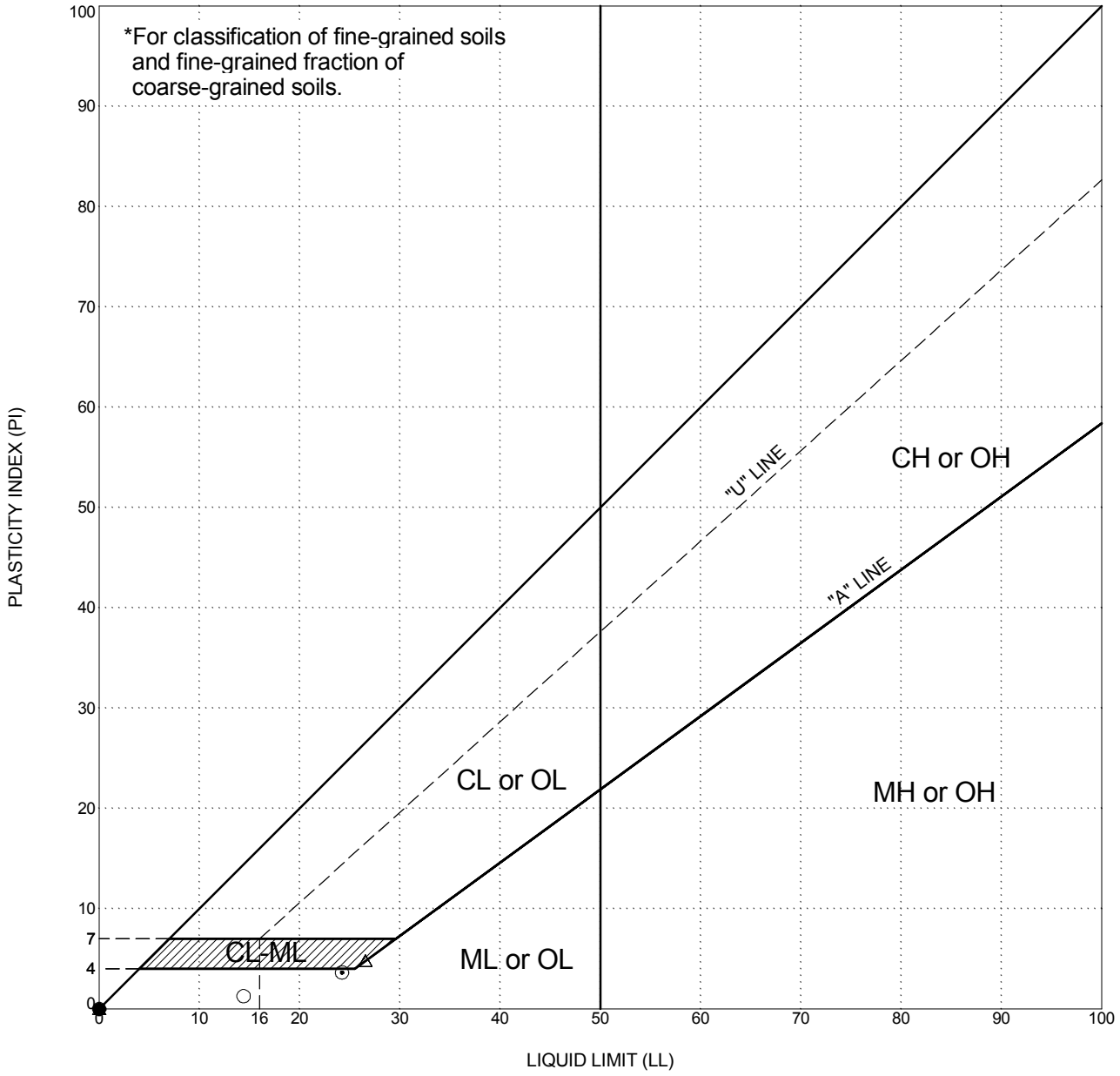
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-23	128.6	Lean CLAY (CL)	38	18	20	91
●	MB-23	131.2	Sandy CLAY (CL)	33	16	17	69
△	MB-23	133.9	Lean CLAY with sand (CL)	25	16	9	76
▲	MB-23	136.5	Sandy SILT (ML)	17	15	2	57
⊙	MB-23	143.0	Lean CLAY with sand (CL)	24	14	10	77

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-65

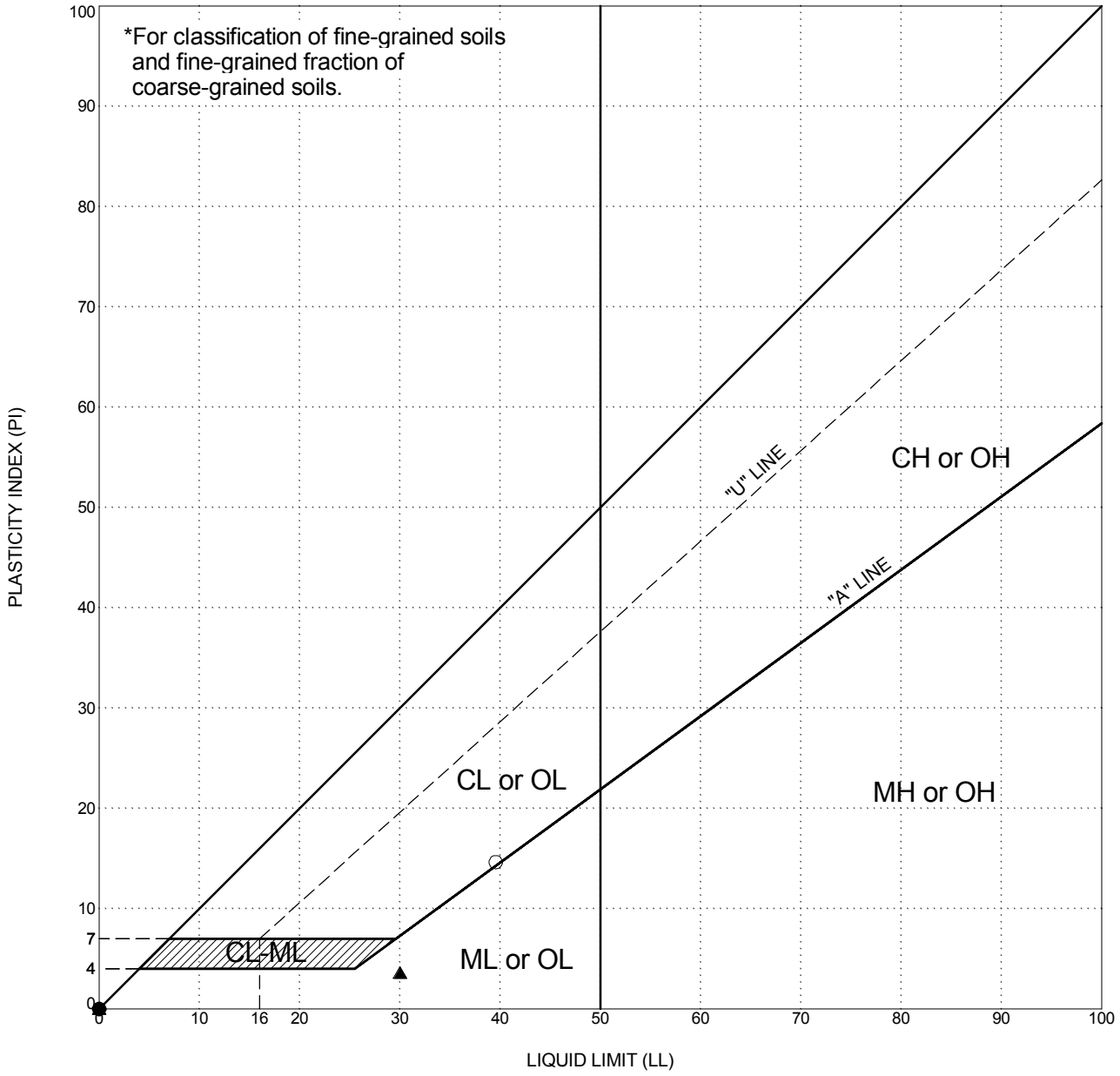


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-23	173.6	Sandy SILT (ML)	14	13	1	51
●	MB-23	241.5	SILT (ML)	NP	NP	NP	99
△	MB-23	241.5	SILT (ML)	27	22	5	99
▲	MB-23	250.0	Sandy SILT (ML)	NP	NP	NP	65
⊙	MB-23	263.8	Sandy SILT (ML)	24	21	3	64

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-66

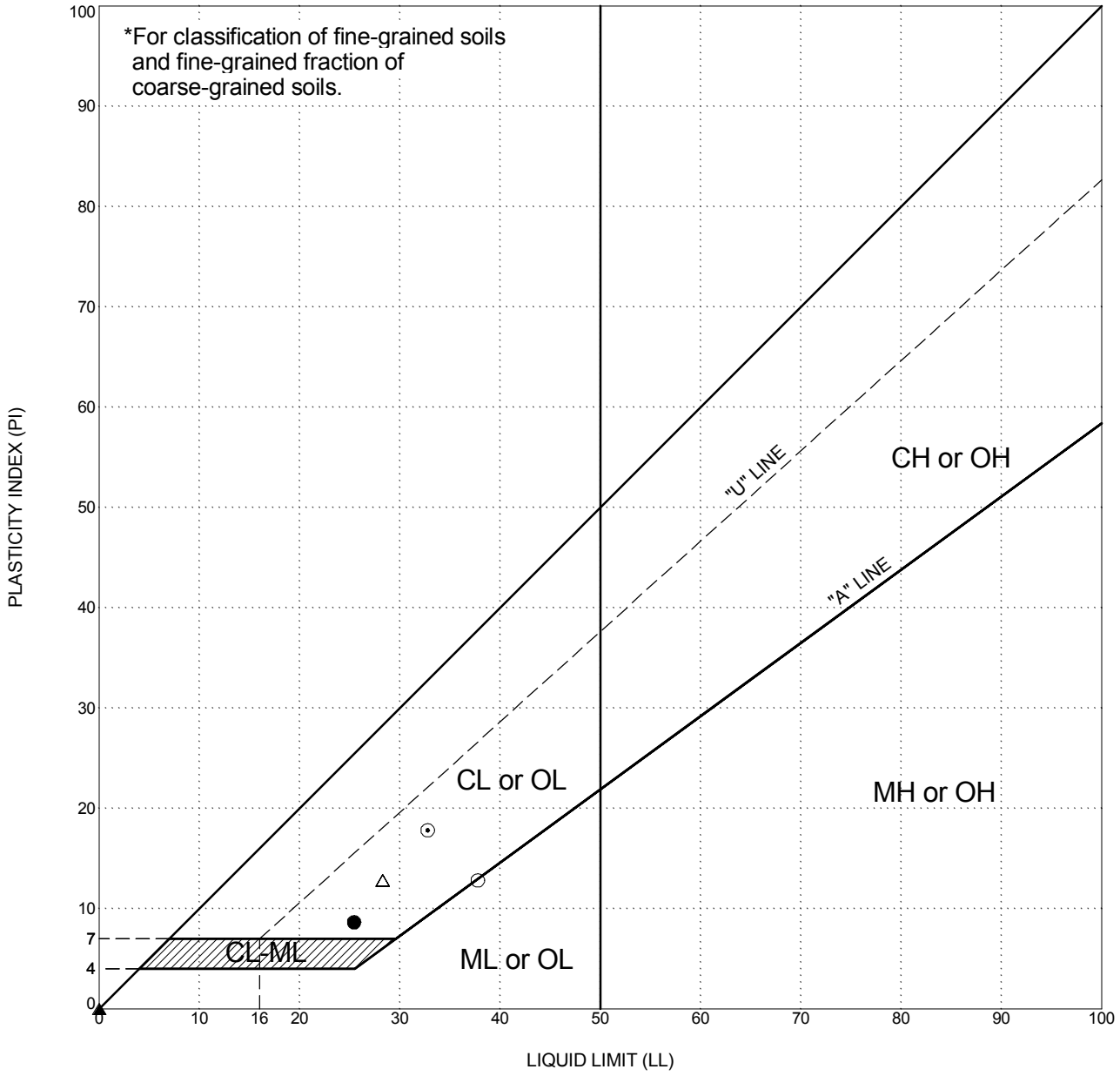


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-23	266.4	SILT (ML)	40	25	15	96
●	MB-23	266.5	SILT (ML)	NP	NP	NP	
△	MB-23	273.6	SILT (ML)	NP	NP	NP	90
▲	MB-23	287.4	SILT (ML)	30	26	4	89
⊙	MB-23	287.5	SILT (ML)	NP	NP	NP	

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-67



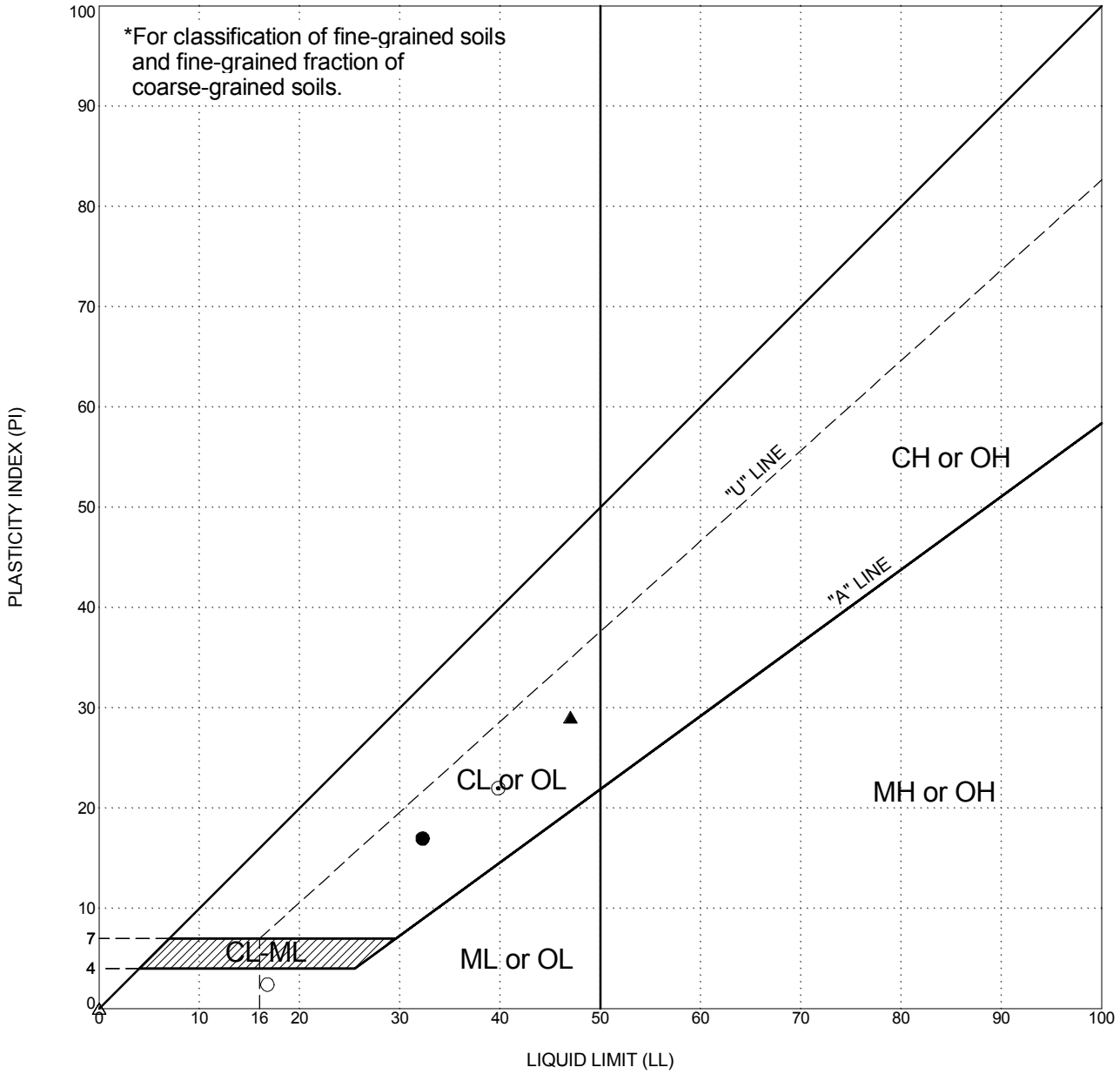
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-23	296.9	SILT (ML)	38	25	13	99
●	MB-24	1.5	Lean CLAY with sand (CL)	25	17	8	81
△	MB-24	9.4	Lean CLAY with sand (CL)	28	15	13	84
▲	MB-24	10.2	SILT (ML)	NP	NP	NP	
⊙	MB-24	13.6	Lean CLAY with sand (CL)	33	15	18	82

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-68



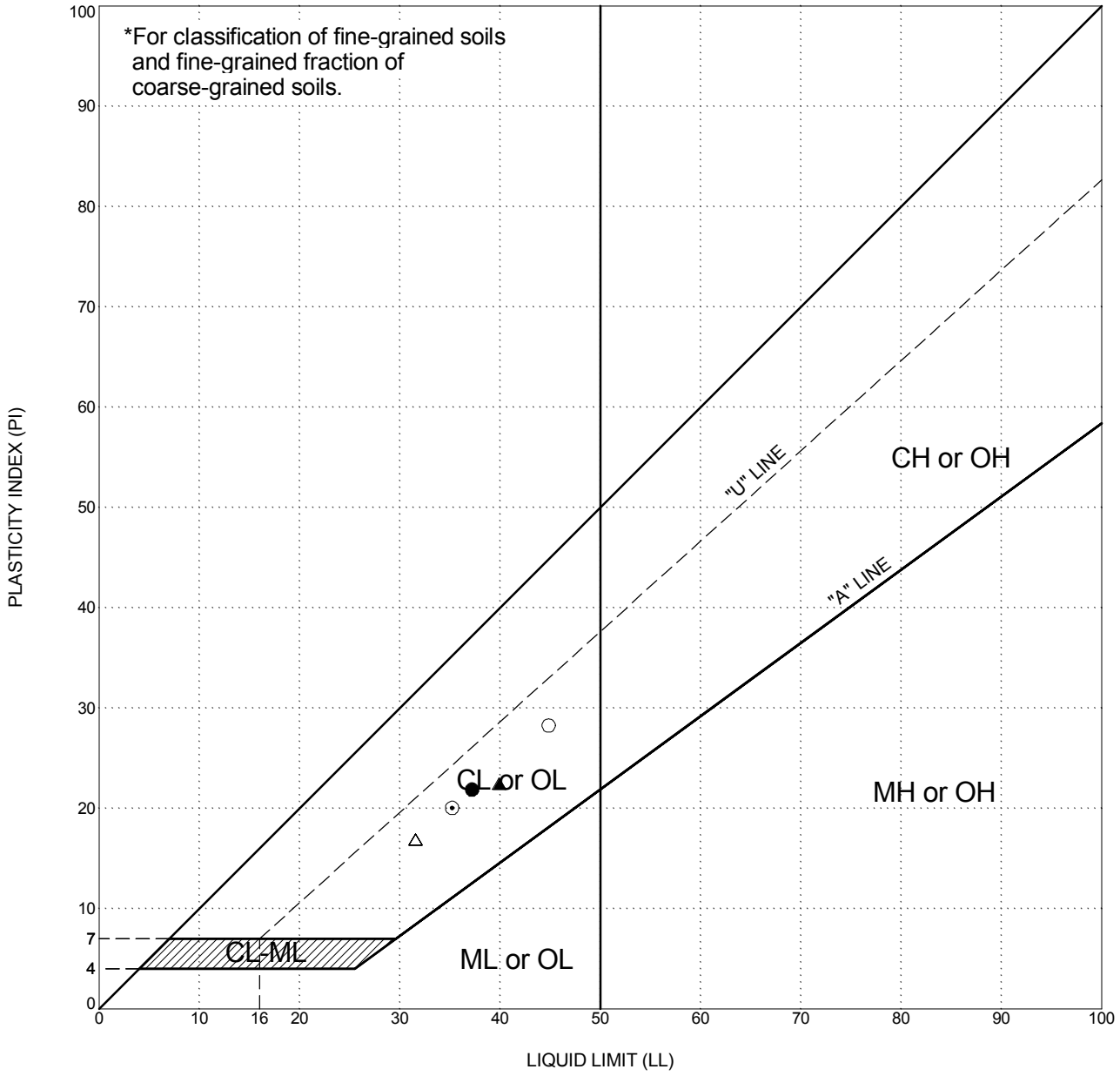
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-24	18.5	SAND with silt (SP-SM)	17	14	3	10
●	MB-24	35.4	Sandy Lean CLAY (CL)	32	15	17	63
△	MB-24	40.3	Silty SAND (SM)	NP	NP	NP	17
▲	MB-24	65.9	Lean CLAY (CL)	47	18	29	89
⊙	MB-24	76.6	Lean CLAY (CL)	40	18	22	92

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-69

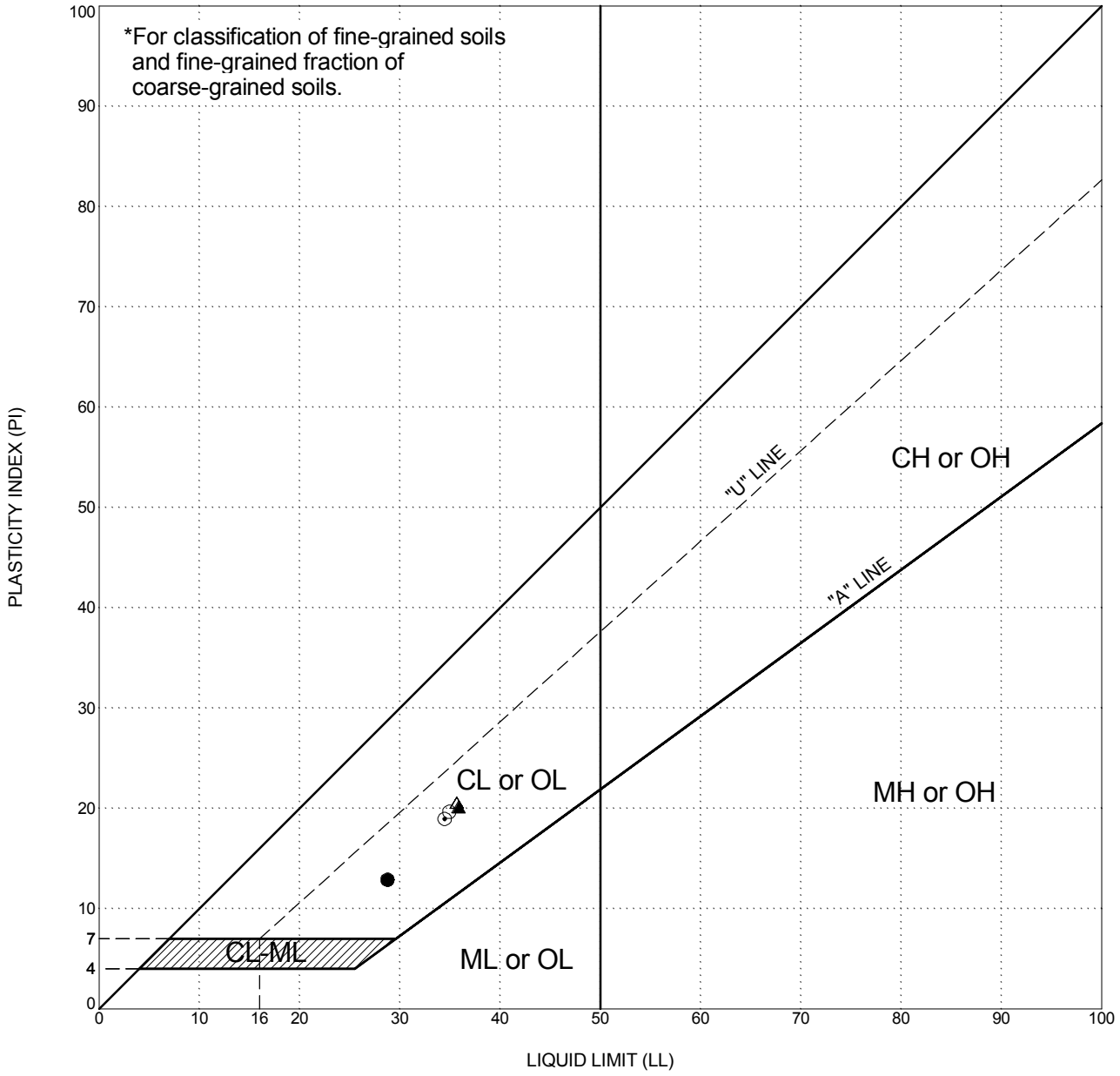


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-24	85.6	Lean CLAY (CL)	45	17	28	
●	MB-25	1.1	Sandy Lean CLAY (CL)	37	15	22	68
△	MB-25	6.9	Lean CLAY with sand (CL)	32	15	17	73
▲	MB-25	51.2	Lean CLAY (CL)	40	17	23	92
⊙	MB-26	2.0	Lean CLAY with sand (CL)	35	15	20	71

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-70



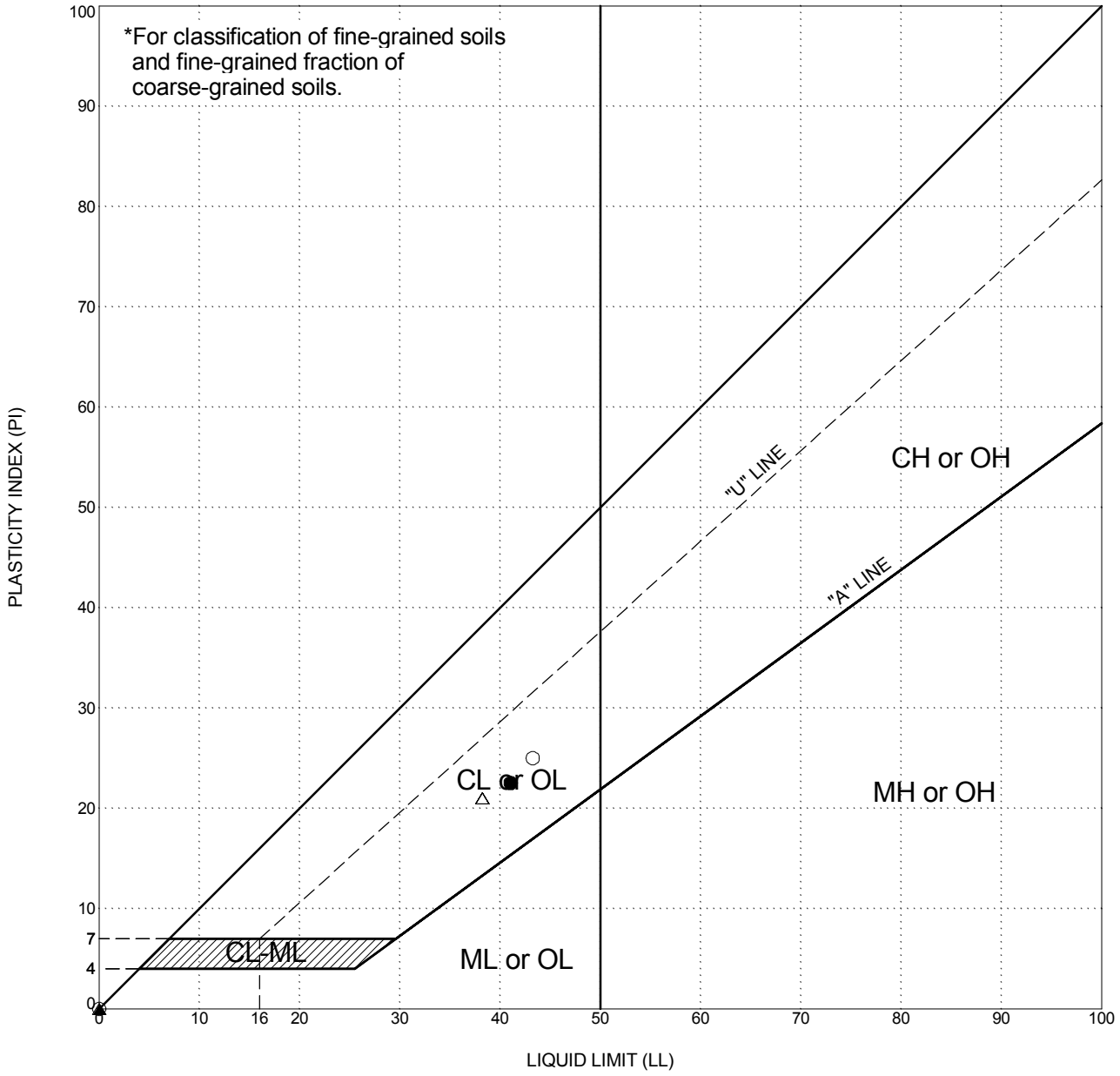
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-26	4.3	Gravelly Lean CLAY with sand (CL)	35	15	20	50
●	MB-26	6.1	Lean CLAY with sand (CL)	29	16	13	74
△	MB-26	9.4	Lean CLAY with sand (CL)	36	15	21	73
▲	MB-26	16.7	Lean CLAY (CL)	36	16	20	86
⊙	MB-26	20.0	Lean CLAY with sand (CL)	34	16	18	78

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-71



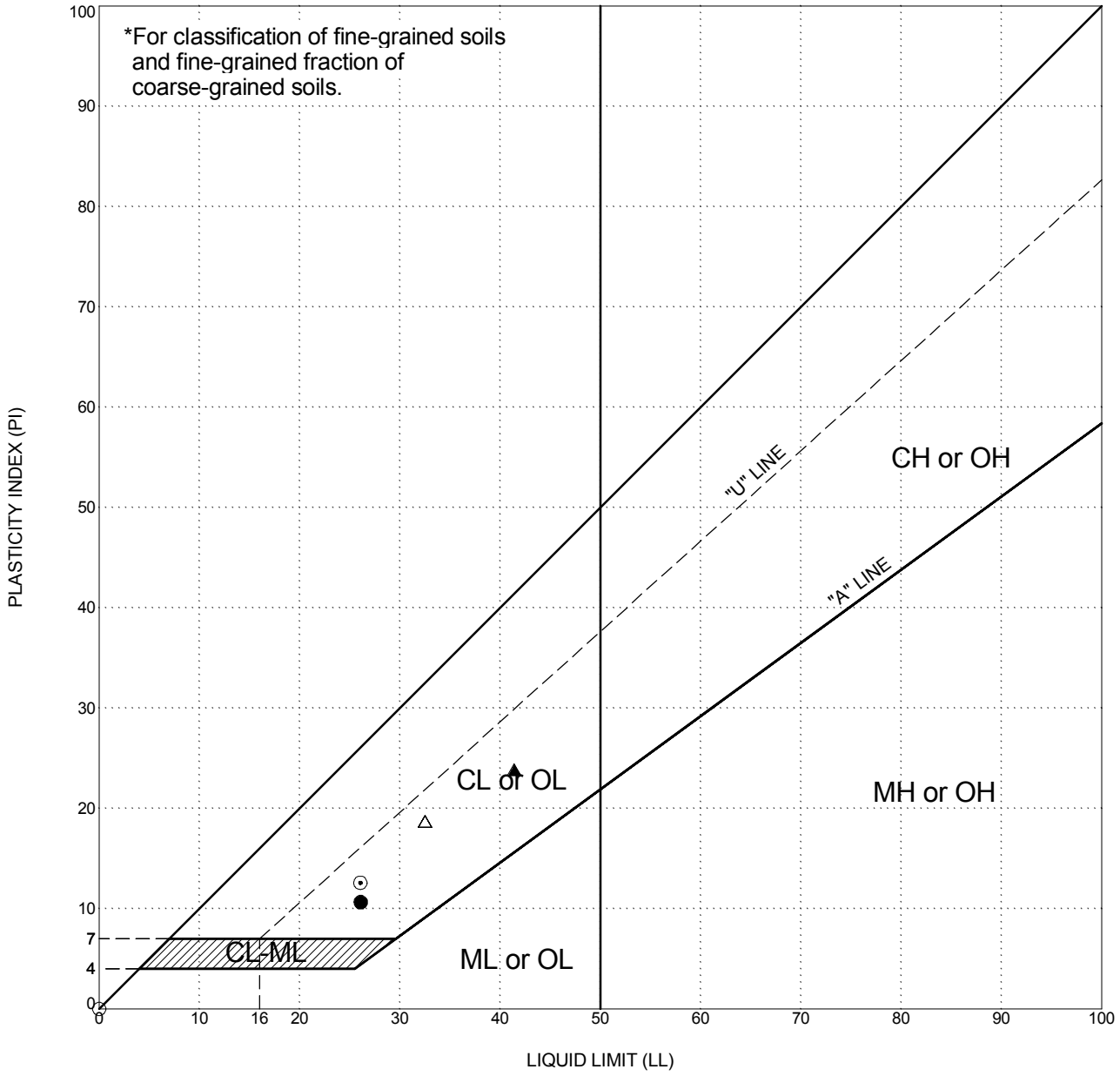
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-26	31.5	Lean CLAY (CL)	43	18	25	92
●	MB-26	34.8	Lean CLAY (CL)	41	19	22	92
△	MB-26	40.5	Lean CLAY (CL)	38	17	21	88
▲	MB-27	2.0	SAND with silt (SP-SM)	NP	NP	NP	8
⊙	MB-27	4.4	SAND (SP)	NP	NP	NP	1

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-72

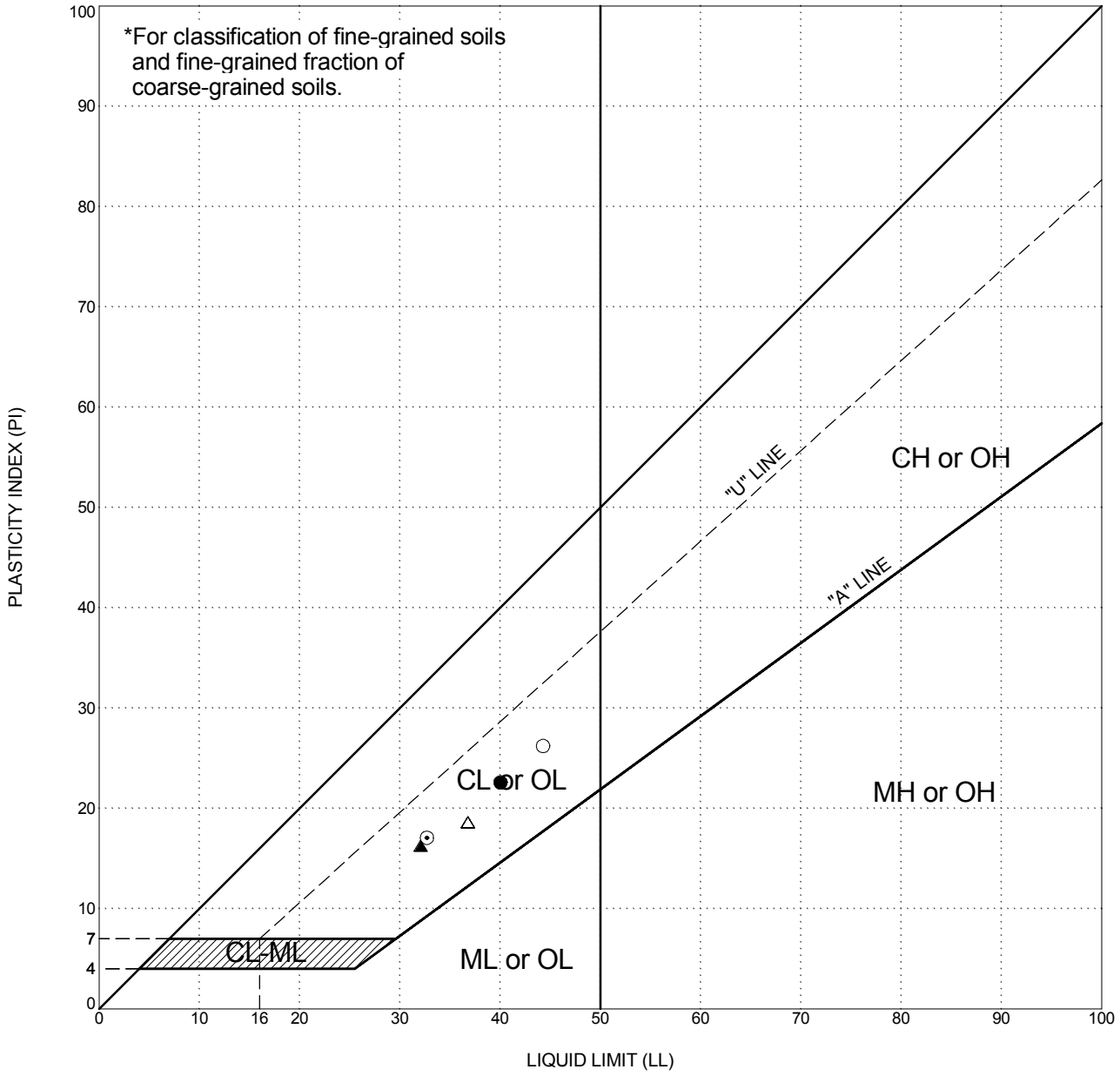


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-27	11.8	Silty SAND (SM)	NP	NP	NP	45
●	MB-27	21.7	Lean CLAY with sand (CL)	26	15	11	80
△	MB-27	27.4	Lean CLAY with sand (CL)	32	14	18	71
▲	MB-27	32.3	Lean CLAY (CL)	41	18	23	89
⊙	MB-27	39.1	Sandy Lean CLAY (CL)	26	13	13	66

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-73



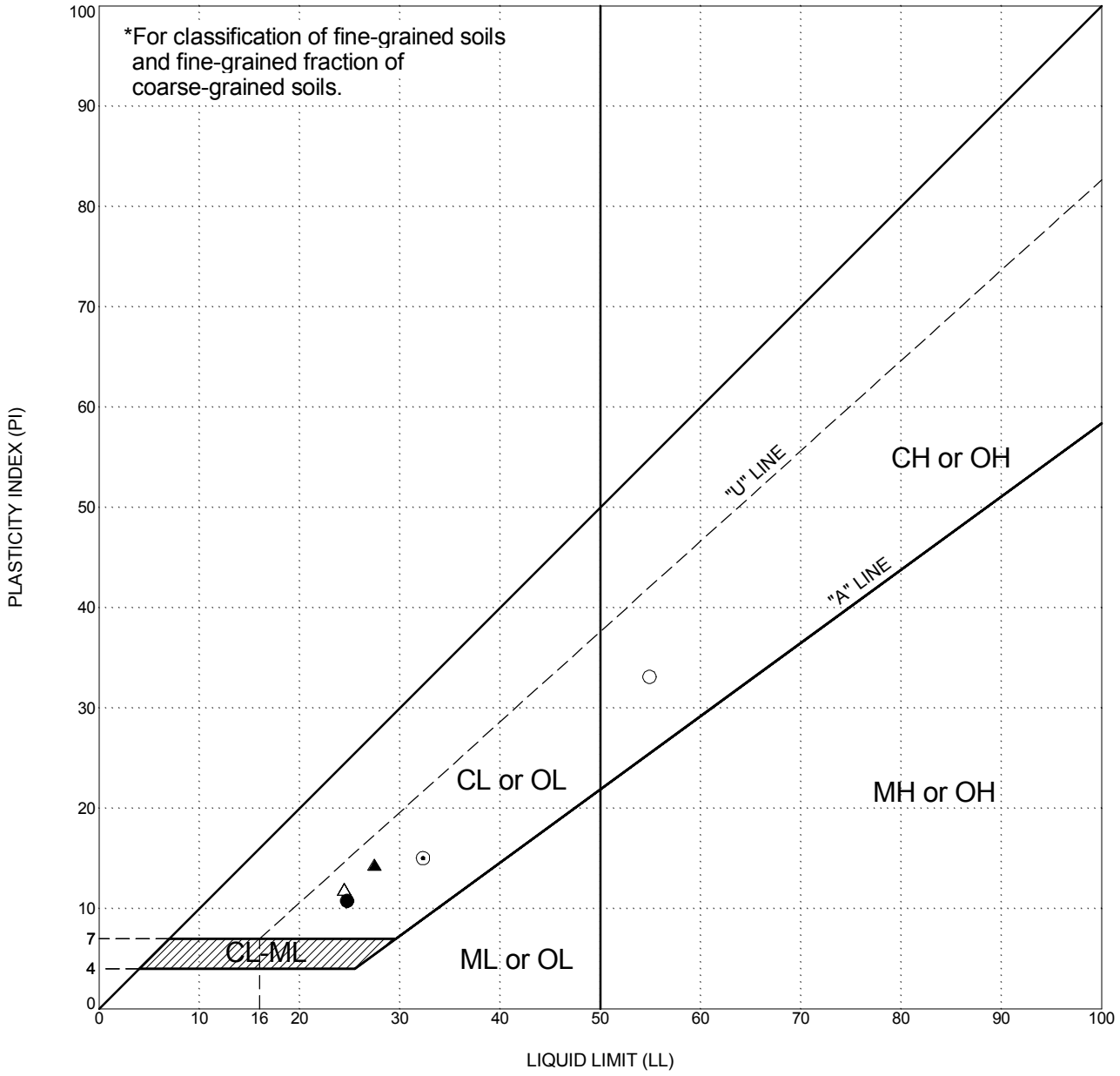
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-27	42.0	Lean CLAY (CL)	44	18	26	93
●	MB-27	47.1	Lean CLAY (CL)	40	17	23	90
△	MB-27	53.8	Lean CLAY (CL)	37	18	19	93
▲	MB-27	59.7	Lean CLAY with gravel (CL)	32	16	16	80
⊙	MB-27	61.8	Lean CLAY with sand (CL)	33	16	17	71

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-74



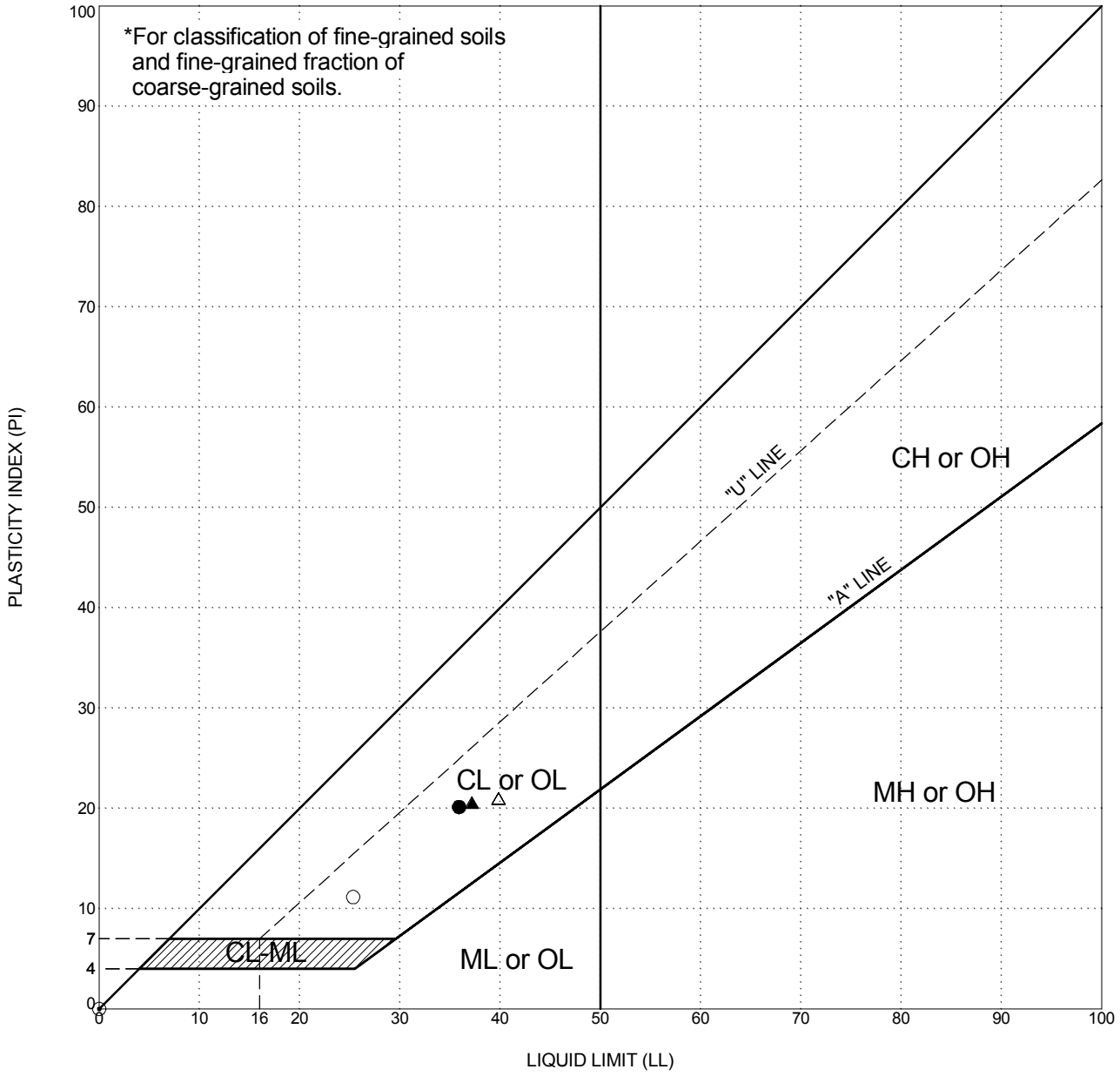
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-27	63.0	Fat CLAY (CH)	55	22	33	99
●	MB-27	67.6	Gravelly Lean CLAY (CL)	25	14	11	55
△	MB-27	71.3	Gravelly Lean CLAY (CL)	24	13	11	51
▲	MB-27	72.8	Lean CLAY with sand (CL)	27	13	14	83
⊙	MB-27	77.4	Lean CLAY (CL)	32	17	15	98

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-75



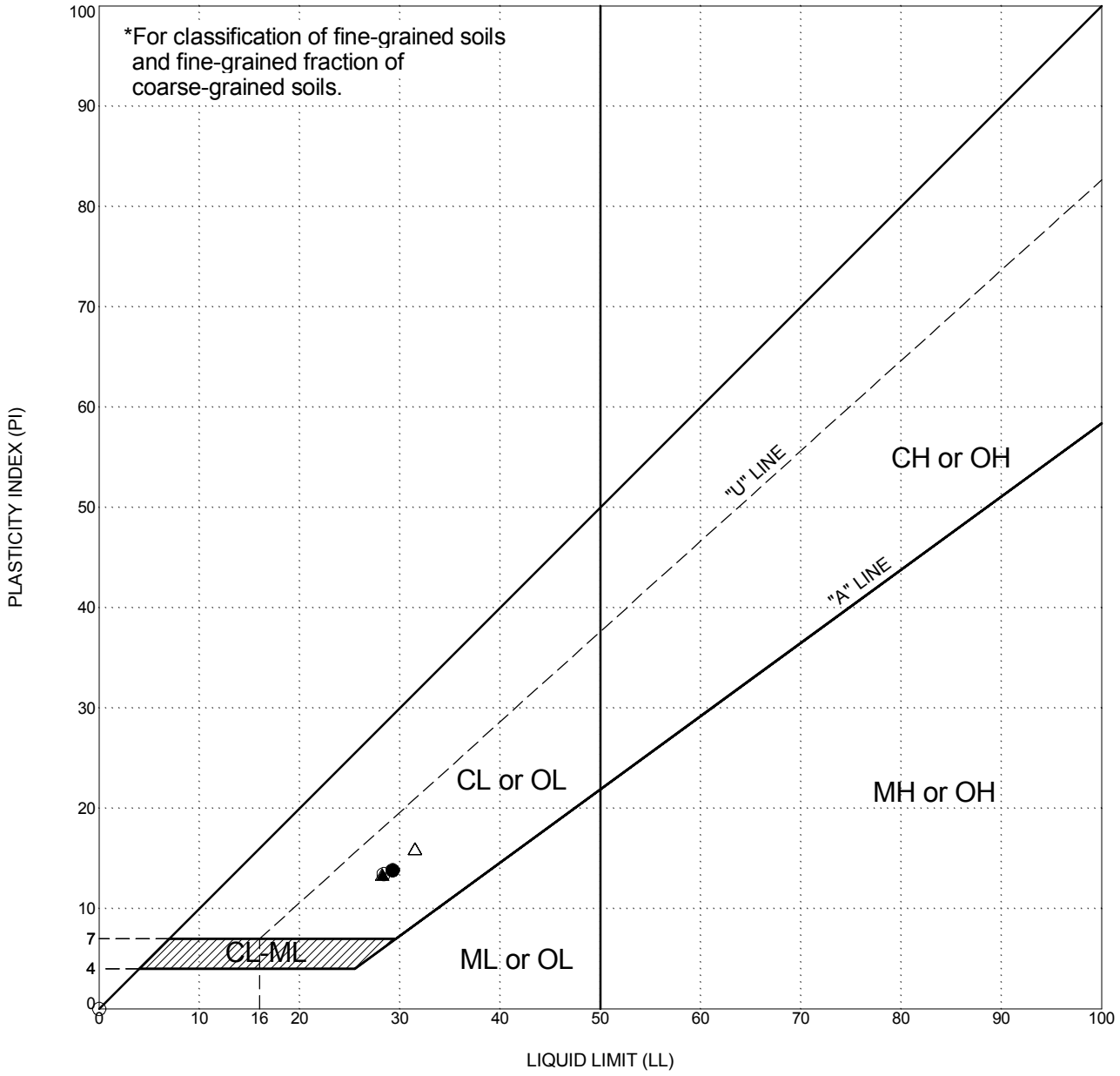
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-27	80.9	Lean CLAY with sand (CL)	25	14	11	75
●	MB-27	97.1	Lean CLAY with sand (CL)	36	16	20	84
△	MB-27	113.9	Lean CLAY (CL)	40	19	21	97
▲	MB-27	119.5	Lean CLAY (CL)	37	17	20	97
⊙	MB-27	137.1	Clayey SAND (SC)	NP	NP	NP	13

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-76



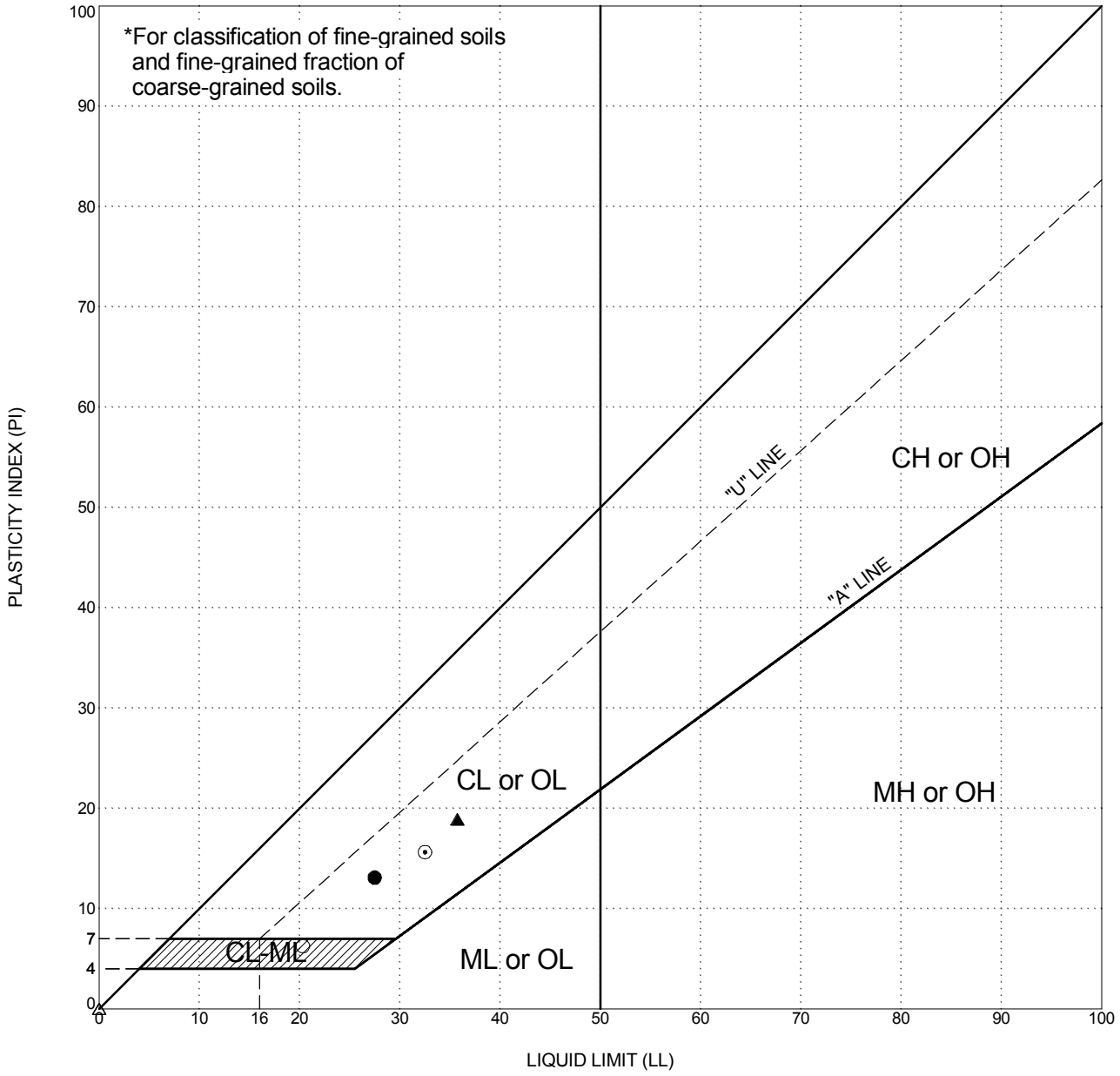
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-28	9.4	Silty SAND (SM)	NP	NP	NP	
●	MB-28	16.7	Lean CLAY (CL)	29	15	14	89
△	MB-28	22.4	Lean CLAY with sand (CL)	32	16	16	81
▲	MB-28	24.9	Lean CLAY with sand (CL)	28	15	13	78
⊙	MB-28	31.5	Lean CLAY with sand (CL)	28	15	13	83

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-77



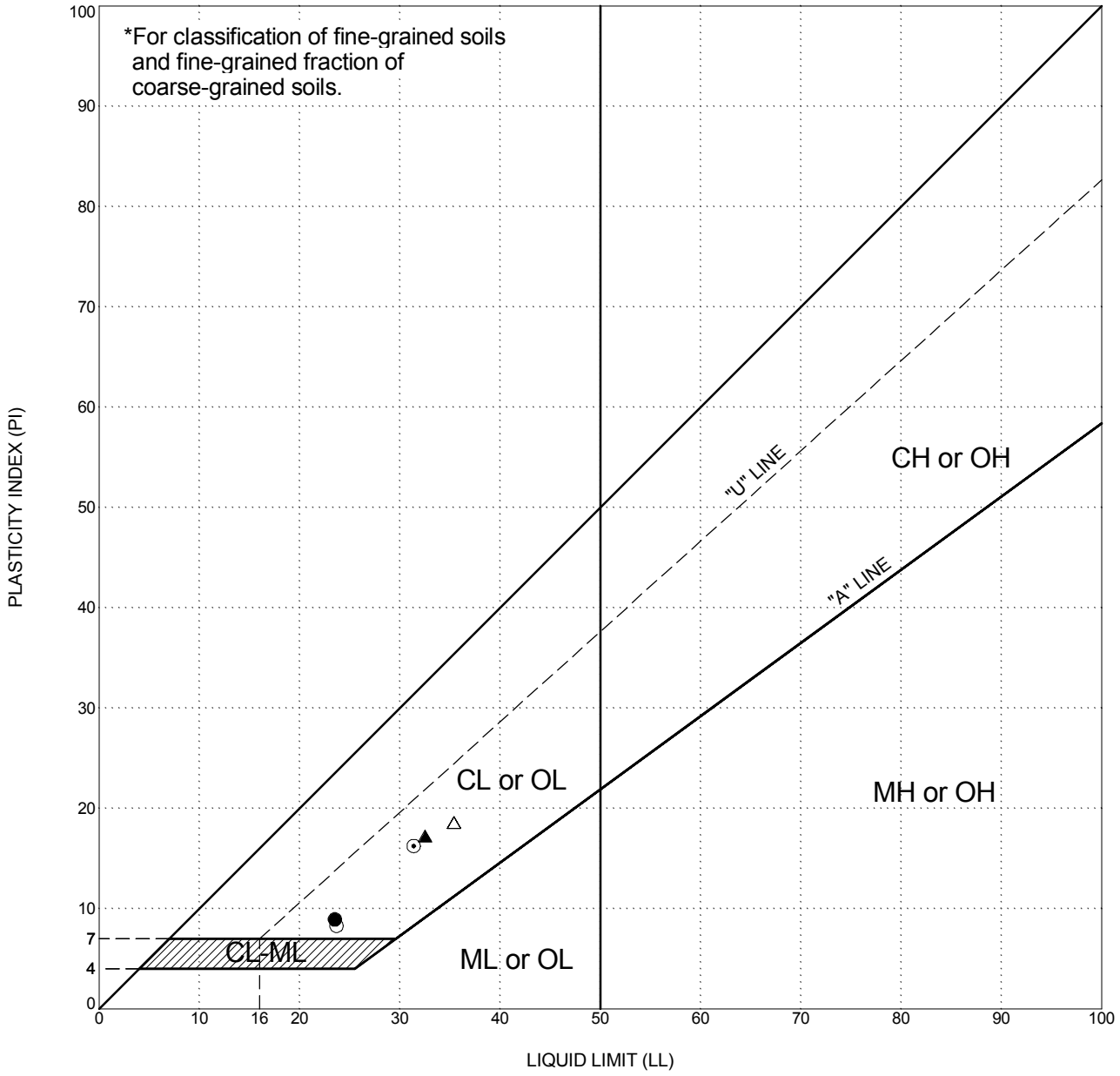
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-28	41.3	Silty, Clayey SAND (SC-SM)	20	14	6	22
●	MB-28	45.4	Lean CLAY with sand (CL)	27	14	13	82
△	MB-28	50.4	Sandy Lean CLAY (CL)	NP	NP	NP	62
▲	MB-31	13.8	Lean CLAY (CL)	36	17	19	93
⊙	MB-31	15.9	Lean CLAY (CL)	32	17	15	86

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-78



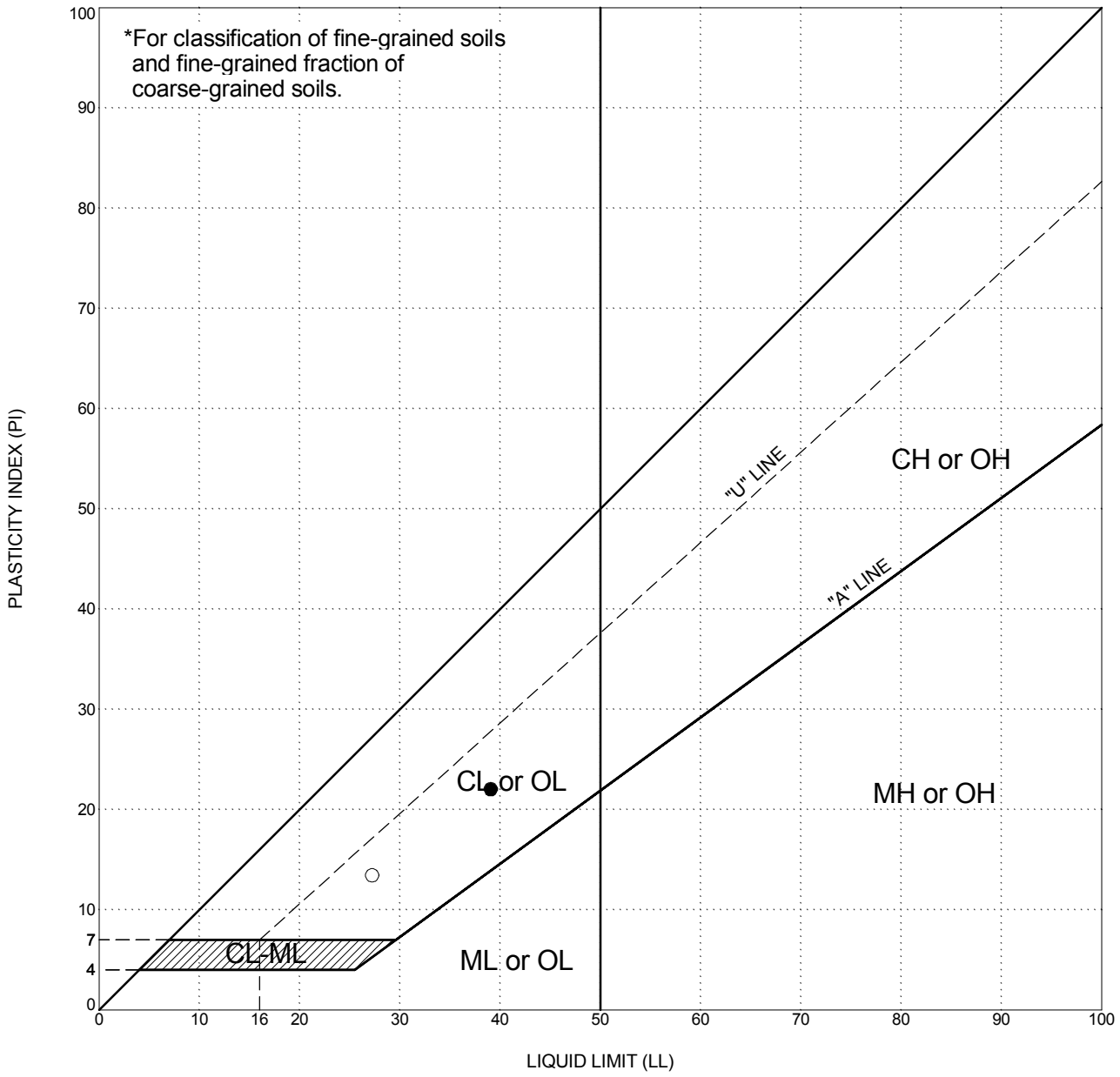
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	MB-31	25.8	Lean CLAY with sand (CL)	24	15	9	79
●	MB-31	28.2	Lean CLAY with sand (CL)	24	15	9	82
△	MB-31	36.4	Lean CLAY with sand (CL)	35	17	18	82
▲	MB-31	38.9	Lean CLAY with sand (CL)	32	15	17	81
⊙	MB-31	46.6	Lean CLAY with sand (CL)	31	15	16	83

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-79



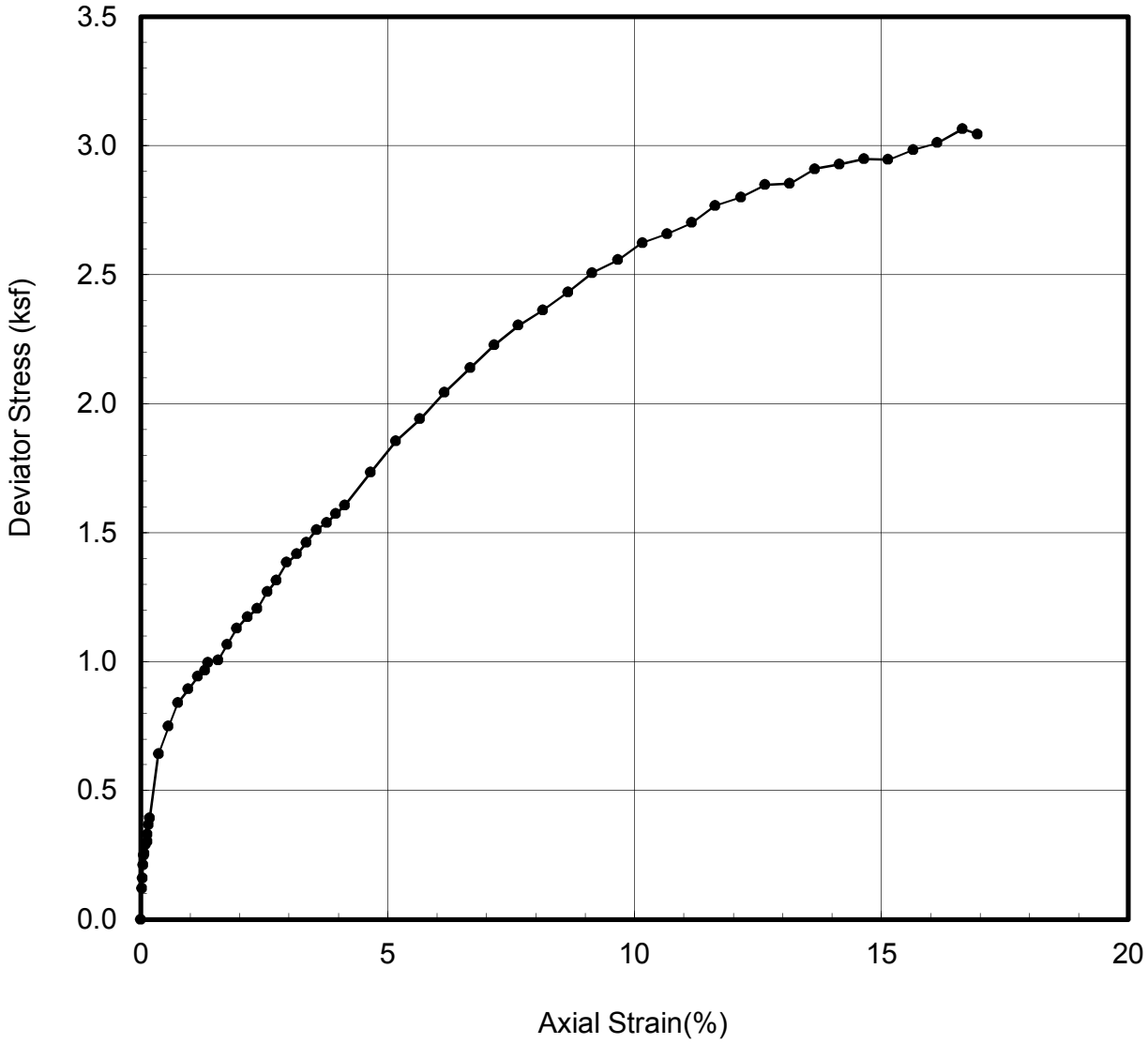
ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	%-200
○	MB-31	50.7	Clayey SAND (SC)	27	14	13	
●	MB-31	51.8	Lean CLAY (CL)	39	17	22	

NP = Non-Plastic

PLASTICITY CHART
ALASKA LNG PROJECT
MARINE LNG FACILITIES
NIKISKI, ALASKA

PLATE E3-80

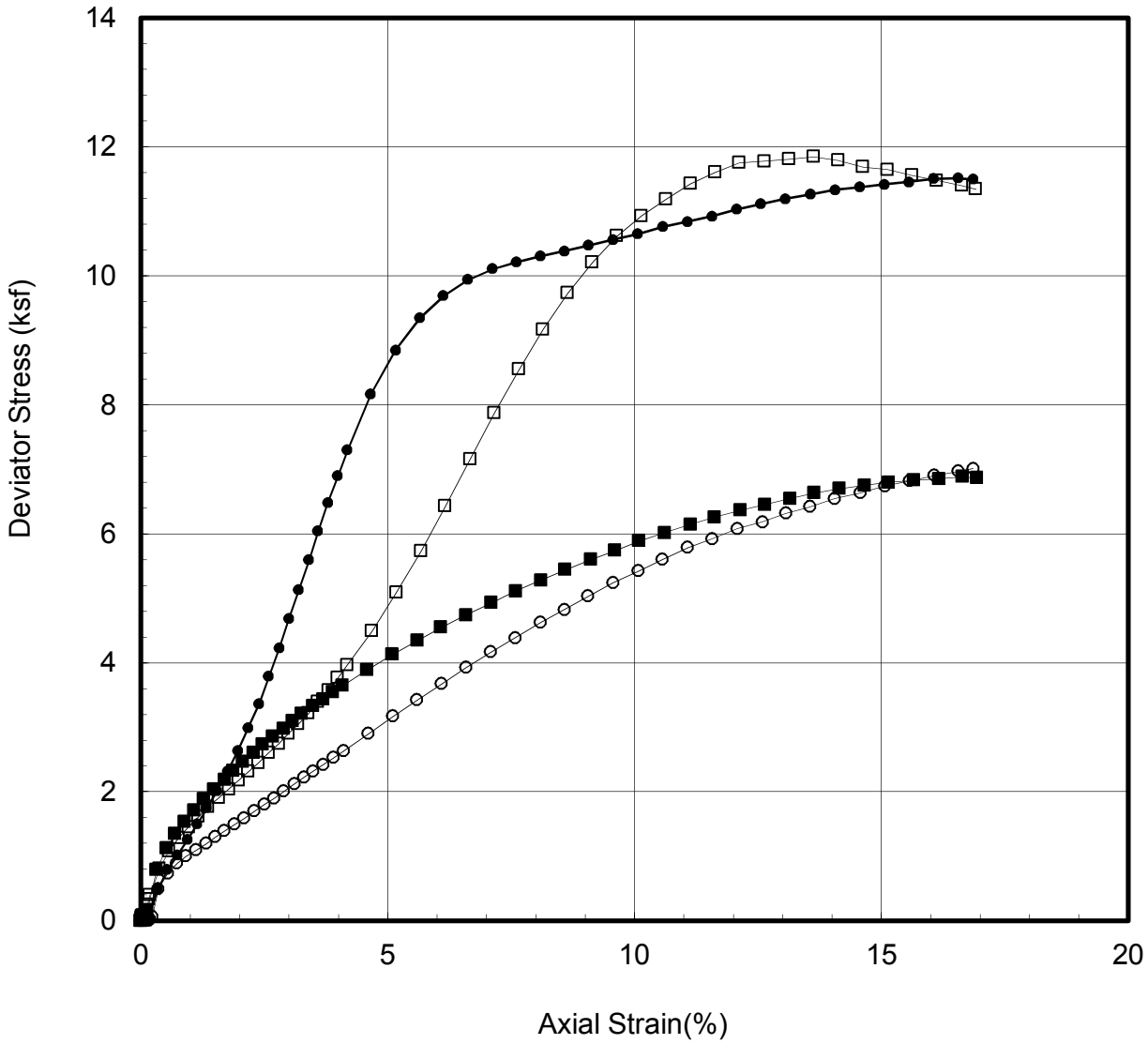


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	32.32	S-13A	R	1.6	3.1	1.5

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-02
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-1

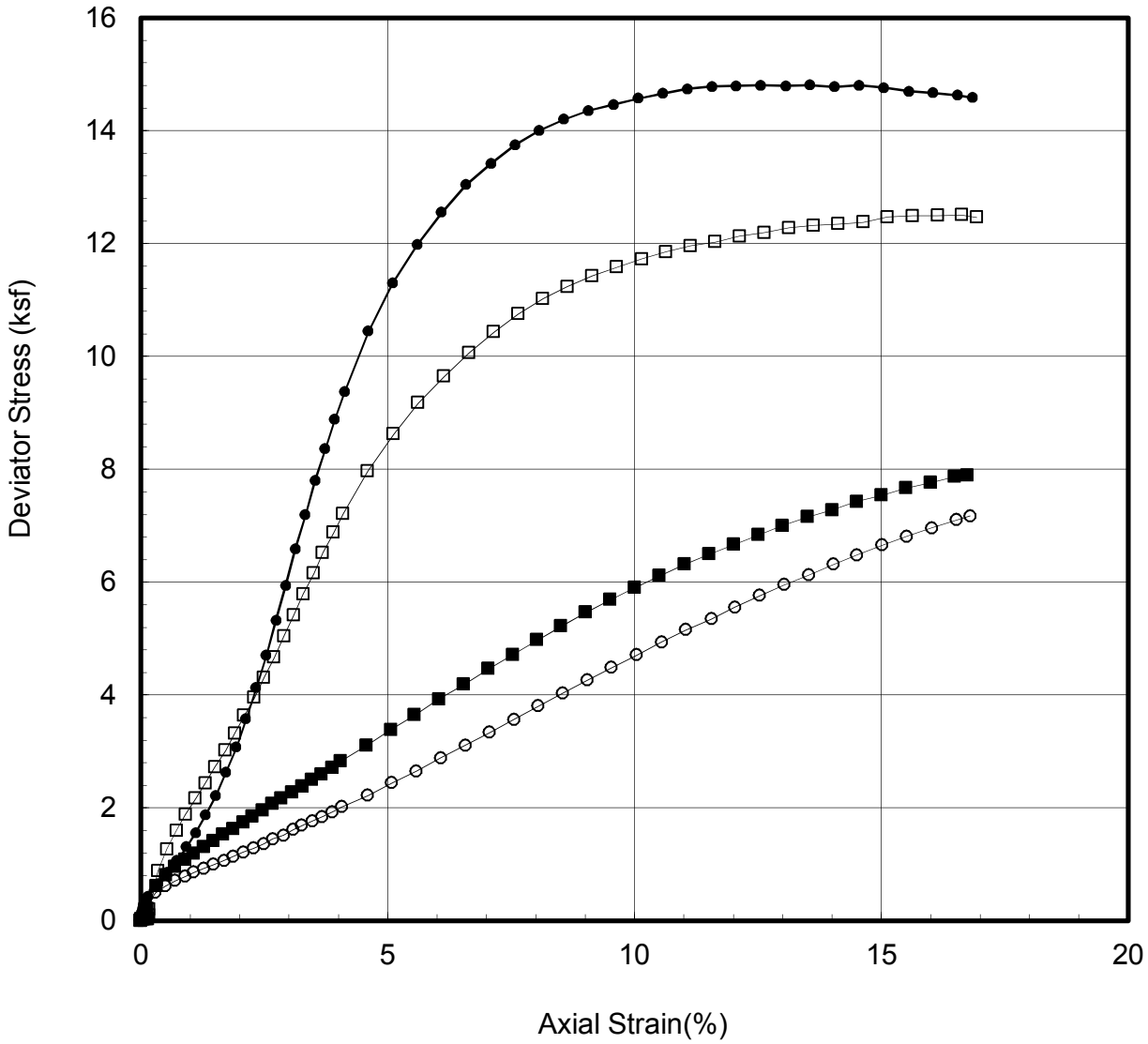


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	61.52	S-21aaA	U	3.3	11.5	5.8
○—	61.52	S-21aaA	R	3.3	7.0	3.5
□—	76.61	S-24aaA	U	4.0	11.8	5.9
■—	76.61	S-24aA	R	4.1	6.9	3.4

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-03
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-2

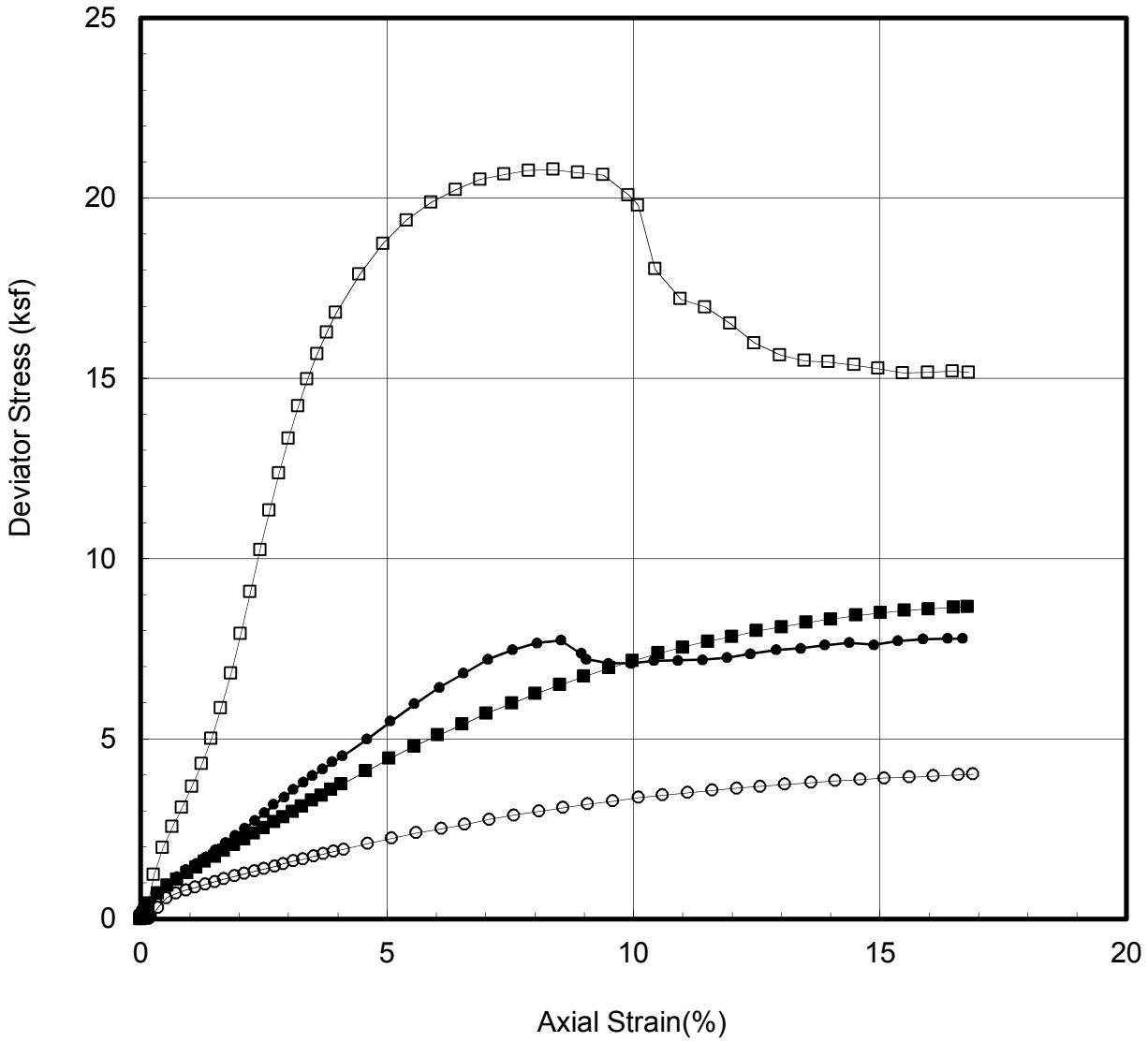


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	91.37	S-27aaA	U	4.8	14.8	7.4
○—	91.37	S-27aaA	R	4.8	7.2	3.6
□—	115.98	S-31aaA	U	6.1	12.5	6.3
■—	115.98	S-31aaA	R	6.1	7.9	3.9

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-03
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-3

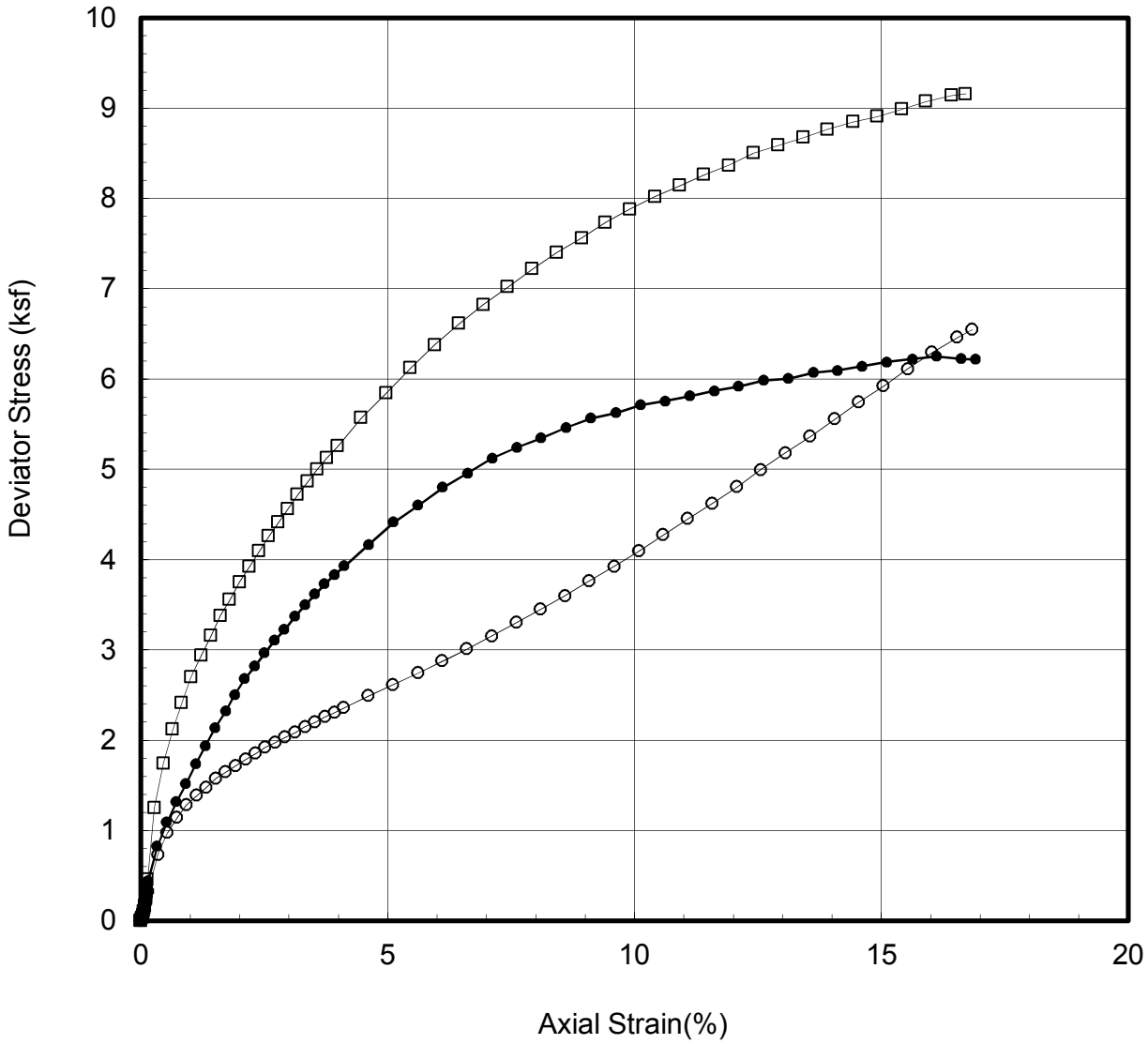


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	45.11	S-18aA	U	2.4	7.8	3.9
○—	45.11	S-18aaA	R	2.4	4.0	2.0
□—	75.30	S-24aA	U	4.0	20.8	10.4
■—	75.30	S-24aaA	R	4.0	8.7	4.3

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-04
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-4

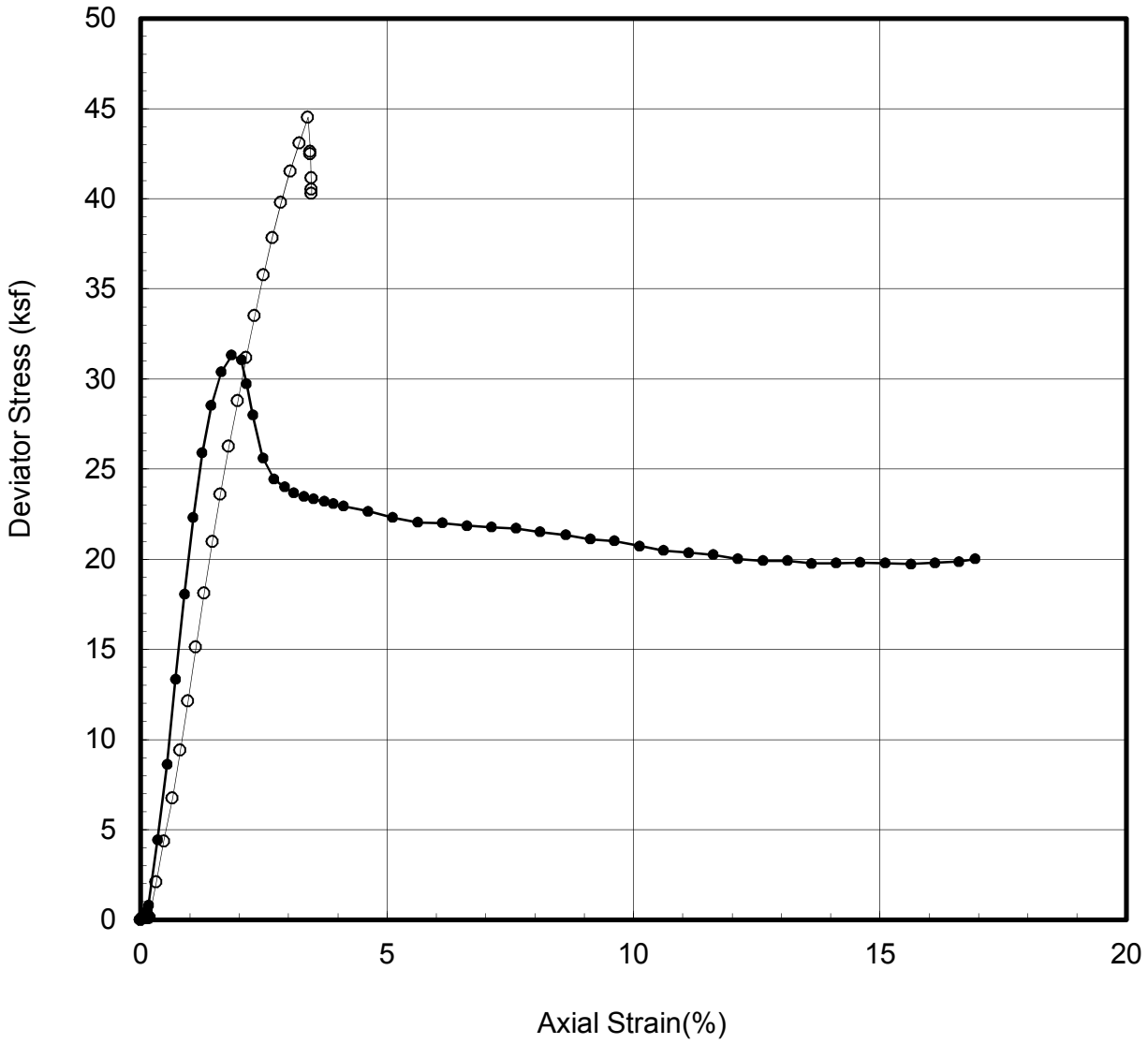


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	90.09	S-27aA	U	4.8	6.2	3.1
○—	97.75	S-29aaA	U	5.3	6.5	3.3
□—	97.75	S-29aaA	R	5.3	9.2	4.6

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-04
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-5

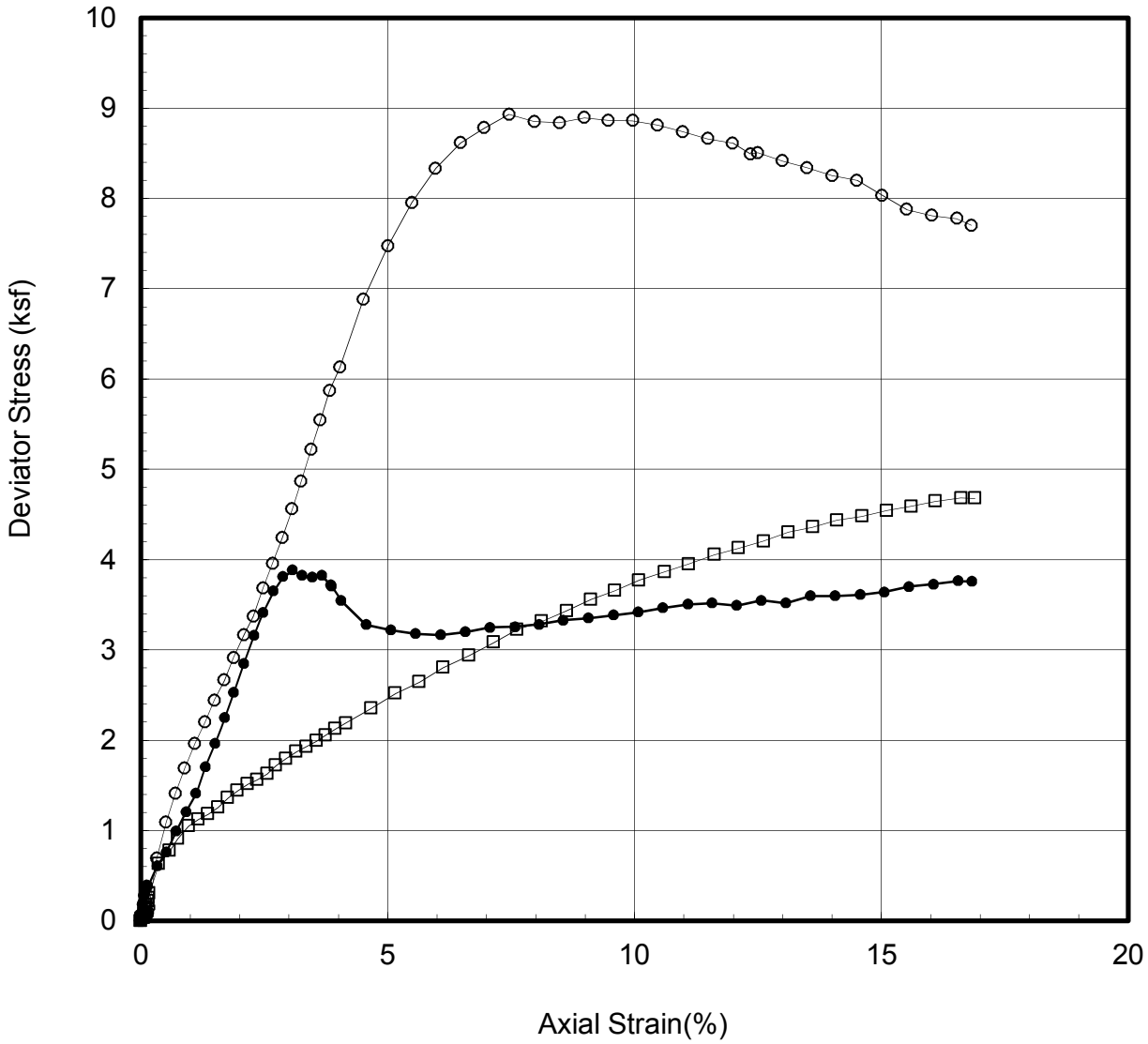


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	108.43	G-1A	U	7.6	31.3	15.7
—○—	120.90	G-2A	U	8.2	44.5	22.3

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-04
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-6

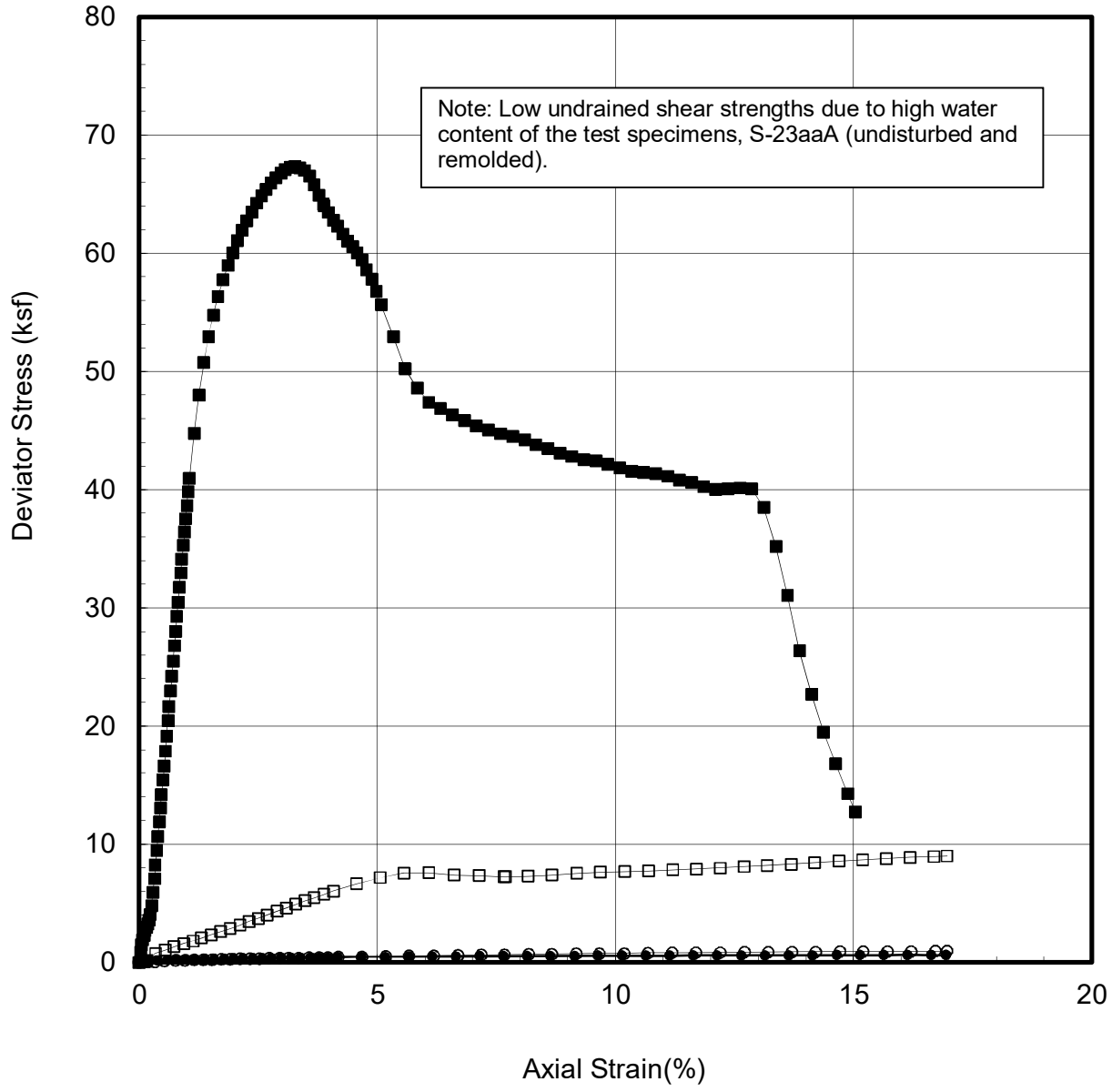


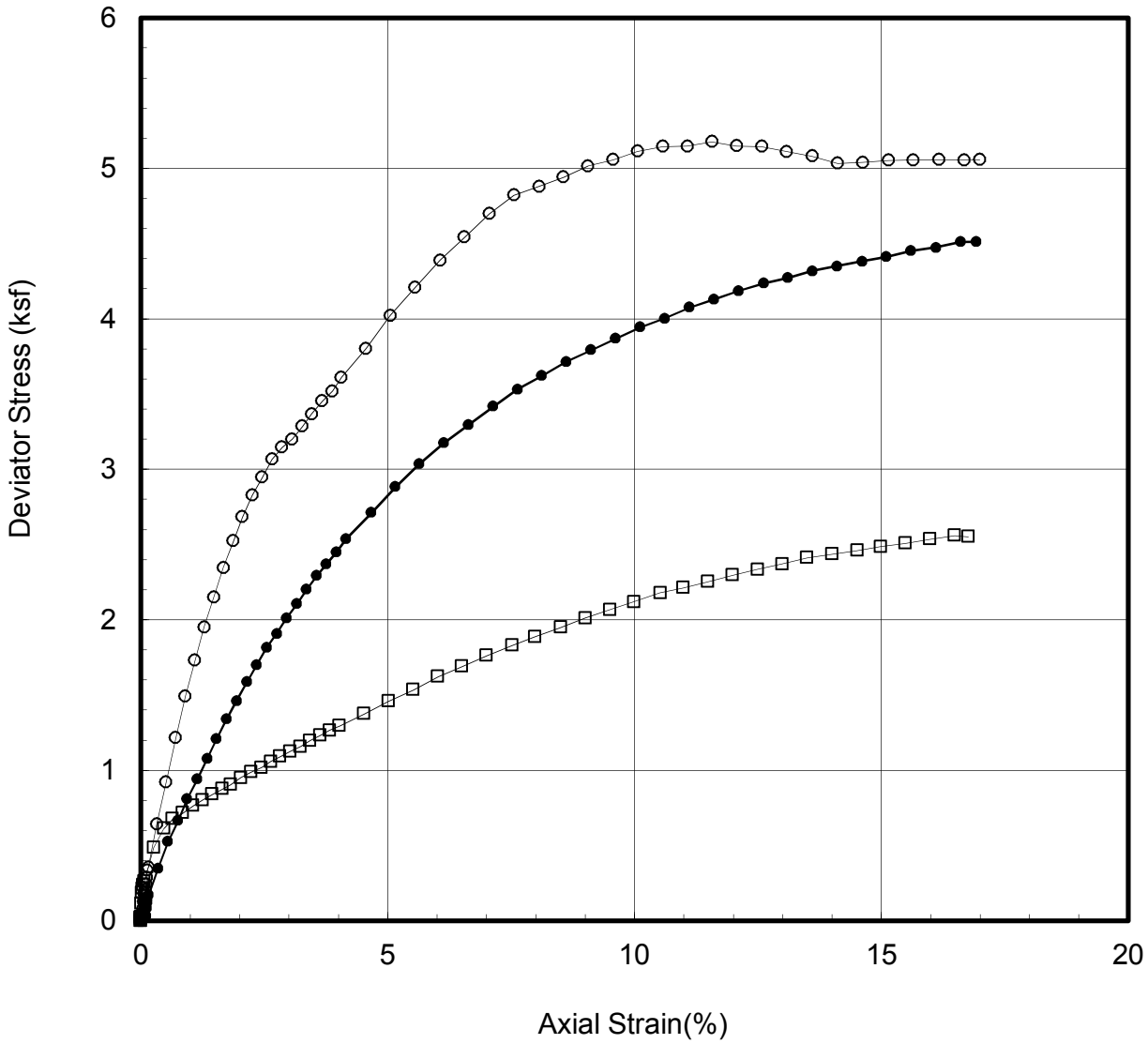
Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	5.22	S-2aA	U	0.3	3.9	1.9
○—	55.02	S-20aA	U	2.9	8.9	4.5
□—	55.02	S-20aA	R	2.9	4.7	2.3

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-05
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-7


Plot
Note: Low undrained shear strengths due to high water content of the test specimens, S-23aaA (undisturbed and remolded).
Deviator Stress (ksf)
Axial Strain(%)
0
10
20
30
40
50
60
70
80
0
5
10
15
20

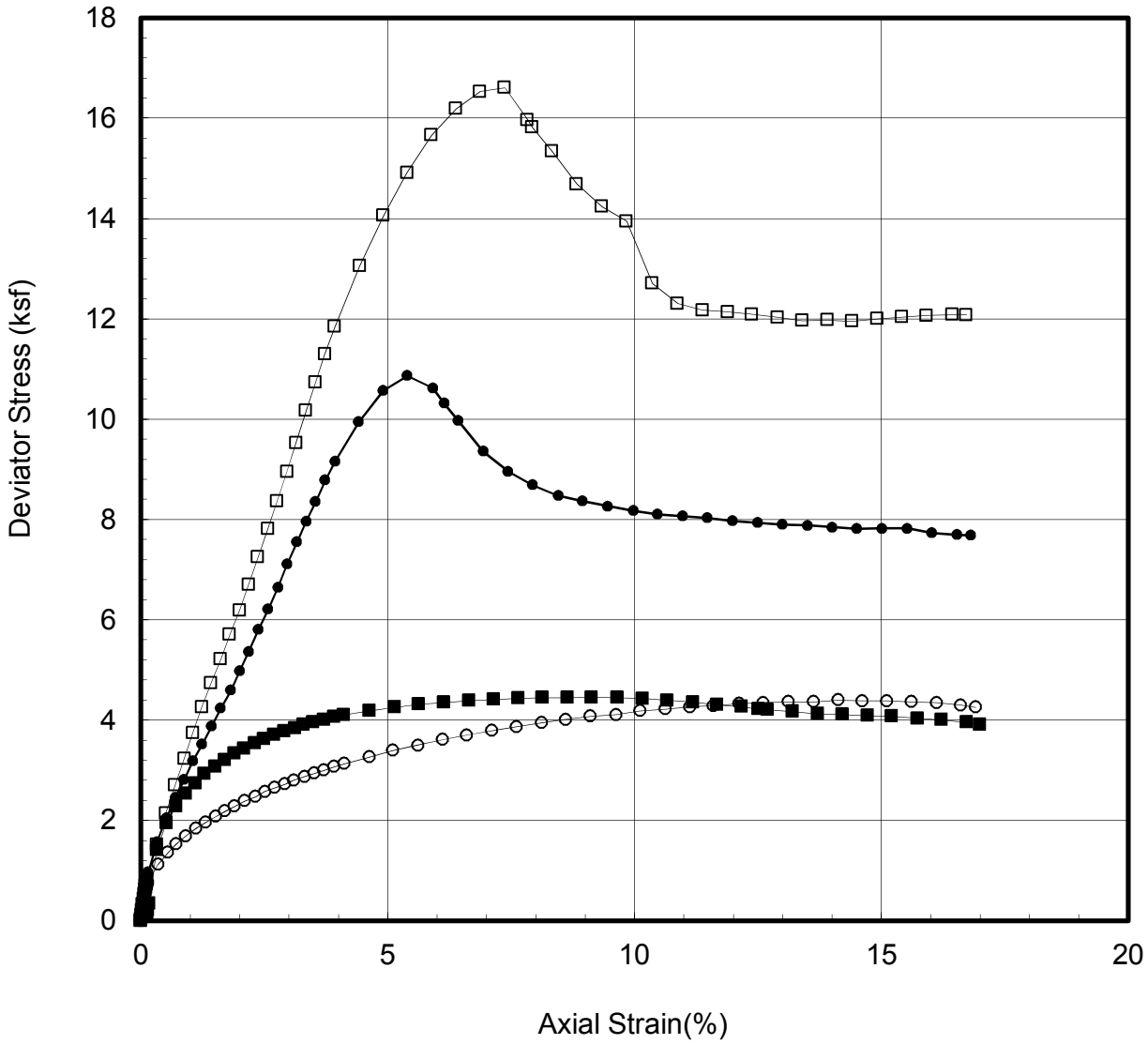


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	50.70	S-19aA	U	2.7	4.5	2.3
○—	50.20	19aA	U	2.7	5.2	2.6
□—	50.20	19aA	R	2.7	2.6	1.3

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-06
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-9

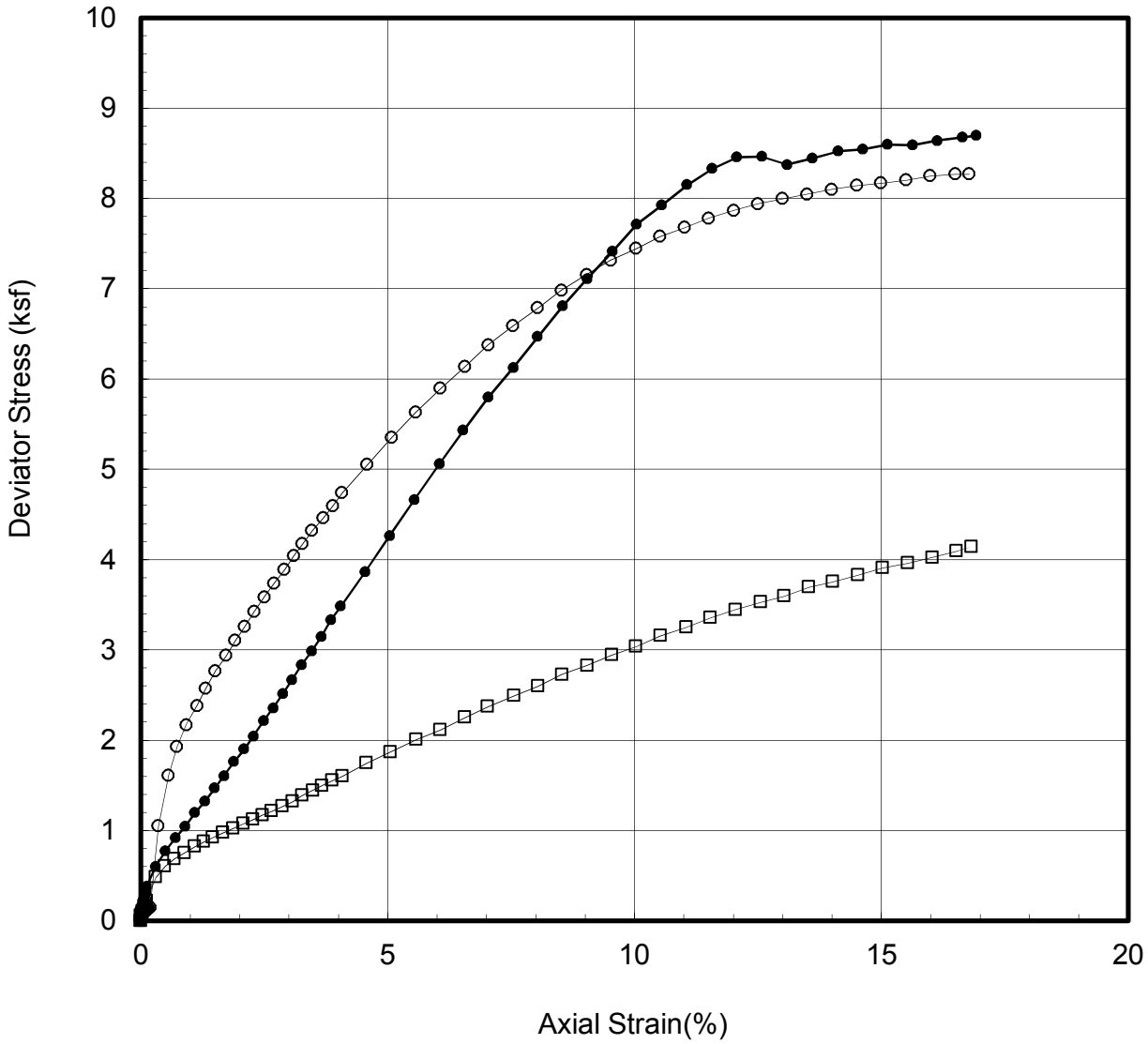


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	66.50	22aA	U	3.5	10.9	5.4
○—	66.50	22aA	R	3.5	4.4	2.2
□—	76.30	24aA	U	4.1	16.6	8.3
■—	76.30	24aA	R	4.1	4.4	2.2

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-06
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-10

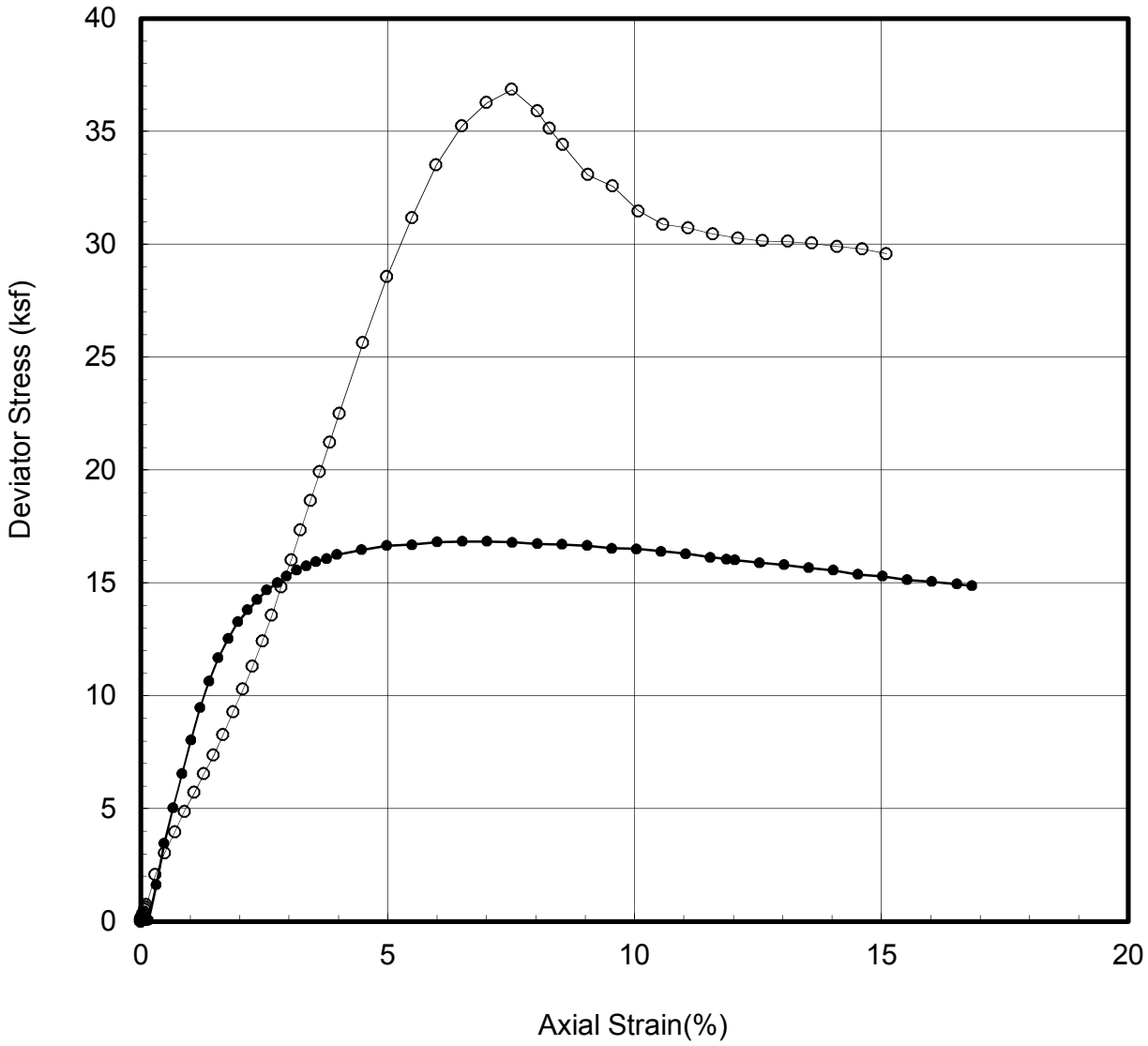


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	84.70	26aA	U	4.5	8.7	4.3
○—	84.70	26aA	R	4.5	8.3	4.1
□—	96.50	S-28aA	U	5.1	4.1	2.1

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-06
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-11

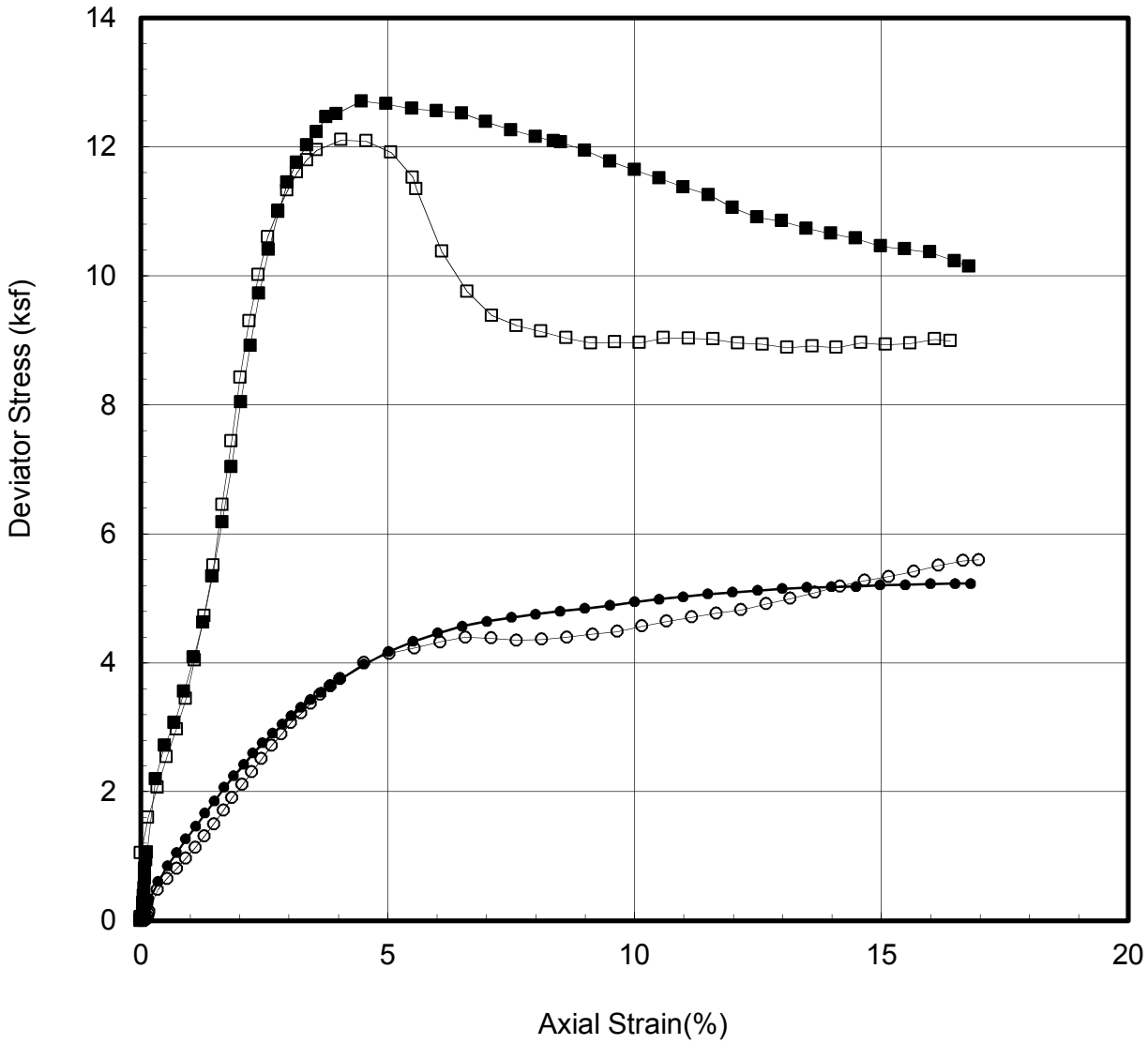


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	107.00	G-4bA	U	5.6	16.8	8.4
—○—	133.50	G-8aA	U	7.0	36.8	18.4

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-06
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-12

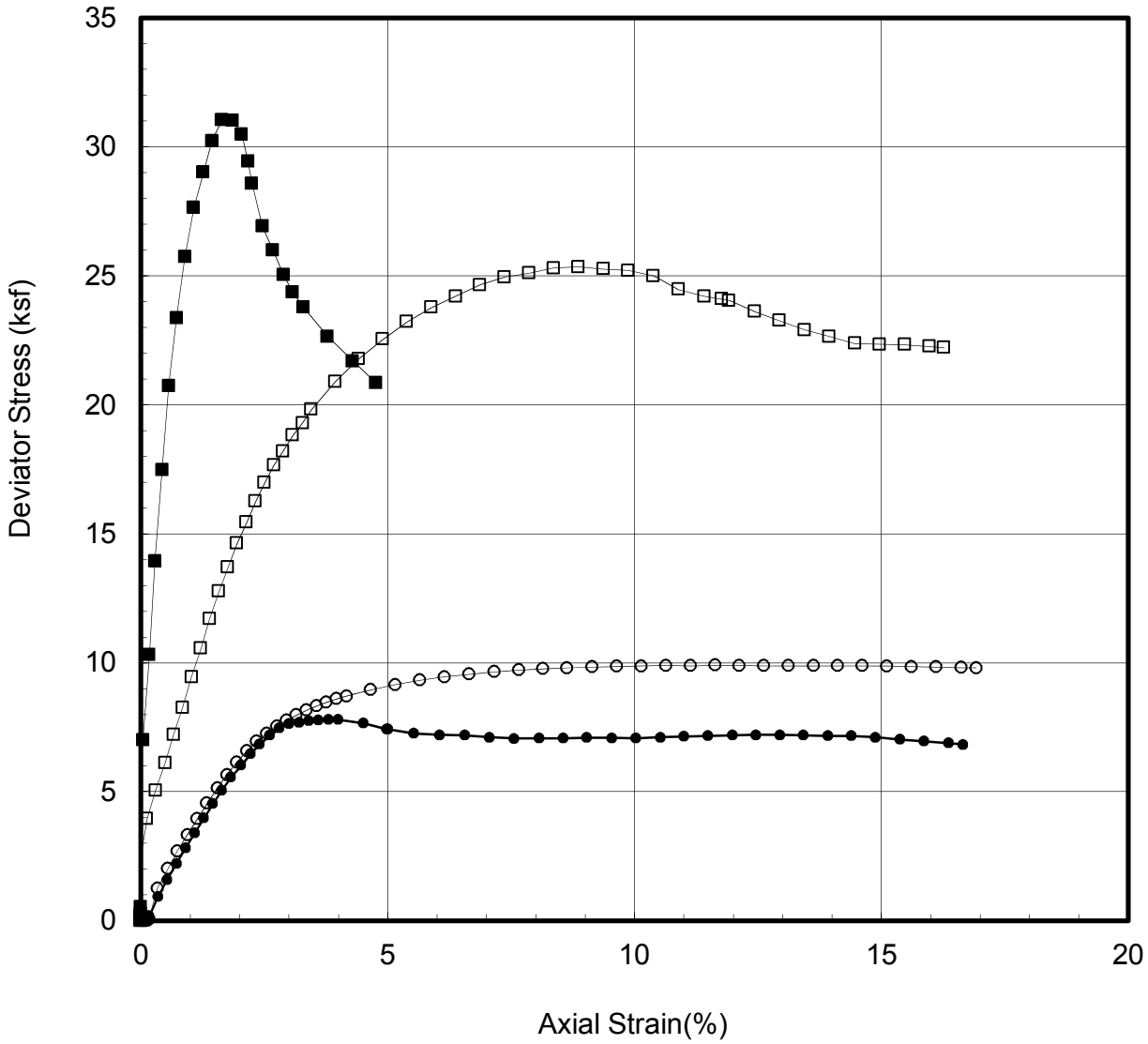


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	19.35	S-8aA	U	2.3	5.2	2.6
○—	62.99	S-21aA	U	3.3	5.6	2.8
□—	77.26	S-24aA	U	4.1	12.1	6.1
■—	87.11	S-26aA	U	4.6	12.7	6.4

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-08
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-13

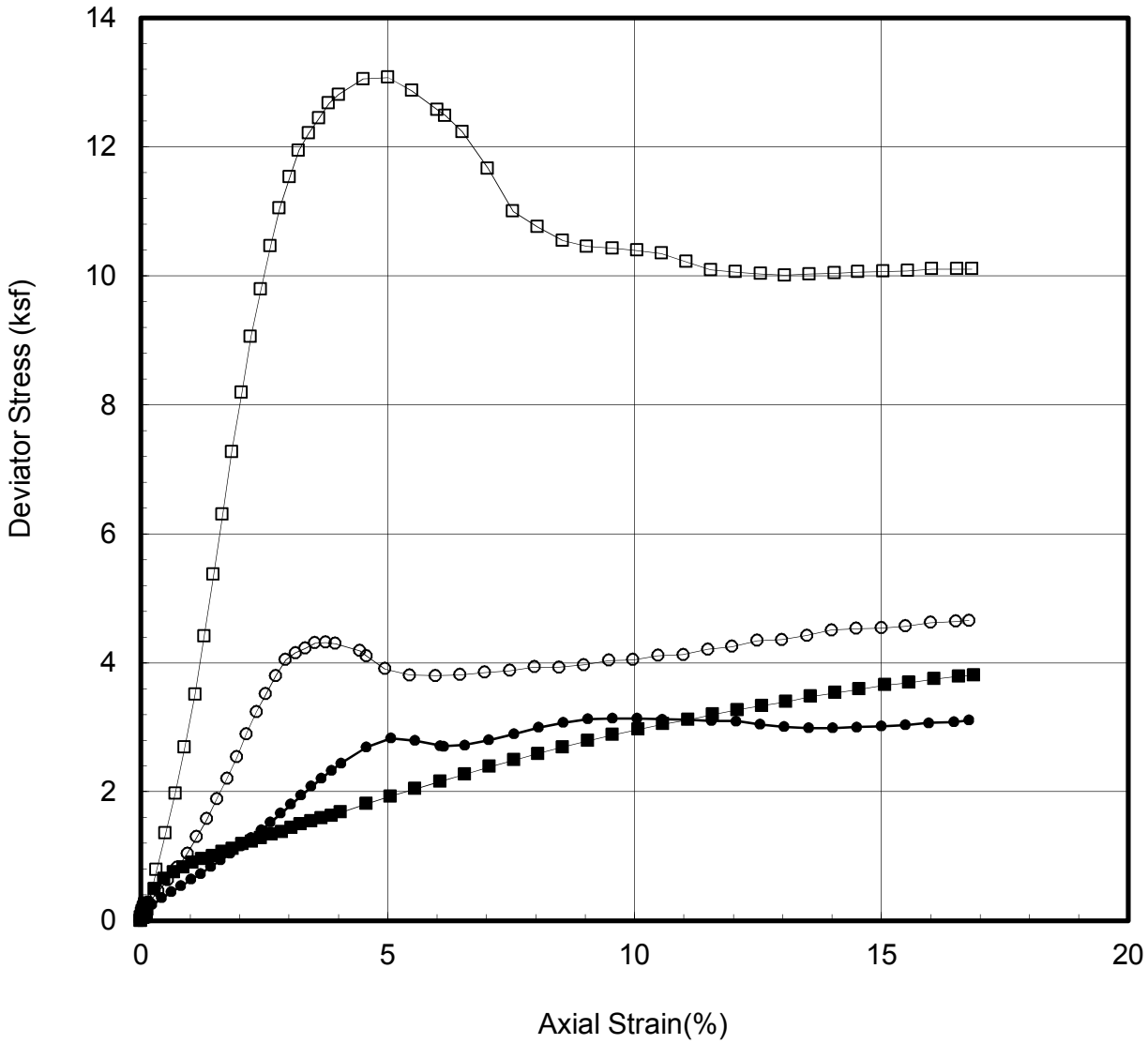


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	96.95	S-28aA	U	5.1	7.8	3.9
○—	111.71	S-30aA	U	5.9	9.9	4.9
□—	131.73	G-15A	U	6.9	25.3	12.7
■—	153.87	G-20A	U	8.1	31.0	15.5

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-08
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-14

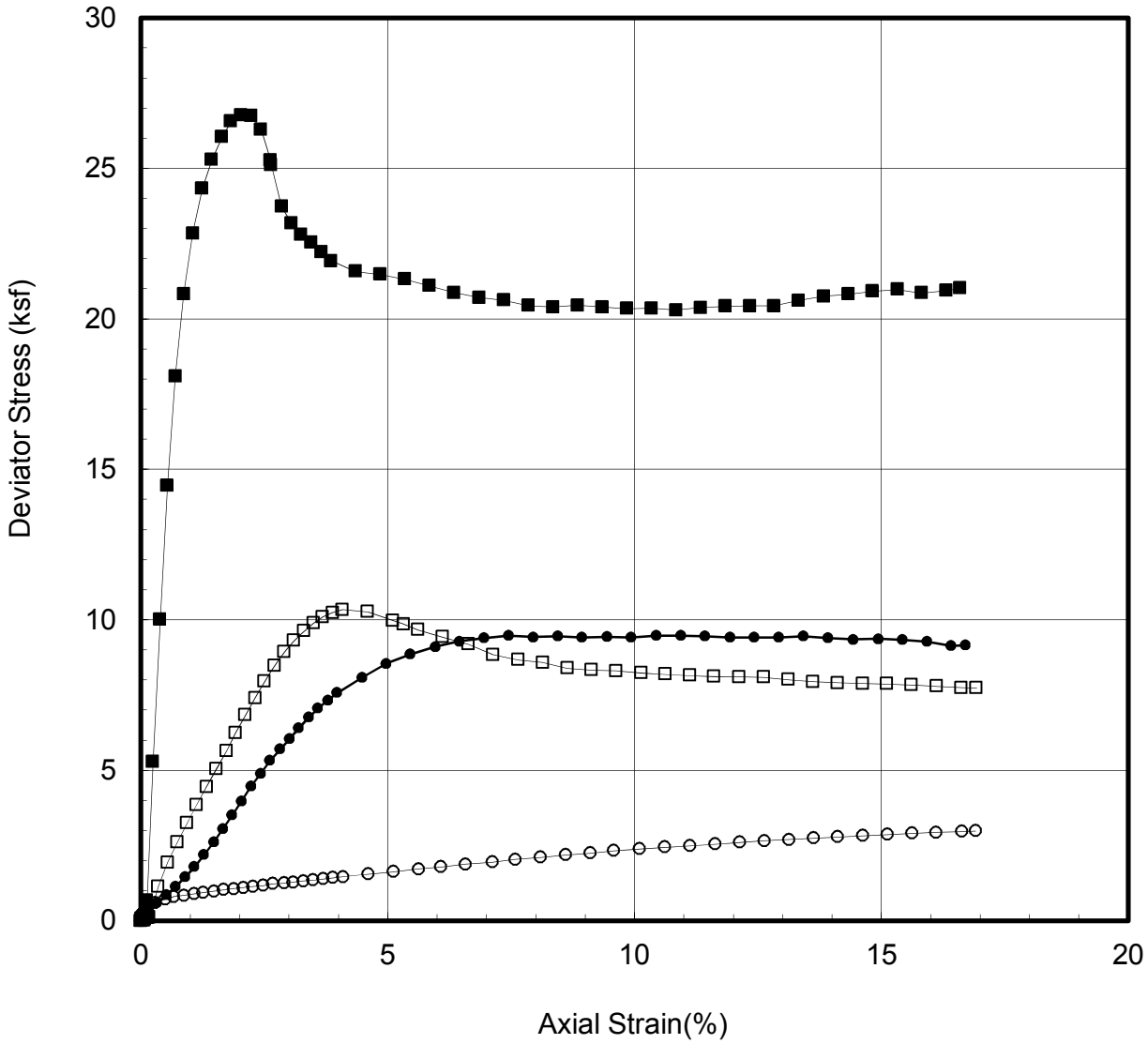


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	5.58	S-2aA	U	0.3	3.1	1.6
○—	11.32	S-4aA	U	0.6	4.7	2.3
□—	42.16	S-16aA	U	2.2	13.1	6.5
■—	52.00	S-18aA	R	2.8	3.8	1.9

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-09
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-15

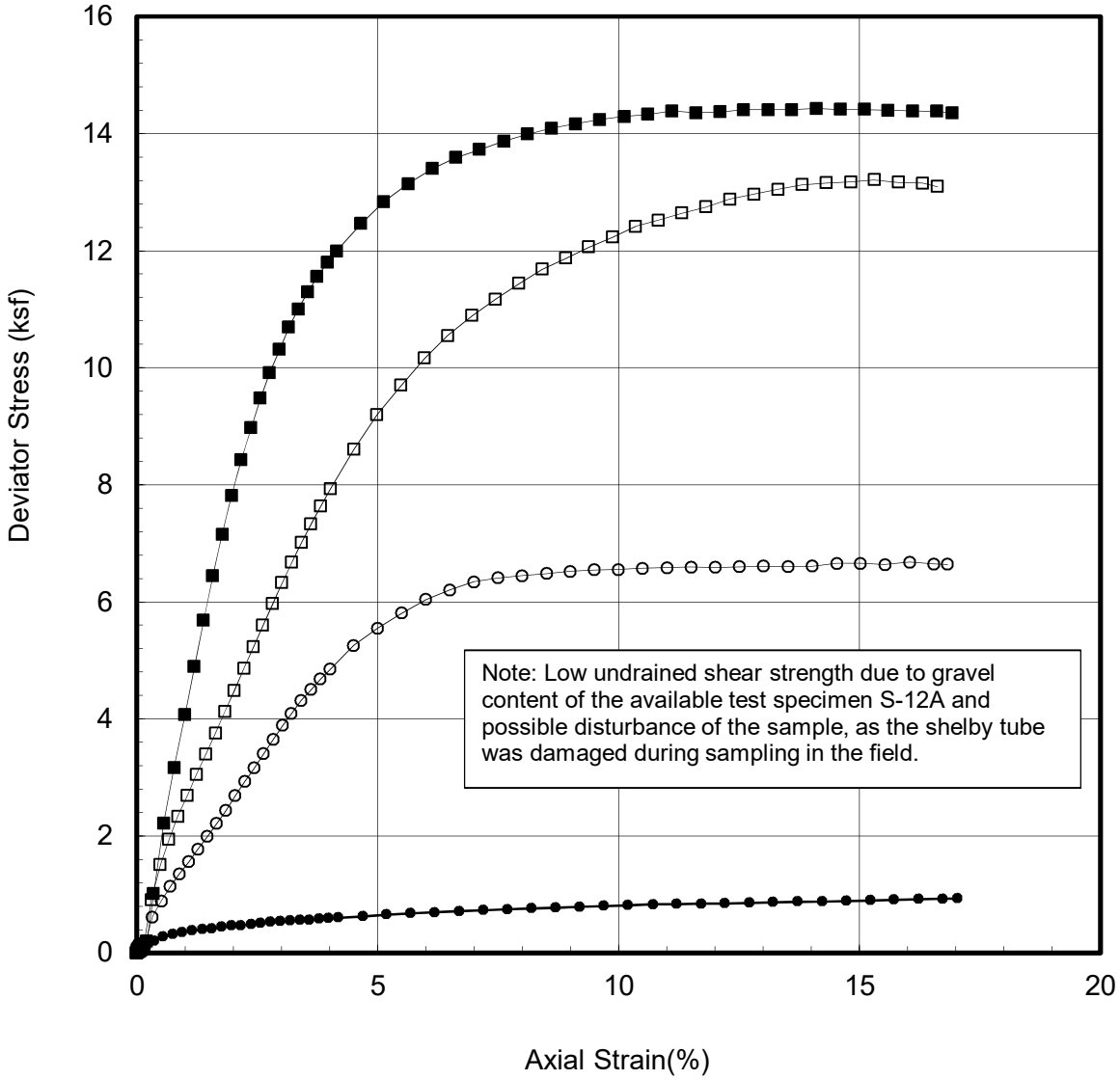


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	61.84	S-20aA	U	3.3	9.5	4.7
○—	81.50	S-24aA	R	4.3	3.0	1.5
□—	96.29	S-27aA	U	5.1	10.3	5.2
■—	145.01	G-9aA	U	7.6	26.8	13.4

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-09
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

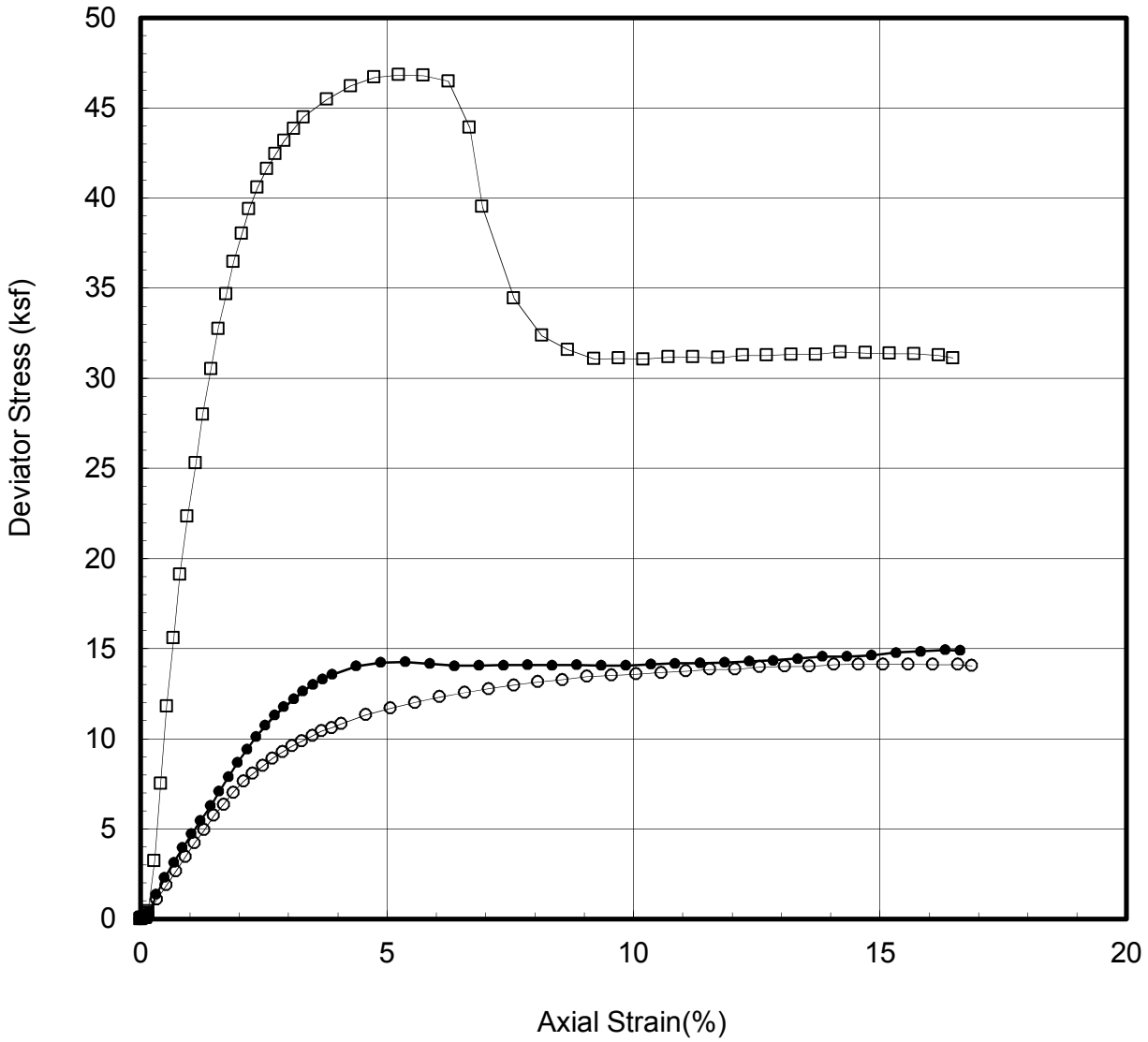
PLATE E4-16



Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	28.87	S-12A	U	1.5	0.9	0.5
○—	61.52	S-22aA	U	3.2	6.7	3.3
□—	75.62	S-25aA	U	5.9	13.2	6.6
■—	95.96	S-29aA	U	7.0	14.4	7.2

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-12
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

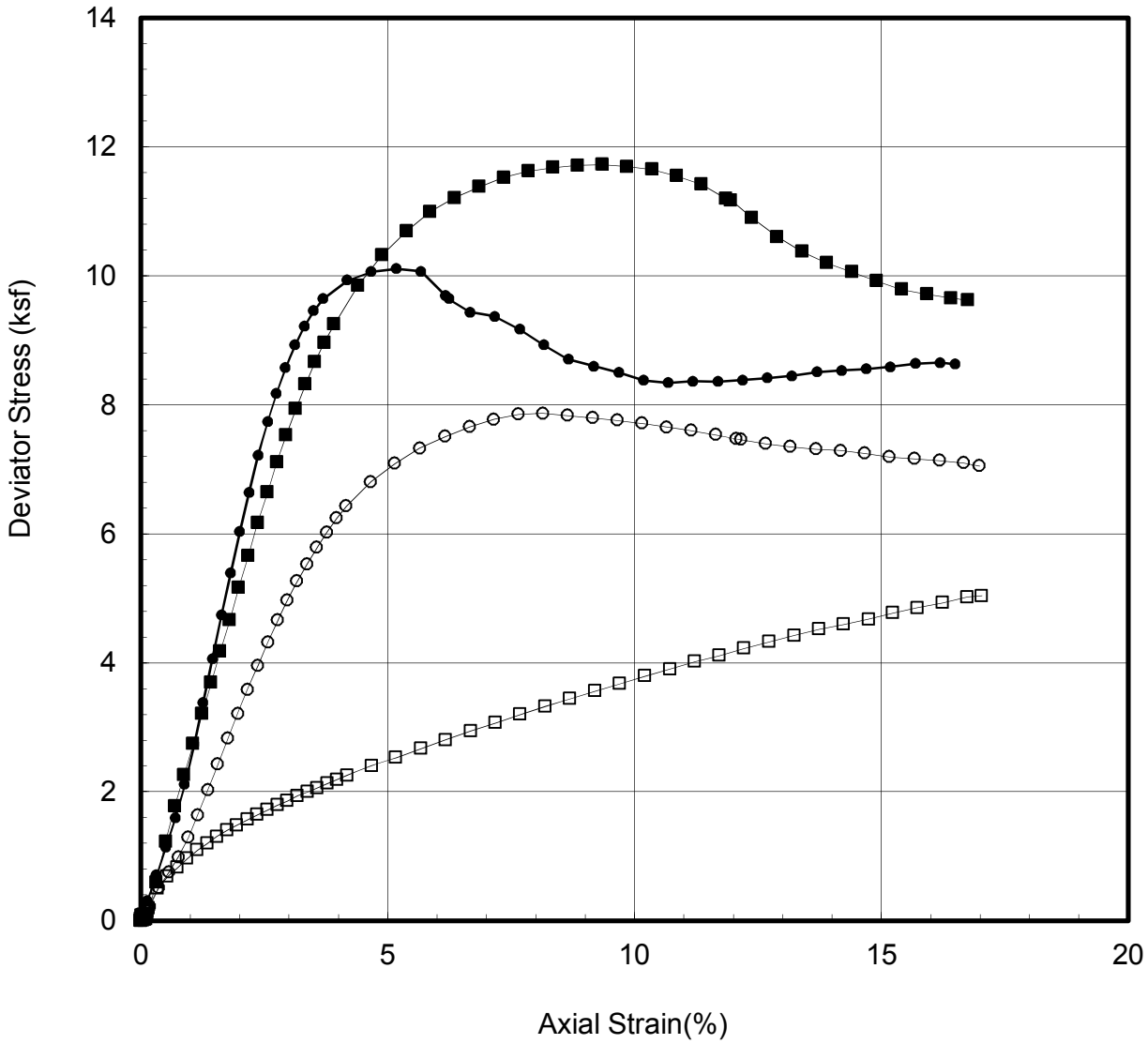


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	100.23	30aA	U	7.2	14.9	7.5
○—	125.33	G-4A	U	6.6	14.1	7.1
□—	149.74	G-7A	U	7.9	46.8	23.4

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-12
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-18

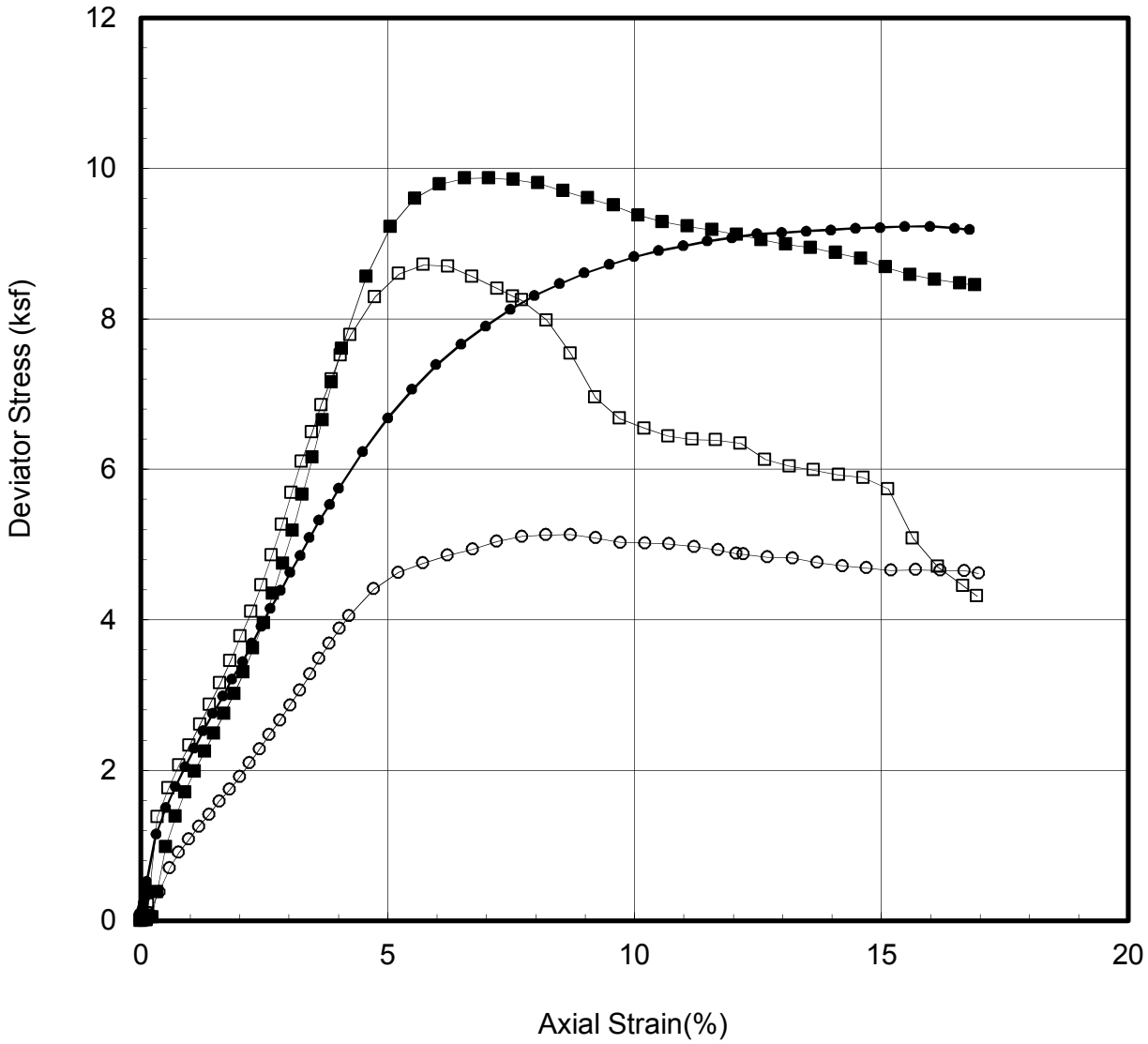


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	4.80	S-2aA	U	0.3	10.1	5.1
○—	23.30	S-9aA	U	1.2	7.9	3.9
□—	39.70	S-15aA	U	2.1	5.0	2.5
■—	52.80	S-18aA	U	2.8	11.7	5.9

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-13
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-19

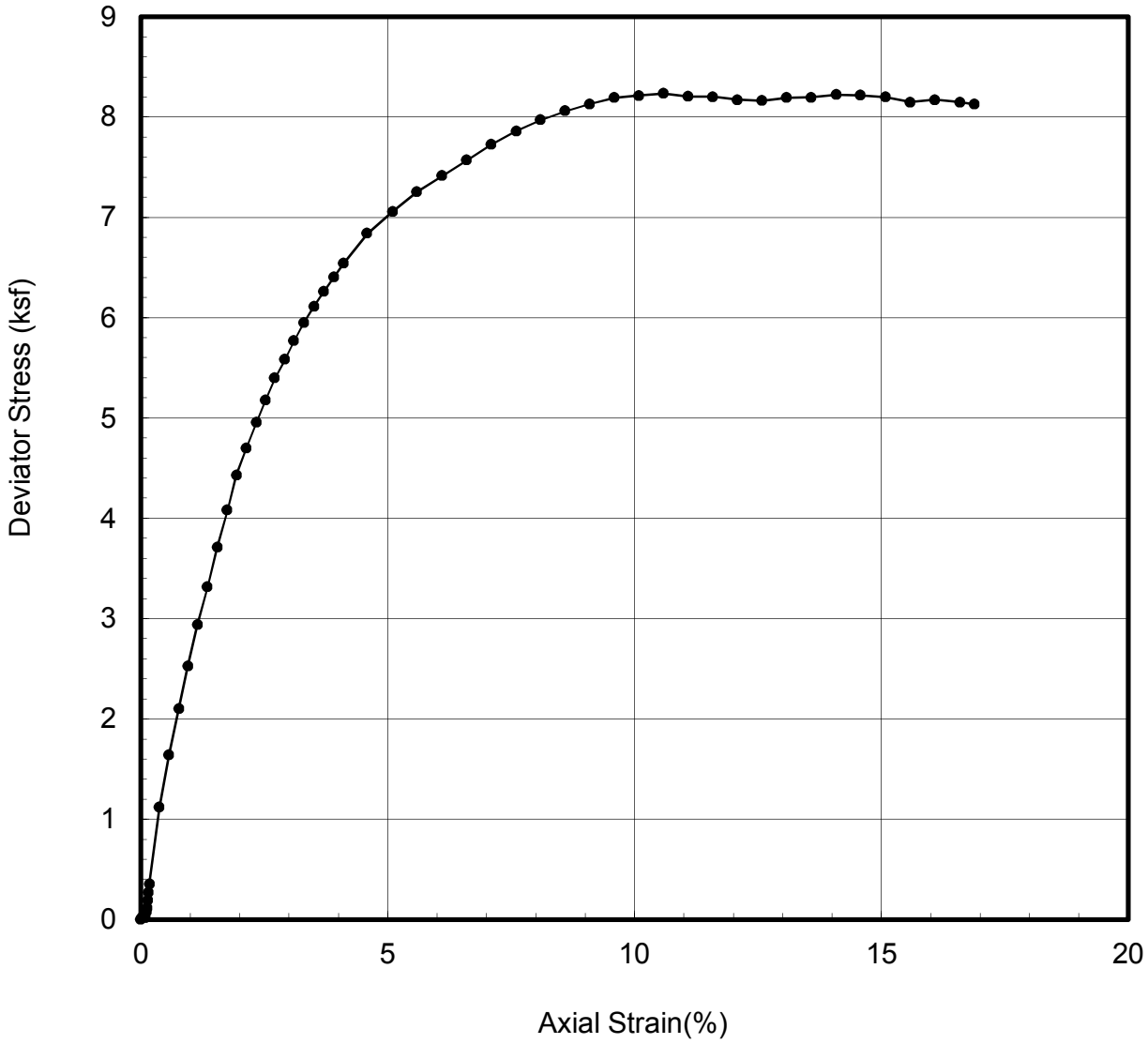


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	56.60	S-19aA	U	3.0	9.2	4.6
○—	67.60	S-21aA	U	3.6	5.1	2.6
□—	77.40	S-23aA	U	4.1	8.7	4.4
■—	87.30	S-25aA	U	4.6	9.9	4.9

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-13
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-20

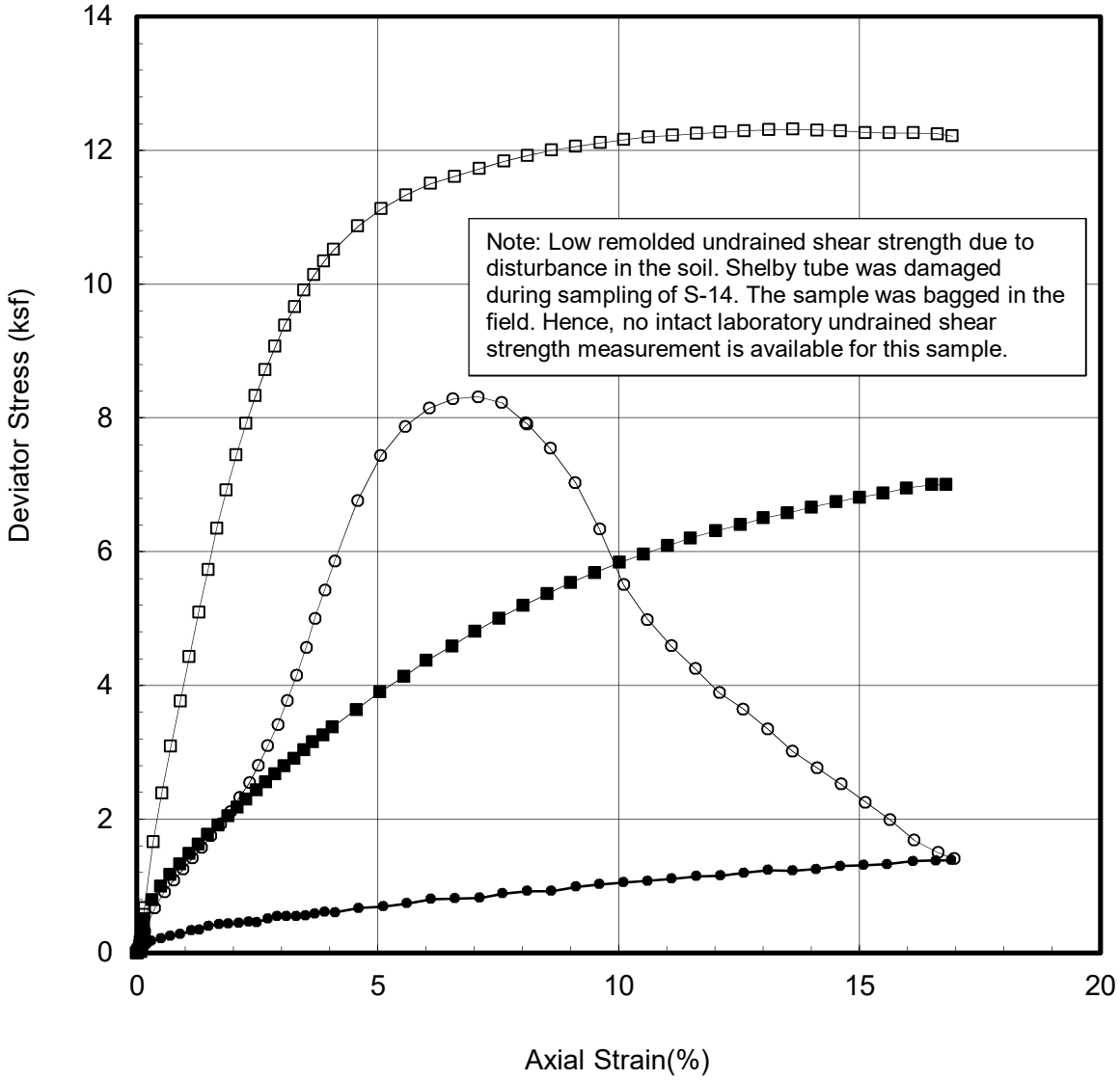


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	111.90	S-29aA	U	5.9	8.2	4.1

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-13
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

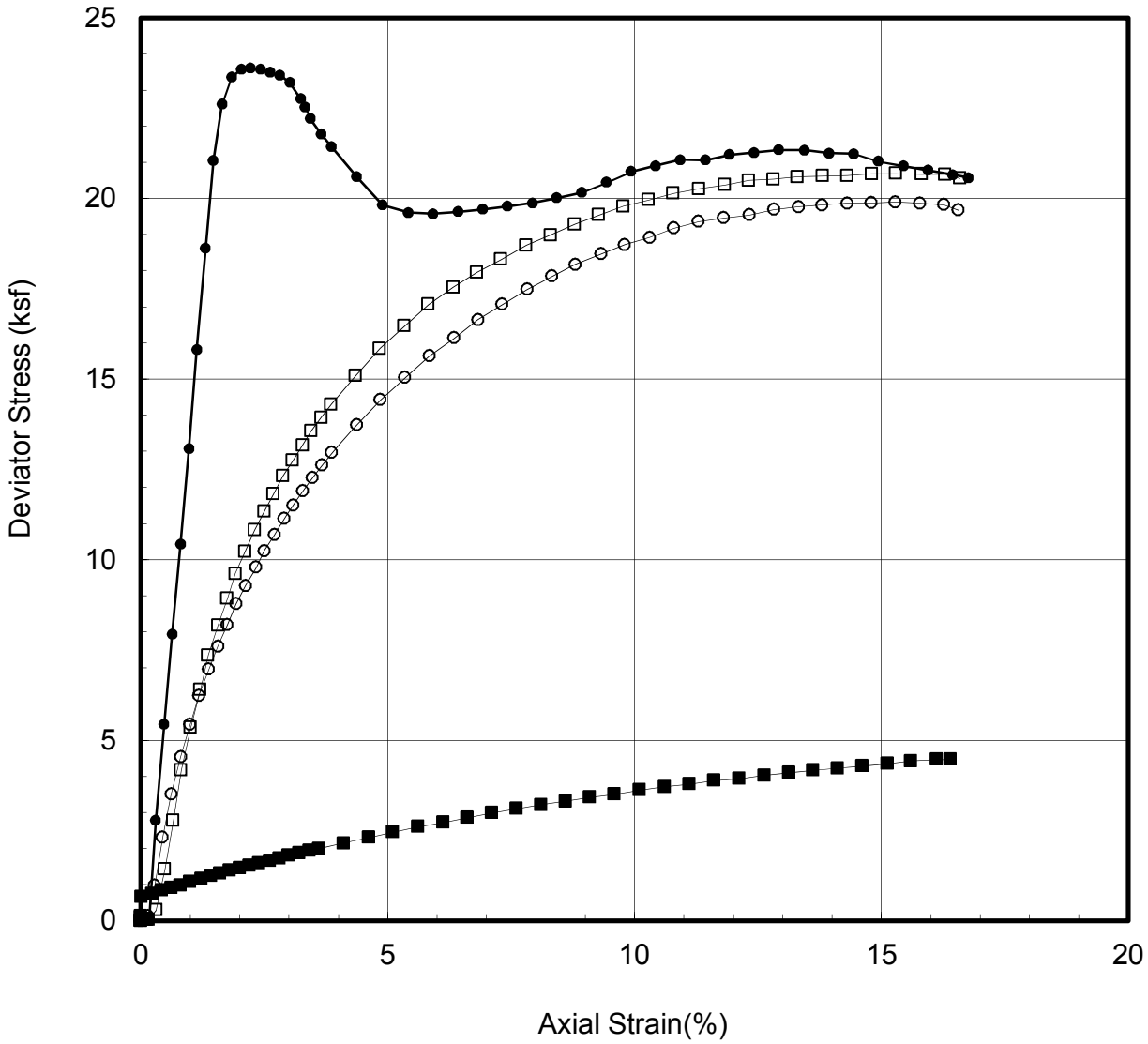
PLATE E4-21



Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	30.00	S-14A	R	1.6	1.4	0.7
○—	62.66	S-23aaA	U	3.3	8.3	4.2
□—	72.51	S-25aaA	U	3.8	12.3	6.2
■—	72.51	S-25aaA	R	3.8	7.0	3.5

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-14
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

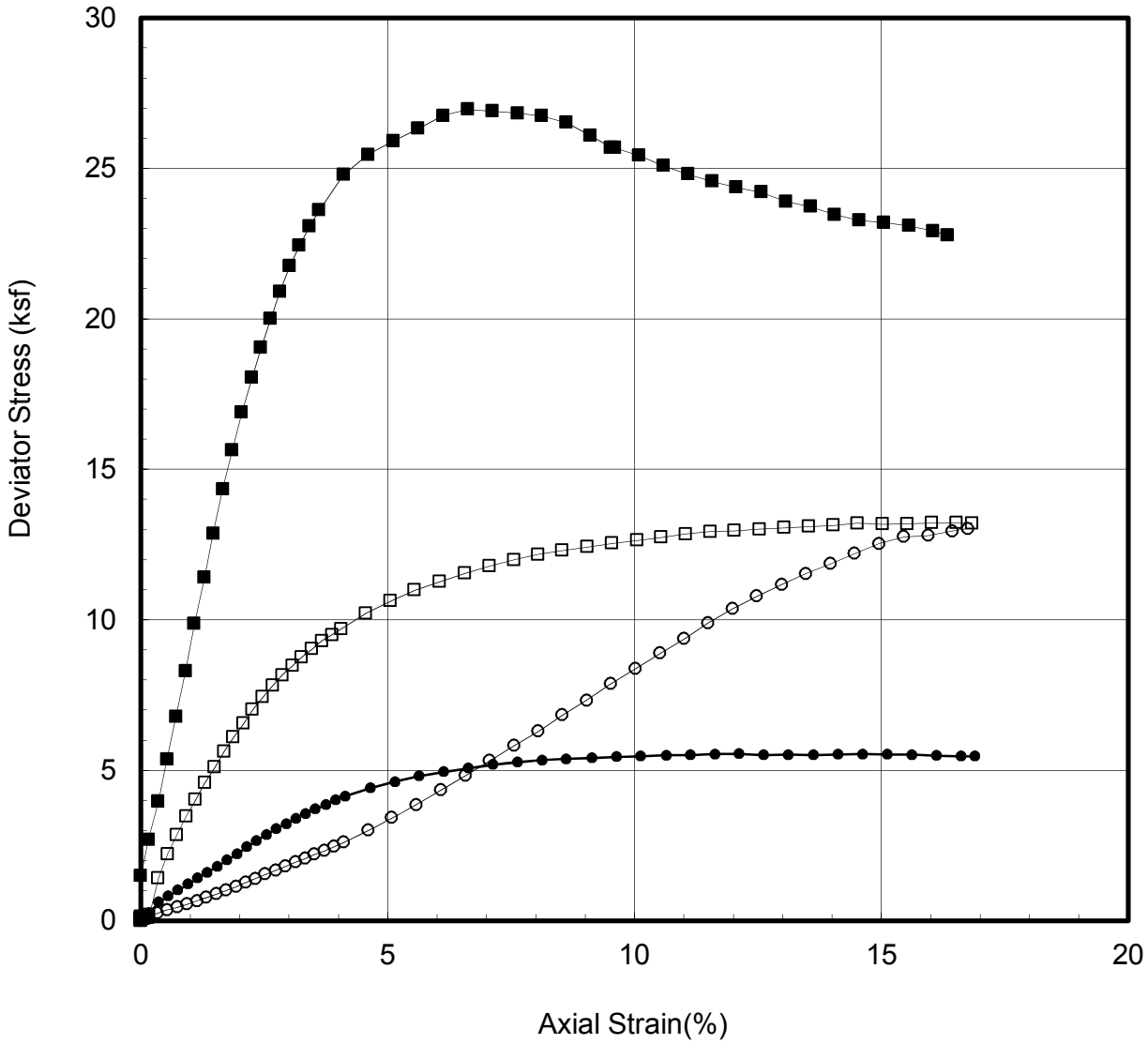


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	87.27	G-1aA	U	4.6	23.6	11.8
○—	116.14	G-5aA	R	6.1	19.9	9.9
□—	121.72	G-6aA	R	6.4	20.7	10.3
■—	137.14	G-9aA	R	7.2	4.5	2.2

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-14
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-23

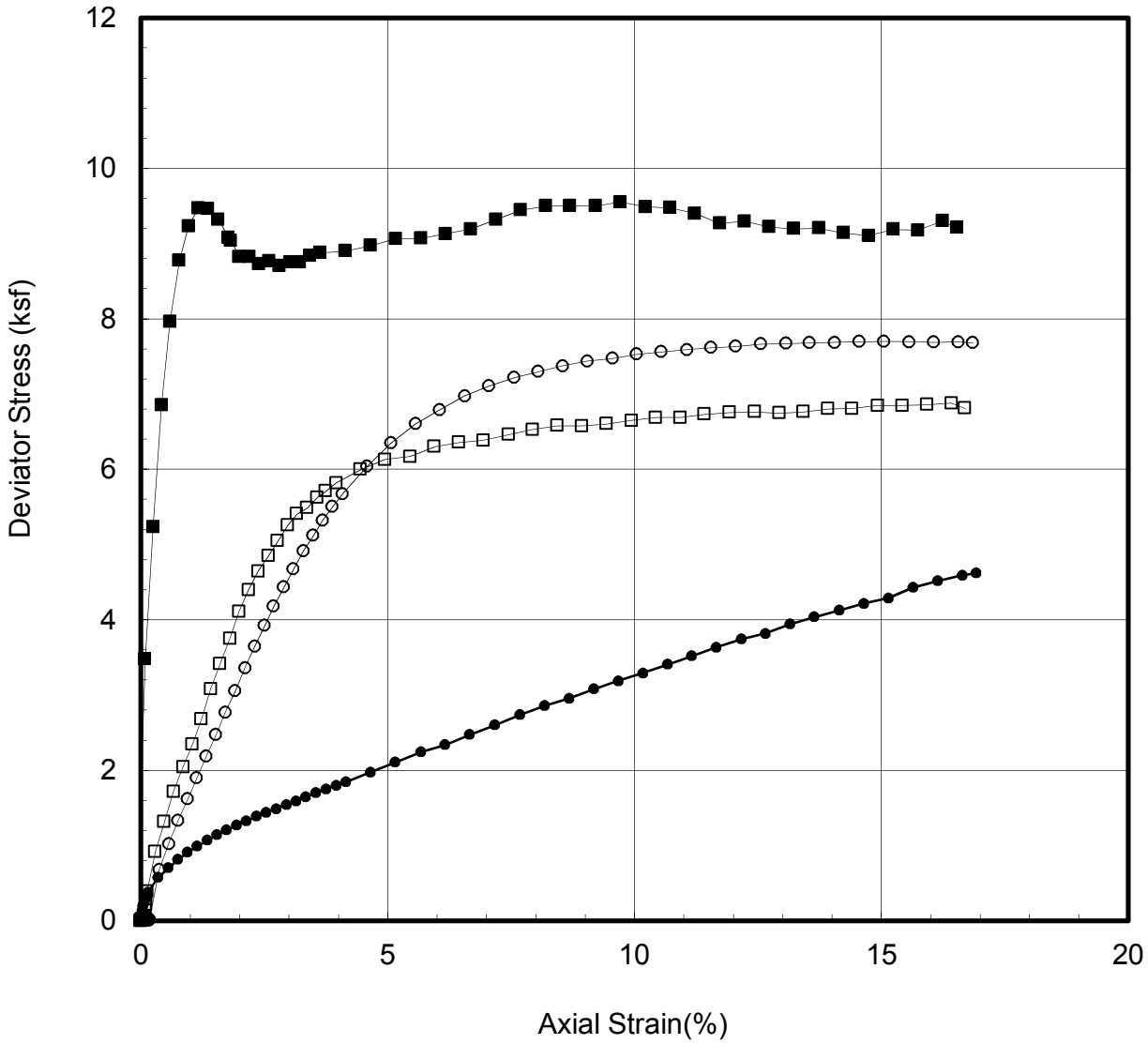


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	61.84	S-19aA	U	5.2	5.5	2.8
○—	81.14	S-23aA	U	6.2	13.0	6.5
□—	100.23	S-27aA	U	7.2	13.2	6.6
■—	128.94	G-6A	U	6.8	27.0	13.5

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-15
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-24

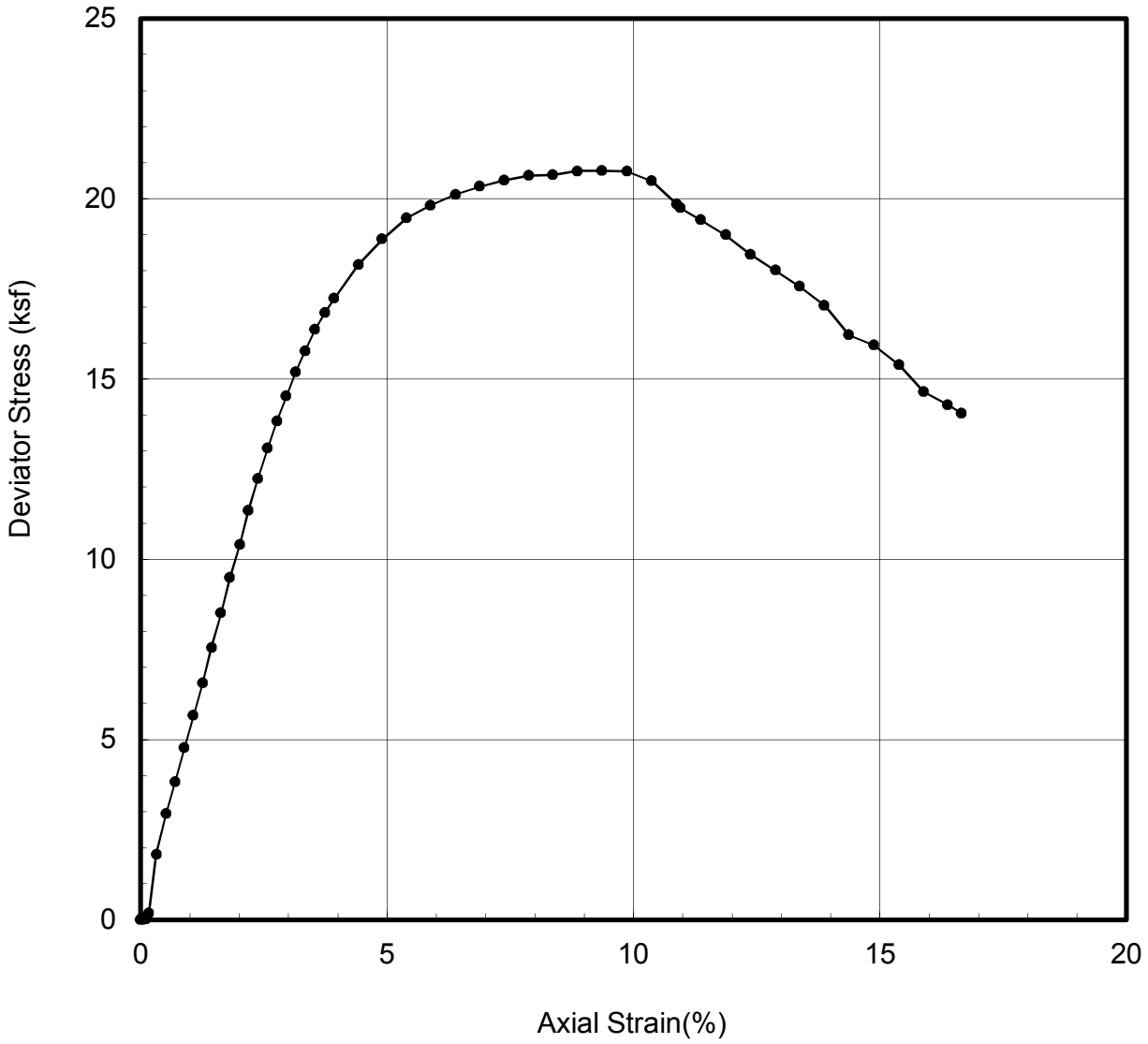


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	30.51	S-12aA	U	1.6	4.6	2.3
○—	77.43	S-26aA	U	4.1	7.7	3.9
□—	87.27	S-28aA	U	4.6	6.9	3.4
■—	103.18	G-2bA	U	5.4	9.6	4.8

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-16
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-25

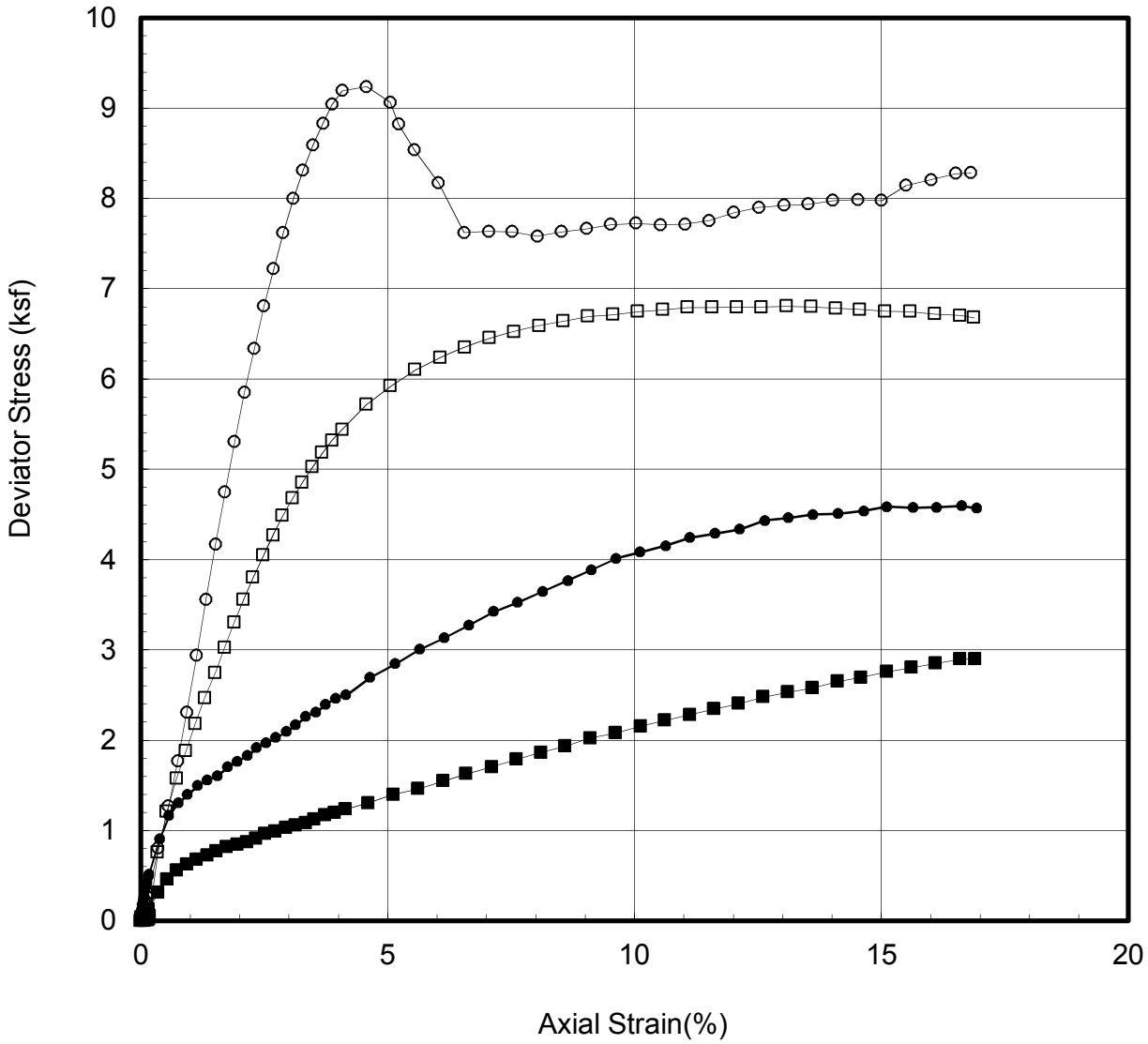


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	150.43	S-37A	U	7.9	20.8	10.4

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-16
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-26

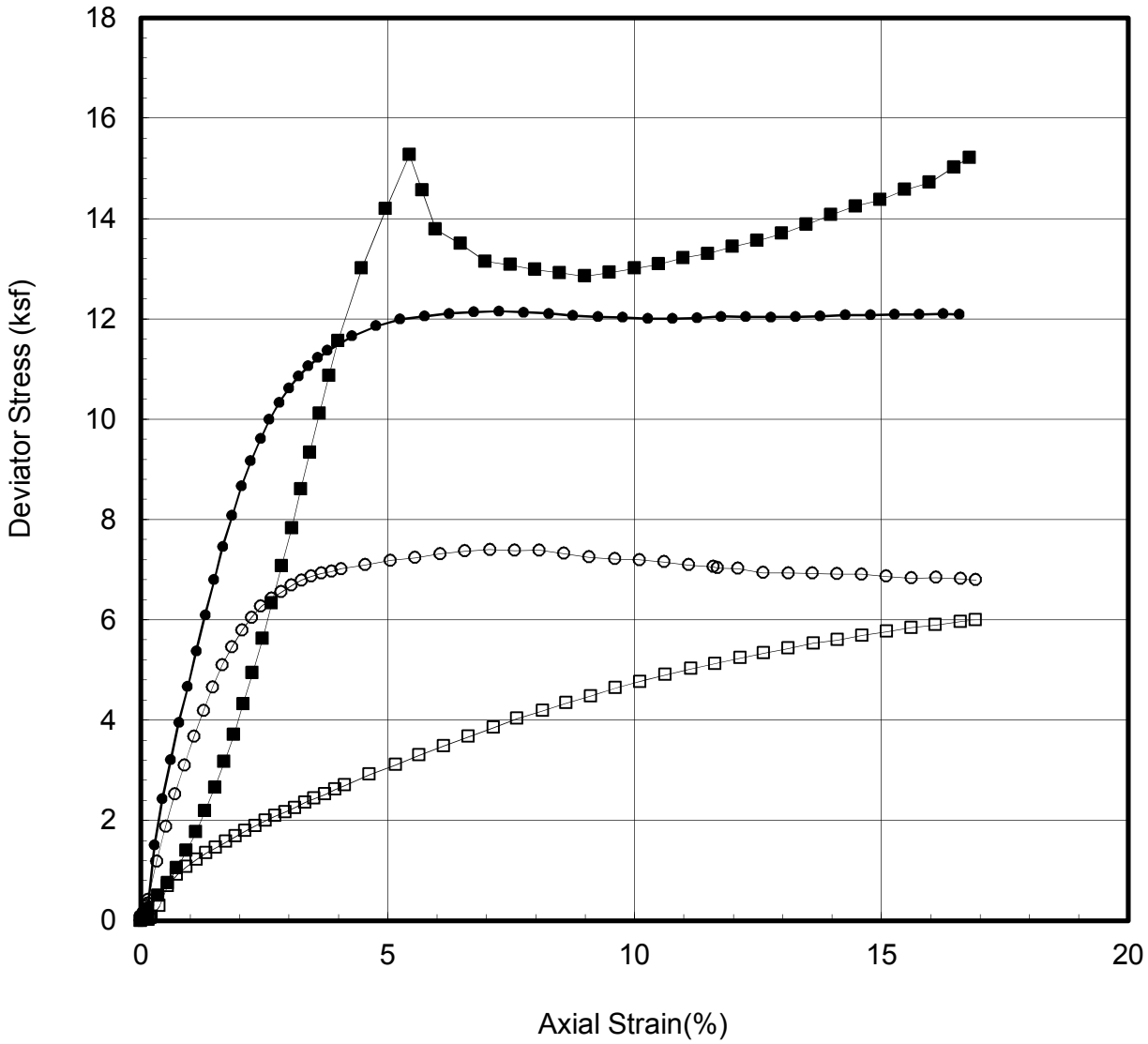


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	19.20	S-8aA	R	1.0	4.6	2.3
○—	27.23	S-11aaA	U	1.5	9.2	4.6
□—	63.48	S-21aaA	U	3.3	6.8	3.4
■—	63.48	S-21aaA	R	3.4	2.9	1.4

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-17
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-27

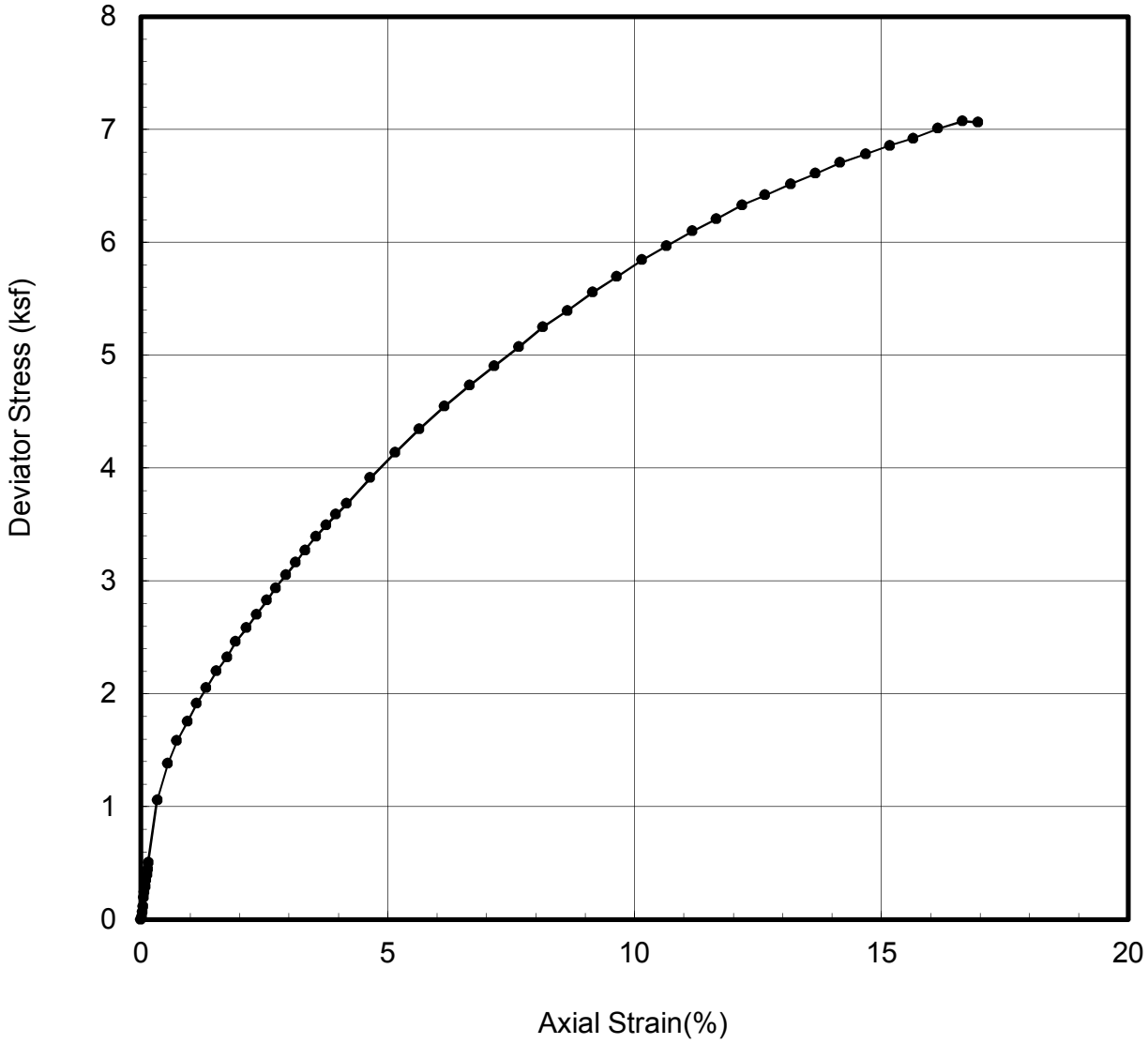


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	72.67	S-23aaA	U	3.8	12.1	6.1
○—	89.73	S-28aaA	U	4.7	7.4	3.7
□—	89.73	S-28aaA	R	4.7	6.0	3.0
■—	104.49	S-31aaA	U	5.5	15.3	7.6

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-17
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

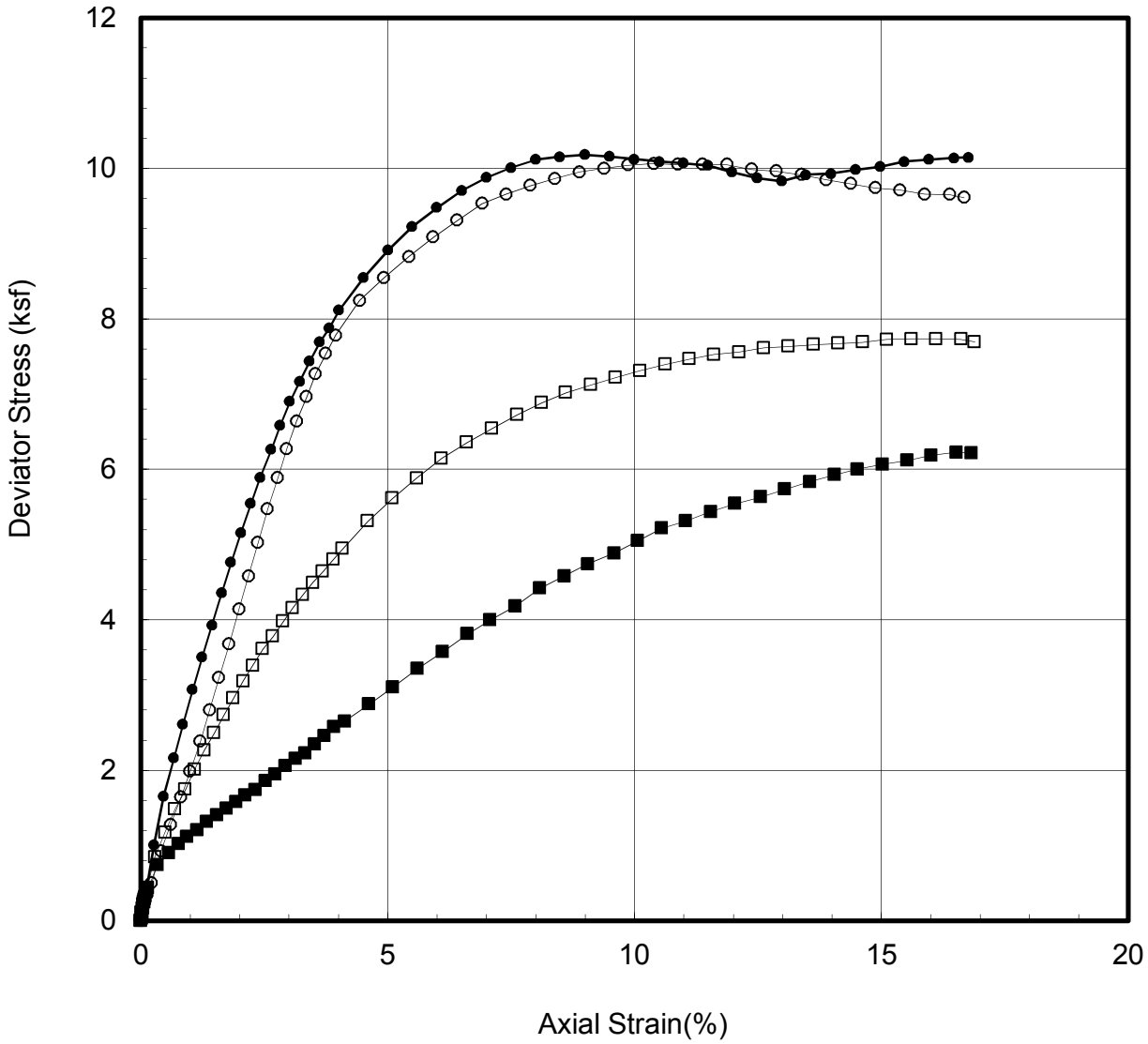
PLATE E4-28



Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	126.00	G-6bA	R	6.7	7.1	3.5

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-17
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

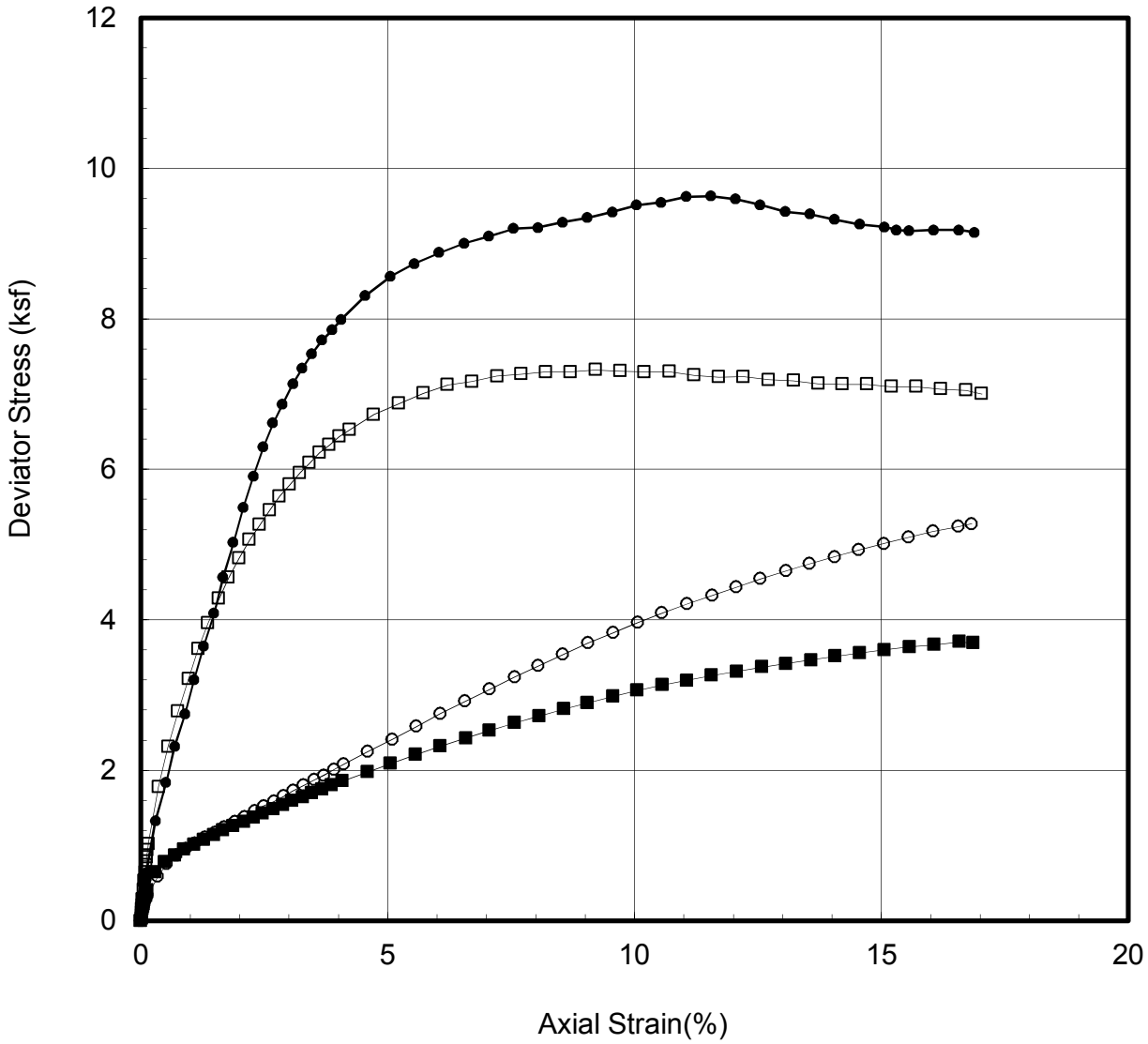


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	4.27	S-2aaA	U	0.2	10.2	5.1
○—	10.20	S-4aA	U	0.5	10.1	5.0
□—	13.45	S-5aaA	U	0.8	7.7	3.9
■—	19.19	S-7aaA	R	1.0	6.2	3.1

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-18
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

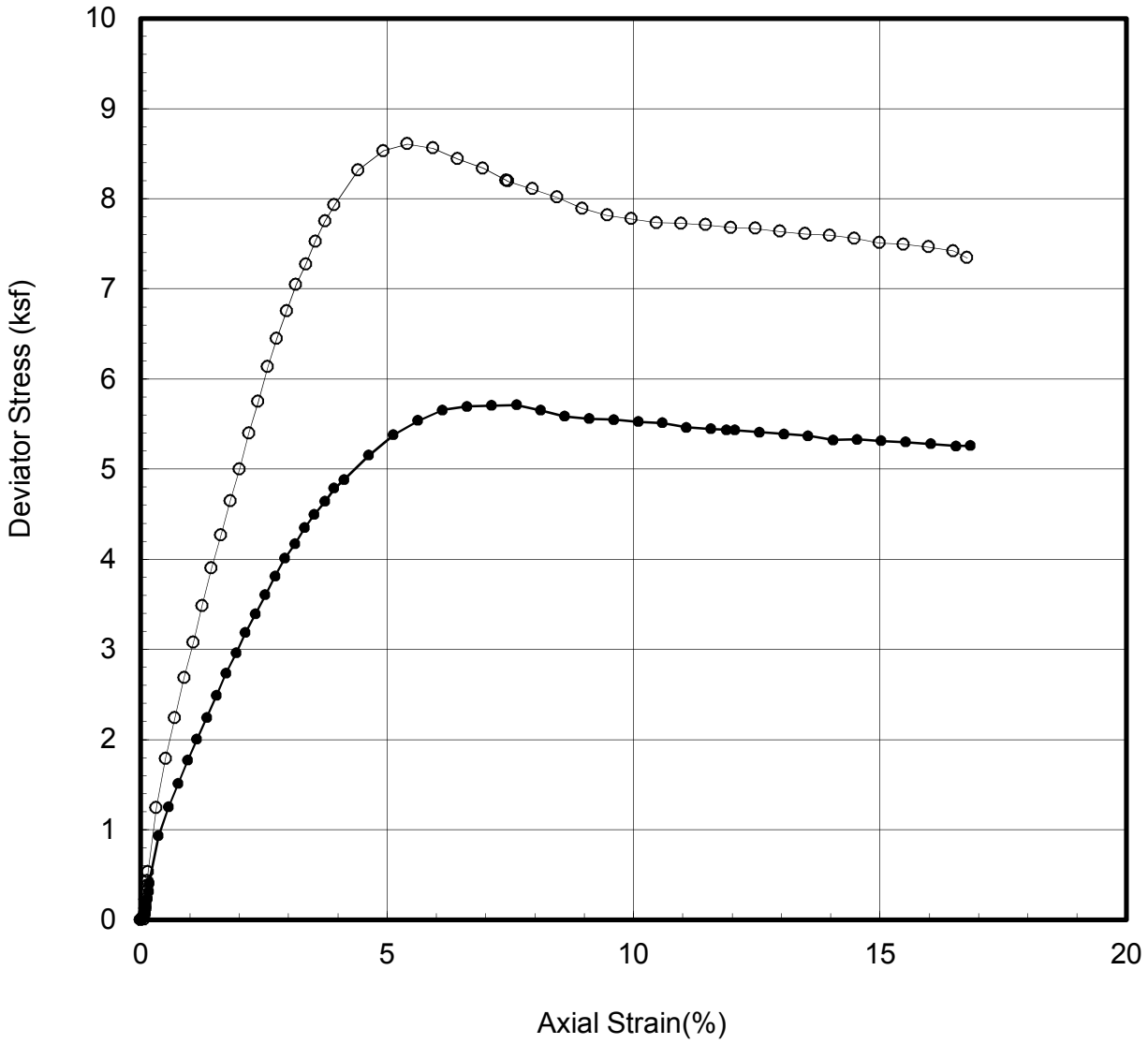
PLATE E4-30



Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	52.00	S-18aaA	U	2.8	9.6	4.8
○—	52.00	S-18aaA	R	2.8	5.3	2.6
□—	81.20	S-23aaA	U	4.3	7.3	3.7
■—	81.20	S-23aaA	R	4.3	3.7	1.9

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-18
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

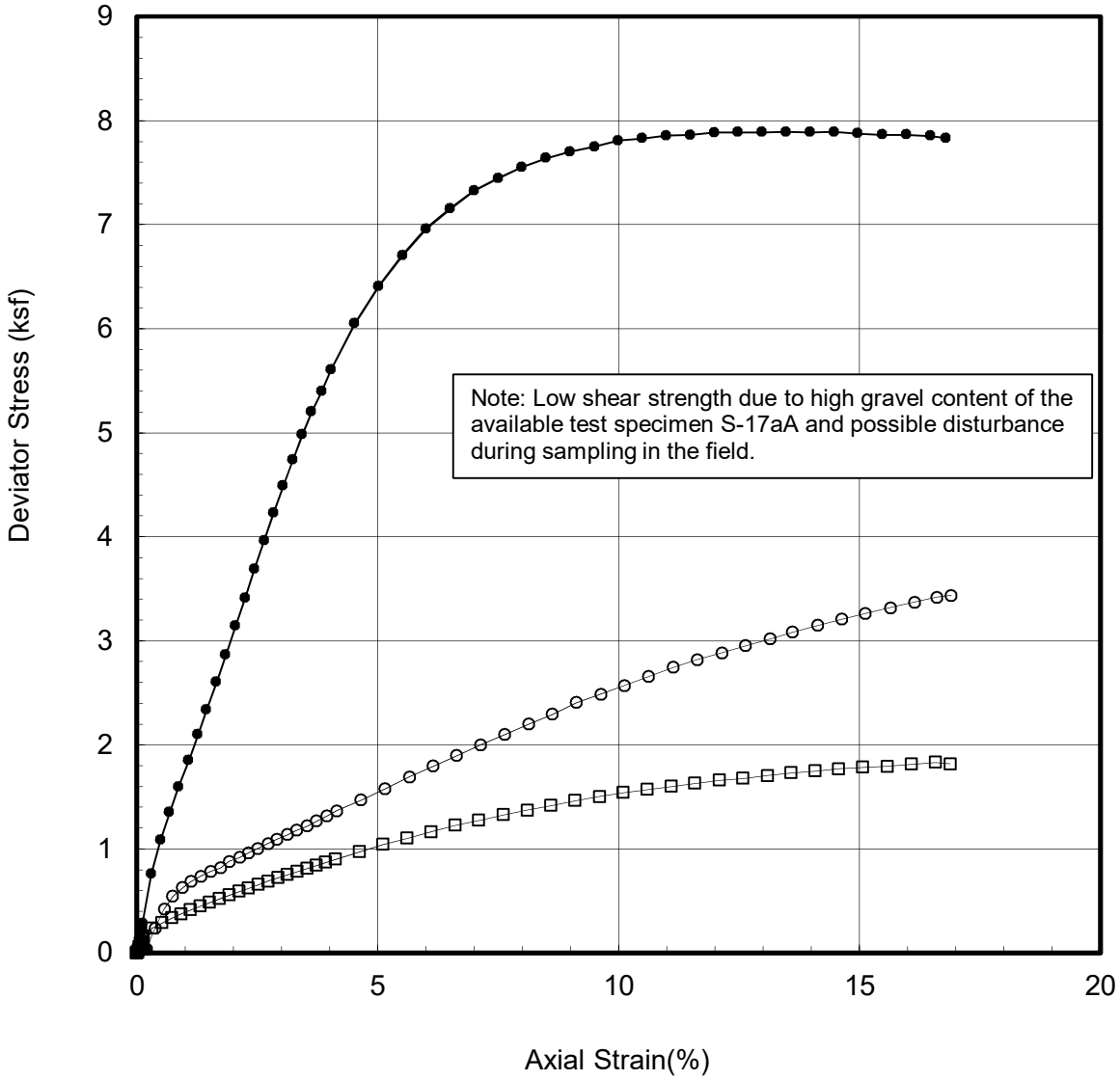


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	91.04	S-25aaA	U	4.8	5.7	2.9
○—	95.96	S-26aaA	U	5.1	8.6	4.3

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-18
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

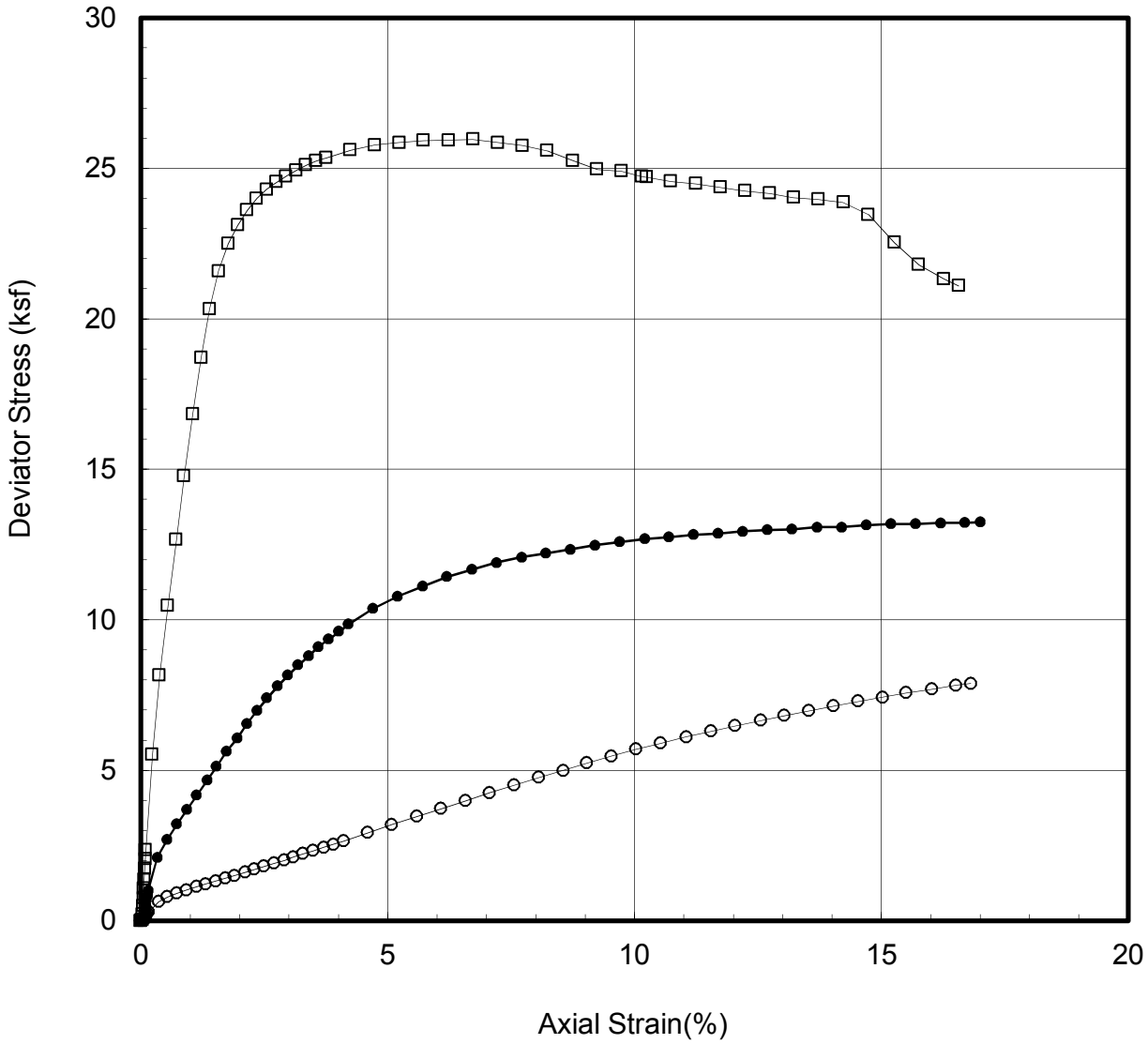
PLATE E4-32



Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	36.42	S-14aaA	U	1.9	7.9	3.9
○—	36.42	S-14aaA	R	1.9	3.4	1.7
□—	48.06	S-17aA	U	2.5	1.8	0.9

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-19
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

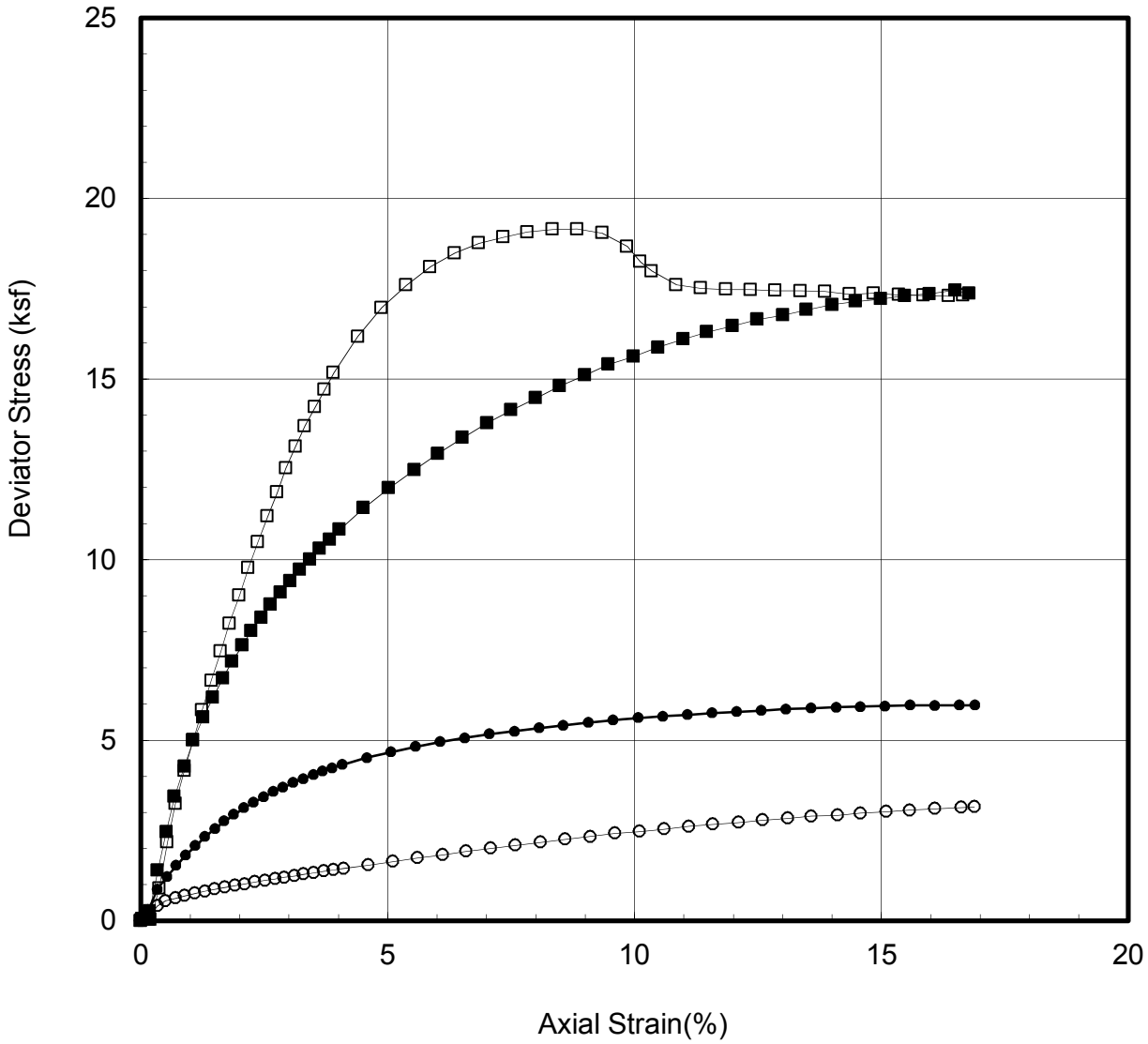


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	62.66	S-20aaA	U	3.3	13.2	6.6
○—	62.66	S-20aaA	R	3.3	7.9	3.9
□—	77.43	S-23aaA	U	4.1	26.0	13.0

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-19
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-34

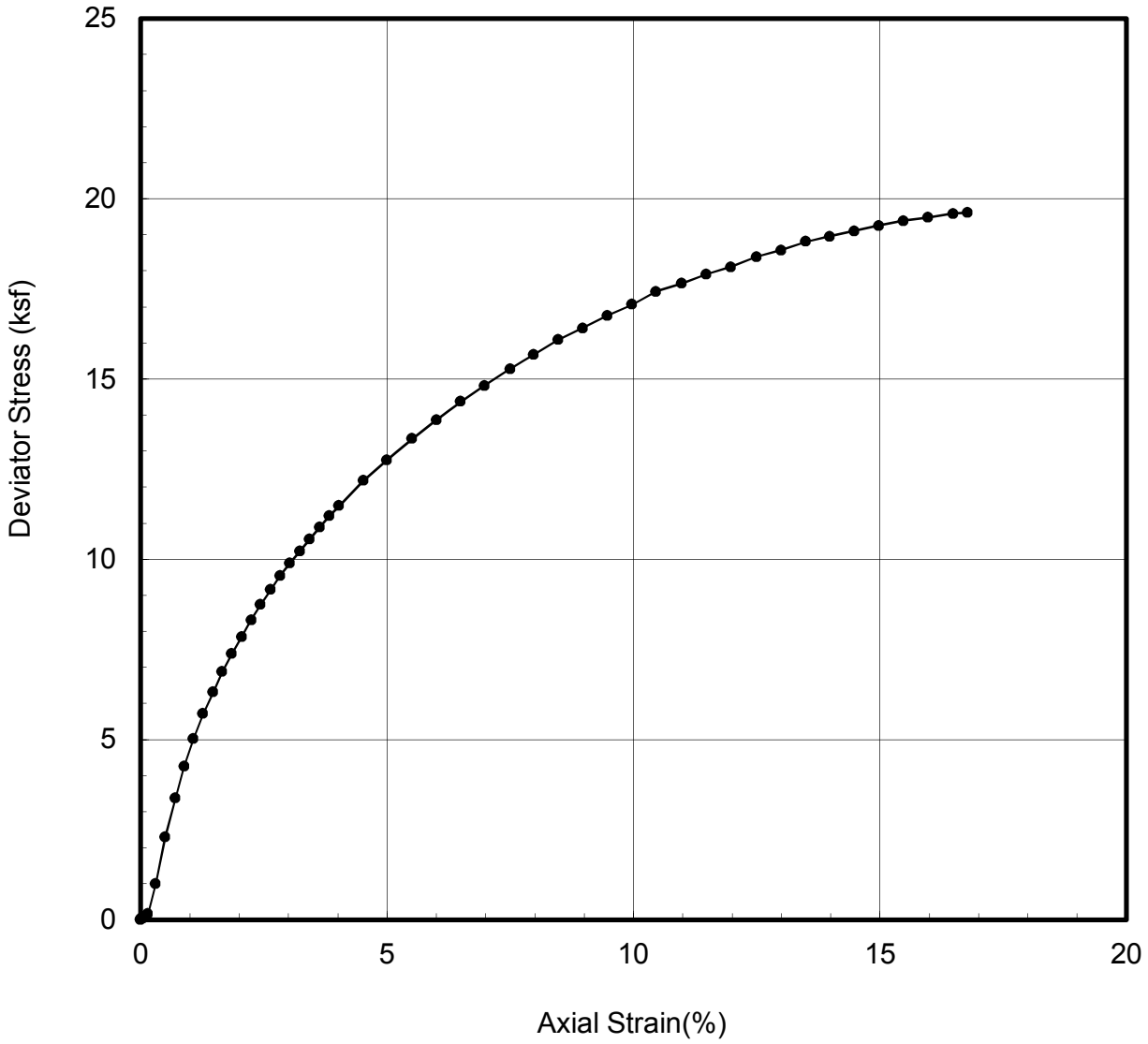


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	92.19	S-26aaA	U	4.9	6.0	3.0
○—	92.19	S-26aaA	R	4.8	3.1	1.6
□—	102.03	S-28aaA	U	5.4	19.2	9.6
■—	119.91	S-30aA	R	6.3	17.5	8.7

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-19
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-35

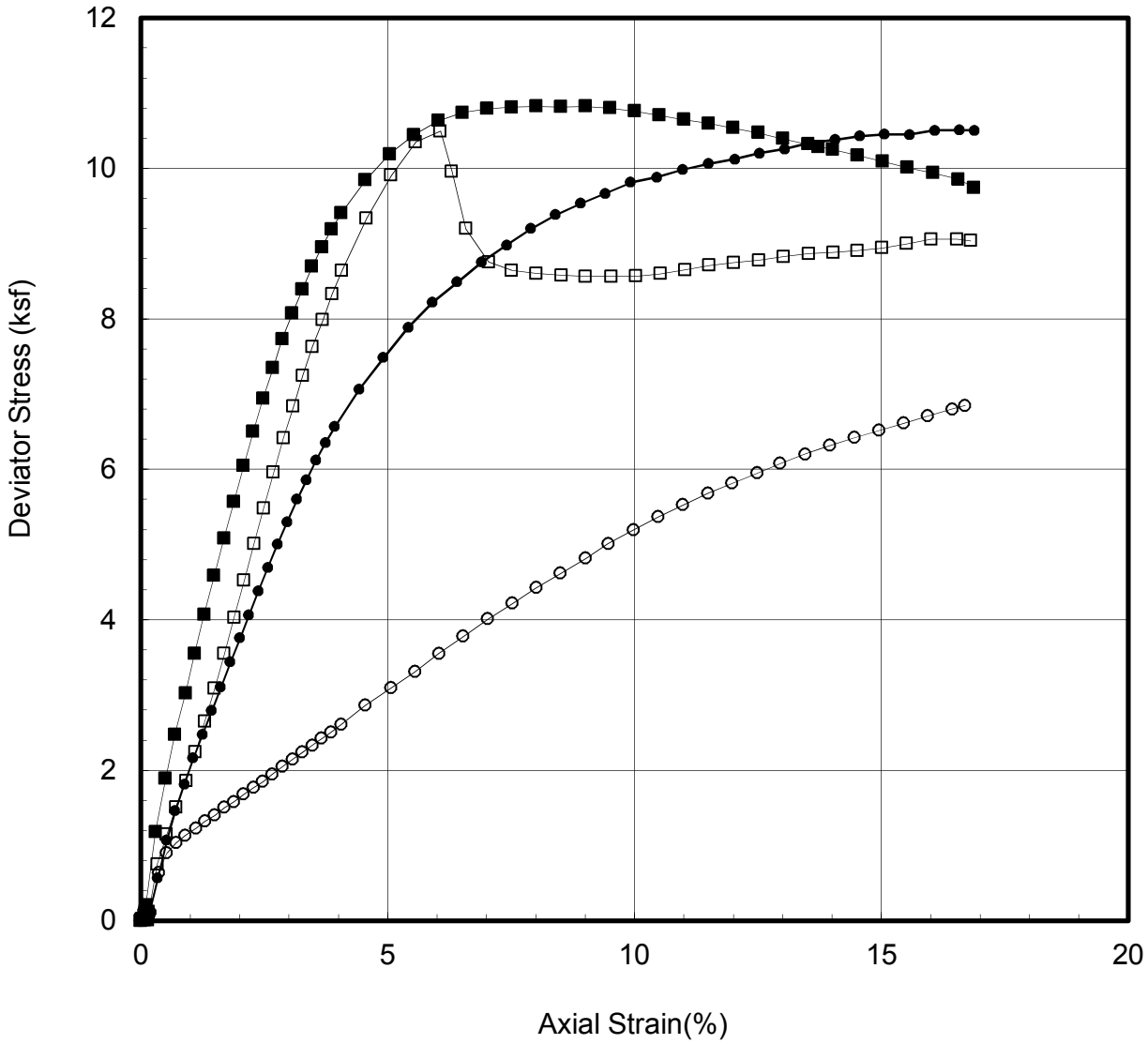


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	132.38	G-11aA	R	7.0	19.6	9.8

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-19
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-36

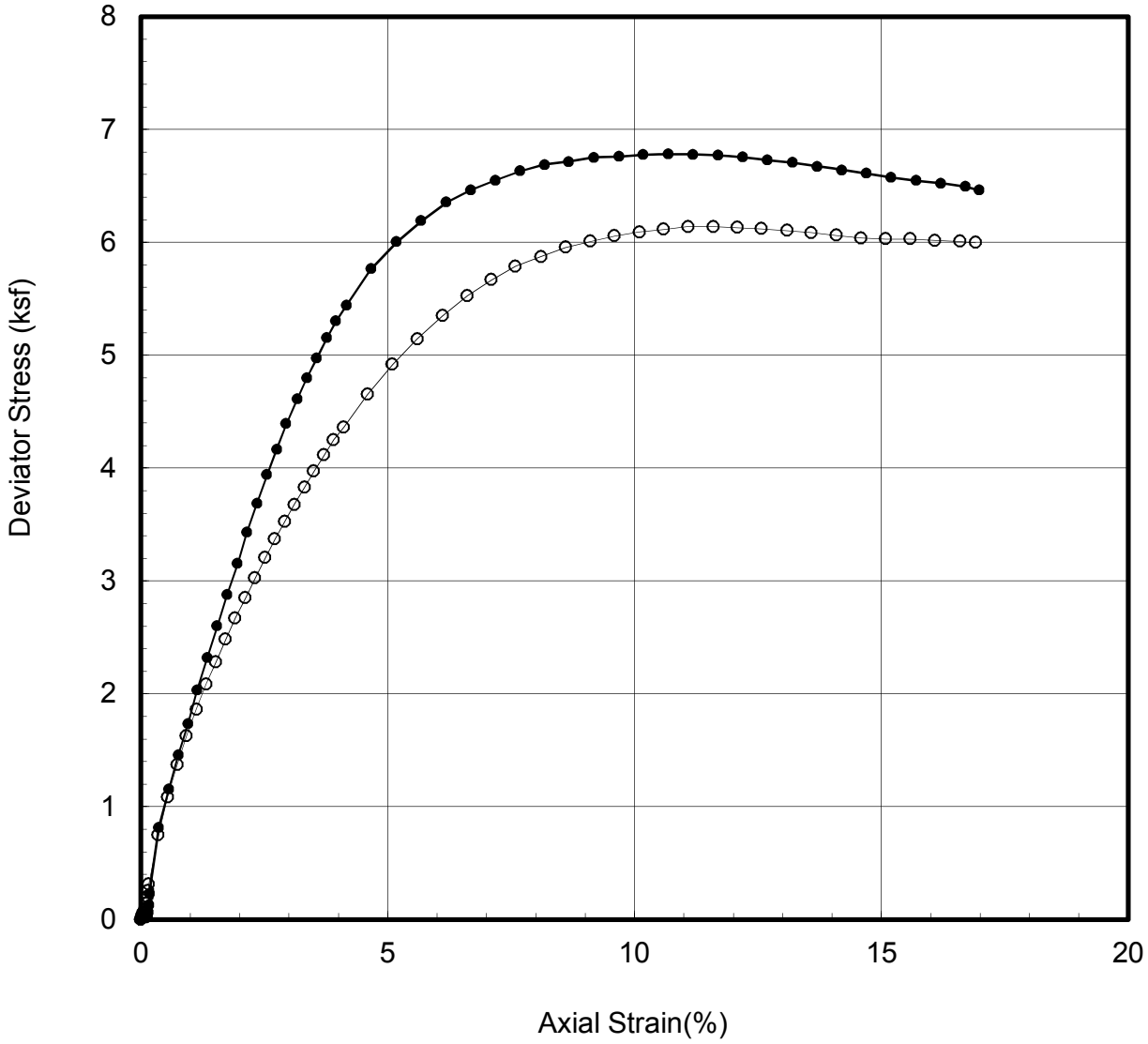


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	39.05	S-16aA	U	1.7	10.5	5.3
○—	39.05	S-16aA	R	1.6	6.8	3.4
□—	46.26	S-18aA	U	2.4	10.5	5.2
■—	60.20	S-21aA	U	3.2	10.8	5.4

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-20
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

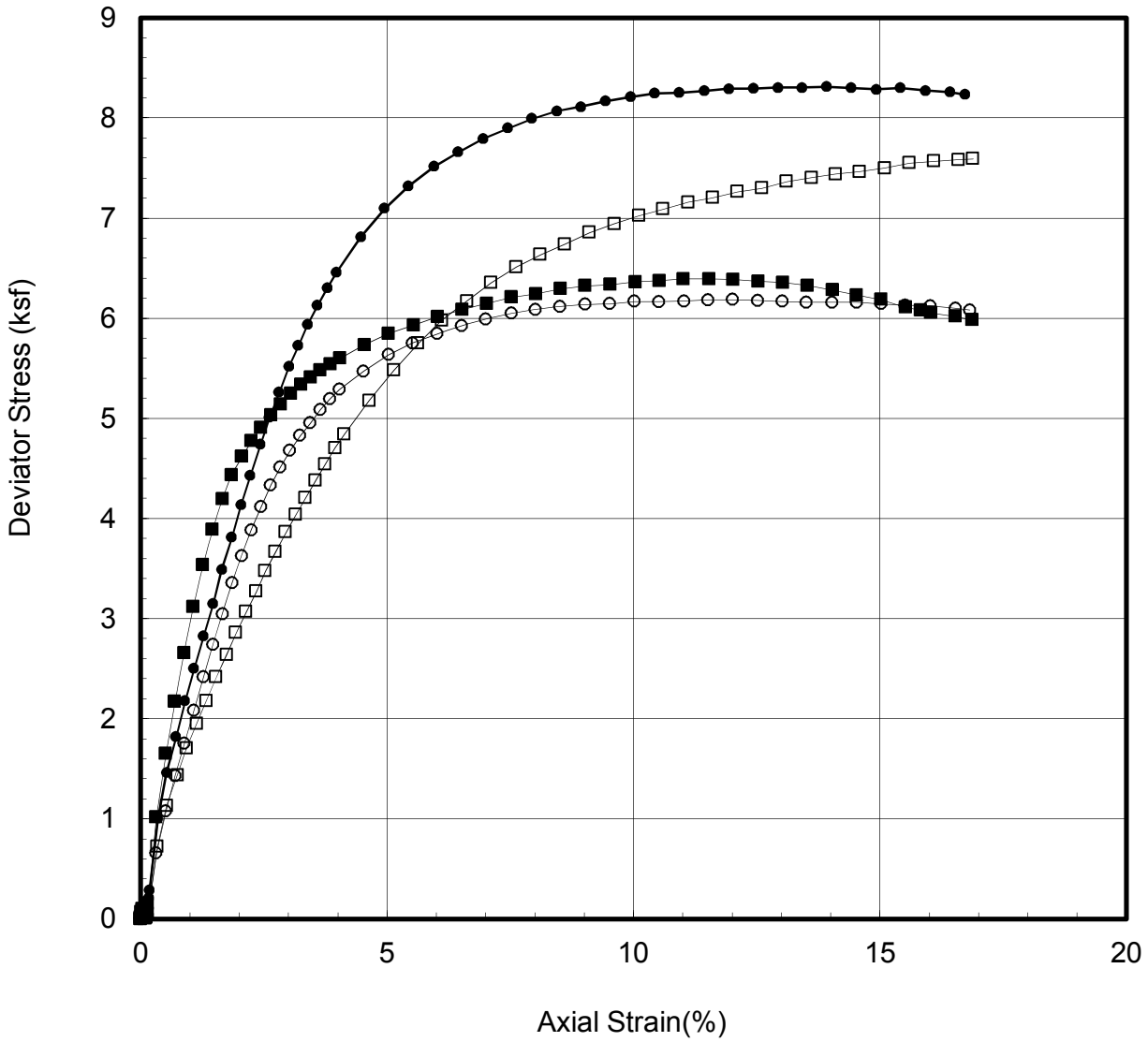
PLATE E4-37



Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	84.81	S-26aA	U	4.5	6.8	3.4
○—	102.69	S-30A	U	5.4	6.1	3.1

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-20
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

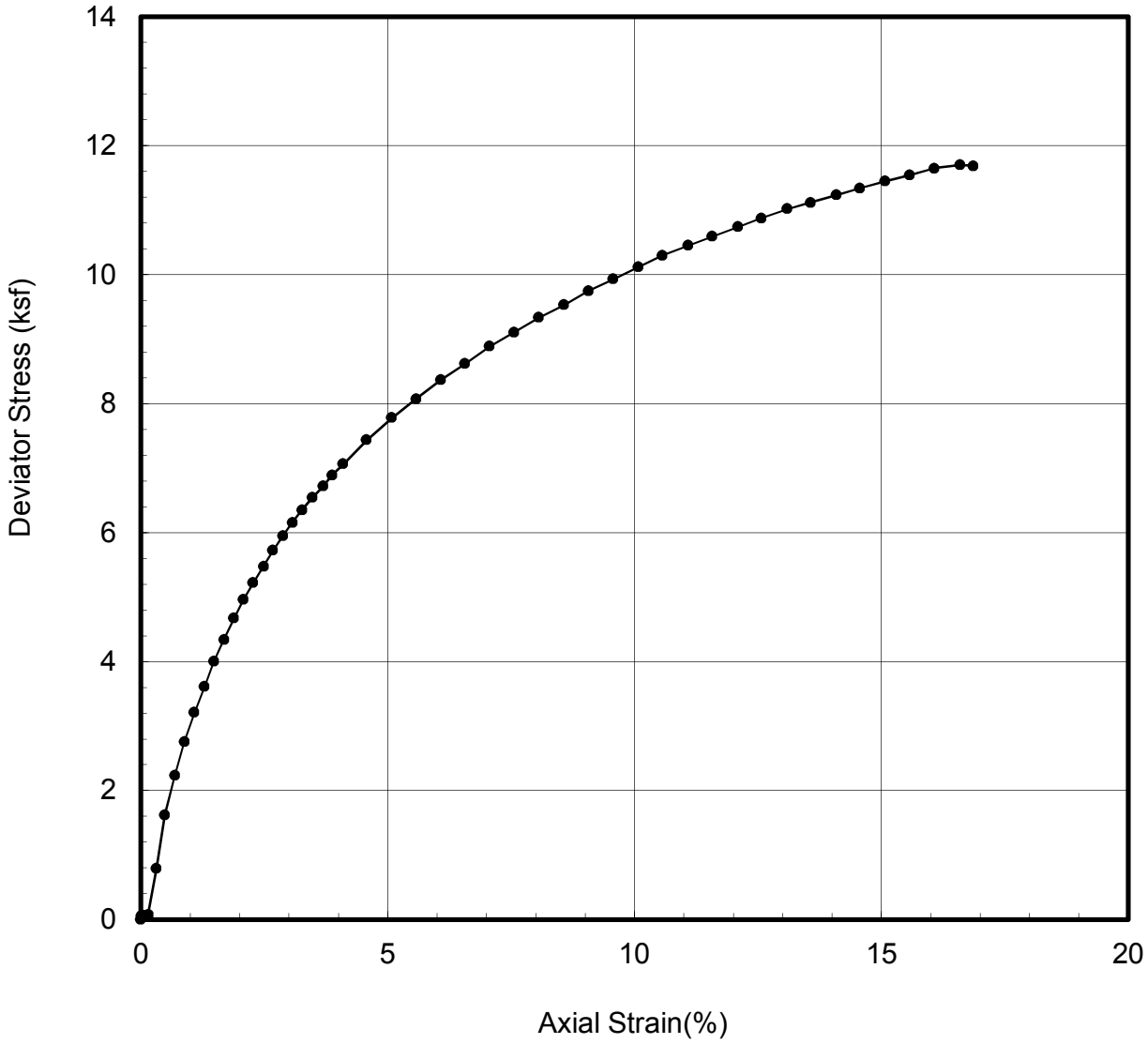


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	63.50	S-21aA	U	3.3	8.3	4.2
○—	78.20	S-24aA	U	4.1	6.2	3.1
□—	97.30	S-28aA	U	5.1	7.6	3.8
■—	117.60	S-31aA	U	6.2	6.4	3.2

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-21
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-39

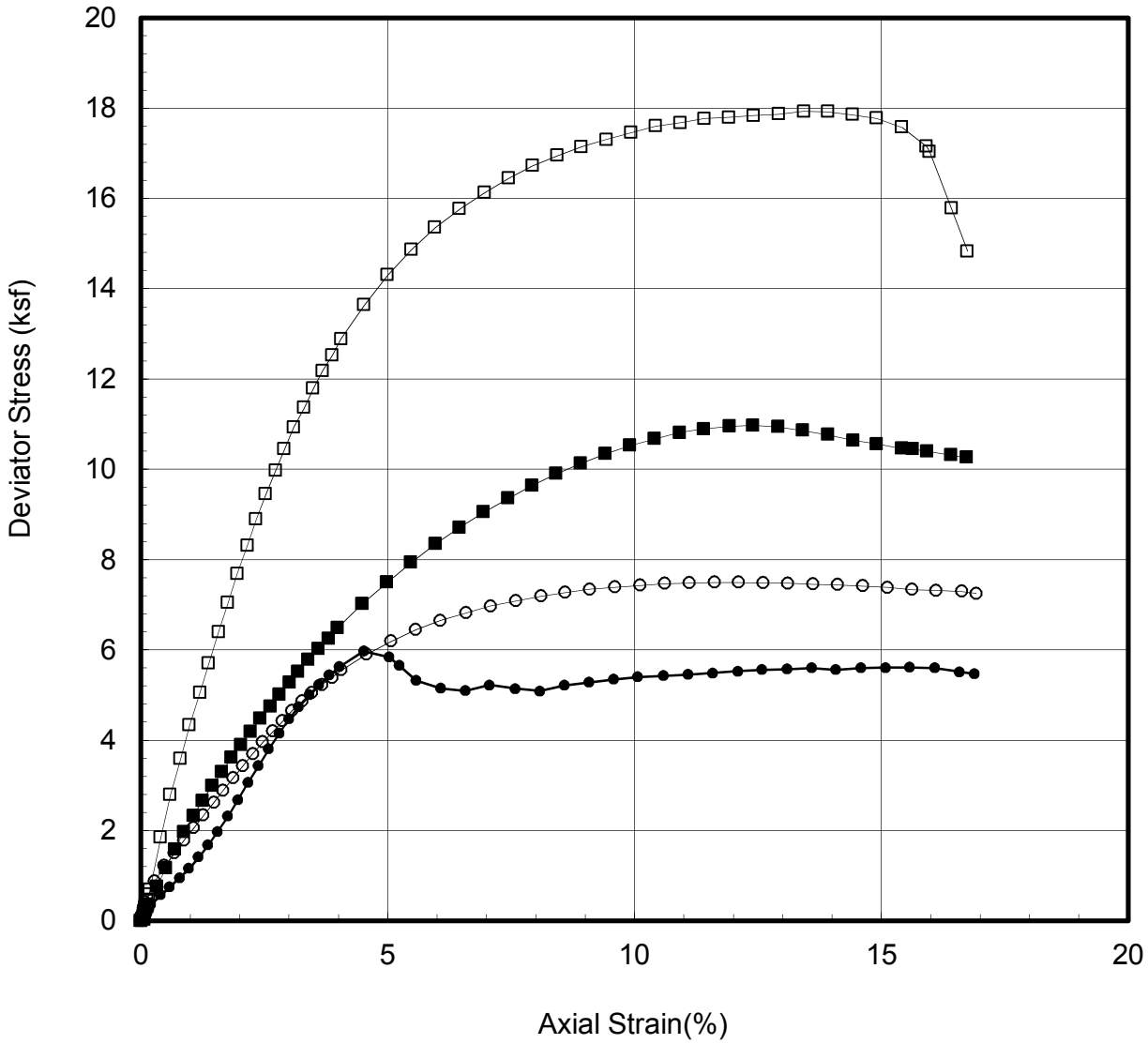


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	153.54	G-6aA	R	8.1	11.7	5.8

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-21
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-40

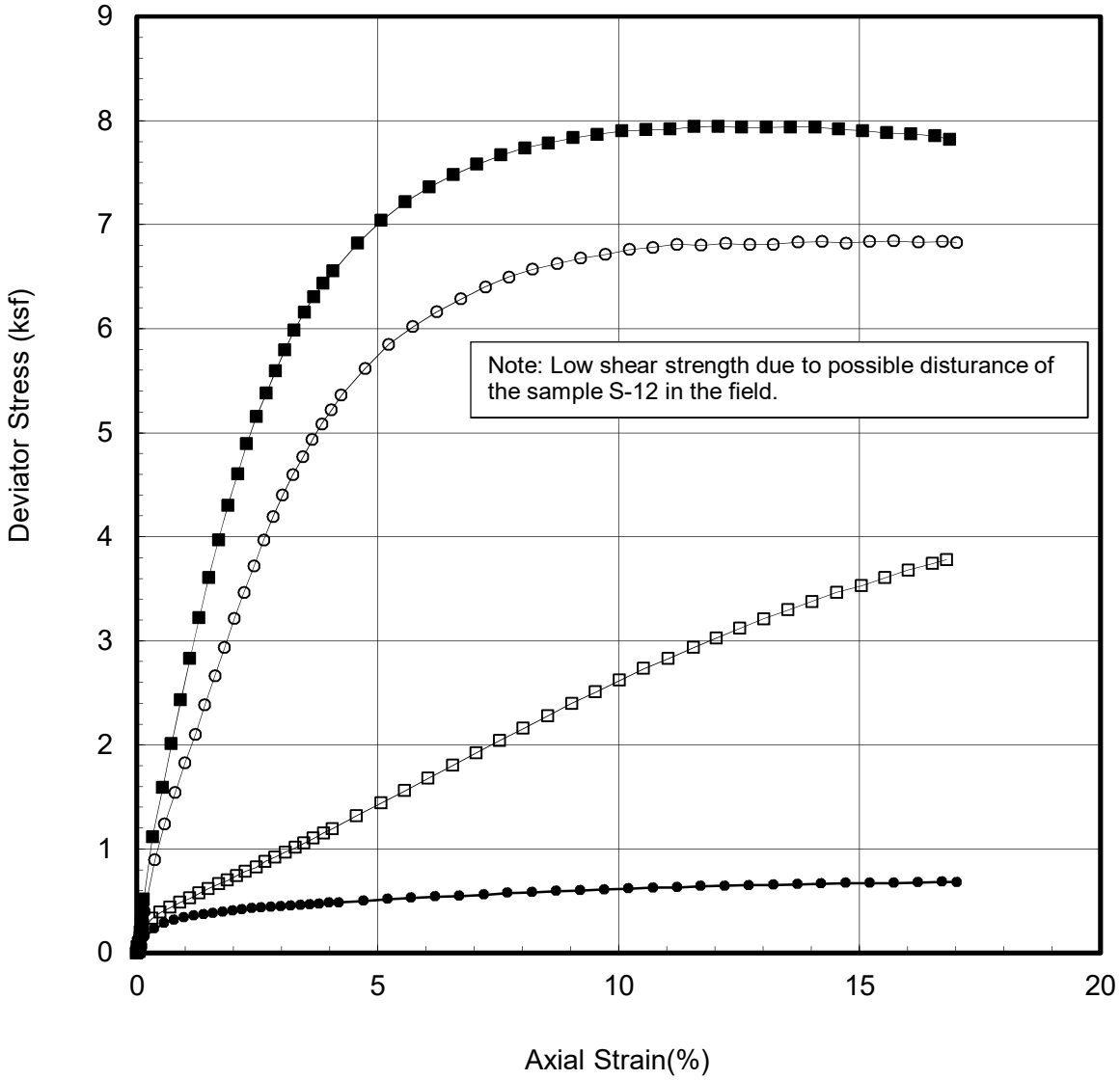


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	6.17	S-3aaA	U	0.3	6.0	3.0
○—	14.11	S-6aaA	U	0.8	7.5	3.7
□—	20.67	S-8aaA	U	1.1	17.9	9.0
■—	20.67	S-8aaA	R	1.1	11.0	5.5

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-22
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

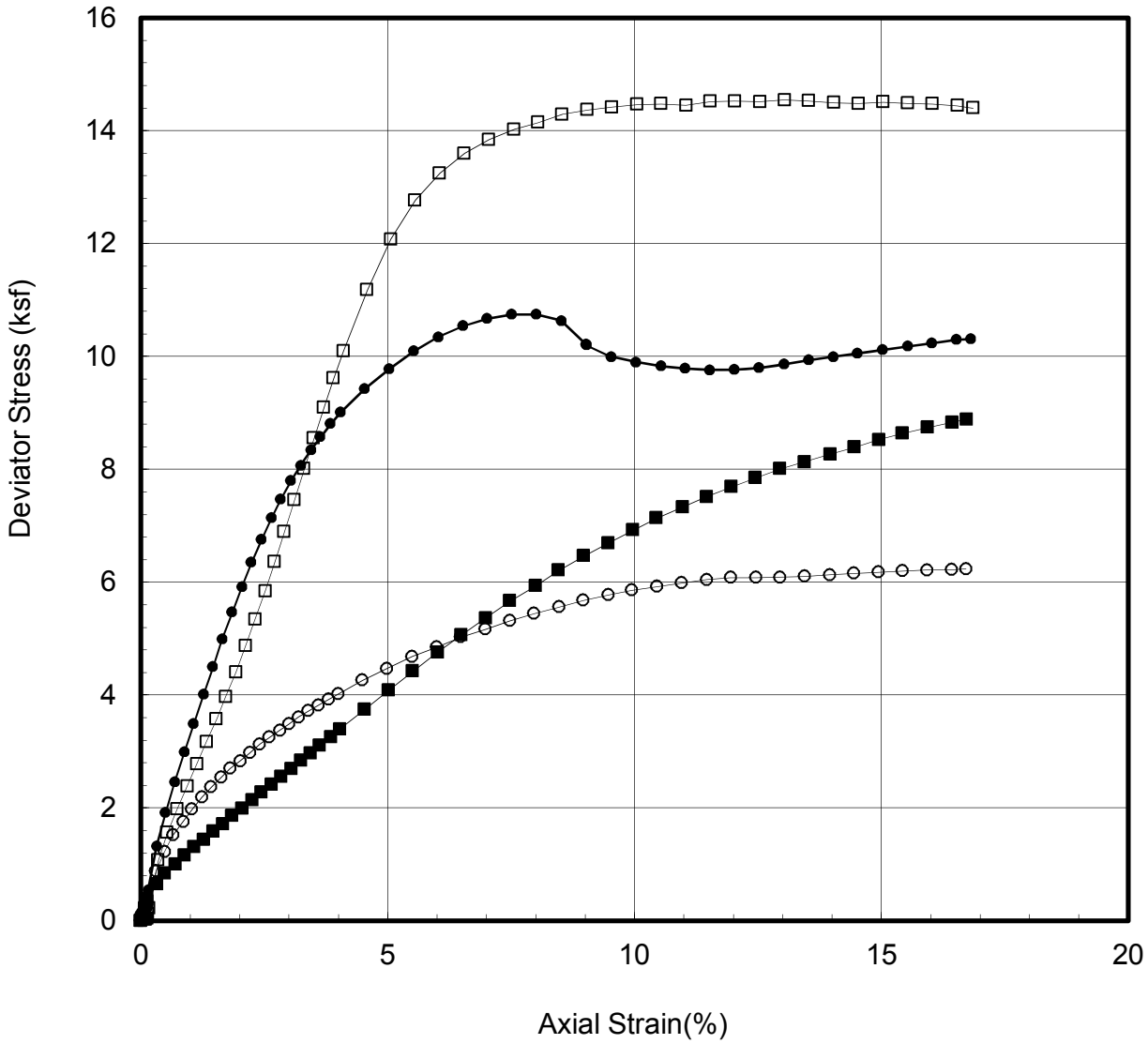
PLATE E4-41



Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	31.50	S-12aaA	U	1.7	0.7	0.3
○—	46.26	S-17aaA	U	2.5	6.8	3.4
□—	46.26	S-17aaA	R	2.5	3.8	1.9
■—	56.10	S-19aaA	U	3.0	7.9	4.0

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-22
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

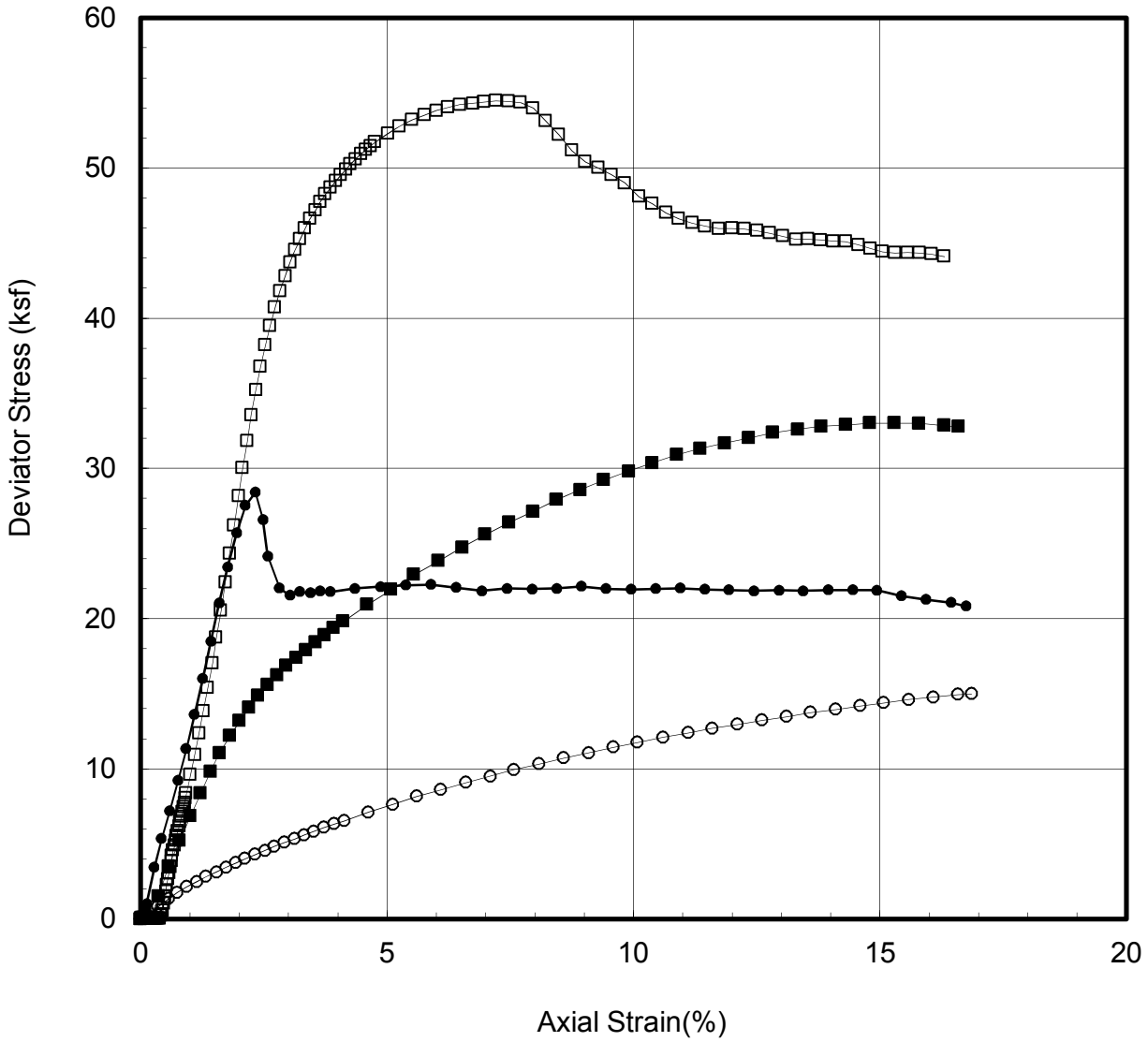


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	23.29	S-9aaA	U	1.2	10.7	5.4
○—	23.29	S-9aaA	R	1.3	6.2	3.1
□—	51.02	S-18aA	U	2.7	14.5	7.3
■—	51.02	S-18aA	R	2.7	8.9	4.4

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-23
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-43

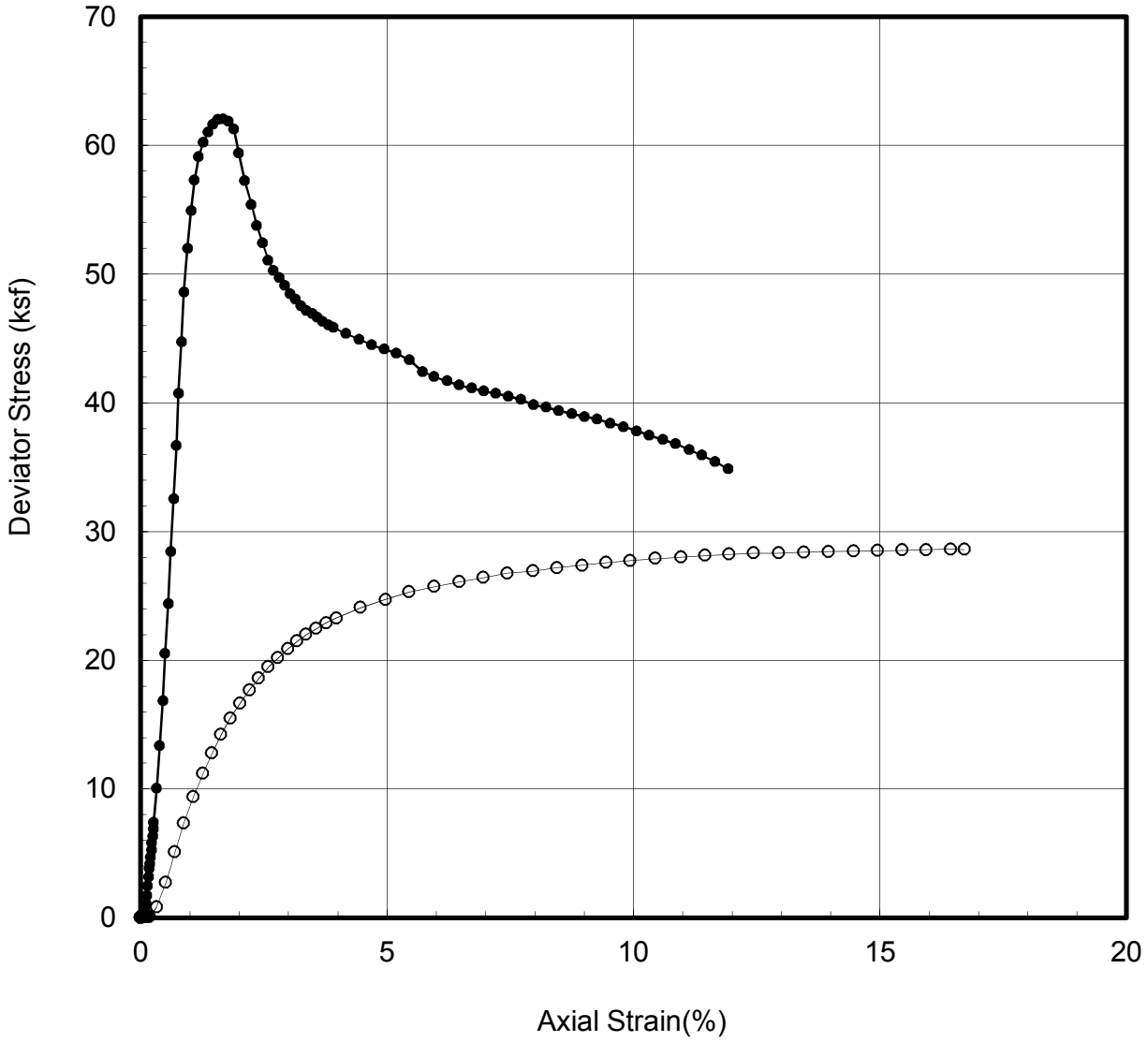


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	128.61	G-16aaA	U	6.8	28.4	14.2
○—	128.61	G-16aaA	R	6.8	15.0	7.5
□—	271.00	G-36aaA	U	14.7	54.5	27.2
■—	271.00	G-36aaA	R	14.3	33.0	16.5

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-23
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-44

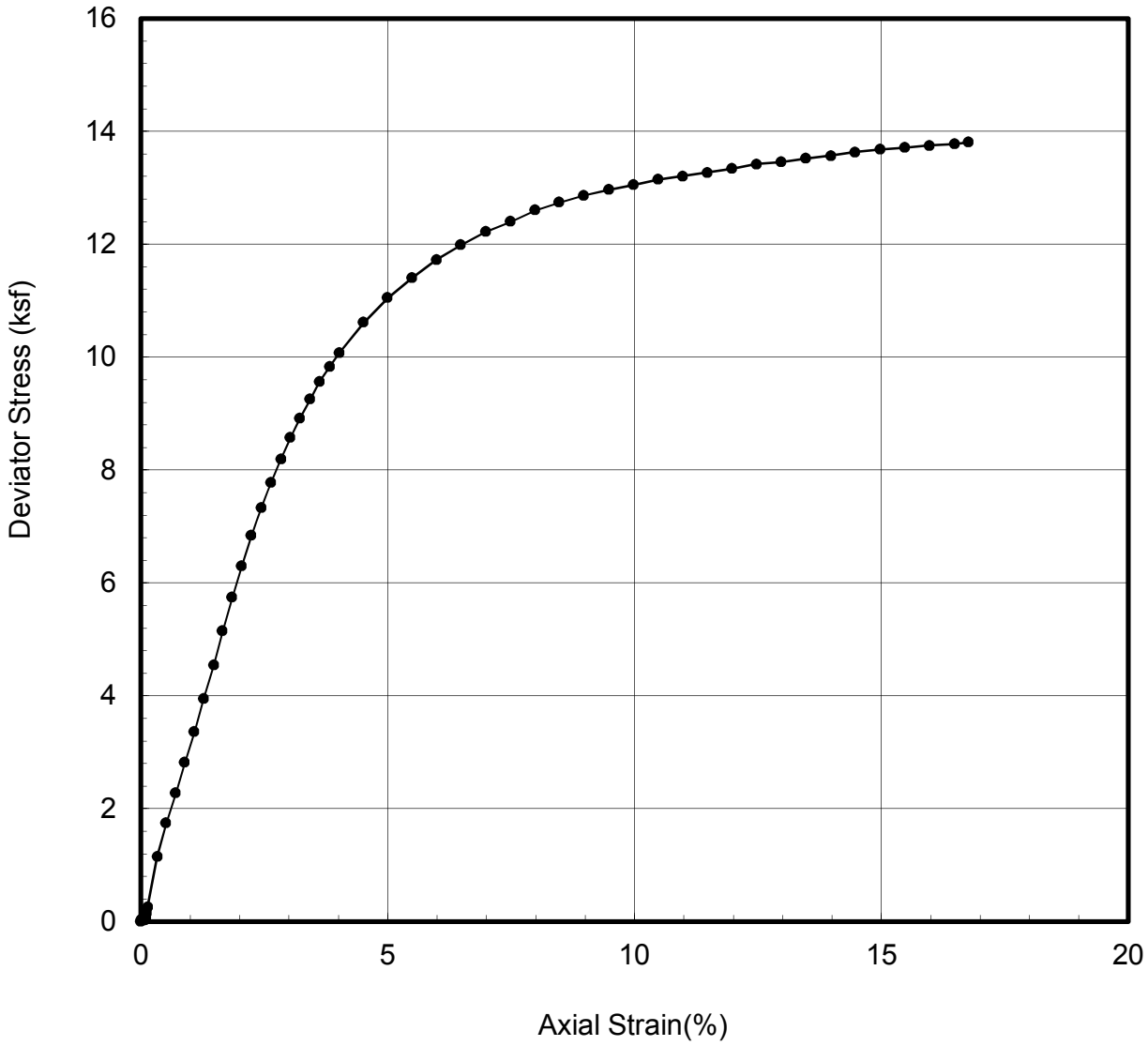


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	281.50	G-38aA	U	15.2	62.0	31.0
—○—	281.50	G-38aA	R	14.8	28.6	14.3

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-23
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E4-45

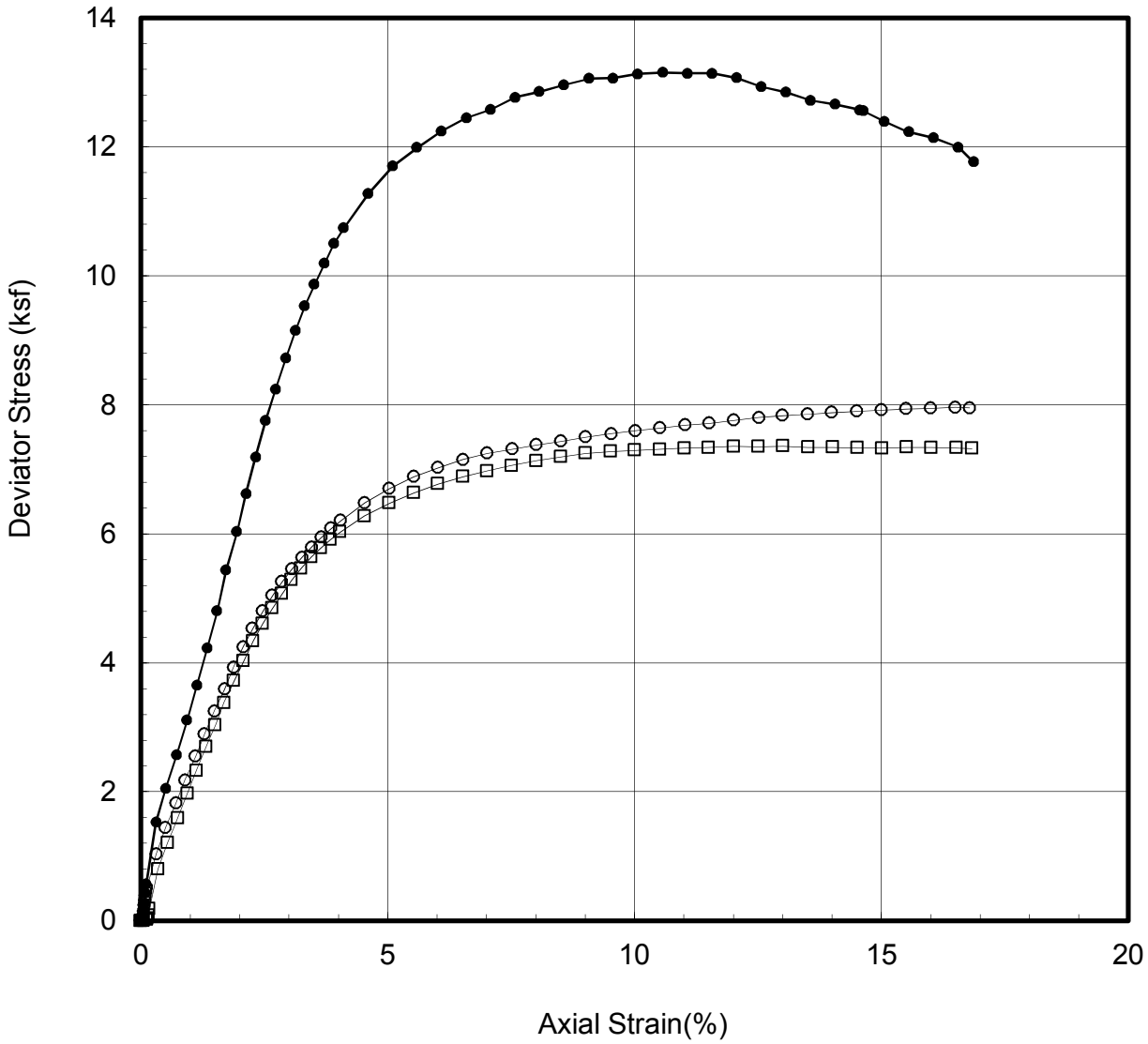


Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
—●—	76.60	S-24aA	U	4.1	13.8	6.9

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-24
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

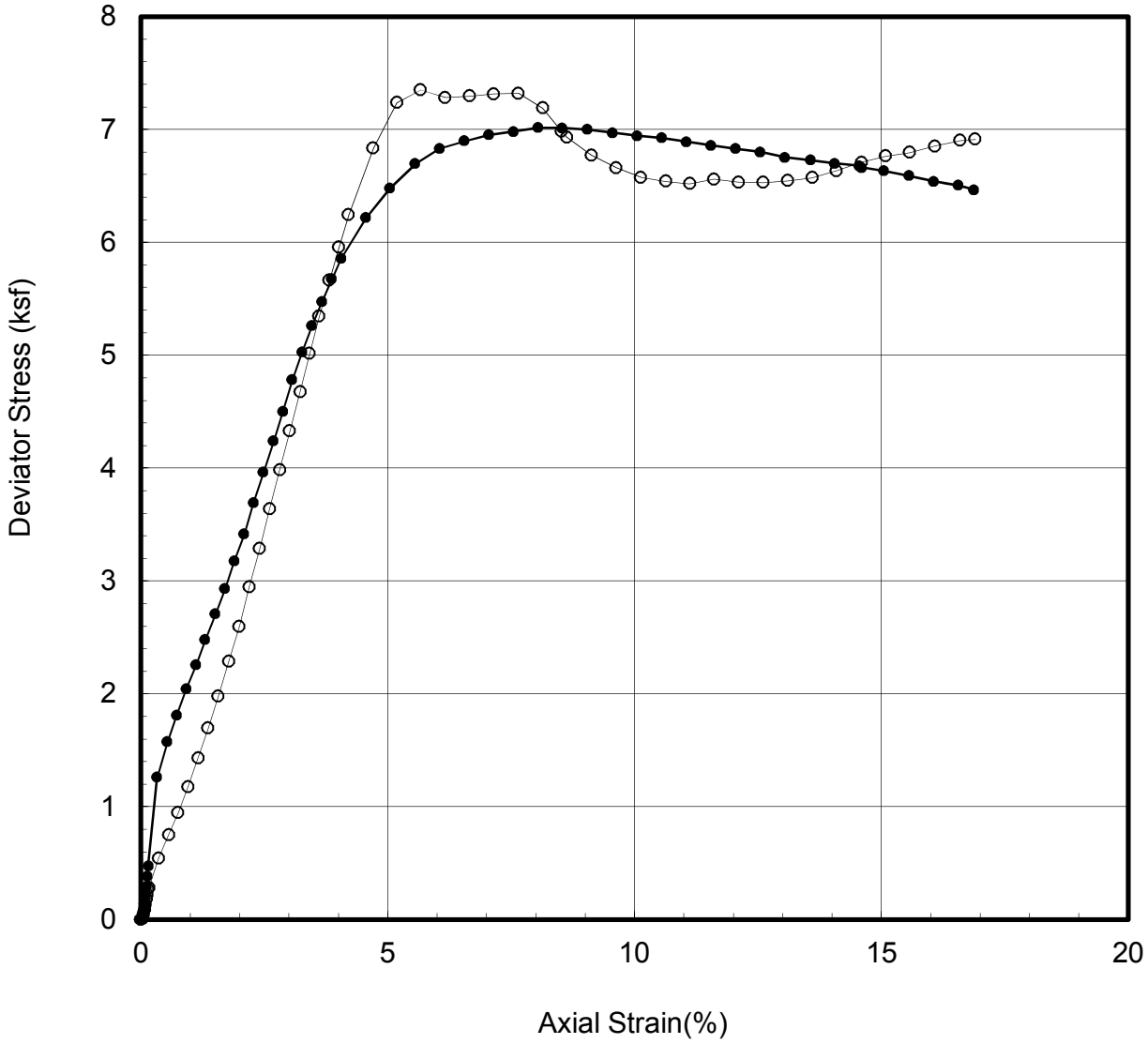
PLATE E4-46



Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	20.00	S-8aA	U	1.1	13.2	6.6
○—	9.60	12A	U	1.7	8.0	4.0
□—	34.80	S-13aA	U	1.9	7.4	3.7

* U=Undisturbed, R=Remolded

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-26
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

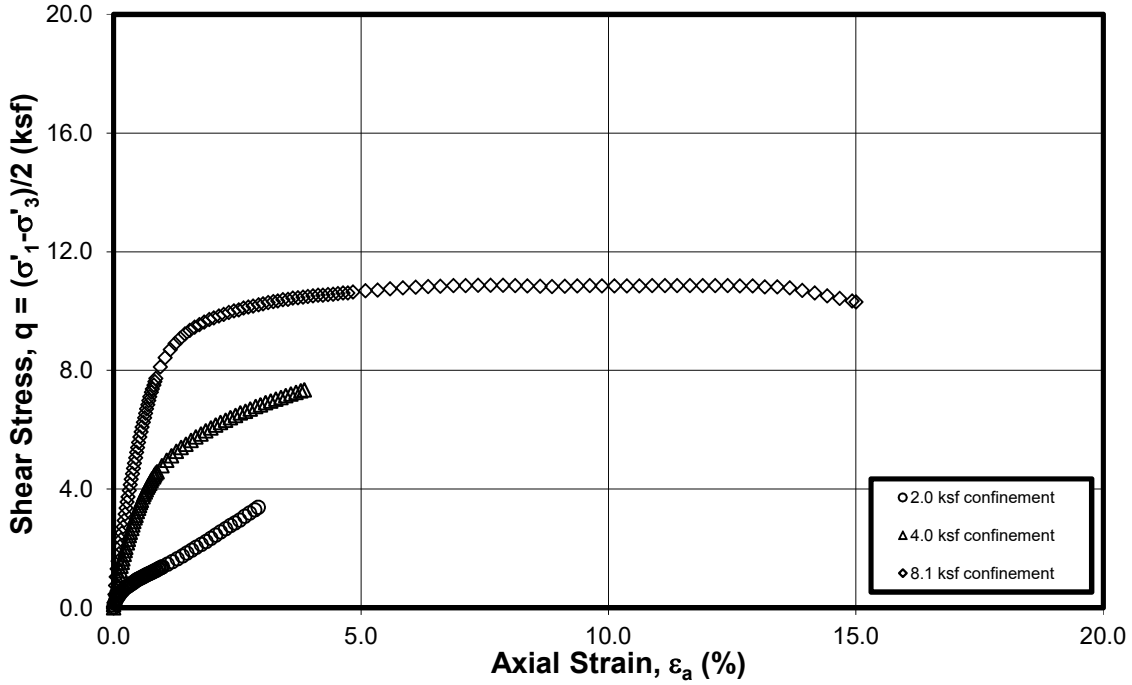


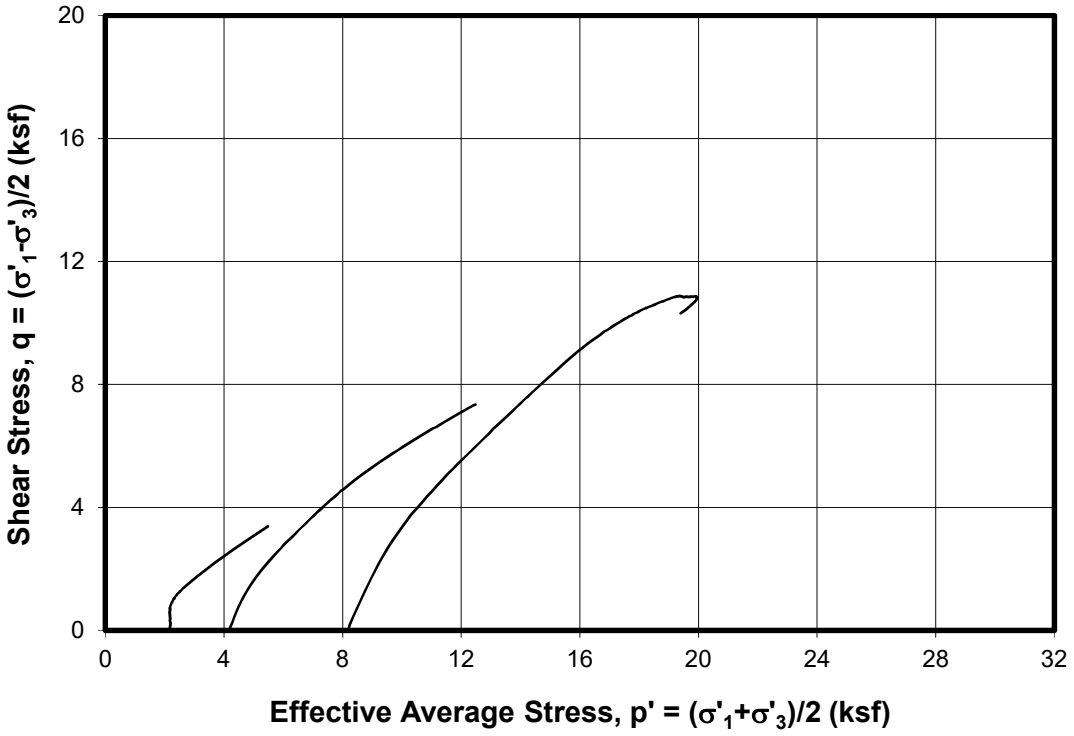
Curve	Depth (ft)	Sample No.	Sample Condition*	Confining Pressure (ksf)	Peak Deviator Stress (ksf)	Shear Strength (ksf)
●—	31.50	S-12aA	U	1.7	7.0	3.5
○—	41.30	S-15aA	U	2.2	7.3	3.7

* U=Undisturbed, R=Remolded

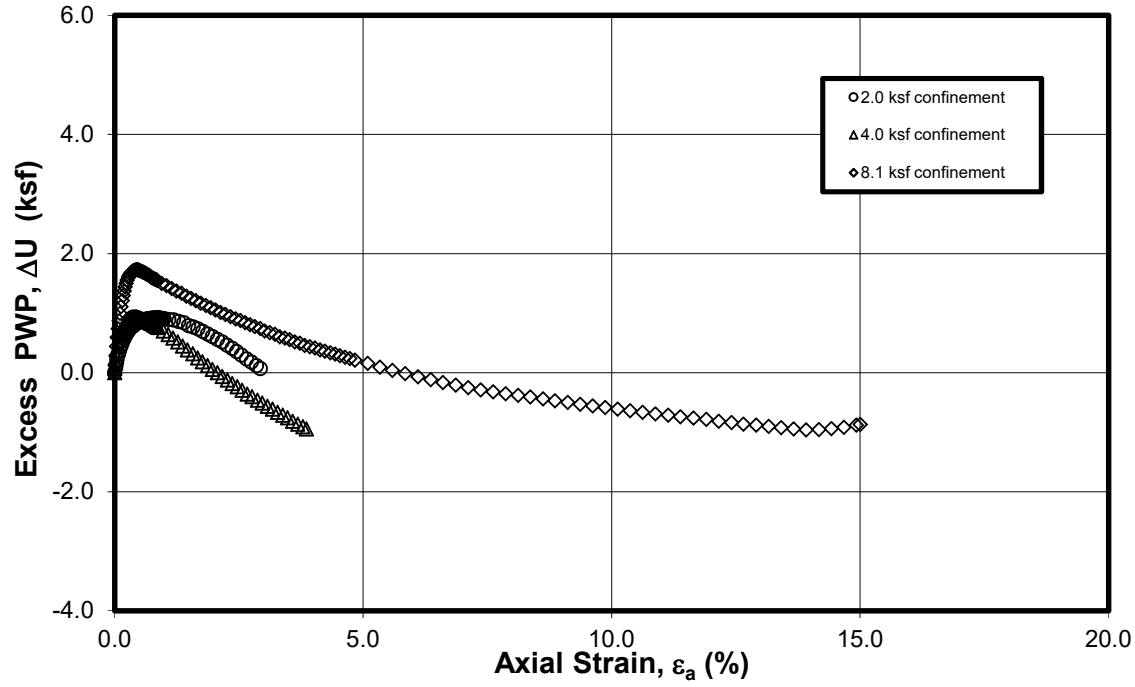
UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
BORING MB-28
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

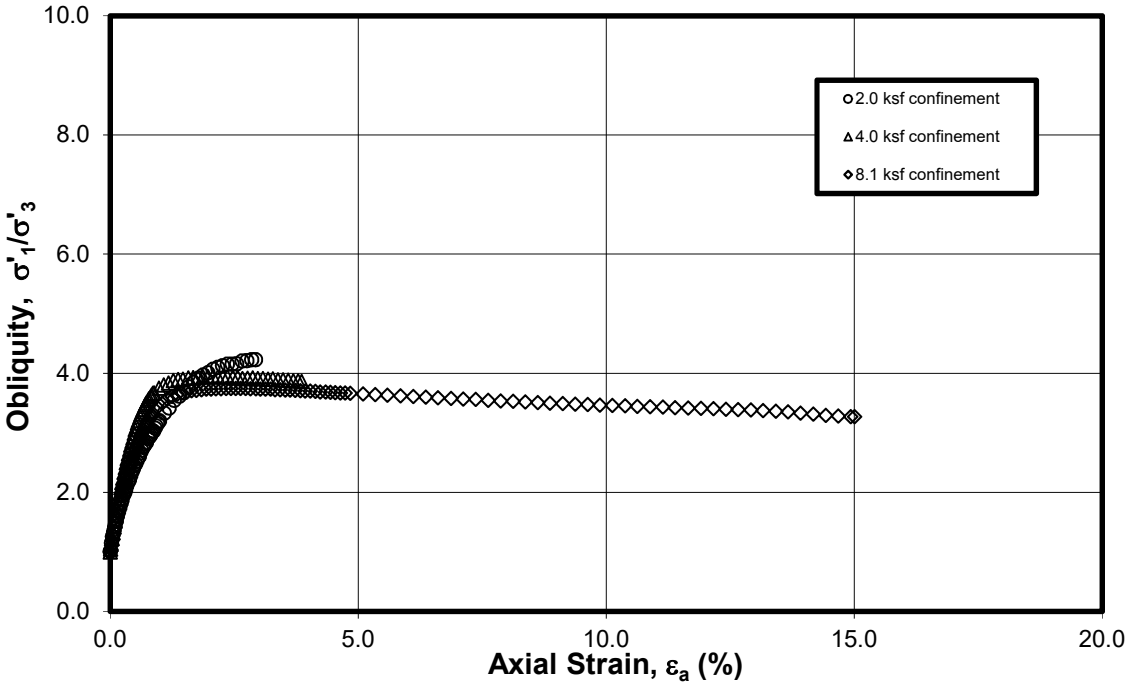
PLATE E4-48



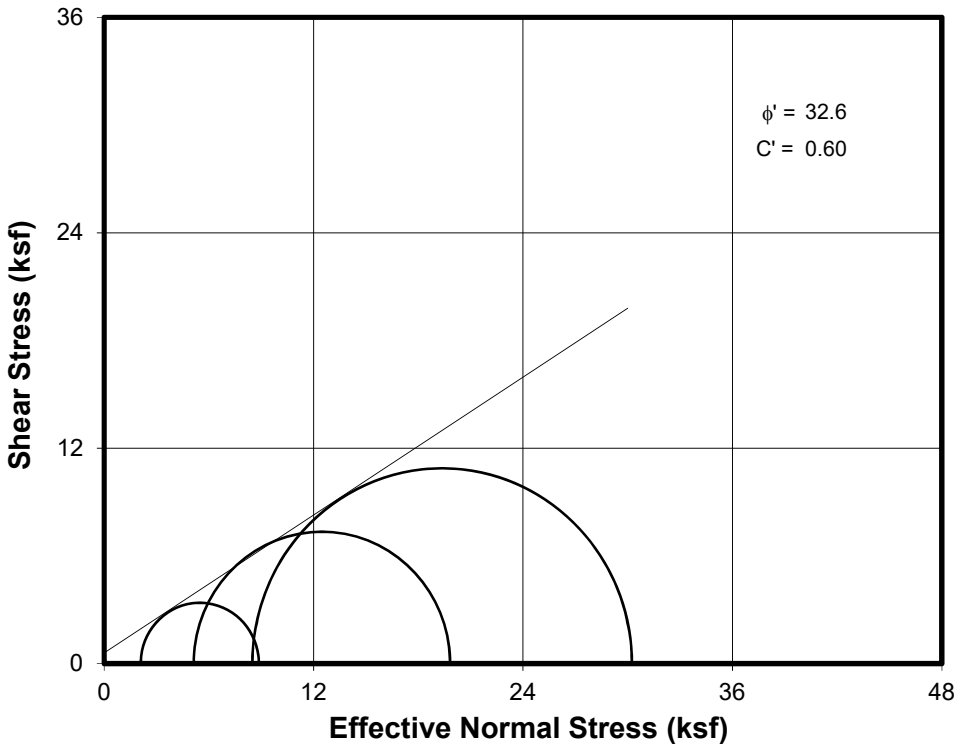


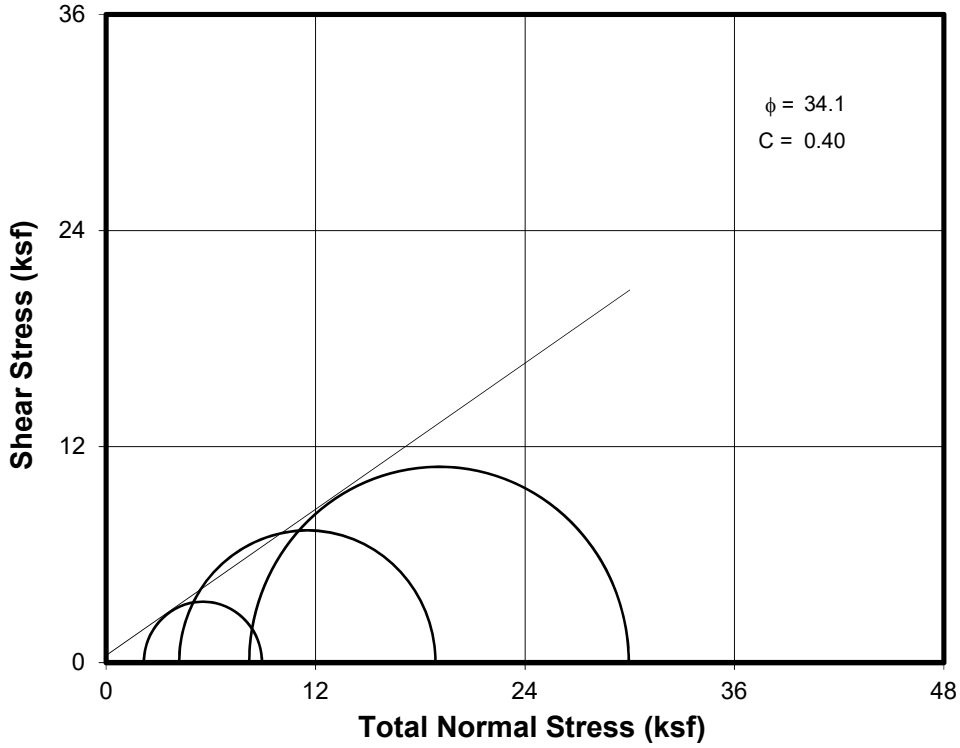
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-03, SAMPLE S-24, DEPTH 75.70 FT
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



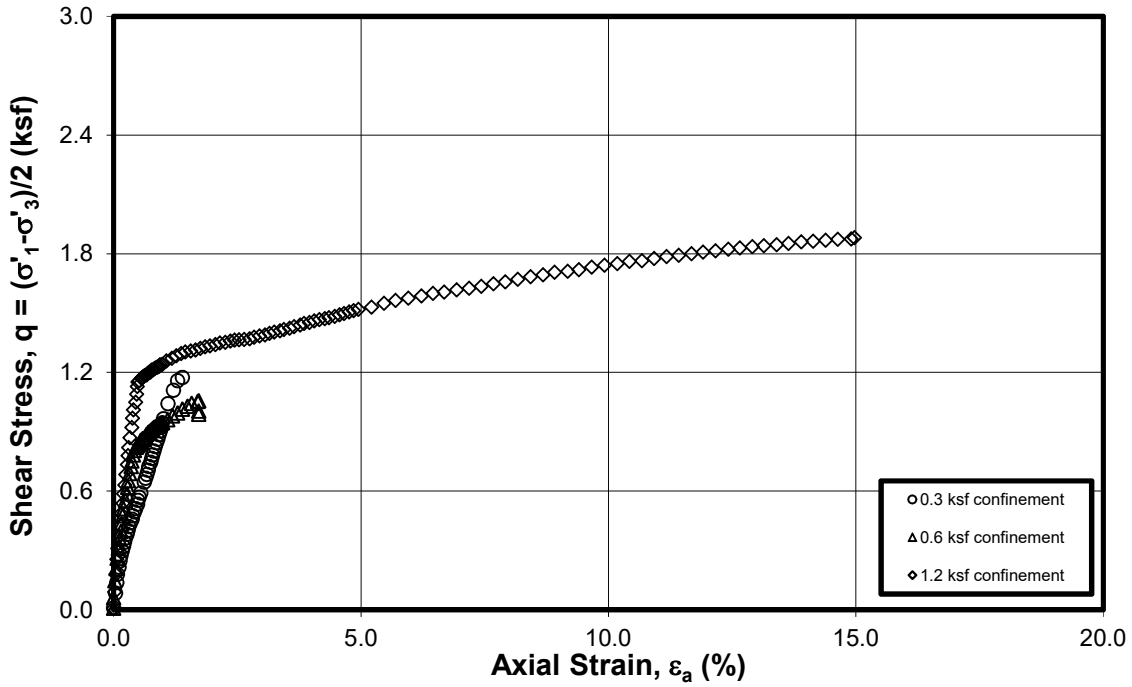


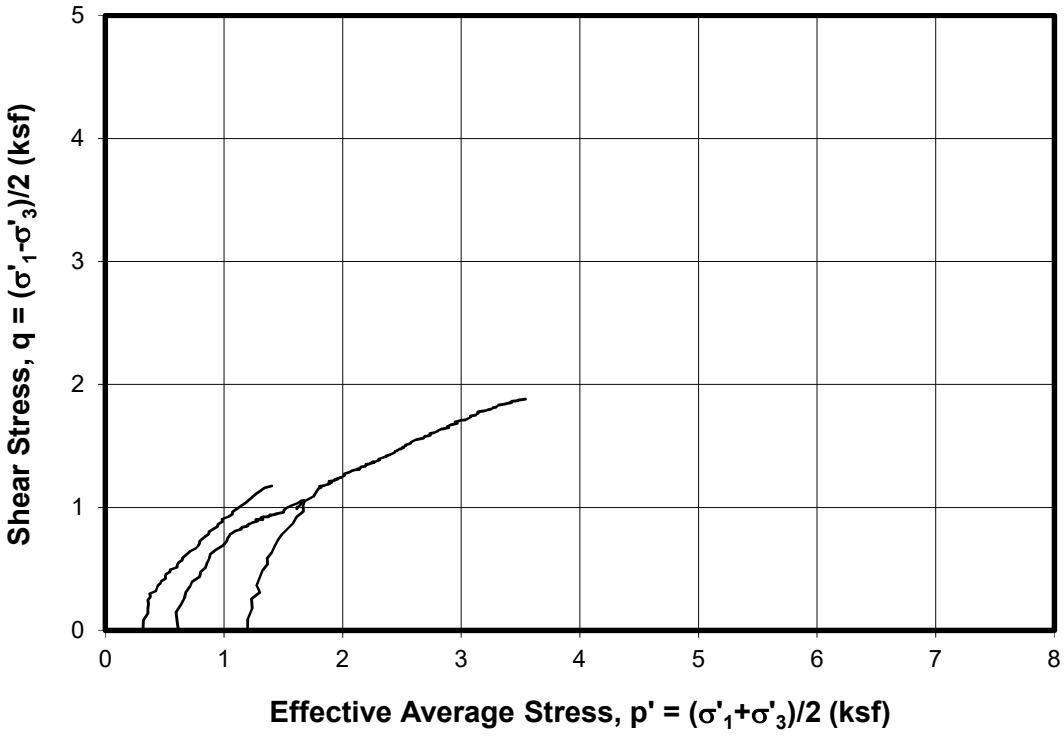
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-03, SAMPLE S-24, DEPTH 75.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



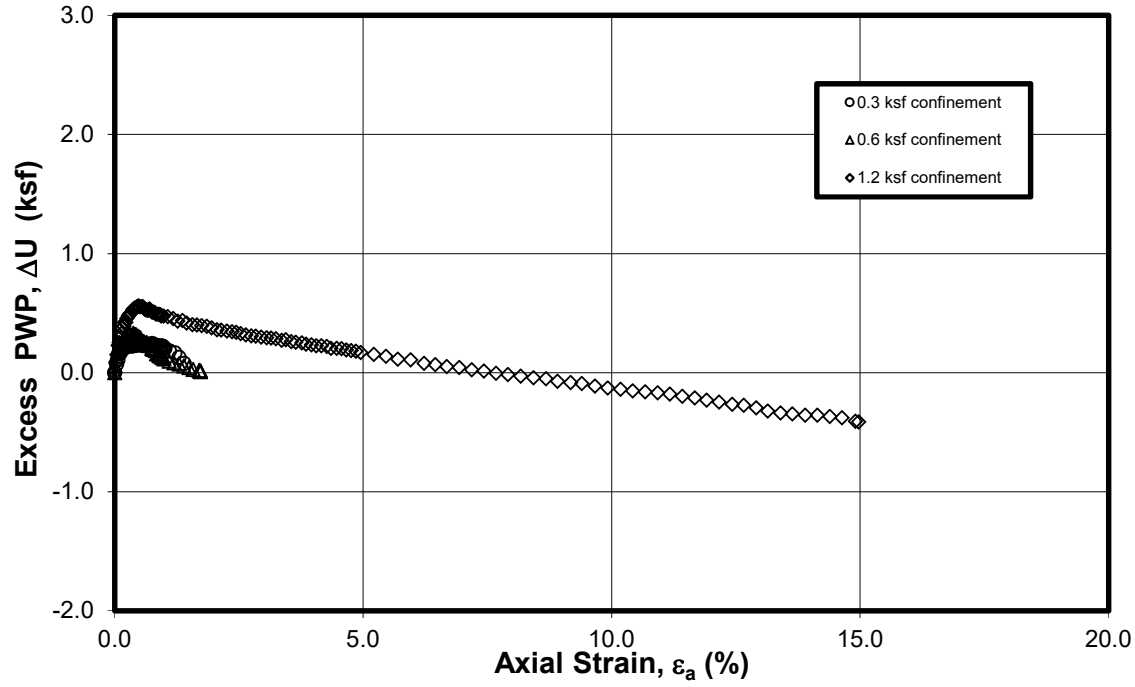


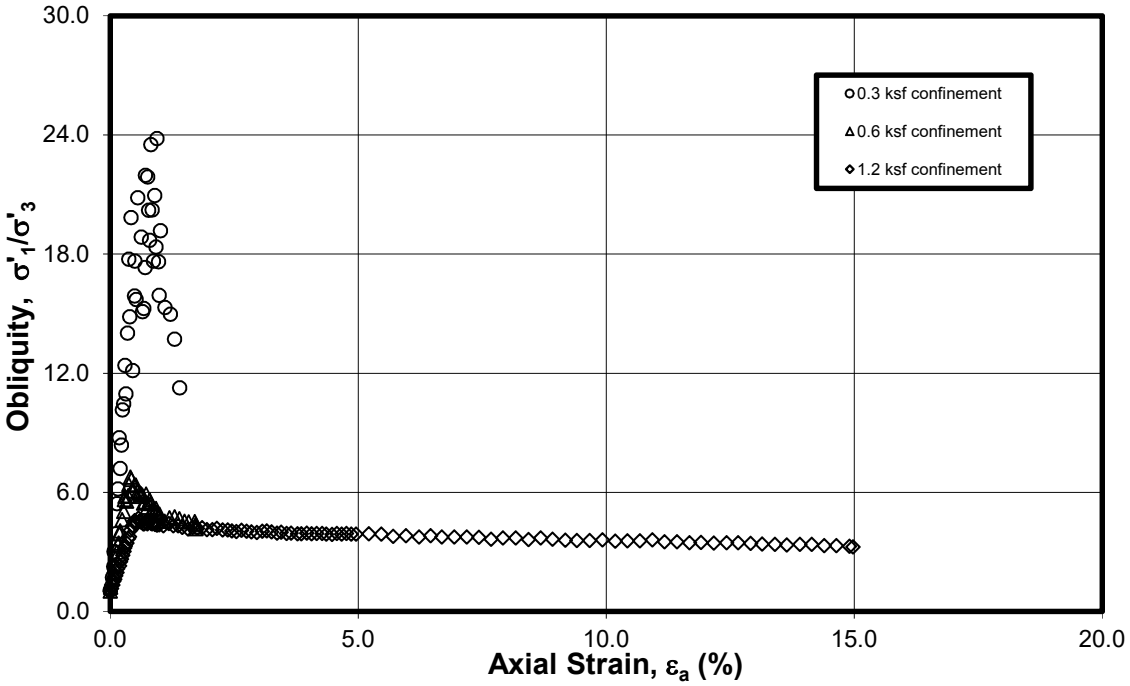
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-03, SAMPLE S-24, DEPTH 75.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



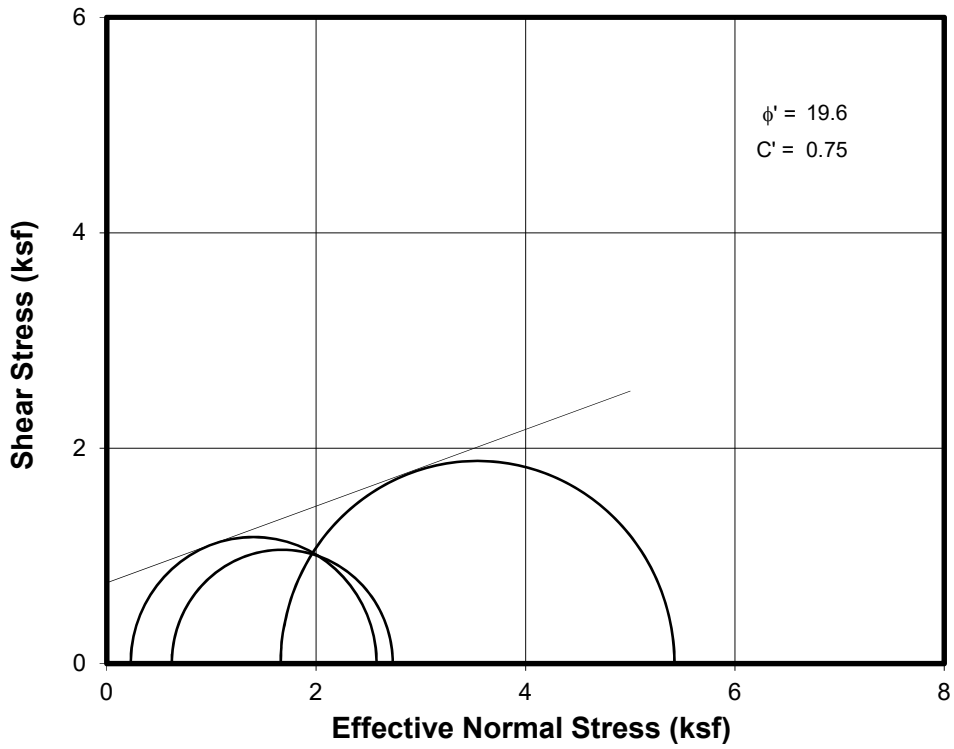


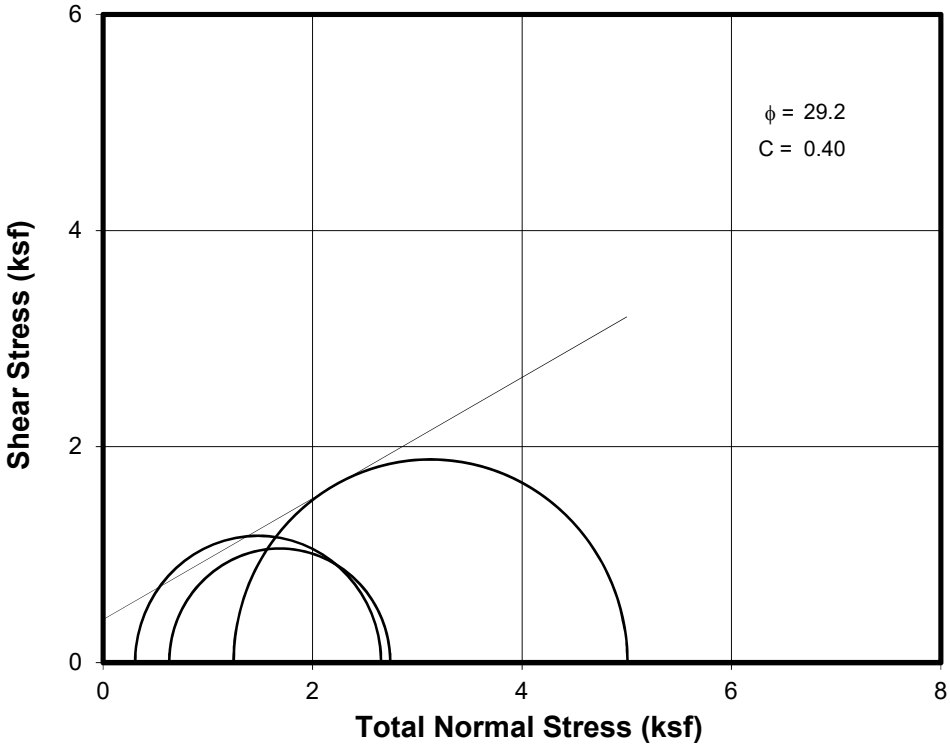
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-05, SAMPLE S-2, DEPTH 4.55 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



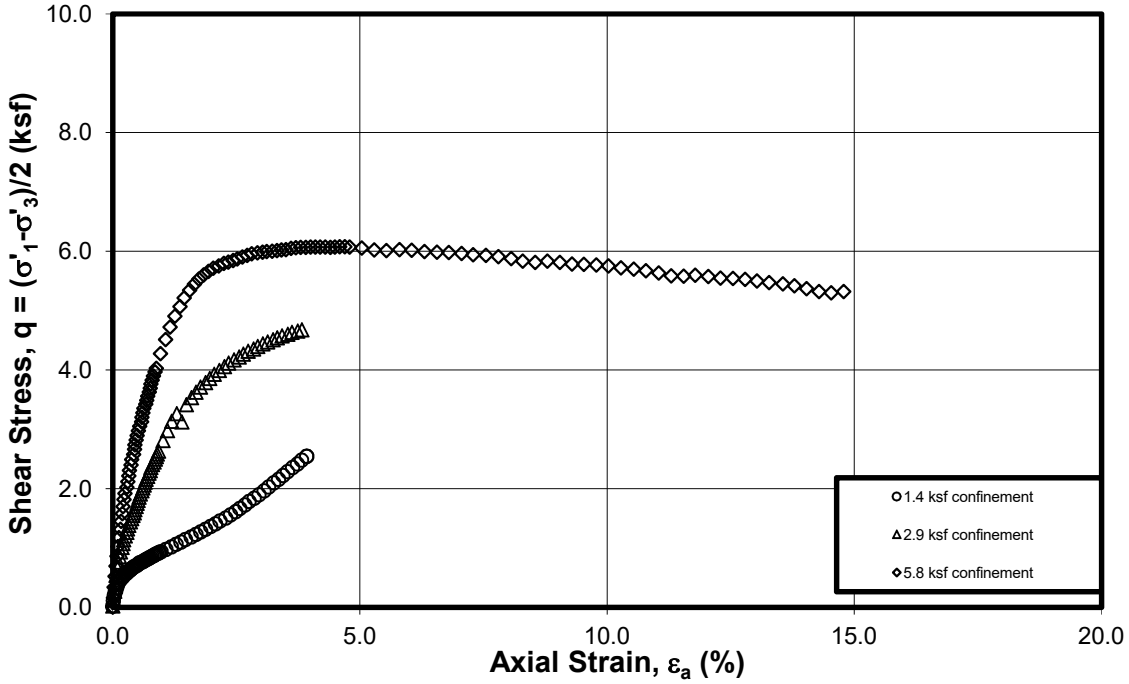


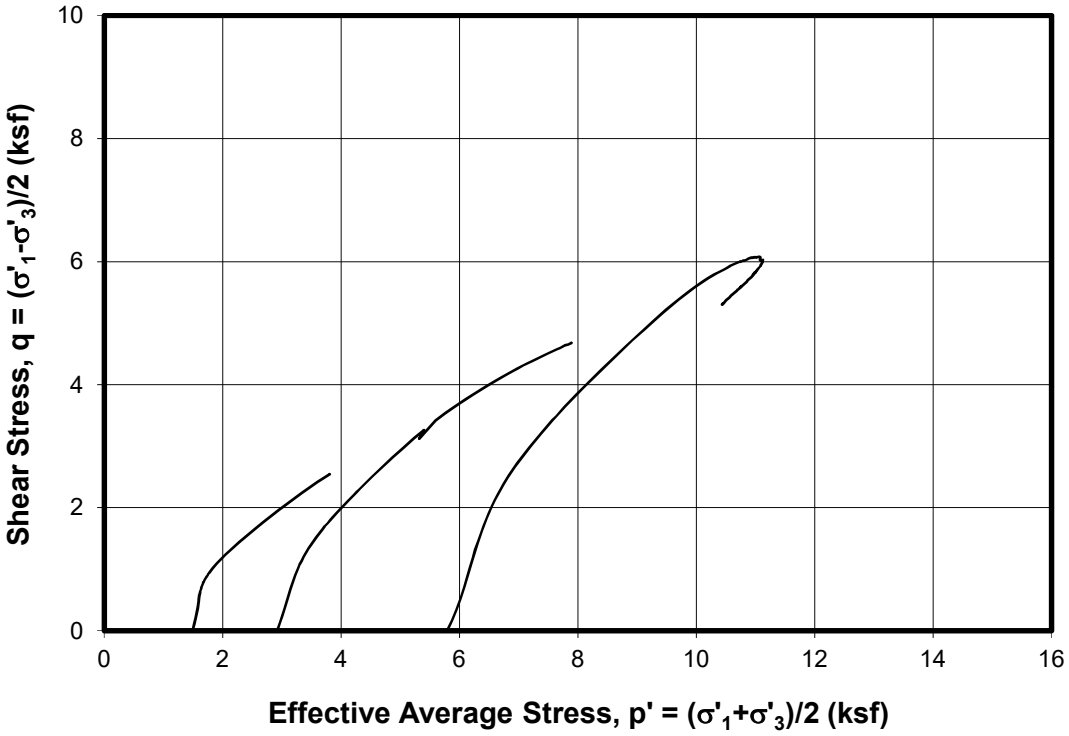
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-05, SAMPLE S-2, DEPTH 4.55 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



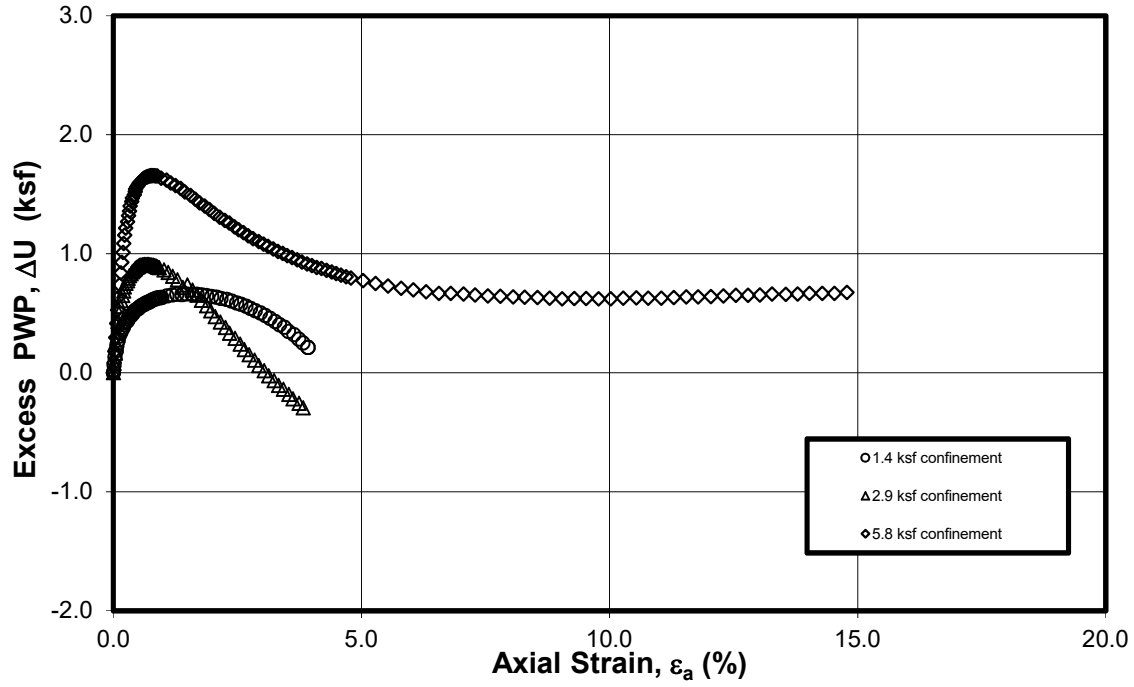


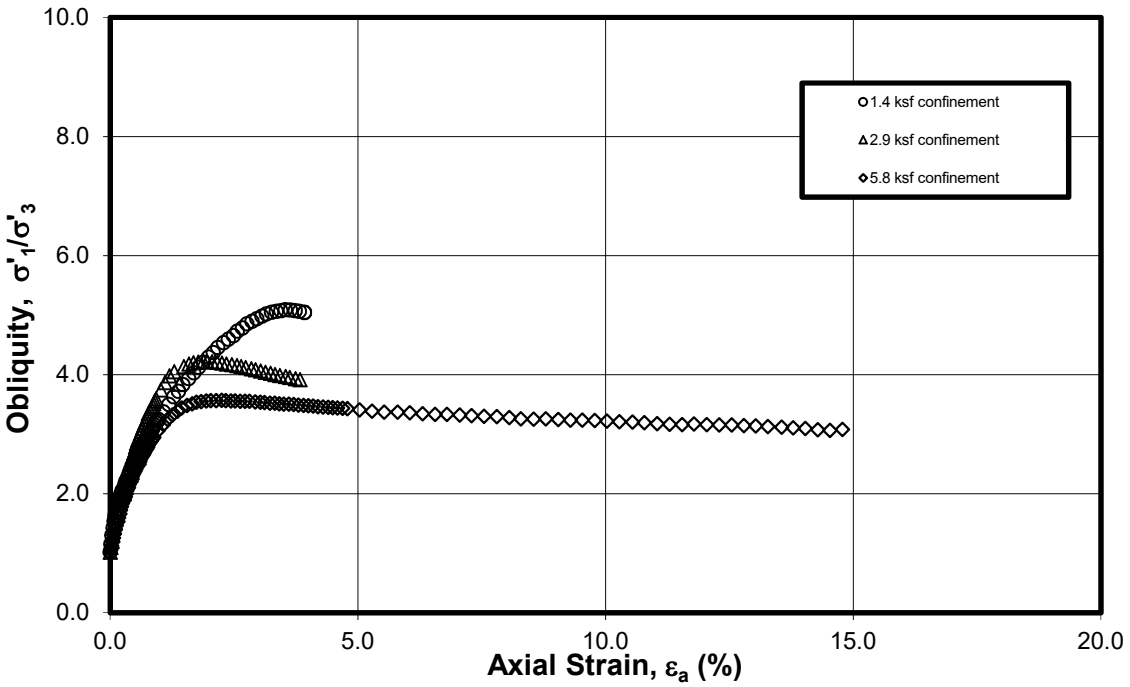
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-05, SAMPLE S-2, DEPTH 4.55 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



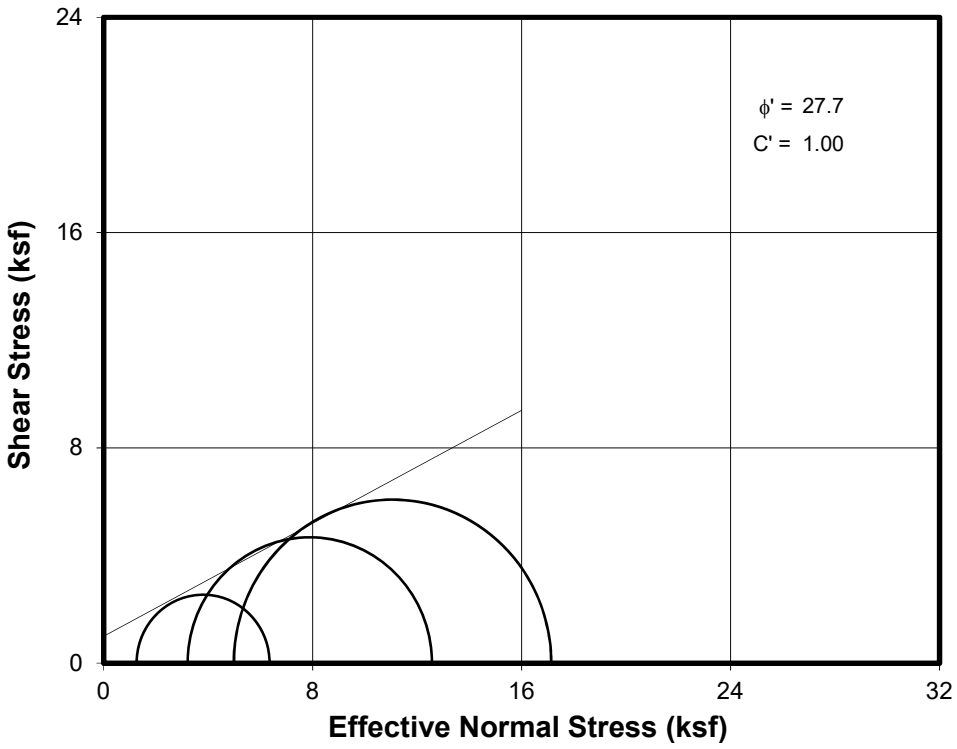


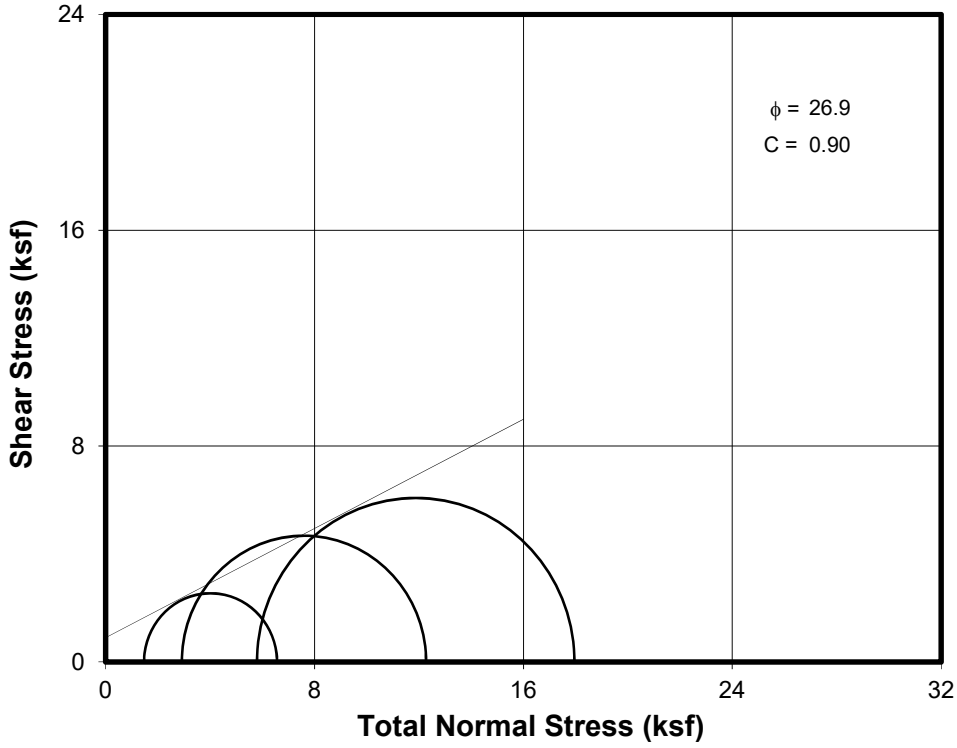
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-05, SAMPLE S-20, DEPTH 54.30 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



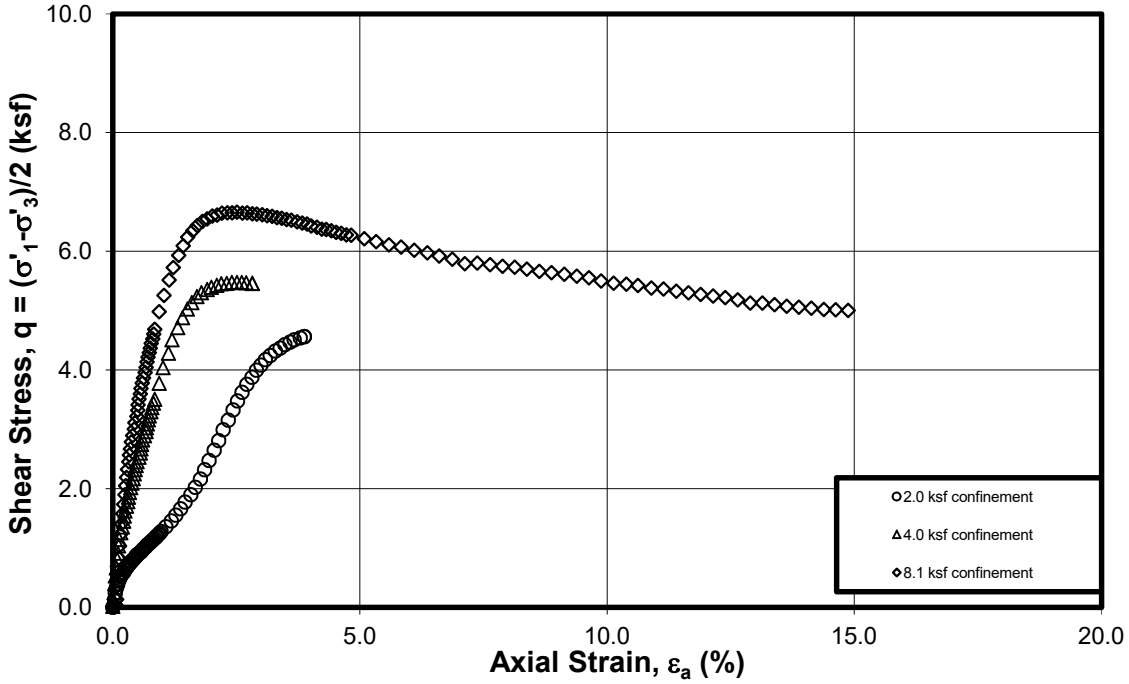


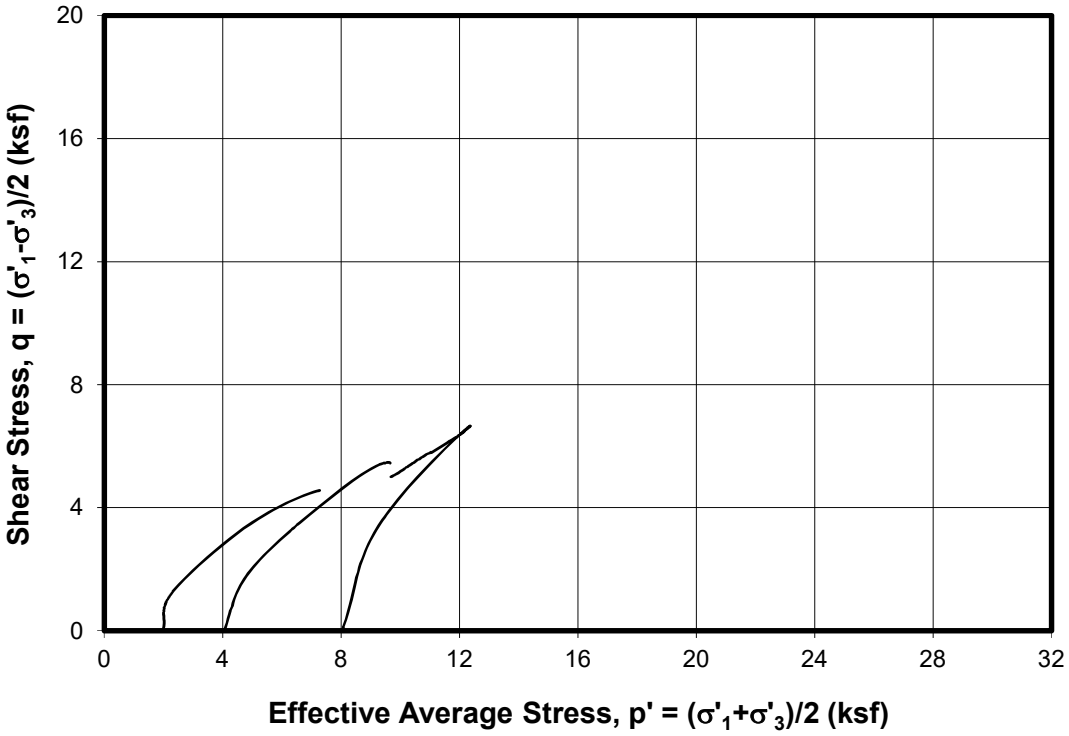
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-05, SAMPLE S-20, DEPTH 54.30 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



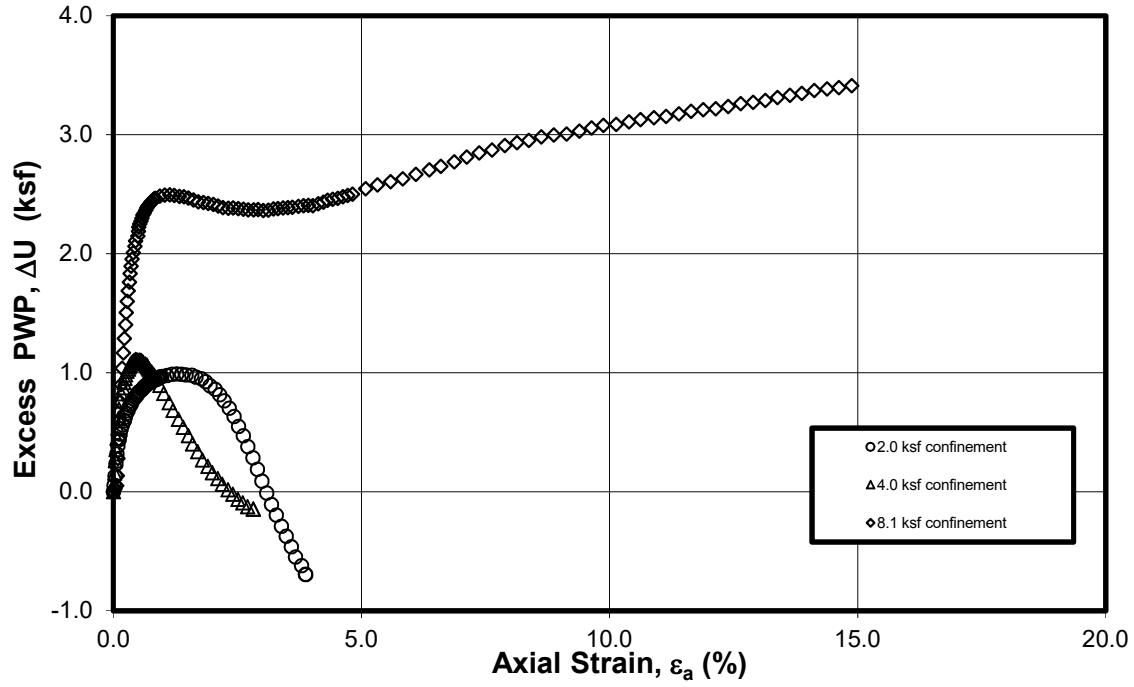


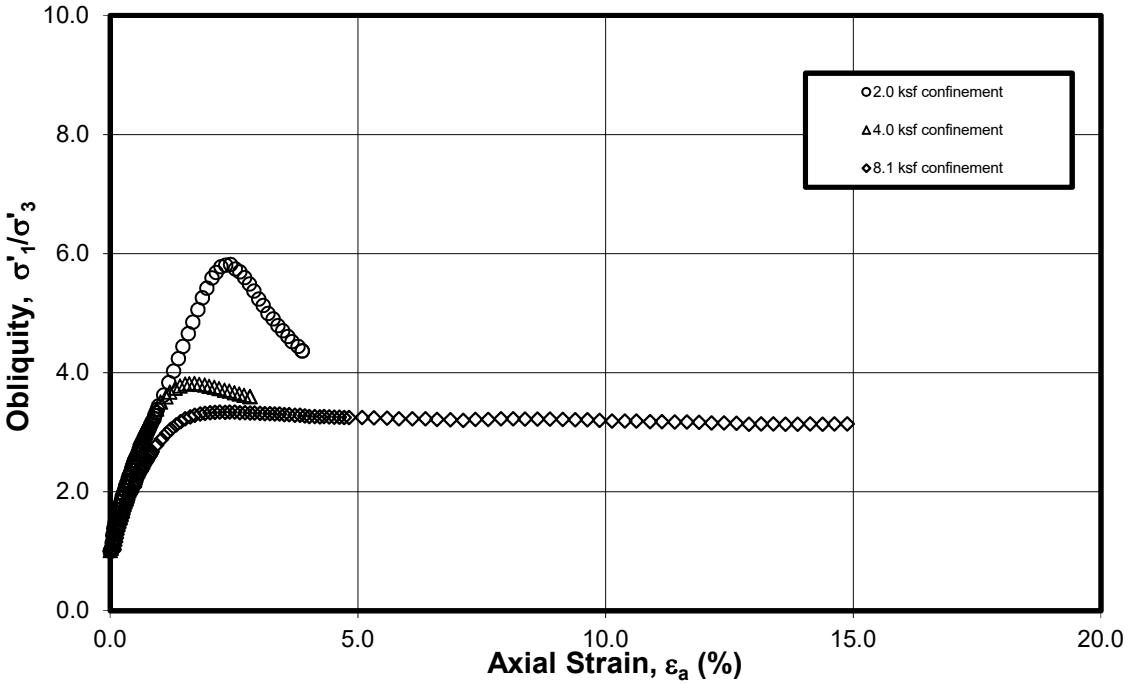
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-05, SAMPLE S-20, DEPTH 54.30 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



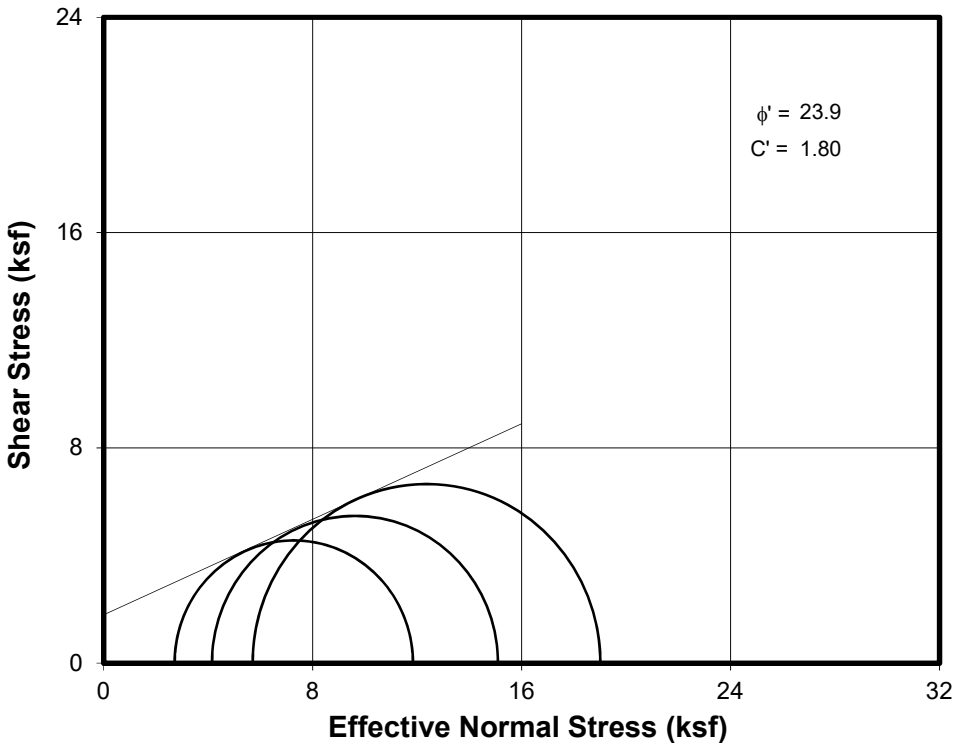


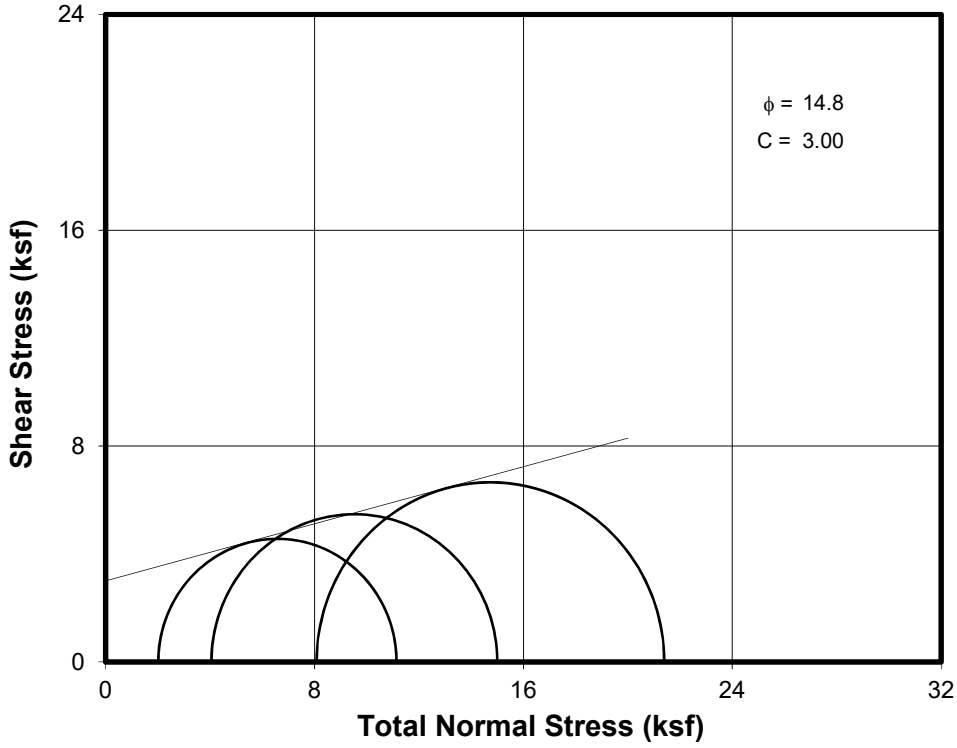
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-08, SAMPLE S-24, DEPTH 76.75 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



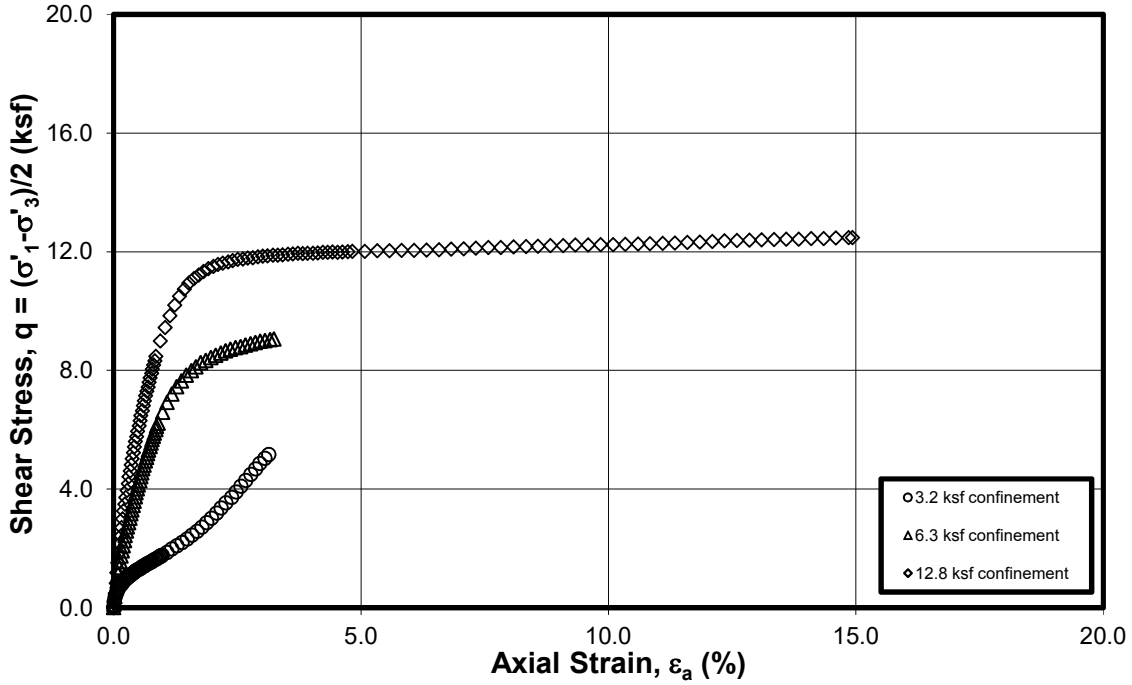


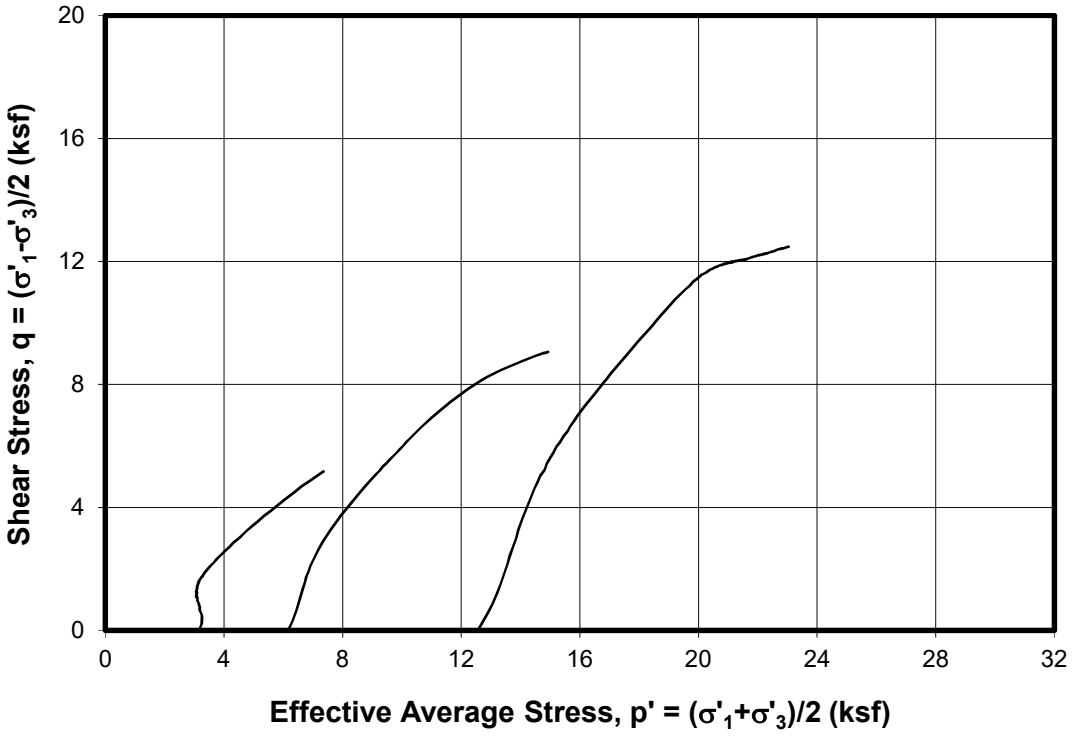
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-08, SAMPLE S-24, DEPTH 76.75 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



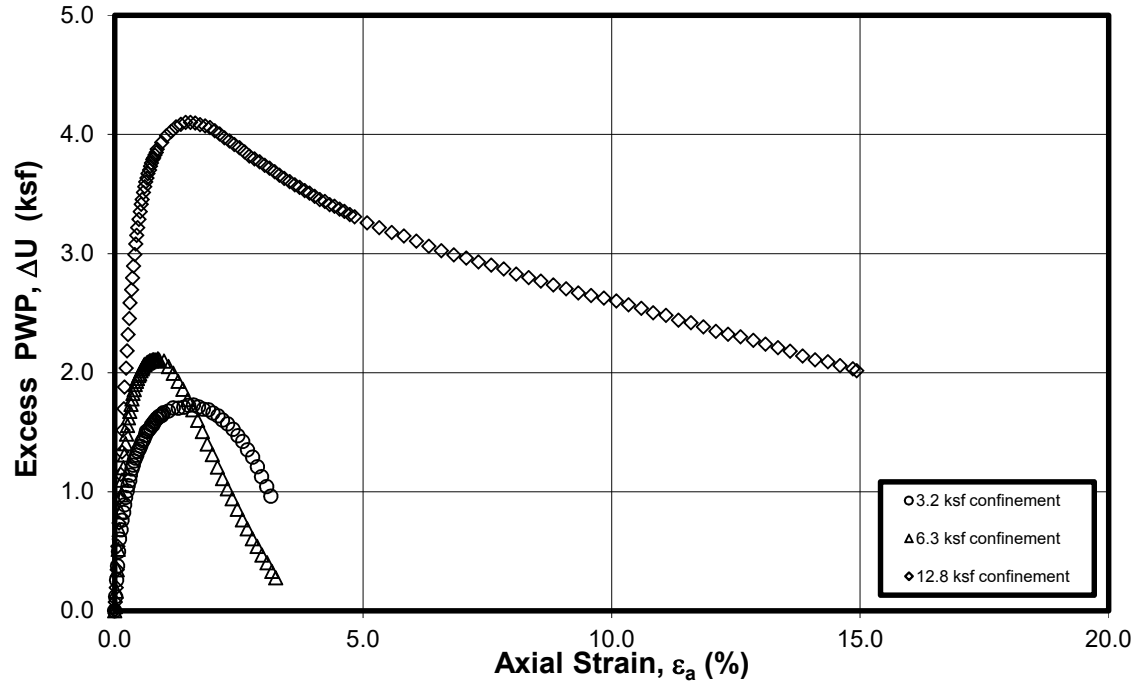


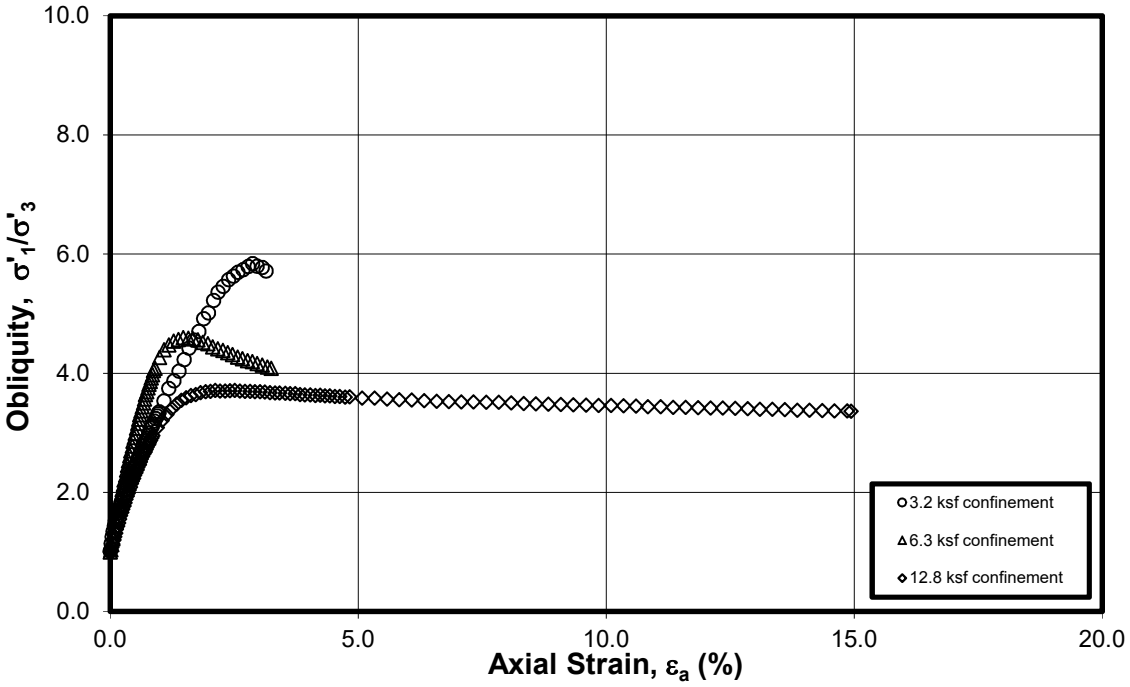
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-08, SAMPLE S-24, DEPTH 76.75 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



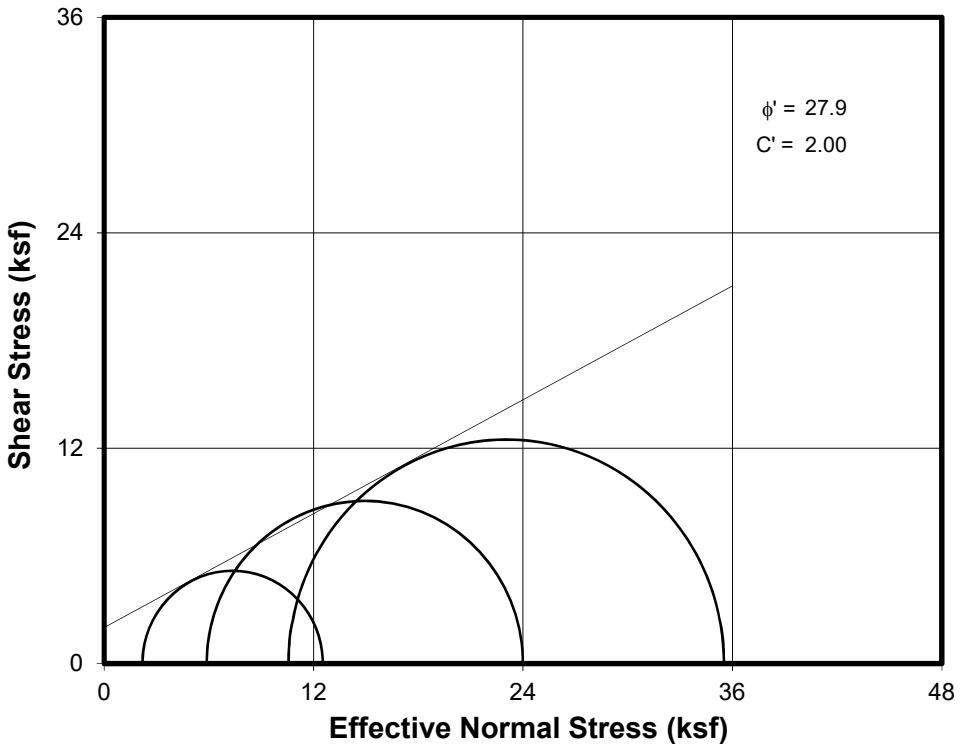


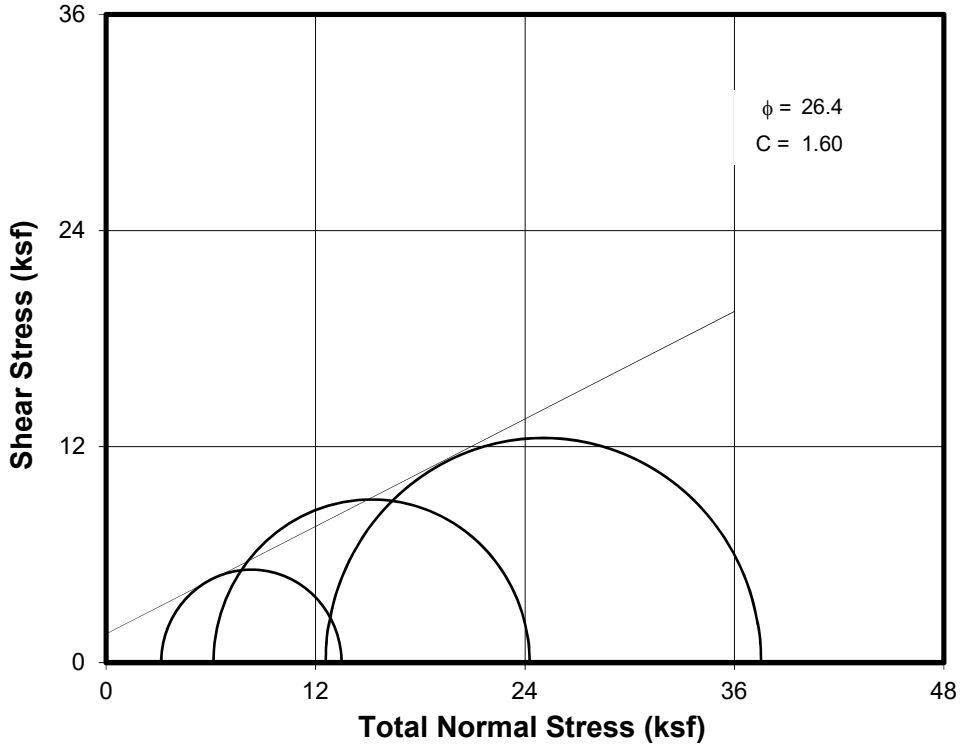
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-08, SAMPLE S-31, DEPTH 120.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



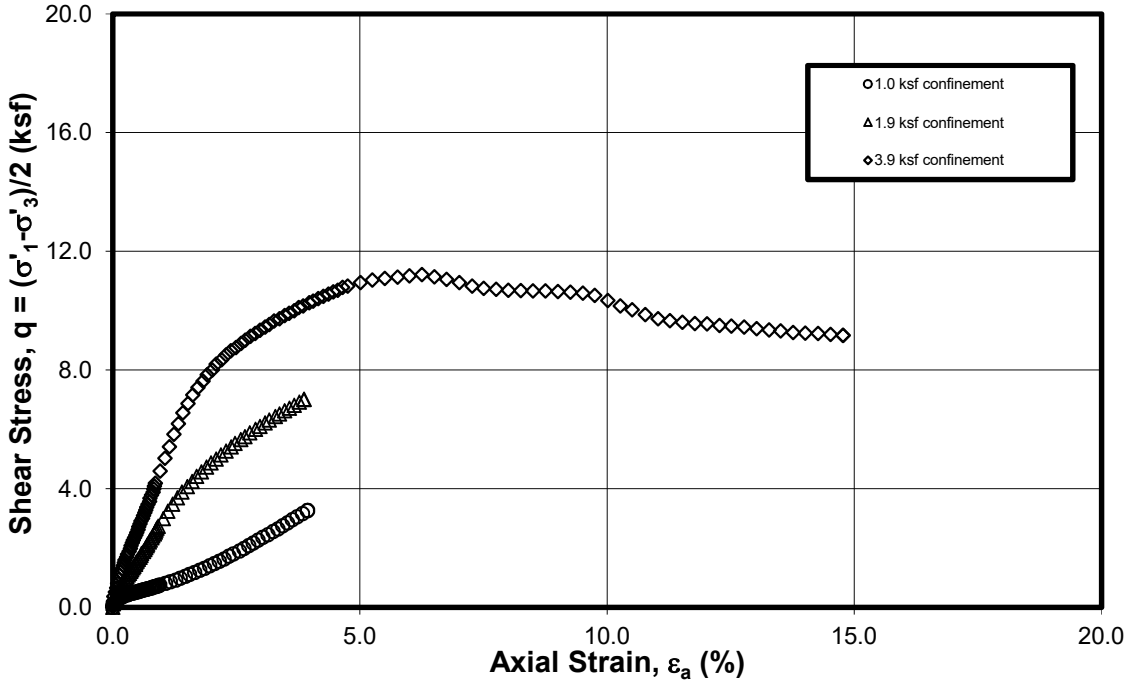


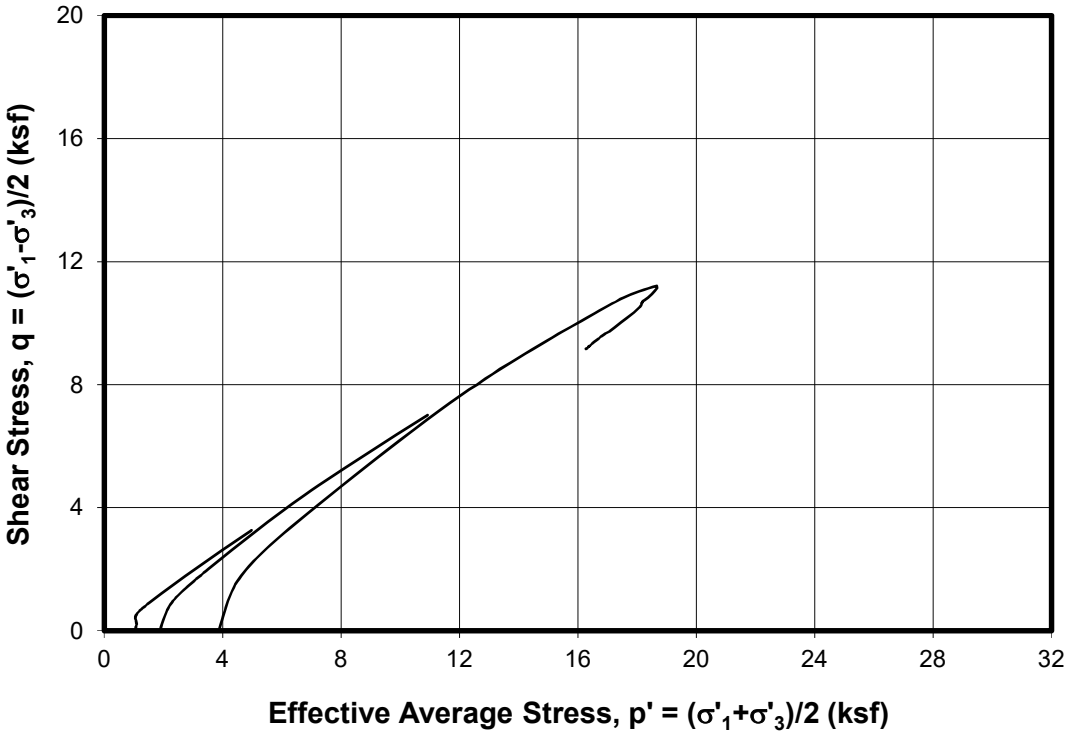
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-08, SAMPLE S-31, DEPTH 120.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



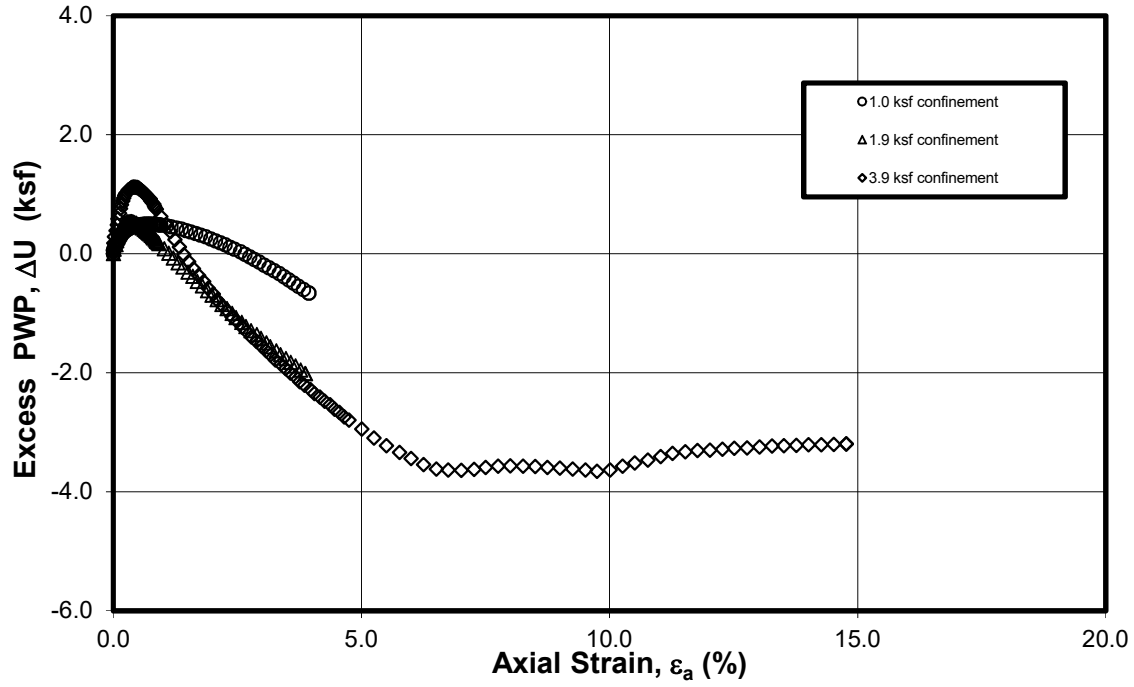


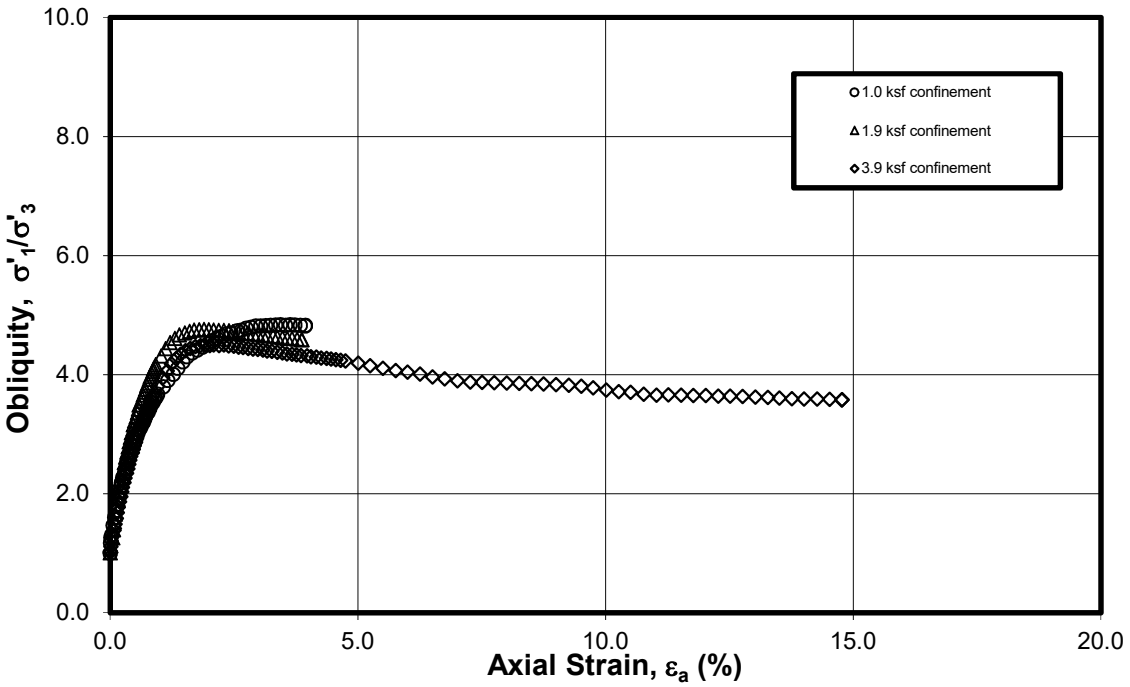
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-08, SAMPLE S-31, DEPTH 120.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



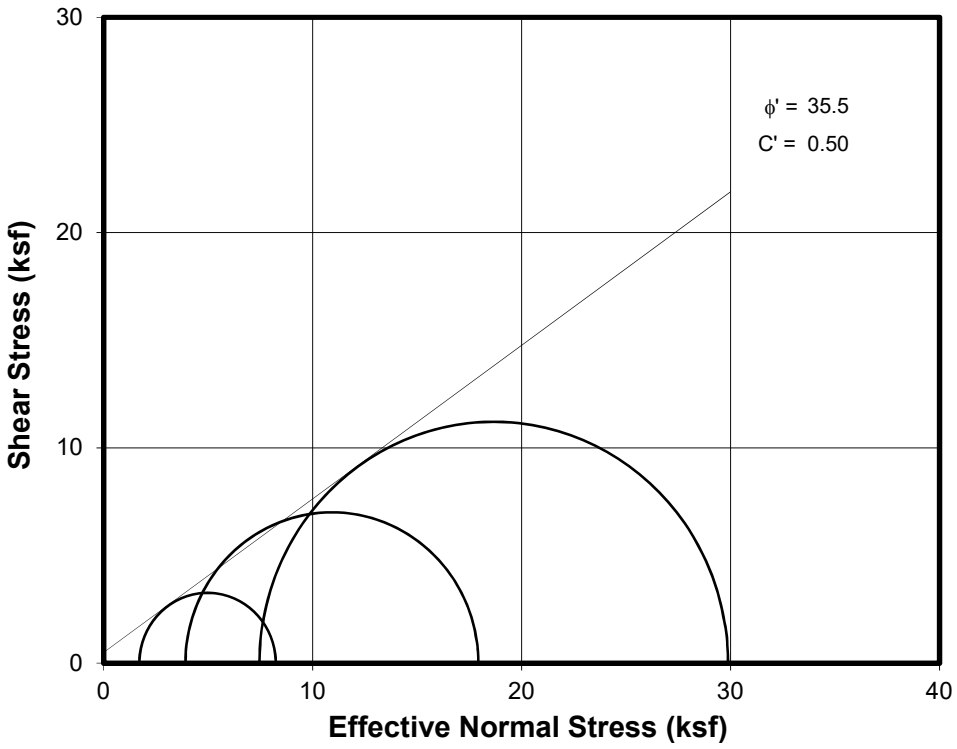


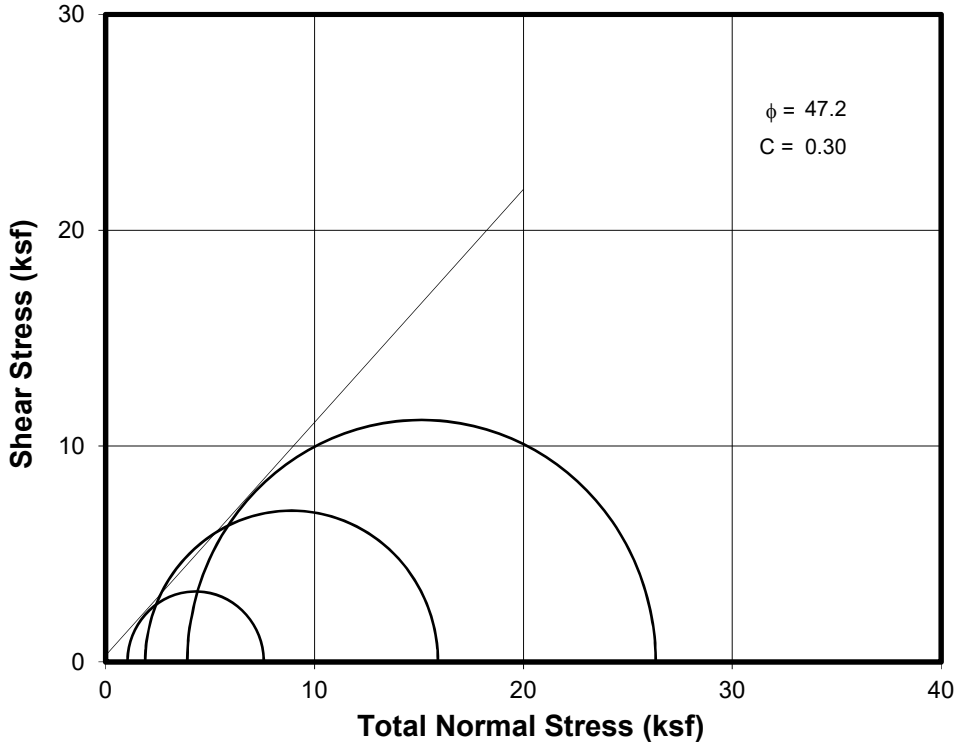
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-09, SAMPLE S-14, DEPTH 36.42 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



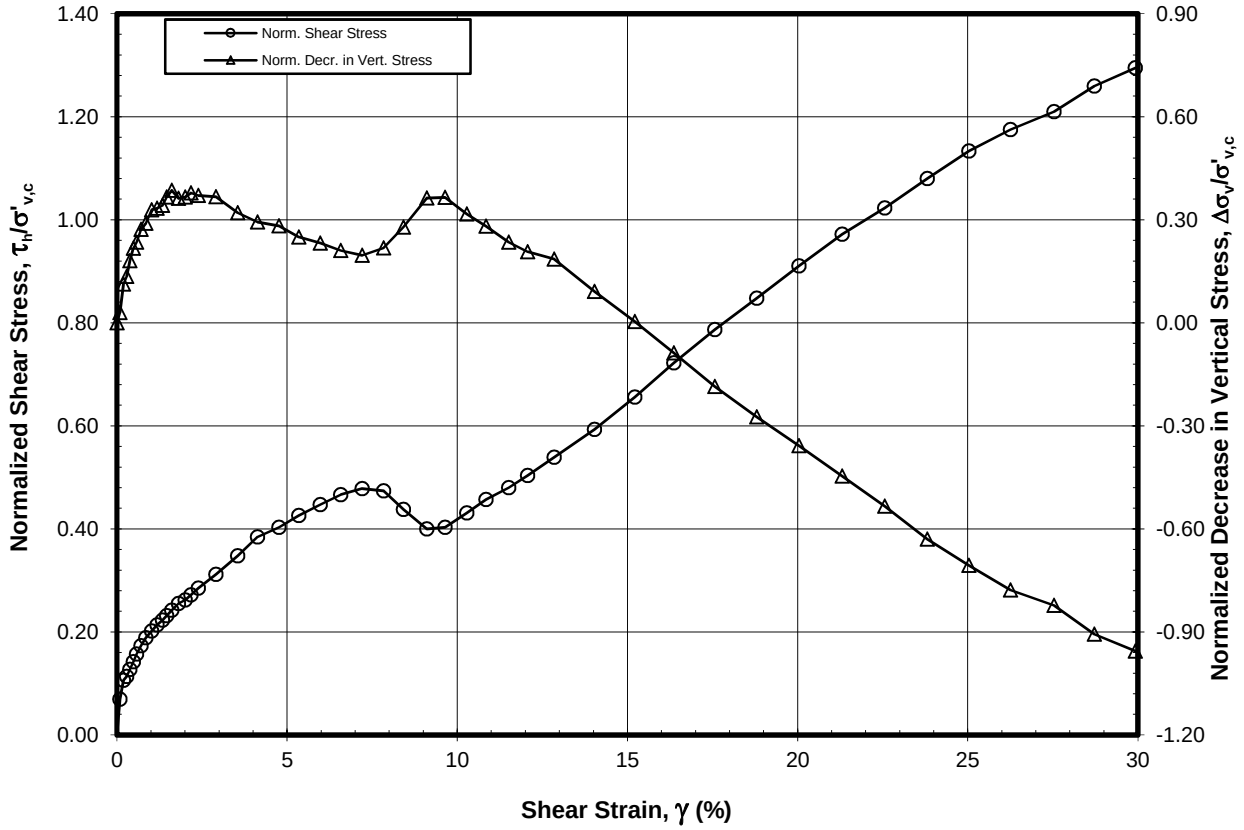


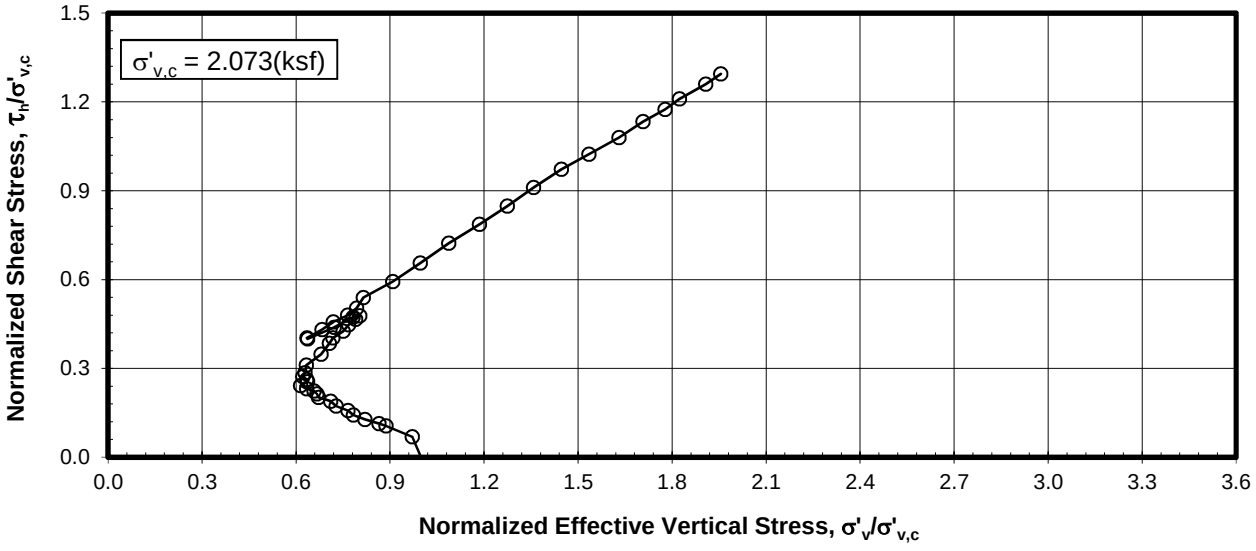
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-09, SAMPLE S-14, DEPTH 36.42 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



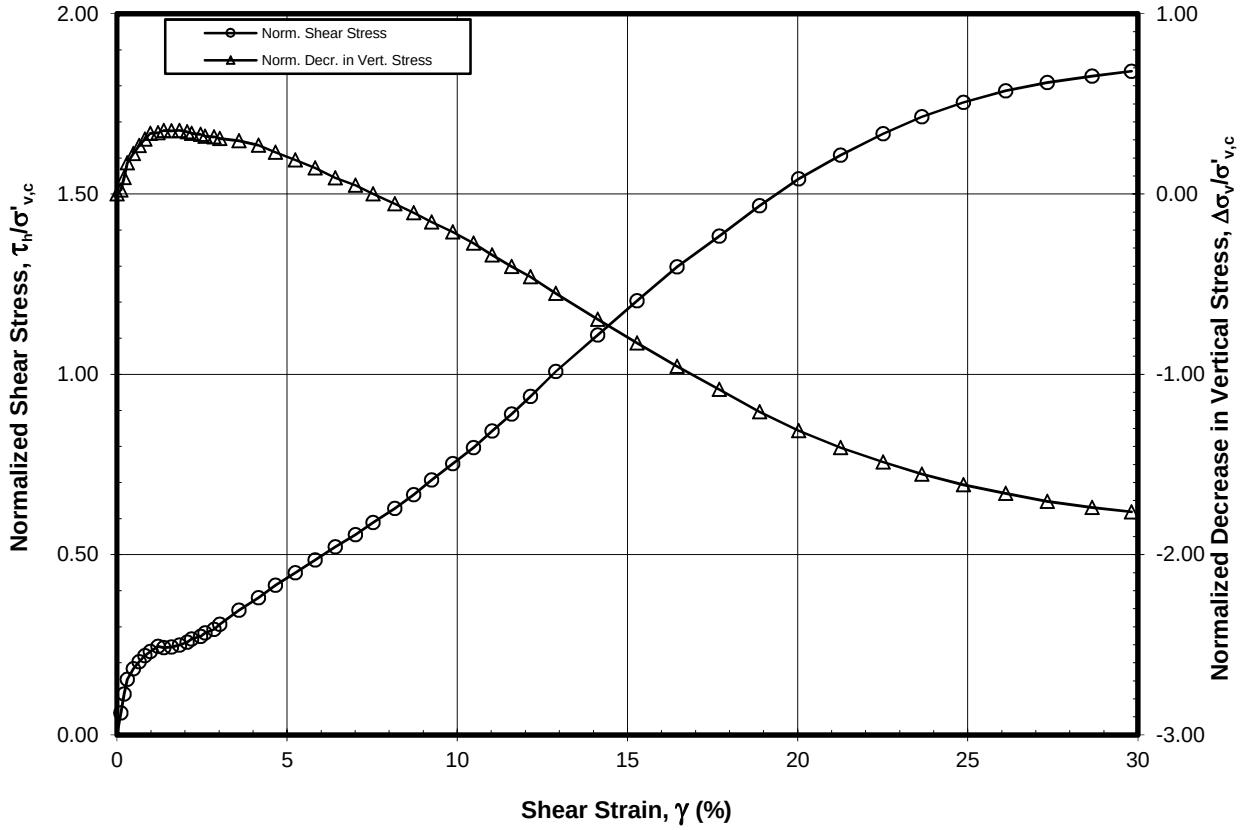


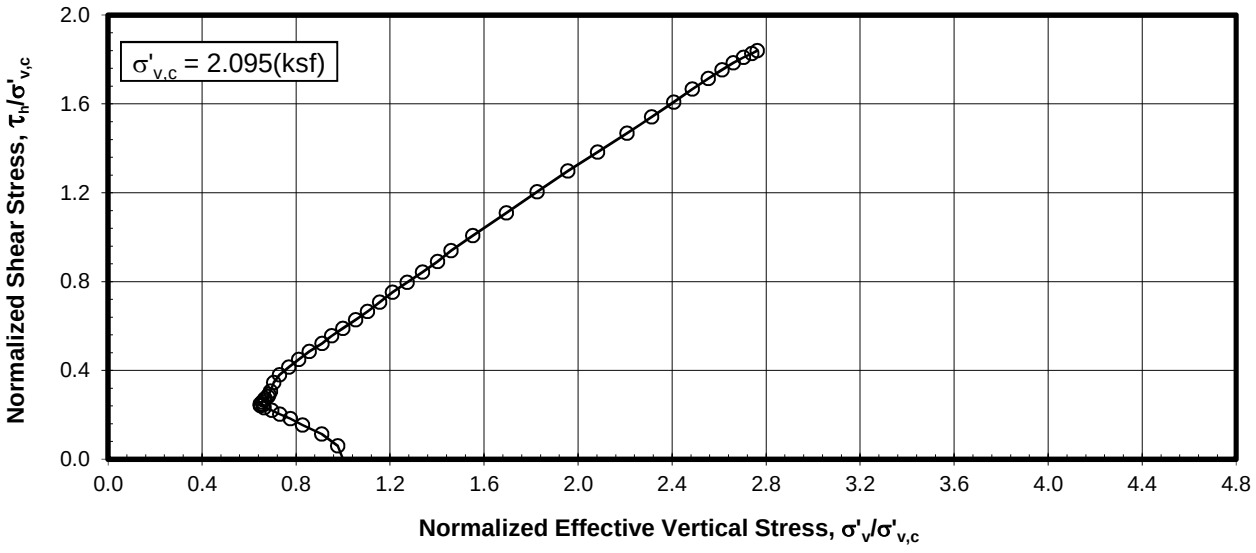
MULTI STAGE CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
BORING MB-09, SAMPLE S-14, DEPTH 36.42 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



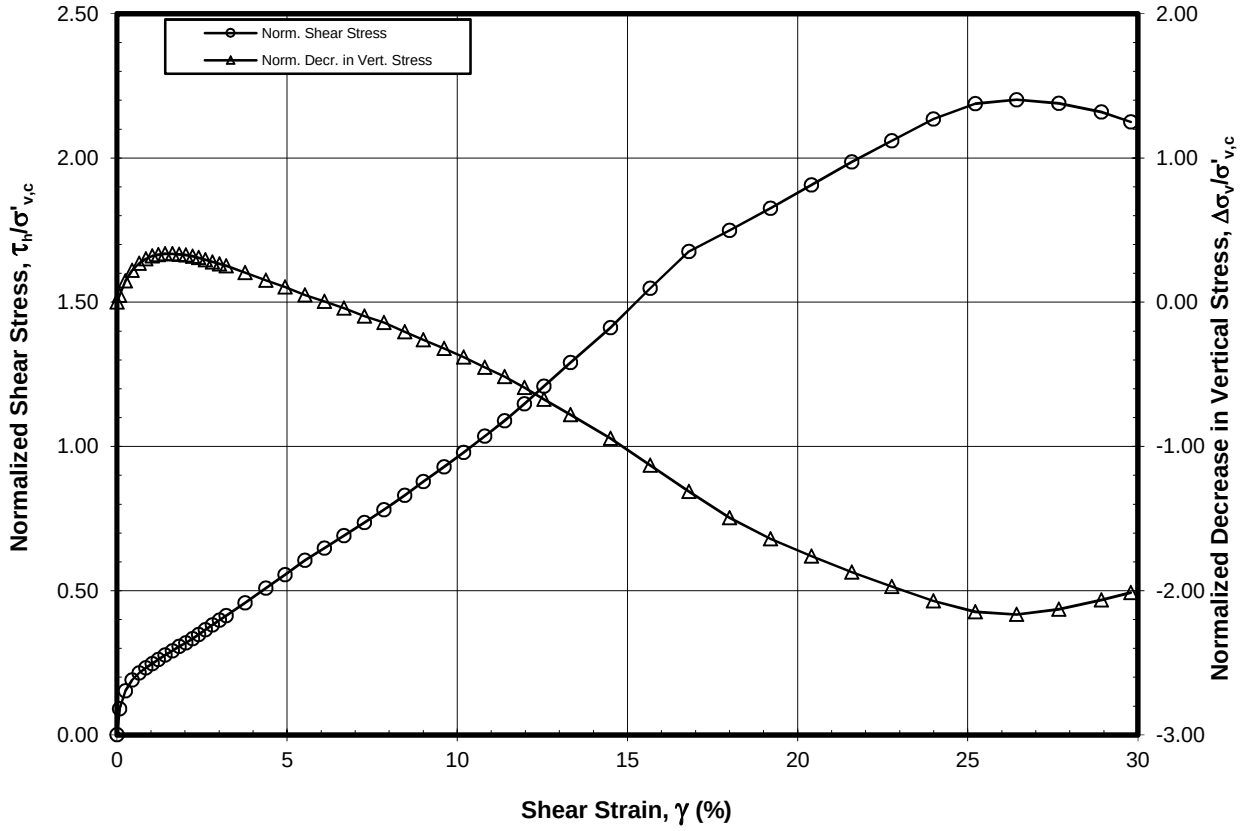


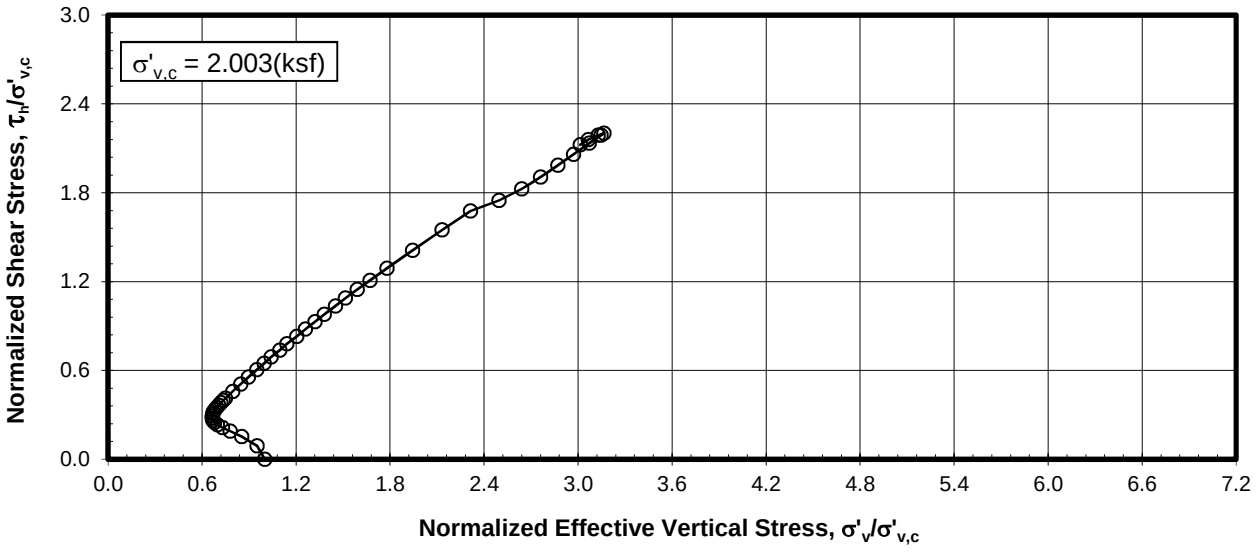
DIRECT SIMPLE SHEAR TEST
BORING MB-05, SAMPLE S-15, DEPTH 36.60 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



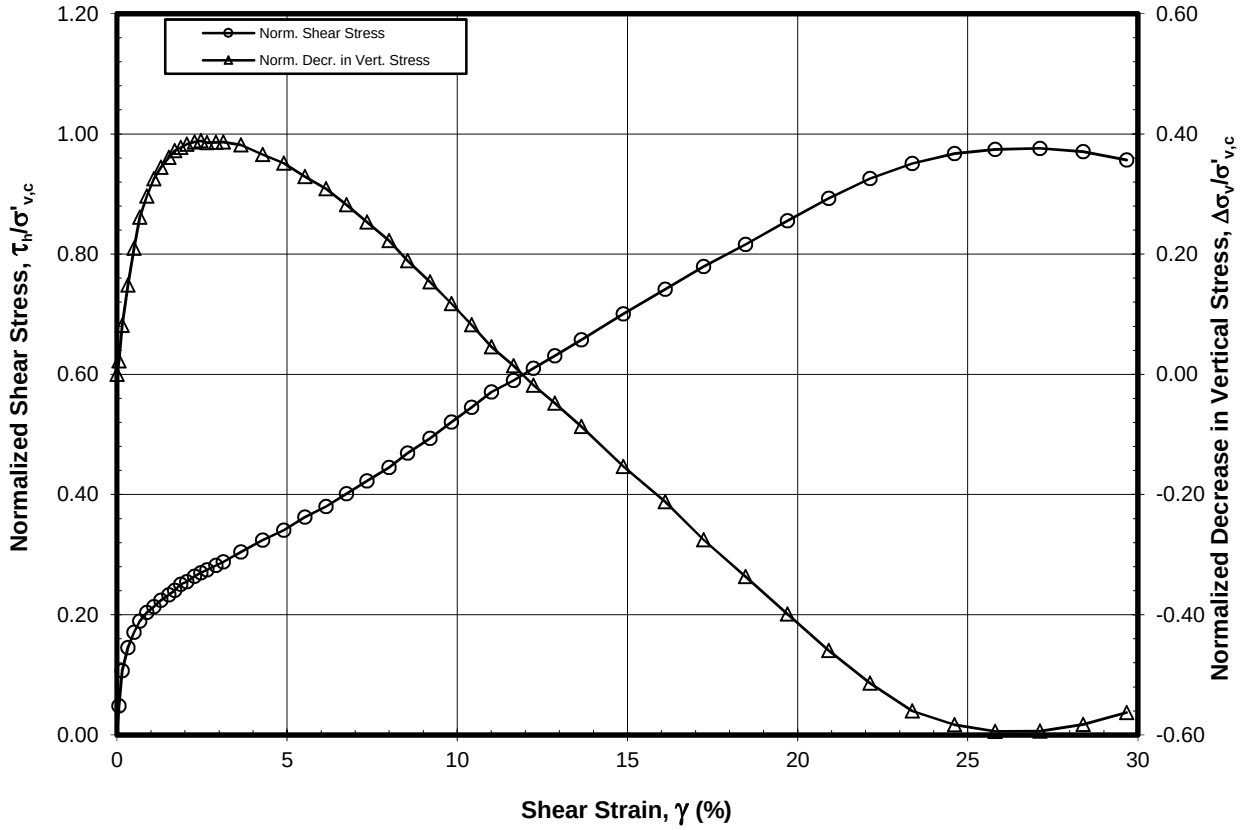


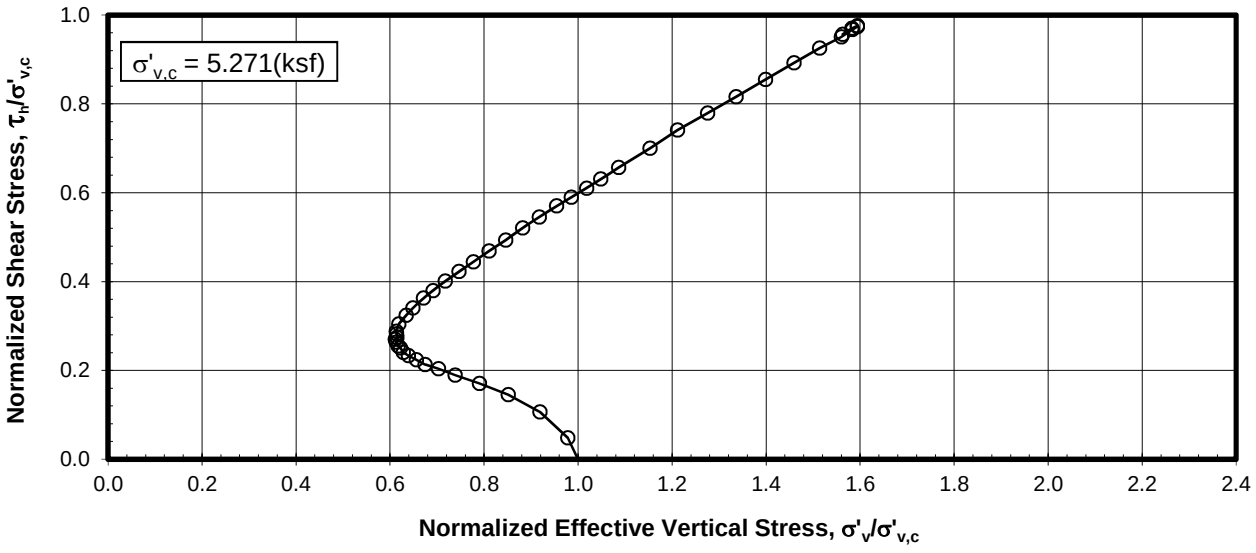
DIRECT SIMPLE SHEAR TEST
BORING MB-08, SAMPLE S-15, DEPTH 37.20 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



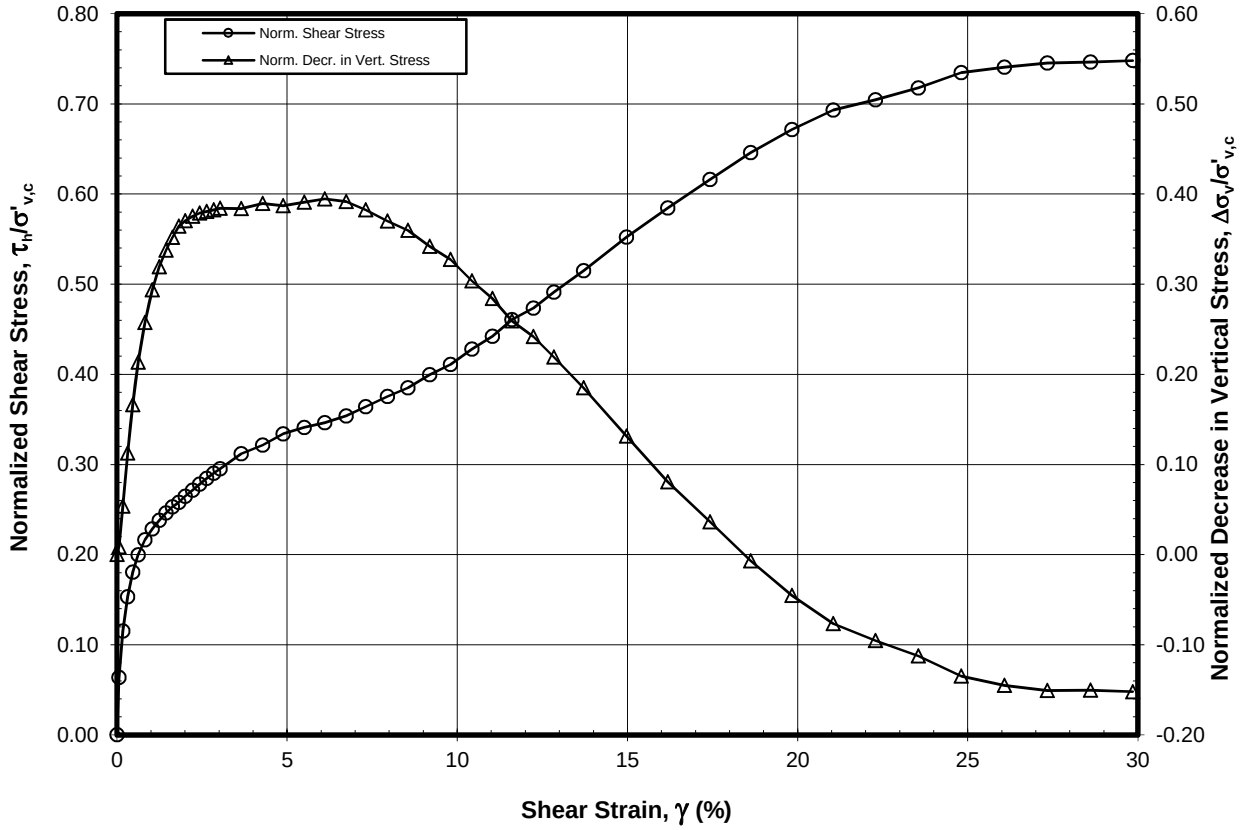


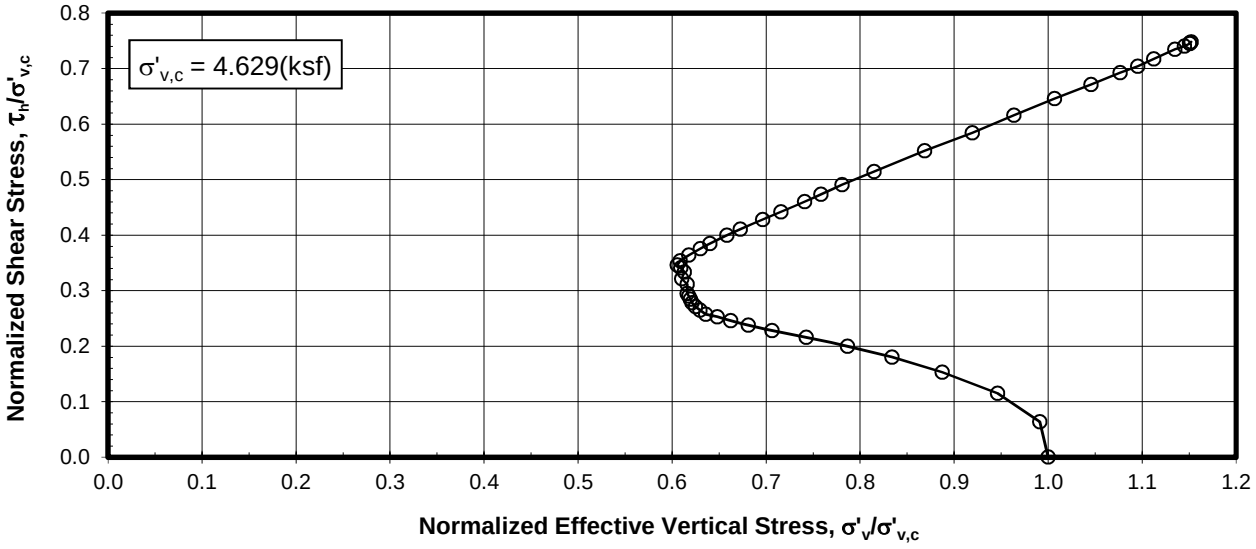
DIRECT SIMPLE SHEAR TEST
BORING MB-17, SAMPLE S-14 AND S-15, DEPTH 38.10 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



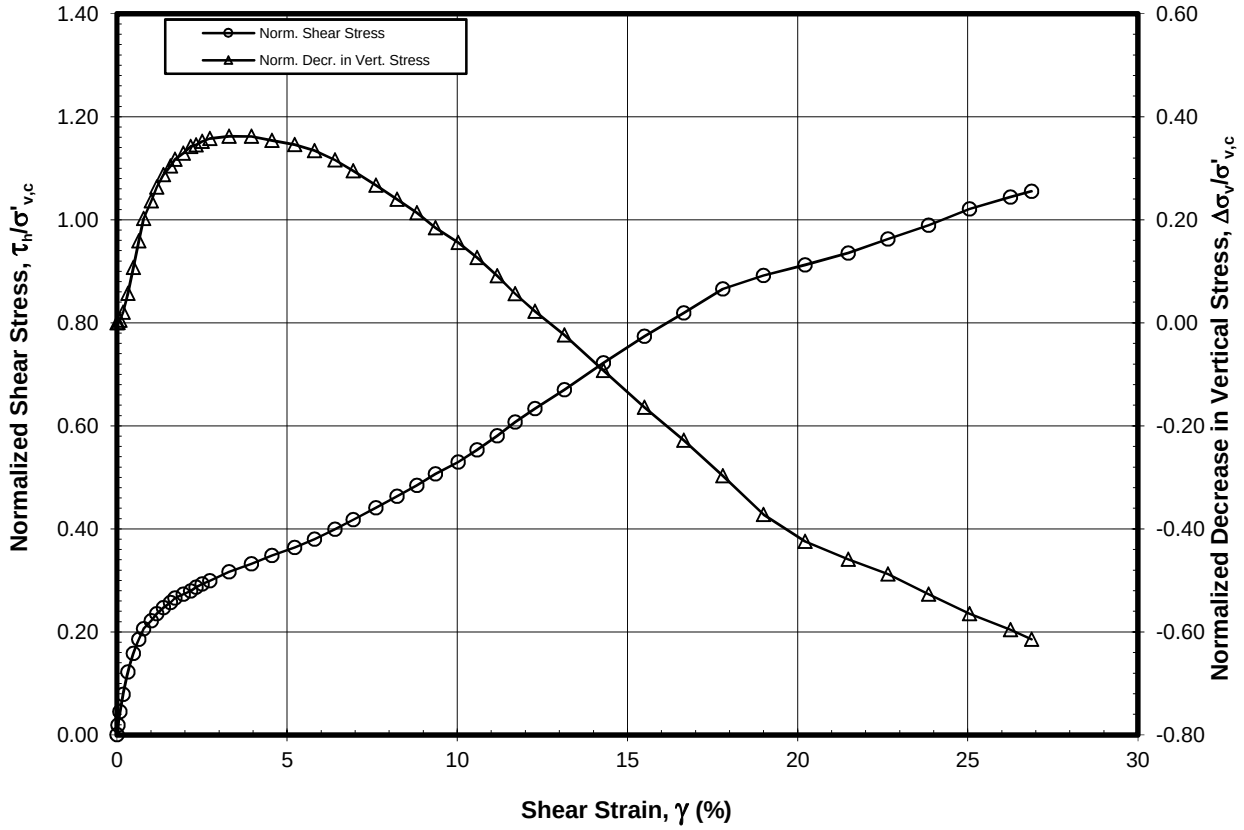


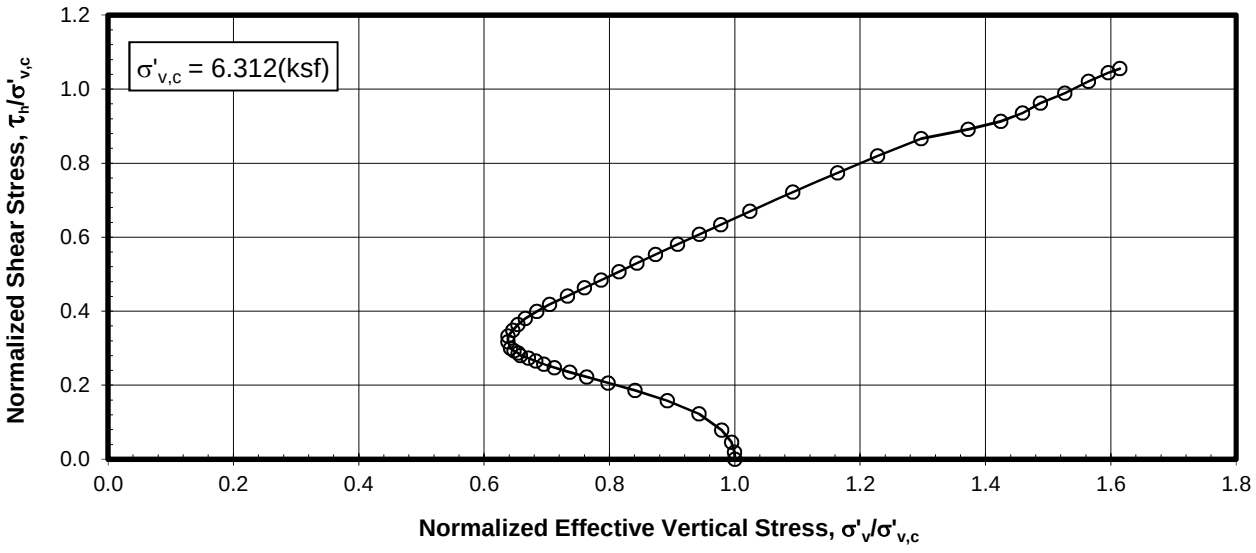
DIRECT SIMPLE SHEAR TEST
BORING MB-23, SAMPLE S-27, DEPTH 93.20 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



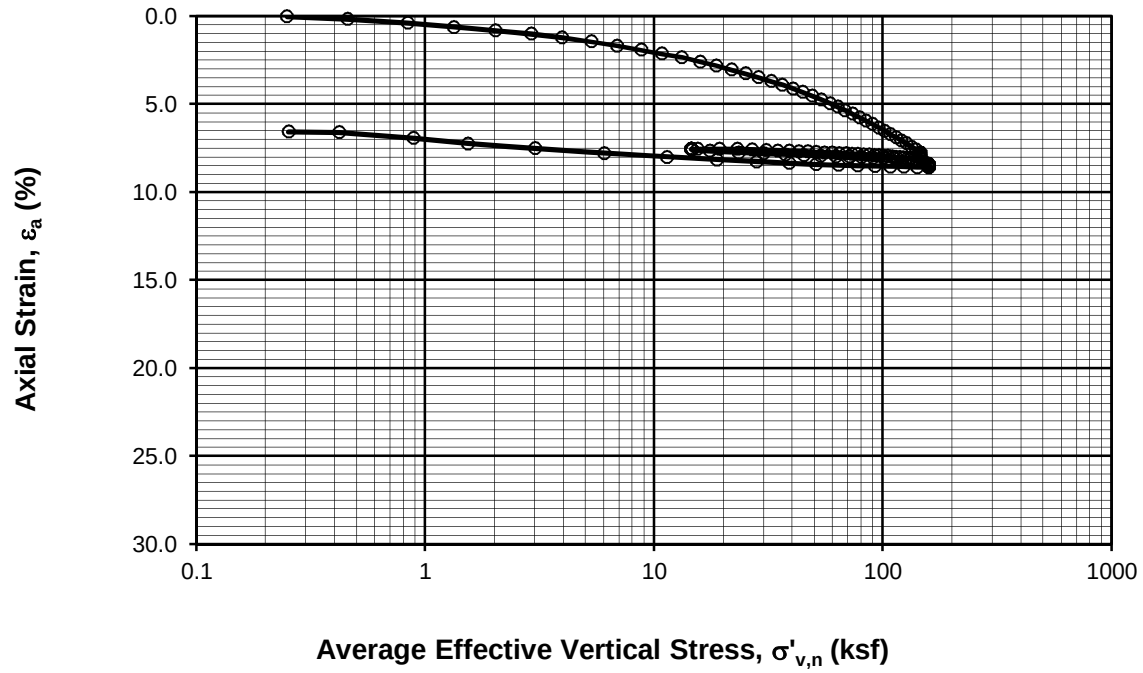


DIRECT SIMPLE SHEAR TEST
BORING MB-27, SAMPLE G-9, DEPTH 86.60 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA





DIRECT SIMPLE SHEAR TEST
BORING MB-27, SAMPLE G-14, DEPTH 121.40 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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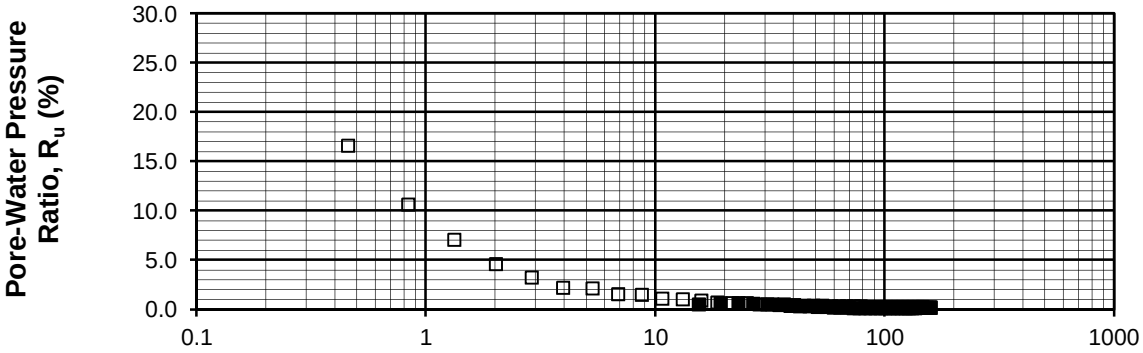
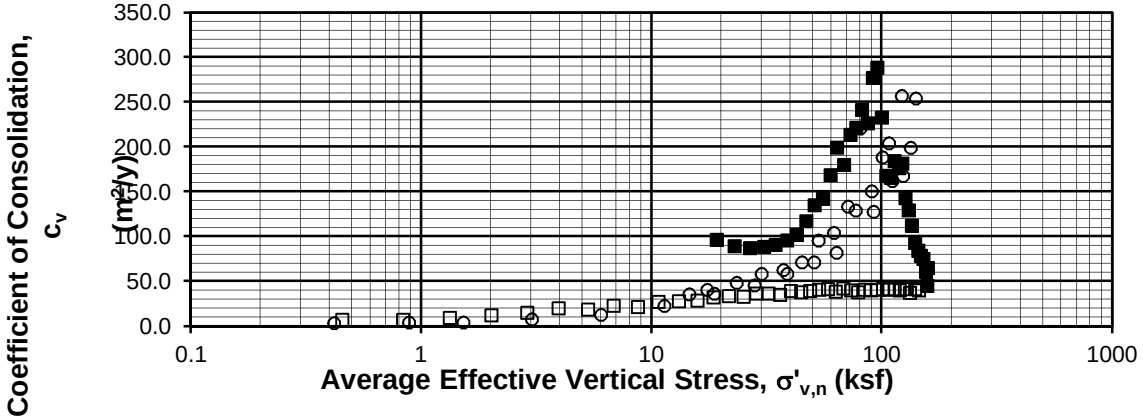
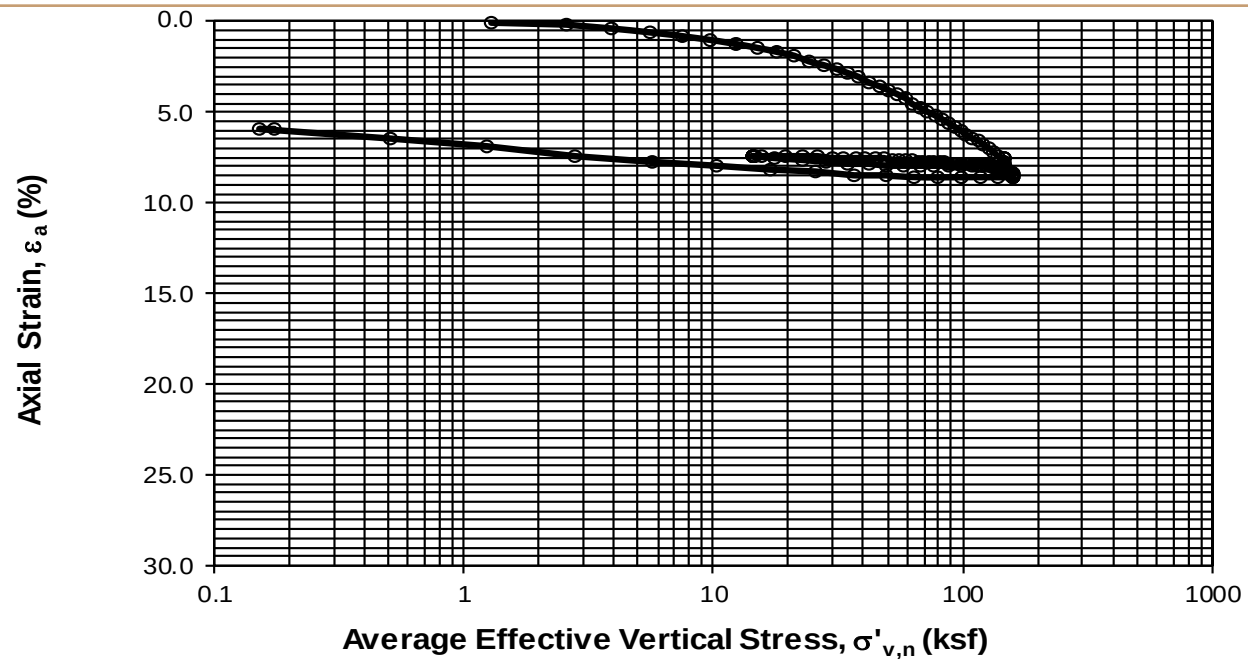
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-03, SAMPLE S-24, DEPTH 76.10 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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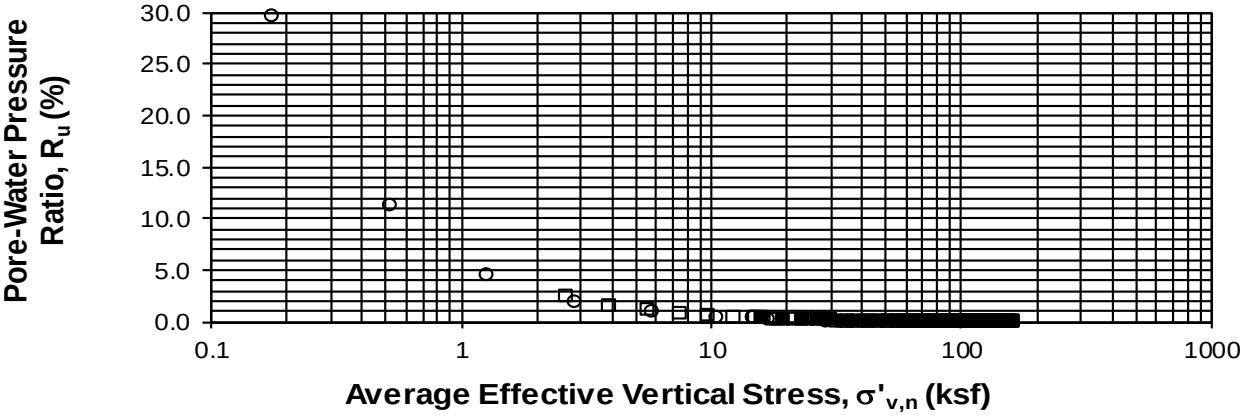
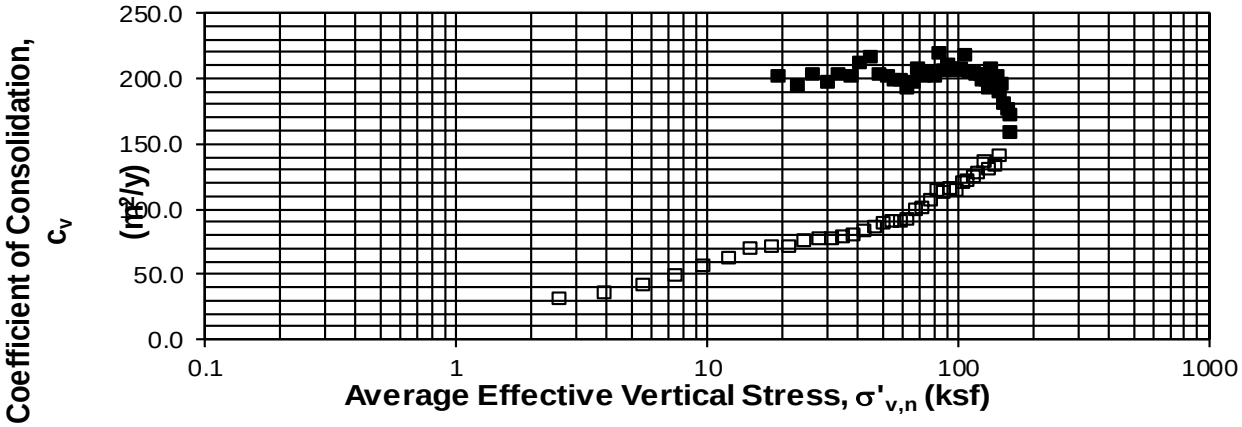
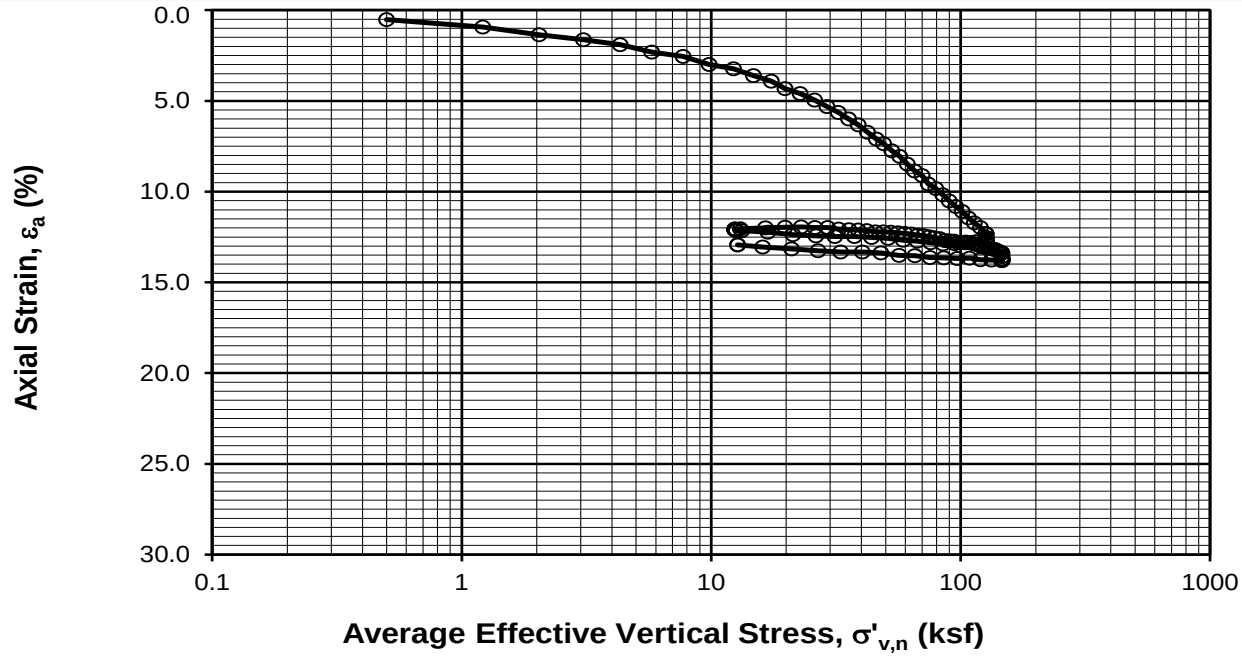
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-05, SAMPLE S-2, DEPTH 4.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E7-2



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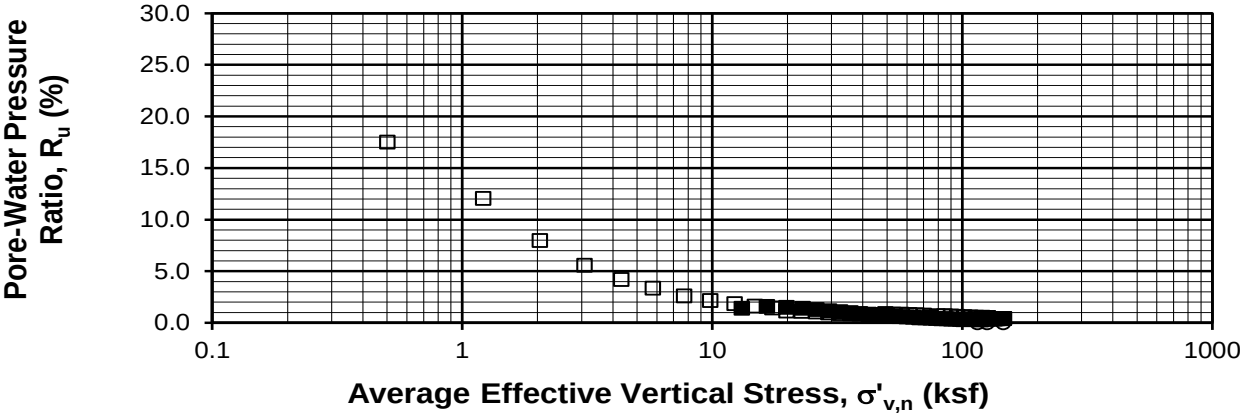
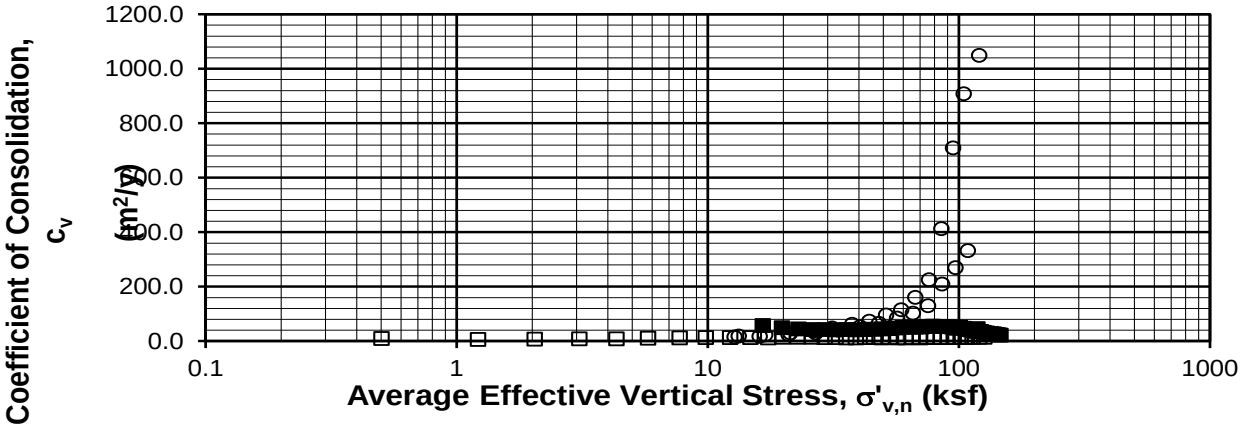
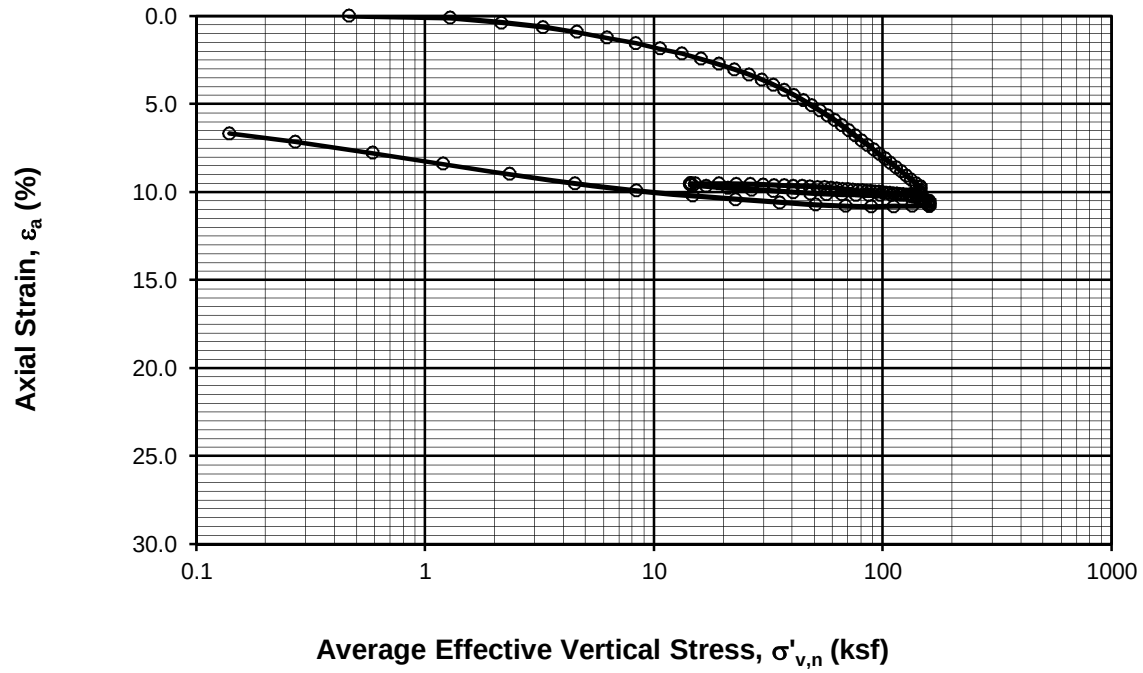
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-05, SAMPLE S-20a, DEPTH 55.02 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E7-3



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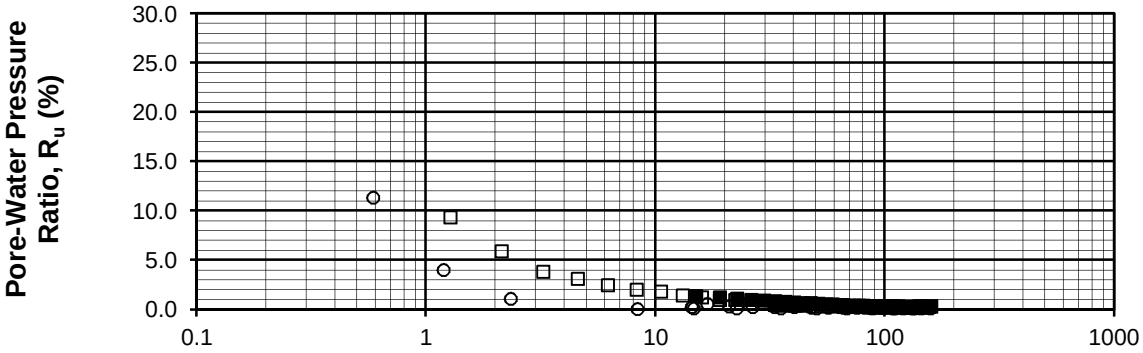
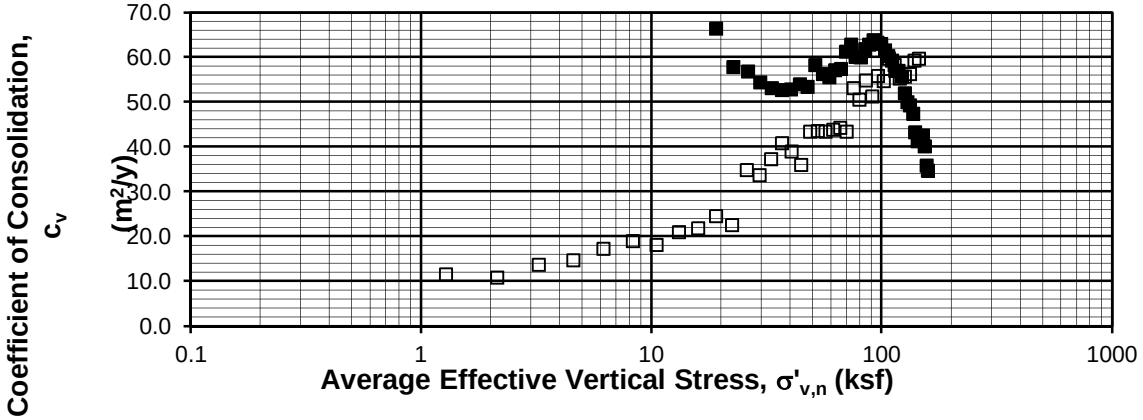
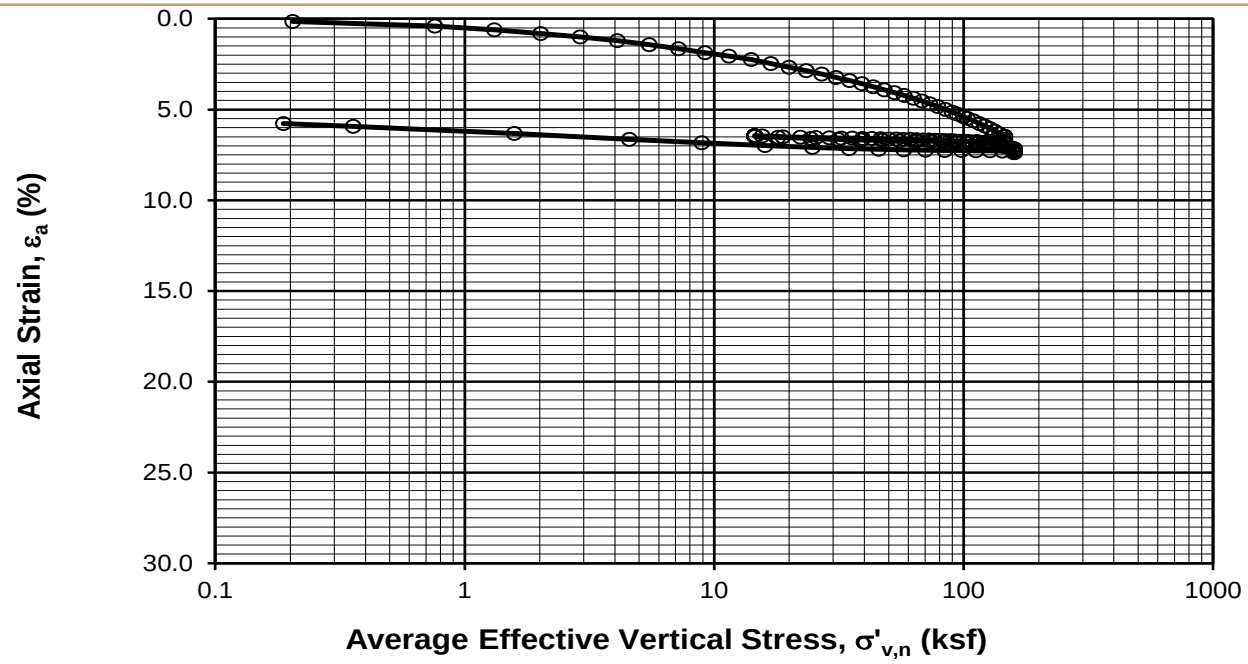
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-05, SAMPLE S-20b, DEPTH 54.30 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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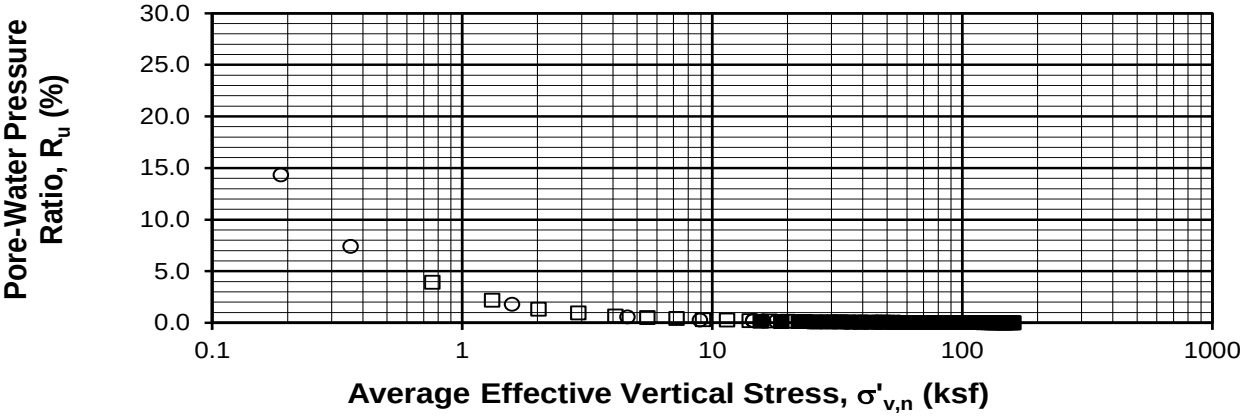
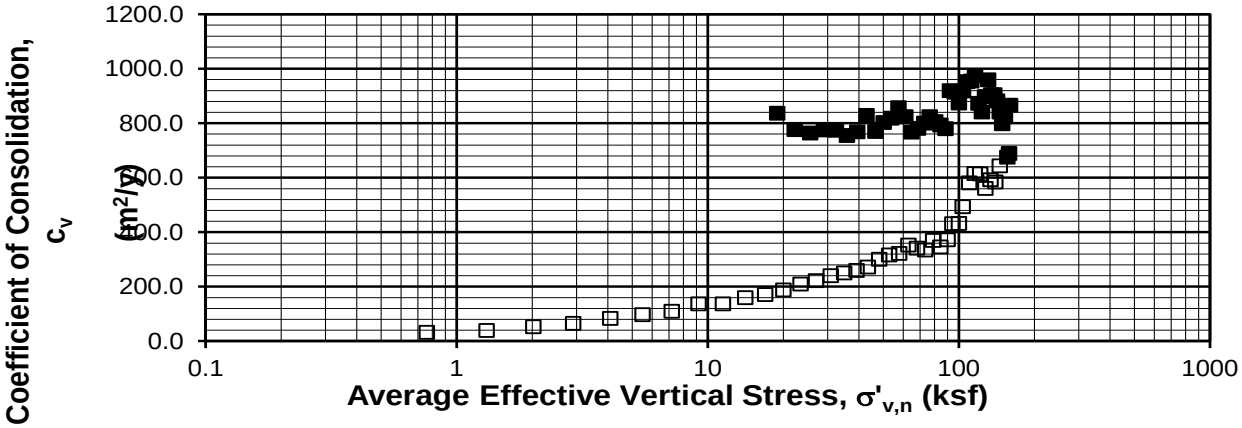
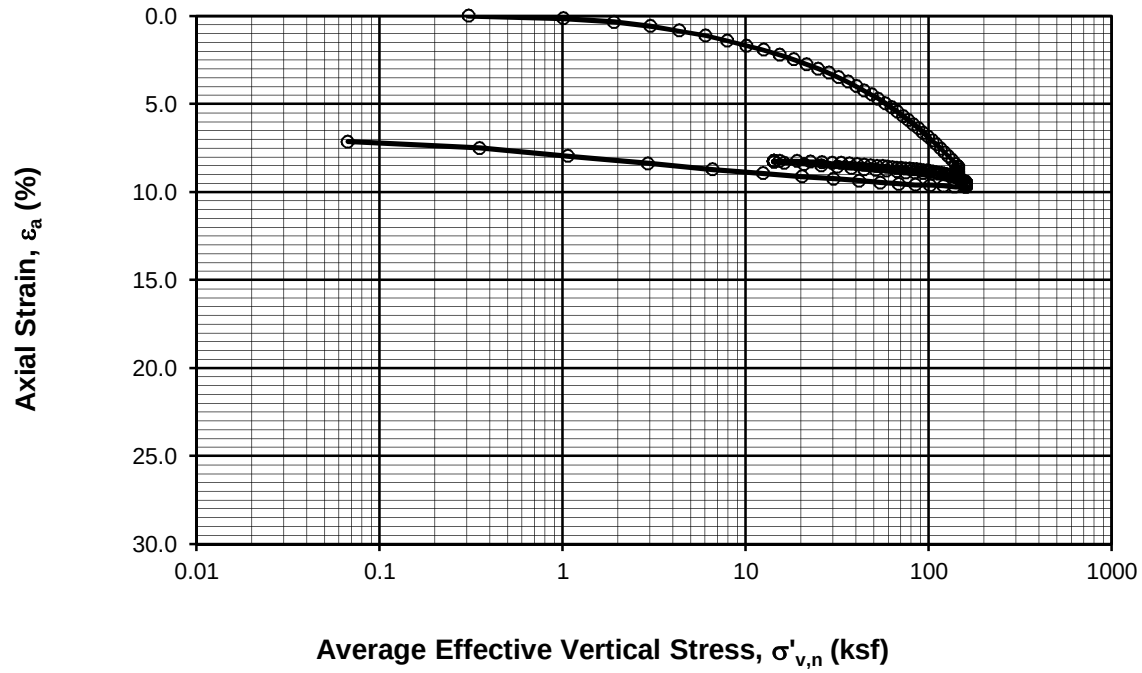
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-05, SAMPLE S-24a, DEPTH 71.29 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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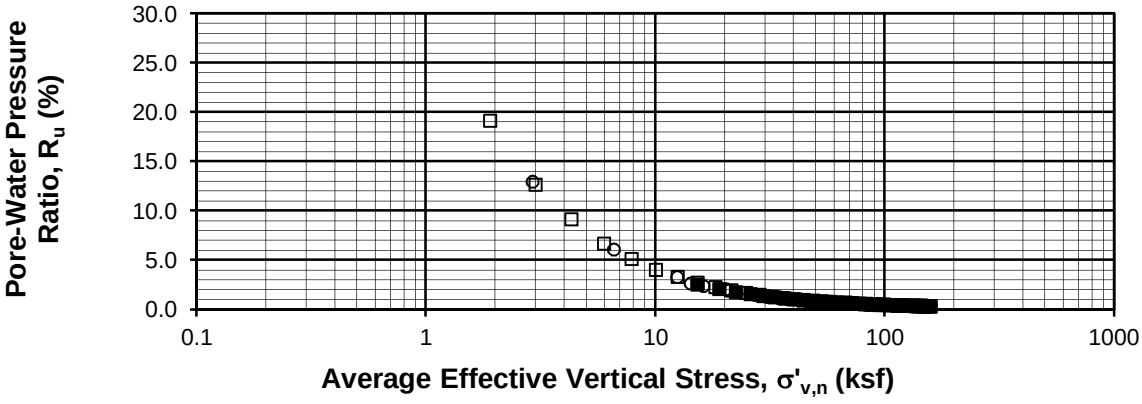
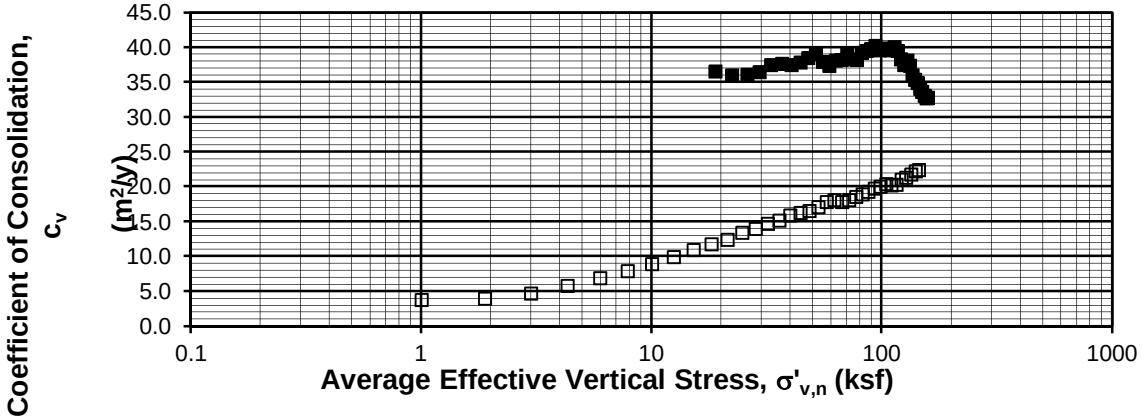
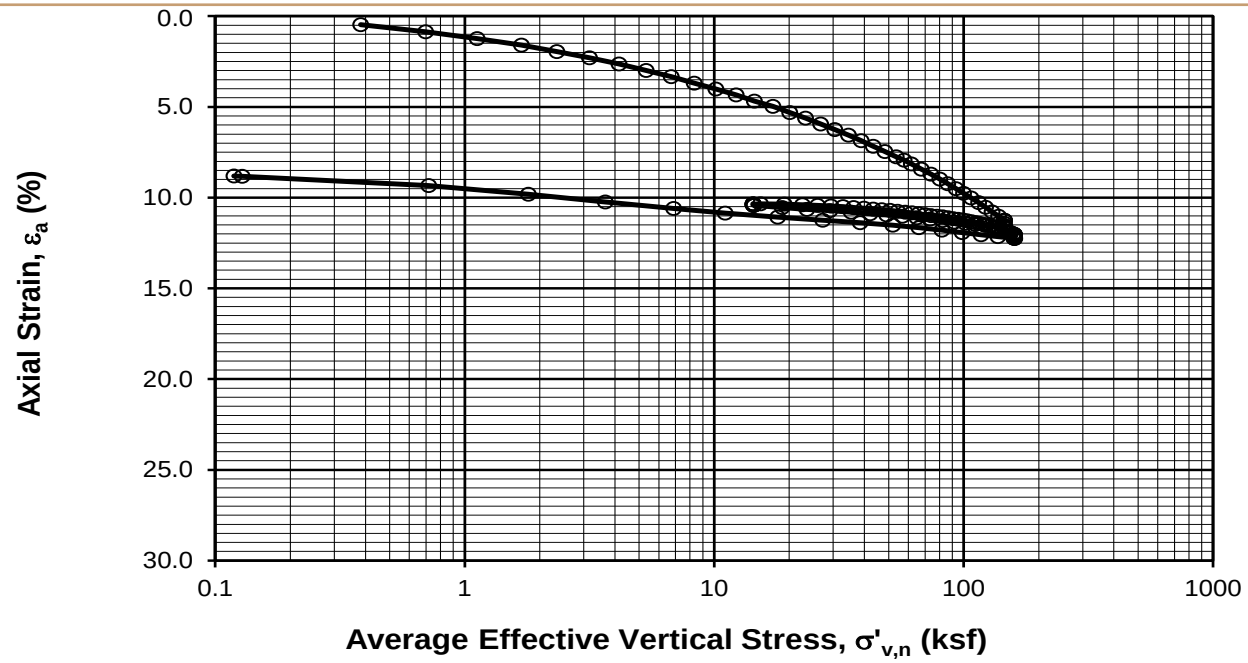
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-05, SAMPLE S-24b, DEPTH 70.55 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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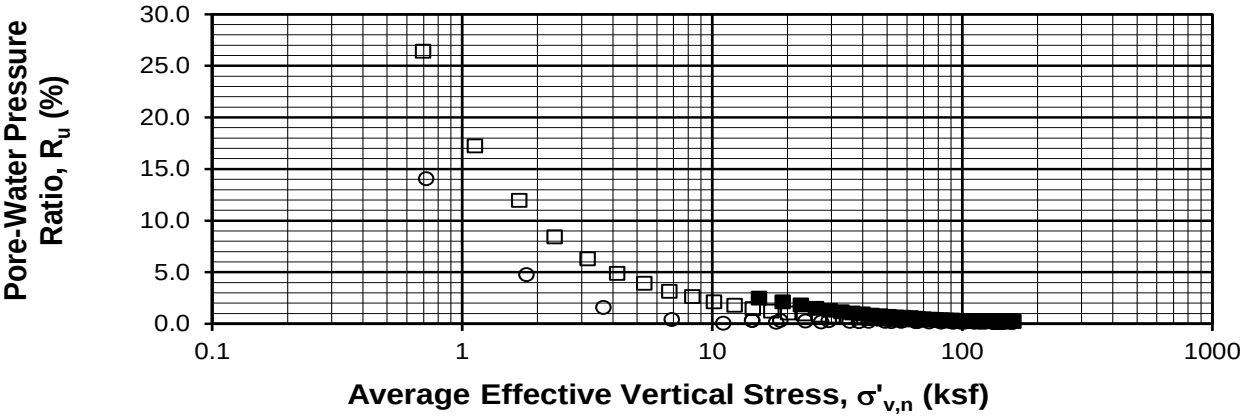
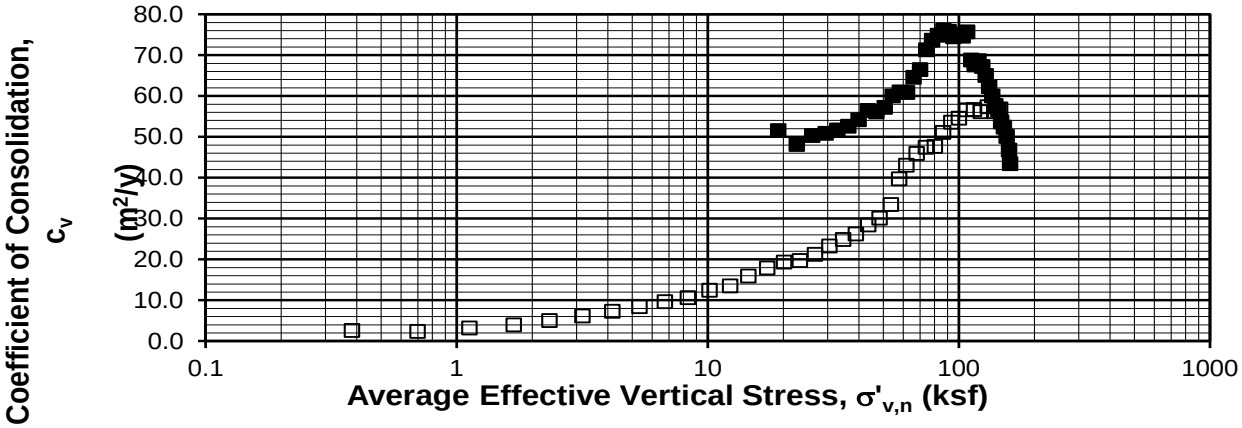
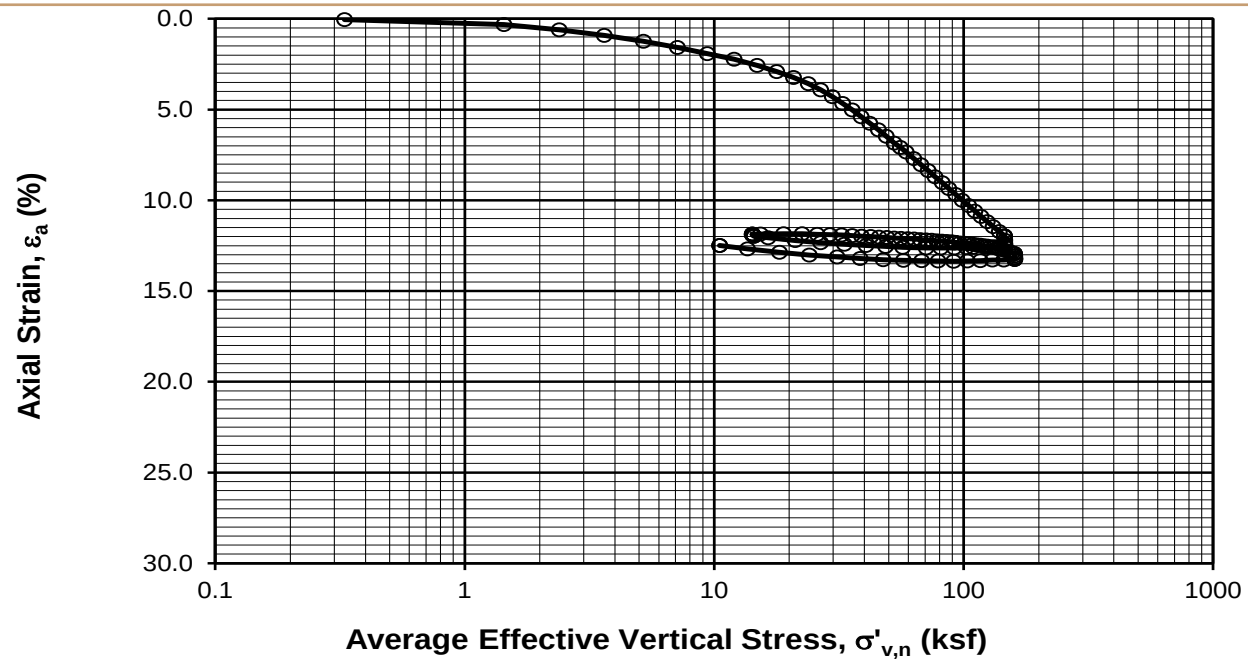
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-08, SAMPLE S-8, DEPTH 19.69 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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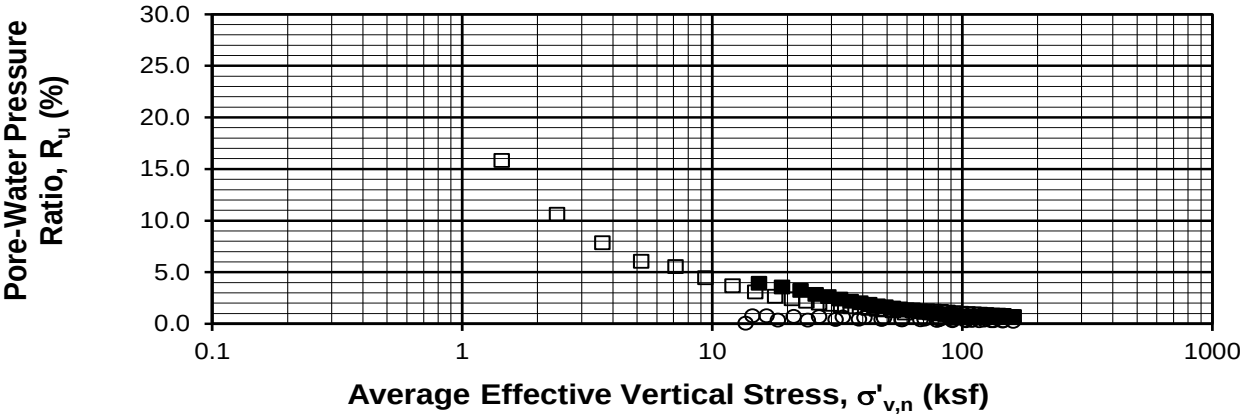
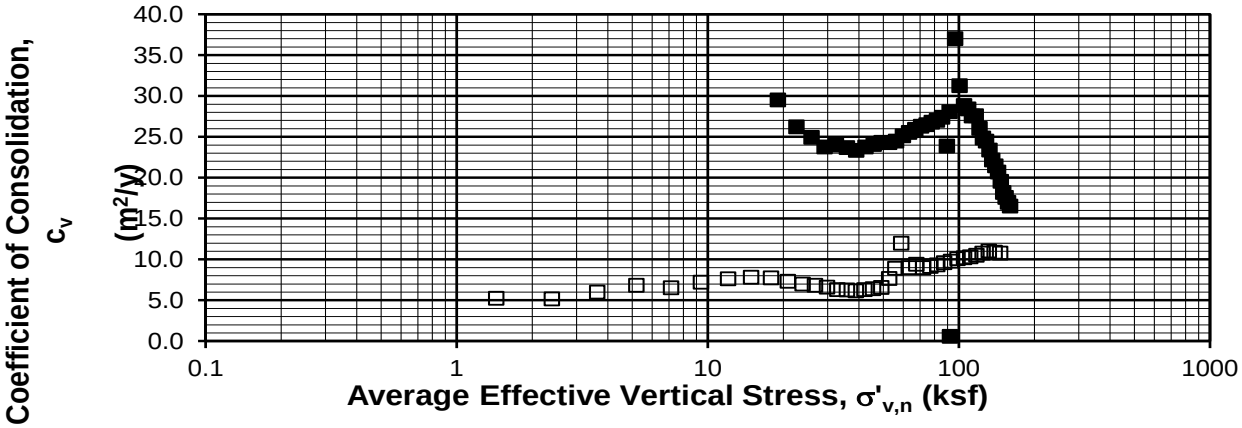
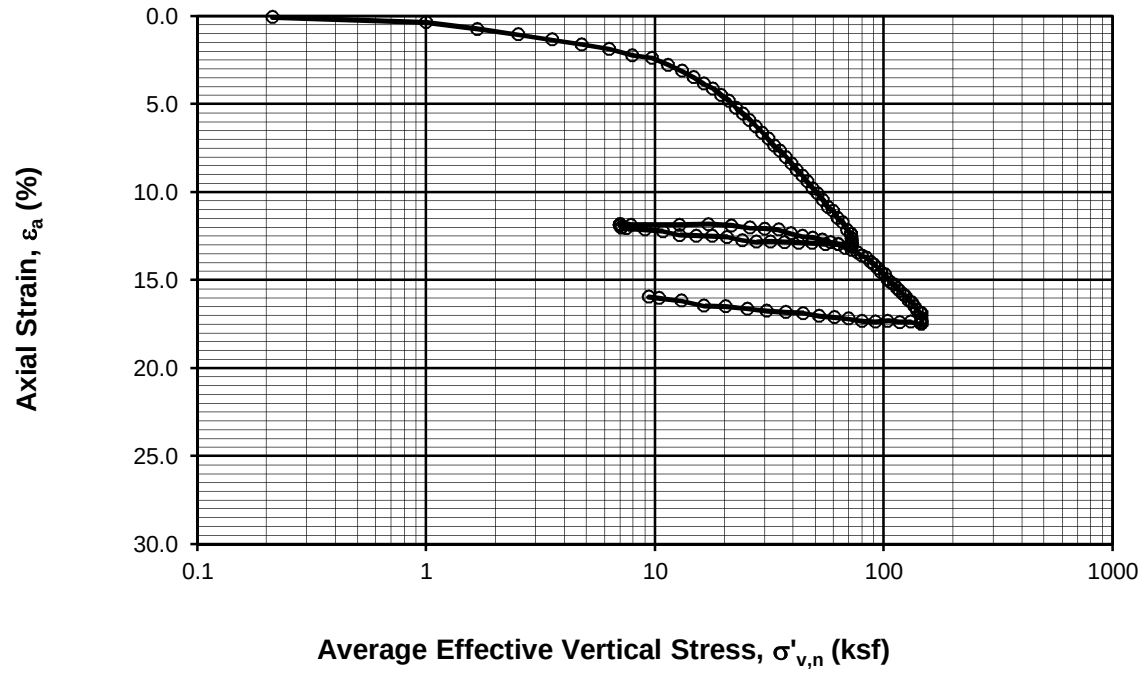
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-08, SAMPLE S-20a, DEPTH 58.07 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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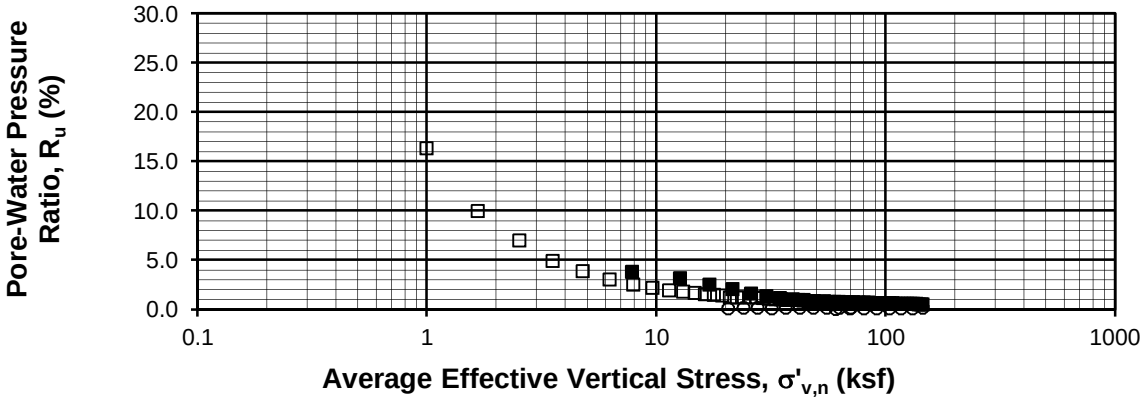
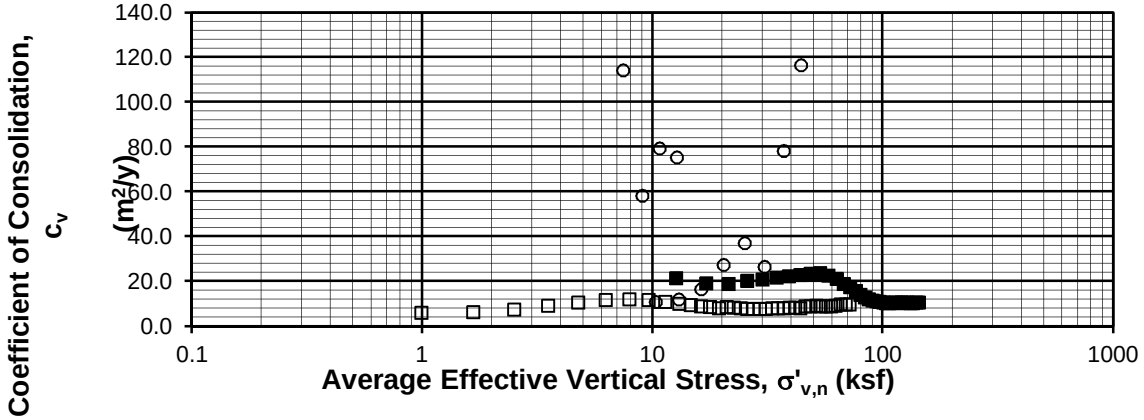
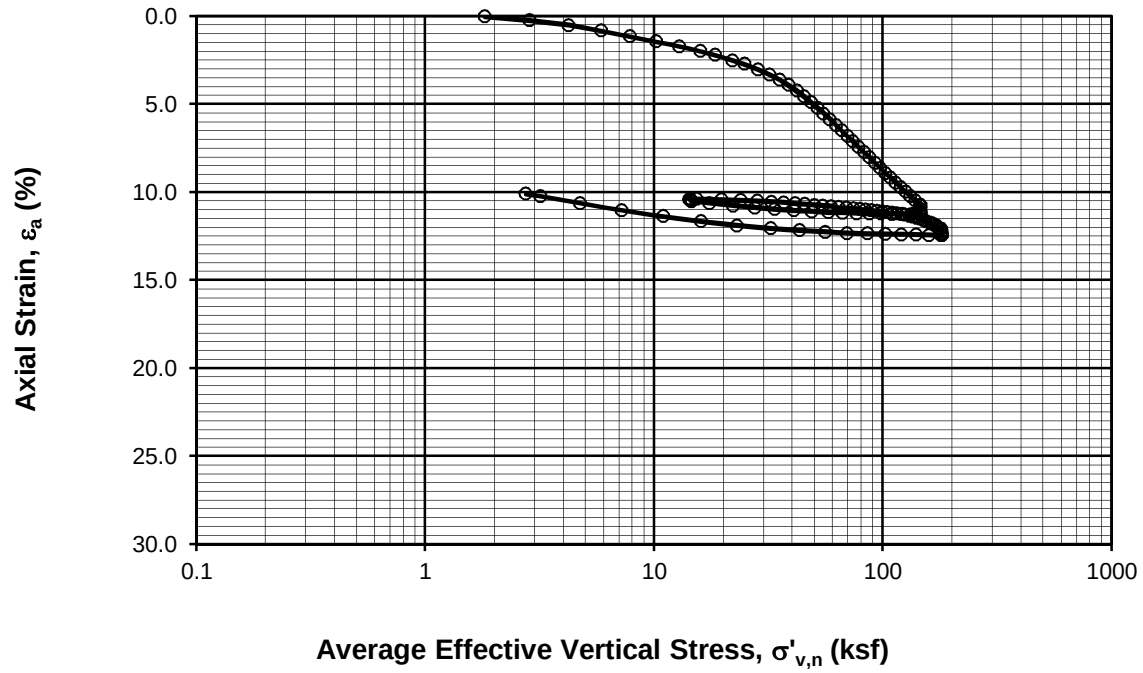
with solid symbols indicating reloading increments

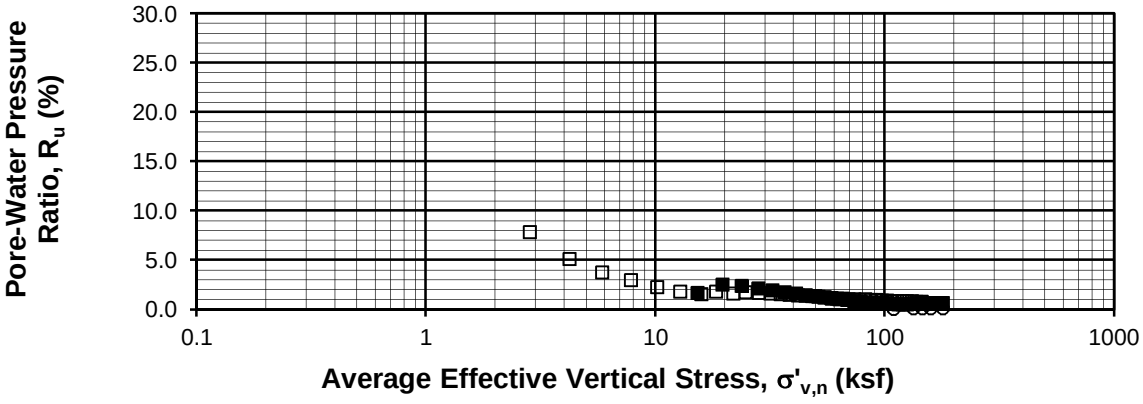


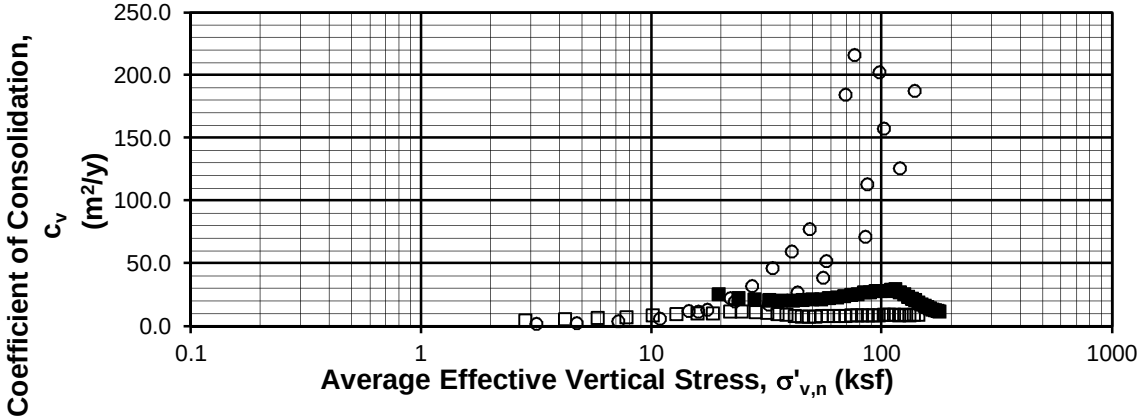


ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-08, SAMPLE S-20b, DEPTH 57.51 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

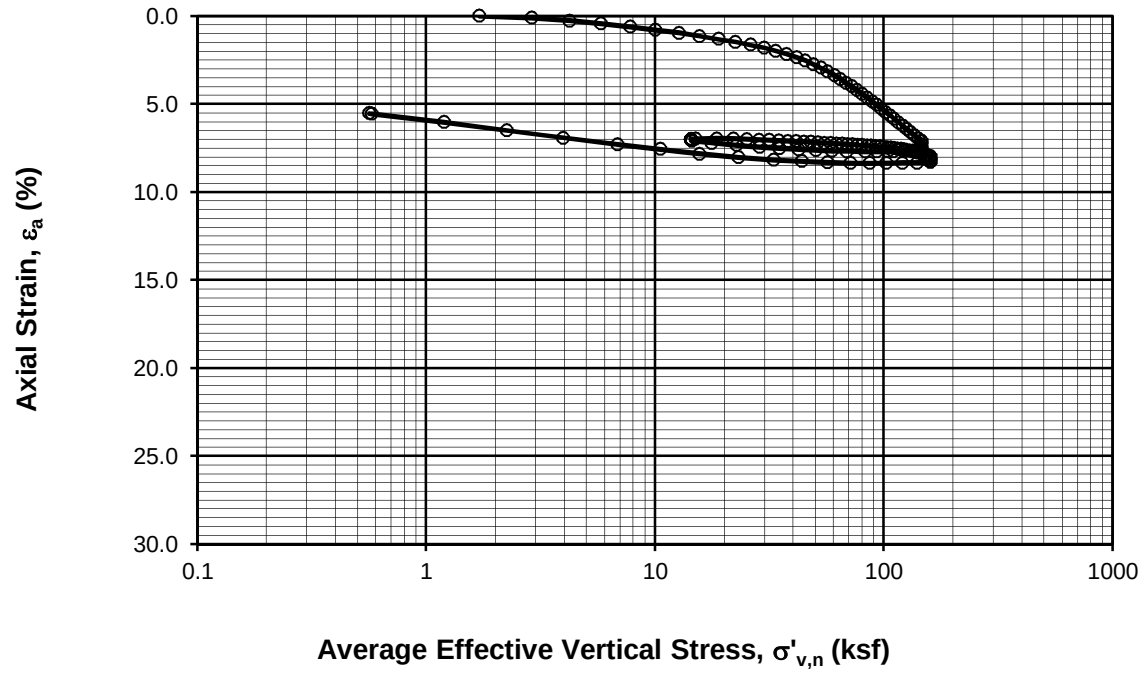


□ - Loading
○ - Unloading (Final)
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-08, SAMPLE S-24, DEPTH 76.29 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



□ - Loading
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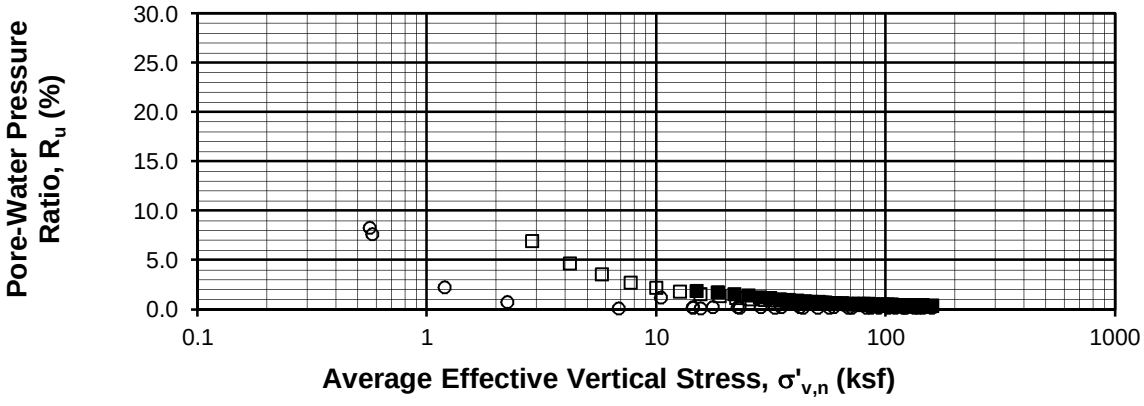
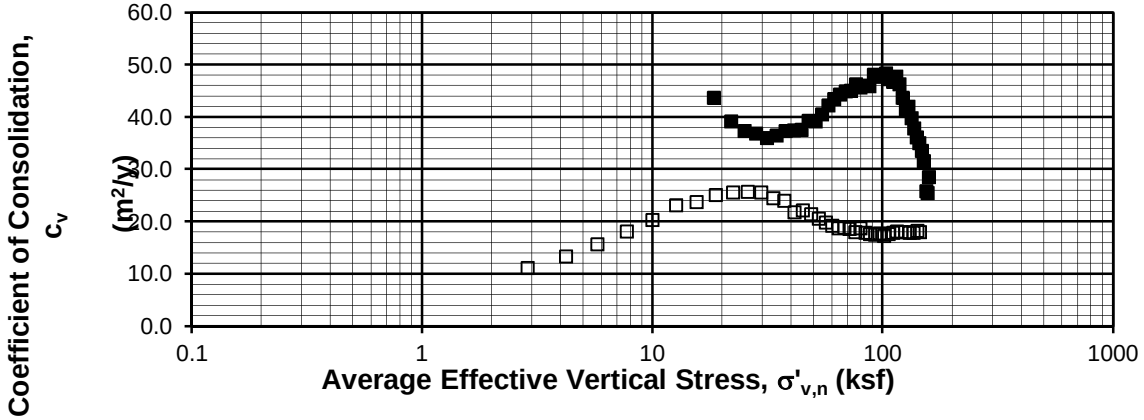
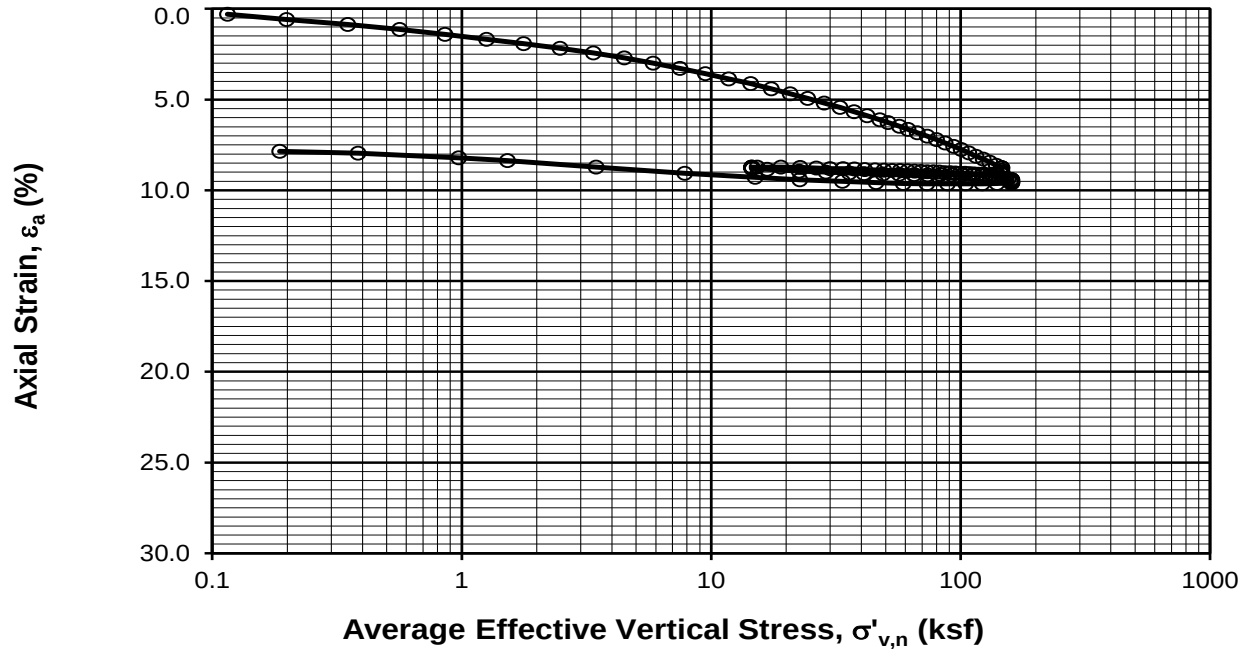
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-08, SAMPLE S-31, DEPTH 120.85 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



□ - Loading
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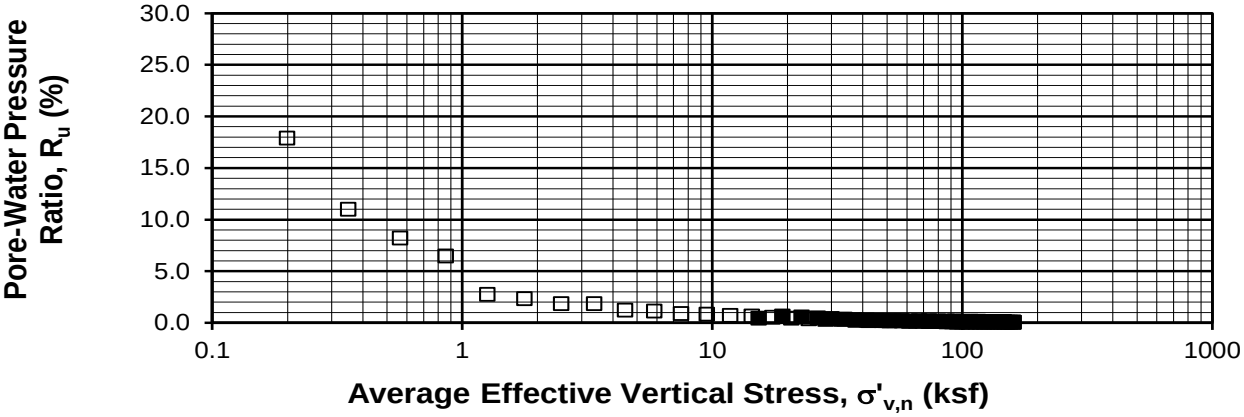
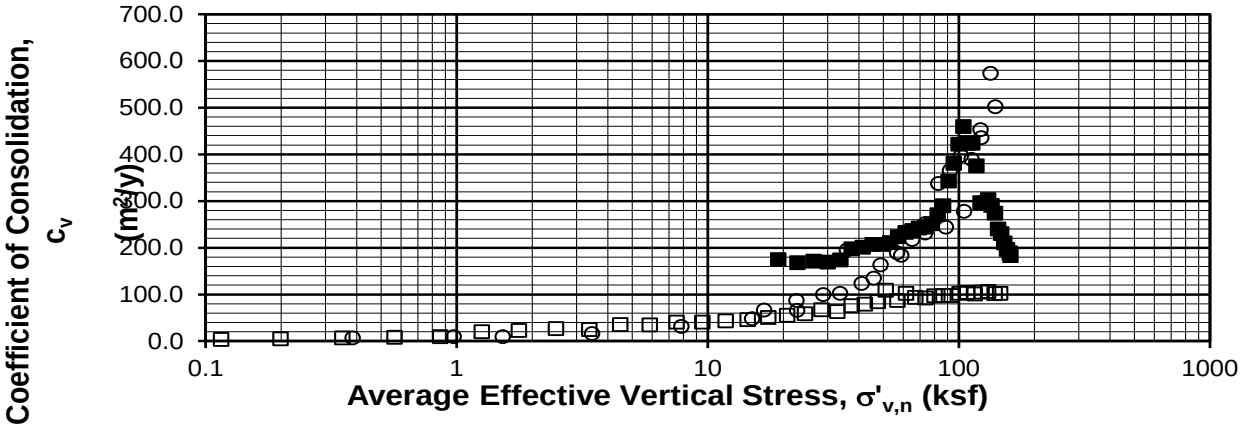
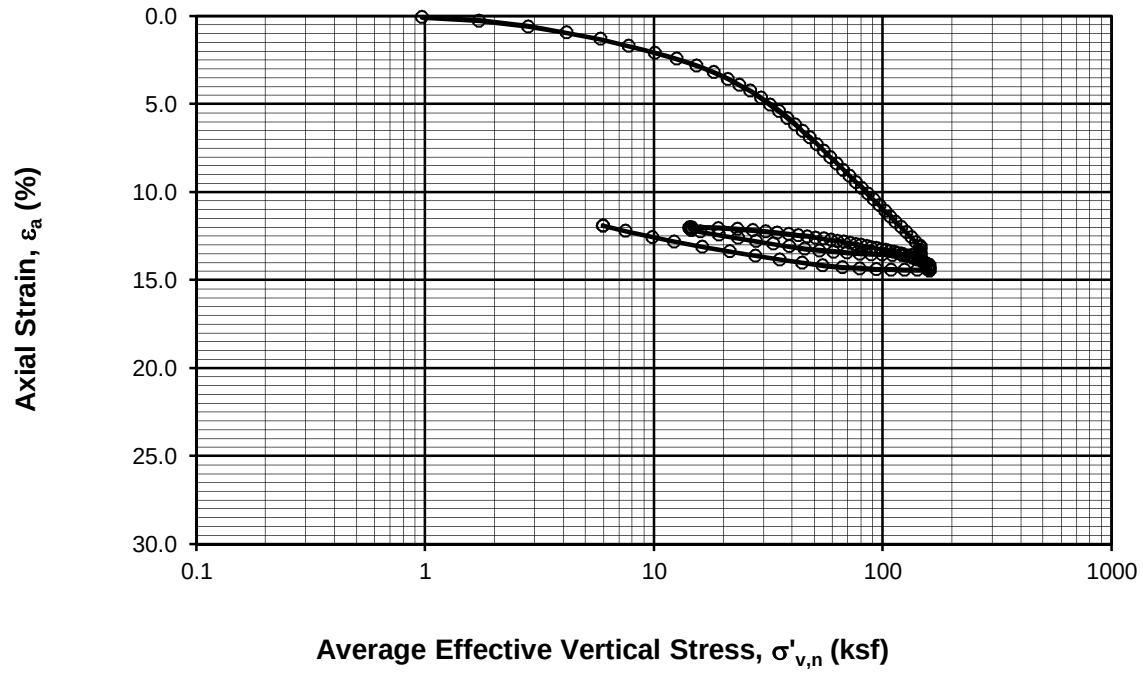
with solid symbols indicating reloading increments

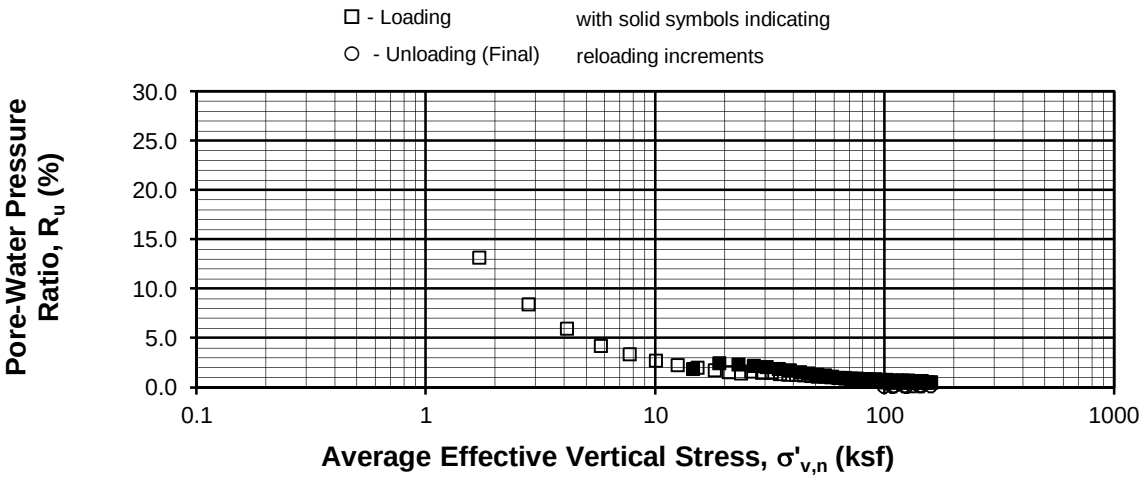


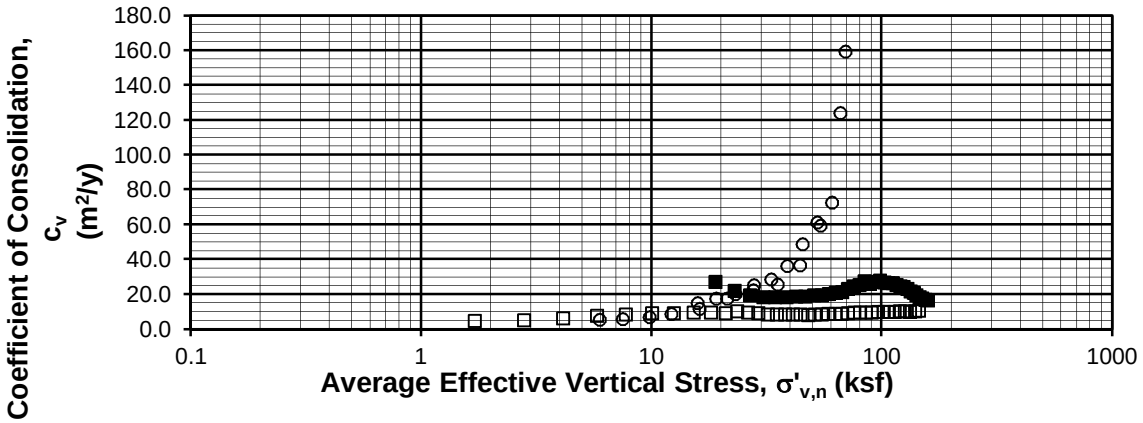


ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-09, SAMPLE S-2a, DEPTH 5.58 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

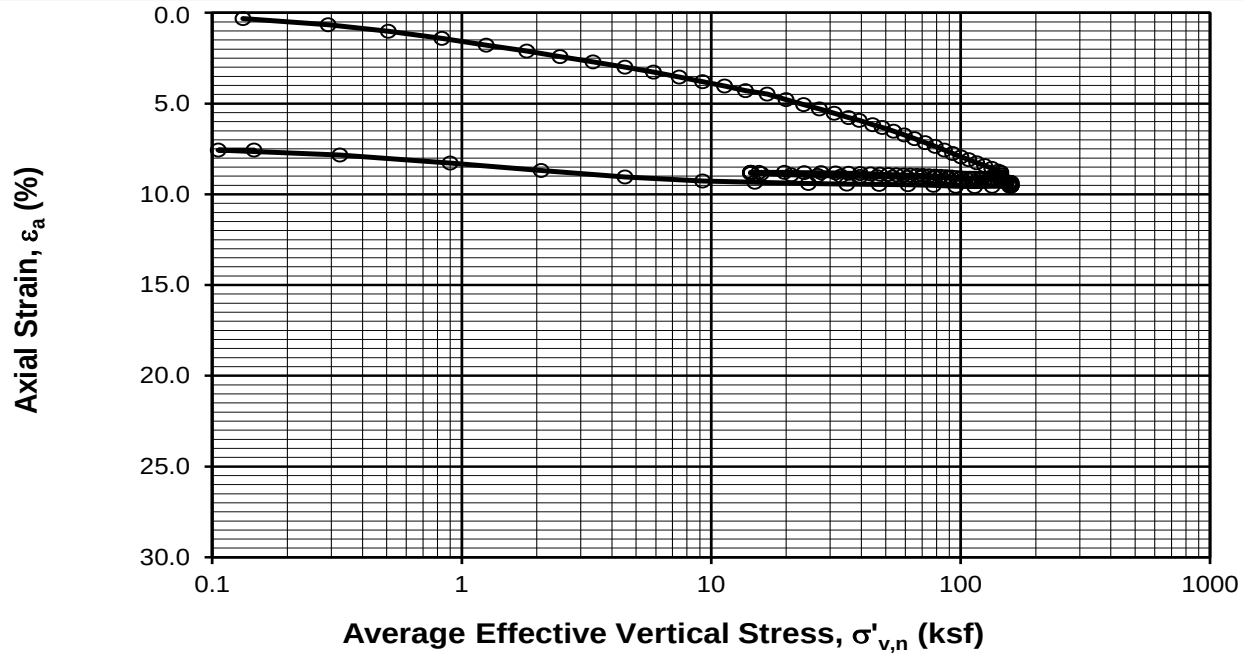
PLATE E7-12



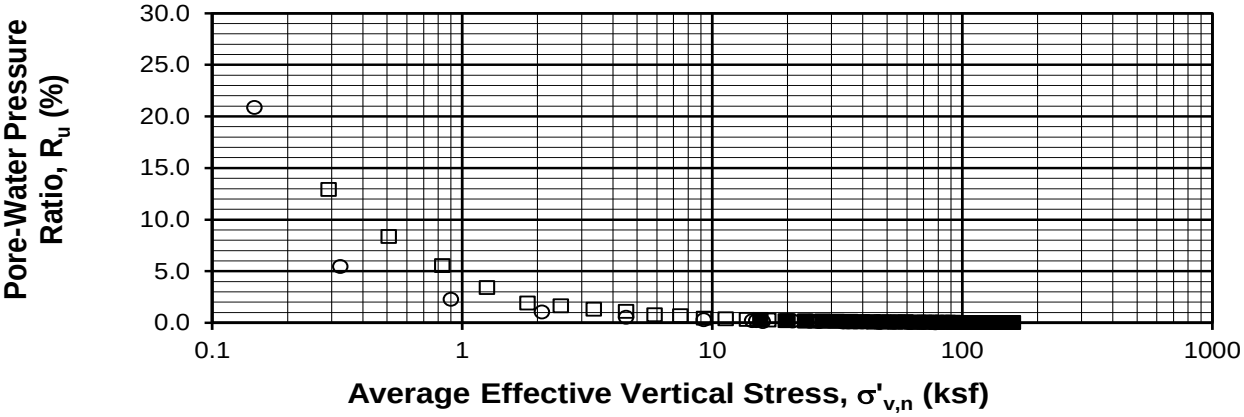


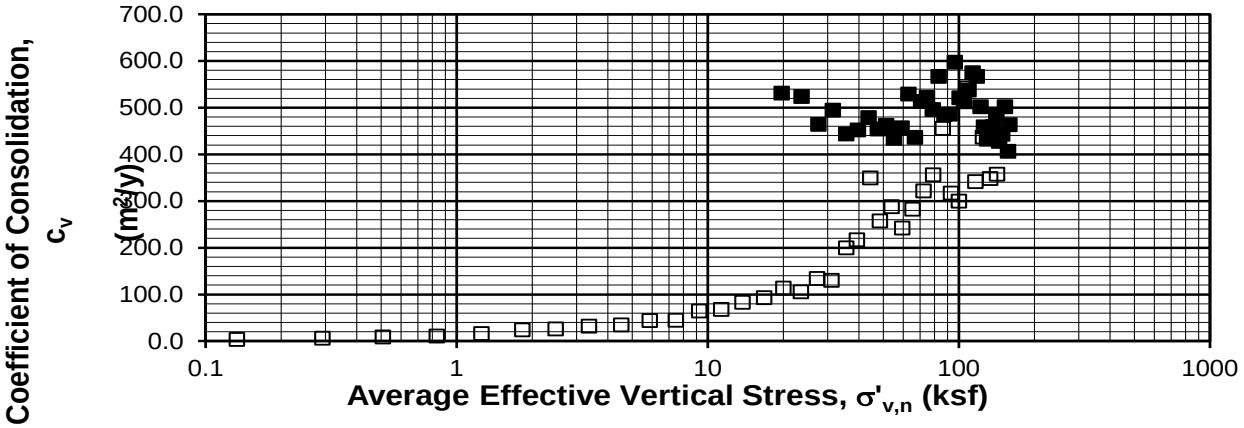


ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-09, SAMPLE S-2b, DEPTH 4.85 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

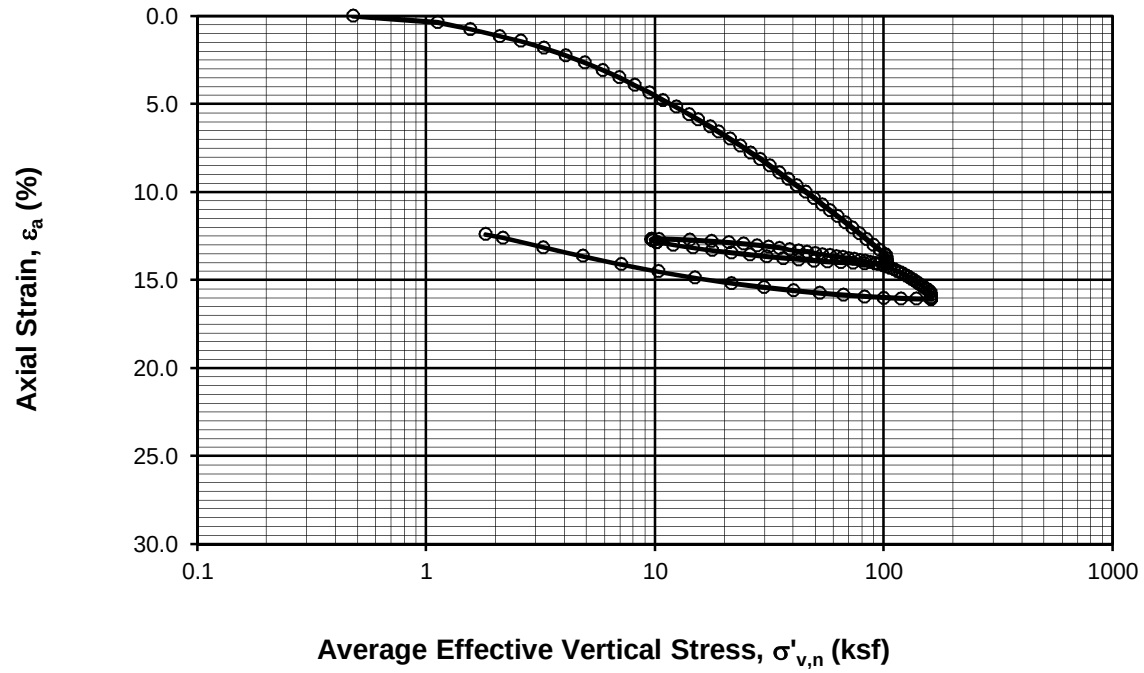


□ - Loading
○ - Unloading (Final)
with solid symbols indicating reloading increments

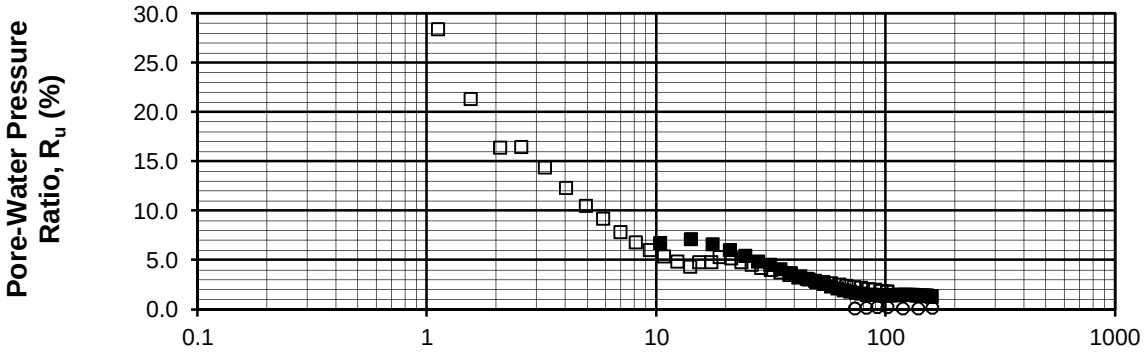


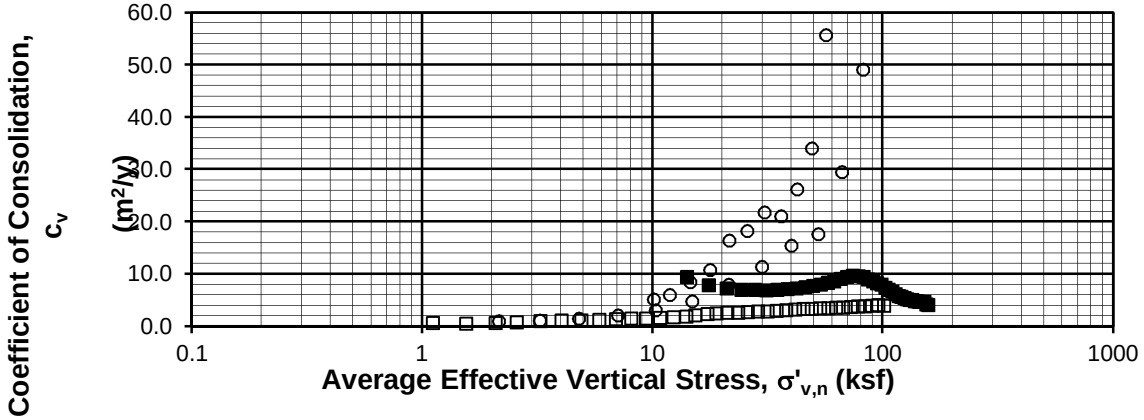


ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-09, SAMPLE S-21a, DEPTH 66.77 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

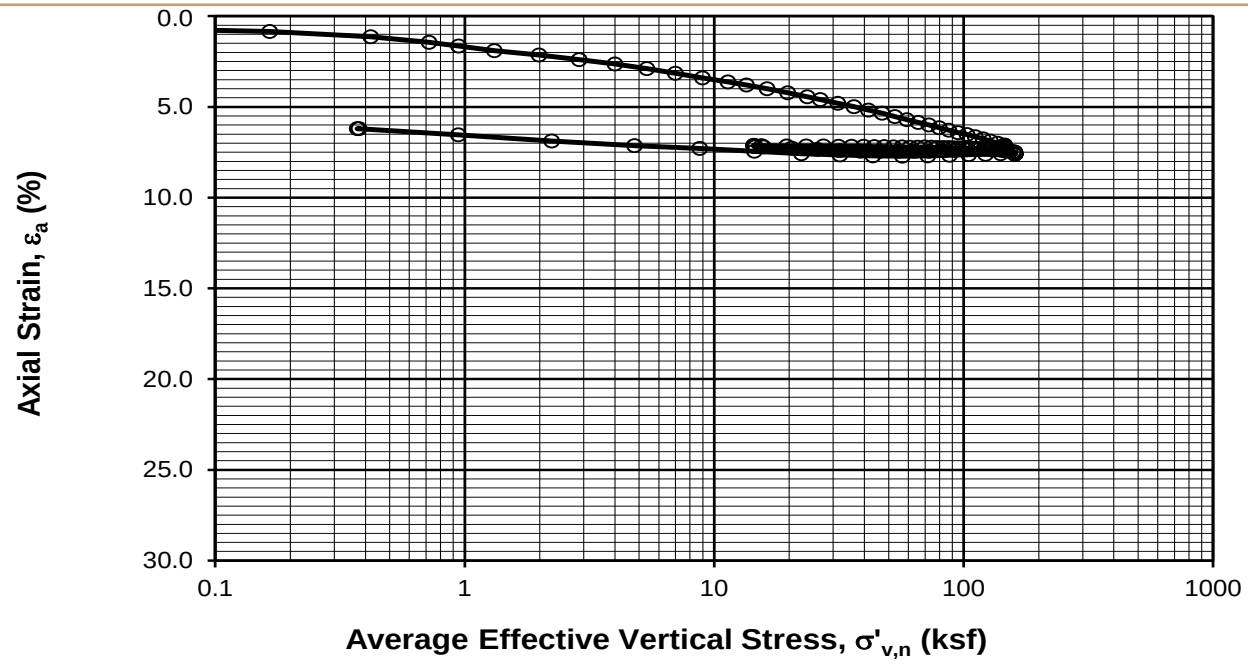


□ - Loading
○ - Unloading (Final)
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-09, SAMPLE S-21b, DEPTH 66.62 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



□ - Loading
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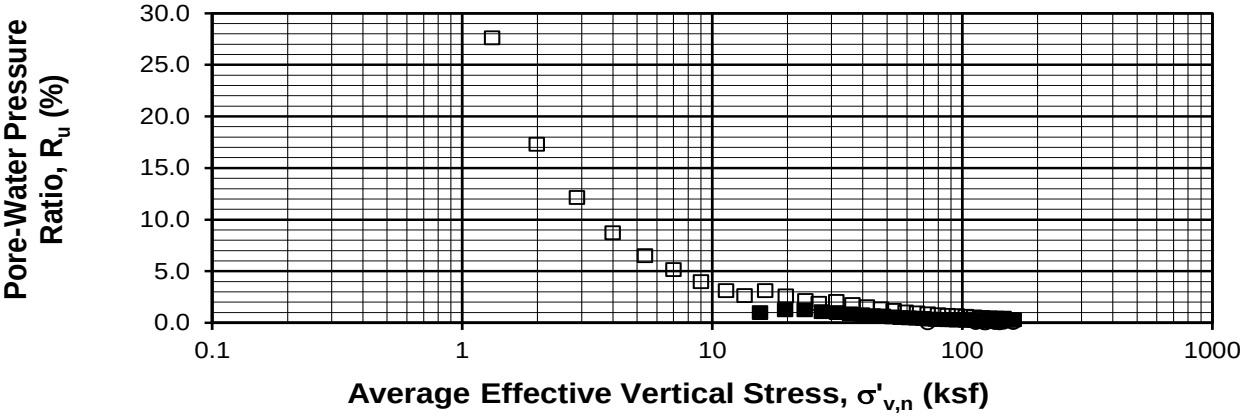
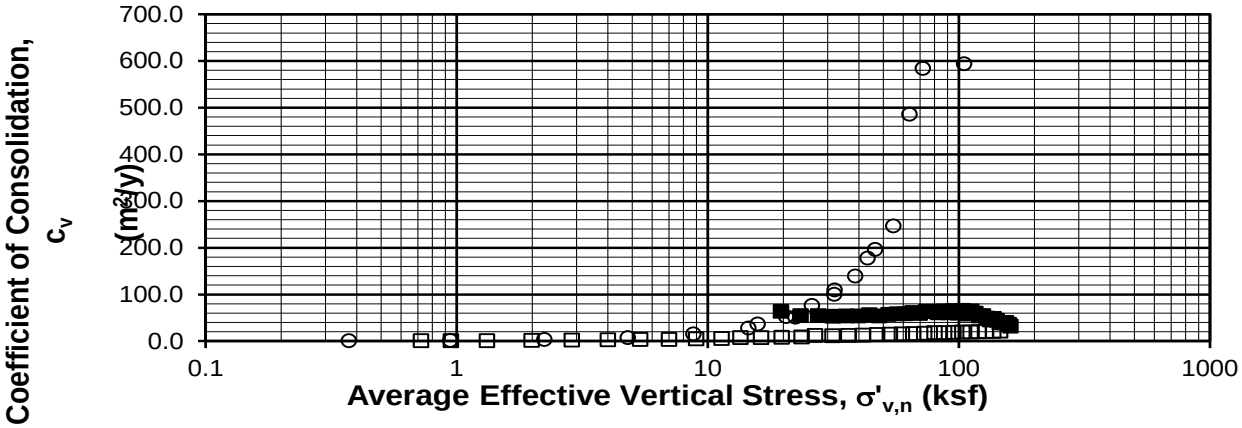
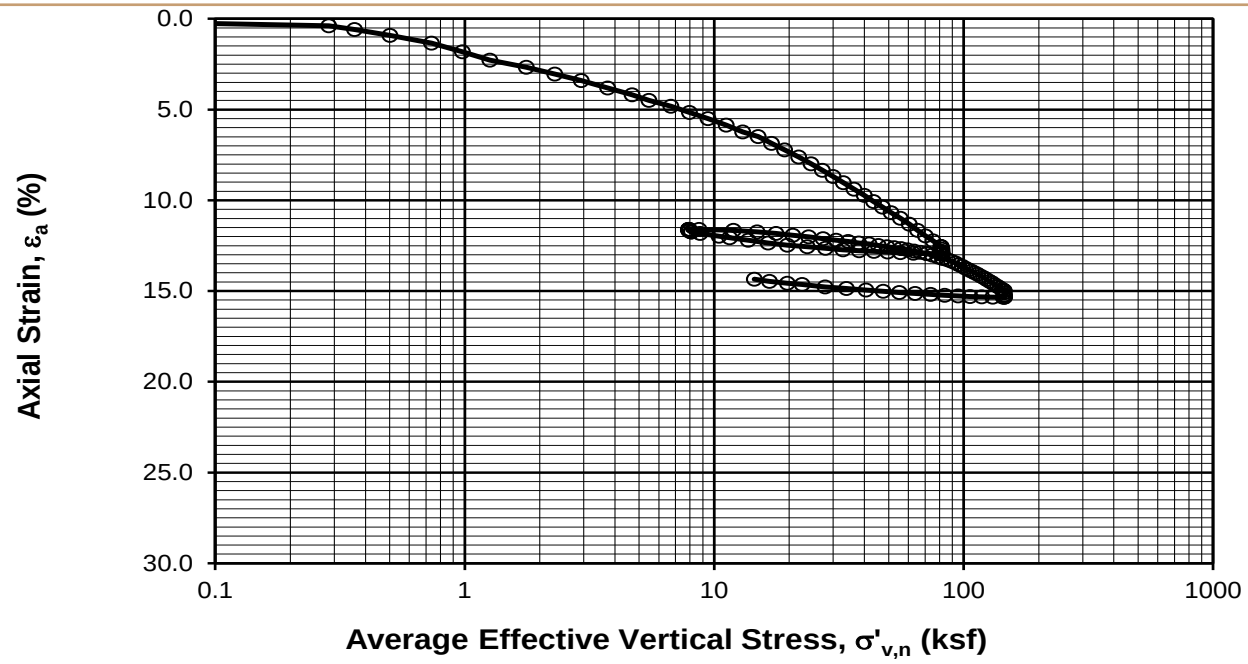
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-12, SAMPLE S-17, DEPTH 41.67 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



□ - Loading
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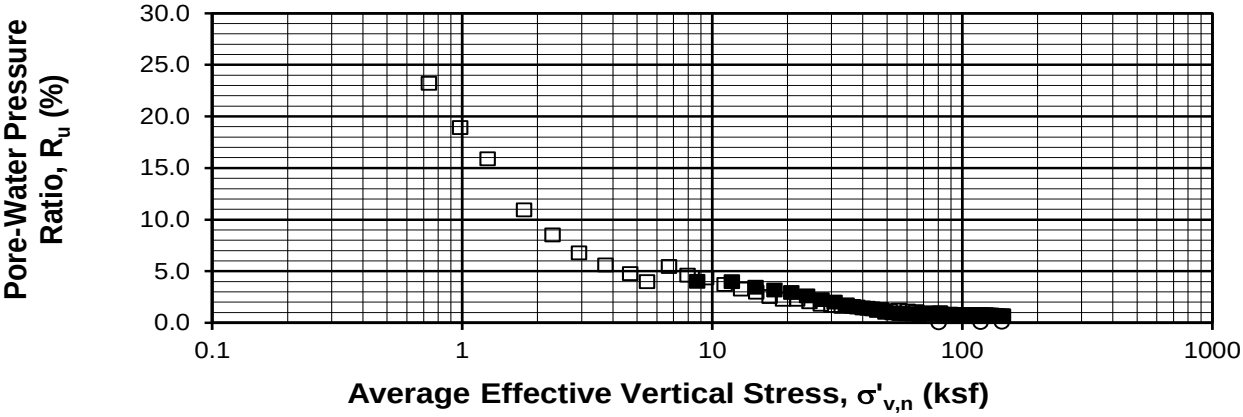
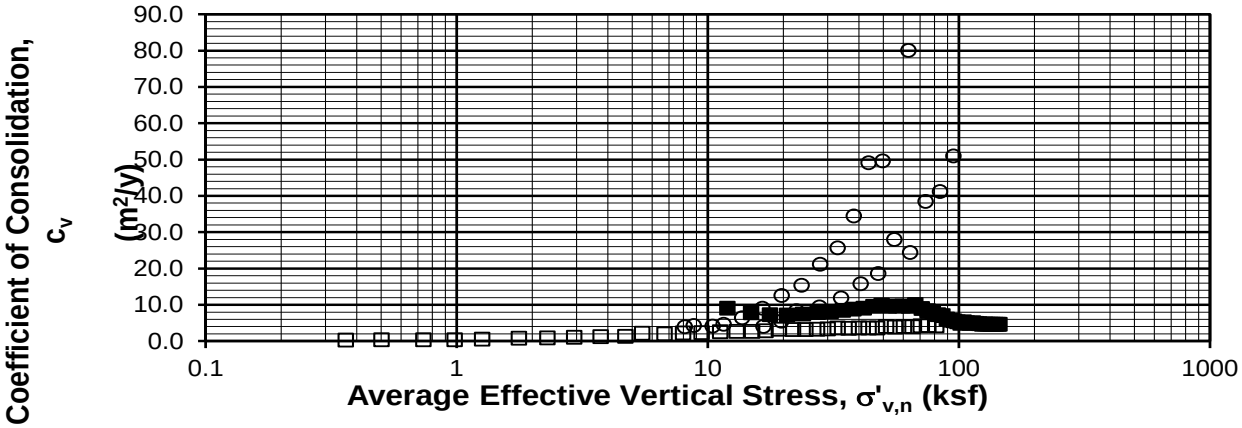
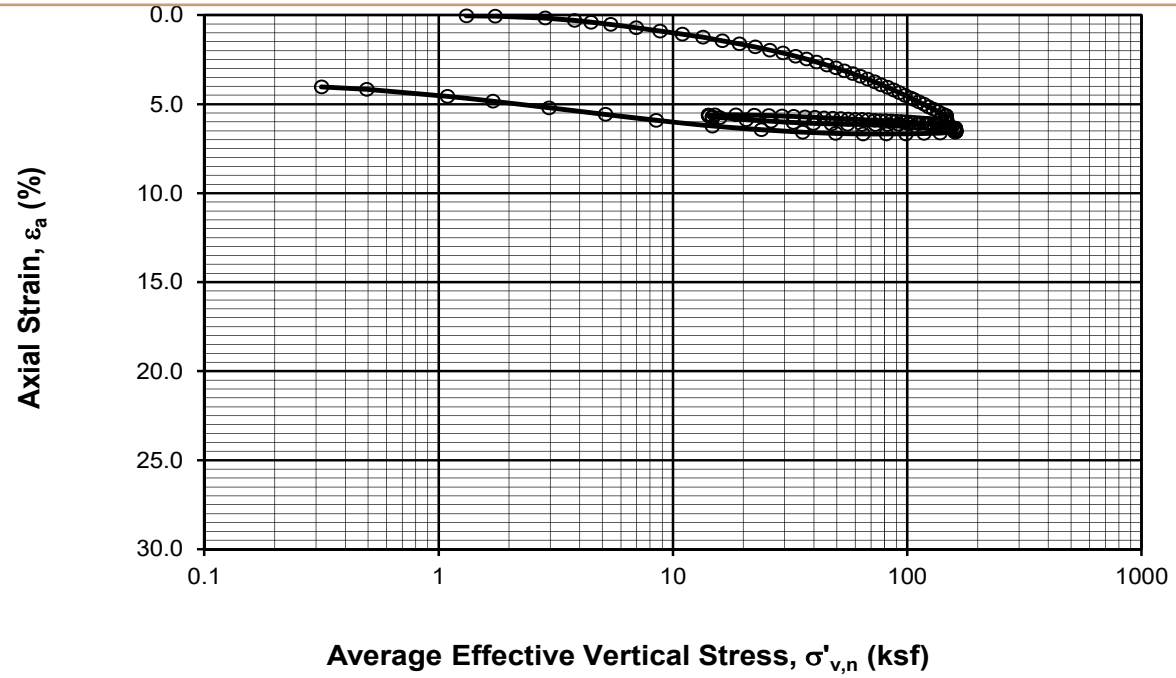
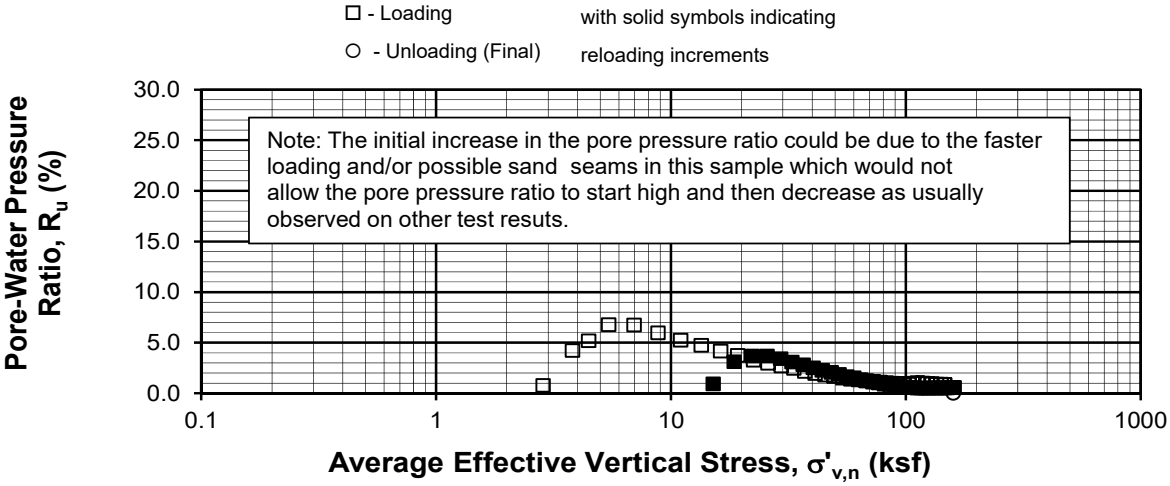
with solid symbols indicating reloading increments

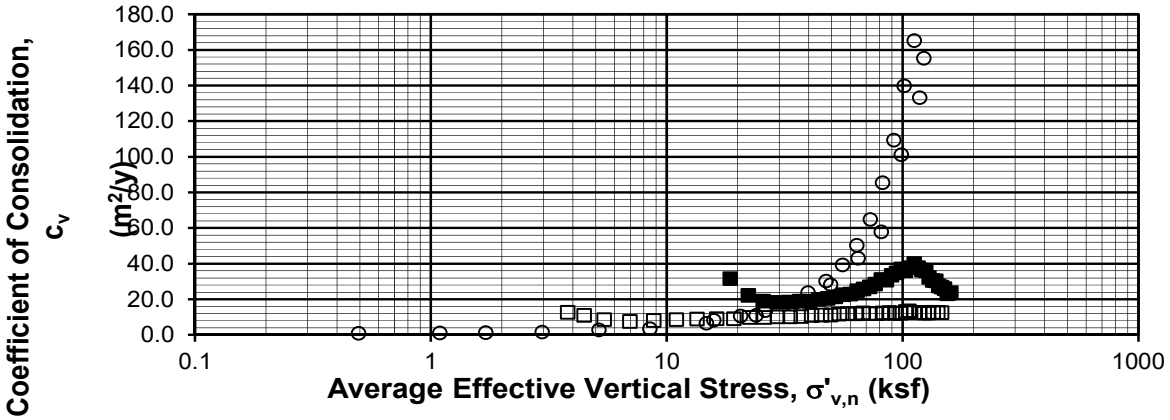




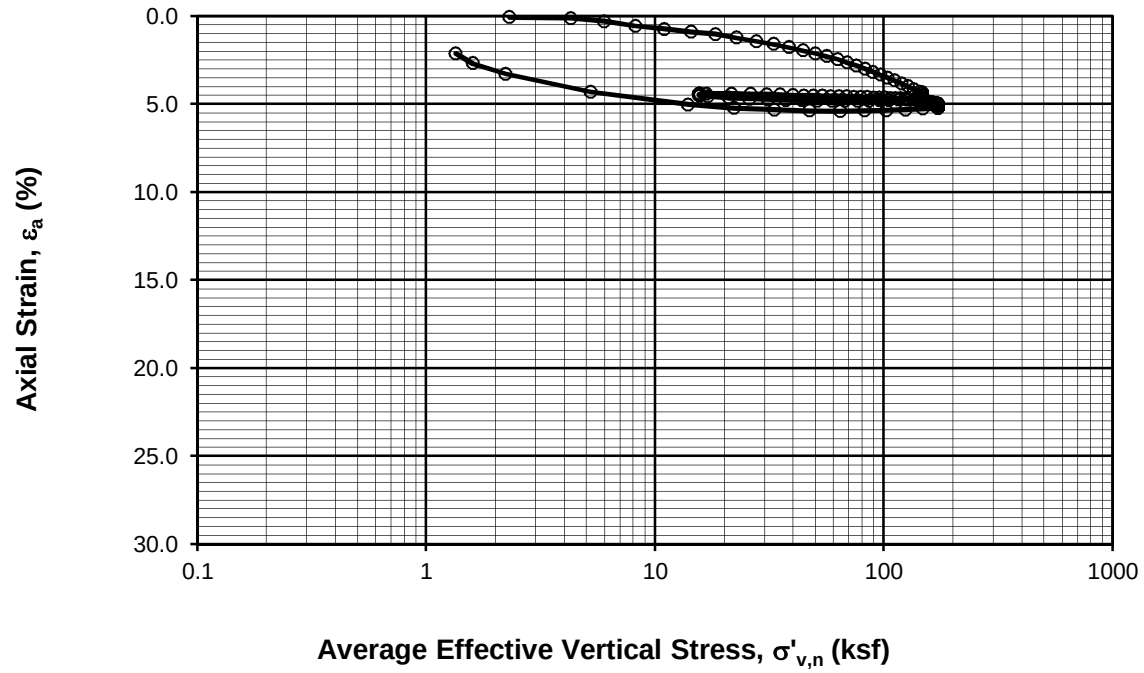
ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-15, SAMPLE S-22, DEPTH 76.61 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA







ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-15, SAMPLE S-29a, DEPTH 119.09 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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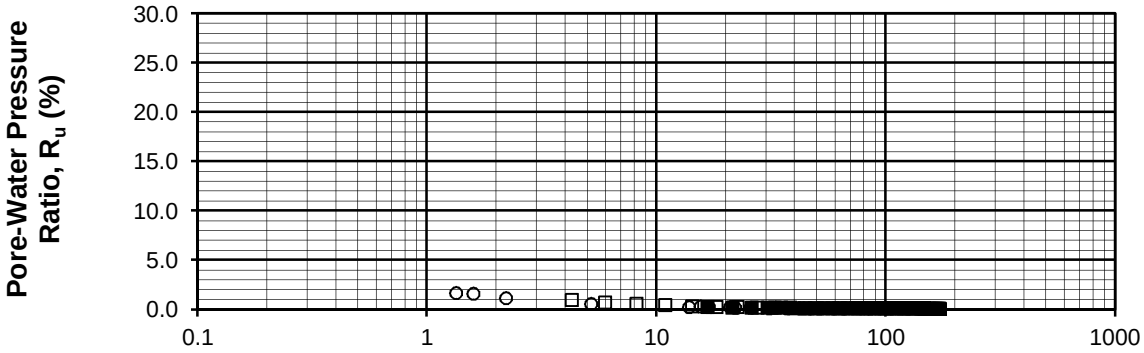
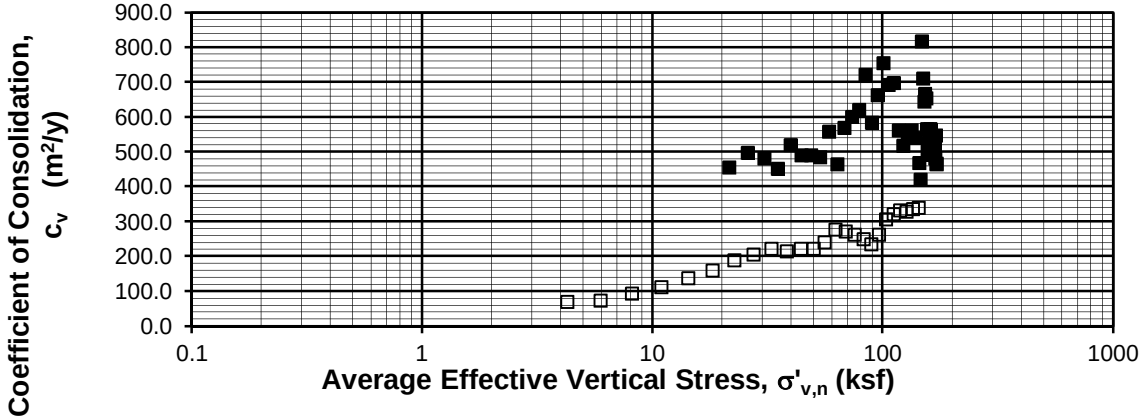
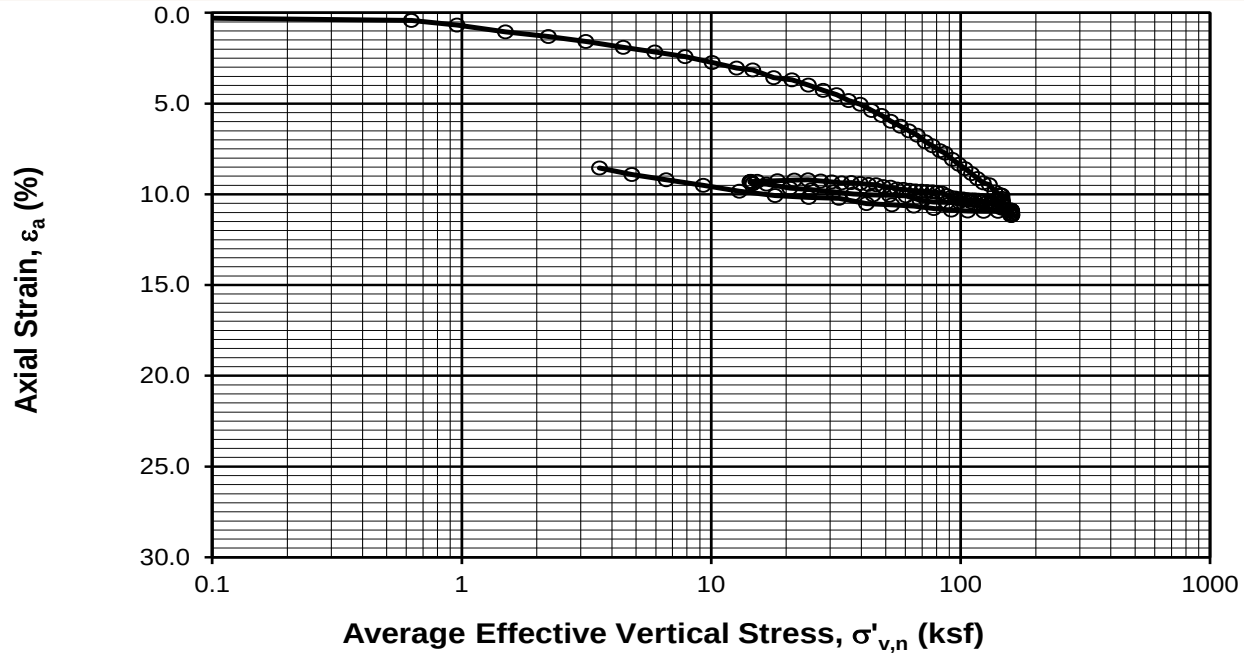
with solid symbols indicating reloading increments





ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-15, SAMPLE S-29b, DEPTH 118.91 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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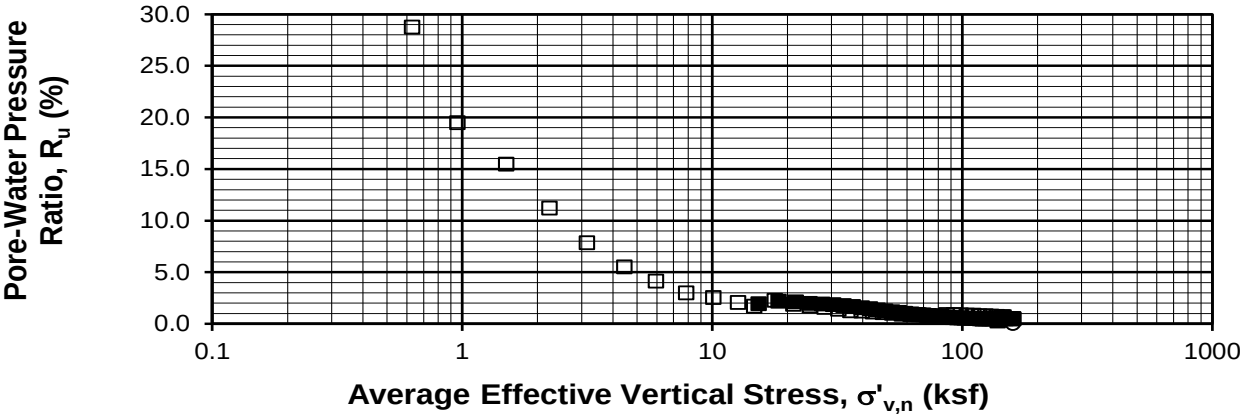
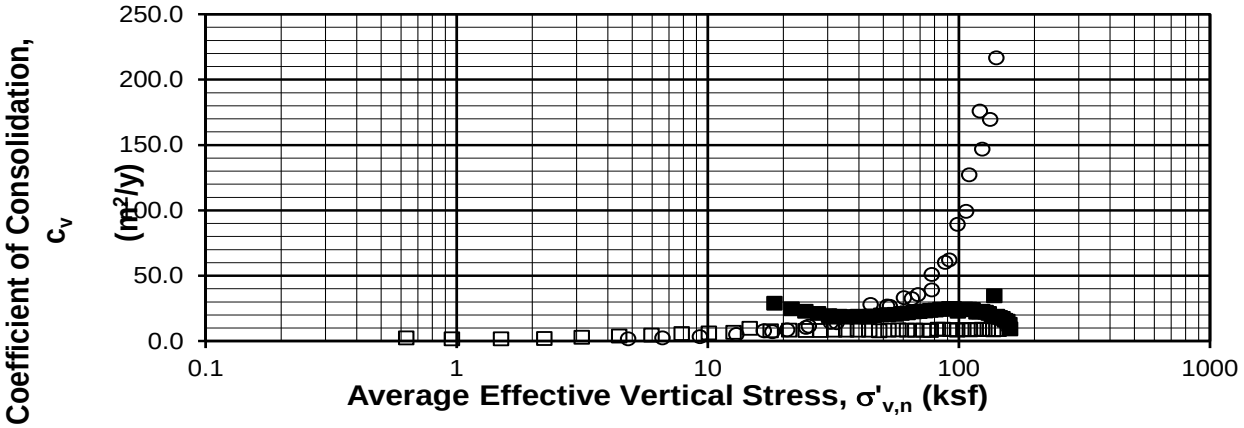
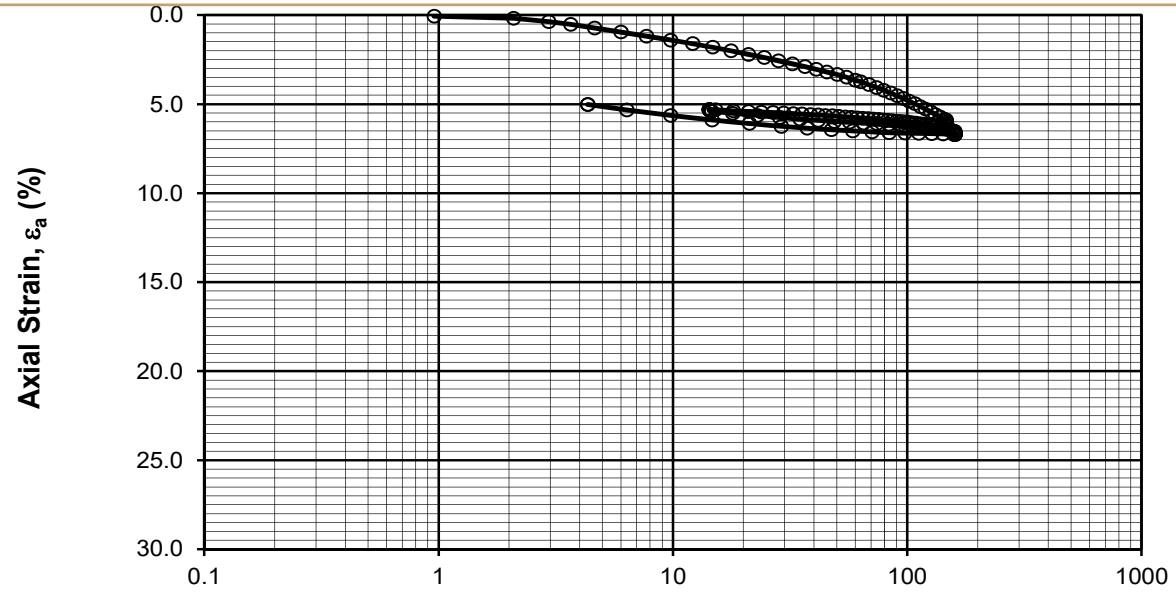
○ - Unloading (Final)
with solid symbols indicating reloading increments

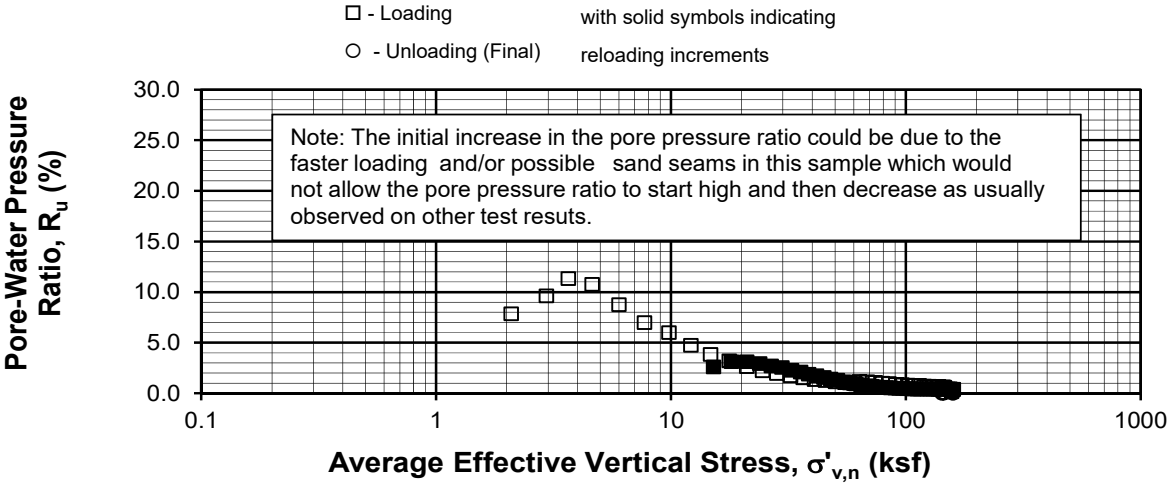


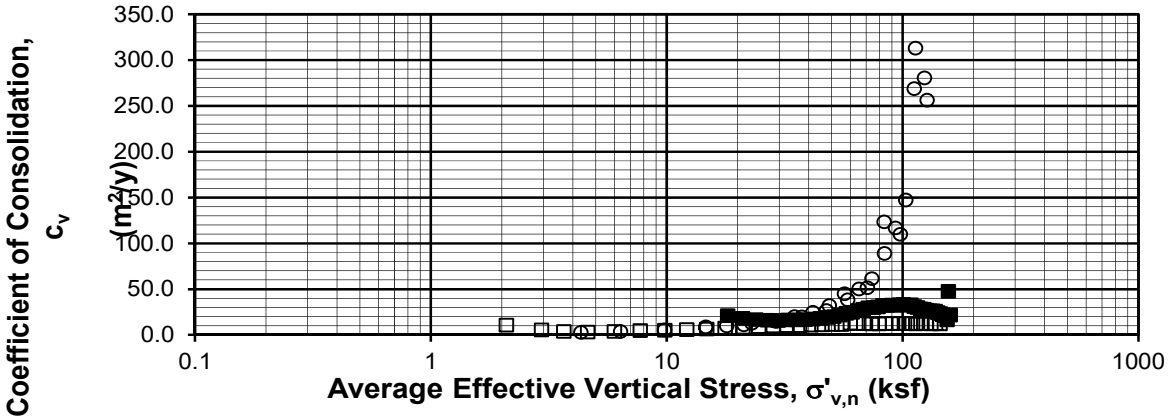


ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-16, SAMPLE S-12, DEPTH 30.51 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

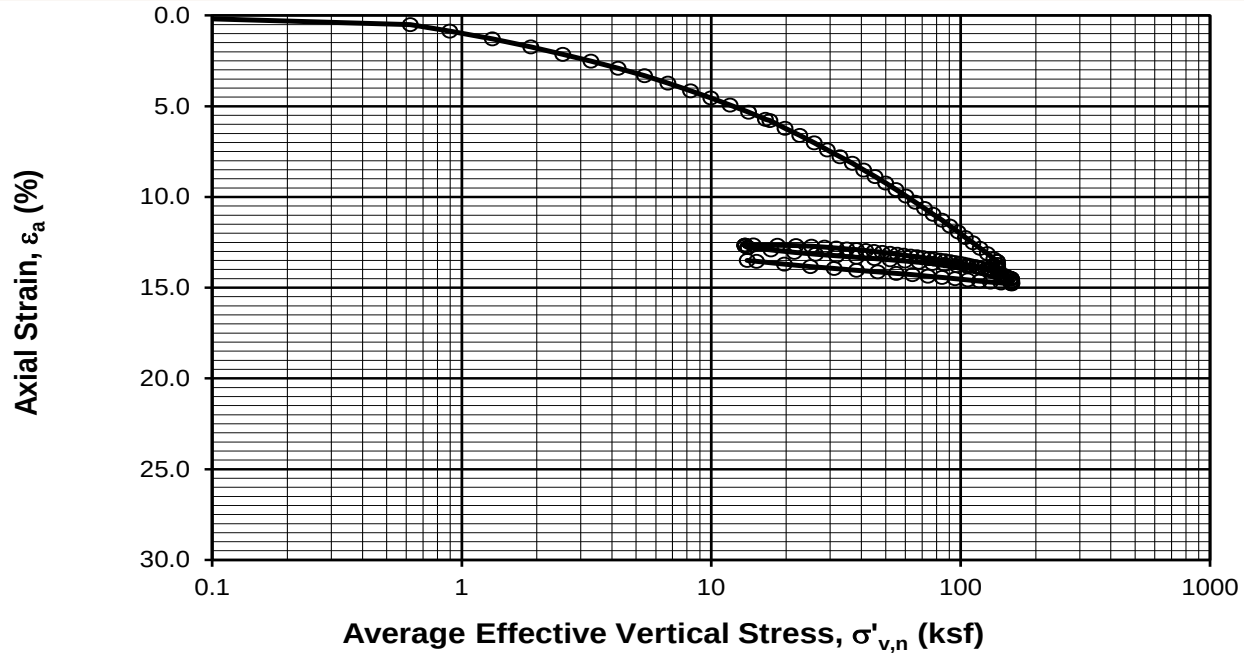
PLATE E7-20







ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-16, SAMPLE NO. S-37, DEPTH 150.43 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



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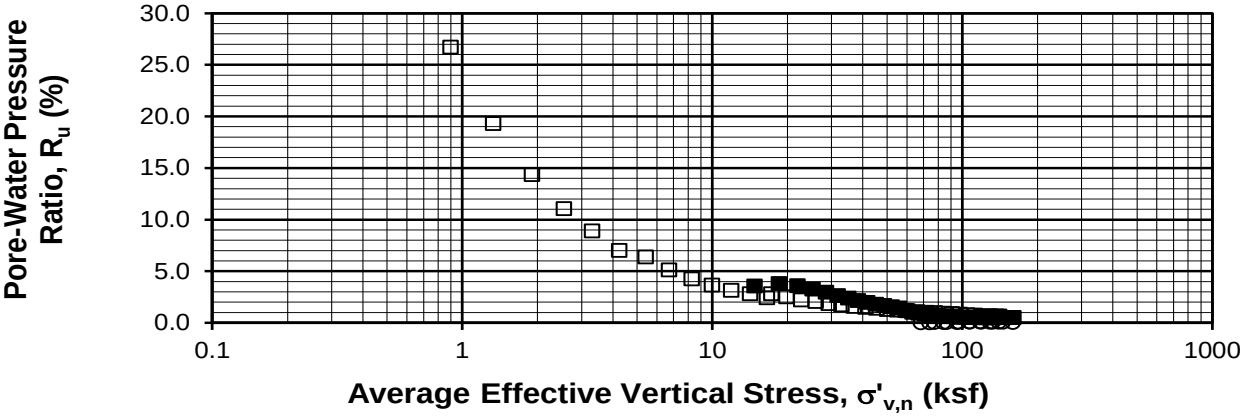
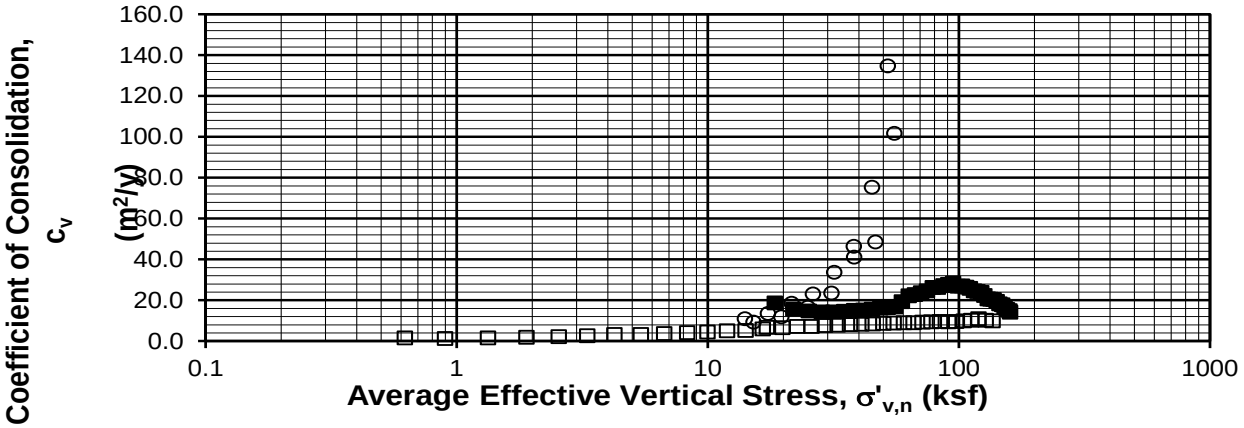
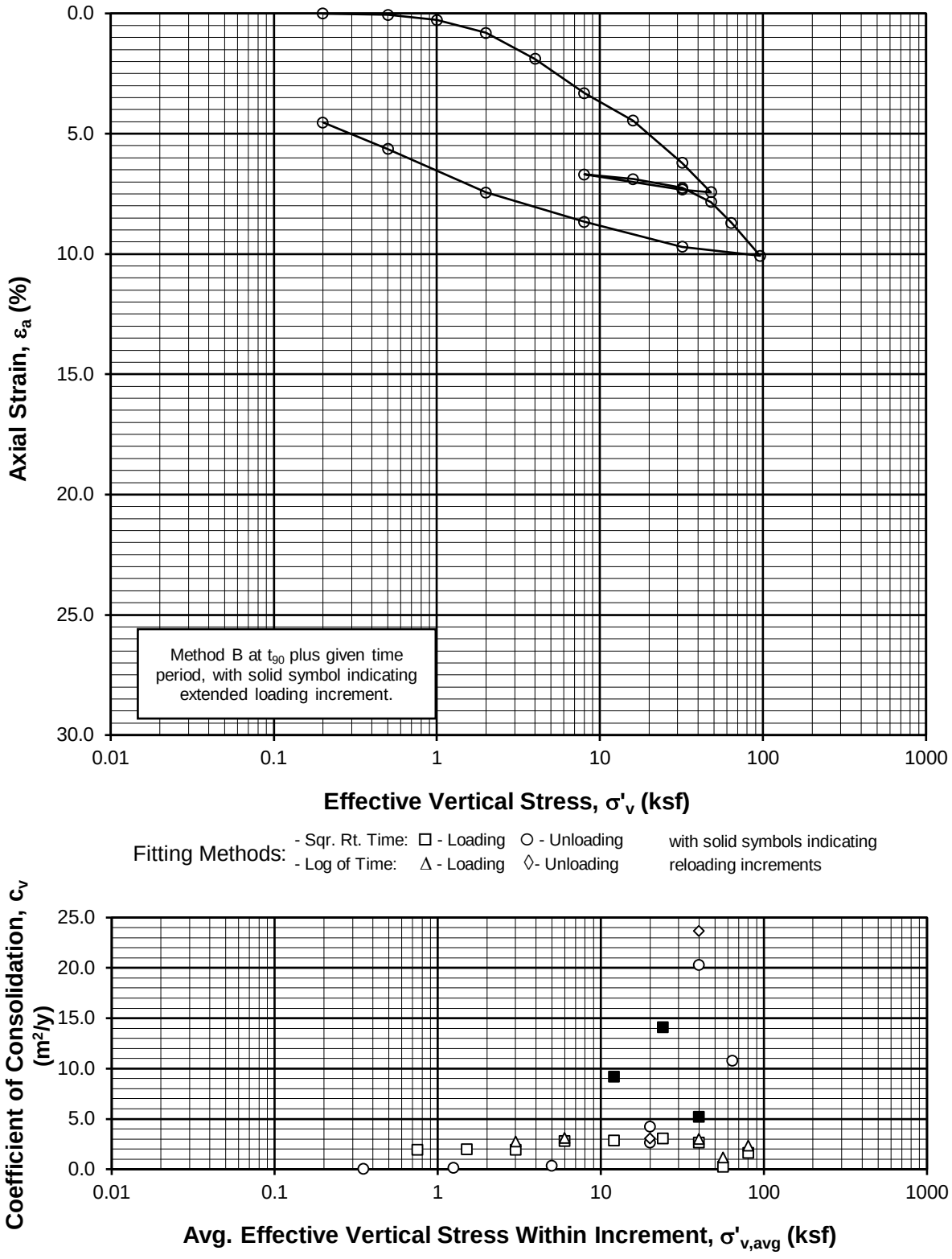
○ - Unloading (Final)
with solid symbols indicating reloading increments





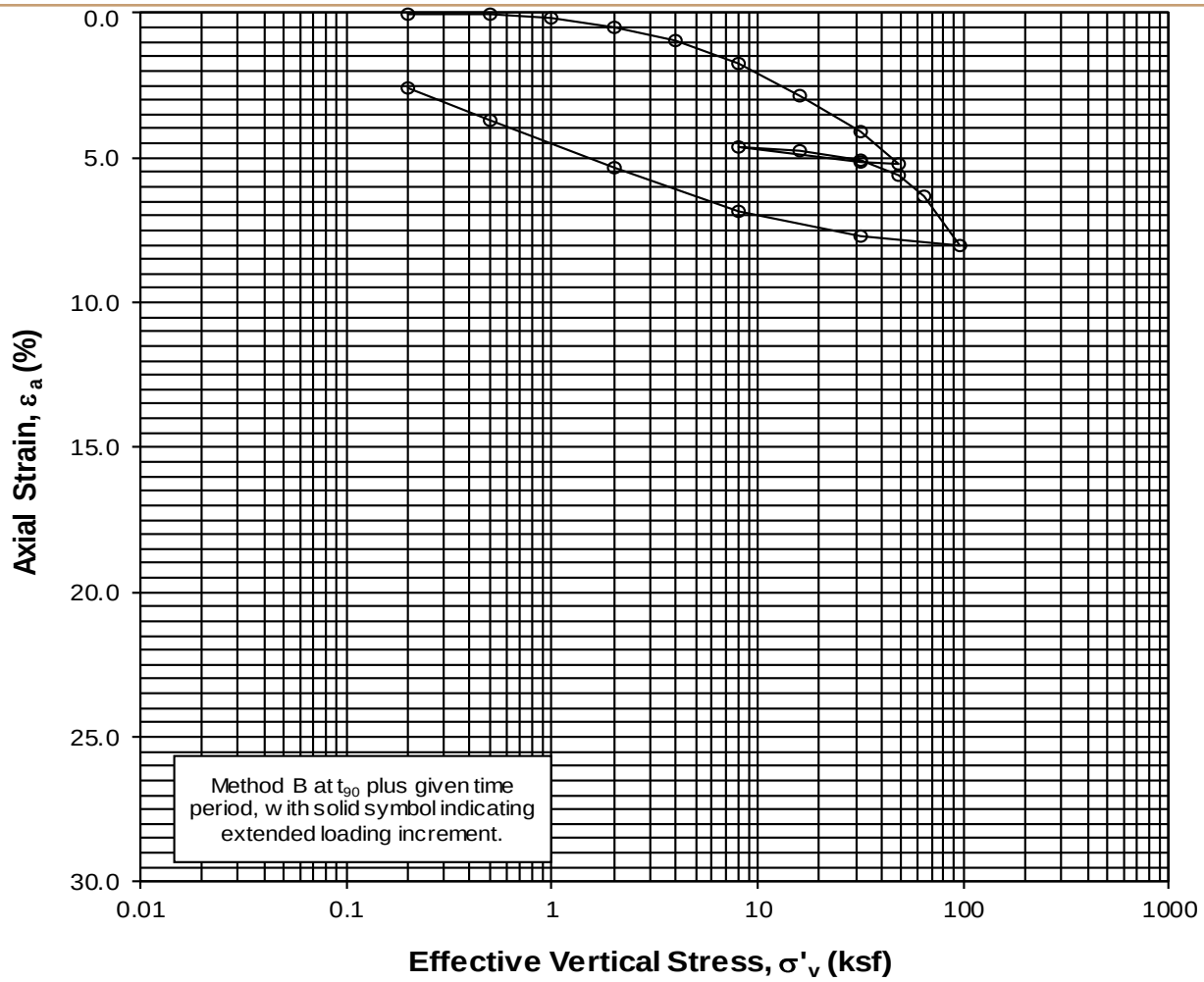
ONE-DIMENSIONAL CRS CONSOLIDATION TEST
BORING MB-20, SAMPLE S-13, DEPTH 31.33 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

PLATE E7-22

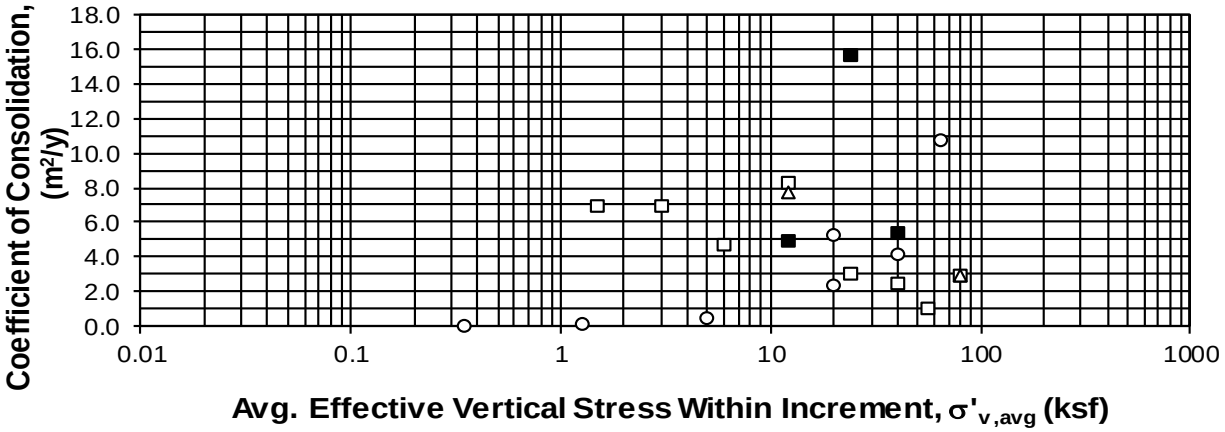


ONE-DIMENSIONAL INCREMENTAL CONSOLIDATION TEST
BORING MB-18, SAMPLE S-4a, DEPTH 10.2 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

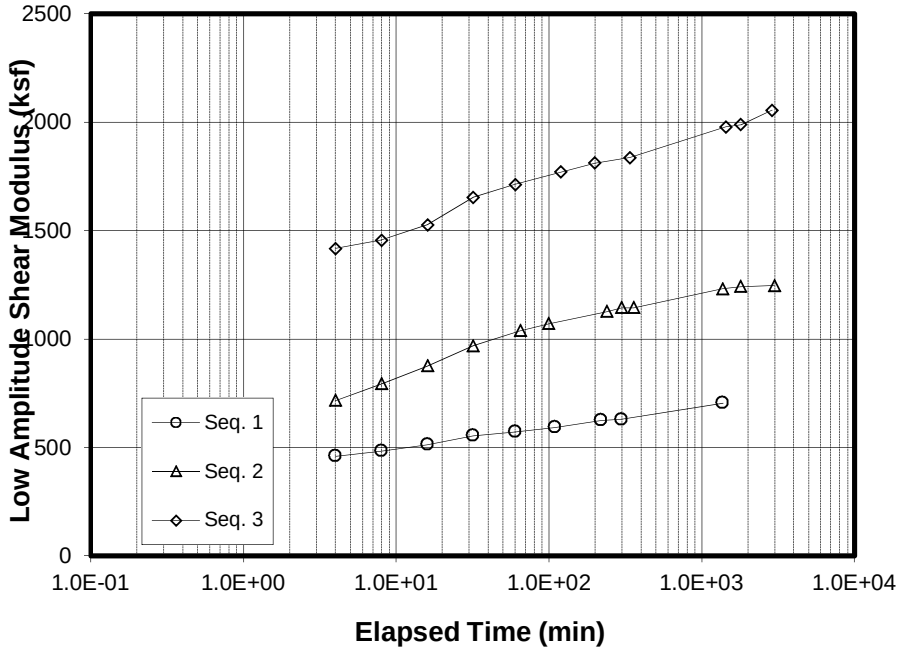
PLATE E7-23

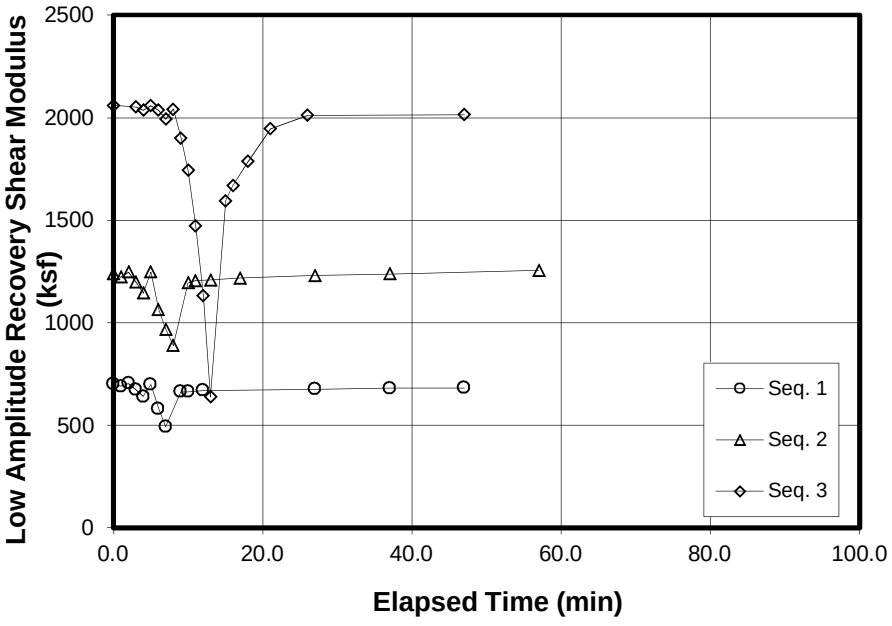


Fitting Methods: - Sqr. Rt. Time: □ - Loading ○ - Unloading
- Log of Time: Δ - Loading ◊- Unloading
with solid symbols indicating reloading increments

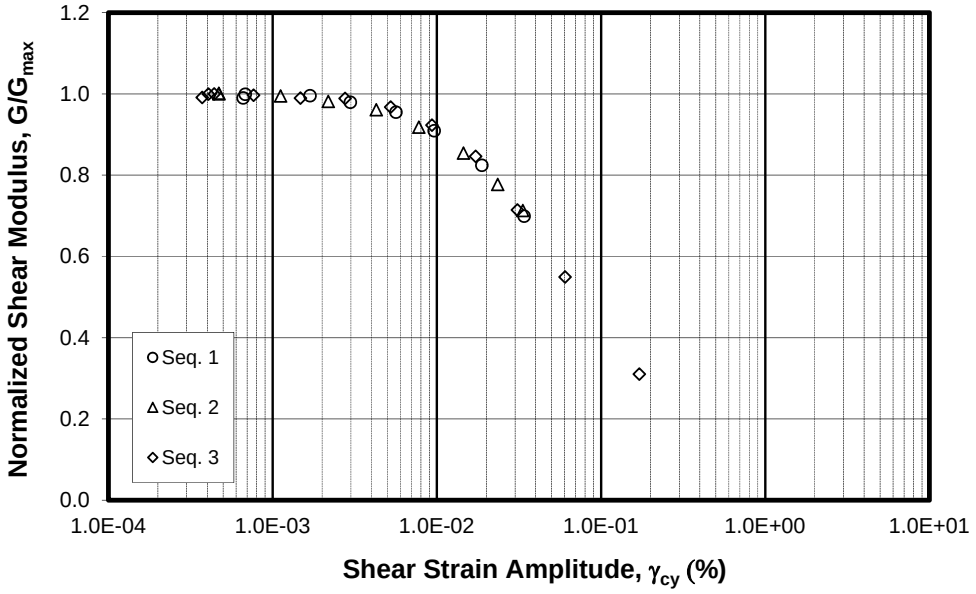


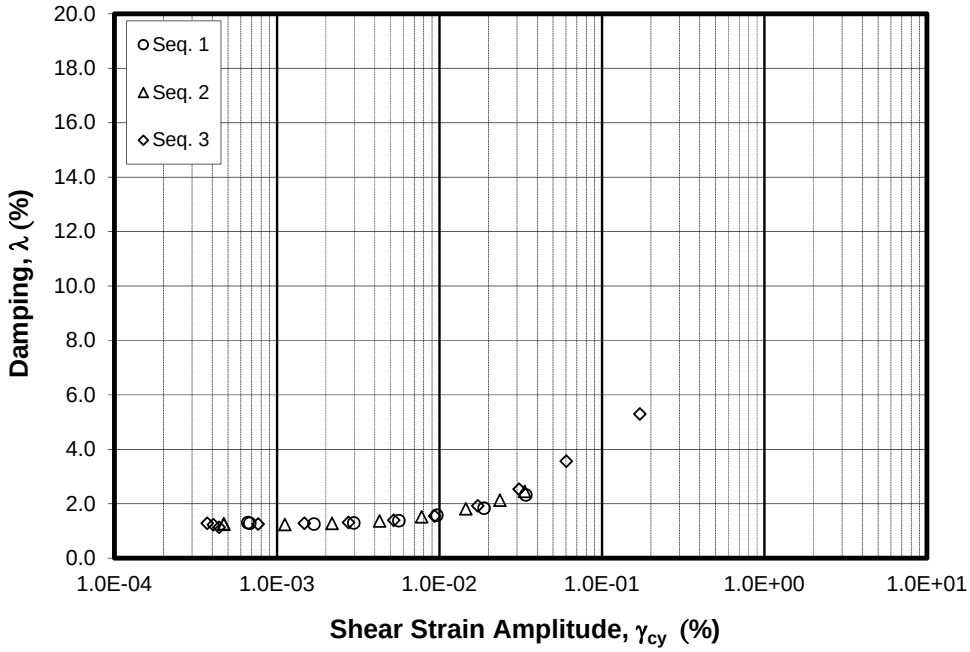
ONE-DIMENSIONAL INCREMENTAL CONSOLIDATION TEST
BORING MB-18, SAMPLE S-4b, DEPTH 10.05 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



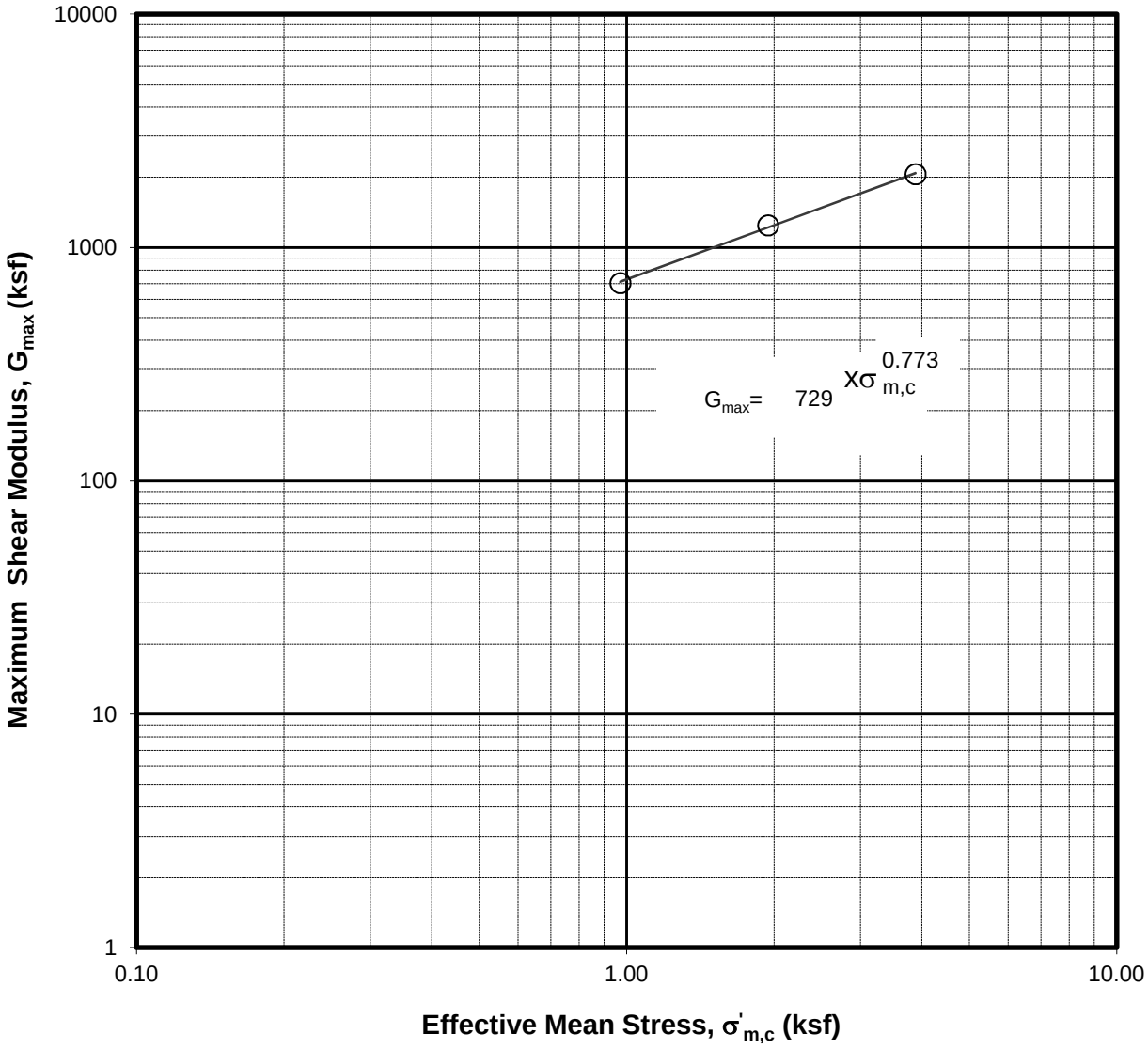


RESONANT COLUMN TEST
BORING MB-08, SAMPLE S-21, DEPTH 62.50 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

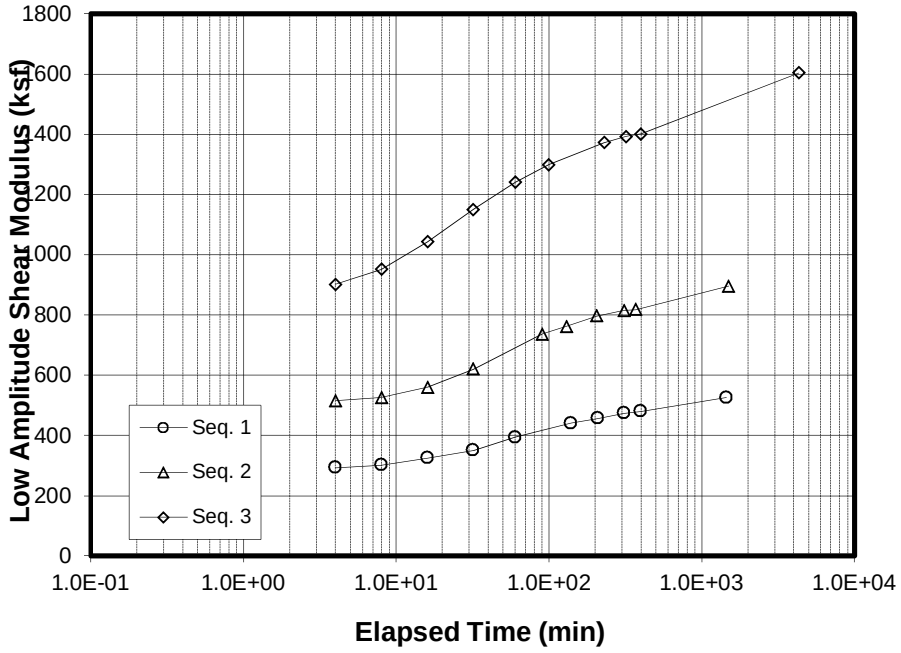


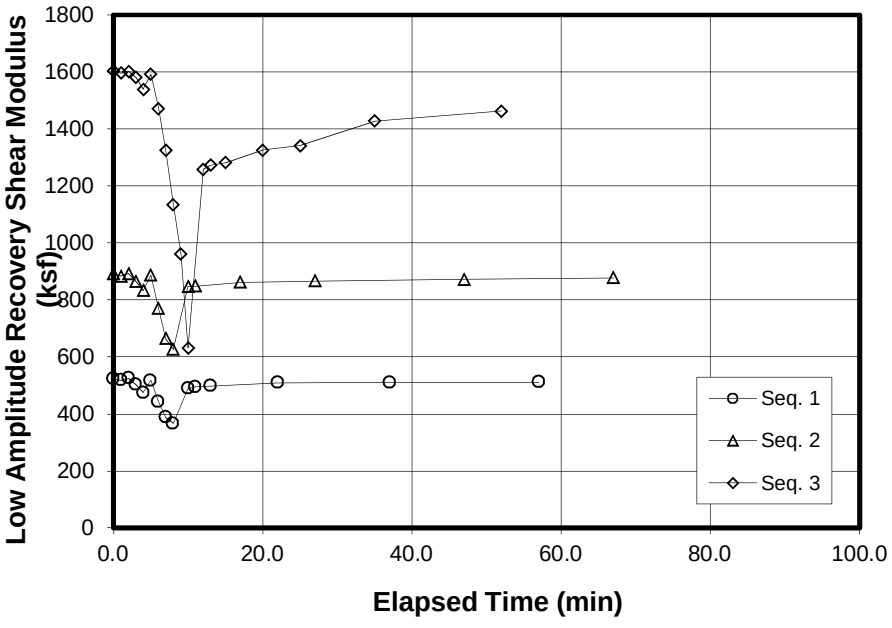


RESONANT COLUMN TEST
BORING MB-08, SAMPLE S-21, DEPTH 62.50 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

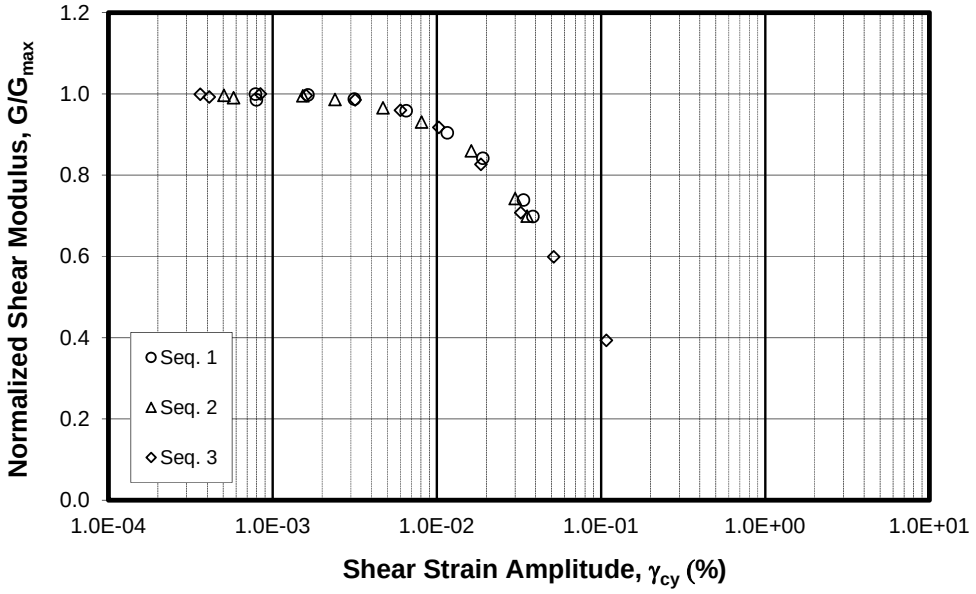


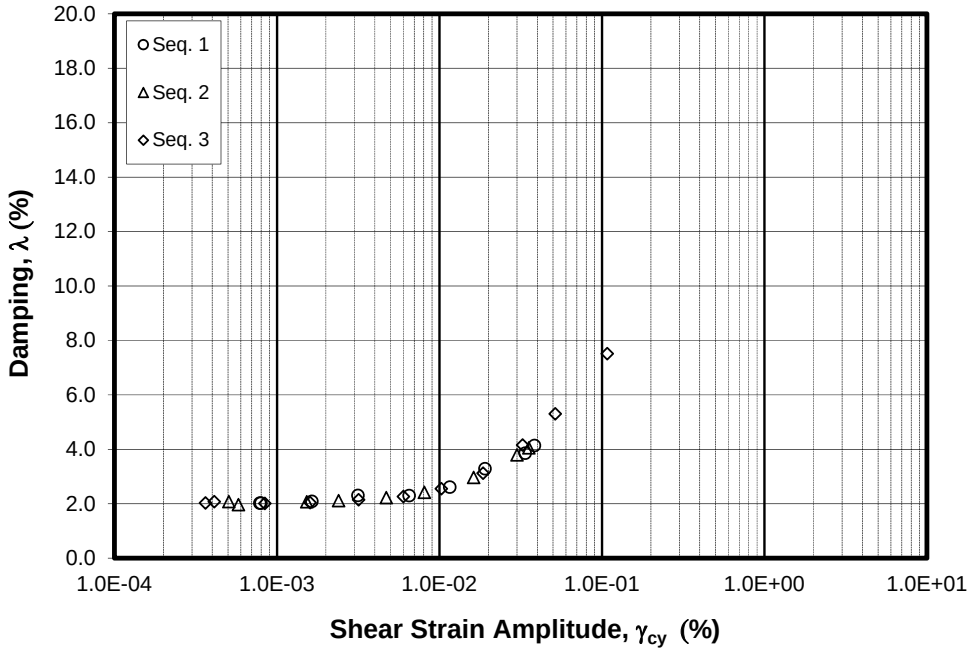
RESONANT COLUMN TEST
BORING MB-08, SAMPLE S-21, DEPTH 62.50 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



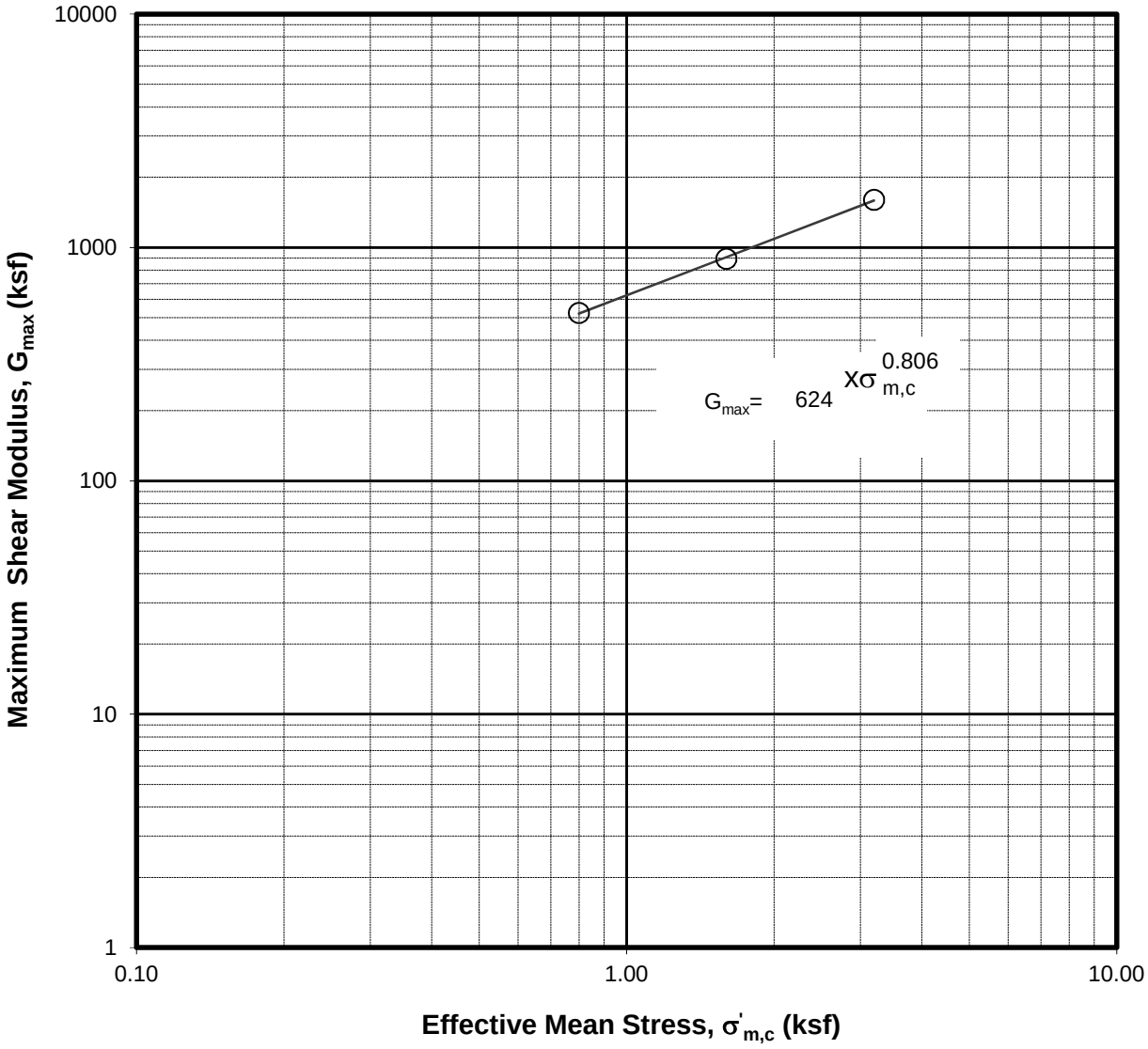


RESONANT COLUMN TEST
BORING MB-09, SAMPLE S-18, DEPTH 51.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

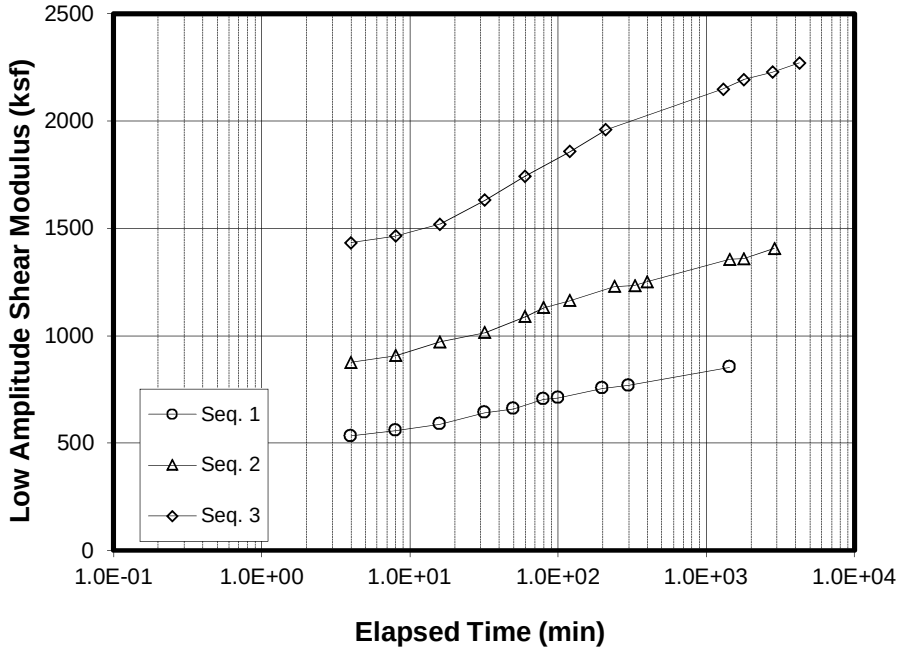


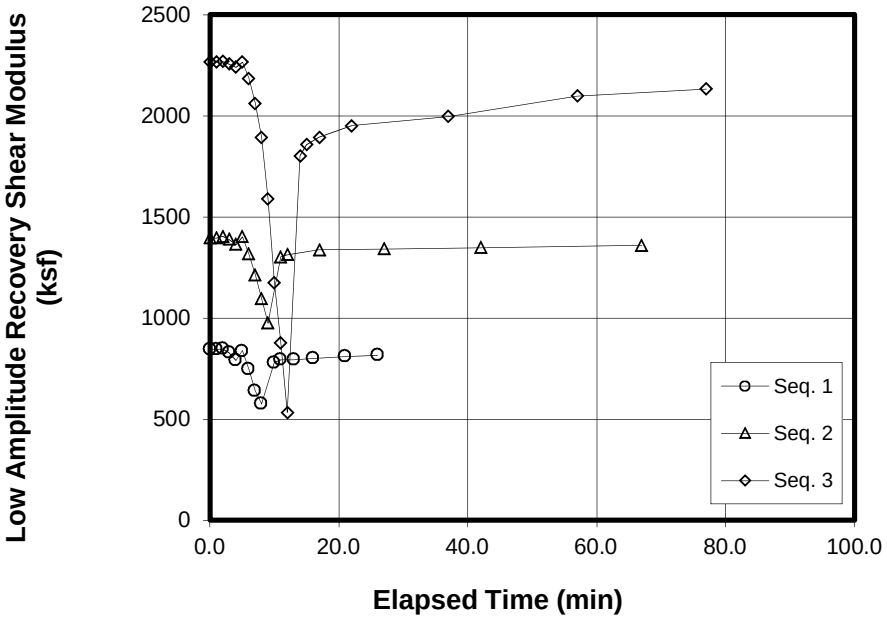


RESONANT COLUMN TEST
BORING MB-09, SAMPLE S-18, DEPTH 51.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

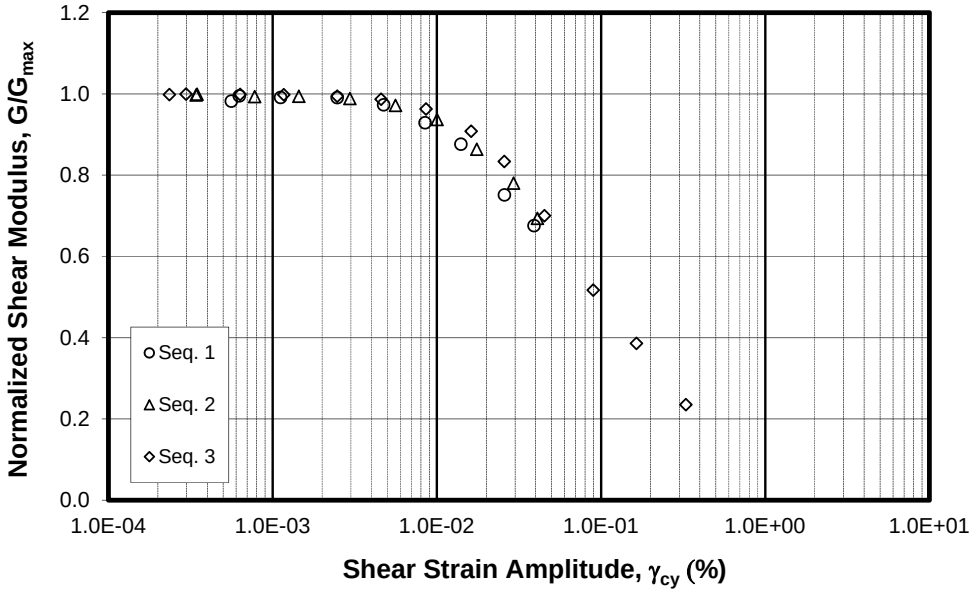


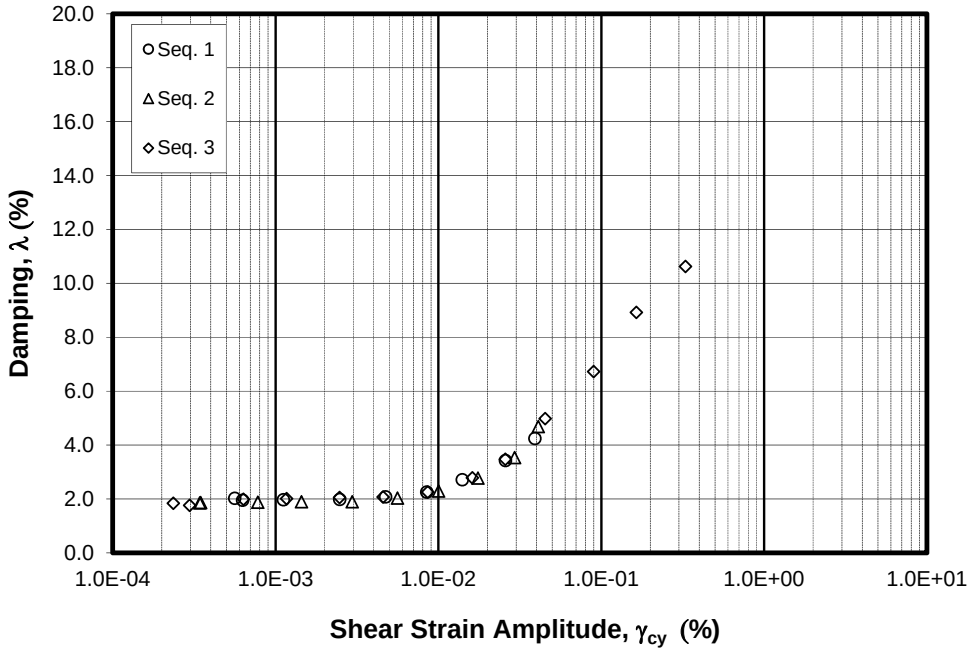
RESONANT COLUMN TEST
BORING MB-09, SAMPLE S-18, DEPTH 51.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



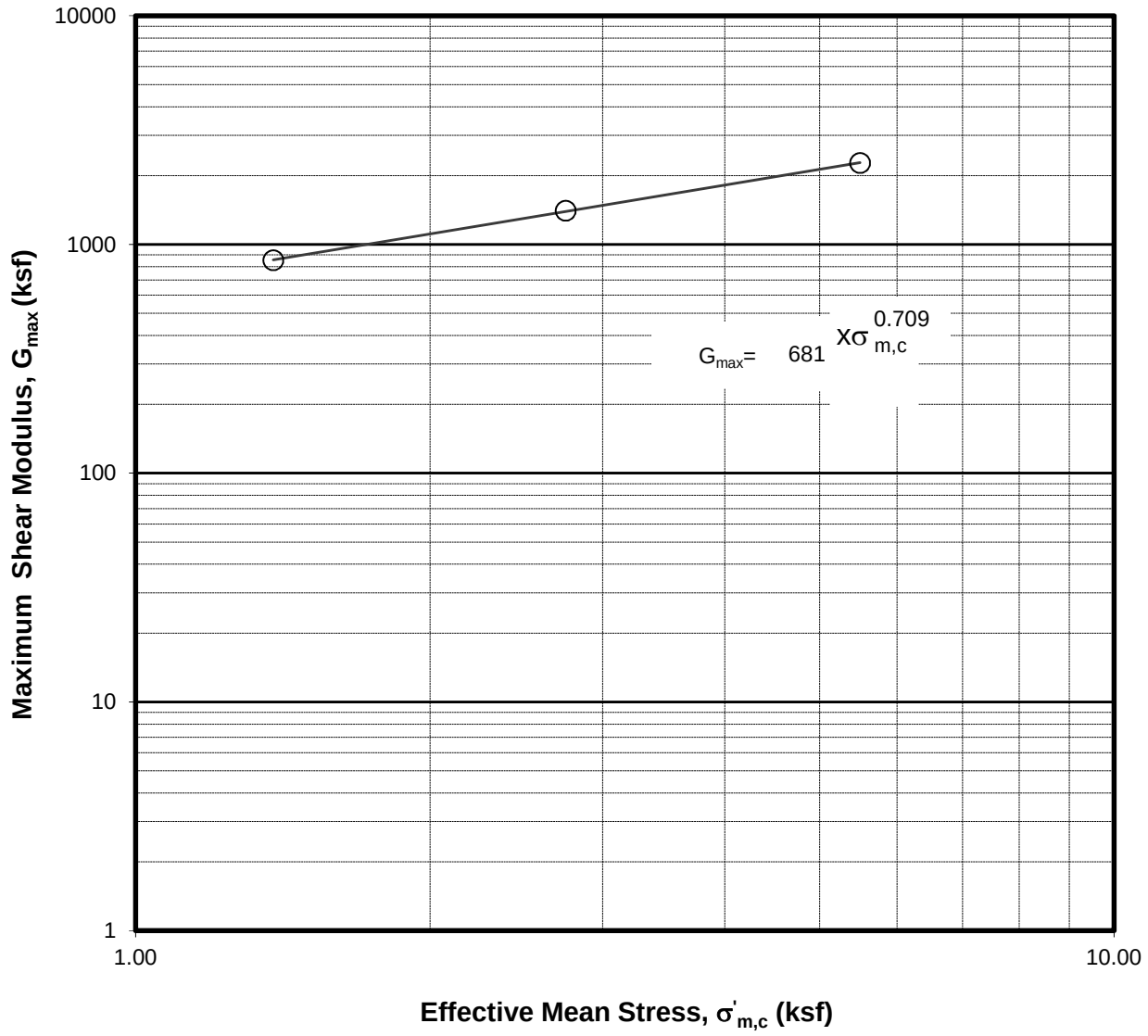


RESONANT COLUMN TEST
BORING MB-09, SAMPLE S-24, DEPTH 79.60 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

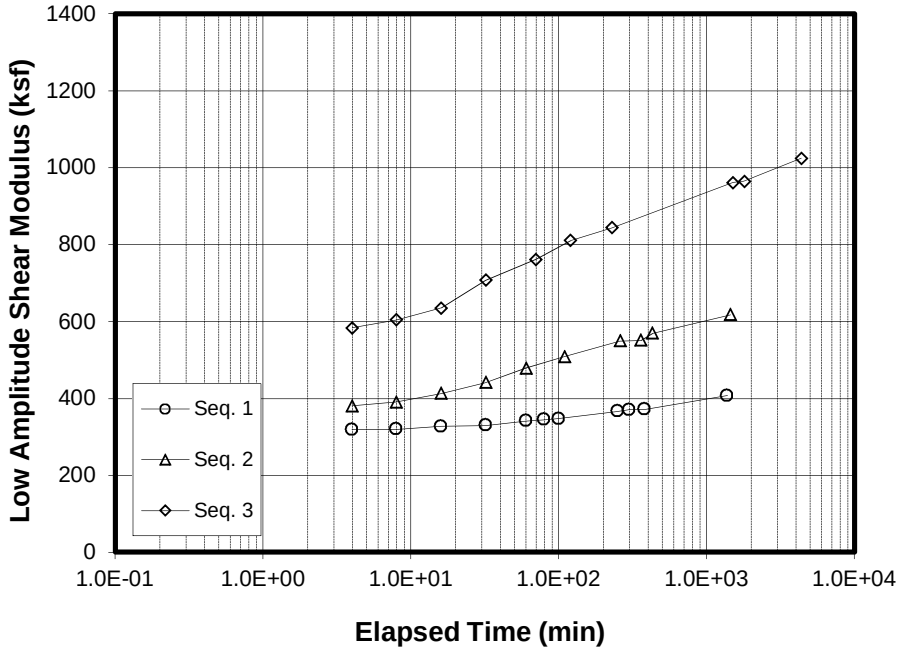


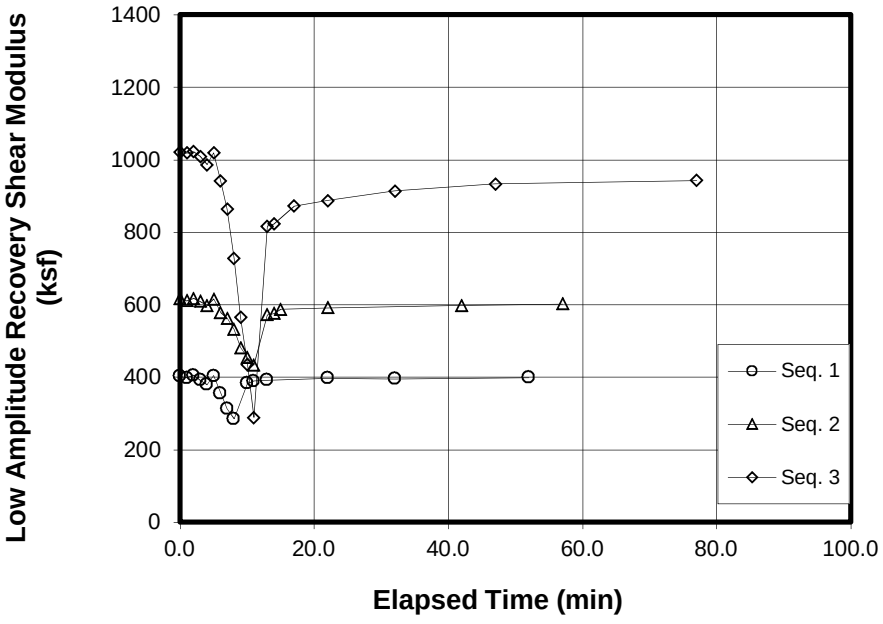


RESONANT COLUMN TEST
BORING MB-09, SAMPLE S-24, DEPTH 79.60 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

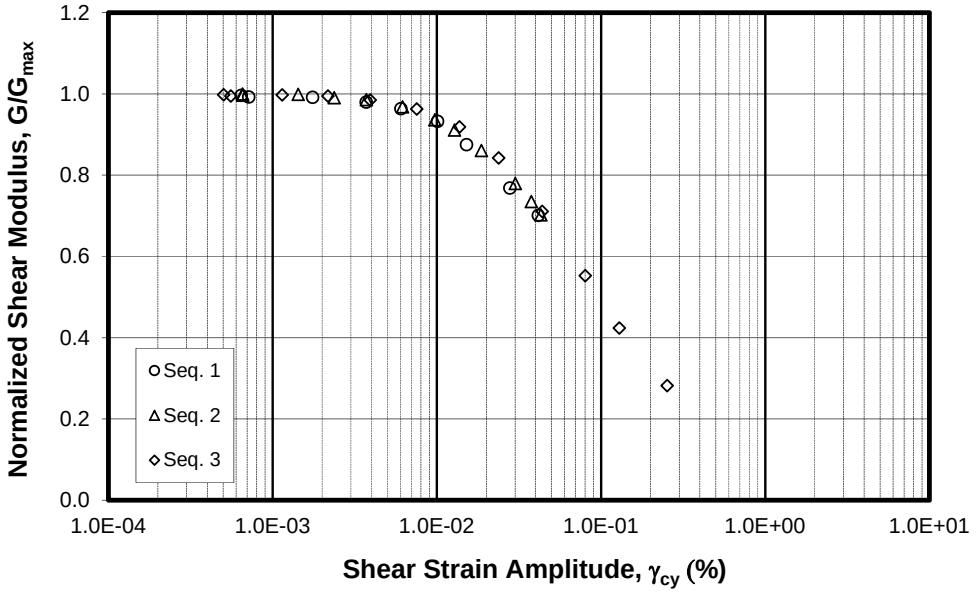


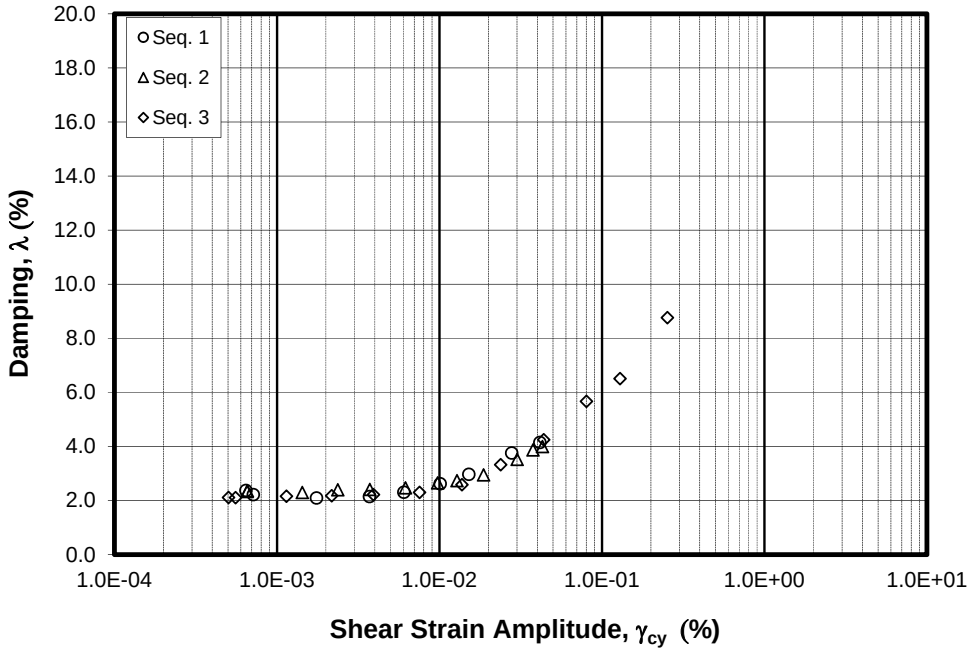
RESONANT COLUMN TEST
BORING MB-09, SAMPLE S-24, DEPTH 79.60 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



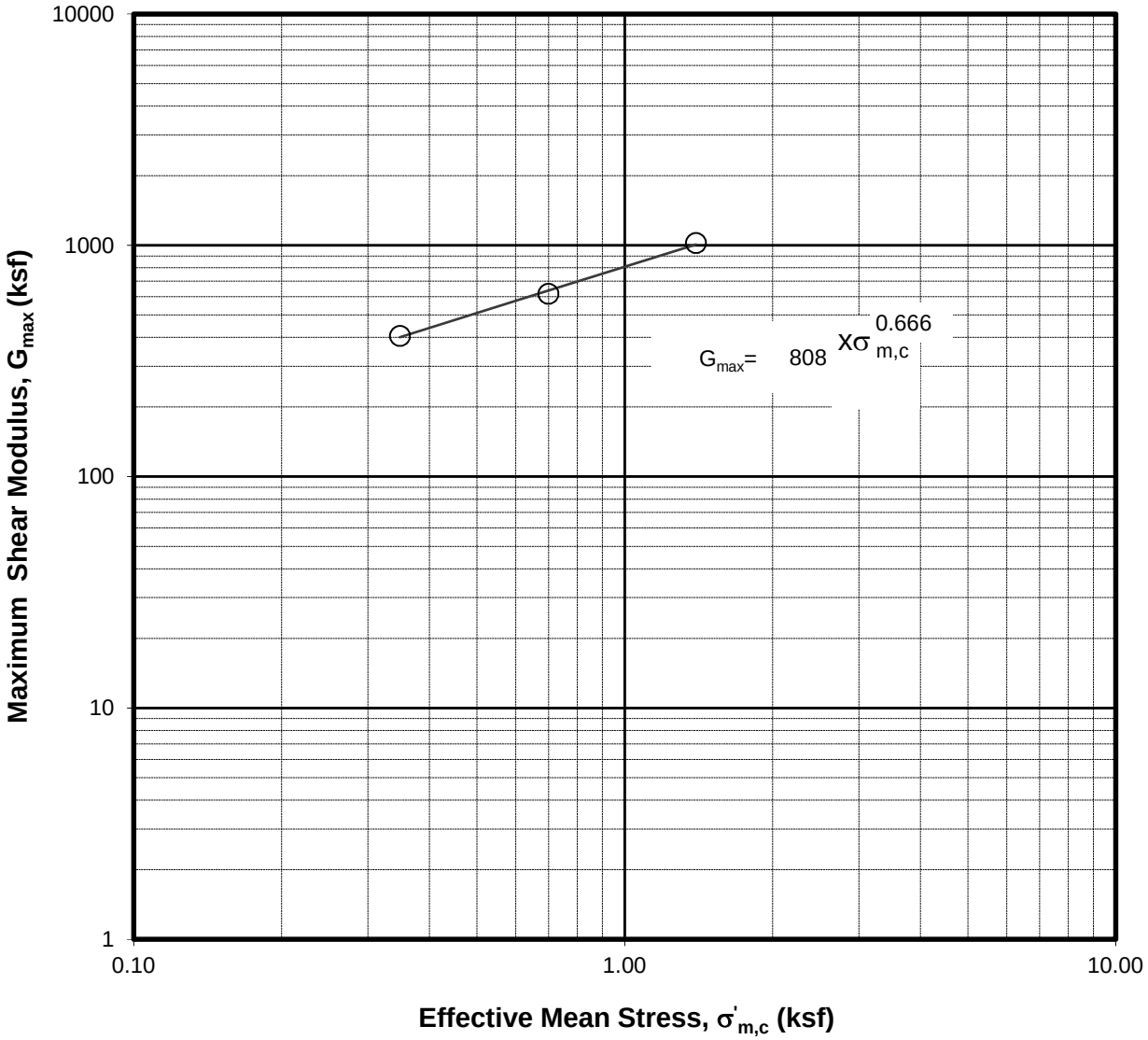


RESONANT COLUMN TEST
BORING MB-13, SAMPLE S-9, DEPTH 23.30 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

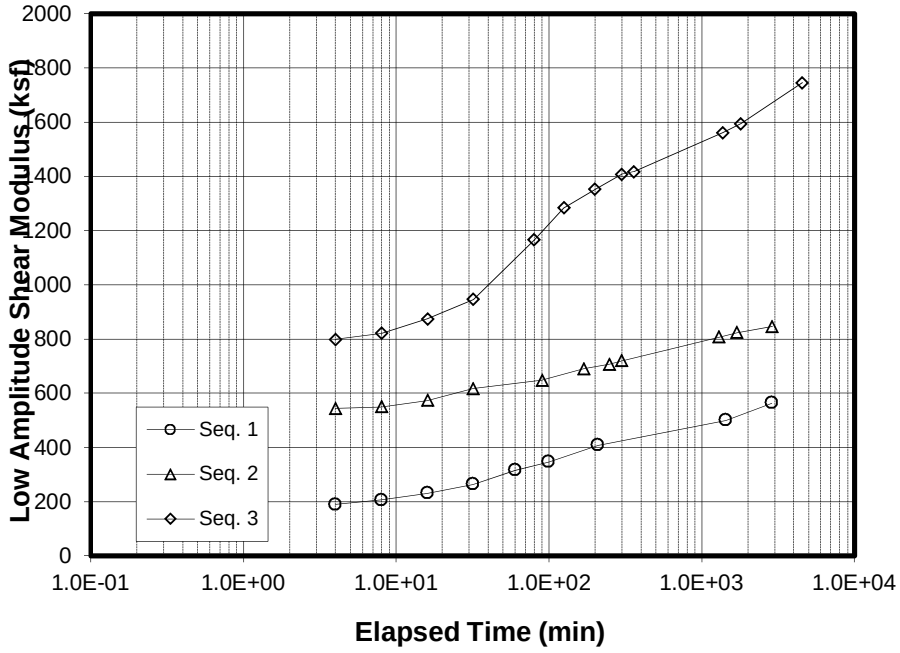


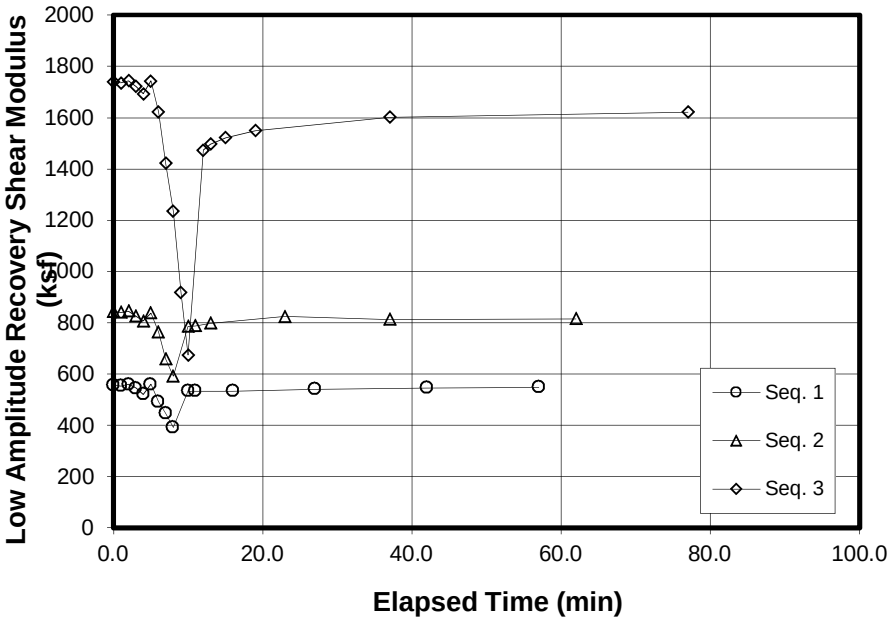


RESONANT COLUMN TEST
BORING MB-13, SAMPLE S-9, DEPTH 23.30 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

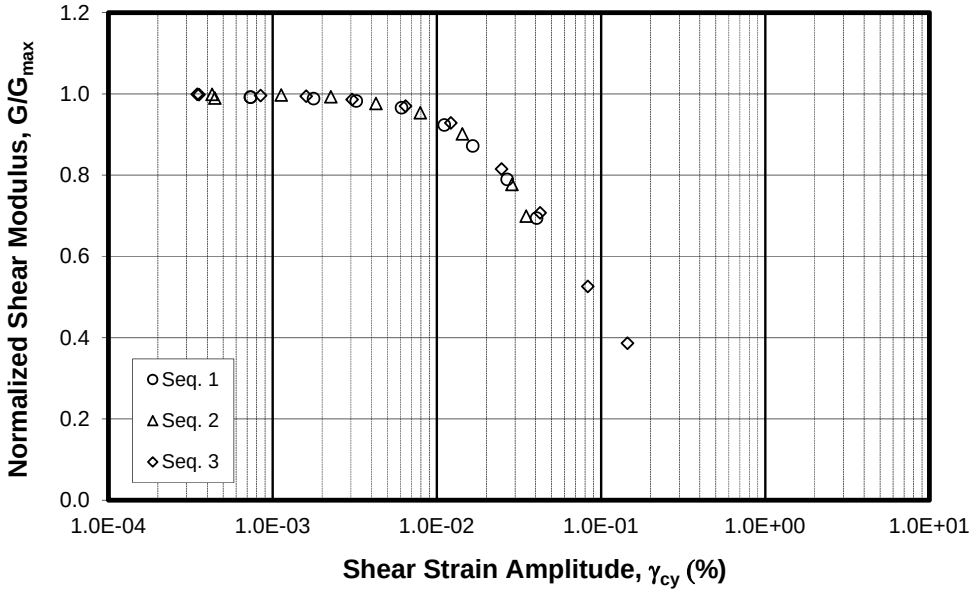


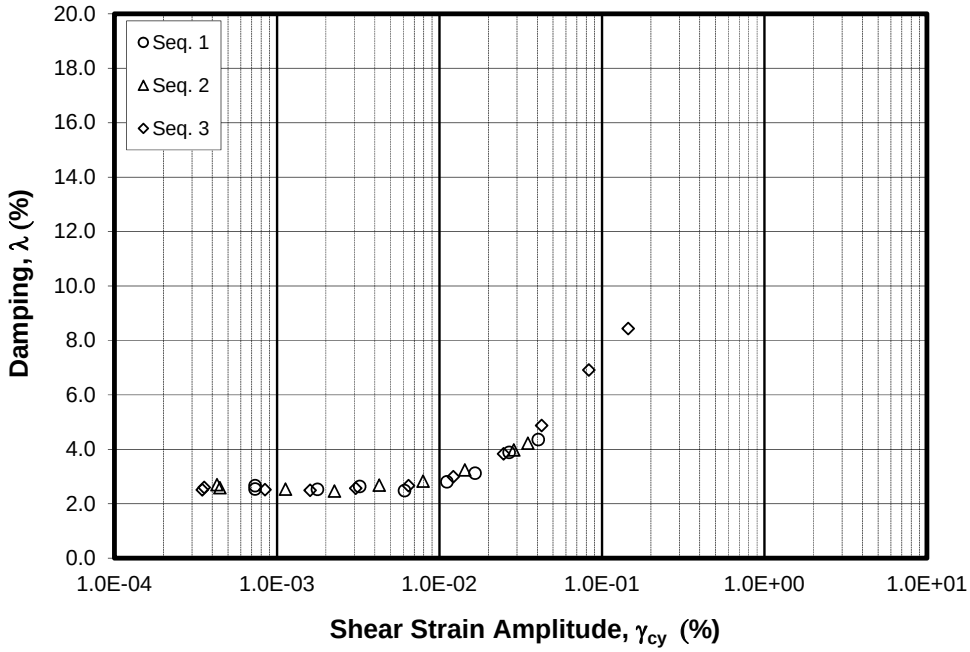
RESONANT COLUMN TEST
BORING MB-13, SAMPLE S-9, DEPTH 23.30 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



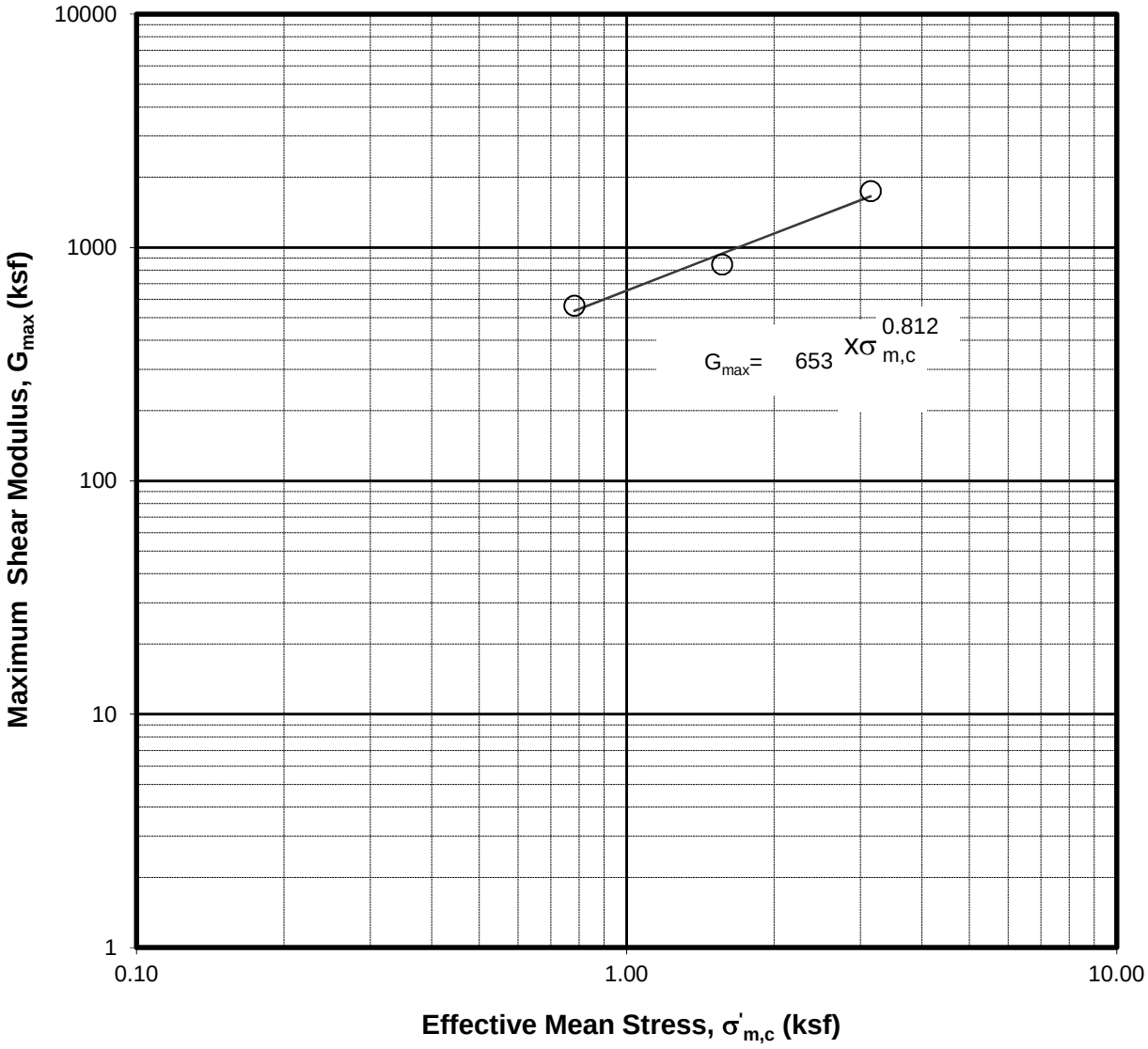


RESONANT COLUMN TEST
BORING MB-23, SAMPLE S-16, DEPTH 43.00 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

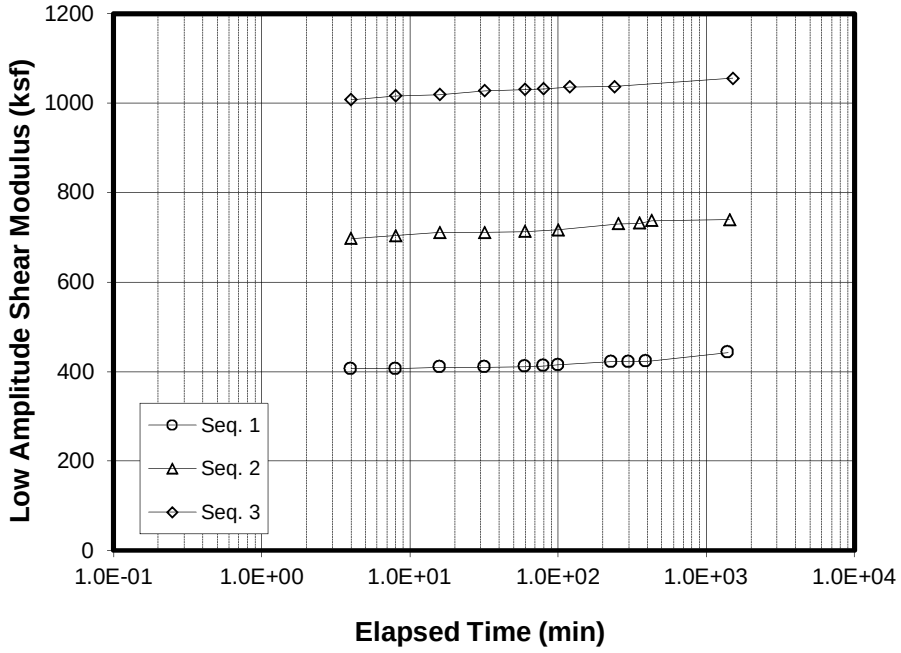


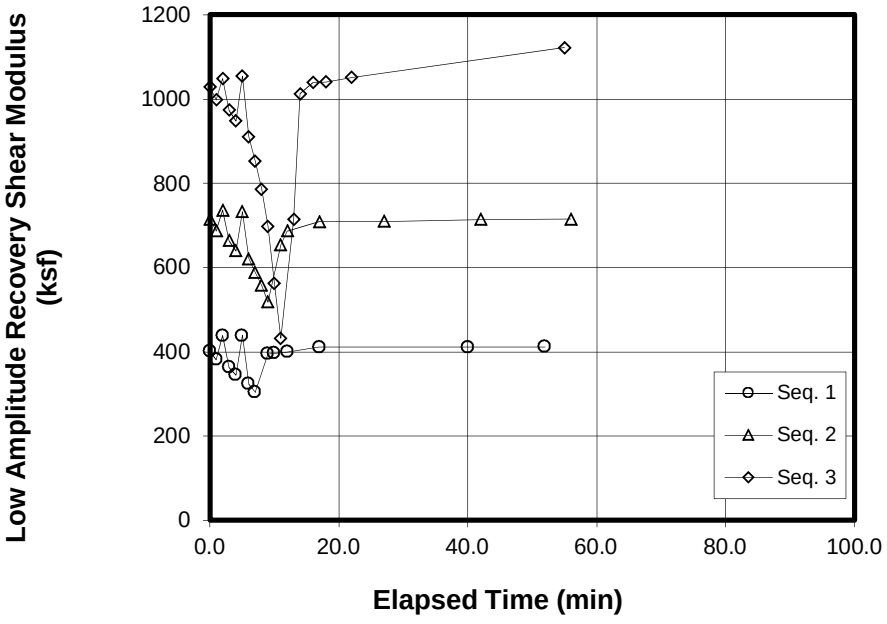


RESONANT COLUMN TEST
BORING MB-23, SAMPLE S-16, DEPTH 43.00 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

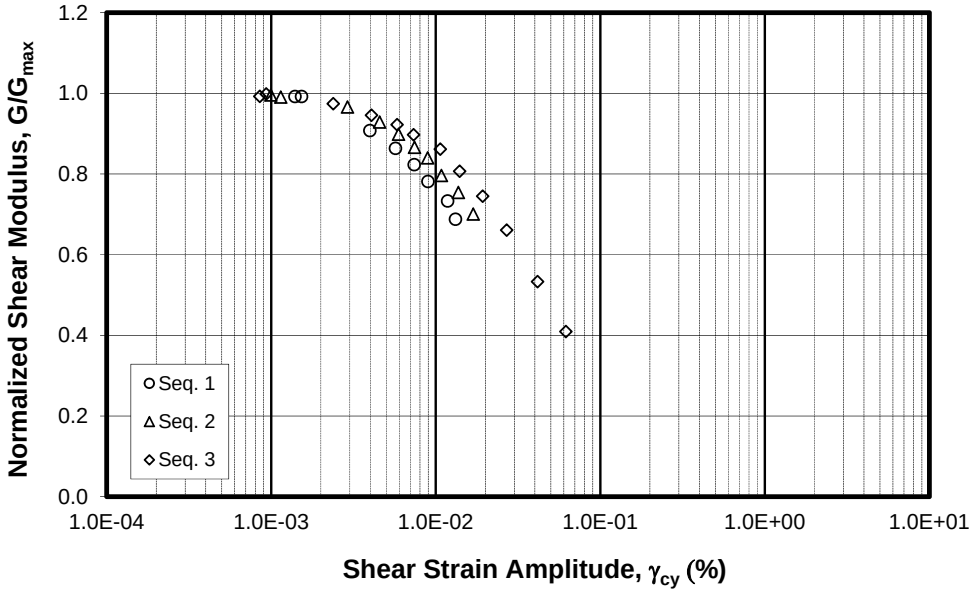


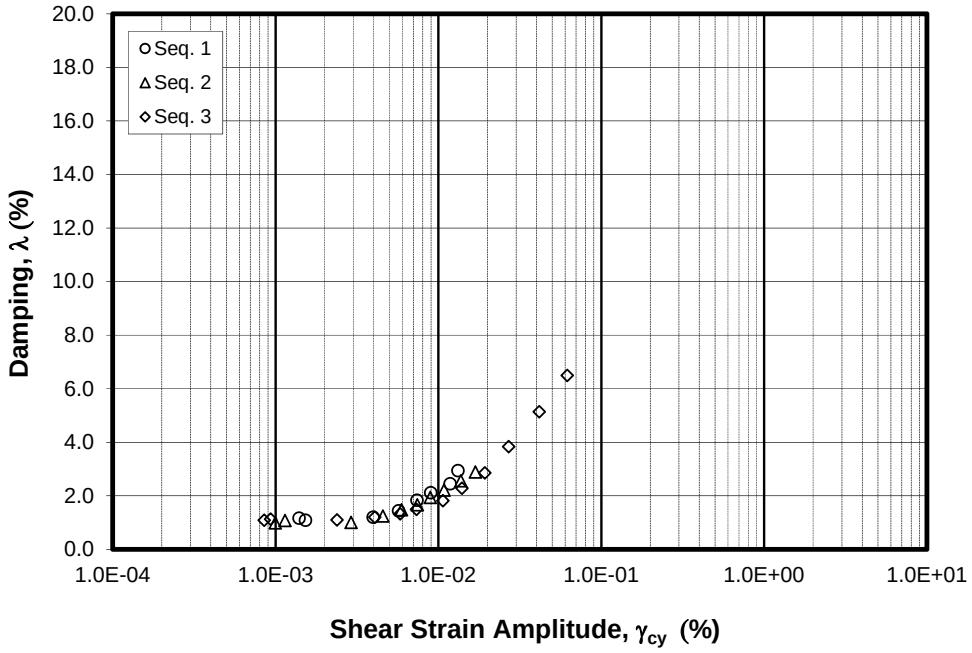
RESONANT COLUMN TEST
BORING MB-23, SAMPLE S-16, DEPTH 43.00 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



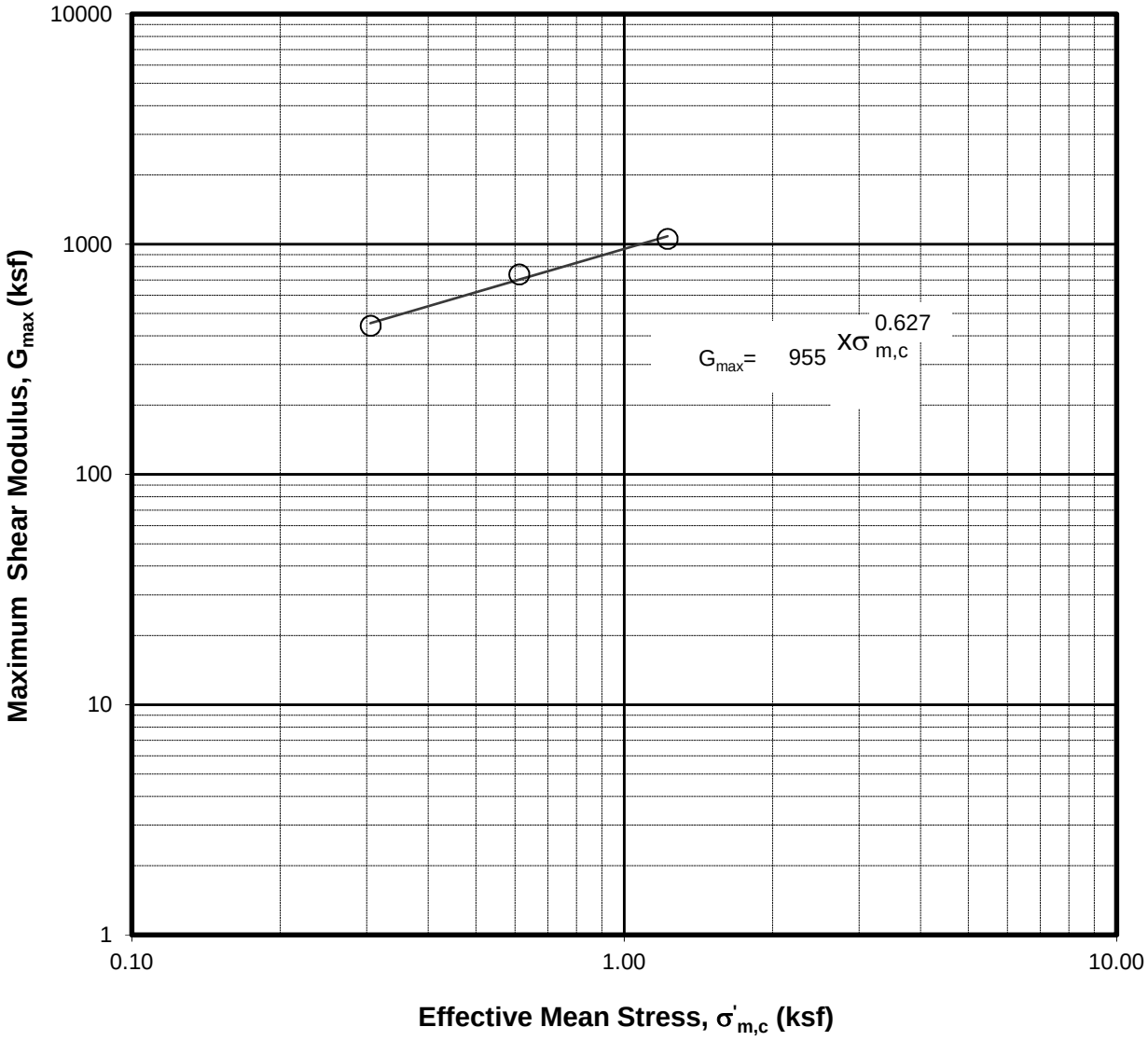


RESONANT COLUMN TEST
BORING MB-28, SAMPLE S-8, DEPTH 18.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

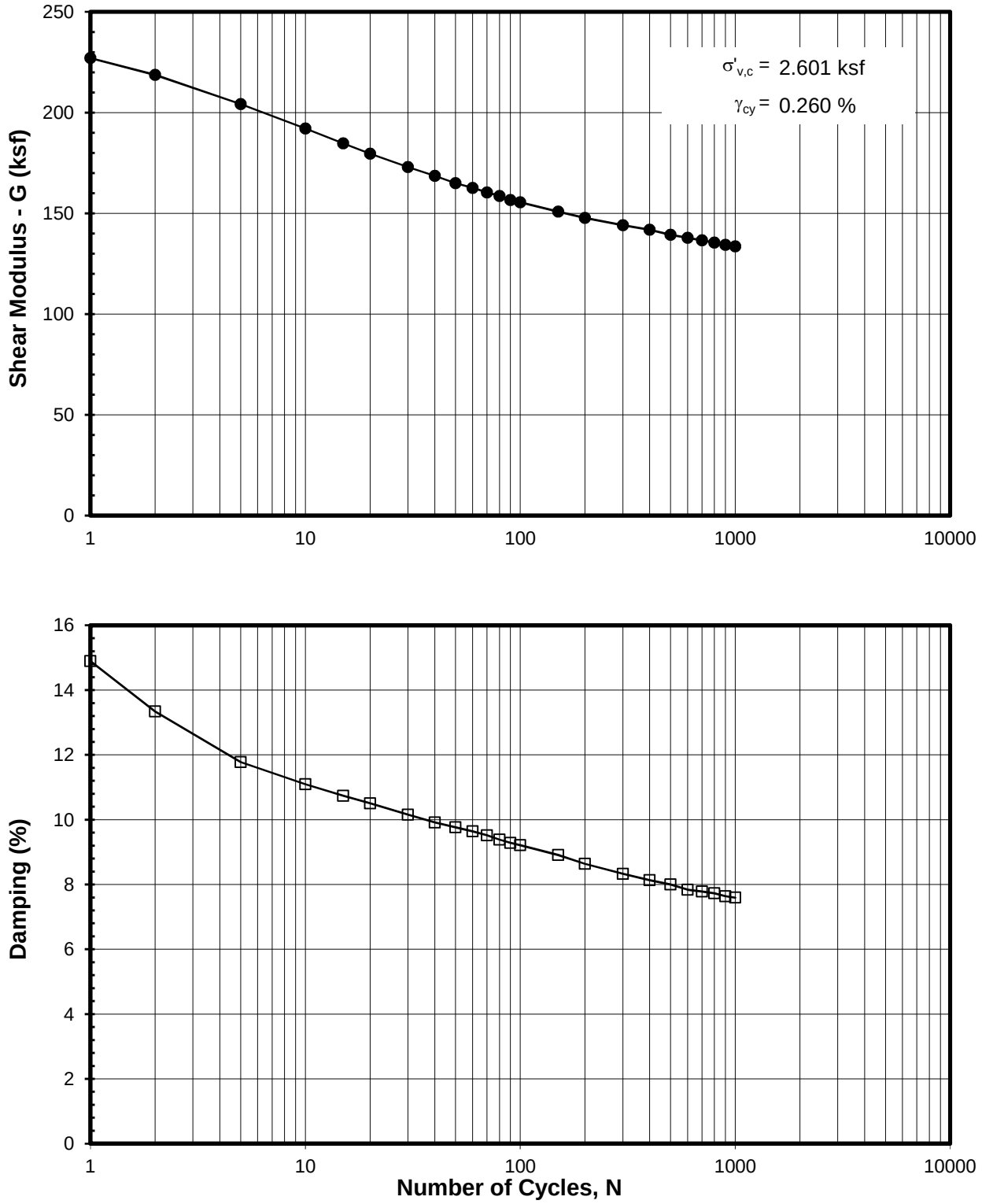




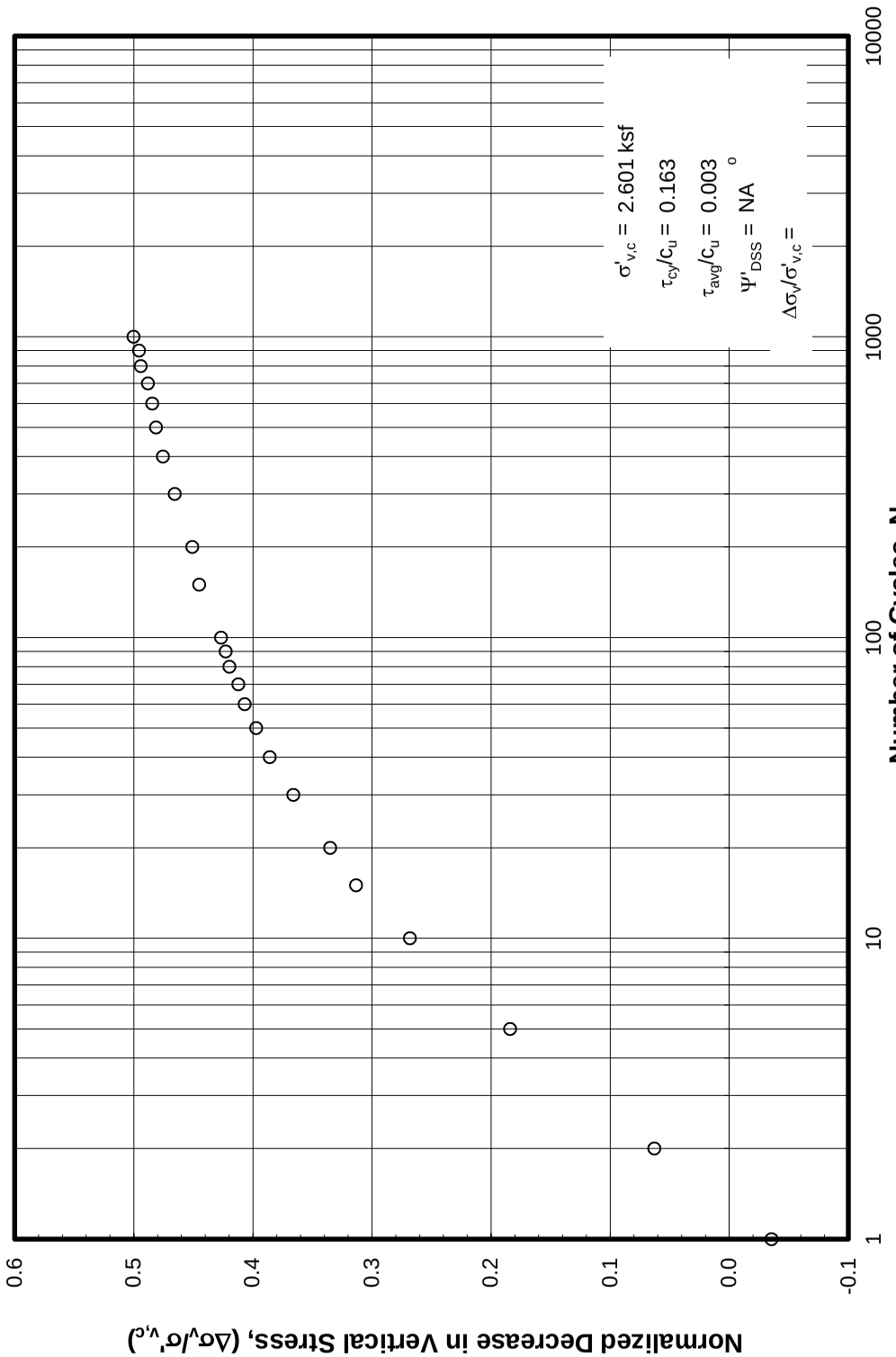
RESONANT COLUMN TEST
BORING MB-28, SAMPLE S-8, DEPTH 18.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



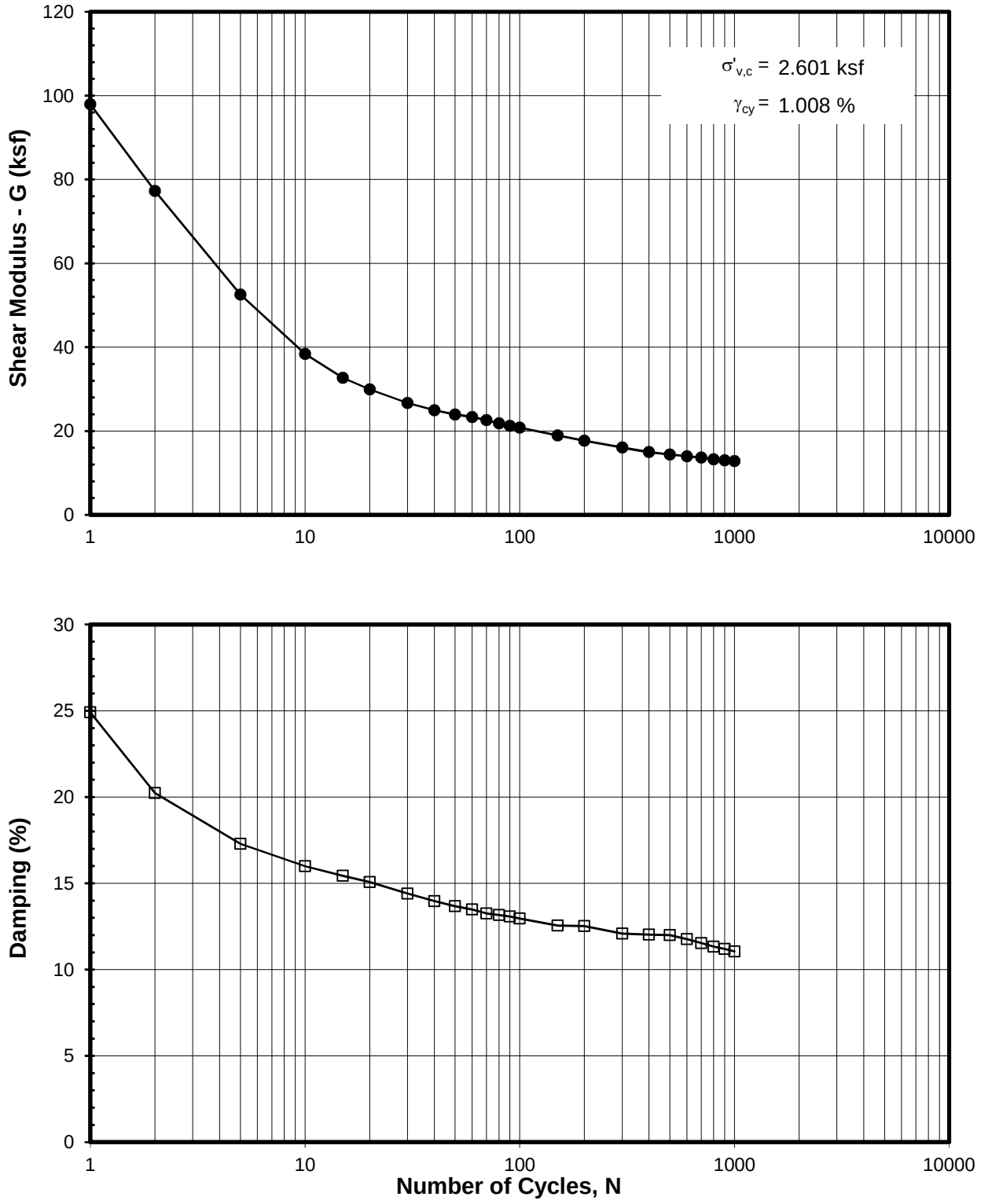
RESONANT COLUMN TEST
BORING MB-28, SAMPLE S-8, DEPTH 18.70 FEET
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



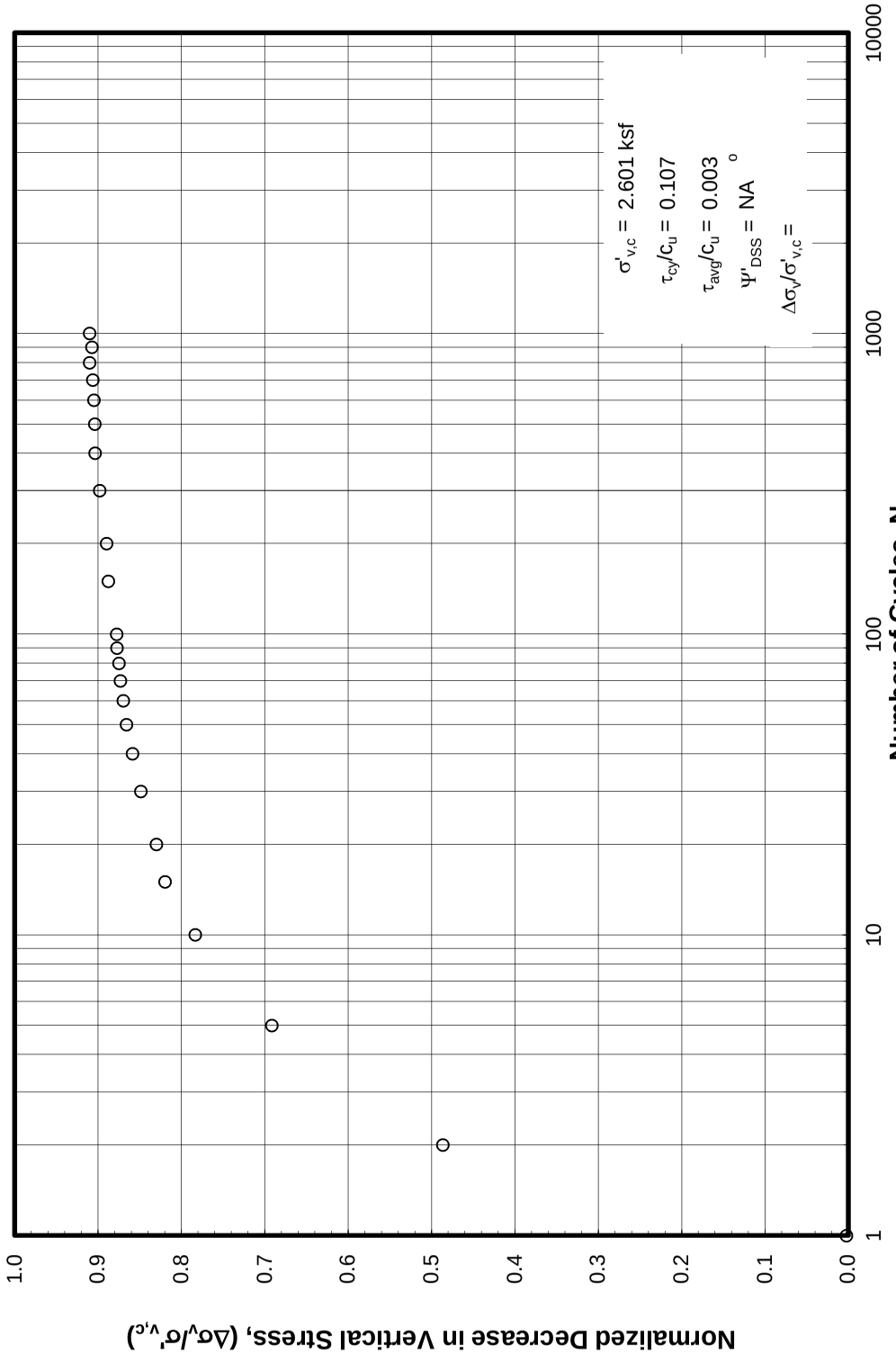
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-18, DEPTH 51.00 FEET, SHEAR STRAIN 0.25 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



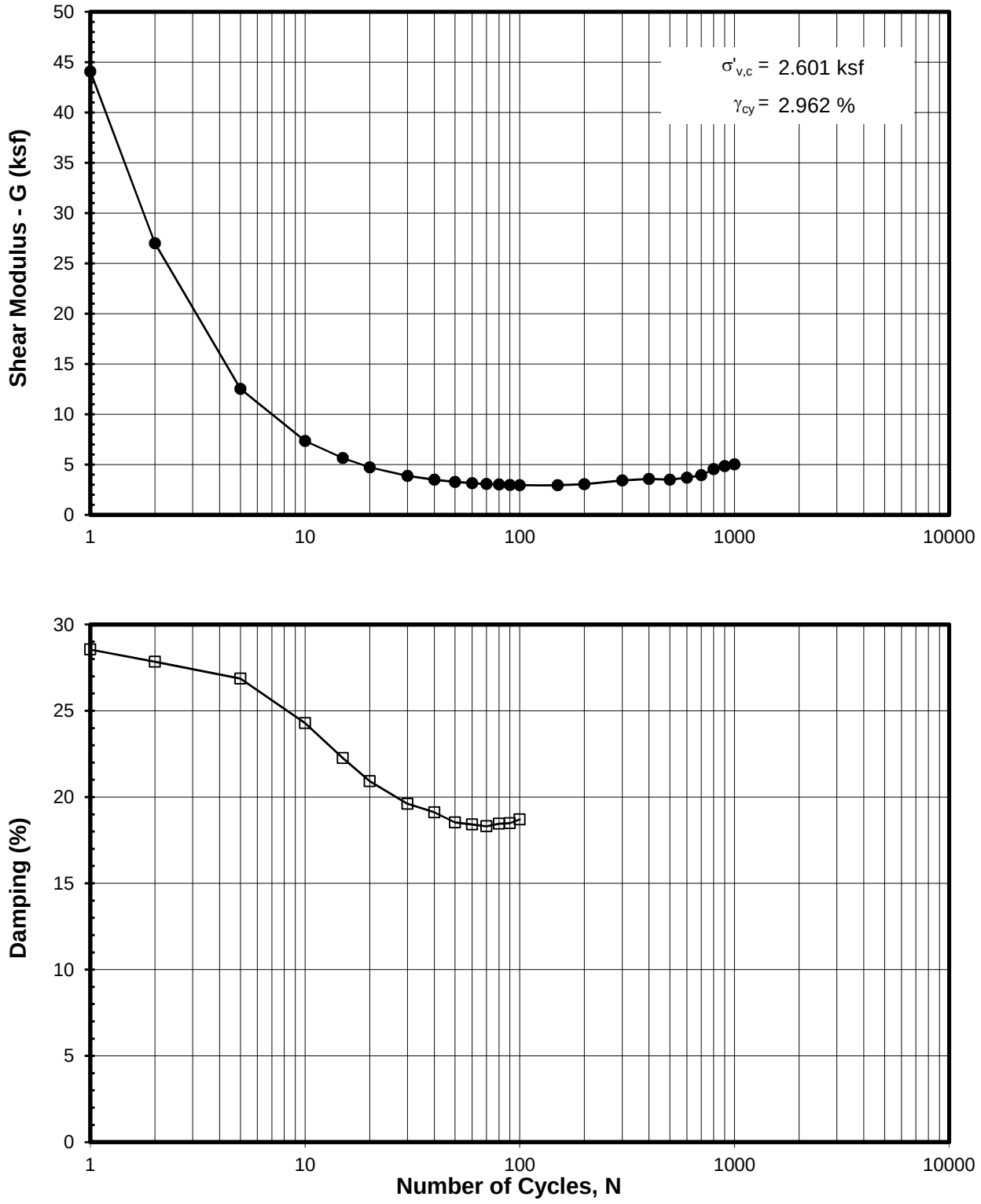
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-18, DEPTH 51.00 FEET, SHEAR STRAIN 0.25 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



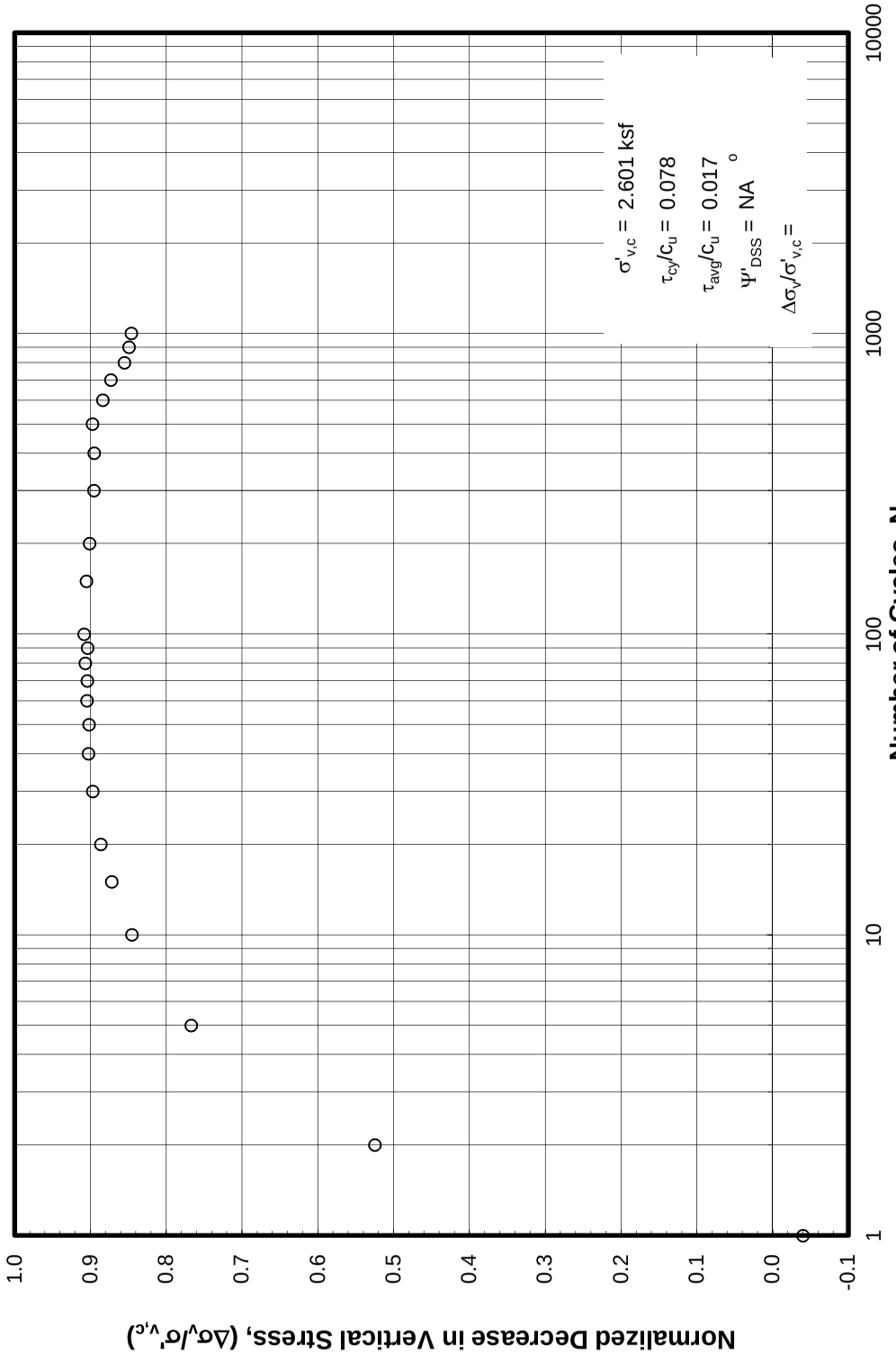
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-18, DEPTH 50.85 FEET, SHEAR STRAIN 1.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



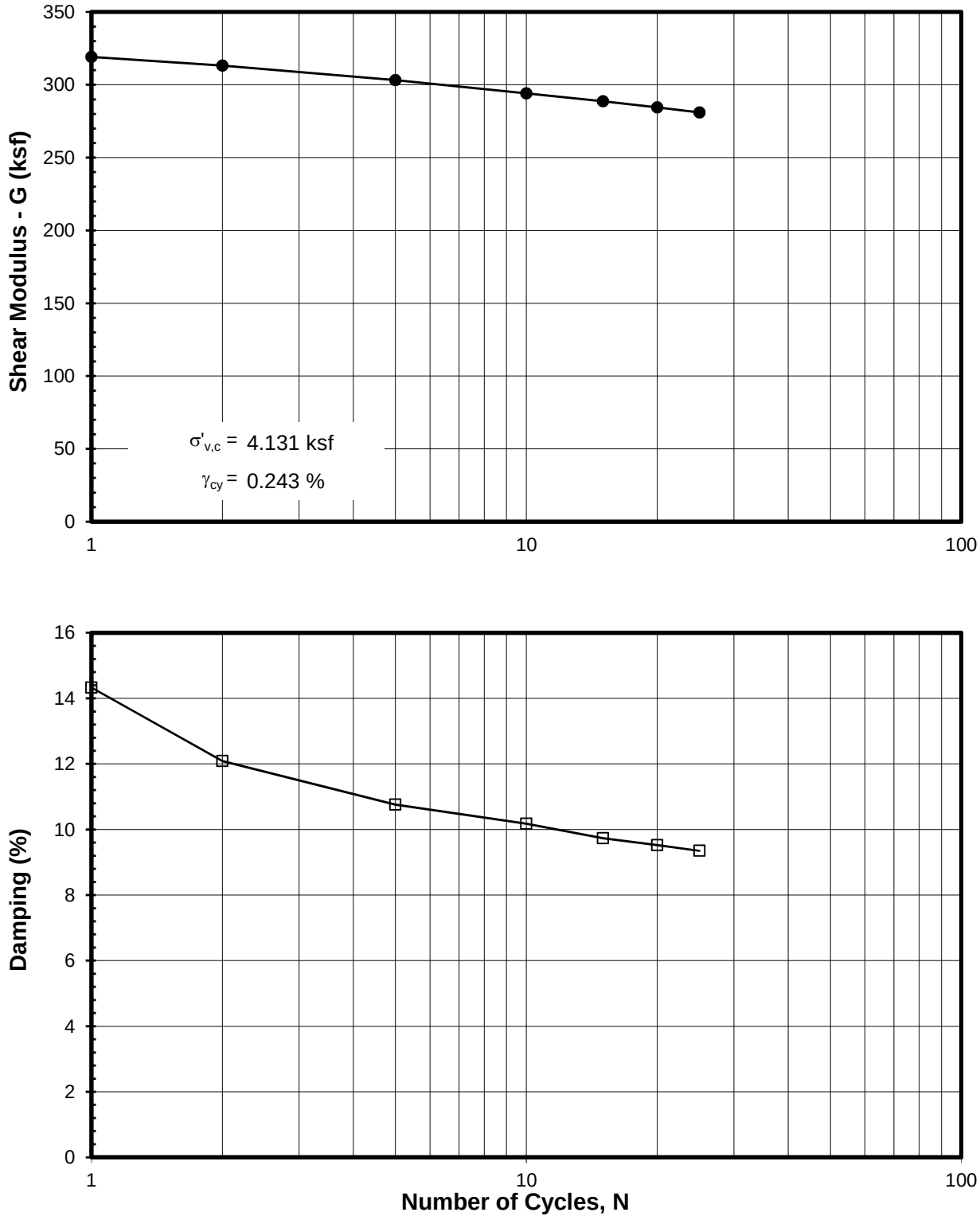
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-18, DEPTH 50.85 FEET, SHEAR STRAIN 1.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



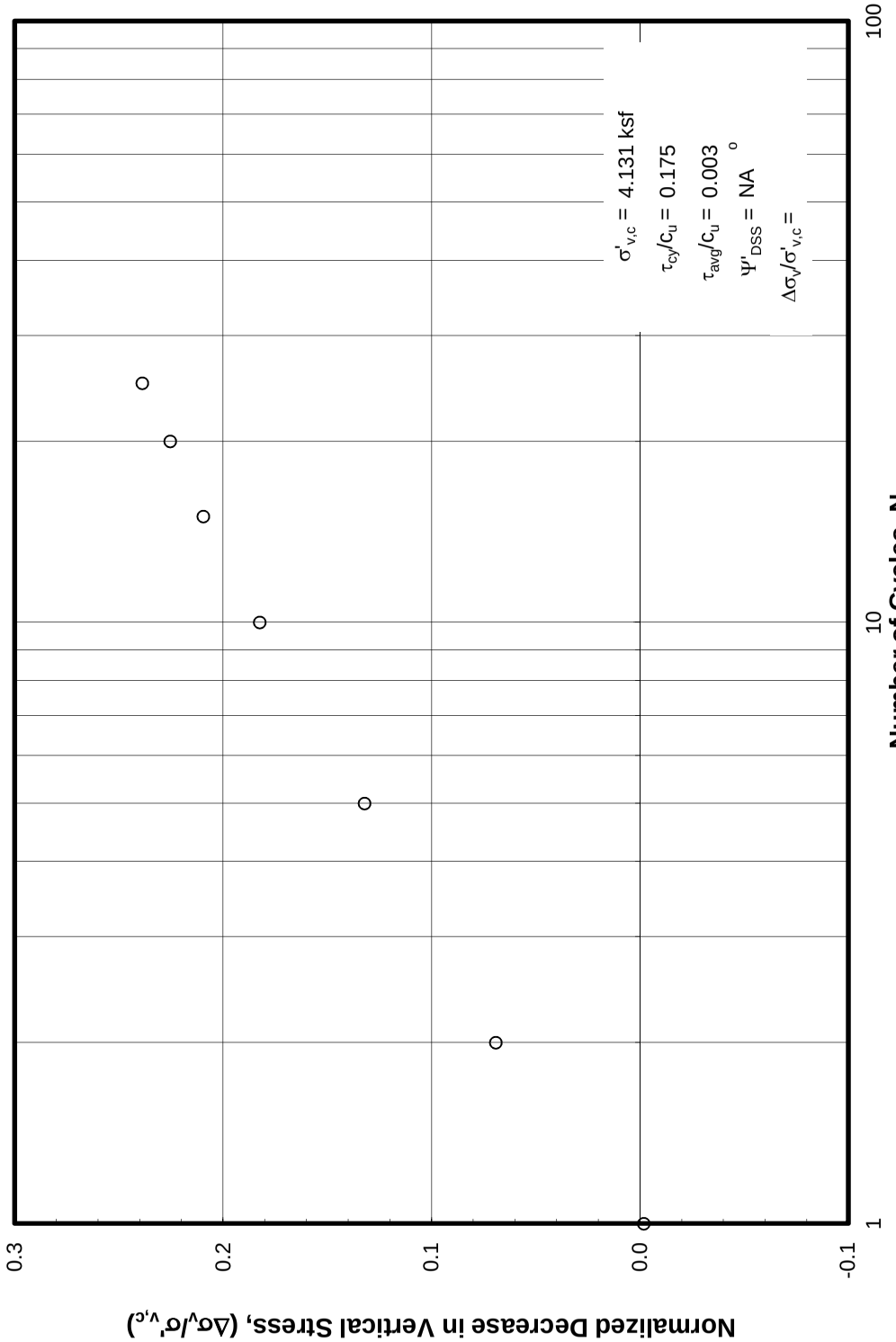
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-18, DEPTH 50.70 FEET, SHEAR STRAIN 3.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



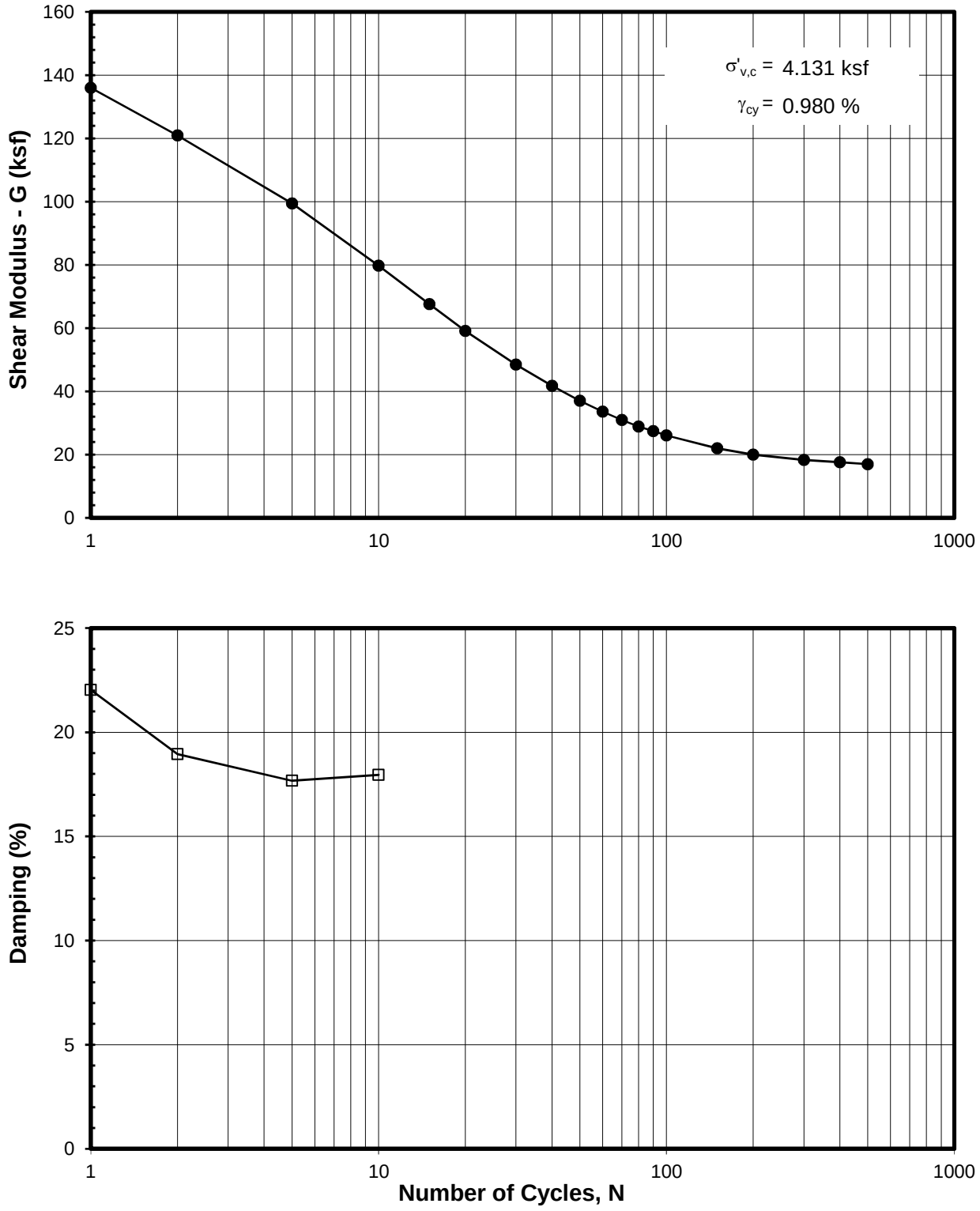
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-18, DEPTH 50.70 FEET, SHEAR STRAIN 3.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



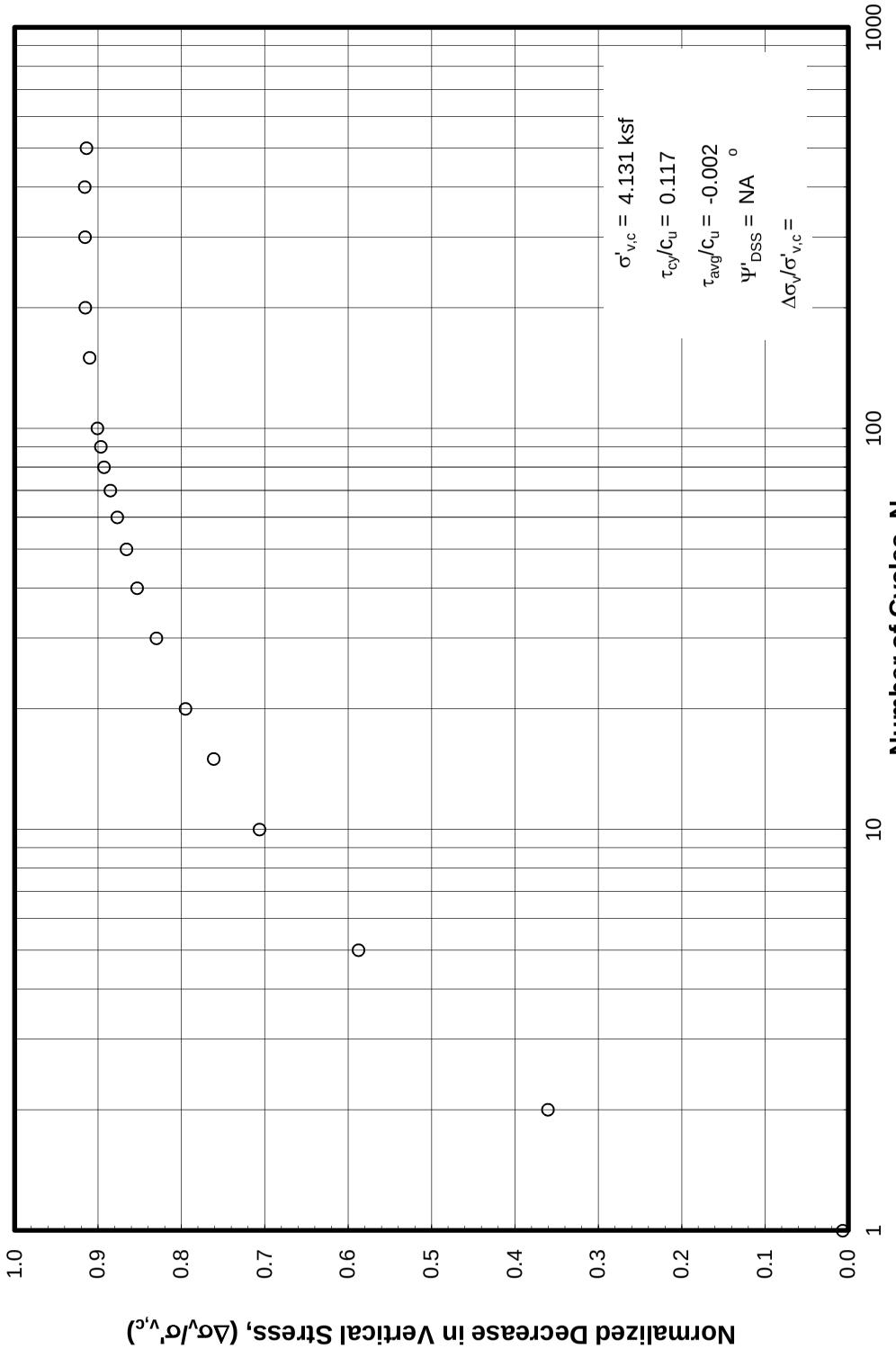
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-24, DEPTH 80.05 FEET, SHEAR STRAIN 0.25 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



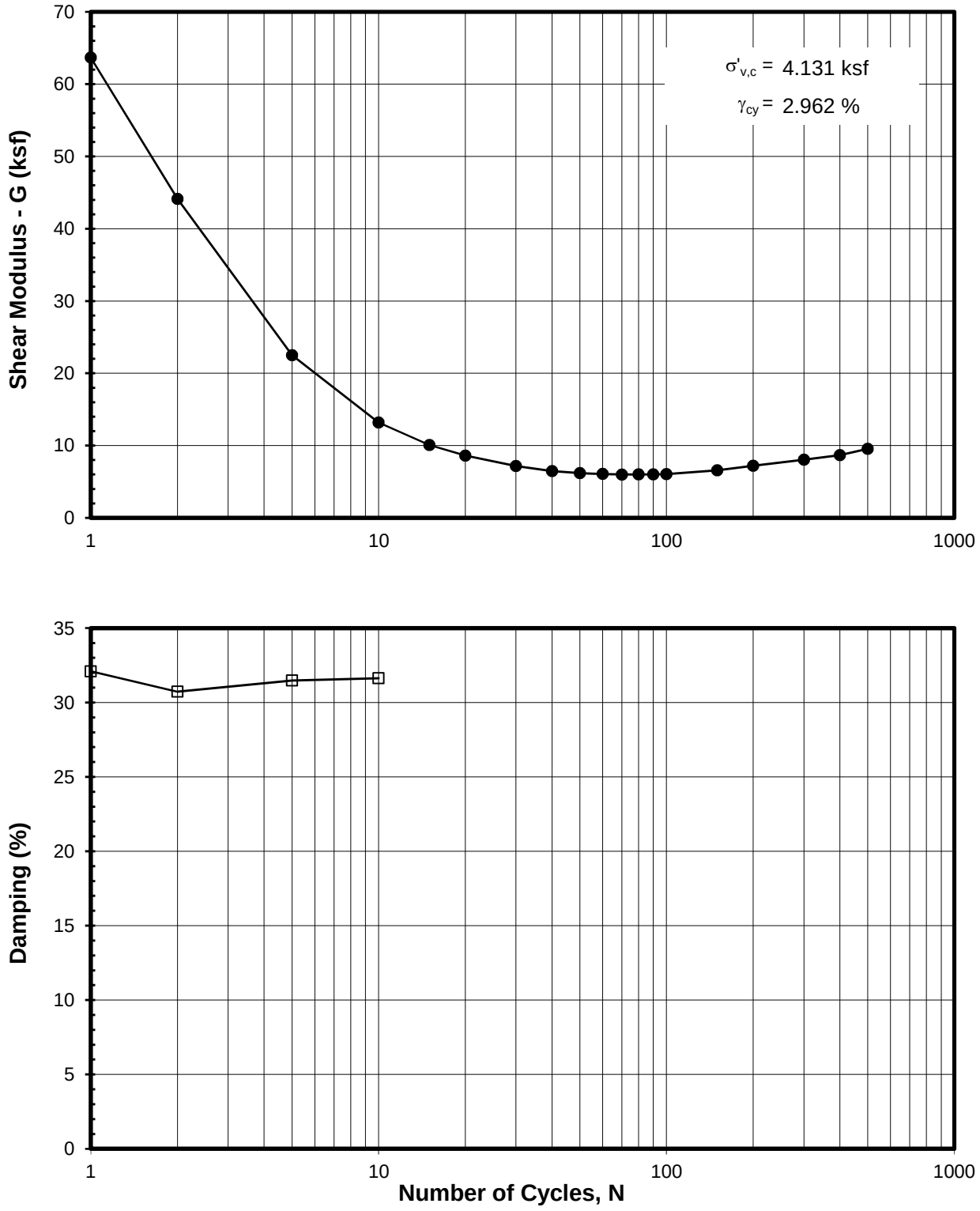
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-24, DEPTH 80.05 FEET, SHEAR STRAIN 0.25 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



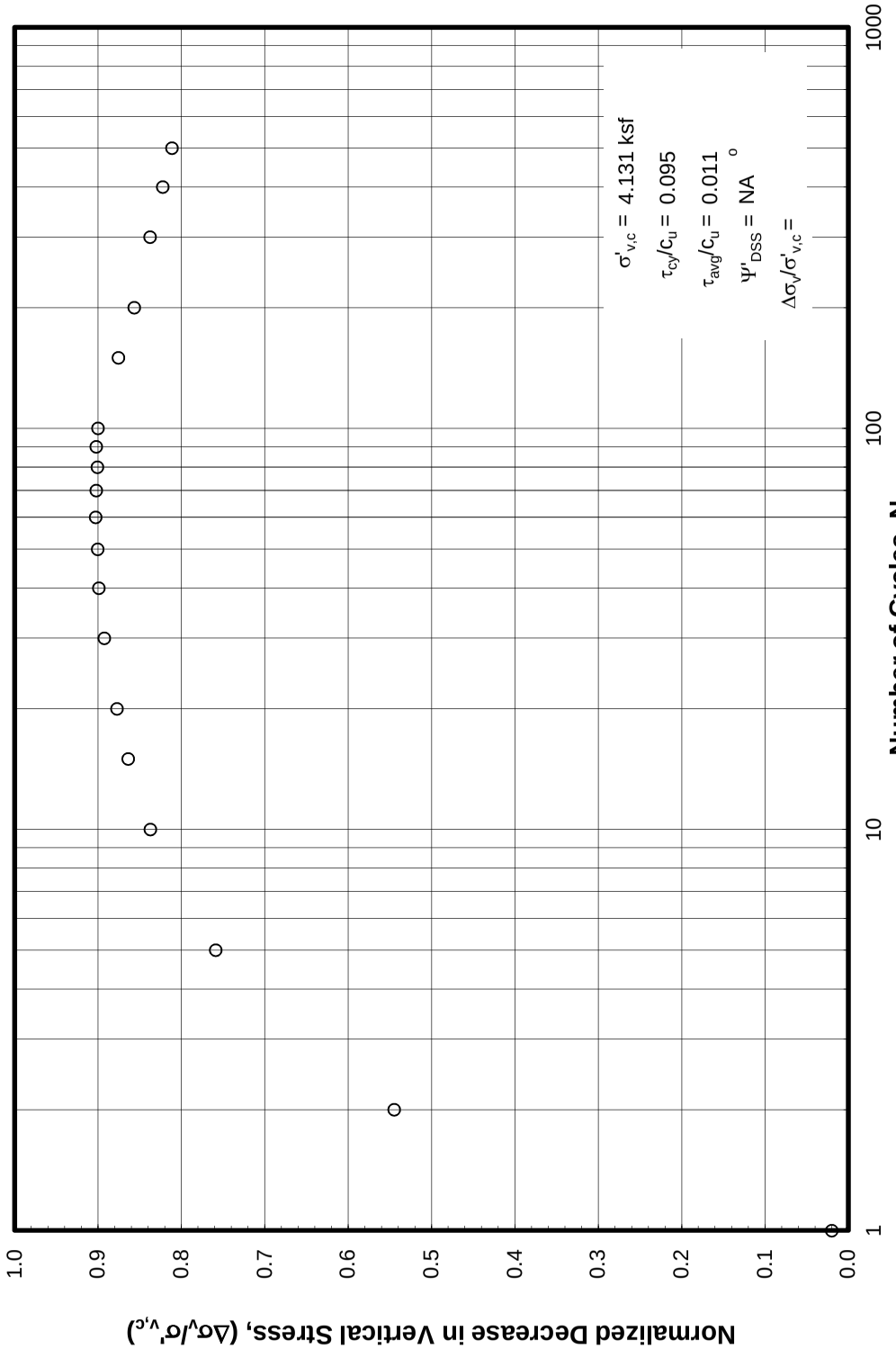
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-24, DEPTH 80.20 FEET, SHEAR STRAIN 1.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



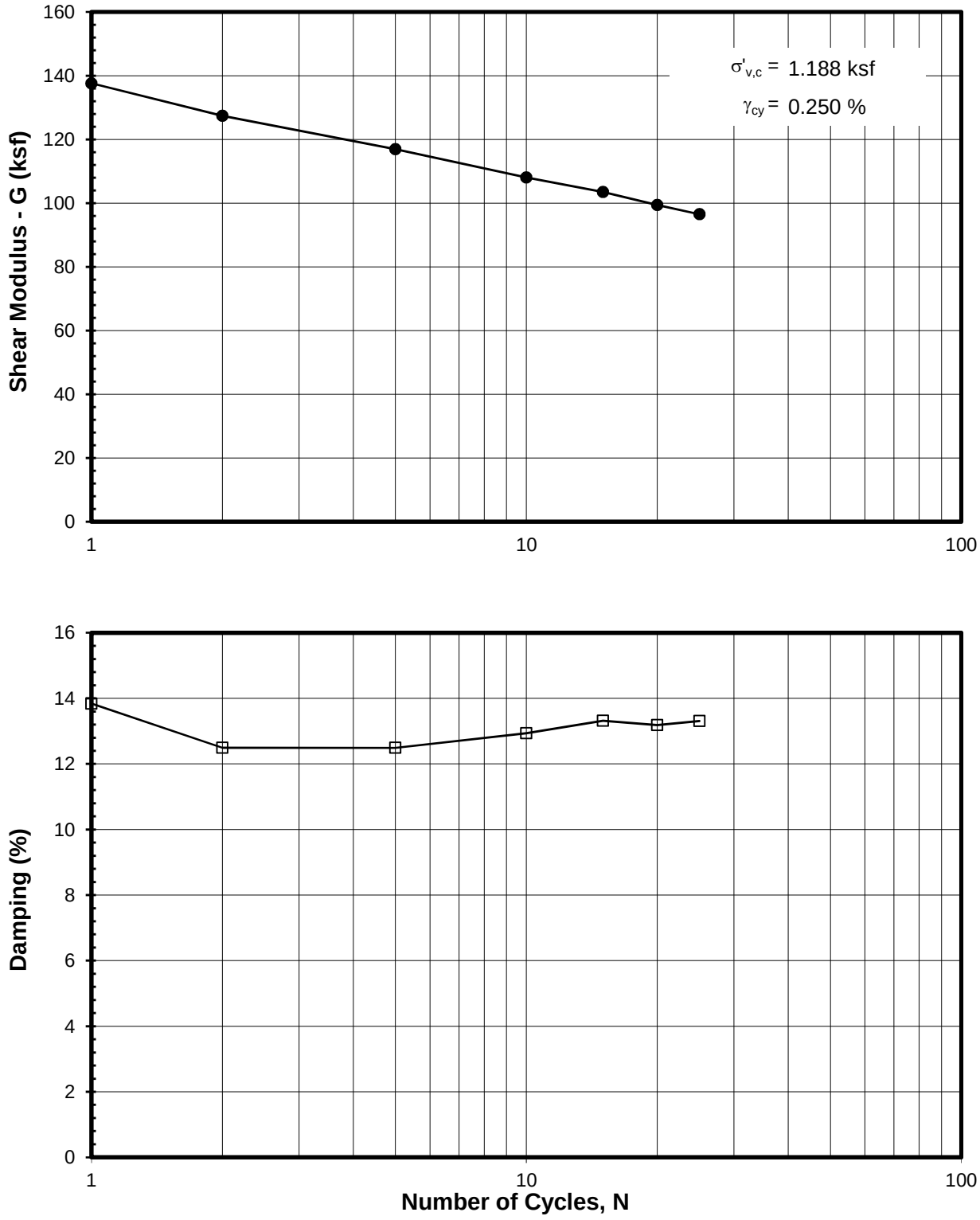
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-24, DEPTH 80.20 FEET, SHEAR STRAIN 1.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



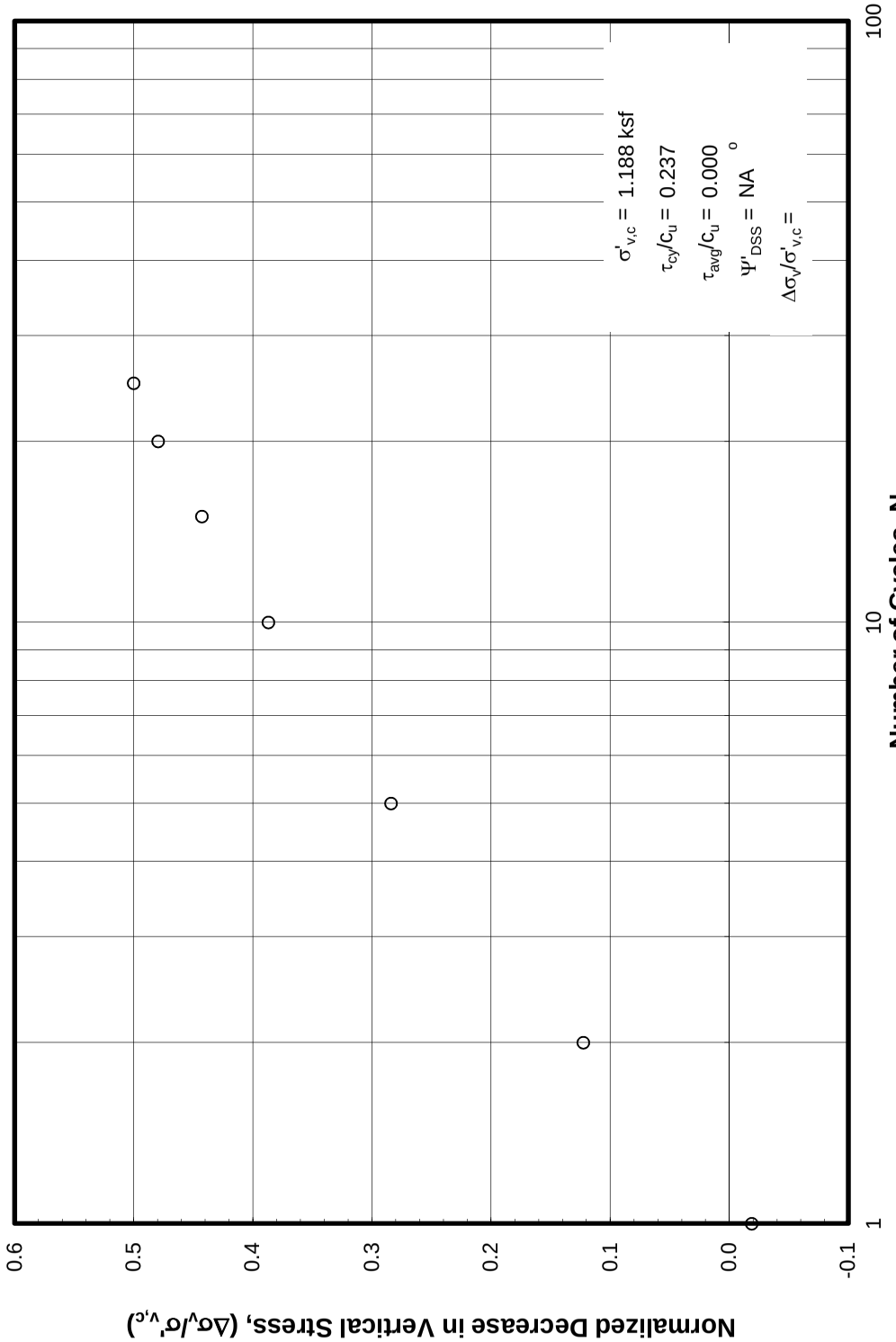
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-24, DEPTH 80.05 FEET, SHEAR STRAIN 3.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



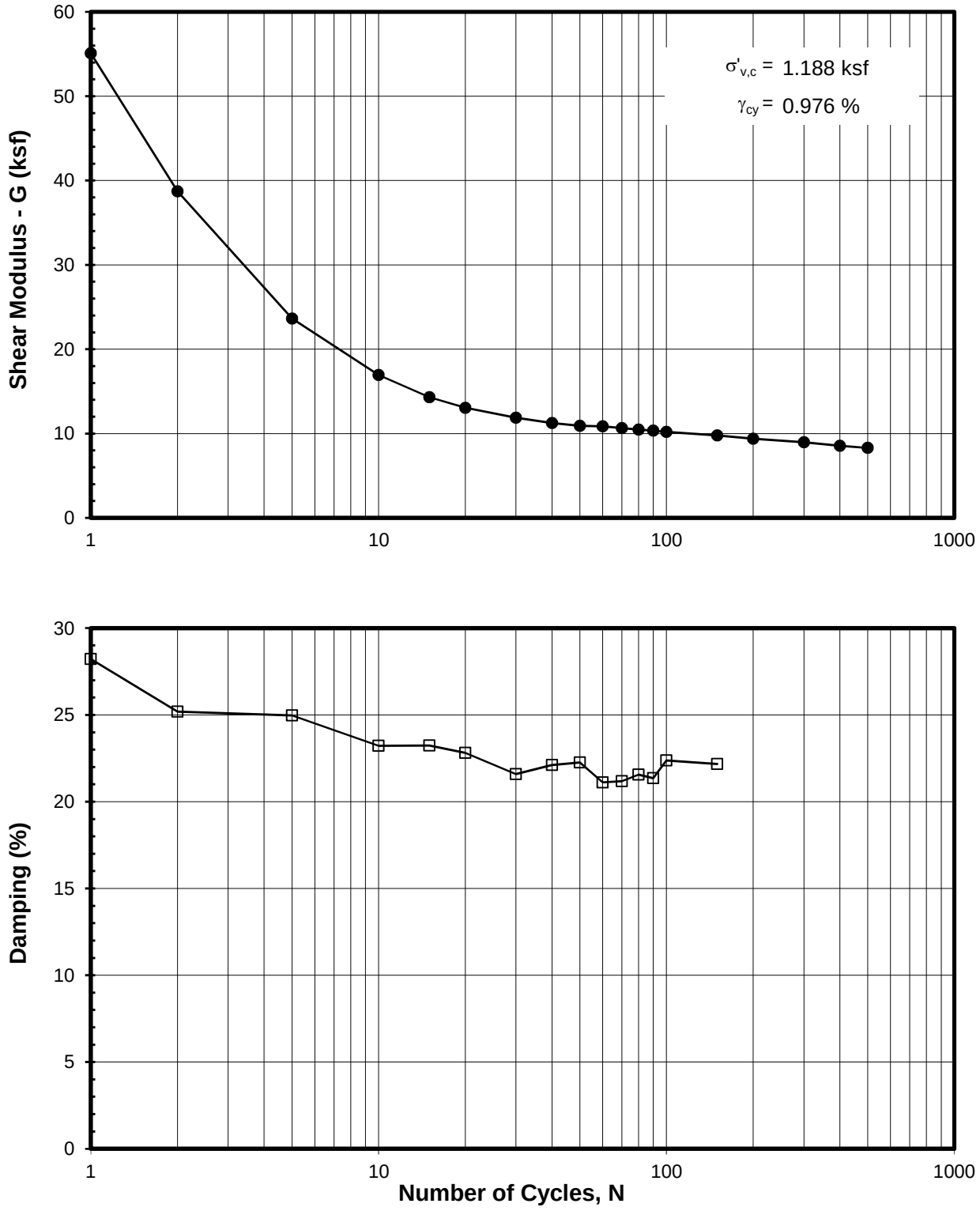
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-09, SAMPLE S-24, DEPTH 80.05 FEET, SHEAR STRAIN 3.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



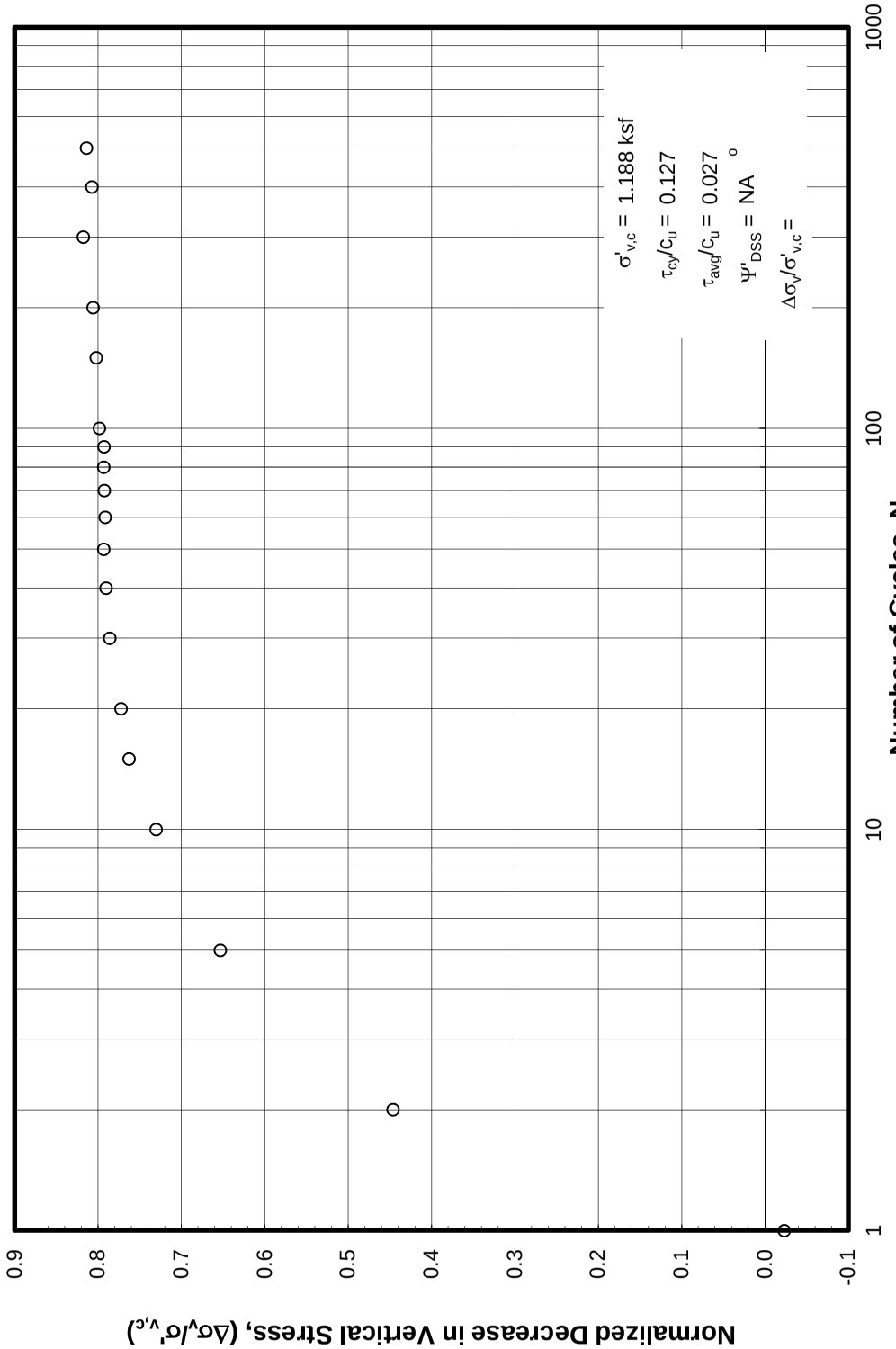
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-13, SAMPLE S-9, DEPTH 22.40 FEET, SHEAR STRAIN 0.25 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



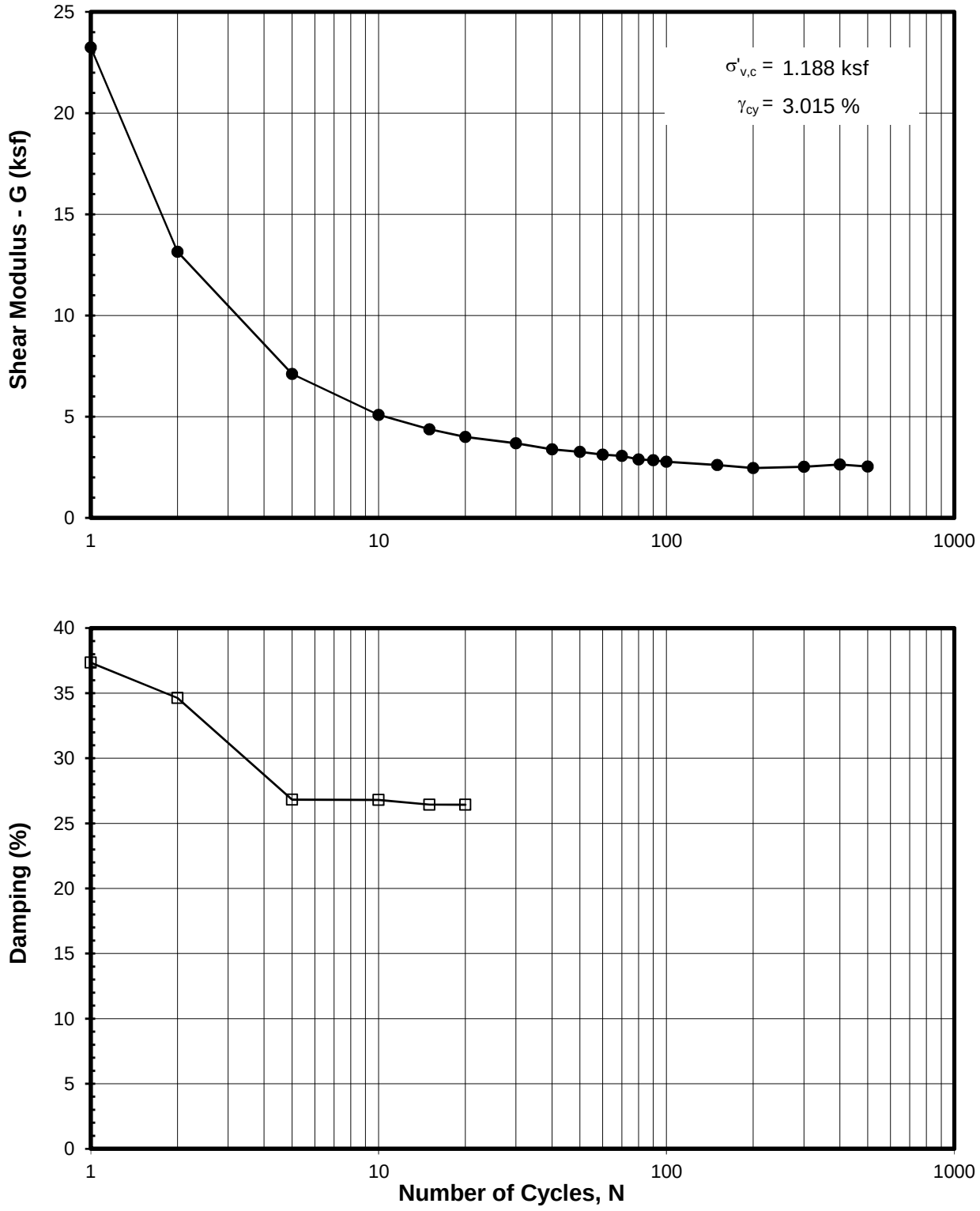
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-13, SAMPLE S-9, DEPTH 22.40 FEET, SHEAR STRAIN 0.25 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



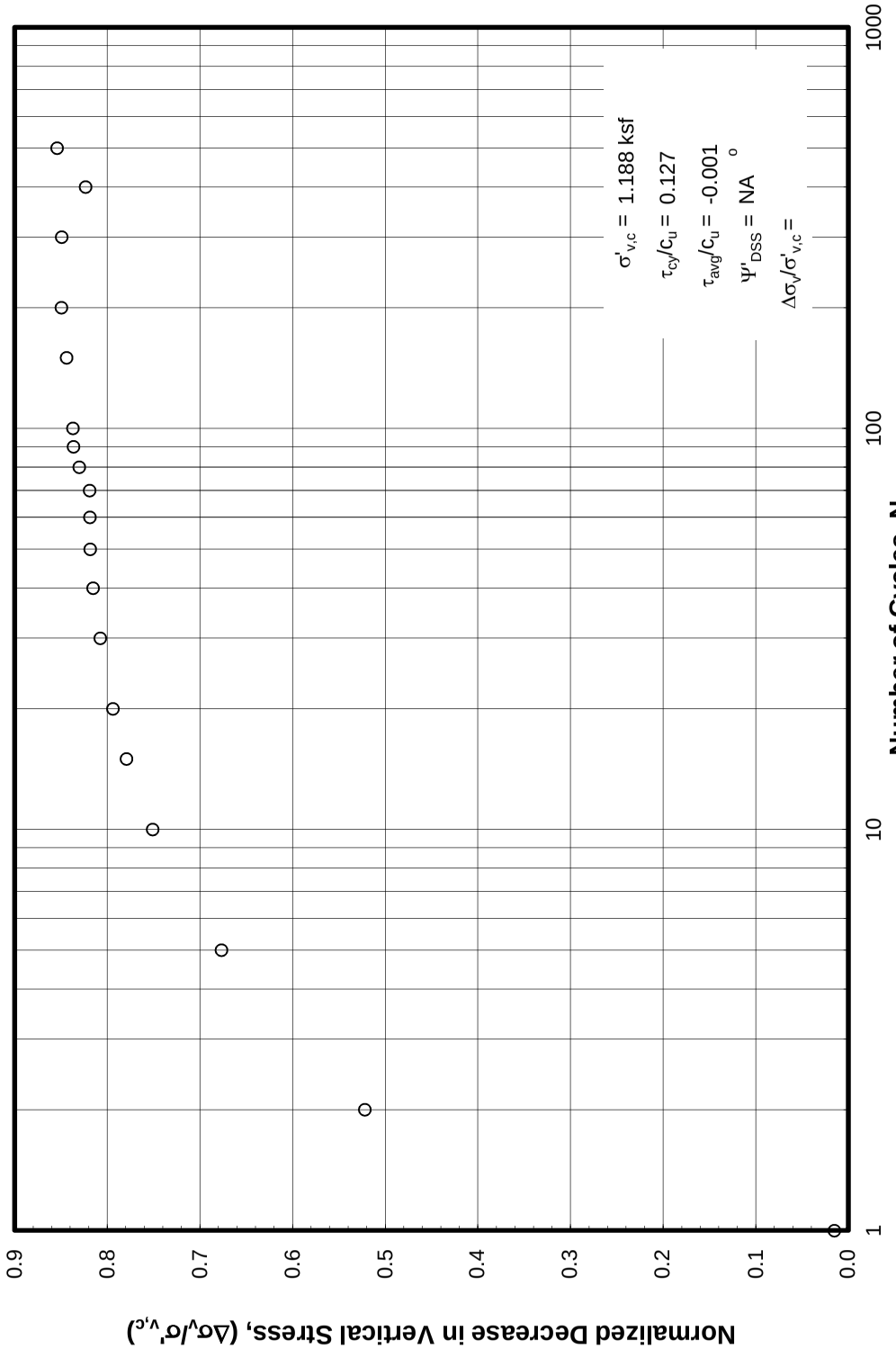
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-13, SAMPLE S-9, DEPTH 22.10 FEET, SHEAR STRAIN 1.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



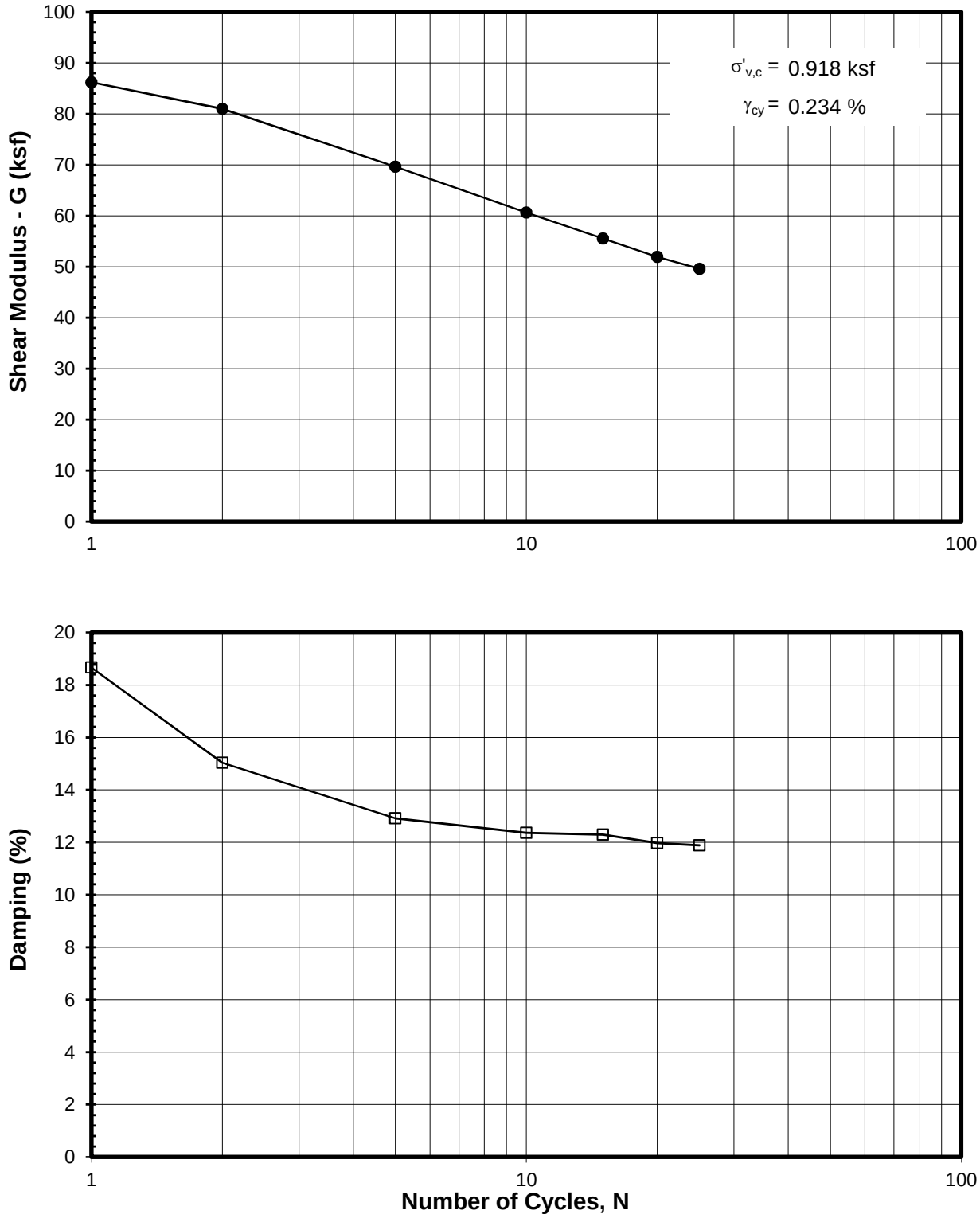
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-13, SAMPLE S-9, DEPTH 22.10 FEET, SHEAR STRAIN 1.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



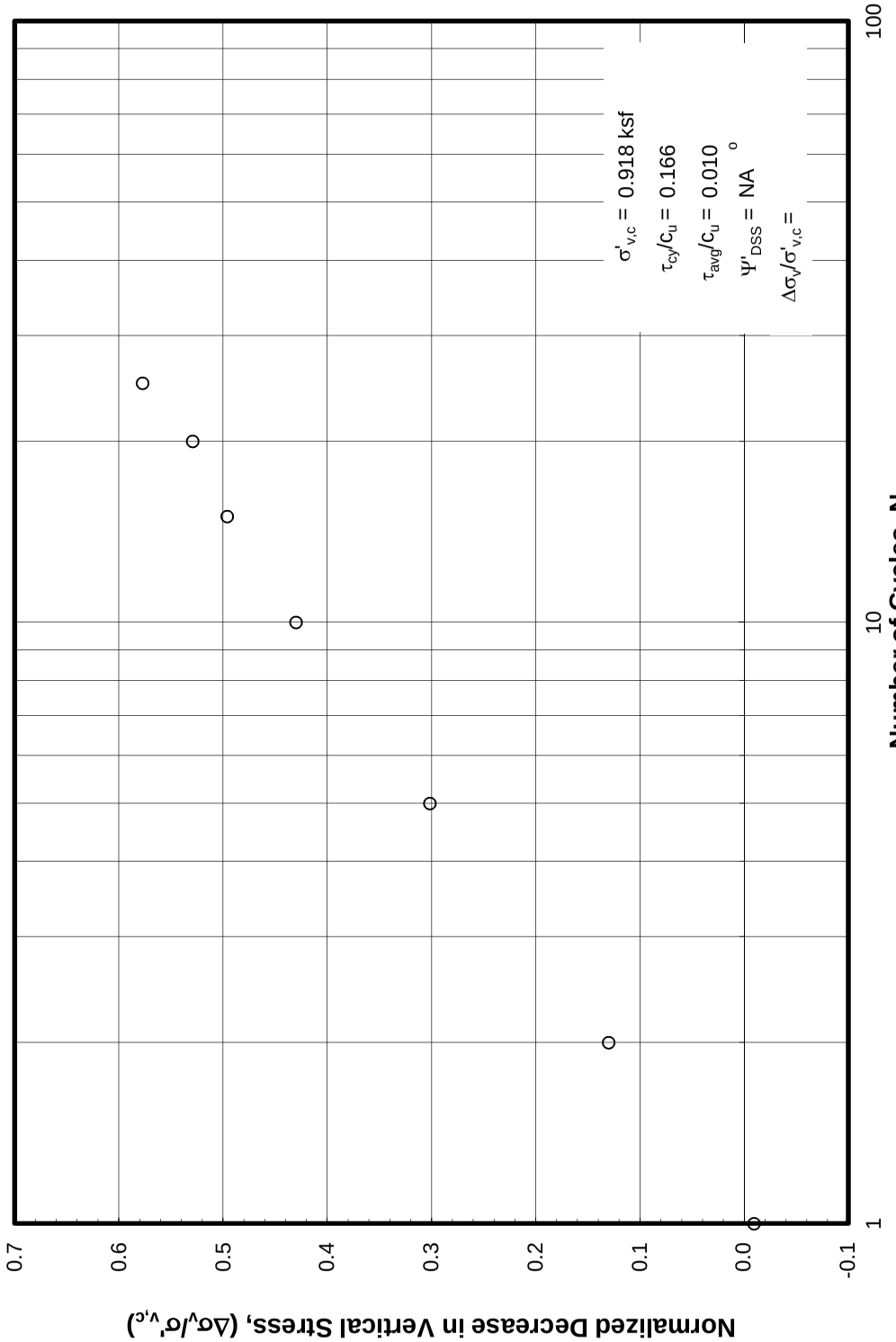
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-13, SAMPLE S-9, DEPTH 22.40 FEET, SHEAR STRAIN 3.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



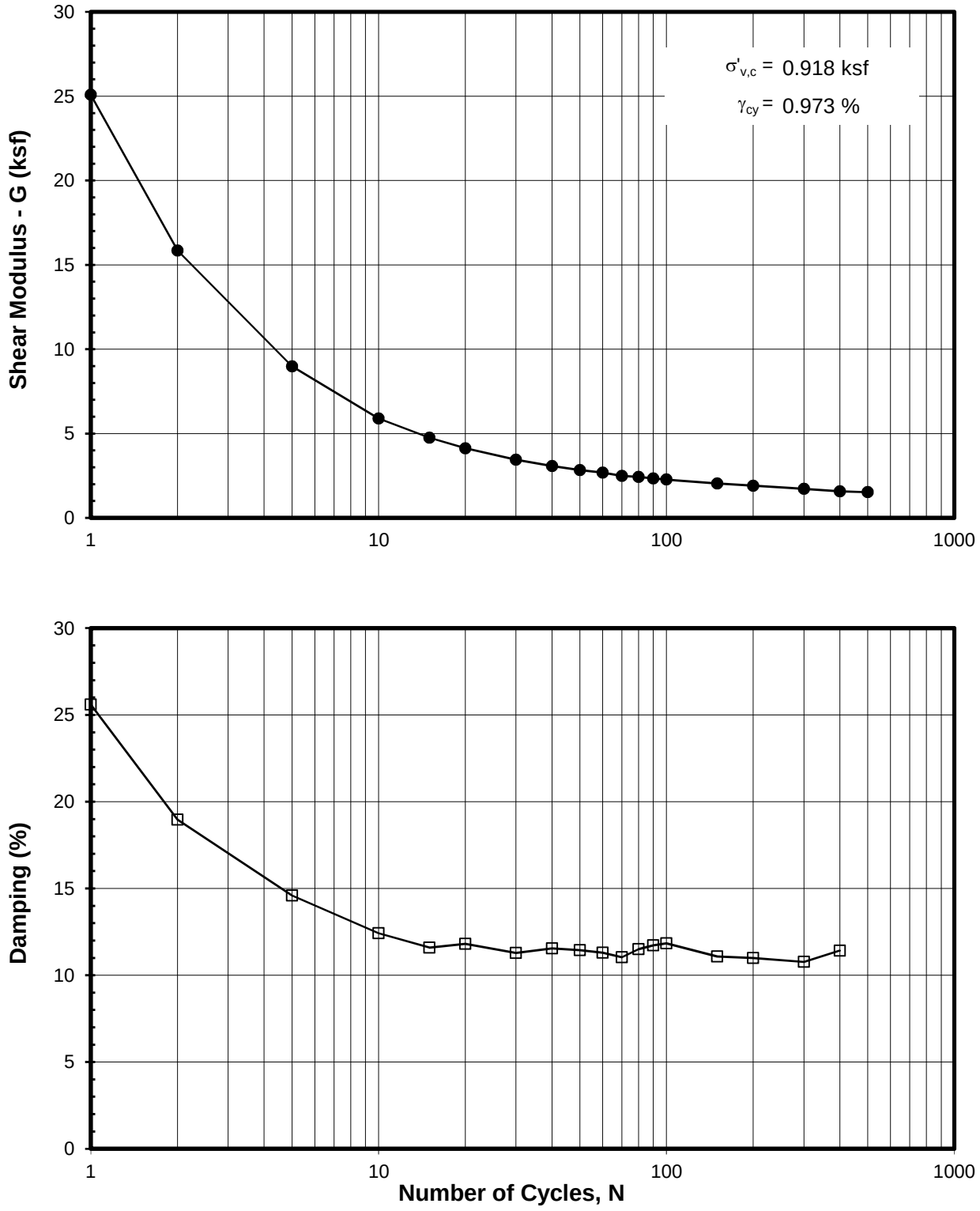
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-13, SAMPLE S-9, DEPTH 22.40 FEET, SHEAR STRAIN 3.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



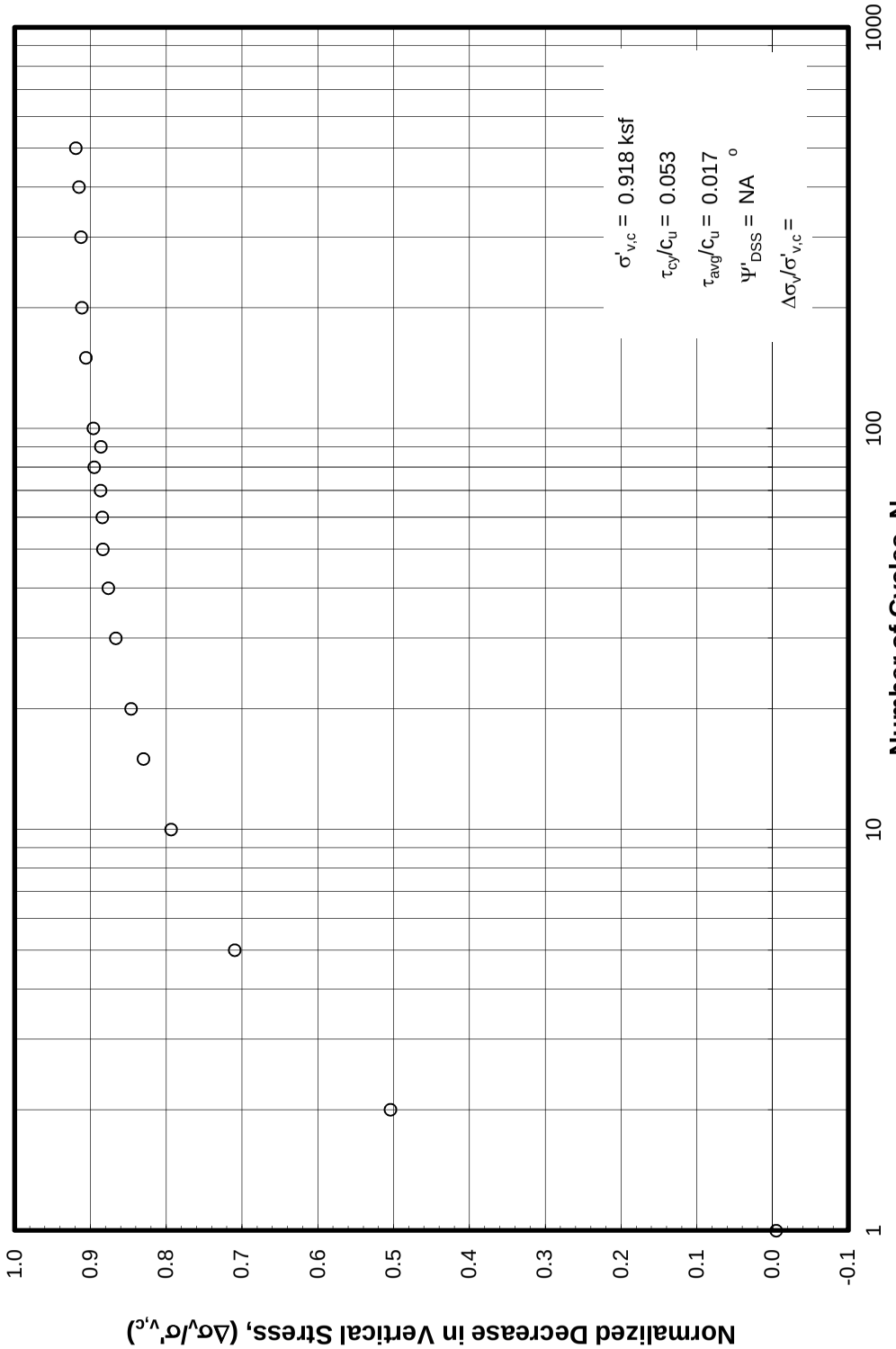
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-28, SAMPLE S-8, DEPTH 18.30 FEET, SHEAR STRAIN 0.25 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



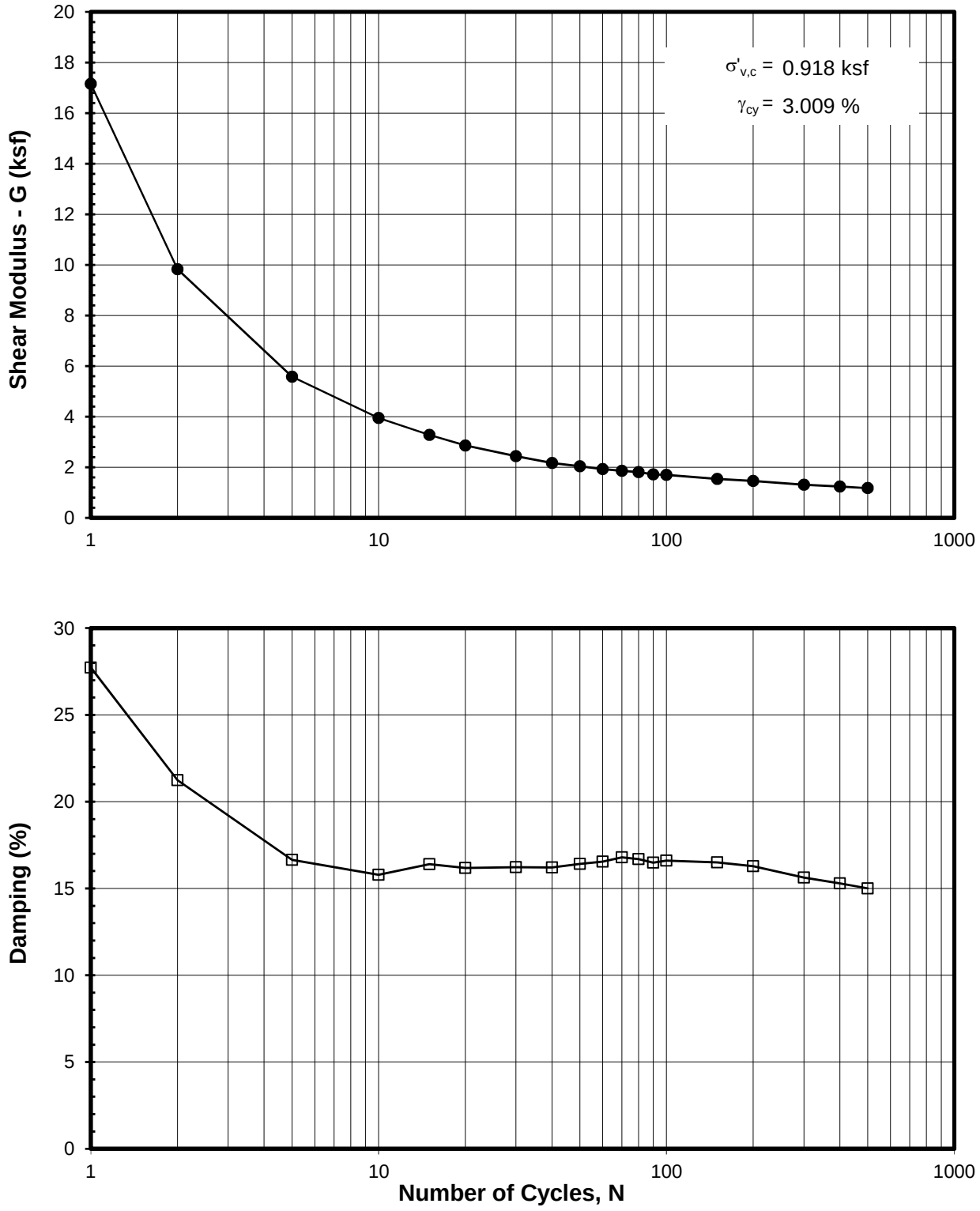
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-28, SAMPLE S-8, DEPTH 18.30 FEET, SHEAR STRAIN 0.25 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



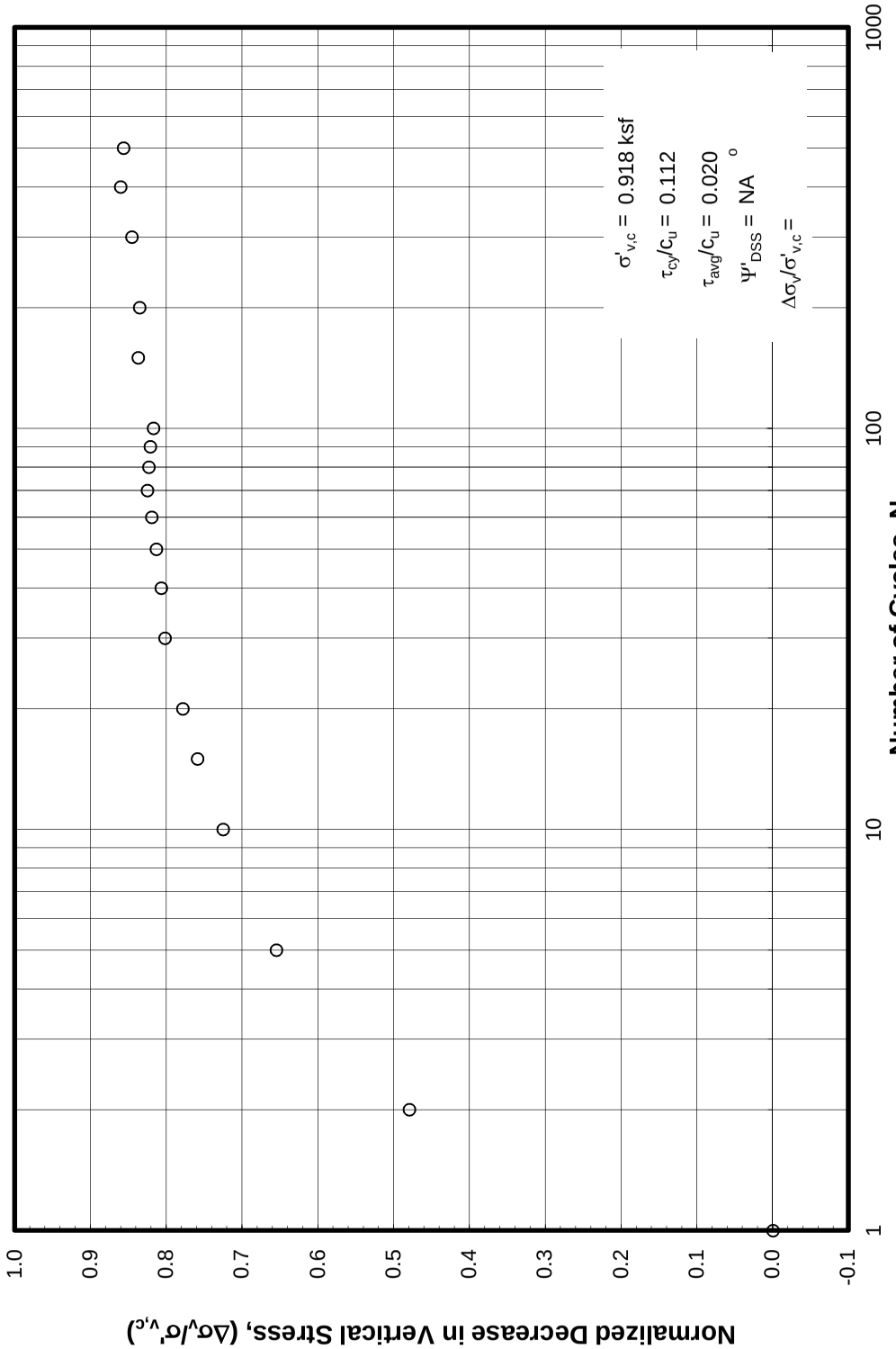
CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-28, SAMPLE S-8, DEPTH 18.00 FEET, SHEAR STRAIN 1.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-28, SAMPLE S-8, DEPTH 18.00 FEET, SHEAR STRAIN 1.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-28, SAMPLE S-8, DEPTH 18.30 FEET, SHEAR STRAIN 3.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA



CYCLIC DIRECT SIMPLE SHEAR TEST
BORING MB-28, SAMPLE S-8, DEPTH 18.30 FEET, SHEAR STRAIN 3.00 %
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-04, S-2, 3.28 – 5.25'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SEONG-YEOL JEON**

LAB NUMBER: **0922024**

REPORT DATE: **09-24-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **09-22-15**
TIME RECEIVED: **0830**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.1	SU	ASTM D4972 •	1000/09-24-15	SD
Sulfate, Soluble	464 *	mg/kg	ASTM D-516 **	1100/09-24-15	SD
Chloride, Soluble	2,549 *	mg/kg	ASTM D-512 **	1200/09-24-15	SD
Electrical Resistivity @ 15.5°C	172	ohm-cm	ASTM G-57	0600/09-24-15	SD

SO4CL 091-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-05, S-6a, 13.12 – 14.40'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SEONG-YEOL JEON**

LAB NUMBER: **0922025**

REPORT DATE: **09-24-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **09-22-15**
TIME RECEIVED: **0830**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.3	SU	ASTM D4972 •	1000/09-24-15	SD
Sulfate, Soluble	< 100 *	mg/kg	ASTM D-516 **	1100/09-24-15	SD
Chloride, Soluble	240 *	mg/kg	ASTM D-512 **	1200/09-24-15	SD
Electrical Resistivity @ 15.5°C	140	ohm-cm	ASTM G-57	0600/09-24-15	SD

SO4CL 091-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-09, S-1a, 0.0 – 0.39'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SEONG-YEOL JEON**

LAB NUMBER: **0922026**

REPORT DATE: **09-24-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **09-22-15**
TIME RECEIVED: **0830**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	7.9	SU	ASTM D4972 •	1000/09-24-15	SD
Sulfate, Soluble	470 *	mg/kg	ASTM D-516 **	1100/09-24-15	SD
Chloride, Soluble	2,919 *	mg/kg	ASTM D-512 **	1200/09-24-15	SD
Electrical Resistivity @ 15.5°C	688	ohm-cm	ASTM G-187	0600/09-24-15	SD

MANY ROCKS IN SAMPLE

SO4CL 091-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-17, S-3, 4.92 – 6.89'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SOCHAN JUNG**

LAB NUMBER: **1201001**

REPORT DATE: **12-08-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **12-01-15**
TIME RECEIVED: **0630**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.3	SU	ASTM D4972 •	0930/12-07-15	SD
Sulfate, Soluble	515 *	mg/kg	ASTM D-516 **	1200/12-07-15	SD
Chloride, Soluble	2,587 *	mg/kg	ASTM D-512 C **	1300/12-07-15	SD
Electrical Resistivity @ 15.5°C	308	ohm-cm	ASTM G-187	0630/12-08-15	SD

SO4CL 110-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-18, S-1c, 0.46 – 1.97'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SOCHAN JUNG**

LAB NUMBER: **1117035**

REPORT DATE: **11-24-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **11-17-15**
TIME RECEIVED: **1000**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.2	SU	ASTM D4972 •	0900/11-24-15	SD
Sulfate, Soluble	564 *	mg/kg	ASTM D-516 **	1030/11-24-15	SD
Chloride, Soluble	2,349 *	mg/kg	ASTM D-512 **	1100/11-24-15	SD
Electrical Resistivity @ 15.5°C	320	ohm-cm	ASTM G-187	0600/11-24-15	SD

SO4CL 107-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-19, S-3, 4.92 – 6.89'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SOCHAN JUNG**

LAB NUMBER: **1201004**

REPORT DATE: **12-08-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **12-01-15**
TIME RECEIVED: **0630**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.4	SU	ASTM D4972 •	0930/12-07-15	SD
Sulfate, Soluble	503 *	mg/kg	ASTM D-516 **	1200/12-07-15	SD
Chloride, Soluble	3,223 *	mg/kg	ASTM D-512 C **	1300/12-07-15	SD
Electrical Resistivity @ 15.5°C	292	ohm-cm	ASTM G-187	0630/12-08-15	SD

SO4CL 110-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-19, S-7, 14.76 – 16.73'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SOCHAN JUNG**

LAB NUMBER: **1201005**

REPORT DATE: **12-08-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **12-01-15**
TIME RECEIVED: **0630**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.5	SU	ASTM D4972 •	0930/12-07-15	SD
Sulfate, Soluble	584 *	mg/kg	ASTM D-516 **	1200/12-07-15	SD
Chloride, Soluble	2,829 *	mg/kg	ASTM D-512 C **	1300/12-07-15	SD
Electrical Resistivity @ 15.5°C	281	ohm-cm	ASTM G-187	0630/12-08-15	SD

SO4CL 110-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-21, S-2, 2.46 – 4.43'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SOCHAN JUNG**

LAB NUMBER: **1201002**

REPORT DATE: **12-08-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **12-01-15**
TIME RECEIVED: **0630**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.3	SU	ASTM D4972 •	0930/12-07-15	SD
Sulfate, Soluble	520 *	mg/kg	ASTM D-516 **	1200/12-07-15	SD
Chloride, Soluble	2,859 *	mg/kg	ASTM D-512 C **	1300/12-07-15	SD
Electrical Resistivity @ 15.5°C	263	ohm-cm	ASTM G-57	0630/12-08-15	SD

SO4CL 110-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-25, S-3, 4.92 – 6.89'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SOCHAN JUNG**

LAB NUMBER: **1117036**

REPORT DATE: **11-24-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **11-17-15**
TIME RECEIVED: **1000**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.0	SU	ASTM D4972 •	0900/11-24-15	SD
Sulfate, Soluble	367 *	mg/kg	ASTM D-516 **	1030/11-24-15	SD
Chloride, Soluble	2,175 *	mg/kg	ASTM D-512 **	1100/11-24-15	SD
Electrical Resistivity @ 15.5°C	420	ohm-cm	ASTM G-187	0600/11-24-15	SD

SO4CL 107-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-26, S-1, 0.00 – 1.97'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SOCHAN JUNG**

LAB NUMBER: **1118043**

REPORT DATE: **12-02-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **11-18-15**
TIME RECEIVED: **1000**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.0	SU	ASTM D4972 •	0930/12-01-15	SD
Sulfate, Soluble	803 *	mg/kg	ASTM D-516 **	1000/12-01-15	SD
Chloride, Soluble	3,374 *	mg/kg	ASTM D-512 **	1100/12-02-15	SD
Electrical Resistivity @ 15.5°C	274	ohm-cm	ASTM G-187	0630/12-02-15	SD

SO4CL 108-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-28, S-3, 4.92 – 6.73'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SOCHAN JUNG**

LAB NUMBER: **1201003**

REPORT DATE: **12-08-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **12-01-15**
TIME RECEIVED: **0630**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.2	SU	ASTM D4972 •	0930/12-07-15	SD
Sulfate, Soluble	554 *	mg/kg	ASTM D-516 **	1200/12-07-15	SD
Chloride, Soluble	3,626 *	mg/kg	ASTM D-512 C **	1300/12-07-15	SD
Electrical Resistivity @ 15.5°C	303	ohm-cm	ASTM G-187	0630/12-08-15	SD

SO4CL 110-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO CONSULTANTS, INC.

6100 HILLCROFT **HOUSTON, TEXAS 77081**
PHONE (713) 369-5400 **FAX (713) 369-5518**

RESULTS OF TESTS

PROJECT: **MB-31, S-2, 2.46 – 4.43'**

FOR: **FUGRO CONSULTANTS, INC.**
HOUSTON, TEXAS

REPORTED TO: **SOCHAN JUNG**

LAB NUMBER: **1118044**

REPORT DATE: **12-02-15**
CLIENT NUMBER:
JOB NUMBER: **1014-0334**
REPORT NUMBER:
DATE SAMPLED:
TIME SAMPLED:
SAMPLED BY: **CLIENT**
DATE RECEIVED: **11-18-15**
TIME RECEIVED: **1000**
RECEIVED BY: **SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
pH, Method A	8.0	SU	ASTM D4972 •	0930/12-01-15	SD
Sulfate, Soluble	564 *	mg/kg	ASTM D-516 **	1000/12-01-15	SD
Chloride, Soluble	2,999 *	mg/kg	ASTM D-512 **	1100/12-02-15	SD
Electrical Resistivity @ 15.5°C	325	ohm-cm	ASTM G-187	0630/12-02-15	SD

SO4CL 108-15

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

• CALCIUM CHLORIDE pH RESULTS NOT REPORTED

**** WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.**

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

APPENDIX F

Method Statements

Table F: Summary of Method Statements

Category	MS No.	Task
Marine Geotechnical Investigation	MR-GT-MS-001	Skate 3 Mobilization
	MR-GT-MS-002	Moving and Positioning Skate 3 JUB
	MR-GT-MS-003	Crew Transfer
	MR-GT-MS-004	Drilling Operations
	MR-GT-MS-005	Spoil and Cargo Transfer
	MR-GT-MS-006	Lifting Operations on Site and JUB
	MR-GT-MS-007	Fueling Operations
	MR-GT-MS-008	Procedure for Site Assessment
	MR-GT-MS-009	PS Suspension Logging
	MR-GT-MS-010	Sample Handling and Transport

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1. Introduction
2. Main Activity/Area of Work
3. Manpower and Supervision
4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)
5. Hazard/Risk Assessments
6. Security - Barriers/Fences/Warning Signs
7. Constraints/Restrictions/Special Considerations
8. Plant and Equipment
9. Materials (handling/storage/disposal)
10. Preparation of Works/Location of Services
11. Emergency Procedures
12. Personal Protective Equipment/Safety Equipment
13. Methodology & Sequence of Work

Appendix 1: Deck Plan

Appendix 2: Lift Plans

Appendix 3: PTW

Appendix 4: JUIC

Issue details:	Issue 1 Revision 4	
Distribution:	Controlled copies: Fugro	Uncontrolled copies: Client
Originated by: Andi Hagan	Reviewed/authorised for issue by: Andi Hagan	

A METHOD STATEMENT IS ONLY A SAFE METHOD WORKING IF IT IS DISCUSSED AND AGREED BEFORE WORK BEGINS AND THEN FOLLOWED BY THOSE CARRYING OUT THE WORK.

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1. Introduction

This method statement outlines the site specific elements for the mobilisation of Skate 3 in Nikiski, Alaska for the Alaska LNG (AKLNG) Geophysical and Geotechnical Site investigation Project.

2. Main Activity / Area of Work

Skate 3 will be shipped from the UK or Canada via standard container freight and delivered to the Rig Tenders Quay (RTQ). At this point the project site team will take delivery and implement this plan for the safe offloading using the appropriate crane and lifting equipment.

Figure 1. Rig Tender Quay, Nikiski

A lift plan will be approved by the appointed person (AP) who can be based offsite, and must be in place prior to any lifting operations taking place. This lift plan can be found in Appendix 2 at the end of this document. While every effort will be taken to avoid working at height, if this is not possible, suitable controls will also be in place for activities or accessing the back of lorries.

Once communicated and the relevant risk assessments have been reviewed the Supervisor will hold responsibility for the safe implementation of the plan(s) and ensure any changes are communicated to the crew by Tool Box Talk (TBT), to the project team through the MOC procedure on form HS-F80and recorded in the project file.

The mobilization will be conducted in line with the Skate 3 Operations Manual taking into consideration local factors such as tide, current and wind conditions.

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Figure 2. Aerial view of Rig Tenders Quay & storage area

The Skate 3 will be assembled on the North West area of the quay on either the north or the western wall depending on tide, wind and sea conditions at the time of the operation.

Figure 3. Aerial view of Rig Tenders Quay in North West Area

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3. Manpower and Supervision

Job Title	Responsibility
Project Manager	Responsible for the execution of works in a safe, effective manner. Ensure development and application of safe systems of work, competence of personnel and that equipment suitable, properly maintained and certified.
Site Engineer	Responsible for detailed planning and execution of the work scope in a safe manner. Development of mobilisation Health and Safety documentation, ensuring Toolbox Talks and Inductions are executed. Shall ensure competent appointed person is in place for the operation.
Appointed Person for lifting operations	Responsible for assisting in the planning of the operations and the lift plan. Responsibilities outlined in BS 7121. Will ensure competent supervision of all lifts and executed in a safe manner. Ensure any feedback from the operation is recorded and documentation updated accordingly.
Bargemaster/Supervisor	Responsible for supervision and control of the barge in accordance with the operations Manual, JUB Standing instructions and this Method Statement. Communicates with local Marine authorities, quay operators, crane operators and Tug skipper. Ensure the operation is conducted in a controlled and safe manner.
Tug Skipper	Has overall responsibility for tug if required for manoeuvring the JUB.
Crew Transfer Vessel (CTV) Skipper	Has overall responcibility for the marine element of the crew transfer.
First Aider(s)	At least one certified first aider to be available on each vessel for each shift

4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

Document(s)	Serial Number(s).
AKLNG Work Execution Plan	Latest revision
AKLNG Project Management Plan	C1707- Latest revision
• AKLNG ERP	C1707 – Latest revision
• Skate 3 Operations Manual	Rev 3 Feb 2014
• JUB Standing Instructions	Rev 1 Oct 2013
• Mobilisation Lift Plan	(See appendix 2)
• Skate 3 Deck Plan	Latest revision
FCL Management of change	HS-P15
Project SIMOPS matrix	Latest version updated weekly

5. Risk Assessments

Risk assessments relevant to the work activity are held in the project office (paper or electronic) and onboard the JUB (paper copy)

RA No - RA Title / Work Activity

RAS 001 - Working Over Water

RAS 002 – Towing and Positioning

RAS 004 – Personnel Transit by Crew Boat or RIB

RAS 009 - Abrasive Wheel - Grinding Activities

RAS 010 - Use of Equipment, Tool & Materials at Height

RAS 011 - Hot Works

RAS 014 – Craneage

RAS 020 - Use of Power Tools

RAS 024 - Interaction with Dock Users, mariners & General Public

RAS 027 - Interaction with Other Marine Traffic

RAS 033 - Man Overboard

RAS 037 - On Board General Fabrication

RAS 044 - Welding Operations

RAS 045 - Gas Cutting

RAS 046 - Storage of flammable Materials

RAS 049 - Manual Handling, lifting Acc

RAS 051 - Manual Handling Assessment (Gas Cylinders)

RAS 053 - Work at Height

RAS 058 - Confined Space Entry & Work

RAS 059 - Stored energy in Hydraulic & Pneumatic Systems

RAS 060 - Jacking Operations

RAS 061 - Use of Power Hand Tools

RAS 062 - Drilling Mast - Winch Operations

RAS 067 - Launching and Recovery of A RIB

RAS 069 - Manual Handling General Activities

RAS 070 - Mechanical Lifting Operations - Mobile Crane

RAS 071 - Mechanical Lifting Operations (Hiab & Deck Mounted Cranes)

RAS 075 – Loading and Unloading of Trucks on Site

6. Security - Barriers/Fences/Warning Signs

In compliance with the ASRC Dock access procedures all crew movements into and out of the dock will be completed with sufficient TWIC card holders to ensure a 20% ration of card holders to crew. The FSCL Crew will not hold TWIC Cards.

In collaboration with the quay owners, suitable signs and barriers will be put into place to ensure only personnel associated with the work activities can access the area. The working area will not be accessible to members of the public. The project crew will ensure no unauthorised access to the work area during operational activities.

7. Constraints/Restrictions/Special Conditions

Working hours for the mobilization will be 12hrs per day and seven days per week.

In order to execute the mobilisation in safe manner the crane operations will entail limiting factors - Wind speed of 12 m/s or as stipulated by the crane manufacture/Appointed person, whichever is the least value.

Each lifting operation will be risk assessed and executed in accordance with the task specific Lift Plan.

During Rafting Operations the RHIB will be manned and in the water positioned such that it is outside all lifting radius but able to quickly respond to a MOB Event. The RHIB will NOT use an anchor to hold station as this will slow response time.

Work permits will be required for the following tasks – Working at height and Hot Works. PTW for working at heights and hot works will be accompanied by a task specific risk assessment and method statement. FSCL will adopt any local PTW systems required by the ASRC Dock alongside the FSCL System

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Hot works permits shall be time related and signed off and closed out on completion of the allotted time period. Fire watch personnel may be required including the suitable placing of firefighting equipment within close proximity

Working limits for Skate 3 are as follows:

Item No	Description	Sea state (-Hmax (m and ft)	Wind speed Beaufort scale Force	Wind speed (m/s and mph)	Current (Knots)
1	Crew Evacuations	1.5m (5ft)	Wind Force 6	12m/s (27mph)	6
2	Crew Changes	1.2m (4ft)	Wind Force 6	12m/s (27mph)	4
3	Moving Between BH locations	0.75m (2.5ft) Hmax	Wind Force 5	10m/s (22mph)	2
4	Jacking Up/ Down	0.75m (2.5ft)	Wind Force 5	10m/s (22mph)	2
5	Final setting of conductor or riser casing	1.2m (4ft)	Wind Force 6	12m/s (27mph)	1
6	Drilling operations	1.5m (5ft)	Wind Force 6	12m/s (27mph)	4
7	Towing Jack Up	0.75m (2.5ft)	Wind Force 5	10m/s (22mph)	4
8	Equipment/Sample transfer to/from jack Up	1m (3ft)	Wind Force 4	8m/s (18mph)	2
9	Fog	Visibility of greater than 500m approximately for moving between boreholes and crew transfer			

These values are realistic limits based upon experience for when conditions are likely to become unworkable. They are indicative guidelines only and can vary up or down subject to compounding effects and other environmental conditions e.g. wave shape, wave period. At all times the decision of the Bargemaster, tug skipper or Supervisor is final in determining the suitability of the conditions for the operation/ Assembly

Work outside the guardrails / protected areas / access platforms shall not be undertaken unless a detailed risk assessment has been carried out and the appropriate control measures implemented e.g. fall arrest system block and harness. If fall arrest systems are in use an approved rescue plan must be in place such that the risk from suspension trauma is mitigated

Tidal Restrictions for Assembly

Due to the tidal nature of the mobilisation berth, the rafting of the jack up will have to take place at the following times.

- Spring tides – At Slack water or outgoing tide to low tide
- Neap Tides – At any time during the neap tide tidal cycle

The JUB will be rafted and Jacked up during a single 12 hour shift to avoid leaving the pontoons moored up on ropes.

***Note that once the jack up is rafted and jacked up the tide and current will not have an influence in the continuation of normal mobilisation operations other than moving the jack up if required*.**

8. Plant and Equipment

Basic Plant and Equipment List

- Skate 3 jack-up barge (JUB)
- Suitably sized mobile crane Supplied by ASRC
- Forklift (telescopic) Supplied by ASRC
- Man riding basket (required for leg assembly)
- Deck Mounted Drill
- Various associated drill casings and equipment
- Hydraulic hoses and drilling consol;
- Mud tank
- "Mudslayer" mud management system
- Pump & hoses
- Core boxes
- Various hand held tools
- Various pneumatic and electronic tools.

All lift equipment used will have been inspected, tested and certified fit for use. FSCL operate a colour coding system for all items of equipment that are to comply with the requirements of LOLER, and all equipment will be colour coded in accordance with the current 6 month through inspection regime. (The colour coding will be displayed throughout the Jack Up Barge. The colour code for the period during which the mobilisation and fieldworks are planned is **BLUE.**

All plant and equipment is to be visually inspected prior to use. Plant that is provided by 3d parties .i.e. will be inspected by the operators and records of the inspection will be issued to Fugro Seacore for validation.

All plant and equipment that use, store or are contaminated by chemicals or fluids (oil, fuel or hydraulic fluids) must be set up with secondary containment. This applies in all cases including storage, temporary installation and the permanent installation. Special care is to be taken when lifting items of plant to ensure that no pressure is placed on any part of the plant by lifting equipment that may increase the risk of a spill All secondary containment is to be checked at the start of each shift followed by;

- Empty any rain water from drip trays into designated storage barrel.
- If contaminants are present trace the source and repair/replace to stop the release of contaminants
- Ensure absorbent material/pads are secured in place.

On completion of the mobilisation all new or repaired structural welding will be tested through the following means - MPI/NDT testing by a competent trained and authorised 3rd party. All welding will be to the relevant ASME Standard.

The lifting equipment associated with the drilling equipment (Sample winch, Heavy Lift winch, Pilcon free fall winch, derrick, Etc) are to be in-test with respective certification available to demonstrate that the equipment has undergone a 6 months thorough inspection.

Prior to use of any FSLC lifting equipment or plant a load test as outlined in the load test procedure provided by FSCL plant department (Load cell to be utilised)will be completed by a qualified FSCL Engineer

The FSCL PPM (Planned Preventative Maintenance scheme) shall be implemented during mobilisation and shall be utilised during the course of the works. A copy of the plan along with records of any works completed will be maintained on the JUB at all times.

9. Materials (handling/storage/disposal)

Materials are to be handled, stored and disposed in accordance with the material safety data sheet, and should be read in conjunction with the Control of Substances Hazardous to Health COSSH(Chemicals or Substances Hazardous to Health) file, respective material safety data sheets and the JUB Standing Instruction Manual.

10. Preparation of Works/Location of Services

Appropriate permissions will be sought from the Port/Harbour Master if required prior to arrival; good lines of communication will be maintained throughout mobilisation with the Harbour Master and local port authority.

The Barge master will report to the Port Manager prior to each shift to coordinate SIMOPs with other dock users and marine traffic.

All service drawings (overhead and Underground) are to be supplied by the client prior to mobilisation. The minimum requirement is;

- Buried utility services - Details of the type of service, location of the service and the depth of the service within the area that is to be used to mobilise the JUB
- Overhead utility services - Details of the type of service, location of the service and the height of the service within the area that is to be used to mobilise the JUB
- Subsea utility services - Details of the type of service, location of the service and if the service is buried or on the seabed within the area that is to be used to mobilise the JUB

11. Emergency Procedures

See project Emergency Response plan for details.

12. Personal Protective Equipment (PPE) & Safety Equipment

The following personal protective equipment will be worn:

All PPE to be compliant with the Personal Protective Equipment Regulations 2002 and be marked with a CE

Overalls	mandatory - all sites/activities
Safety helmet	mandatory - all sites/activities
Steel toed Safety boots/shoes	mandatory - all sites/activities
Safety glasses or goggles that are suitable for task	mandatory – all hazardous activities as per risk assessment
High visibility tabard/jacket	mandatory - vehicle movements & slinging
Ear defenders/ear plugs	mandatory - noise above the FAL – 80dB(A)
Gloves that are suitable for task	Advised to wear at all times and must be worn as per risk assessment.
150 N Lifejacket fitted with PLB	All activities over water or within 1.0m of the quay wall.

13. Methodology & Sequence of Work

Pre-activity Communications

Prior to the commencement of each operational shift the Project Manager and/or the Site Supervisor/Bargemaster will ensure that a Toolbox Talk is executed in respect of the planned activities. This will cover appropriate and safe methodology, and highlight associated hazards and dangers.

All third party subcontractors, (if required), will be procured via FSCL SC procurement procedures.

All HSEQ documentation is to be reviewed, amended and updated throughout the course of the operations to ensure the planned and current methodology is reflected in the project documentation. Remember: Operations Manuals for each relevant item of plant must be reviewed and best practice methodology implemented for each defined task.

All plant/equipment is to be constructed / dismantled in accordance with the relevant Operations Manual.

Consideration and careful planning must be given to the use of chocks / braces and the use of mechanical aids (I.e. mobile crane). No bolts are to be inserted / removed until the safe methodology has been assessed / agreed by the supervisor/Bargemaster.

Due to the strong tidal currents in the area, no works will take place in the water during high spring tides. JUB mobilisation works will be carried out during low spring and neap tides.

Day 1

Tool box talk – Project Induction to be held prior to commencing operations (Considering/addresses the working environment & surrounding influences)

Tool box talk – Mobilisation Method Statemment, Lifting operations Method Statement

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Roles and responsibilities are to defined for the mobilisation team/crew

Role	Task	Name
Lift Supervisor (LS) (to appoint other roles/responsibilities to other members of the team/crew)	Responsibility for planning/implementing/managing a safe system of work for lifting operations in accordance with FSCL company requirements & British Standards LS to review/check crane & crane operator certification prior to commencing operations Incl. setup of fall at mitigation preventive (Air Bags/bean bags) See Section 3 of this MS	
Signaler (SS)	To control the Slinger(s) SS, & Crane Operator (CO). To maintain communication with the SS & CO at all times (Radio and/or formal hand signals) Maintain clear line of site of lifting operation	
Singer/Rigger(s) (SS)	To sling loads appropriately using suitable lifting tackle & dedicated lifting points (when available). Ensuring loads are stable, requesting test lifts (as required) Utilise tag lines as instructed Signaler All slinging/rigging loads to only be undertaken by qualified operatives	
Crane Operator (CO)	To setup and operate the crane in accordance with Cranes manufactures instructions & methodology defined in the Lift Plan. See Section 3 of this MS	

<u>All persons/crew: To be trained, competent & authorised</u>

1) Set up and planning

a) Mobile Crane to arrive & set-up in accordance with manufactures instructions (Further defined in Lift Plan).
b) Areas to be fenced off or signposted to ensure no conflict with other dock users.
c) Where possible each load shall be slung at ground level (I.e. SS standing at ground level connecting lifting tackle to crane hook block).
d) Tag lines shall be connected to each load prior to lifting load (ensure sufficient length)

e) Each JUB pontoon is to be lifted from the truck bed using the single point lift 4-leg chain slings (accessible at ground level).

f) No persons/crew to climb on top of containers without suitable means of fall arrest restraints being in place.

g) Should a ladder be required, it shall be footed by a member of the crew/team, whilst one person shall climbs the ladder maintaining three points of contact at all times.

h) No persons/crew to stand under loads during lifting operations. Ensure a clear and agreed landing place as been defined for each load/lift.

i) Unload Containers and lay all loads onto quay area (I.e. Pontoons, drill spread & containers)

j) Checks made to ensure all plant and equipment has been delivered in line with the operations manual and deck plans.

k) Service any plant that is in need

Day 2

Tool box talk – work above/adjacent to water, work at height, slinging, over sailing, high pressure systems.

2) Raft JUB

a) Roles and responsibilities are to defined for the mobilisation team/crew (if different from Day 1)

b) Tide times will dictate the time of day the rafting commences. The aim will be to raft the 7 pontoons within a high tide cycle over a 4-5 hour period (2 hrs either side of high tide). Given the long daylight hours expected (August), the mob shift times May vary to make best use of the tides and assuming the previous steps had taken place in sufficient detail.

c) The JUB will then be rafted in line with the Skate 3 Operations Manual.

d) JUB to be mobilised in accordance with JUB Operations Manual and Standing Instructions Manual

e) The HPU will now be located on the deck as per the lift plan and the hoses can be plumbed

f) Generator will also be lifted and sea fastened on the deck

g) The galley / workshop container will now be connected to the generator so that systems can be powered.

h) The jacking console can now be plumbed and commissioned.

i) Install Leg Bearings – Refer to Operations Manual

j) Install JUB legs section in line with Operations Manual.

k) For assembly of individual legs section, see separate SMS-08.

l) Locating of the Thruster at aft end of JUB to be pinned & containers locked. Sling and lift access steps to the thruster (bolt to deck_8No.)

Day 3

TBT – Lifting ops, Simops, hot works (ensure permit in place & closed out), assembly of CR2

Roles and responsibilities are to defined for the mobilisation team/crew (if different from Day 1)

The LS/BM will plan, co-ordinate the lifting, and positioning of the deck equipment in line with the project specific deck plan. This will be completed whilst considering the equal distribution of weight so as to maintain a level barge if floating, the method of works for the drilling operation and safe clear access to all emergency equipment

3) Installation of deck equipment

a) Once the major items of plant have been lifted onboard, then the hydraulic fitting of the items can commence. This is in line with the operations manuals associated with each item and the hydraulic line diagrams issued for the project.
b) Electrical installations and connections will be made simultaneously and electrical; checks made.
c) Load Commachio drill rig onto JUB and sea fasten appropriately
d) Assemble CR2 Derrick on quayside – **As per Operations Manual**, Load drill deck with mud mixing equipment and tanks
e) Lift crane base and bolt to fishplates on the deck with correct bolts and impact wrench
f) Lift crane and bolt to crane base using correct bolts (grade and length as per ops manual), then plumb crane for operation.
g) Locate winches on derrick and on Pilcon base
h) Plumb winches and mud mixing equipment

Day 4

TBT – simops, work at height, hot works (ensure permit in place & closed out), bunkering, housekeeping

Roles and responsibilities are to be defined for the mobilisation team/crew (if different from Day 1). NEW team/crew member from FSL installing Starfix Positioning System.

The Barge Master will co-ordinate the lifting, and positioning of the deck equipment in line with the project specific deck plan. If there are any changes to the plan, these must be communicated to the project manager for possible further engineering checks.

4) Installation of remaining deck equipment inclusive of Lab, Workshop and drilling equipment

a) FSL RAMS to be reviewed / agreed with FSCL LS/BM. Install Starfix survey
b) Complete installation & function test all hydraulic systems.
c) Function test all electrical systems
d) Check all emergency equipment is located in line with the fire plan, is in date, functional and accessible,
e) Jack down into the water and check freeboard and load line
f) Jack back up to safe working height
g) Sea trials for tender rib
h) The Barge Master will carry out a JUB Induction for all crew, Engineers and Client Reps followed by the below drills
    i) Evacuation drill
    ii) Fire drill
    iii) Man overboard drill
    iv) Environmental spill drill
i) Once the Barge is loaded the Barge Master will complete the following final checks. These will also include final checks of the BH coordinates and that navigation systems are operational, Tide tables are available and emergency procedures are clear.
j) The Jack up and crew are now fully operational and ready to commence Drilling Operations

Prior to any movement from the quayside JUB will be fully mobilised and a **JUIC 01** form shall be completed by the BM.

Day 5

TBT – induction onto JUB, borehole scope, drilling, crew change etc

Roles and responsibilities are to defined for the mobilisation team/crew (if different from Day 1)

Dependant on progress of Day 4 some activities may be required to be finished today such as commissioning of Starfix, sea fastening, testing or commissioning duties.

Normally a final Client HSEQ inspection will be conducted on day 5, although it is recommended this is started on Day 4.

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Appendix 1 – Deck Plan

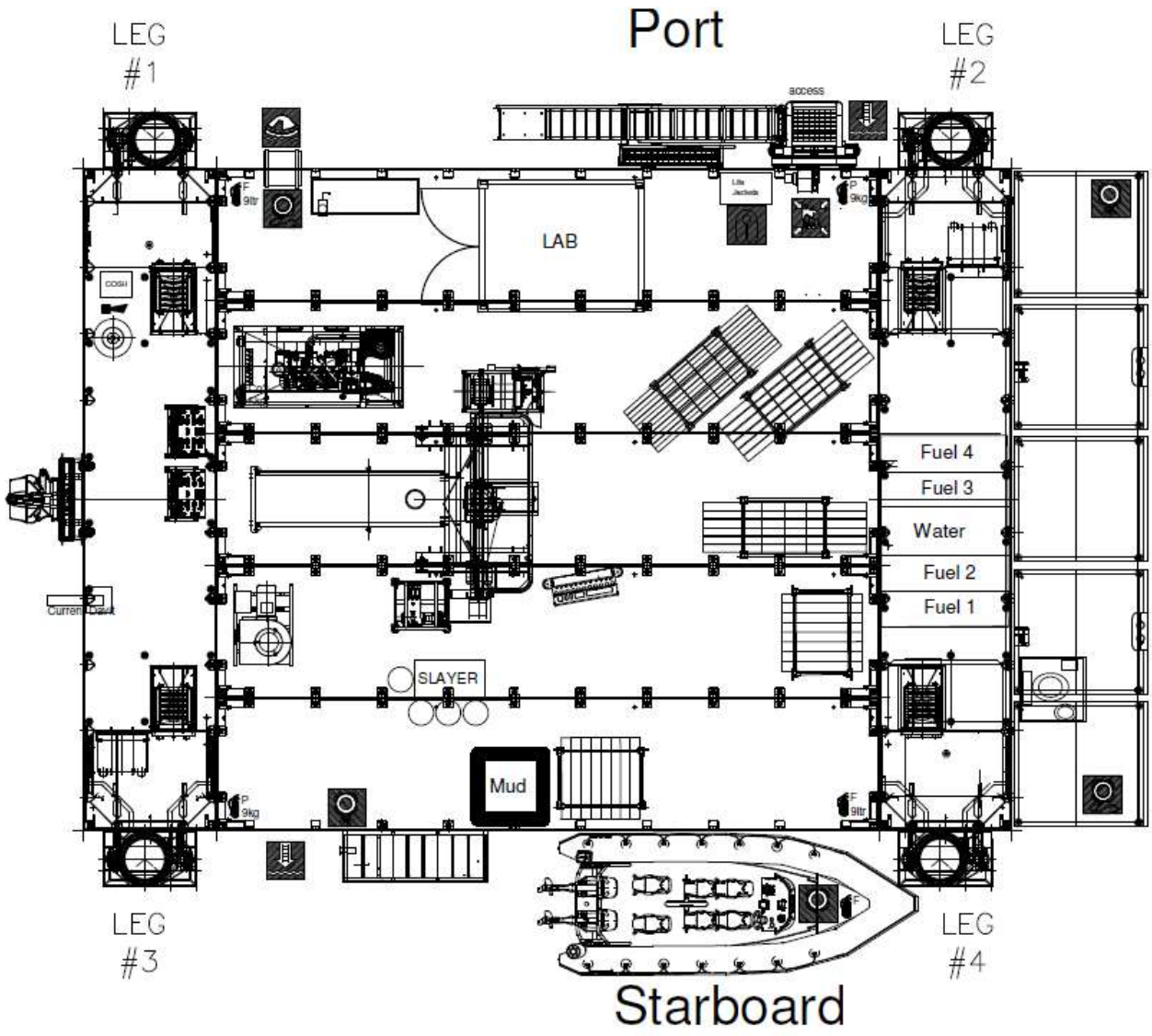

PLATE F-15

Appendix 2 – Lift Plans

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Appendix 3 Permit to work

PERMIT TO WORK
FORM HS-F15

Work to be completed:		Location of Work:	
Date of Work:		Permit Recipient:	
Permit Issue Time:		Permit Approver:	
Permit Expire Time:		Permit Extended?	☐ Yes ☐ No ☐ N/A
Permit Completion Time:		Permit Extension Approval (approver's initials):	

Risk Assessment Carried Out	☐ Yes ☐ No	Emergency Procedures In Place (ie Rescue Plan)	☐ Yes ☐ No ☐ N/A
Lock Out / Tag Out applicable?	☐ Yes ☐ No	Toolbox Talk Conducted?	☐ Yes ☐ No

Confined Space Entry ☐ N/A		**Work At Height** ☐ N/A	
Space thoroughly ventilated;	☐ Yes ☐ No ☐ N/A	Fall Protection to be utilized;	☐ Yes ☐ No ☐ N/A
Atmosphere tested and found to be safe; Clean certificate obtained (rail cars)	☐ Yes ☐ No ☐ N/A	Fall Protection Inspected;	☐ Yes ☐ No ☐ N/A
Rescue and resuscitation equipment available at entrance; Rescue plan developed;	☐ Yes ☐ No ☐ N/A	Employee trained in fall protection use;	☐ Yes ☐ No ☐ N/A
Responsible person in attendance at entrance;	☐ Yes ☐ No ☐ N/A	Freefall less than 6 feet;	☐ Yes ☐ No ☐ N/A
Communication arrangements made between person at entrance and those entering;	☐ Yes ☐ No ☐ N/A	Fall distance / length of fall protection adequate;	☐ Yes ☐ No ☐ N/A
Access and illumination adequate;	☐ Yes ☐ No ☐ N/A	100 % Tie-Off;	☐ Yes ☐ No ☐ N/A
All equipment to be used is of approved type;	☐ Yes ☐ No ☐ N/A	Guardrail system in place / sufficient;	☐ Yes ☐ No ☐ N/A
When breathing apparatus is to be used: Familiarity of user with apparatus is confirmed; Apparatus has been tested and found to be satisfactory.	☐ Yes ☐ No ☐ N/A	Scaffolding Inspected / tagged;	☐ Yes ☐ No ☐ N/A
Equipment Maintenance ☐ N/A		**Electrical Work** ☐ N/A	
Removed from service / isolated from source of power / energy source;	☐ Yes ☐ No ☐ N/A	Equipment fully de-energized;	☐ Yes ☐ No ☐ N/A
All relevant personnel informed;	☐ Yes ☐ No ☐ N/A	Lock/ Out Tag Out required;	☐ Yes ☐ No ☐ N/A
Warning notices displayed;	☐ Yes ☐ No ☐ N/A	Hazardous atmosphere assessed;	☐ Yes ☐ No ☐ N/A
Hot Work ☐ N/A			
Ventilation adequate;	☐ Yes ☐ No ☐ N/A	Fire extinguisher in good order;	☐ Yes ☐ No ☐ N/A
Equipment in good working order;	☐ Yes ☐ No ☐ N/A	Area clear of dangerous material and gas-free;	☐ Yes ☐ No ☐ N/A
Fire watch in place (To remain in place for a minimum of 30 minutes after completion of hot work); N/A			☐ Yes ☐ No ☐

Acknowledgement:			
Permit Recipient Name:		Permit Recipient Signature:	
Permit Approver Name:		Permit Approver Signature:	

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Appendix 3 Jack Up Inspection Check Sheet

Seacore JACKUP INSPECTION CHECKLIST (JUIC) FUGRO

CONTRACT NO:		LOCATION:		JACK UP:	

Health, Safety and Environmental Inspection:

Inspections are to be carried out by a competent person(s) on completion of mobilisation, prior to leaving the sea wall and thereafter on the last working day of each month.

The extent of the inspection will depend on the type of contract and Vessel/Jack-Up/Plant being used.

The completed checklist will form the basis of internal HSEQ audits and inspections.

An inspection of the following has been undertaken: *(tick the sections inspected)*

- Management/General ☐
- Working Platforms/Pontoons ☐
- Electrical Equipment/Supply ☐
- Cranes and Lifting Accessories ☐
- Fixed & Auxiliary Plant, Machinery and Tools ☐
- Access Equipment ☐
- Fire and Safety Equipment ☐
- Hazardous Substances/Compressed Gases ☐
- Personal Protective Equipment and Clothing ☐
- Welfare & First Aid ☐
- Environmental Controls ☐
- Crew Boat/RIB ☐
- Communication ☐

Reporting:

A copy of the completed checklist is to be sent to HSEQ Department, who will circulate it within FSCL.

Name: (of the person completing the inspection checklist) (Project / Site Manager/Supervisor / Barge Master)	**Signature:**	**Date:**

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JACKUP INSPECTION CHECKLIST (JUIC)

Management/General	**Comments (if none or not applicable state "none or NA")**
Where available has the following interpreted site specific information /data been given to Barge Master and are copies available on the jackup, i.e. met ocean, bathymetric, magnetometer, geophysical and geotechnical etc?	
Is an up to date operating manual available on the jackup? (including preload and leg penetration record and environmental calculator)	
Has an up to date project management plan been prepared and implemented including risk assessments and method statements?	
Is the jackup "classification" certification in date and a copy held on the jackup?	
Have emergency contingency /response plans been put in place and displayed? e.g. collision, man over board and UXO etc?	
Has a jackup "safe haven" been identified?	
Have all personnel received a site safety induction, including Jack-Up emergency procedures?	**Check requirements**
Have all personnel been issued with a Fugro Golden Rules of HSE booklet?	
Is the following information posted/displayed: Insurance Certificates; H,S & E Policy Statements; Environmental Load Chart; SOLAS 1; Health and Safety Law Poster; Emergency Contact Numbers/ Channels etc?	
Working Platform/Pontoons	**Comments (if none or not applicable state "none or NA")**
Is the jackup evenly loaded and operating within its predetermined payload and stability limits – plimsoll line / floating marks?	
Is the jackup structure securely connected, level and free from obvious damage?	
Are pontoons/walkways free from obstructions and are equipment / plant / materials stored safely and securely? (above and below deck)	
Is edge protection in place to prevent falls (Guard Rails) and are all holes, gaps covered or securely fenced off?	
Is adequate lighting provided throughout the working area including all access and egress points?	
Is emergency lighting installed if so, is it functioning correctly?	
Electrical Equipment/Supply	**Comments (if none or not applicable state "none or NA")**
Are switch gear / junction box covers in place and secure?	
Are distribution cables routed correctly, supported and protected from sharp objects /traps?	

Seacore

JACKUP INSPECTION CHECKLIST (JUIC)

Are all cables, sockets and protection devices i.e. RCD's and MCB's in good condition i.e. not cracked or damaged and functioning correctly?	
Are all portable electrical tools (110v) including cables, plugs and extension leads in good condition, undamaged and in date for annual inspection/test (PAT)?	
Deck/Pedestal Mounted Cranes and Lifting Accessories	**Comments (if none or not applicable state "none or NA")**
Are statutory registers and certificates held for lifting equipment and accessories?	
Has all lifting equipment e.g. crane(s), winches, etc been inspected & load tested post installation and inspected every 12 months thereafter. **(6 months when lifting persons / man riding)?**	
Have daily, pre use, and where necessary, weekly inspections been carried out on lifting equipment e.g. crane(s), winches/winch wire, sheaves, etc.? Are the inspections being recorded?	
Are all lifting accessories clearly marked with the safe working load (SWL), in good condition and free from visual defects e.g. frayed nylon, webbing and wire ropes, corrosion - (particularly at wire termination); damaged/distorted shackles, eye bolts, wire ropes and chain slings and correctly colour coded inline with FSCL 6 monthly through examinations?	
Fixed & Auxiliary Plant, Machinery and Tools	**Comments (if none or not applicable state "none or NA")**
Has a PPM scheme been provided and are records being completed and returned to the plant department?	
Are jackup support leg interlocks/locking mechanisms functioning correctly and in good condition?	
Is a leg jetting system installed? If fitted is it serviceable?	
Are all dangerous parts e.g. exposed gears, rotating drive shafts /drill string, pulleys etc. guarded. Are guards secured and in good condition?	
Are compressors, air receivers, associated pipe work and gauges being inspected inline with its PPM scheme / statutory requirements?	
Are all hydraulic systems including hoses, connections and gauges etc being inspected inline with its PPM scheme?	
Are hydraulic system / power pack hoses correctly routed, supported and not causing a trip hazard?	
Are all safety devices functioning correctly e.g. emergency stops and interlocks etc?	
Are hand held tools in good condition and free from defects?	
Access Equipment	**Comments (if none or not applicable state "none or NA")**
Is the jackup access ladder correctly positioned, in good condition and free of defects?	

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Seacore

JACKUP INSPECTION CHECKLIST (JUIC)

Is the personnel transfer basket in good condition, free from defects and correctly colour coded inline with FSCL 6 monthly thorough examination regime?	
Are all portable ladders/step ladders in good condition inspected and colour coded inline with FSCL 6 monthly thorough examination regime?	
Are all other access/working platforms in good condition, edge protection in place and properly positioned and where necessary erected and inspected by a competent person? e.g. aluminium tower.	
Is the Crown-Block access ladder fitted with safety hoops and or fall-arrestor system? (If so is it in date for test)	
Are safety harness / lanyards / fall-arrester blocks in good condition, free of defects, inspected and colour coded inline with FSCL 6 monthly thorough examination regime?	
Fire and Safety Equipment	**Comments (if none or not applicable state "none or NA")**
Is all safety equipment, where applicable in date for inspection/test, correctly located and in good condition e.g. life rafts, flare packs, life rings/ lines, man overboard smokes/lights, life jackets, first aid kits, eye wash bottles, fog horn and VHF radio?	
Have emergency alarms e.g. high-level, smoke/heat detection, gas detection etc, been tested and records maintained?	
Are all fire extinguishers identified with a FSCL issue tag, in date for inspection/test, in good condition and correctly positioned?	
Have emergency drills e.g. fire, man over board, abandonment, etc been carried out and recorded?	**Insert dates:**
Are emergency "Grab Bags" (smoke hood, life jackets, etc) available within crew cabins / muster points?	

Hazardous Substances/Compressed Gases	**Comments (if none or not applicable state "none or NA")**
Are a COSHH file, register and assessments available and up to date?	
Are oxygen & acetylene cylinders, gauges, regulators, flashback arrestors, hoses and torches inspected, in good condition and free from damage and contamination, e.g. oil, grease, cuts, cracks or any other surface defects?	
Are spare oxygen and acetylene cylinders stored correctly and segregated by at least 3 metres (where possible) and secured in an upright position?	
Are all hazardous substances secure and stored correctly e.g. petrol, oils, greases, paint and solvents etc?	
Are restricted / hazardous areas / cabinets marked as such and free from stored equipment and spares? (warning /mandatory/information signs)	

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Seacore JACKUP INSPECTION CHECKLIST (JUIC)

Personal Protective Equipment and Clothing (PPE)	**Comments (if none or not applicable state "none or NA")**
Has adequate PPE, e.g. safety helmets, safety boots, overalls, gloves, dust/vapour masks, lifejackets, buoyancy aids, immersion suits, goggles, ear protection, sun and/or wet weather gear been provided?	
Is PPE stored correctly i.e. where appropriate hung up in a dry, dust free area?	
Welfare & First Aid	**Comments (if none or not applicable state "none or NA")**
Is there adequate first aid provision i.e. first aid kit, stretcher, and eye wash bottles, situated in appropriate positions?	
Are there adequate provisions for first aid cover e.g. least one first aider available per shift?	
Where plumbed in toilets are not installed has a chemical toilet been provided on the jackup or arrangements made to use shore side facilities?	
Is adequate hand washing facilities available? (hot water, soap and towel)	
Where installed are shower facilities being maintained in a clean condition?	
Are there suitable arrangements in place for the preparation of hot / cold food and drinks. Is fresh / bottled drinking water available on the jackup?	
Are crew accommodation/cabins being maintained in a clean, tidy condition? (on board or ashore)	
Is the galley/canteen, rest room, toilets being kept in a clean, tidy, and dry?	
Environmental Controls	**Comments (if none or not applicable state "none or NA")**
Have adequate bunding arrangements been provided to retain any leaks / spills / pollution incidents from hydraulic systems and hydraulic storage areas?	
Are emergency spill kits available and oil dispersants, available, suitably positioned and are all personnel aware of the emergency spill procedures?	
Have adequate arrangements been made for the storage and removal of waste materials / garbage and oil etc?	
Are hazardous waste materials / substances (waste oil, oil filter, contaminated rags, paint etc) being separated from all other waste materials?	
Crew Boat/RIB	**Comments (if none or not applicable state "none or NA")**
Is the crew boat in sea worthy condition e.g. hull and buoyancy free from any obvious structural damage and leaks?	

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JACKUP INSPECTION CHECKLIST (JUIC)

Are the lifting points in good condition, secure and in date for inspection, test, and inline with FSCL colour code 6 monthly thorough examinations?	
Are all safety and other equipment, where applicable, in date for inspection/test, correctly located and in good condition e.g. flare packs, life rings/ lines, first aid kit, compass, GPS, torch, fire extinguisher, thermal /space blankets, anchor, spare fuel, fog horn, VHF radio and paddles?	
Is the outboard engine in a good state of repair, functioning correctly and bolted & locked to the transom?	
Has the use of a second/auxiliary engine been considered /required?	
Communication	**Comments (if none or not applicable state "none or NA")**
Has the driller good visual contact with the drill floor / second man from the control console? (day and night)	
Has the Barge master good visual contact during jacking operations from jacking console? (see all legs)	
Are pre-shift tool box talks / safety briefings involving all personnel carried out and recorded? (on the DPR at the very least).	
Is the monthly HSE Jackup meeting being held and attended by site /project personnel? Are the minuets of the meeting being circulated /sent to the head office?	

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A METHOD STATEMENT IS ONLY A SAFE METHOD WORKING IF IT IS DISCUSSED AND AGREED BEFORE WORK BEGINS AND THEN FOLLOWED BY THOSE CARRYING OUT THE WORK.

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ALASKA LNG GI **Moving & Positioning (Skate 3A)**	Issue:	1	Rev 5
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1. Introduction

This Method Statement refers to the towing and moving operation associated with Skate 3 jack up barge (JUB). Jacking and pre-loading operations are covered in the Operation Manual. Please refer to the Project Execution Plan (PEP) document for full project details.

2. Main Activity / Area of Work

The main activities that are described in this document are;

- Moving/towing JUB Skate 3 from the mobilisation berth at Rig Tenders Quay, Nikiski to the main L NG works site some 3 miles to the south.
- The moving and positioning of the JUB at and between borehole locations

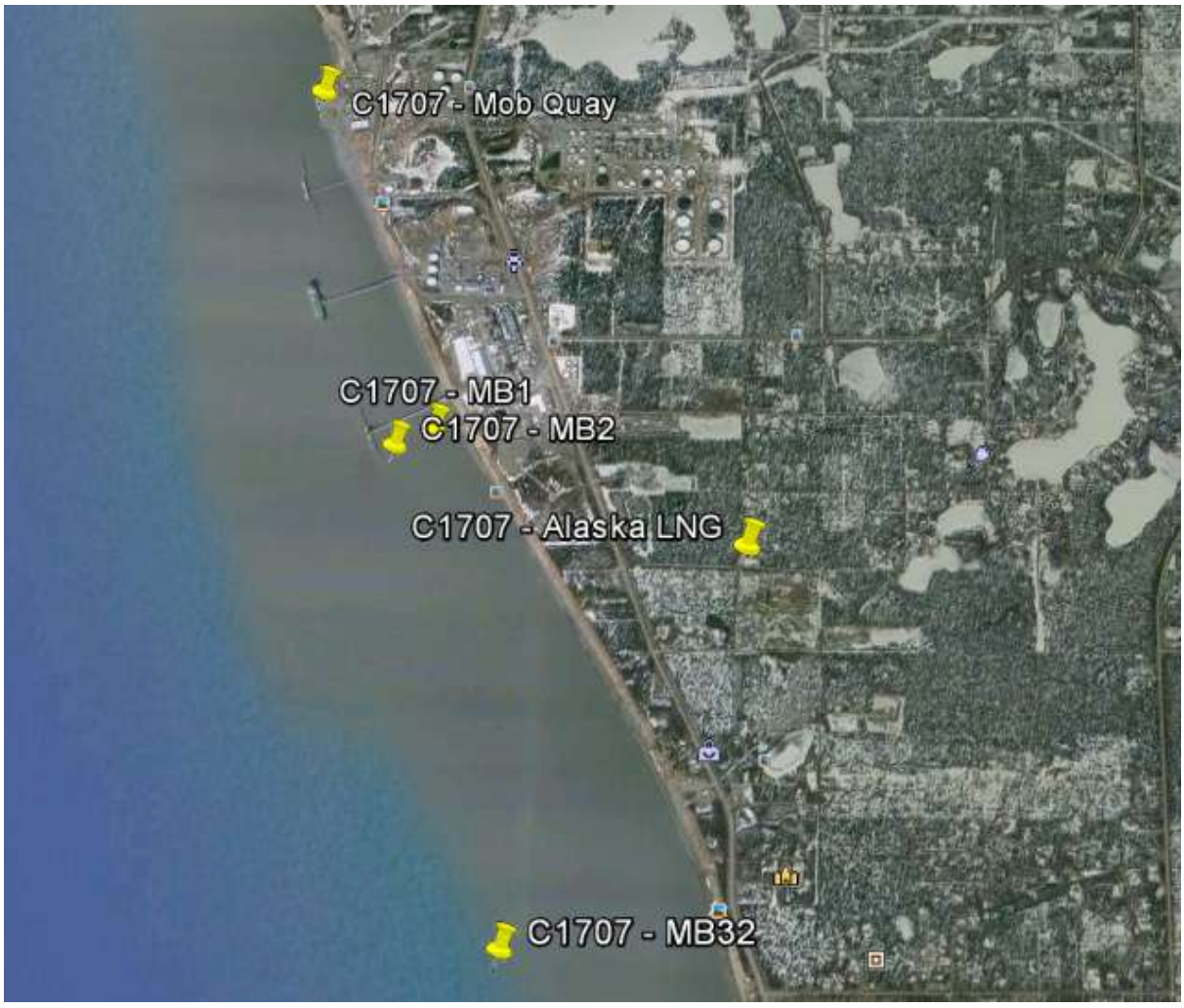

Figure 1. Mob Quay and BH location Plan on Main Work Site

3. Manpower and Supervision

Nominated Person	Responsibility
FSCL Bargemaster	Ensure the safe jacking and the final stability of the platform in readiness to conduct the required drilling operations. Responsible for the safety of the vessel and all onboard at all times. Ensure jacking operations are in accordance with this method statement.
FSCL Project Manager	Advise the Bargemaster on the project requirements to comply with this method statement and supply the appropriate information and instructions to enable this to be carried out safely.
FSCL Marine Crew	To assist in marine operations, under the guidance and instruction of the Bargemaster
Tug Skipper	Has overall responsibility for tug if required for manoeuvring the JUB.

4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

Document(s)	Serial Number(s).
AKLNG Work Execution Plan	Latest revision
AKLNG Project Management Plan	C1707- Latest revision
FSCL ERP	C1707 – Latest revision
Skate 3 Operations Manual	Rev 3 Feb 2014
JUB Standing Instructions	Rev 1 Oct 2013

5. Risk Assessments

Risk assessments relevant to the work activity as listed in the Project Plan

RAS 001 Over-water Working
RAS 002 Towing and Positioning
RAS 003 Jacking-up Positioning
RAS 004 Crew transfer
RAS 026 Loss of Tow
RAS 024 Interaction with other Marine Traffic / Mariners
RAS 033 Man Overboard

RAS 035	Emergency abandonment and evacuation of Jack Up
RAS 060	Jacking Operations
RAS 067	Launch and recovery of RHIB
RAS 078	Fixed ladder access and egress
RAS 083	Night time working

6. Security - Barriers/Fences/Warning Signs

All work being carried out will be completed in conjunction with the safe systems of work and in compliance with all relevant risk assessments.

Any personnel onboard who are inexperienced and/or not involved in the moving or marine operations will be instructed by the Bargemaster to remain in one safe location until the operations are complete.

7. Constraints/Restrictions/Special Conditions

Prior to any moving operations taking place the destination location will be confirmed as being free of any sub-surface obstructions and services. Service information will be checked prior to commencement of ops. Each work location is to be assessed where possible using (if any) existing soils data for rapid uncontrolled penetration (RUP) and anticipated leg penetration prior to JUB arriving on location. If soft ground conditions are encountered, it may not be possible in some areas to jack free of the water. All locations will be approached on a risk managed basis with weather conditions, tides, current, water depth and leg penetration being taken into account before moving commences.

All SIMOPs are to be coordinated by AK LNG Site Manager. The Bargemaster will contact the AK LNG Site Manager to confirm all marine movements prior to commencement.

The Barge Master will contact the local Port/Maritime Authority and confirm the details of the intended move and coordinate the timings with that of other marine traffic

The environmental limitations relating to vessel operations are laid out in the table below:

Environmental Limitation (Skate 3)

Item No	Description	Sea state (-Hmax (m and ft)	Wind speed Beaufort scale Force	Wind speed (m/s and mph)	Current (Knots)
1	Crew Evacuations	1.5m (5ft)	Wind Force 6	12m/s (27mph)	6
2	Crew Changes	1.0m (3.3ft)	Wind Force 6	12m/s (27mph)	4
3	Moving Between BH locations	0.70m (2.3ft) Hmax	Wind Force 4/5	10m/s (22mph)	2
4	Jacking Up/ Down	0.70m	Wind Force 5	10m/s (22mph)	2

		(2.3ft)			
5	Drilling operations	1.5m (5ft)	Wind Force 6	12m/s (27mph)	6 Note; setting and retrieving casing up to 1 knot
6	Towing Jack Up	0.70m (2.3ft)	Wind Force 4/5	10m/s (22mph)	4
7	Equipment/Sample transfer to/from jack Up	1m (3.3ft)	Wind Force 4	8m/s (18mph)	2 depending on orientation of vessel.
8	Fog	Visibility of less than 500m approximately during crew transfer and the movement of the JUB to or between locations			

NOTE: The above table indicates the limiting conditions for sea-state and wind. However other adverse environmental conditions can also affect the workability of the marine spread, in particular (but not limited to) currents, tides, local soil conditions and visibility. The Bargemaster will have the final decision on whether it is safe to work based on the prevailing conditions.

8. Plant and Equipment

The following plant and equipment will be used:

- Skate 3 JUB
- Fugro Starfix DGPS positioning systems for both the JUB and the Tug
- VHF/UHF radios
- 3rd party support tug (TBC)
- Towing bridle and towing equipment
- Thruster
- Valeport Current Meter

9. Materials (handling/storage/disposal)

Prior to Towing out to the works site or moving the JUB between locations the Barge Master will assess the anticipated conditions and sea fasten all materials to ensure that they will remain stable in the anticipated condition.

10. Preparation of Works/Location of Services

Prior to the JUB arriving on location and jacking out of the water/spudding on location:

- Appropriate permissions & consents will be in place prior to moving to the first BH location
- Sub-surface check for services, wrecks, obstructions will be completed and communicated prior to positioning the JUB on any BH location. These will have been identified by the Client prior to the JUB moving and the details and coordinates entered into the onboard navigation and positioning system, STARFIX. This will allow the barge Master and the Tug Skipper a visual representation of any subsea obstructions along with mandatory exclusion zones.

- The Barge Master will appropriate environmental checks of forecast sea state, tidal conditions and expected weather conditions for the entire duration of the tow or move. For prolonged moves of the JUB a tow management plan must be prepared with safe havens identified.
- Assessment of expected leg penetration using existing available data prior to arriving on site
- JUB risk calculator to be reviewed. If the conditions on site for tide, leg penetration or wave Hmax are anticipated to be different to those already assessed the JUB risk calculator must be reassessed with the new conditions entered.
- Ensure the positioning equipment is working and coordinates are working for the proposed location. If required have these checked by the surveyor and or client rep onboard.

11. Emergency Procedures

The project specific Emergency Response Plan (ERP) will be adhered to at all times.

The Task specific Tow Management Plan will detail lost tow procedures

Safe Havens for the work site are also discussed in the ERP.

12. Personal Protective Equipment (PPE) & Safety Equipment

The following personal protective equipment will be worn:

PPE	**Requirement**
Overalls BS EN 471	mandatory - all sites/activities
Safety helmet BS EN 397	mandatory - all sites/activities
Safety boots/shoes BS EN 345	mandatory - all sites/activities
Ear defenders/ear plugs BS EN 352	mandatory - noise above the FAL – 80dB(A)
Safety glasses	mandatory – where risk assessed
Life jacket – 150 N	mandatory – where risk assessed (when working outside of the JUB handrails or instructed by the BM and/or PM, Supervisor
Gloves	mandatory – where risk assessed

13. Methodology & Sequence of Work

Prior to leaving the mobilisation Quay at Rig Tenders, Nikiski the Bargemaster shall complete a Jack Up Check sheet (JUIC) and Tow Worthiness Checklist; this is not required for subsequent tows between locations on the worksite.

1. Assess weather and sea state conditions prior to leaving / moving to next location (ensure a sufficient weather window is available in order to execute the move between locations).

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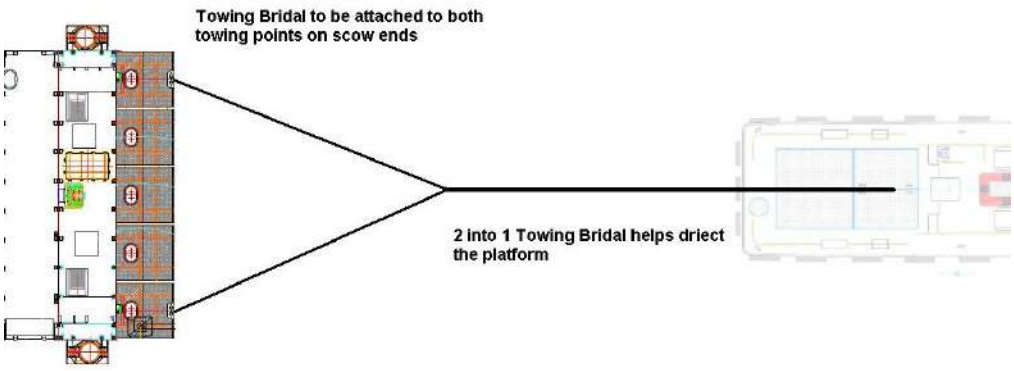
This is an ongoing process. Site specific weather forecasts are received on a daily basis as a minimum and additional up to the minute forecasts may also be requested. The Bargemaster also has access to FURO GEOS (if required) and other web based weather forecasting sites as necessary.

2. Determine the period of time required to complete the move to the next location, jack up, pre-load and if necessary withdraw to the Safe Haven on site or back to mob quay (See appendix 3)
3. Assess the required safe working height taking into consideration the maximum leg penetration for the proposed location and the predicted weather conditions.
4. Notify tug of plans to move location and discuss operation fully including forthcoming weather.
5. The barge and drill crew ensure that all equipment is stowed or secured correctly to ensure no harm is caused to personnel or damage to the equipment occurs during the move.
6. Bargemaster jacks down into the water until the weight of the JUB is taken by the buoyancy effect. The Bargemaster can now free and begin to remove the legs from the seabed.
7. Once all legs are free and before they are clear of the seabed, the tow is connected.
8. Tug to make fast with JUB. The orientation of the JUB, direction of current and next location, will determine which bollard the tow line may be connected to. (A visual inspection of the bridal to executed). Ensure only essential parties are involved in the connection of the bridal, consideration for pinch point and crushing zones. (Restricted access area to be adhered to.)
9. Draft towing connections: (To be finalised on selection of towing tug and detailed within the Tow Management Plan)



10. Bargemaster and Skipper of tug to confirm that all parties are happy with the tow connection.
11. Bargemaster to confirm desired location giving the tug bearing and direction reference.
12. The remaining JUB legs are lifted clear of the seabed and the tow commences.
13. The Bargemaster continues to lift the legs above the seabed to a suitable height such that the legs do not come into contact with the seabed during the tow.
14. The tug tows the JUB towards location.
15. When nearing the new location the Bargemaster instructs the Skipper of the tug to reduce towing speed to below 1 Knot. To achieve this it may be necessary for the JUB to be towed beyond the desired location, turned and pulled against tidal currents.
16. When less than around 20m from the require location and speed less than 1 Knot the Bargemaster will instruct the tug to cease the tow and lower two of the legs to the seabed.

17. Once over the position, or close by, the JUB will stop with legs on the seabed and the tow will be released.
18. The Bargemaster will consider the orientation of the JUB relative to the final required position of the moonpool and decide on which leg or legs the JUB may be spun in order to within the required contract tolerance of 7.6m away from the proposed borehole location.
19. **Note due to expected current conditions the bow (or stern) of the JUB must be facing the current flow direction. This ensures the loading the legs is minimised during peak tidal flow.**
20. The JUB will be spun onto position using its onboard thrusters, tidal currents or the push bow of the tug if required.
21. JUB on position – PM/BM/PE cross checks position and ensures the JUB is within the required 7.6m tolerance and confirms with the Bargemaster.
22. Review Starfix positioning system and confirm acceptance of location of the JUB with the Client Representative.
23. Once position is confirmed the Bargemaster commences preloading procedures.
24. Pre-loading is completed by lifting diagonal legs resulting in the loading of diagonally opposite legs in pairs and reaching a pre-load pressure.
25. Leg Penetrations will be compared with any geophysical or geotechnical data already obtained at the location and an assessment made of the potential for 'punch through'. If such a risk exists the Bargemaster will work to push the legs beyond the ground causing concern. The Bargemaster will monitor actual leg penetration against the predicted leg penetration and advise the Site Manager of any differences.
26. Pre-loading complete the Bargemaster jacks to a safe working height.
27. The actual Leg Penetrations and Preload Pressures are to be recorded on the Daily Progress Reports (DPR).

Scour and Rapid Uncontrolled Penetration (RUP) can seriously jeopardise the stability of the barge - it is therefore standard Fugro Seacore Ltd procedure for the Bargemaster to determine if a particular leg has either '*scoured*' or suffered an RUP and is carried out in the following way:

Checking of the pre-loading will be carried out at the beginning of each shift where practicable, where this is unacceptable due to the addition of drill casings or other items that limit the elevation of the vessel careful monitoring of the inclinometers will be required to check that the level of the vessel has remained constant. This does not take into account scour pits forming and subsequently undermining an individual leg and it must be stressed that monitoring alone cannot replace regular pre-load checks. All pre-load checks will be recorded and attached to the Daily Progress Report (DPR).

The working height of the platform will be determined by the Bargemaster taking into consideration:

- The tidal range
- The actual weather
- The forecasted & predicted weather
- The amount of works to be carried out at the location (anticipated duration)
- The ability to jack to storm survival height (if at a Safe Haven location)

In the event of adverse weather conditions, the Bargemaster will make the decision of whether the JUB will stay on position or jack down and tow to a known safe haven.

The JUB constantly monitors met ocean conditions as detailed below:

Visual Crosscheck:

An assessment of the on-site weather conditions is also carried out by the Bargemaster with visual checks and a hand held anemometer may be used to verify the electronic data.

Weather Forecasts:

The JUB will receive twice daily weather reports that provide a dedicated site specific 5-day weather forecast.

Note: more details on jacking procedures can be found in the current JUB Operating Manual.

SAFE WORKING HEIGHT

JACKING OPTION 1 (Safe Haven Location)

The JUB should be jacked out of the water to allow for maximum tidal range, plus a maximum forecasted wave (including storm surge). The JUB must always be able to reach Safe Haven where environmental conditions have the potential to exceed safe operational limits.

A safe haven is not expected to be possible on the AKLNG marine site. With this in mind the shore base at ASRC Rig Tenders will be used as a safe haven during periods of excessive tidal flows or wave heights etc.

JACKING OPTION 2 (Risk Managed Locations – Worksite)

When a weather window is insufficient for the JUB to move to a risk managed location, the barge will be jacked up to a height that will allow the maximum forecast wave with a 1.5m air gap to pass beneath.

WEATHER WINDOWS

The required weather window is controlled by the moving limitations of the JUB. The duration of the working window is affected by the actual leg penetrations, jacking height of the hull, wind speed and wave height.

The length of the weather window required to ***move the JUB*** will be determined by using the following factors:

- Time to jack down from and take on tow from safe haven.
- Transit time to the next location.
- Time to preload and assess if required elevation can be achieved.
- Time to jack down and take on tow.
- Transit time to safe haven.
- Time to preload and jack to required elevation.
- Factor of safety.

The length of the ***working*** weather window required will be determined by using the following factors:

- Time to jack down and take on tow.
- Transit time to next location.
- Time to preload and jack to required elevation.
- Duration of the programmed works.
- Time to jack down and take on tow.
- Transit time to next location.

- Time to preload and jack to safe elevation.

The exact calculation of the weather window for each individual location will be determined and agreed with the Bargemaster, Site Manager and the Client's Representatives in consultation with shore support prior to moving to or commencing any works on a risk managed location. An example weather window calculation is shown in Appendix 3.

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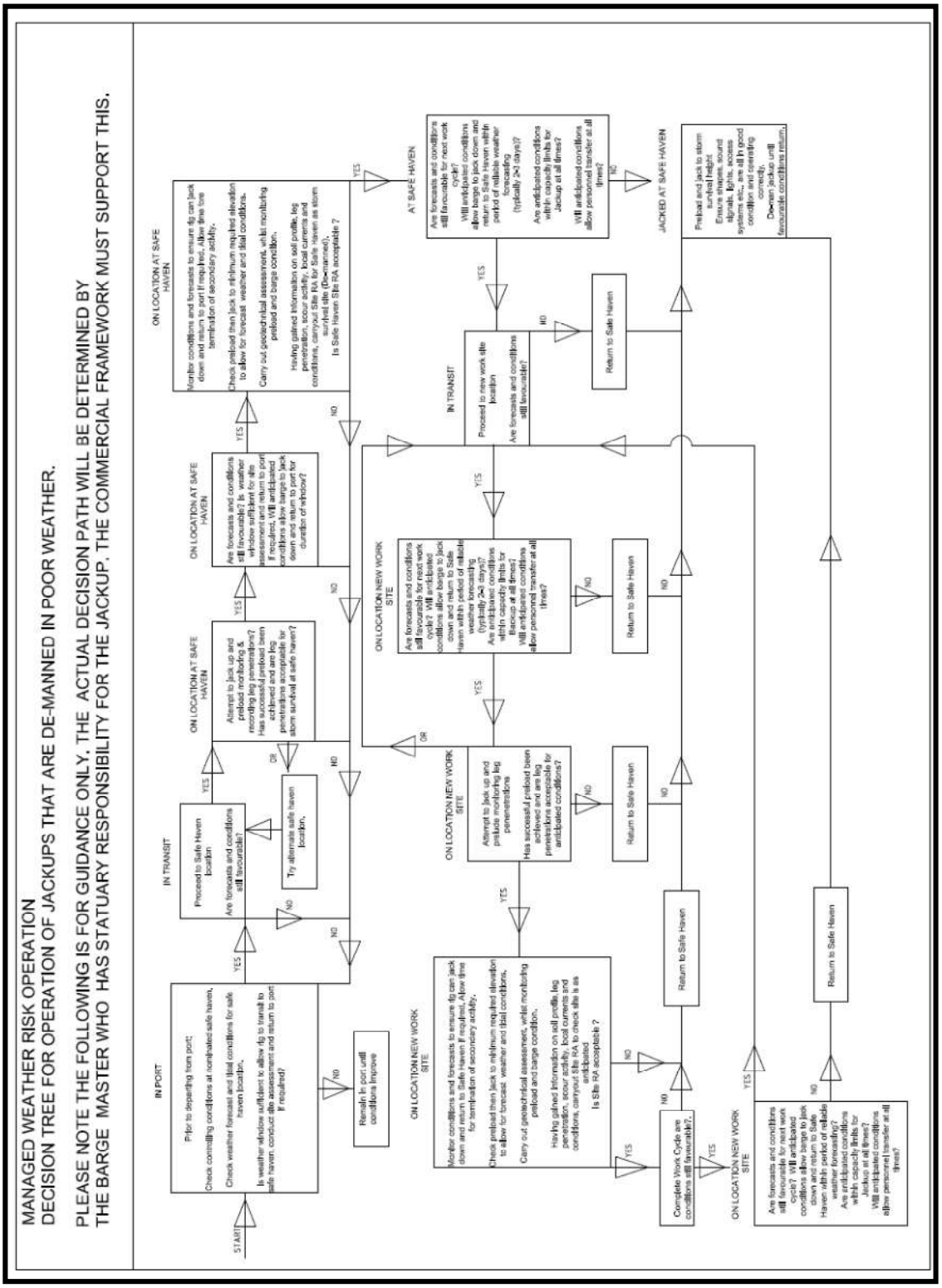
Appendix 1 - JUB Site Management and Risk Assessment Process Flow Chart



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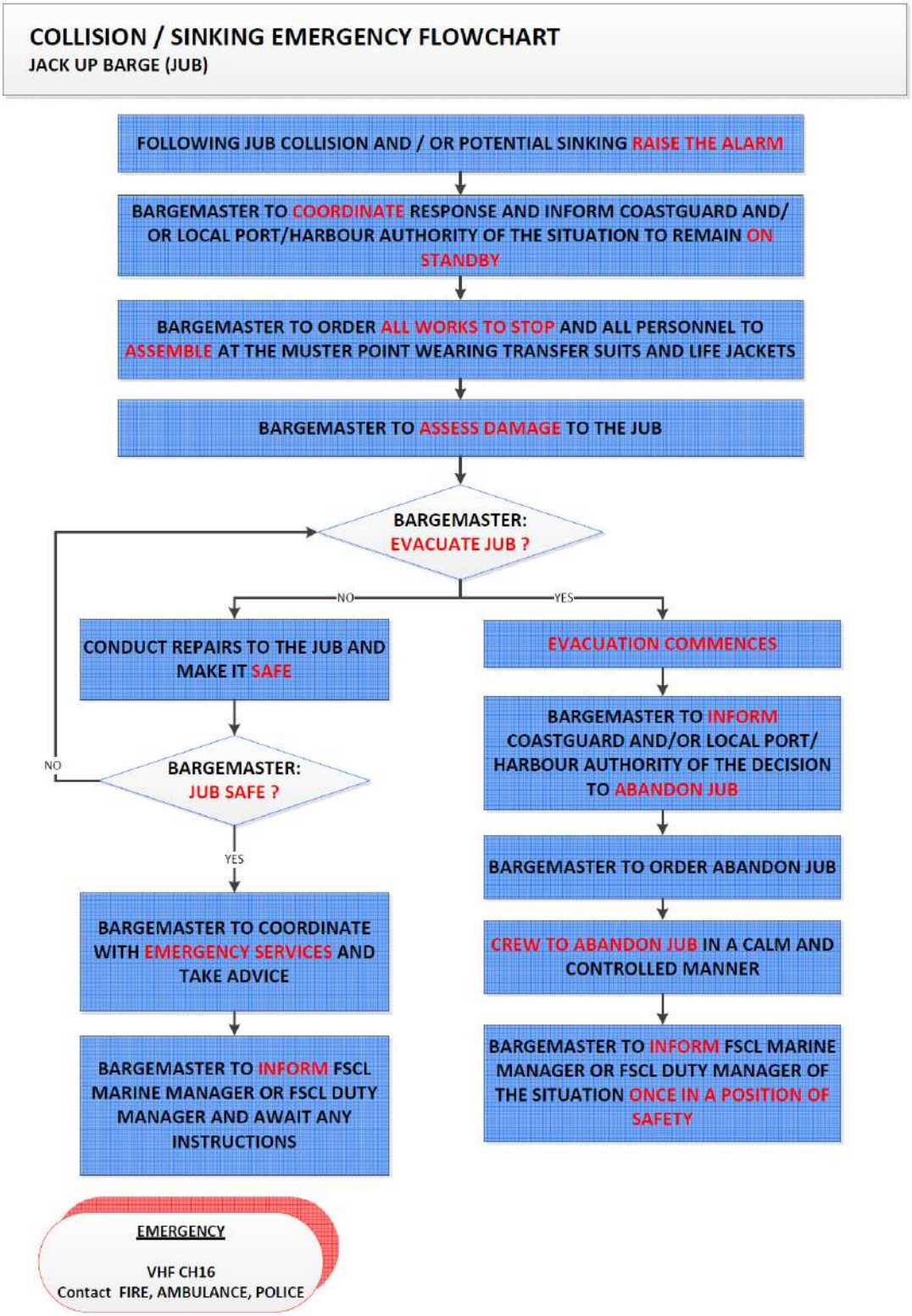
Appendix 2 – Emergency Abandon Vessel Procedures



Appendix 3 - Example Weather Window Calculation

WEATHER WINDOW MOVE
From **BOREHOLE 1** TO XX HOLE **BOREHOLE 2** ON **12/010/2016**
AND TO A SAFE LOCATION
FOLLOWING FORECAST AT 07:00HRS ON 12/10/2016
(Confirmed by Fugro Geos)

ACTIVITY	**REQUIRED TIME (hr)**	**COMMENT**
Time to jack down and take on tow		Legs **in 3m. Move xx:xxhrs Day XX Month to make use of Weather Window.**
Transit time to		Distance X km.
Time to jack down		
Transit time to safe location		Safe location at XXXX (where legs actually penetrated Xm)
Time to preload at safe location		
TOTAL TIME TO COMPLETE OPERATIONS		If have to abort and return to safe haven
Total weather window expected		*XX:XXhrs XX Month till XX:XXhrs XX Month HS < 0.5, wind <25K*
Total remaining weather window		Remaining working weather window
CALCULATION FOR MAXIMUM ALLOWABLE LEG PENETRATION TO ACHIEVE SAFE WORKING HEIGHT		
calcs = SWH		
High tide over working period		Highest tide over working weather window of xx hrs using Belfield software tide plotter
Storm surge		Maximum storm surge forecasted over the duration of the working weather window.
0.7 x Hs max of 0.5m		Max Forecasted Hs over duration of working weather window.
Air gap		Between wave crest and hull of barge
TOTAL REQUIRED AIR GAP ABOVE LAT		
Minimum Deck Elevation LAT		depth of hull (4.2m) + air gap
Spare jacking		
LAT AT NEW POSITION		Water depth in LAT
Total air gap above LAT		See above
Useable leg length		
MAX ALLOWABLE LEG PEN TO ACHIEVE SWH		(useable leg length – water depth – air gap)

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Appendix 4 – Example Forecast Tide & Current info Sept 2015)

Nikiski, 0.8 mile west of

Predicted Tidal Current — August, 2015

Flood Direction, 350 True. — Ebb (-) Direction, 173 True.

NOAA, National Ocean Service

	Slack Water	Maximum Current		Slack Water	Maximum Current		Slack Water	Maximum Current		Slack Water	Maximum Current		Slack Water	Maximum Current	
Day	Time h.m.	Time h.m.	Veloc knots	Time h.m.	Time h.m.	Veloc knots	Time h.m.	Time h.m.	Veloc knots	Time h.m.	Time h.m.	Veloc knots	Time h.m.	Time h.m.	Veloc knots
1	0114	0344	+5.2	0719	1006	-5.3	1337	1627	+5.6	2011	2243	-5.1			
2	0158	0425	+5.4	0806	1053	-5.5	1419	1701	+5.8	2051	2326	-5.3			
3	0244	0508	+5.4	0854	1140	-5.3	1504	1740	+5.8	2133					
4		0010	-5.3	0331	0554	+5.2	0946	1231	-5.0	1551	1824	+5.5	2217		
5		0058	-5.1	0422	0646	+4.7	1044	1324	-4.5	1642	1915	+5.1	2306		
6		0147	-4.8	0518	0747	+4.2	1149	1422	-3.9	1741	2013	+4.5			
7	0002	0240	-4.3	0622	0907	+3.6	1304	1525	-3.3	1848	2121	+3.9			
8	0106	0337	-3.8	0734	1055	+3.4	1420	1652	-2.9	2000	2244	+3.6			
9	0214	0444	-3.4	0849	1222	+3.8	1532	1846	-3.1	2112					
10		0002	+3.6	0321	0658	-3.3	1000	1324	+4.3	1636	1950	-3.5	2217		
11		0103	+3.9	0421	0807	-3.7	1058	1416	+4.7	1730	2043	-3.9	2312		
12		0155	+4.2	0513	0856	-3.9	1145	1459	+5.0	1815	2129	-4.0	2359		
13		0240	+4.4	0559	0932	-4.0	1225	1536	+5.1	1854	2209	-4.0			
14	0040	0321	+4.5	0640	0938	-4.1	1300	1606	+5.0	1930	2236	-4.0			
15	0119	0358	+4.6	0718	0957	-4.2	1333	1632	+5.0	2003	2243	-4.0			
16	0156	0432	+4.6	0756	1031	-4.4	1406	1655	+4.9	2034	2304	-4.1			
17	0232	0505	+4.5	0835	1109	-4.4	1439	1719	+4.9	2105	2335	-4.3			
18	0309	0538	+4.3	0916	1150	-4.3	1515	1748	+4.8	2138					
19		0012	-4.3	0346	0614	+4.1	1000	1235	-4.1	1553	1823	+4.6	2213		
20		0054	-4.2	0426	0655	+3.7	1049	1323	-3.8	1636	1905	+4.2	2254		
21		0139	-4.0	0511	0744	+3.3	1147	1415	-3.3	1727	1953	+3.7	2342		
22		0227	-3.6	0606	0847	+2.8	1256	1511	-2.9	1829	2049	+3.2			
23	0040	0320	-3.3	0713	1042	+2.6	1407	1611	-2.6	1937	2157	+2.9			
24	0146	0418	-3.1	0824	1206	+3.0	1513	1719	-2.6	2045	2320	+2.9			
25	0251	0520	-3.2	0929	1302	+3.5	1611	1826	-2.9	2145					
26		0027	+3.3	0352	0623	-3.5	1024	1346	+4.1	1701	1921	-3.4	2238		
27		0118	+3.9	0445	0719	-4.0	1111	1423	+4.6	1744	2008	-4.0	2325		
28		0203	+4.5	0534	0811	-4.6	1153	1456	+5.1	1824	2052	-4.6			
29	0010	0246	+5.1	0620	0901	-5.0	1234	1529	+5.6	1902	2135	-5.1			
30	0053	0329	+5.5	0706	0949	-5.4	1316	1603	+5.9	1941	2218	-5.5			
31	0138	0411	+5.7	0754	1037	-5.5	1359	1639	+6.1	2022	2301	-5.7			

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Appendix 5 – Example Planned sequences of works

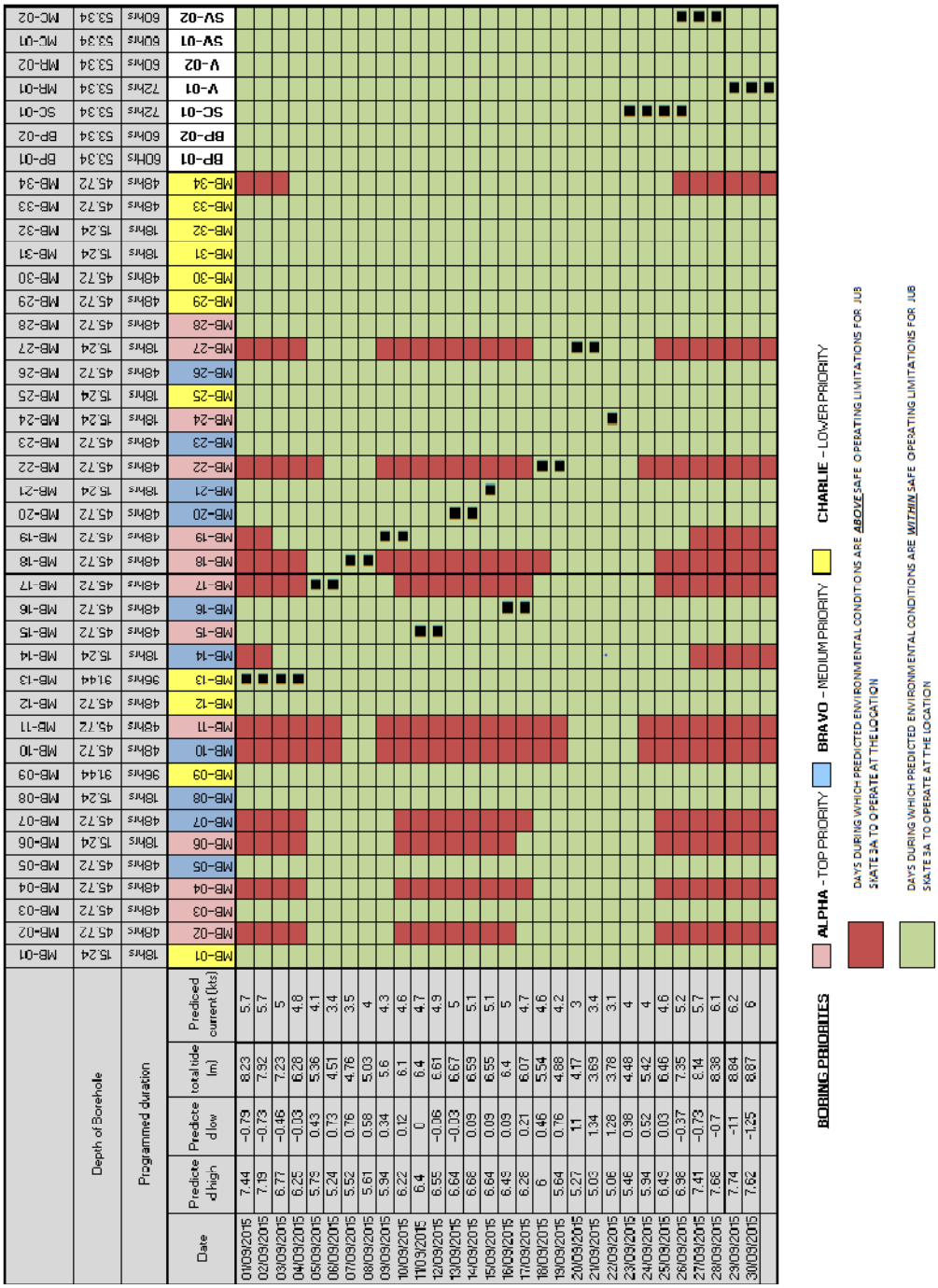

PLATE F-38

Appendix 6 – Example Tow Plan – Mob berth to Main Worth site

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8. Plant and Equipment
9. Materials (handling/storage/disposal)
10. Preparation of Works/Location of Services
11. Emergency Procedures
12. Personal Protective Equipment/Safety Equipment
13. Methodology & Sequence of Work

Appendix 1: Crew boat equipment checklist

Appendix 2: Landing craft Data Sheet

Appendix 3: Avon Searider RHIB Data Sheet

Issue details:	Issue 1 Revision 7	
Distribution:	Controlled copies: Contract File Project Manager	Uncontrolled copies: Client
Originated by: **Andi Hagan**	Reviewed/authorised for issue by: L. Griffin & M. Adams	

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1. Introduction

This Method statement covers the crew transfer options between the work site (which is approximately 2nm south of Rig Tenders Quay, Nikiski AK) and various shore side crew transfer locations. It then details the various methods for the safe transfer of crew between the Landing Craft Vessel (LCV), Rigid Hull Inflatable Boat (RHIB) and the Jack-up Barge (JUB), using the fixed boarding ladder as the primary method and the rope ladder as secondary support where required.

2. Main Activity / Area of Work

This method statement deals with the crew transfers between the following crew change points and Skate 3

- **Primary Crew Change Point** - Rig Tender Quay (RTQ) and adjacent beach area, Nikiski (Figure 1 and 4) – Distance 2.5 NM
- **Secondary Crew Change point -** Kenai city dock – Distance 8.5NM south of the LNG terminal site

The crew transfers will be primarily carried out using the LCV or in increased weather, the case of an emergency or the LCV is not available, the RHIB will be the preferred option. Crew transfers will take place during both daylight and darkness hours when possible shift times will be matched to achieve the best option for daylight activities.

Figure 1 Skate 3 fixed access ladder

Skate 3 is fitted with a fixed vertical access ladder and angled stairway that can be adjusted to suit the local conditions such as sea state and wave height. The access ladder is specifically designed for use with a RHIB or medium size landing craft.

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Figure . Crew transfer route - Site to ASRC

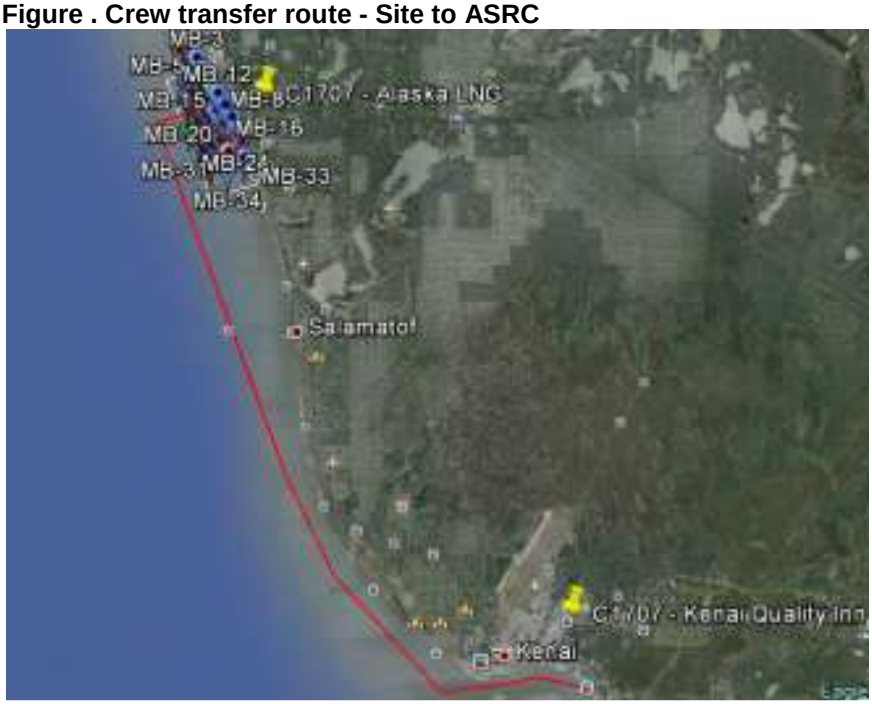

Figure 1. Crew transfer route - Site to City Quay, Kenai

This method statement aims to encompass all aspects of the crew transfer. Should the safe method of crew transfer need to be changed due to site conditions the method statement will be revised.

3. Manpower and Supervision

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All personnel involved in the nearshore geotechnical site investigation (including visitors) shall hold as a minimum a valid basic sea survival training certificate to STCW-95 (**or US equivalent – Cold Water Survival**).

The table below lists the manpower involved in the crew transfer and their responsibilities.

Nominated Person	**Responsibility**
Site Project Manager	• Overall responsibility for all site activities • Advise Bargemaster and coxswain on the project requirements, and the requirement to comply with this method statement in order to enable the work to be carried out safely. • Monitor the weather forecast and have daily communication with the Bargemaster regarding the weather forecast and environmental conditions including but not limited to: o Waves o Current o Wind o Tide
Bargemaster	• Overall responsibility for the safety of Skate 3, and all onboard • Assess weather and environmental conditions and determine suitable conditions for crew transfer • Organisation and safety of crew transfer taking due consideration of this method statement, site requirements and the operating instructions and limitations of Skate 3 and Landing craft My Marie • Communications with HSE manager(s) and support vessels during crew transfer • Maintenance and if necessary repair of access ladder •
LCV Skipper	• Responsible for all operations of the LCV during crew transfer • Inspect LCV before each crew transfer • Operate the LCV in a safe and responsible manner giving due regard to local environmental conditions • Instruct all transferees before crew transfer to enable safe transfer of all • Ensure everyone boarding the LCV is wearing the required PPE • Maintenance and if necessary repair of the landing Craft

RHIB Skipper	• Responsible for all operations of the RHIB during crew transfer • Inspect RHIB before each crew transfer • Operate the RHIB in a safe and responsible manner giving due regard to local environmental conditions • Instruct all transferees before crew transfer to enable safe transfer of all • Ensure everyone boarding the RHIB is wearing the required PPE • Maintenance and if necessary repair of the RHIB
Crane Operator (RHIB operations only)	• Responsible for safe launch and recovery of the RHIB from/to the Skate 3 deck and sea • Inspect crane and all required lifting equipment
All Personnel	• Responsible for the safety of themselves and others around them • Maintenance and storage of their own life jackets and immersion/transfer suits • Ensure they wear the required PPE for the crew transfer • Have read and understood this method statement and the crew transfer risk assessment • Follow instructions from Bargemaster, Landing Craft Skipper or RHIB Skipper at all times during crew transfer

4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

The table below lists the other documents relevant to the crew transfer.

Document	Reference Number
AKLNG Work Execution Plan	Latest revision
Project Management Plan	C1707 - Latest revision
Emergency Response Plan	C1707 - Latest revision
Skate 3 Operating Manual	Latest revision
Landing craft My Marie Operating Manual	Latest revision
Management of Change Procedure	FSCWP218 Issue 1 Rev 0
Management of Change Form	FSCWF217 Issue 2 Rev 0
JUB Standing Instruction Manual	Issue 1 Rev 0

Access Ladder Operator Manual	Issue 1 Rev 2

5. Risk Assessments

Risk assessments relevant to the crew transfer are listed in the table below.

Risk Assessment	Title
RAS001	Working Over water
RAS004	Personnel Transit by Crew Boat or RHIB
RAS 007	Boat Lift from water to barge deck
RAS 022	Access via Rope Ladder
RAS 033	Man Overboard
RAS 071	Lifting operations – Deck Crane
RAS 078	Access to JUB via fixed ladder

6. Security - Barriers/Fences/Warning Signs

LCV - During the transit to/from the works site all crew will remain seated on the benches on deck such that their centre of gravity is below the vessels edge protection.

RHIB – During the transit to/from the works site the crew will remain seated on either the centre seat or the RHIB tubing.7. Constraints/Restrictions/Special Conditions

All personnel involved in the near shore geotechnical site investigation (including visitors) shall hold as a minimum a valid basic sea survival training certificate to STCW-95 (**or US equivalent – Cold Water Survival**).

Crew transfers shall only be carried out with permission of the Fugro Barge Master or Project Manager.

All vessel movements on site, including crew transfer with the LCV will be coordinated by Fugro Project Manager and or Barge Master to ensure coordination of SIMOPs.

All rules and guidance on site are located in the Project File kept onboard the jack up and in the project office at RTQ.

The vessel used for crew transfers will be chosen after assessing the local weather conditions in consultation with the weather criteria listed in table 1.

During all operations, the emergency channel (VHF channel 16) shall be constantly monitored.

Weather

The LCV or RHIB will be operated within the predetermined operating limits as detailed in table 1 of this document, giving due regard to the sea state, prevailing weather conditions and number of passengers.

Sources to be used for weather forecasts;

- National Oceanic and Atmospheric Administration – www.noaa.gov
- www.windfinder.com.
- Live data from the NOOA station at Nikiski - http://www.ndbc.noaa.gov/station_page.php?station=nkta2

The Bargemaster, skipper and Coxswain shall assess weather and environmental conditions and determine whether conditions are suitable for crew transfer for to and from the JUB. The table below lists the limiting environmental conditions for operating the LCV and RHIB during crew transfer. The limits listed refer to the maximum value of each parameter. Final decision on any activity however is the responsibility of the Bargemaster or LCV Skipper and lower limits may be decided upon depending on prevailing conditions.

Limiting conditions:

Table 1 - Summary of Sea/Wind Conditions vs. Jack-up Operations

Item No	Description	Sea state (-Hmax (m and ft)	Wind speed Beaufort scale Force	Wind speed (m/s and mph)	Current (Knots)
1	Crew Evacuations	1.5m (5ft)	Wind Force 6	12m/s (31mph)	6
2	Crew transfer and evacuation	Minimum water depth to allow safe transfer and evacuation 0.9m (3ft) at all states of tide.			
3	Fog	Visibility of greater than 500m for crew transfer operations			
4	RHIB Crew Changes	1.2m (4ft)	Wind Force 6	12m/s (31mph)	4
5	LCV Crew Changes	0.9m (3ft)	Wind Force 6	12m/s (31mph)	4

The data above details the limiting conditions for sea-state and wind. However, other environmental conditions can also affect the workability of the marine spread, in particular (but not limited to) wave direction, currents, tides and visibility. The Bargemaster will have the final decision to advise the personnel if it is safe to transfer based on the prevailing conditions. The individual personnel can refuse to transfer if they do not feel capable of the transfer.

Works suspended due to environmental conditions.

If works on the JUB are suspended due to environmental conditions the JUB may be left unmanned for a number of days. In this case, the Barge Master MUST;

- Ensure that the position of the leg ladder takes account of the anticipated tidal conditions on the day that forecasts indicate a return to the JUB will be possible.
- The Barge Master will plan the return to the JUB at a time that the Tidal Conditions are such that safe access to the ladder is achieved.

Working Hours and Day Light

Crew transfers will be carried out during both daylight and hours of darkness.

The table below shows the average working day light hours from August to November 2015

Date	Sunrise	Sunset	Daylight (hrs)	Darkness (hrs)
August 01, 2015	*4:35*	*21:42*	17:00	5
September 01, 2015	*5:53*	*20:12*	14:00	10
October 01, 2015	*7:06*	*18:38*	11:5	12.5
November 01, 2015	*8:26*	*17:05*	8:5	15.5

When crew transfer is carried out during the hours of darkness the following additional controls must be in place

- The departure and arrival location are to be lit to a safe level
- The LCV deck will be lit in such a manner that allows for safe access and egress of the vessel.
- The access ladder on the JUB must be such that access onto either vessel will be well lit to provide good visibility for access and egress.
- All life jackets to be fitted with both a light and Personal locator beacon (PLB)
- Both crew transfer vessels to have established and stored safe passage route in the onboard GPS Plotter
- Landing craft to confirm with the JUB that it has commenced the transit to allow the barge master to task the onboard crew to assist the embarking crew.

Transfer suits will be worn for **All** crew transfer due to the nature of the currents in Cook Inlet. Details of the transfer suit are given in appendix 3.

The LCV and RHIB Skipper(s) to brief all transferees on the method of transfer, and the associated risks, in advance of crew transfer.

During emergency evacuations from Skate 3 the rope ladder installed onboard can be used if the main access ladder is not suitable/available. At all other times, the fixed ladder shall be used for access and egress.

Clear lines of communication between all parties involved shall be maintained at all times during crew transfers. Line of site and verbal communication will be possible during the process. The Bargemaster and Landing Craft Skipper will also have VHF radios to allow contact if verbal communication is not possible.

During periods of cold weather (below 3°C or 37°F Air Temperature) the on board crew will ensure that the ladder is free from ice deposits immediately prior to the embarking crews arrival.

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Prior to commencing the transfer of crew using the Landing craft, the Skipper will stand off the boarding ladder and observe;

- Direction and strength of the tidal current.
- Effects of any other elements on the landing craft.
- Swell conditions at boarding ladder.
- That sufficient lighting is in place for crew transfer during hours of darkness

Only if conditions are within the safe working limits and both the Barge Master and Landing Craft Skipper agree that it is safe to proceed with the transfer will the transfer commence.

Skate 3 will be positioned as shown below. This will allow crew transfers to take place during both the ebb and flood tides and provide optimum positioning for launching and recovering the RHIB.

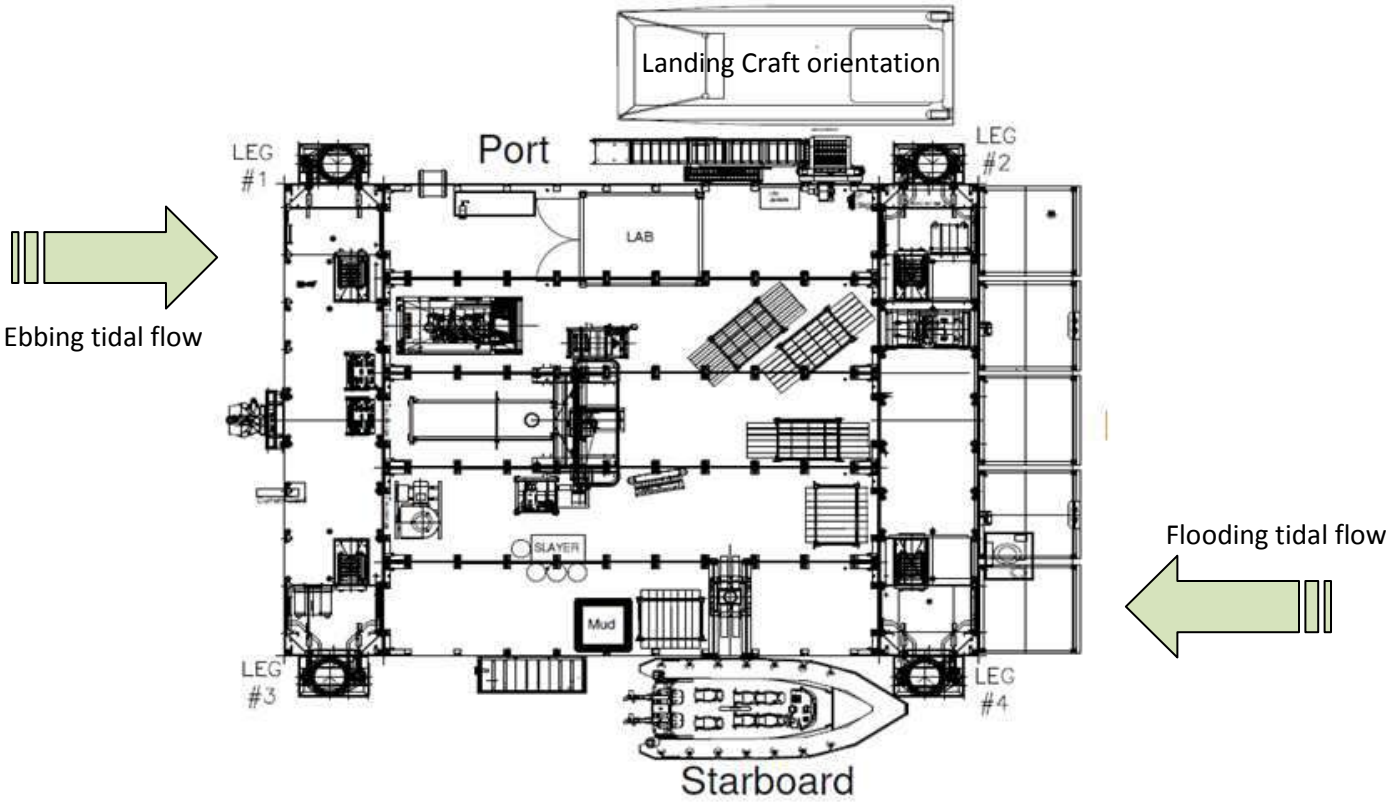

Figure 3. Orientation of Skate 3 relative to current direction

When Skate 3 is positioned in shallow water, the water depth shall be taken into account for crew transfers. The minimum water depth for the LCV safely reach Skate 3 is 1.5 metres allowing for the draft of the vessel. If the location is within a surf zone the skipper of the landing craft MUST carry out a visual assessment of the conditions to ensure that he is confident that it is safe to place his vessel beam onto the swell.
The minimum water depth for using the RHIB is 0.6m (2 ft), dependant on swell conditions being minimal.

8. Plant and Equipment

The following plant and equipment will be used during crew transfer:

- Skate 3
- LCV (Primary Crew Transfer Vessel)
- RHIB (Secondary Crew transfer vessel)
- Volvo power pack
- Skate 3 access ladder
- Skate 3 deck crane
- VHF radios
- Fall arrest system on quay wall boarding ladder (if required)
- PLB – Fastfind 220 GPS (406 MHz)

Note: All equipment and accessories shall be maintained in accordance with the predetermined maintenance schedule and visibly inspected before use.

9. Materials (handling/storage/disposal)

Large items of equipment and materials shall be transferred from the landing craft to the JUB by crane.

Handheld bags and small items of equipment SHALL NOT be carried when embarking or disembarking Skate 3 by the fixed access ladder. These items are to remain in the Landing craft and be lifted up separately. In the case of the RHIB, the deck crane will lift the RHIB out of the water to put aboard the JUB onto the boat cradle where they can be handed over by the Coxswain once RHIB is secure.

Note: Rucksacks are not to be worn during the transfer!

10. Preparation of Works/Location of Services

All transferees shall be experienced in the type of crew transfer adopted. Prior to mobilisation to site the Bargemaster skippers, and Coxswain will assess the competence of all crew members. Competence will be assessed based on prior demonstrable practical experience of using similar access provisions, a valid medical certificate, and as a minimum valid one day sea survival course.

Prior to the commencement of crew transfer operations the following criteria shall be evaluated for acceptability:

- Vessel manoeuvring characteristics
- Weather conditions
- Sea state
- Direction and speed of current
- Appropriate PPE
- Tides

Prior to boarding the Landing craft;

- All crew and personnel will be briefed on the planned operation. This will be of particular importance for visitors and people accessing the JUB for the first time. Specific information will be provided about the access arrangements and the need to comply with the Skippers instructions at all times.

- All equipment is checked (by a competent person) immediately prior to its use. All certification for the equipment being used where applicable should be available either on the LCV or JUB and be in date.
- The Landing craft shall be inspected before each use by the Skipper using the Crew Boat Equipment Checklist that is included in Appendix 1 or set procedure as set by the sub-contractor.
- All personnel will be made aware of the ERP by the Skipper including, but not limited to, "man overboard" and first aid procedures.
- All personnel will be issued with the appropriate PPE (lifejacket, PLB and transfer suit).
- All personnel will be made aware of slippery and wet surfaces and briefed on use of steps or ladders.
- Before lifting the RHIB the deck crane and lifting gear shall be visually inspected and approved for use by the Crane Operator.

Note Tug will be on work site at all times during crew Change and normal site operations. The tug will always maintain a position down tide to act as a safety/First response in the event that of MOB

The Landing craft, RHIB and Support Tug to be fitted with the locating device for the personal locator beacons (PLB) should a MOB event take place.

11. Emergency Procedures

The emergency procedures will be adhered to at all times. Details of emergency response are incorporated in the project Emergency Response Plan.

All personnel arriving on the jack up for the first time will receive a safety brief on the emergency procedures and location of emergency equipment and muster point from the Bargemaster or supervisor.

12. Personal Protective Equipment (PPE) & Safety Equipment

The following personal protective equipment shall be worn during crew transfer:

Item	Description
Transfer Suit (Mullion North Sea or equivalent)	Mandatory for crew change operations (Above 12°C water temp)
Immersion Suit (IMG5 or equivalent)	Mandatory for crew change operations (Below 12°C water temp)
Safety glasses or goggles	Mandatory on the Jack up (for all site activities)
Safety boots/shoes	Mandatory (for all site activities)
150 N Lifejacket	Mandatory during crew change operations
Safety Helmets	Mandatory on Jack up
Personnel Locator Beacons (Fstfind 220 GPS –406 MHz)	Mandatory for Crew Change operations. Fastfind units can be picked up on all vessel GPS units.

13. Methodology & Sequence of Work

Permissions:

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Crew transfer is part of the daily operations and will be indicated as such during the daily briefing/ tool box talks.

The Barge Master and Landing Craft Skipper will contact Conoco Phillips and Trasoro and coordinate any marine SIMOPs. All SIMOPs will be reported to the AK LNG Site Manager

General:

The Bargemaster or Appointed Supervisor will ensure that all transferring personnel have been briefed on this method of transfer prior to its use and understand fully the instructions for the transfer. In the case of an emergency that requires the use of the rope ladder, the Barge Master will brief the crew on this operation and associated risks during their site/project induction. The Landing Craft Skipper and RHIB Coxswain will complete a drill prior to operations to ensure that they are familiar with the safe method

Prior to a crew transfer taking place, the Bargemaster and Landing Craft Skipper will review the existing weather conditions and forecasts (including, but not limited to wave heights, currents, wind speed and direction) to determine whether a safe transfer is possible and that there is a sufficient window to complete the shift and safely remove the crew. If so, then the following procedure will take place.

(**Note:** The Bargemaster has been briefed on site specific conditions and will use this knowledge along with actual physical conditions at the time and past experience to determine whether the transfer should take place. A transfer may be abandoned at any time should conditions become unfavourable.)

The Bargemaster or Landing craft Skipper will ensure all crew being transferred don their PPE before leaving Skate 3 or the quay side.

All crew will have undergone a briefing on the crew transfer process.

Embarking and disembarking of the Landing Craft shall be carried out in an orderly manner, one person at a time under the control of the Barge Master and Landing Craft Skipper.

Transfer of personnel will immediately stop if any of the following situations occurs:

- Weather or sea state becomes unfavourable
- VHF radio communication with any vessel fails
- Emergency Alarm activated on any vessel
- Any vessel involved in the operation experiences equipment malfunction or failure
- Supervisory crew member of either vessel leaves the transfer area without a replacement

Each person to be transferred has the right and responsibility to refuse the operation without fear of reprisal if conditions are not safe in their opinion!

In the event of a person falling into the water, the Man-Over-Board response procedure as per the Emergency Response Plan shall be initiated.

Crew transfer sequence

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For investigation locations where access to Skate 3 is not restricted by the tides (i.e. water depth is always sufficient for the LCV/ RHIB to reach Skate 3), crew changes will follow the sequence below:

- Obtain relevant permissions as stated in this document, prior to leaving the beach
- Landing craft Skipper/Bargemaster confirms conditions are within safe limits
- Carry out transfer procedure as stated below
- Recover disembarking crew
- Completion of crew transfer reported to Project Site Base

For investigation locations stipulated in the scope of work, there are no locations that dry out at low tide.

Details of the different steps in the crew transfer sequence are listed below.

Transfer between beach and the LCV

1. The crew boat Captain/coxswain and the crew members involved must all be happy with the prevailing weather and sea conditions for the crew transfer to go ahead. The duty Bargemaster/Marine supervisor will check weather forecast and current conditions before commencing any crew transfers. There must be a suitable weather window to conduct the transfer safely and not risk having crew trapped on the platform.
2. All crew transfer members must don transfer suits, PLB's & lifejackets before leaving the quayside and boarding the crew boat. PLBS to be checked on a regular basis by the person they have been assigned to and any anomalies reported to their line manage. NO LIFEJACKET and PLB..... NO TRANSFER
3. When using the LCV, the Skipper will notify the jack up Barge Master of the crew change via the VHF channel 16.
4. The vessel will approach the beach and deploy a stern anchor 20m from shore to stabilise the stern of the vessel once on the beach. Keeping its engines running to allow the boat to keep position on the beach the landing craft will position itself ready to commence the transfer of crew. The bow (front) of the LCV will then drop down on to the beach allowing the crew members to enter. Once all the crew members are on board the bow will be raised and the boat will pull away from the beach.
5. Personnel being transferred must not carry any items with them that might interfere with their grip or ability to transfer onto the vessel. Bags and equipment being transferred can be passed across by hand and not carried.
6. Throughout all transfer operations everyone must stay alert and look out for others transferring. Be familiar with the location of life buoys etc.

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Figure 5. Beach crew transfer location

Transfer of personnel from LCV/ RHIB to Skate 3 fixed access ladder:

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1. Upon arrival at Skate 3 the skipper will stand off and observe the conditions at the boarding platform.
2. The skipper will confirm that the Barge Master is ready for the crew transfer and that assistants are in place.
3. The Barge master will advise the on station Tug to take up station 300m down tide, ready MOB retrieval equipment and post watches.
4. The remaining crew will take up watch and positions of readiness in case of a MOB event
5. The skipper positions the vessel alongside the access platform, allowing crew transfer to take place via the side of the craft. The assistant will be positioned to assist personnel during the transfer if required.

Figure 6 .Skate 3 fixed access ladder

6. Once the vessel is in position alongside, the skipper will instruct the crew to commence transfer operations.
7. Note; when using the Landing Craft for the crew change then steps up to the side of the hull will be in place before stepping on to the boarding ladder.
8. Personnel will embark Skate 3 one at a time by stepping across from the transfer vessel onto the landing platform on the peak of the swell / wave.
9. All instructions from the Skipper/ Coxswain will be followed during the transfer process. The Skipper shall maintain continuous visual contact with the crew member concerned and give instructions accordingly throughout the transfer until the crew member has safely arrived on the Skate 3 deck.
10. The Assistant will assist all transferees on the platform. Communication between Skipper and person at the top of the platform will be verbally and by using hand signals.
11. Climbing the stairs shall be carried out at all times maintaining 3 points of contact.
12. The above process will be repeated one person at a time until all transferees are onboard the deck of the JUB.
13. Once the final transferee is safely on deck the Barge Master will confirm that the vessel can move off the ladder and hold station until the disembarking crew is ready to transfer.

14. If the transfer is completed using the SKATE 3 RHIB - After the last transferee has reached the deck and upon instruction from the Coxswain the assistant will move away from the RHIB bow and take a seat in the RHIB as indicated by the Coxswain.
15. The Coxswain will position the RHIB on the port side of Skate 3, in reach of the HIAB, for recovery of the RHIB onto the deck.

Transfer of personnel from Skate 3 fixed access ladder to Landing craft:

1. After completing the shift handover briefing the on signing Barge Master will confirm that the disembarking crew are all wearing the correct PPE and contact the landing craft skipper and request that he brings the vessel along side.
2. The Barge master will advise the on station Tug to take up station 300m down tide, ready MOB retrieval equipment and post watches.
3. The remaining on signed crew will take up watch and positions of readiness in case of a MOB event
4. The Skipper positions LCV alongside the access platform, allowing crew transfer to take place via the side of the Landing craft. The assistant will be positioned to assist personnel during the transfer if required.
5. Once Landing Craft is in position, the skipper will instruct the crew to commence transfer operations.
    a. Note; When using the Landing Craft for the crew change then steps up to the side of the hull will be in place before stepping on to the boarding ladder.
6. Personnel will disembark Skate 3 one at a time by descending the access stairs and stepping across to the Landing craft on the peak of the swell / wave.
7. Landing Craft Skipper will instruct personnel what position to take in the landing craft
8. Once in the landing craft the crew member will sit down and remain seated during the transfer.
9. The above process will be repeated one person at a time until all personnel are on board the Landing craft.
10. Once all personnel are on board and secure, the Skipper will transit to one of the selected crew transfer points as detailed in section 2
11. The vessel will approach the beach and deploy a stern anchor 20m from shore to stabilise the stern of the vessel once on the beach. Keeping its engines running to allow the boat to keep position on the beach the landing craft will position itself ready to commence the transfer of crew. The bow (front) of the LCV will then drop down on to the beach allowing the crew members to exit. Once all the crew members have disembarked the bow will be raised and the boat will pull away from the beach.
12. Personnel being transferred must not carry any items with them that might interfere with their grip or ability to transfer onto the vessel. Bags and equipment being transferred can be passed across by hand and not carried.
13. Throughout all transfer operations everyone must stay alert and look out for others transferring. Be familiar with the location of life buoys etc.
14. The Skipper of the Landing Craft will contact the JUB and confirm that the transfer is complete

Launch of RHIB from jack up:

1. Barge Master and Coxswain will monitor sea and weather conditions and agree if they are within the crew transfer operating limitations. Particular attention shall be given to currents and tidal conditions
2. If conditions are within the crew transfer operating limitations and suitable for a crew transfer then the Bargemaster will inform all the crew of the intention to carry out the crew transfer.
3. Crane Operator starts power pack and checks deck crane.

4. Coxswain and assistant embark RHIB by stepping from the Skate 3 deck into RHIB.
5. Coxswain checks over RHIB
6. Crane Operator lowers crane hook to single lifting point of RHIB.
7. Assistant and Coxswain check connection of hook to RHIB single lifting point.
8. Coxswain instructs Crane Operator to start the lift.
9. RHIB is lifted out of its cradle and boomed down out over the side of the JUB, clear of the legs.
10. RHIB is slowly lowered into the water, bow facing the current.
11. Upon touching the water the Coxswain will start the engines and check the cooling water outlet. The main body of the RHIB hull should be largely out of the water with just the outboard legs placed into the water.
12. If Coxswain is satisfied the engines are running fine and RHIB is stable, the Coxswain will instruct the assistant to prepare to release the hook.
13. The crane operator will then lower the RHIB fully into the water and the assistant will release the hook from the lifting point.
14. Crane operator will raise crane hook clear of RHIB.
15. Coxswain assesses the environmental conditions on site before approaching the access platform.
16. Coxswain moves RHIB to Skate 3 access platform.
17. Crew transfer to RHIB via lower access platform.

Transfer of personnel from shore side using RHIB :

1. Dependant on the weather conditions on site, the RHIB will either crew change on the RTQ (Rig Tender Quay) at Nikiski or in Kenai City Dock
2. If using the ladder on the Northern side of the quay, the RHIB will approach the ladder bow first.
3. The crew will disembark from the bow, one at a time, with the RHIB pulling away from the quay as each crew member ascends the ladder.
4. If required a fall arrest system will be used, dependant on the height of the climb.
5. The replacement coxswain will climb down the ladder and onto the boat and crew change onboard with the existing coxswain.
6. Once handed over the off signing coxswain will leave the boat via the quay ladder.
7. Remaining on signing crew climb down onto the RHIB.
8. RHIB returns to the JUB

NOTE:- If the weather is such that the new crew is unable to on sign the JUB then the RHIB will either be lifted out of the water with the shoreside crane or be moored down at Kenai City Dock or Cannery.

Recovery of RHIB onto jack-up:

1. Coxswain will position the RHIB on the Port Side of Skate 3, bow into the current and underneath the crane hook. When RHIB is in position Coxswain will notify the Crane Operator to lower crane hook to the correct height.
2. Crane Operator lowers crane hook to single lifting point of RHIB.
3. Assistant connects the hook to the single lifting point.
4. Crane Operator instructed to start the lift. When the boat starts to become free of the water, the Coxswain switches engines off.
5. RHIB is lifted from the water slowly and brought alongside and secured in the boat cradle.
6. When the RHIB is in position and safe, Coxswain and assistant disembark by stepping from RHIB onto the Skate 3 deck. Any bags or small materials carried in the RHIB can now be handed from the RHIB to the deck.
7. Bargemaster will report completion of crew transfer to shore side offices.

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Appendix 1 – Crew Boat Equipment Checklist

Seacore CREW BOAT/RIB EQUIPMENT LIST FUGRO

TO BE CHECKED PRIOR TO USING THE BOAT/RIB. YOUR LIFE MAY DEPEND ON IT!!

ITEM TO BE CHECKED	PRESENT
FUEL TANK, FUEL and OIL	☐
PORTABLE VHF HANDSET	☐
ENGINE EMERGENCY CUT OFF LANYARD	☐
COMPASS FIXED OR HAND HELD	☐
ANCHOR ROPE AND CHAIN	☐
PYROTECHNICS FLARES AND SMOKES	☐
PADDLES X 2	☐
FIRST AID KIT	☐
TORCH	☐
FIRE EXTINGUISHER	☐
PLASTIC BAILER	☐
FOG HORN	☐
PERRY RING	☐
THERMAL PROTECTION AIDS X 2	☐
ENGINE SPARES	☐
OPTIONAL	
HAND HELD GPS	☐
LIGHT	☐
AUXILIARY ENGINE	☐

Appendix 2 – LCV My Marie Data Sheet

Landing Craft My Marie

Hull Specifications

- Length: 42'
- Beam: 10'
- Draft (Static): 5'
- Hull Material: ¼" Aluminum
- Cargo Capacity: 7,000 pounds
- Gross Tons: 10
- Net Tons: 8
- Draft (Cruising): 10"
- Work Deck: 8' x 24'

Mechanical

- Propulsion: 2) John Deere 6068 SFM 50, Jet Drive, Diesel
- Speed: 32 Knots
- Cooling: Keel Cooler
- Horse Power: 620 (combined)
- Fuel Capacity: 335 Gallons
- Fuel Consumption: 30 Gallons/Hr.
- Range: 300 Miles

Accommodations

- Dinette Seating for four
- 2 Burner Stove, Microwave
- Fresh Water: 85 gallons
- 110, 5.5 KW Generator
- Berths: 2
- 2 Heater Systems
- Marine Head (MSD)
- 22" TV Monitor

Deck Gear

- Lifting A Frame, 1,200# Capacity
- Anchor: Fortress, 20' chain, 300' line
- Portable Hydraulic Power Pack
- Electric Anchor Winch
- 2) 250 watt deck lights
- 1/4 " bow gate

Safety

- 8 Man Life Raft
- 6 Immersion Suits
- 3) Type B Fire Extinguishers
- 406 MHz EPRP
- Type III Work Vest PFD's
- 24" Life Ring

Vessel modifications can be made to accommodate client needs. Call for additional information.

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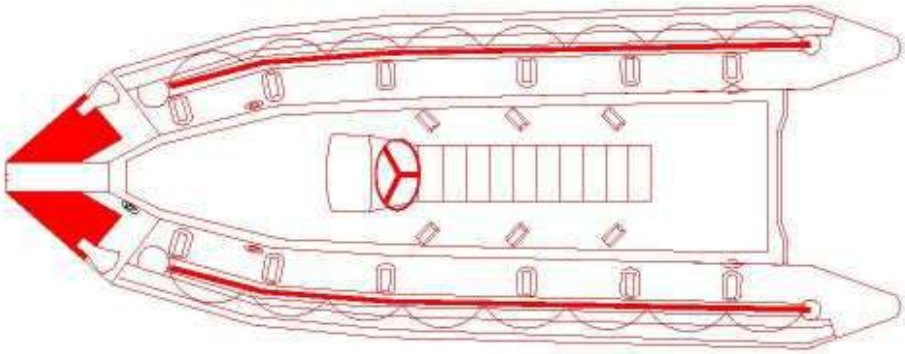
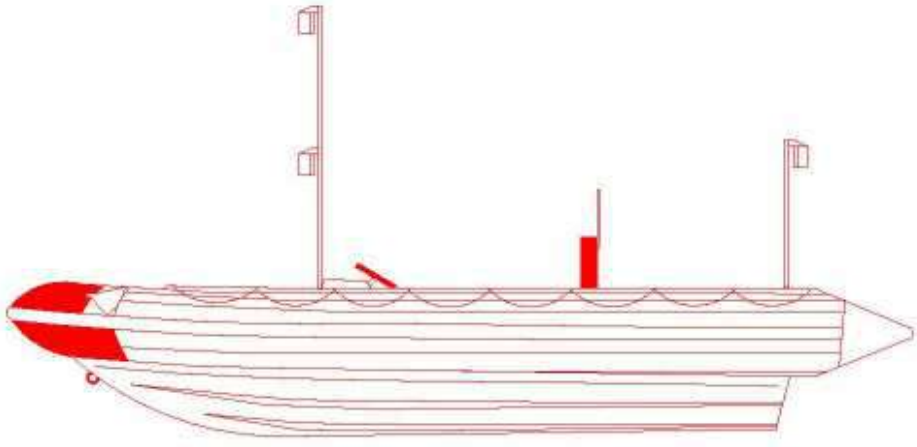
Appendix 3 – Avon Searider RHIB Data Sheet

Avon Searider Semi-rigid Inflatable





SPECIFICATIONS:

Length	:	6.0 m
Beam	:	2.8 m
Weight	:	326 kg
Max. Capacity	:	950 kg (10 persons)
Engine	:	2 x Yamaha (twin) 80Hp

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Issue details:	Issue 1 Rev 5	
Distribution:	Controlled copies: Project Manager Contract File	Uncontrolled copies: Client
Originated from: **Andi Hagan**	Reviewed/authorised for issue by: Andi Hagan	

A METHOD STATEMENT IS ONLY A SAFE METHOD OF WORKING IF IT IS DISCUSSED AND AGREED BEFORE WORK BEGINS AND THEN FOLLOWED BY THOSE CARRYING OUT THE WORK.

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1. Introduction

This Method Statement relates to the drilling procedures for the Marine Geotechnical boreholes.

2. Main Activity / Area of Work

Proposed Borehole No. and depths:

- Pipe Line Locations
  - 8 No. 175ft (53.5m)
- Main Terminal Locations
  - 2 No. 300ft (91.50m)
  - 22 No. 150ft (45.5m)
  - 10 No. 50ft (15m)

(The above borehole depths maybe subject to change).

Water depths over the site vary from 2m to 12.5m + 7.5m of tide

Drilling operations including but not limited to:

- Setting the 12”conductor casing casing
- Setting the riser casing
- Deployment of downhole sampling tools (Shelby push and piston samplers, SPTs etc.)
- Geobor-S coring
- Mud mixing operations
- On deck handling of samples and core
- Re-circulation tank maintenance
- Removal of drill cutting

3. Manpower and Supervision

The table below lists the manpower involved in the drilling operations and their responsibilities.

Nominated Person	Responsibility
Site Project Manager	• Overall responsibility for all site activities • Advise Bargemaster and Geotechnical Engineer on the project requirements and the requirement to comply with this method statement in order to enable the work to be carried out safely and obtain the required quality.
Bargemaster	Overall responsibility for the safety & operation of the Skate 3 jack-up Ensure Skate 3 is elevated to a safe working height and stable for the commencement of the drilling operations Monitor the weather throughout the drilling operations Communications with the project manager, support vessels and site project manager during the drilling operations

Geotechnical Engineer	Ensure drilling operations are carried out according to the contract requirements, specification and this MS. Take custody of samples once recovered to the deck and have been suitably labelled Photograph, log and store the samples according to the contract requirements and quality plan
Driller	Ensure drilling operations are carried out safely Ensure drilling operations are carried out in line with this method statement and the relevant standards Maintenance and if necessary replacement or repair of drilling equipment
Assistant driller(s)	Maintenance, cleaning and the safe operations including as necessary replacement or repair of drilling equipment Ensure the safety of himself and other in and around the drill deck Compliance with company HSE procedures and taking guidance from the Driller & supervisor. Cleaning down drill deck as required

4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

The table below lists the other documents relevant to the drilling operations.

Document	Reference Number
AKLNG Project Execution Plan	Latest Issue
Project Management Plan	C1707 – Latest Issue
Emergency Response Plan	C1707 - Latest Issue
JUB Standing Instructions	Latest Issue
Quality Assurance Project Plan	Approved version
APDES (Discharge permit)Permit 001 and 002	Permit No AK0062278

5. Risk Assessments

Risk assessments relevant to the drilling operations are listed in the following table and are held on site enclosed in the Nearshore Geotechnical Operational Plan.

Risk Assessment	Title
RAS 001	Working Over Water

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RAS 005	Working Time
RAS 013	Drilling Operations
RAS 020	Use of Power Tools for Maintenance & Fitting
RAS 023	Drilling, Free Fall Winch Operations
RAS 025	Drilling Operations in High Wind Conditions
RAS 030	Jack-Up Fire Assessment
RAS 031	Sample Preparation and Testing
RAS 033	Man Overboard
RAS 035	Emergency Abandonment, Evacuations of Jack-Up
RAS 038	Removing Core Sample from Inner Barrel
RAS 039	Fishing Down Hole Tools
RAS 048	Manual handling of 25kg bags of Grout/ Guar Gum
RAS 049	Manual Handling Assessment (Handling Lifting Accessories)
RAS 050	Manual Handling Assessment (Tripping in & out Drilling Equipment)
RAS 062	Drilling Mast - Winch Operations
RAS 069	Manual Handling (General Activities)
RAS 071	Mechanical Lifting Operations (Hiab & Deck Mounted Cranes)
RAS 101	Night Time Working
RAS 102	Mixing Guar Gum and Grout

6. Security - Barriers/Fences/Warning Signs

Access to the jack-up platform will be restricted to Fugro employees and the Clients Representatives. All persons that wish to access the Jack Up Platform will have as a minimum;

- A basic sea survival in cold water.
- A current off shore medical certificate
- Have attended a rig induction

Access to the drill floor will be restricted to Driller, Assistant Driller and Geotechnical Engineer. Any other person wishing to access the drill floor must first seek the approval of the driller.

All guarding and safety barriers will be in place at all times during drilling operations.

7. Constraints/Restrictions/Special Conditions

Drilling operations will take place 24 hrs per day 7 days per week. Drilling operations will be scheduled in such way that crew transfers will predominantly be carried out during daylight hours and time of suitable tide height and current flow.

Drilling operations during the hours of darkness all lights on the jack-up shall be switched on and working. All lighting will be directed onto the platform to avoid light pollution effecting marine environment.

Current – setting of the riser casing will be limited to times when the tide is flowing at its least. Normally the current will need to be 1 knot or below (depending on water depth) to ensure verticality of the riser casing. If the current is too strong the drilling operations must stop until such time as the safe and accurate deployment of the riser can take place.

The returning drill flush will be re-circulated though an onboard system that utilises a “mudslayer” to remove all solids and a settlement tank with internal weir system. Once cleaned the drill flush will be pumped into either a holding tank for return into the drill string or a drilling “mud” mixer dependant on the requirements of the ground being drilled**.** Please see full system schematic available in **APPENDIX 2.**

All waste collected by or in the “mudslayer” or the settlement tanks will be stored on board the Jack Up in sealed steel 45 gallon (Imperial) drums. Upon the completion of each location the sealed barrels will be offloaded to shore where they will be stored in a bunded area prior to removal by a licenced waste disposal company

The remaining liquid drilling fluid/flush will be re circulated back into the drilling system or stored on board the jack up in the settlement tank and holding tanks.

Upon the completion of a borehole location and prior to the “pulling” of the casing from the seabed the below procedures must be completed

- The casing will be flushed for 30 minutes to ensure clean discharge.
- Completion of a Static Sheen test (if static sheen test fails the borehole will be flushed for a further 30 minutes and the test repeated until a clear test is achieved)

When required at the end of the drilling operations the remaining drilling fluid will be pumped into sealed drums and transported to shore where they will be stored in a bunded area prior to removal by a licence waste disposal company.

The discharge to the sea of the remaining drilling fluid will be suspended if;

- An oily sheen, floating foam or solids are detected either in the grab sample or the receiving water surface.
- Protected marine mammal species are sighted,
- Fishing or shellfish harvesting activities are occurring in the immediate area of discharge.
- A spill occurs on the JUB or to the water being discharged

8. Plant and Equipment

All drilling operations will be conducted using the Comacchio MC-S1200.1 Drill and Pilcon winch on the CR2 drill derrick.

The following plant and equipment will be used during the drilling operations:

- Skate 3 jack-up
- Comacchio drill rig
- CR2 drill derrick
- Pylon freefall winch
- 7” -12” conductor casing
- Geobor drill string
- SPT hammer
- HWY rods
- Deck Clamp
- Cat Pump
- Mud Tank
- Mud management unit (“mudslayer”)
- HPU power pack
- Generator
- Deck lights
- Settlement Tank

9. Materials (handling/storage/disposal)

Drilling consumables will be delivered to the JUB on an “as required” basis and managed by the driller and/or supervisor. A stock control system will be operated using the onboard computer.

Spares and consumable will also be stored onshore at the designated project base. These will be transferred using the support tug/vessel.

All samples that are retrieved to the deck will be handed to the Geotechnical Engineer on board the jack-up. The Geotechnical Engineer will ensure all samples have been logged and processed correctly following the procedures outlined in MS010 – Sample Handling & Transport. All samples will be stored in a dry, safe area on board the jack-up until transferred to the sample storage area onshore. A chain of custody form will be used to transfer custody from the jack up barge to the appropriate laboratory for testing.

Drill cuttings/ fluid processed by the onboard Mud management system and settlement tanks. Please refer to appendix 2 for Mud Management schematic that details the system

10. Preparation of Works/Location of Services

Before the start of the drilling operations at a particular investigation location the following activities will be carried out:

- Skate 3 will be positioned on the borehole location using the tug and/or thruster (refer to method statement MS002).
- Upon arrival on the investigation location, the legs will be lowered to the sea bed (refer to Operations Manual).
- Standard preloading/jacking procedures will be carried out (refer to Operations Manual).
- The Current Meter will be deployed and the Bargemaster will confirm that the tidal current is at a safe working limit for the commencement of drilling operations

When the jack-up is stable, level and at a safe height, the Bargemaster will inform the drill crew of the borehole drilling, testing and sampling requirements. Only then drill will the drill crew proceed with the drilling operations.

11. Emergency Procedures

The vessel emergency procedures will be adhered to at all times. Details of emergency response are incorporated in the Project Specific Emergency Response Plan.

12. Personal Protective Equipment (PPE) & Safety Equipment

The following personal protective equipment shall be worn during drilling operations:

Item	Description
Overalls	Mandatory (for all site activities)
Thermal overalls	Mandatory when ambient temperature is 3ºC (37ºF)
Safety helmet	Mandatory (for all site activities)
Safety glasses (Task specific)	Mandatory (for all site activities) As per risk assessment
Safety boots/shoes (Steel toe cap)	Mandatory (for all site activities) As per risk assessment
Gloves (task specific)	Mandatory (for all site activities)
Safety glasses or goggles	As per risk assessment
Ear defenders/ear plugs	Mandatory if noise above FAL 80dB(A)

Additional personal protective equipment shall be worn in case of special activities.

13. Methodology & Sequence of Work

Prior to commencement of drilling operations at each proposed borehole location, a Borehole Requirements form will be generated and a sampling program will be agreed upon with AKLNG's technical representative. If

unexpected conditions are encountered, the program will be modified at the on-board engineer's discretion to ensure the most representative samples are obtained.

Sampling Methodology

- All testing sampling will be completed in general accordance with ASTM standards.
- Both the Driller and the Engineer/Geologist on shift will keep accurate logs of all activities performed and all recovered materials.
- We anticipate that the subsurface profile will consists of seafloor sediments so the borehole will be advanced using a cable percussive drilling system to a minimum depth of 2m to ensure the stability of the riser casing. The bore hole will then be progressed using either Cable Percussive or wash boring drill technique with disturbed and un-disturbed samples taken at the required depths.
- Sediment samples will be taken with either a Piston or Push Shelby tube sampler or a split spoon SPT sampler. Should unconsolidated sands, gravels or weathered formations be encountered that cause borehole instability, first the conductor casing will be required to be advanced to a depth suitable to isolate this formation and commence Geobor coring operations. This riser casing will be progressed using either Cable Percussive or wash boring drill techniques. Sampling and testing will be attempted in front of advancing the conductor casing. Boreholes will be advanced with Geobor coring or using drag-bit, tri-cone, or other non coring device (NCD) to reach the sampling and/or testing depth.
- Sampling will be performed continuously at (2.5-ft intervals) within the upper 40 feet, at 5 feet intervals to a depth of 100 feet, and at 10 feet intervals below 100 feet of depth and at changes in soil stratification, to termination depth of each boring.

Undisturbed and Disturbed Sampling Methods

- The borehole will be sampled by SPT or piston/push Shelby tube sampler following the project specification and ASTM standards.
- In cohesive soils, undisturbed samples of nominal 76mm diameter will be taken using Piston or Push Shelby tubes.
- Special attention will be given to the collection of intact samples if soft to medium-stiff fine-grained overburden soils are encountered within the upper 40 ft of each borehole. Such materials will preferably be sampled with Piston Shelby tube sampling methods, or secondarily Push sampling. If this is not feasible (such as due to sand/gravel content or lack of cohesiveness), the SPT sampler will be utilized.
- In granular (non-cohesive) soils, samples will be collected from the SPT split barrel and cutting shoe.
- Down hole percussion samples using 6" bailer if granular material cannot be sampled by any other means. (only carried out in the 7" casing section of the borehole)
- In stiff to hard clays, if soil strength exceeds limitations of Shelby tube sampling methods sampling will be undertaken by SPT sampling and/or Geobor S rotary coring.
- In gravels, cobbles, boulders and rock sampling coring can also be utilized to attempt sampling of material that result in SPT refusal (such as large gravel, cemented sands, or cobbles). If two successive sampling intervals result in refusal, SPT sampling will be suspended and substituted by Geobor-S coring. SPT or other suitable sampling methods will be resumed if a subsequent strata change occurs. SPT refusal is defined as 50 blows, or 10 successive blows with no observable advancement of the sampler, within the first 6-inch (seating) interval of the test.

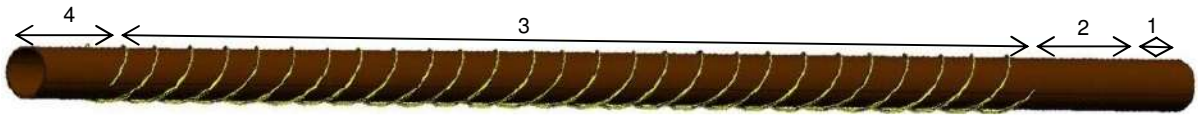
- Bedrock is not anticipated to be encountered at the site. If encountered, continuous Geobor –S coring will be performed until the end of the borehole. The same requirement of two successive SPT refusals will be utilized as criteria to suspend sampling.

Sampling/ In-situ testing intervals Interval

0.75m (2.5ft) – From 0 to 12m (40ft)
1.5m (5ft) – From 12m to 30m (40ft) to (100ft)
3.0m (10ft) – From 30m to base of borehole

Setting Casing/ Progression of Borehole

- The drill crew will run the following casing in order to commence the hole in the most safe and practical manner and dependant on tidal current.
  12" Riser Casing will be lowered through the moon-pool to the sea bed in order to act as a Conductor when required by tidal currents. Maximum to allow safe deployment is 1 Nt of current.
- All joints in the 12" Casing will be welded to prevent "backing off". Each section of casing will have a 25mm fillet weld on opposite sides of the casing. The weld will be formed at the joint between two lengths of casing. NO TAGS ARE TO BE WELDED TO THE CASING
- The 12" casing will be "straked .



1. 302mm Ø Cutting shoe
2. 3.0m, 302mmØ Lead length that will penetrate the mud line to stabilise the conductor case.
3. 12.0m, 302mm Ø Lead length "straked"
4. 302mm Ø Conductor casing. Length dependant on DTM

- If 12" riser casing is used, then 7" casing will be run inside the conductor casing followed by the Geobor casing.

Set Riser Casing

Running in and setting Conductor Casing 7-12"

- The drill crew will run either 12" or 7" casing in order to commence the hole in the most safe and practical manner.

  7" Casing
- The longest single length of conductor casing is 1.5m long.
- A lifting sub screwed into the casing will be used for lifting purposes.
- Using the heavy lifting mast mounted hydraulic winch, the driller will lift the section of casing into a vertical position and lower into clamps on drill.

12" Conductor casing

- The longest single length of conductor casing, the "Lead Length" is 12m long. This length will be pre-assembled inclusive of a 3.0m length, unstraked and the cutting shoe that will be drilled into the seabed to provide a fixed point and supported from the CR2 Derek
- The Lead length will be lowered until either;
    1. ***The lead length touches down on the sea bed***. If there is sufficient "stick up" to commence drilling operations the Bargemaster will jack up to suit the casing and clamp the lead length in the deck clamp.
    2. ***The Lead Length doesn't touch down on the sea bed***. The lead length is clamped in the deck clamp ready to add additional lengths.
- A lifting sub screwed into the casing will be used for lifting purposes.
- Using the heavy lifting mast mounted hydraulic winch, the driller will lift the section of casing into a vertical position and lower into clamps on drill.
- When section of casing is secure in clamp, driller will instruct crew to remove lift sub.
- Lift sub will be lowered and crew will screw into next length of casing to be lifted.
- Next section of casing will be lifted vertically and lowered into section held in clamps.
- Casing will be screwed in by hand using chain wrench if necessary.
- When joint suitably made, they will be welded together,(only when using 12" casing) the driller will release clamp and lower sections of casing using winch until joint is at right position for clamping.
- When lowering the casing, be very wary of sudden movement caused by sea/waves. Take note of any entrapment points and avoid these areas. If the movement is too violent – STOP OPERATIONS!!
- Driller will clamp casing and crew will remove lift sub from casing.
- The process is repeated until all sections of casing have been connected together and the casing reaches the seabed.
- The casing string is to be set a minimum of 0.5m into the ground and during slack water to ensure it is vertical.
- The driller can check the depth the casing is initially set at by measuring the deck to sea bed level and then work out the amount of casing that is below this level.
- The 12" riser casing will be progressed using cable percussion drilling techniques until the casing is at a minimum of 2m below mud line to ensure the stability of the casing in the anticipated water depths and tidal currents.

Note if a 12" riser casing is used then there will also be a requirement to install 7" drill casing for drilling purposes using the procedures out lined above before rotary coring is commenced.

When removing the casing, be very wary of sudden movement as sections are lifted – stand clear and observe movement prior to approaching the casing to undo sections.

On removal, the breaker on the drill may be used to break casing joints prior to unscrewing by hand using a chain wrench.

Piston sampling (Soft sediments)

- The piston assembly is fitted with a Shelby tube and lowered to the base of the borehole.
- The piston head sits flush with the shoe of the Shelby tube and the base of the borehole.
- The tube is pushed into the ground while the piston head remains stationary. The piston head keeps the tube stabilized and creates suction to aid in recovery.
- The sample assembly is recovered to deck and the Shelby tube removed for sample processing.

Push Sampling (Cohesive materials)

- The drill string (Geobor-s) will be pulled back by 1m.
- The push sample tool will have a 76mm Shelby tube attached to it (thin or thick walled depending on ground conditions).
- The tool will be lowered into the Geobor drill string and allowed to free fall into position, latching in the barrel.
- The drill string will then be pushed 1m.
- The tool and Shelby tube (now containing the sample) shall be retrieved using the overshot device.
- The Shelby tube can then be disconnected from the tool and handed to the geotechnical engineer.
- The borehole can then be cleaned out using the Geobor-S coring device or Non Coring Device (NCD) which will be lowered into the drill string and advanced using rotary techniques.

Geobor S Rotary Coring

- Once hard/dense strata has been reached, a Geobor S wireline casing with appropriate drill bit (Polycrystalline Diamond Bits (PCD)), see Appendix 1, will be lowered down inside the 7" borehole with the aid of the hydraulic winch and clamped.
- Further sections will be added with the aid of the hydraulic winch until enough sections are in place to touch down on to the base of the hole. The inner core barrel can then be inserted into the Geobor casing string.
- Drilling operations can now be progressed by 'attaching' the rotary power swivel to the top of the drill string, starting the drill water pump and rotating the drill string. The driller will carefully coordinate the bit weight, rotation speed and pump flows /pressures to optimize sample quality and advancement of the borehole.
- The drilling will be carried out using sea water as the flushing medium.
- Inert drilling additive (Guar Gum) may be introduced to act as a viscosifier or to stabilise the borehole as is necessary. The additive will be mixed aboard the jack-up in the fully agitated mud mixing system.
- Rotation speeds will vary between 50-200 rpm, depending on the geology.
- The Geobor S system drills a 146mm O/D hole and recovers a 102mm core. Clear core liners will be used.

Retrieval of core

- Halting rotation and flush.
- Clamping the drill string.
- Disconnecting and raising the power swivel.
- Lowering the overshot upon wire line cable until it has latched upon the inner barrel.
- Retrieving the inner barrel to the drill deck.
- Removing the full core liner.

- The sample tube is handed to the Geotechnical Engineer for cutting the liner, removing any water, removing any cuttings, labelling, photographing, describing and sealing in accordance with the contract requirements.
- The drill string is now clear to allow testing or sampling as per procedures.

SPT procedure

The SPT equipment and testing will be carried out in accordance with ASTM D1586.

- The borehole will be cleaned out to the required test horizon.
- The SPT split-spoon sampler assembly will be lowered to the bottom of the borehole on the NWY drive rods, the rods being tightly coupled together by screw joints.
- The lowering of test equipment is carried out by the Driller operating a hydraulic headline winch.
- On reaching the bottom of the borehole, the drive assembly (trip hammer), shall be connected to the top drive rod with a screw joint. Care must be taken when connecting the trip hammer weight (63.5kg) to the top rods as the trip assembly has to be activated.
- Mark the drill rods in three successive 0.15 m increments so that the advance of the sampler can be easily observed for each increment.
- Drive the sampler with blows from the hammer and count the number of blows applied in each 0.15-m increment until one of the following occurs:
  - A total of 50 blows have been applied during any one of the three 0.15-m increments.
  - A total of 100 blows have been applied.
  - There is no observed advance of the sampler during the application of 10 successive blows of the hammer.
  - The sampler is advanced the complete 0.45 m without the limiting blow counts occurring as described in
- On completion of the test, the drive assembly shall be removed from the rods. The rods with the SPT split-spoon sampler assembly shall then be withdrawn from the borehole. The SPT split-spoon sampler assembly will then be disassembled, the sample will be documented and the results recorded. Material within the spoon shall be retained as a disturbed sample. All results to be recorded within the borehole log. The SPT split-spoon sampler assembly will then be cleaned and prepared for further tests.

In the event no sample is recovered from a sampling interval, an attempt will be made to resample the missed interval. Depending on anticipated soil type and the suitable sampling method, the resample will be performed at the same depth or immediately below the missed interval at the on-board engineer's discretion. Typically, disturbed samples of granular material will be resampled at the same depth to recover representative material with multiple attempts noted on boring log. Undisturbed samples of fine-grained material will be taken below the missed interval. In addition, SPT samples may be advanced an additional 6 inches beyond the standard 18-inch penetration to aid in recovery. Minimum recovery will be 6 inches for SPT samples and 12 inches for Shelby tube samples. All attempts will be made to achieve maximum recovery when coring, and adjustments will be made accordingly during drilling operations.

Geophysical P&S Logging

On completion of the drilling operations at selected borehole locations P&S geophysical logging will be completed. This is discussed in a separate document.

Drill Cutting Collection and Disposal

The drilling mud used is collected, re-conditioned and re-used through a "mudslayer" mud management unit and settlement tank installed on the JUB. Please see **APPENDIX 2**

- Drilling fluid consisting primarily of sea water and Guar Gum will be used in the rotary- and core drilling process to cool the bit, remove the cuttings from the drill hole, and to stabilize the boring walls during the drill process. The water will be pumped from the sea into the holding tank aboard the deck of the jack-up by a submersible pump suspended from the drilling deck into the ocean.
- The returned drilling fluids will be processed by a "mudslayer" mud management system and in a baffled mud tank adjacent to the moon pool secured to the side of the jack up
- Drilling mud flows through a "Goose neck" junction in the top of the riser casing which leads to the moonpool insert mud collection unit. A 4" hose from the top of the drill pipe connects to the mud collection tank.
- The drilling Fluid/mud is pumped from the mud collection unit within the moonpool to the "mudslayer" mud management unit where all drill cuttings and solids are removed from the drilling fluid.
- The mud is then pumped into the settlement tank which contains 3 No., 55 gallon collection barrels, separated by baffles
- Any remaining silt is filtered and "settles" at the base of the barrels
- With the mud now cleaned of solids, it can be said to be re-conditioned and is pumped out of the tank and back to the mud holding tank on the deck and down through the drill string
- Once the barrels are full, or moving of the JUB is required, they will be collected by the JUB's LCV. The barrels are lifted out using their own lifting frame and the on-board HIAB and placed onto the LCV deck. The vessel will return to Nikiski harbour and the barrels placed ashore. For information on how this waste is disposed, please refer to MS005 Spoil Removal.
- On completion of each borehole;
  - The drilling string is lifted up/ pulled out to just 1.0m Below the mud line.
  - The remaining casing will be flushed for 30minutes through the mud management system.
  - A Static Sheen test will be carried out.
  - Once a successful Static Sheen test is completed the mud management system will be isolated and The remaining drill mud within the settlement tank is pumped out to a holding tank on board the jack up so that it does not spill when jacking down and moving to the next location.
  - The remaining casing will be pulled back to the deck and drilling fluid inside the casing is released into the sea.
- If the mud in the settlement tank needs to be replaced at any time, the remaining drilling fluid is pumped out in to either 55 gallon drums or 1000 litre (IBC) containers for transportation to the Rig Tenders Quay in Nikiski for disposal.

Sample Handling

The following outlines our general procedure for sample storage and shipping. Sample handling procedures are further described in MS010 – Sanple Handling & Transport:

- Soil samples will be immediately logged, packaged, and labelled with project number, date, depth, boring number, etc. upon collection. Transportation will be provided by the jack-up's support vessel.
- After filling and labelling the core boxes, the core boxes will be photographed in colour with the cover label of the core box and colour scale shown in the photograph to document the intervals of the core box contents.

Transport from the drill site to the mainland will occur on completion of each boring if weather conditions allow or at regular intervals.

Completion

Upon reaching target depth, all necessary tests have been undertaken and a successful Static Sheen test has been completed permission will be sought from the Geotechnical Engineer to terminate the borehole and to pull all the casings back on to deck.

- All testing equipment/drill string will be recovered to the deck using the drill mast.
- Each casing will be pulled to the nearest casing joint using the hydraulic winch and then be clamped.
- The casing length will then be separated from the drill string.
- The casing length will then be lowered to the drill deck with the aid of the hydraulic winch
- This will be repeated until all casings are retrieved to the drill deck.

Appendix 1 Drill and Drill Mast Data Sheet

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FUGRO SEACORE
MC-S 1200 Drill Rig

The MC-S 1200 is an hydraulic skid-mounted drilling rig capable of operating all rotary and/or rotary percussive drilling systems. During the design stage Fugro Seacore worked closely with Comacchio to ensure the development of a fully integrated drilling unit capable of withstanding the complex and rigorous nature of marine works.

For example the MC-S 1200 has a unique triple holding clamp and breakout arrangement for handling the various casings required, complemented by a set of hydraulically adjusted drill string centralisers. The main mast is equipped with a crane boom and drill string manipulator arm enabling drill rods and casings to be manoeuvred to and from the working deck with minimal manual intervention. The main power supply is fully silenced with a closed loop lubrication system using bio-degradable oil.

The control console is deployed on a multi-positional arm giving the driller uninterrupted views of all drilling activities and all rotating parts are guarded within a fully interlocked cage. The MC-S 1200 is suitable for all aspects of rotary soil investigations, core drilling and specialist civil engineering works such as micropiles, anchors and ground consolidation.

Power Pack:
- Diesel Engine: New generation 132 kW DEUTZ diesel engine series 2012
- Engine power: 132kW (180HP) / 2300 rpm
- Main Pump: 2 x 190 lt/min / 2 x 50,2 gal/min
- Oil tank: 400lt / 105,6 gal Fuel tank: 350lt / 92,5 gal

Mast:
- Feed stroke: 7.200m Feed force: 7.000 daN/ 15,736 lbs
- Total length: 9.550m
- Retract force: 7,000 daN/ 15,736 lbs

Rotary Head:
- Gears: 6
- Max torque: 1,230 daNm/ 9,072 lb-ft
- Max speed: 340 (550) rpm
- Head passage: 93mm/3,6 in Swivel passage: 2 in

Clamps:
- Min Handling: 45mm / 1,8 in Max Handling: 360mm/14,1in
- Clamping force: 280 kN/62,946 lbs Breaking Torque: 3.50 daNm/25,814 lb ft

Winch:
- Max line pull: 2.000daN / 4,496 lbs Drum capacity: 50m / 164 ft
- Rope speed: 30m/min / 98 ft/min Rope diameter: 10mm / 0,39 in

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FUGRO SEACORE CR2 Drilling Mast

Fugro Seacore's specialised inshore marine drilling mast CR2 is a multi-purpose, twin 'A' frame mast measuring 12m x 2.1m. It is designed to reduce the unproductive, labour intensive operations normally associated with overwater drilling.

Cable tool boring is carried out using a 2.5 tonne freefall winch. The use of the hydraulic rod/casing clamp replaces time consuming, conventionally bolted clamps. Deck mounted mechanical bailing tippers allow removal of spoil from drilling tools in a productive, but safe, operative manner.

If required insitu testing equipment, rods, conductor casings etc., can be vertically stacked within the mast in 9 metre lengths. These are handled by a 5T hydraulic winch.

The CR2 incorporates a high powered Dando 500 hydraulic power swivel for rotary drilling and coring. For rotary open-hole drilling the boreholes are excavated without conductor or liner casings. Stability of the unlined holes is provided by drilling muds which are guar-based, non toxic and bio-degradable.

Conventional or wireline cores can be carried in a variety of sizes.

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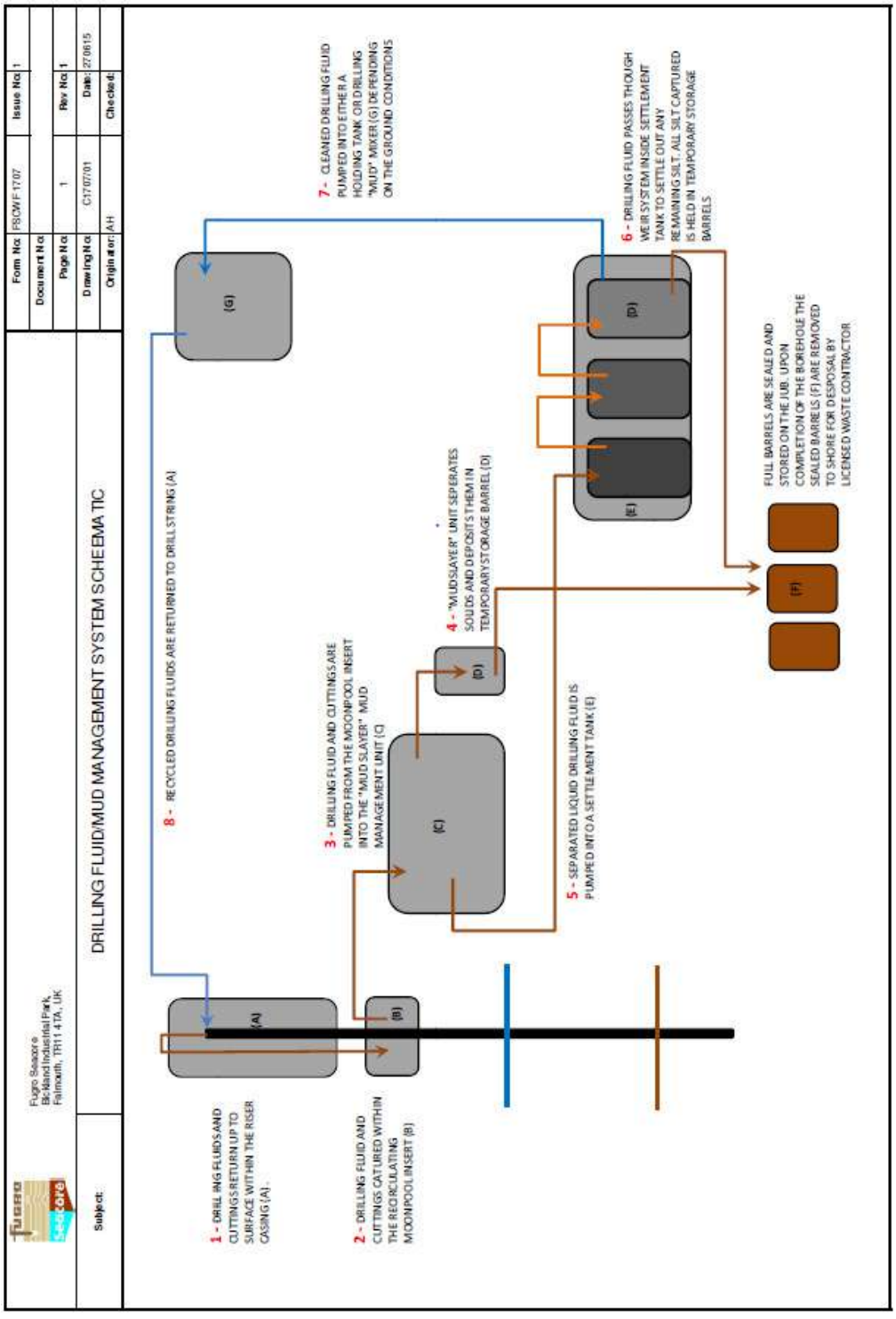
Appendix 2 Drilling Fluid Management system



Appendix 3 Geobor S Coring Data Sheet

GEOBOR-S

GEOBOR-S triple tube wireline drilling system which has been specially developed for high quality geotechnical investigations of soil and rock formations

In its 30 years of drilling experience, Fugro Seacore has examined and tested many methods of coring - aiming to minimise core disturbance and maximise core recovery.

GEOBOR-S System

Our experience leads us to recommend the use of GEOBOR-S triple tube wireline drilling system, which has been specially developed for core drilling and undisturbed sampling in a wide variety of soil and rock formations. The GEOBOR-S is a "triple tube" core barrel which cuts an "S" size core sample. It has a plastic core liner, which is seated within the inner barrel assembly, considerably reducing friction between the core and the inner tube and enhancing core recovery.

Sample Recovery

A nominal 102 mm diameter core sample is recovered from this system, generally in 1.5 m lengths. This larger diameter enhances drilling performance whilst obtaining t high quality core samples, for soil and rock testing.

We provide a wide range of coring bits including, for example, annular and face discharge, surface set and impregnated diamond bits, saw tooth and tungsten carbide etc.

The core barrel itself is designed for flushing with water, mud or air, and can easily be adapted for most soil and rock conditions by the use of an appropriate core bit or non coring devise.

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GEOBOR-S

Core Liner

The core liner is a rigid, transparent PVC tube with a wall thickness of approximately 1 mm, that fits snugly inside the GEOBOR-S core barrel inner tube, trimmed to 1.5 m lengths. This is provided for all coring works.

The core samples are recovered within the core line tube and removed from the inner barrel between each consecutive run. The sample can be retained within the core line tube sealed at both ends and placed into the core box. This minimises handling induced core disturbance, both on the drill deck, and during subsequent transport of the core sample to the onshore core store and testing laboratories.

From our experience the combination of the GEOBOR-S system used with core liners:

- reduces coring and transport induced disturbance
- maintains sample quality
- significantly enhances recovery especially in mixed formations

Furthermore, we monitor the effectiveness of the various bit types throughout drilling, selecting bits appropriate to varying ground conditions as each borehole progresses. This allows us to maximise core quality and recovery in an appropriate and cost effective manner. **Four methods** can be used:

1. In medium to hard formations most suitable for soil conditions, all types of core bits can be used depending on the formation
2. For coring in soft soil formations, only TC-set bits are used and the bit consist of two parts (pilot and reamer)
3. For coring in very soft or loose formations, only TC-set bits are used. The bit is in two parts as in method two but one core lifter is extended to run 25 mm in front of the bit.
4. For coring in very soft, loose formations with varying layers. The spring-loaded inner tube assembly is extended to run in front of the bit, but is retractable for optimized adaptation to the consistency and density of the ground.

Other Advantages

The advantages of wireline coring over conventional coring (using drill rods and core barrels) are:

- separate temporary lining casing for borehole stabilization may not be required
- the drill string is more rigid
- the core barrel may be recovered without the need to remove the outer drill rod, thus the disturbance to the borehole wall is minimized
- the small annulus between the drill pipe and borehole wall requires significantly lower volumes of flush fluid compared to conventional drilling to achieve adequate uphole velocity for removal of cuttings from the hole. As a consequence, erosion of the formation (particulary at the bit face) is reduced.

Technical Specifications

	Metric	Imperial
Hole diameter, method 1-4	146.0 mm	5.75 in
Hole diameter, method 2-3	150.0 mm	5.90 in
Drill bit outer diameter	145.6 / 149.6 mm	5.73 / 5.90 in
Drill rod outer diameter	139.7 mm	5.58 in
Bit kerf, method 1	21.8 mm	0.86 in
Bit kerf, method 2-3	23.8 mm	0.94 in
Core diameter	102.0 mm	4.05 in
Hole area (od 146/150)	167.3 / 176.7 cm²	26.0 / 27.4 in²
Core area	81.7 cm²	12.7 in²
Cutting area in % of hole area	51.7 %	51.7 %

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Appendix 4 Polycrystalline Diamond Bits

Polycrystalline Diamond Bits

Polycrystalline diamond bits are recommended for use when drilling relatively soft, abrasive, unconsolidated sedimentary formations that are not effectively drilled by surface-set diamond bits. Fast, cost effective and accurate. PCD Bits offer high penetration rate, longer bit life and lower cost per metre in very soft to medium-hard sedimentary formations.

JKS Boyles erosion resistant matrix and bit gauge protection with natural diamond ensure a high performance and accurate hole size, minimising the cost per metre.

POLYCRYSTALLINE DIAMOND BITS ARE DIVIDED INTO TWO CATEGORIES

'PCD Type' (Polycrystalline Diamond) that uses larger cylindrical shaped cutters that are composed of a layer of micron sized synthetic diamond particles mounted on a tungsten-carbide substrate.

PCD GEOMETRY

Round Semiround Truncated

FAST PENETRATION: PCD Bits drill with a shearing action rather than crushing or grinding the rock. Fully exposed cutters achieve higher penetration rates than Surface Set or TSP Bits. Cutters are available in different sizes and geometry. Materials are synthetic diamond particles on a tungsten carbide substrate.

'TSP Type' (Thermally Stable Polycrystalline) bits that use smaller triangular and cubic shaped cutters that are composed entirely of micron-sized synthetic diamond particles:

TSP GEOMETRY

Cubes Triangles

GOOD PENETRATION: TSP Bits cut through rock with an efficient shearing/crushing action. The sharp TSP diamond cutting edges shear rock cleanly and efficiently, resulting in an aggresive cutting action and achieving higher penetration rates than surface set natural diamonds. TSP cutters are available in different sizes and geometry. Material is a thermally stable polycrystalline diamond compact, it has properties superior to ordinary monocrystalline and self-sharpens continuously by microfracturing during drilling.

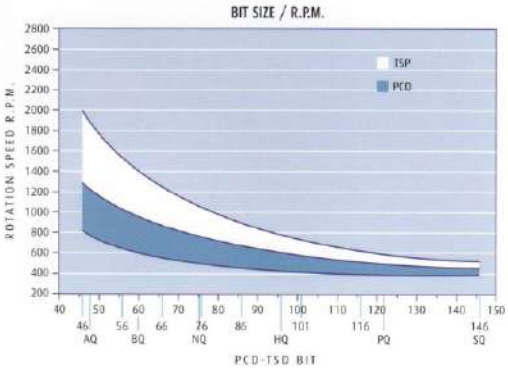
PCD-TSD BITS are available in any standard size with a kerf wider than 8mm.

WEIGHT ON BIT

Recommend:

- 2750 N (600lb.) per PCD cutter.
- 600 N (131lb.) per TSP cutter.

Flushing: Water/Air Volume depends on bit size formation and drilling parameters and conditions. Never shut-off water while drilling.



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Appendix 5 Drilling Fluid Material Safety Data Sheet & COSHH Sheet

Arthur Branwell & CO LTD

SAFETY DATA SHEET
LUXARA 3500 GUAR GUM

Page: 1
Compilation date: 18/10/2011
Revision No: 1

Section 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name: LUXARA 3500 GUAR GUM

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.3. Details of the supplier of the safety data sheet

Company name: Arthur Branwell & Co Ltd
Bronte House
58-62 High Street
Epping
Essex
CM16 4AE
Tel: + 44 (0) 1992 577 333
Fax: + 44 (0) 1992 561 138
Email: suestenhouse@branwell.com

1.4. Emergency telephone number

Section 2: Hazards identification

2.1. Classification of the substance or mixture

Classification under CLP: This product has no classification under CLP.

2.2. Label elements

Label elements: This product has no label elements.

2.3. Other hazards

PBT: This substance is not identified as a PBT substance.

Section 3: Composition/information on ingredients

3.1. Substances

Chemical identity: GUAR GUM

Section 4: First aid measures

4.1. Description of first aid measures

Skin contact: Wash immediately with plenty of soap and water.
Eye contact: Wash out thoroughly with water until irritation ceases. Seek medical advice if irritation persists.
Ingestion: In the unlikely event of ingestion of the powdered material drink upto a litre of water.

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COSHH Assessment

Product & process			
Product name:	Guar Gum	Assessment no.:	M35A
State:	Powder	Colour:	Off White
Contents/ingredients:			
Supplier:	Arthur Branwell & Co Ltd	Contact No.:	01922 577333
Activity:	Drilling		
Equipment used:	Drill & associated equipment		
Location:			

Exposure			
Frequency of use:	Infrequent	Duration of use:	Medium (hrs–)
Quantity used:	Medium	Dust / Volatility:	High
Ventilation:	General– ventilation – do not use in a confined space unless using RPE as described in control measures		
Work practices / Hygiene:	No eating, drinking or smoking. All PPE and RPE is to be inspected prior to donning. All exposed body parts to be thoroughly washed on completion of task.		

First aid

Absorption (skin & eyes):	Wash contaminated skin with soap & water. If substance enters eyes wash immediately with clean water for at least 10 mins. If unsure seek medical attention
Ingestion:	Rinse mouth & throat and give water to drink. DO NOT INDUCE VOMITING. Seek immediate medical attention
Injection:	Injection: Not Applicable
Inhalation:	Inhalation: Remove to fresh air and seek immediate medical attention

Fire

Use a Carbon Dioxide Fire extinguisher

Spillage

Don appropriate PPE as per control measures and sweep up spilt powder. Surface will become slippery if powder contacts water. Place in sealable containers for disposal or reuse. When disposing follow disposal instructions

Disposal

Dispose of as controlled waste using a licensed waste contractor.

Transport (UN No.)

Not Classified for Transport

Storage

Store in a cool well ventilated area. Keep continer tightly closed. Avoid contact with water.

Health

Control measures

Rubber EN388 | Boots EN345-1 S3 | Chemical resistant EN166 4

WEL: No WEL value:
MSDS reference: M35 Guar Gum.pdf
Relevant references / guidance:
Hazard group: A

A	B	C	D	E	S
Least hazardous substances		More hazardous substances		Special cases	Additional Hazards

Completed by: HSEQ Advisor Stephen Dadd
Date: 2008-07-07
Reviewed by: HSEQ Manager David Pettigrew
Date: 2008-07-07

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ALASKA LNG Terminal GI **Drilling Operations**		Issue: 1 Rev 5
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Mudslayer 140

Eliminates the need for shoveling & lifting heavy barrels - reducing risk of injuries

This unit is specifically designed to eliminate shoveling and trip hazards behind the rig. 150 shovel loads per drum. 4 drums per average geo-technical hole. Roughly 2,000 lbs of solids. This eliminates the need for solids to be handled by a worker.

All aluminum construction for ease of movement and setup

Dimensions: 50" long x 26" wide x 52" tall with 4 height adjustable legs

Weight: 375 lbs

Specs:
130 gallon mud tub with tank cleaning system, floor drains and pump connection
Double screen / double shaft shaker deck with 80 g.p.m. processing capacity and 55 gallon drum filler funnel
One 4" desanding cone
One submersible pump
One 8" lift pump for mud return for bore hole
One mud hopper for mud mixing ease

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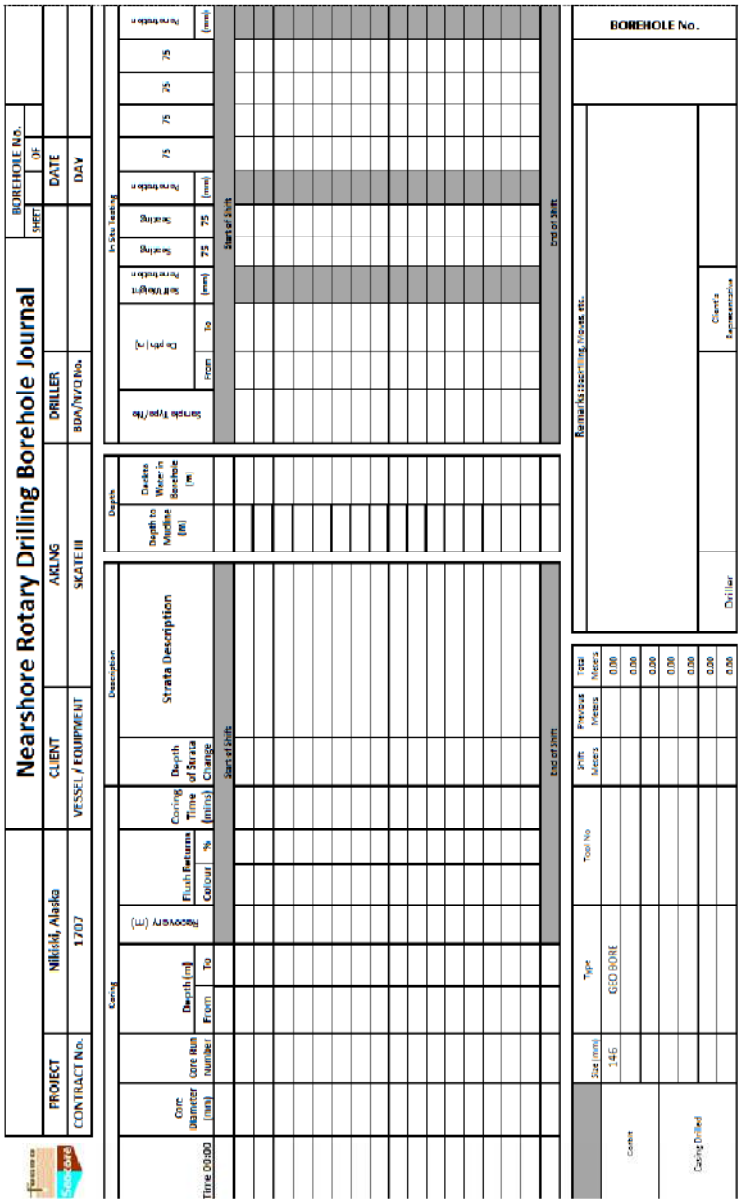
ALASKA LNG Terminal GI **Drilling Operations**		Issue: 1 Rev 5 Date: 26/06/15

Appendix 6 – Sample Drill Log



Appendix 7 Sample Static Sheen log sheet

Static Sheen Test Form (EPA Method 1617)

1	Date of Test:		
2	Who Performed the Test:		
3	Borehole ID #: Borehole Coordinates:		
4	Test Sample	4a -Source (mud pit)	
5	Test Container	5a – Size (must have opening of 1,000 cm^2±50 cm^2 (155.5 ±7.75 in^2), and depth of 13-30 cm (5-11.8 inches).	
		5b – New liner used? (required)	Yes No ☐ ☐
		5c – Water source	
		5d – Water temp (must be close to Cook Inlet temp)	
		5e – Distance container top to water surface (must be < 1.27 cm, 0.5 inch)	
		5c – Liner properly disposed?	Yes No ☐ ☐
6	Lighting *(Describe)*	6a – Type (fluorescent recommended).	
		6b – Position (above test container).	
		6c – Directed over entire container surface (required).	Yes No ☐ ☐
7	**Observation**	7a – Start Time (≤ 1 hr of introduction)	
		7b – Sheen Observed? – Describe sheen color and % surface coverage	Yes No Percent:_____ ☐ ☐ Color:_____
		7c – End Time (if 10-50% observe 1 hr)	
		7d – Test Passed or Failed If >50% failed & must retest If < 50% after 1 hr then passed	Yes No ☐ ☐
8	**Retest**	8a – Start Time (≤ 1 hr of introduction)	
		8b – Sheen Observed? – if so describe sheen color and % surface coverage	Yes No Percentage:_____ ☐ ☐
		8c – End Time (if 10-50% observe 1 hr)	
		8d – Test Passed or Failed If >50% failed & must retest If < 50% after 1 hr then passed	Yes No ☐ ☐
9	Discharges performed following sheen tests?		Yes No ☐ ☐
Notes:			

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ALASKA LNG (AKLNG) **SPOIL AND CARGO TRANSFER**			**ISSUE:** 1 REV 3
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A METHOD STATEMENT IS ONLY A SAFE METHOD WORKING IF IT IS DISCUSSED AND AGREED BEFORE WORK BEGINS AND THEN FOLLOWED BY THOSE CARRYING OUT THE WORK.

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1. INTRODUCTION

This method statement describes the operations required for the safe transfer of spoil and other cargo to and from the JUB. Other cargo includes:

- Delivering consumables to the JUB (Core boxes, wax, drilling supplies etc.)
- Waste from the JUB and Tug;
- Supplies to the Tug using the LCV;
- Soil Samples including core boxes;
- Fuel and water;
- Chemical toilet.

Once onshore the disposal of the spoil (drill cuttings), and any other waste will be controlled and managed by Fugro utilising a licensed waste contractor(s).

2. MAIN ACTIVITY / AREA OF WORK

Transfers of materials and waste to and from the JUB and Tug will be conducted using the landing craft. Due to the large tidal ranges the LCV offers flexibility to access the ASRC quay at all tides. However high tide slack water is preferential for transferring all cargo.

Lifting operations to and from the JUB to the landing craft will be controlled by the Bargemaster and vessel skipper.

Onshore the operations will be controlled by the ASRC personnel when using plant to transport the cargo between the LCV and the final destination (dumpster, lab, warehouse etc.). This will also be overseen by the Fugro Seacore Project Manager.

3. MANPOWER AND SUPERVISION

Nominated Person	Responsibility
Project Manager	Advise the crew on the project Specification(s) to comply with this method statement and supply the appropriate information and instructions to enable this to be carried out safely and the required quality.
Drill supervisor	All drilling activities including health and safety, inspection and maintenance of drilling plant. Ensure all crew members are suitably briefed on this method statement and associated risk assessments.
Barge Master/Marine Supervisor	Position the jack up and elevate to a safe working height. Ensure all safety equipment onboard is checked and inspected. Ensuring waste transfer notes are completed and all waste removed from the vessel is recorded/documented.
Tug Skipper	Remain in daily communication with the LCV skipper ref cargo transportation and the requirements to take on s0upplies and or remove waste. Ensuring waste transfer notes & legal documentation is completed and all waste removed from the vessel is recorded/documented.
Landing craft Skipper	Responsible for the safe operation of the My Marie including the safety of the people onboard (PoB). Liaise and communicate with the JUB crew for the safe removal of the cuttings & cargo on a daily basis. Ensure the shore side facilities for the safe offloading are suitable for the operations by checking tide times, currents and weather forecasts. Ensure QA and HSE documentation is completed by the person/company in receipt of the cuttings.
Zoom-Boom (Telescopic Forklift) operator	Trained and competent in the operation of the designated plant. Responsible for the security for the loads when onshore between the Beach and ASRC facilities or waste disposal location. Communicating with the LCV skipper and the Project Manager.

4. ASSOCIATED DOCUMENTS (DRAWINGS, MANUALS, METHOD STATEMENTS, PLANS, PERMITS)

Document(s)	Serial Number(s).
Work Execution Plan	USAL-FG-GPZZZ-00-000002-000 (04.10140334-1
Project Management Plan	C1707 – Current Revision
Project waste management Plan	C1707 – Current Revision
C1707 MS 006 Lifting operations	C1707 – Current Revision

4.1 Risk Assessments

Risk assessments relevant to the works:

RAS no.	Description
RAS 001	Overwater Working
RAS 014	Craneage
RAS 015	Environmental Protection
RAS 024	Interaction with Dock users, Mariners and General Public
RAS 047	Transportation of Materials by Barge or Boat
RAS 048-051	Manual Handling RAs (Various)

5. SECURITY - BARRIERS/FENCES/WARNING SIGNS

Before and during offloading ensure the work area is free from simultaneous operations (SIMOPS).

An exclusion zone of 100m will be maintained around Skate 3 as detailed in the Notice to Mariners whist all lifting operations to/from Skate 3.

The crane Bargemaster will ensure that all operations on the deck are suspended during all lifting operations to ensure that the area is clear of personnel.

6. CONSTRAINTS/RESTRICTIONS/SPECIAL CONDITIONS

Environmental conditions will be the main restriction for the operations.

Item No	Description	Sea state (-Hmax (m and ft)	Wind speed Beaufort scale Force	Wind speed (m/s and mph)	Current (Knots)
1	Crew Evacuations	1.5m (5ft)	Wind Force 6	12m/s (27mph)	6
2	Cargo/Spoil/Sample transfer to/from jack Up	0.6m (2ft)	Wind Force 4	8m/s (18mph)	2 depending on orientation of vessel
3	Use of deck crane	N/A	N/A	8m/s (18mph)	N/A
3	Fog	Visibility of less than 500m approximately			

Note the above are guidelines only and a combination of factors may make the transfer unsafe. The final decision will remain with the vessel skipper/Bargemaster.

7. PLANT AND EQUIPMENT

- Landing Craft Vessel (LCV)
- Deck Crane
- Suitable and tested lifting equipment
- Zoom boom (Telescopic Forklift) – ASRC supplied
- 208 ltr drums
- 1 tonne (metric) Supersacks (Dumpy bags) – for removal of waste under 200kg only

Figure 1. Landing Craft My Marie

8. MATERIALS (HANDLING/STORAGE/DISPOSAL)

The barge does not have sufficient capacity to store all soil cuttings, arisings and spent drill fluid on-board for the duration of the drilling program. Accordingly, 208 ltr drums and bulk sacks containing excess drill cuttings, arisings and fluid can be transported from the barge to the Plant Site using the landing craft.

Rotary Drilling operations - It is expected that up to 4 barrels per shift could be used when drilling in competent ground. This will depend on ground conditions, productivity and met ocean conditions.

Shell and Auger Drilling operations – When using a 302mm (12”) Conductor Casing it is expected that 1 Bulk sack will be sufficient for 2 borehole locations. Bulk bags to be stored on pallets inside a bund on the deck. To control any leakage from the bulk bags each bag will be double bagged. The bags will be placed on a pallet inside a bunded area and allowed to drain prior to removal. All the run off will be placed into the contaminated waste storage tank and removed and disposed of but a licensed contractor

9. PREPARATION OF WORKS/LOCATION OF SERVICES

Prior to the transfer of any material, cargo, spoil or waste, metocean conditions will be checked by all the vessel masters. Communication in the timing and conditions is paramount to the success of the operations. Communication with eh ASRC quay and the Fugro Land operations (Randy Lukasik) is al required to ensure the support vehicles are available as required (Zoom-Boom etc.).

Areas will be designated for the storage of the various materials within the Rig Tenders Quay space and office parking areas.

- Non Hazardous waste - transferred directly to dumpster in the car park and disposed of using licensed waste contractor.
- Oily Waste – Transferred from the LCV directly to Oily waste station inside the ASRC warehouse. Waste wil be double baged and clearly labelled. Designated containers will be allocated for the marine operations.
- Spoil containers – Once off loaded they will be stored in the ASRC yard prior to collection by the waste contractor.

10. EMERGENCY PROCEDURES

The vessel emergency procedures will be adhered to at all times. Please refer to the project specific Emergency Response Plan (ERP).

All personnel involved in the work activity will receive a safety briefing (tool box talk) on this document from the drilling supervisor. This tool box talk will be documented. Any areas of improvement/change will be, in the first instance recorded by hand on the document followed by a formal revision issued under MOC system.

11. PERSONAL PROTECTIVE EQUIPMENT (PPE) & SAFETY EQUIPMENT

The following personal protective equipment will be worn:

Type	Requirements & Specification
Overalls	Mandatory - all sites/activities
Safety helmet	Mandatory - all sites/activities
Safety boots/shoes	Mandatory - all sites/activities
Safety glasses or goggles	Mandatory - all sites/activities
Gloves	Mandatory for almost all sites/activities. Check RAS.
150N Lifejacket to BS EN 1095 (Solas Approved)	Mandatory - When working within 1m of any unprotected quay side or there is a risk of MOB/persons entering the water
PLBs	Used for all deck operations.
Transfer suit	Mandatory if water temp 12°c (53°F) degrees or below and working within 1m of any unprotected quay side or there is a risk of MOB/persons entering the water

12. METHODOLOGY & SEQUENCE OF WORK

The barge does not have sufficient capacity to store all materials, cargo, soil cuttings and waste on-board for the duration of the drilling program. Accordingly, drums containing excess drill cuttings and fluid can be transported from the barge to the storage location on a daily basis using the landing craft.

It is expected that up to 4 barrels per shift could be used when drilling in competent ground. This will of course depend on ground conditions, productivity and met ocean conditions. All barrels will be mechanically sealed prior to unloading.

Figure 2. Spoil transfer barrel (Drum) with sealed lid (208 ltrs)

Prior to all material transfers the Bargemaster will establish communications with the receiving vessel on VHF Channel 16 and establish a working channel. Weather will be checked along with currents tide levels and forecasted conditions.

Transfers of materials, waste and spoil will ideally be conducted during daylight hours and on the high tide slack water. To make the most of the slack water period at high tides, any cargo requiring transport to the JUB will be laded onto the LCV first prior to transfer to the JUB.

12.1 Waste Removal from Vessels

Each vessel will generate kitchen (general) waste considered to be non-hazardous and sometime recyclable. Whenever possible such waste will be segregated to make the recycling process onshore smoother.

- Kitchen waste will be bagged and placed into the supersack (1t dumpy bag) ready to the lifted onto the LCV.
- Kitchen waste from the TUG may be passed over in individual bags to be placed into the supersack.

- ALL hazardous waste (as specified under legislation either in the USA or Europe) will be double bagged and clearly labelled with its contents. Generally this will be oily waste from engine maintenance and hydraulic oils.
- All containment to be checked prior to transfer and additional bagging used if required.
- Once full the supersack could weight up to 200kg (capacity 1000kg). Bags will be checked for integrity prior to any lifting operations and damaged bags cut up and disposed of.
- Once the LCV has orientated itself underneath the crane along the starboard side of the JUB (as per appendix B), the supersack will be lifted from the JUB to the LCV.
- The sack will then be transferred to the beach at ASRC quay where it can be collected by the Zoom Boom for segregation and disposal of the waste.

Figure 3. Kitchen waste being removed from LCV using Zoom-Boom

- If the landing craft cannot access the beach, then it may come along side the quay and have the materials lifted off using a crane.
- The Barge Master will prepare a Waste Transfer Notice for all waste that leaves the JUB to be signed by the licensed contractor once the waste is collected to maintain the chain of custody.

12.2 Spoil Removal from Vessels

Full 208 litres barrels (approx 400kg) will be offloaded to the Landing craft using the JUB deck crane and polypropylene sling (1t to 5t capacity). A double choke loop will be used to sling the barrel ensuring it will not slip. As a precautionary measure, 1t supersack will also be connected to the hook and loop underneath the load.

Figure 4. Barrel being lifted by double choke slings

It is expected that up to 24 drums could be required in rotation at any one time, depending on the method of cuttings disposal and frequency that licensed contractor can collect the Waste. Empty barrels will be returned to the JUB for re-use.

Spoil resulting from Shell and Auger drilling operations (gravels) will be placed into 1000kg supersacks and lifted into the landing craft via the deck crane. Bulk bags (grey plastic sealed bags) will be “double bagged” to ensure that there is no chance of any discharge from the bulk bags

12.2.1 Receiving vessel

The sequence of operations on the receiving vessel will be;

- Skate 3 rigger (slinger) establishes contact with the rigger on the receiving vessel and agree that the receiving vessel is ready to accept the load.
- Load is lifted over the side of the JUB and the rigger on the receiving vessel confirms that he will be controlling the load.
- Receiving vessel rigger guilds the load down onto the deck and unhooks the load.
- The rigger will instruct the retrieval of the crane block and sea fasten the load

12.2.2 Pay load

The method for lifting cargo will depend on the items to be lifted and will include but not be limited to;

- Slung pallets will be slung using 2 slings sized at 50% over known weight of the load. All palletised loads will be netted.
- Sample Stillage will be slung with 2 slings sized at + 50% over known weight of the load. All stillage will be netted.

Once on the Landing Craft the loads will be sea fastened and transported Rig Tenders Key where they will be unloaded either by:

i. The Landing craft mooring up to the Quay at Rig tenders and the dock crane unloading onto the quay side and then by fork lift to the designated storage area.
ii. The Landing Craft will position itself on the beach and lower the bow access ramp. The waste will then be unloaded by fork lift and transported to the designated waste storage area.

The maximum pay load of the Landing Craft My Marie is 2700kg (5900lbs).

Material	Density	
	(lb/ft^3)	(kg/m^3)
Dirt, loose dry	76	1220
Dirt, loose moist	78	1250
Clay, dry	100	1600
Clay, wet	110	1760
Gravel, dry	105	1680
Gravel, Wet	125	2000
Limestone	160	2560
Loam	80	1280
Mud, flowing	108	1730
Mud, steady	115	1840
Rock, well blasted	155	2480
Sand, dry	97	1555
Sand, wet	119	1905

The waste barrels have a volume of **0.218m³ x WET CLAY @ 1760kg/m³ = 383kg** per Barrel

Maximum 7 Barrels to be loaded onto the LCV

The supersacks have a max volume of 1m³ x WET GRAVEL @ 2000kg/m³ = 2000kg if the bag is full.

Supersacks only to be filled 50% Maximum of soil materials. Maximum 2 x 1000kg supersack per load

12.3 Transfer of Samples to shore

- Bulk and SPT samples will be bagged and stored in totes prior to transfer to shore. Each tote will have a weight limit of 50kg.
- Core samples will be placed into core boxes in readiness for transfer.
- Shelby tubes will be stored vertically in specifically designed wooden boxes prior to transfer to shore.
- ALL samples will then be stored within stillages onboard the JUB. The current, tide and weather conditions must be favourable for the operation to commence.
- LCV to be orientated as per diagram shown in Appendix B
- The stillage will then be lifted from the JUB using he onboard crane onto the LCV.
- As with other transfers the Zooom Boom will be used to transfer the soil samples between the LCV and the ASRC warehouse.

Figure 5. Samples being transferred from LCV to shore at ASRC beach

- Once onshore the Fugro Lab Technician will take receipt of the samples and check against the Chain of Custody documentation.

Figure 6. Samples delivered to ASRC Warehouse

12.4 Materials supply to Vessels

Materials will be transferred to the JUB and to the Tug in the same way as samples were offloaded. Metocean and tidal conditions must be favourable and all lifting equipment thoroughly inspected prior to conducting the operations. Such materials include:

- Food & Water
- Drilling consumables
- Core boxes and Shelby tubes
- Shelby tube boxes
- Sample totes.
- Fuel (see separate MS)

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			DATE: 21/08/2015

A. ESTIMATED WASTE PRODUCTION

Wates stream description	Anticipated waste	unit	rate	unit	sub total	unit	total waste estimat	unit	Method of containment	Action by fugro Seacore
Drill cuttings (Shell and Auger)										
ANTICIPATED SAND, GRAVELS AND CLAY										
0m to -2m below seabed. 177m casing at 10 locations	0.196	m3	2	m	1.96	m3			1m3 dump sacks	Contained waste to be transported to shore
0m to -2m below seabed. 302m casing at 32 locations	0.572	m3	2	m	18.30	m3			1m3 dump sacks	Contained waste to be transported to shore
							20.264	m3		
Drill cuttings (Rotary Coring)										
ATICIPATED MARINE SILTS AND CLAY										
From -2m to -13.24m below sea bed at 10 locations	0.17	m3	4.5	m	5.00	m3			Sealed 55 Gallon drums	Contained waste to be transported to shore
From -2m to -43.72m below sea bed at 23 locations	0.17	m3	4.5	m	37.99	m3			Sealed 55 Gallon drums	Contained waste to be transported to shore
From -2m to -51.34m below sea bed at 7 locations	0.17	m3	4.5	m	13.58	m3			Sealed 55 Gallon drums	Contained waste to be transported to shore
From -2m to -89.44m below sea bed at 2 locations	0.17	m3	4.5	m	6.76	m3			Sealed 55 Gallon drums	Contained waste to be transported to shore
							63.32	m3		
Oil/hydrocarbon contaminated waste										
ANTICIPATE OILY RAGS OLD FILTERS AND SPILL KIT WASTE	25	kg	2	week	550	kg			Sealed and double baged 25kg rubbish plastic rubbish sack	Contained waste to be transported to shore and segregated into Hazardous Waste Skip
							550	kg		
Non hazardous Waste										
ANTICIPATE HOUSEHOLD, FOOD WASTE AND GENERAL PACKAGING	25	kg	7	week	1925	kg			Sealed and double baged 25kg rubbish plastic rubbish sack	Contained waste to be transported to shore and segregated into General Waste Skip
							1925	kg		
Metal (Mixed)										
ANTICIPATE STEEL, ALIMINIUM, COPPER	100	kg	10	week	110	kg			Waste skip	Contained waste to be transported to shore and segregated into Metal waste skip
							110	kg		
Human Waste products										
	70	kg	11	week	770	kg			Contained within chemical toilet	Chemical Toilet taken ashore and pumped out into licensed contractors
							770	kg		

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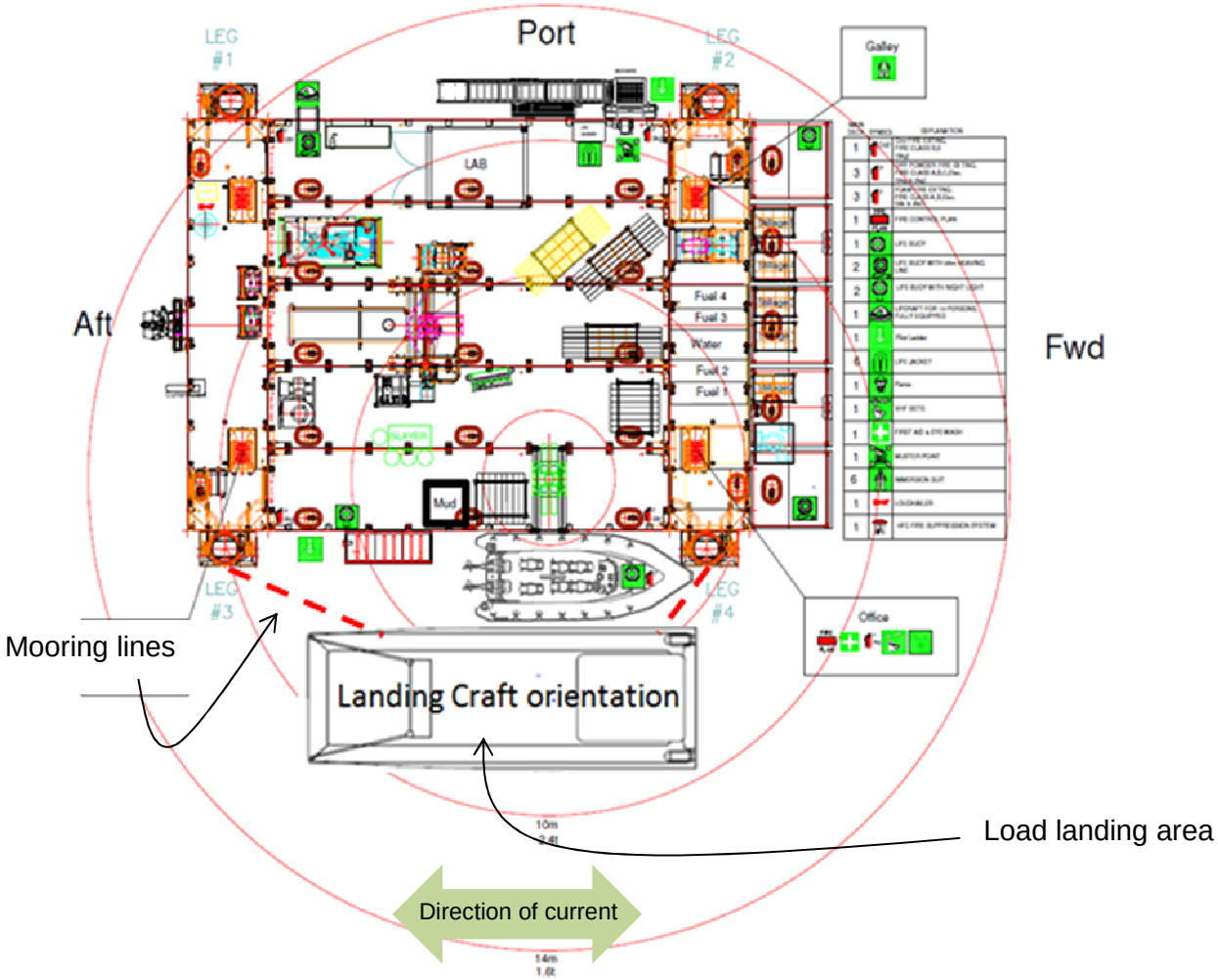
B. ORIENTATION OF RECEIVING VESSEL



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ALASKA LNG (AKLNG) Lifting Operations (Site)		Issue:	REVISION 01
		Date:	09/07/2015

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8. Plant and Equipment
9. Materials (handling/storage/disposal)
10. Preparation of Works/Location of Services
11. Emergency Procedures
12. Personal Protective Equipment/Safety Equipment
13. Methodology & Sequence of Work

Appendix 1- Deck crane duties chart

Appendix 2 – Example generic lift plan for deck operations

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Originated by: Andi Hagan		Reviewed/authorised for issue by:

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ALASKA LNG (AKLNG) Lifting Operations (Site)		Issue:	REVISION 01
		Date:	09/07/2015

1. Introduction

This Method Statement refers only to the "minor" common lifting operations required for the movement of equipment, core boxes, drill cutting or materials from the support craft and the jack-up platforms during the work scope.

2. Main Activity / Area of Work

Movement of materials and equipment around the deck of the JUB will be carried out using a deck-mounted crane and will be loaded/unloaded from the support vessels along side, whilst the platform is jacked-up out of the water.

Crane operations will be carried out using competent personnel authorised by the Operations Manager, as defined in the competence matrix.

This Method Statement covers the following;

- Description of lifting operation
- Lifting of equipment, small plant and materials
- Operation including lifting and moving items around the deck to enable operations and maintenance.
- Lifting of equipment and materials from vessels

3. Manpower and Supervision

Job Title	Responsibility
Project Manager	Responsible for the management of the marine geotechnical scope, including ensuring development and application of safe systems of work, suitable competent personnel are available and that plant and equipment is suitable for the task and are properly maintained and certified.
Site Manager / Supervisor	Responsible for all marine activities including Health and Safety on the jack-ups on a day to day basis. For compound lifting operations will liaise the project team to co-ordinate schedule of vessel and equipment movements. Will authorise all lifting operations.

Bargemaster	Will co-ordinate operations between supply vessel and jack-up barge.
Deck Mounted Crane/Hiab Operator	Member of the jack-up barge crew certified and competent to operate deck cranes. Has overall responsibility for the safety of transfer of equipment to/from the barge.
Slinger / Signaller	Responsible for the safe attachment, movement and landing of all loads. Maintains communication and visual/radio contact with crane operator at all times.
First Aider(s)	At least one first aider to be available on site
Vessel Operator.	Act on instruction of bargemaster and hold vessel safely on station during performance of the lift. Alerts bargemaster immediately of any concern over his ability to do so, such that lifting operations can be suspended.

4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

Document(s)	**Serial Number(s).**
Project Execution Plan	Latest Issue
QA forms	Daily Progress Reports
Project COSHH Assessment File	Vessel COSHH Files (fuels and lubricants)
Certificates of Thorough Examination	Lifting equipment and accessories
Planned Preventive Maintenance	Daily/weekly maintenance records Operators daily inspection records
Generic deck operations lifting Plan	C1707 LP 003

5. Risk Assessments

Relevant risk assessments:

RAS 001 - Working Over Water (C1707)

RAS 007 – Boat lift from water to barge deck
RAS 014 - Cranage (C1707)
RAS 027 - Interaction with other Marine Traffic (C1707)
RAS 047 - Transporting Materials by Barge, Boat (C1707)
RAS 049 - Manual Handling, lifting Acc (C1707)
RAS 047 – Man riding activities.
RAS 071 - Mechanical Lifting Operations - Hiab & Deck Mounted Cranes (C1707)

6. Security - Barriers/Fences/Warning Signs

The jack-up platform is self contained and will be manned 24 hours per day.

7. Constraints/Restrictions/Special Conditions

Working hours will be based around a 24 hour day staffed with 2 x 12 hour shifts.

Lifting operations to be within working limits of crane, sea and wind conditions may limit safe operation

Item No	Description	Sea state (-Hmax (m and ft)	Wind speed Beaufort scale Force	Wind speed (m/s and mph)	**Current (Knots)**
1	Crew Evacuations	1.5m (5ft)	Wind Force 6	12m/s (27mph)	6
2	Crew Changes	1.2m (4ft)	Wind Force 6	12m/s (27mph)	4
4	Jacking Up/ Down	0.75m (2.5ft)	Wind Force 5	10m/s (22mph)	2
5	Drilling operations	1.5m (5ft)	Wind Force 6	12m/s (27mph)	6 note setting casing up to 1 knot
7	Equipment/Sample transfer to/from jack Up	1m (3ft)	Wind Force 4	8m/s (18mph)	2 depending on orientation of vessel.
8	Fog	Visibility of less than 500m approximately			

These values are realistic limits based upon experience for when conditions are likely to become unworkable. They are indicative guidelines only and can vary up or down subject to compounding effects and other environmental conditions e.g. wave shape, wave period. At all times the decision of the Bargemaster, Vessel captain or Supervisor is final in determining the suitability of the conditions for the operation.

8. Plant and Equipment

- Deck-mounted crane
- Certified Lifting accessories
- Task lighting (as required)
- VHF radios (if required)

All lift equipment used will be thoroughly examined, inspected and certified fit for use and colour coded accordingly. Certificates shall be available onboard and in the Falmouth office.

9. Materials (handling/storage/disposal)

Diesel required for operational plant will be stored within a bounded fuel storage tank.

Waste oils removed from the jack-up rig to be stored for removal by a licensed waste contractor. FSCL shall lease with the local agent in order to appoint a local waste haulier. The appropriate transfer documentation will be completed by both parties on the disposal of any waste products/material/goods.

All waste drill cuttings and drill mud removed from the jack up will be returned to the shore and disposed of by a licensed contractor

10. Preparation of Works/Location of Services

Lifting operations on the platform will be supervised by the Bargemaster, who will coordinate vessel movements and equipment/materials to be loaded or unloaded between the support vessel and the jack-up platform.

Crane operator will approve the lifting operation following a review of local weather and sea conditions.

Prior to lifting operations:

- The competent and trained Crane Operator is to brief any personnel involved in the lifting operation.
- Line of sight will be verified between the Slinger signaller and Crane Operator prior to the lift taking place.
- Communications established between Jack up and Vessel prior to loading off loading from jack up

11. Emergency Procedures

Emergency procedures are detailed in the Fugro Seacore Ltd 'Emergency Response Plan' (ERP).

12. Personal Protective Equipment (PPE) & Safety Equipment

The following personal protective equipment will be worn:

Overalls BS EN 471	Mandatory - all sites/activities
Safety helmet BS EN 397	Mandatory - all sites/activities
Safety boots/shoes (steel toe cap) BS EN 345	Mandatory - all sites/activities
Safety glasses or goggles BS EN 345/BS EN 3F	Mandatory - all sites/activities
High visibility tabard/jacket jacket BS EN 471	Mandatory - all movements & slinging
Ear defenders/ear plugs BS EN 352	Mandatory - noise above the FAL – 80dB(A)
Lifejacket BS EN ISO 12402-3	Mandatory - working over water / outside the guardrails / crew change and on exposed quayside
Safety Harness	Mandatory - working at height /outside a protected area (no other control measure in place e.g. guardrails etc)
Gloves BS EN 374	Mandatory – during any preparation and handling of loads and lifting equipment.

13. Methodology & Sequence of Work

Procedure for loading / unloading of equipment / material to and from support vessel AND on the deck of the jack-up:

Prior to commencing the lifting operations verify weather conditions giving consideration to the limiting factors

Crane operator and rigger/signaller to discuss planned lifting operations. Review lift plan
(Note: One trained and competent slinger signaller to be appointed for the operation)

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Crane operator to proceed to crane and is to establish a clear line of communication with Rigger/ signaller (via radio if required). A clear line of site to be established by slinger signaller and crane operator

If lift is to/from support vessel then communication must be established between vessel and jack up. Bargemaster and vessel captain to agree safe weather/sea conditions for operation. Vessel captain to maintain position for operation. 2nd Rigger to on board vessel and to be in communication with Rigger/ signaller and crane op. Rigger/signaller to maintain communication AND clear line of site with crane op and 2nd slinger.

Rigger/ signaller is to be located where he/she can provide the crane operator with clear and accurate instructions by witnessing and controlling the operation its entirety

Rigger/signaller to request crane operator to lower crane hook down towards deck level, lifting chains to be visually inspected, checked to be in test (check colour coding) and attached to crane hook

Rigger/signaller to guide the crane operator lower lifting chains to connect to load via shackle, strop, lifting points or via connecting chains around load

Ensure load to secure, test lift by lifting just off the deck (Ensure stability of load)

Connect tag line to load – as required.

Load to be lifted under control and slewed to desired landing area. Slinger signaller to instruct and guide crane Op to the desired area, giving a detailed account of the lift as it progresses including height from deck as the load is lowered to deck (minimising height of lift path where possible)

SS to confirm to crane op when load is landed safely on deck, slinger signaller to instruct or remove lifting accessories from load

Crane Op to lift lifting chains clear of load and repeat lifts as required and instructed by SS

Avoid crushing and pinch points!

When executing a marine lift to and from a support vessel give consideration to the movement of the vessel influenced by wind, waves and current.

ADDITIONAL NOTES

Assorted lifting accessories are held onboard and are tested and certified in line with LOLER and company testing procedures.

All lifting accessories will be identified as in-test through the colour code marking.

Any which have been identified as “out of test” will be quarantined until re-tested.

Any damaged accessories will be removed from service and discarded.

Competence & Training

Only competent personnel are permitted to operate any lifting equipment onboard.

All lifting operations will be controlled by a trained and competent Slinger Signaller

Competence will be determined by the Operations Manager. The project team are responsible for ensuring that competent personnel are available to carry out operations in accordance with this Method Statement.

The Emergency Response Plan details all contacts and telephone numbers in case of an emergency.

Once the load is onboard the vessel, this is taken back to the Rig tenders Quay for off loading by the main crane under the supervision of the crane operator and banks man at the off loading point.

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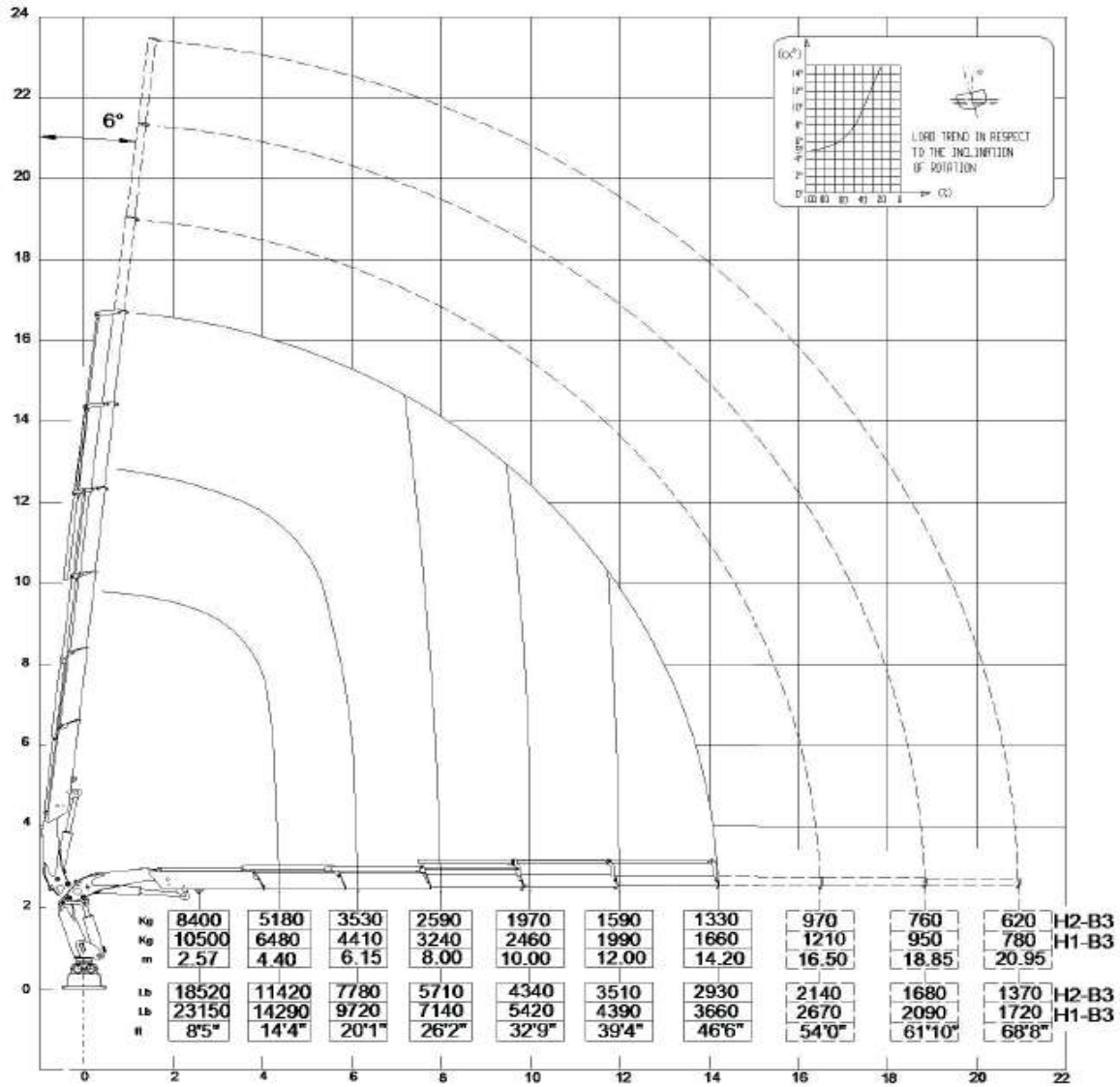
Appendix 1 – Skate 3A Deck crane duties chart

AMCO VEBA

gru modello **933 MF**

933MF 5S

DIAGRAMMA PORTATE LOADING DIAGRAM
DIAGRAMME DE CAPACITÉ TRAGLASTDIAGRAMM
DIAGRAMA DE CARGAS



Kg	8400	5180	3530	2590	1970	1590	1330	970	760	620	H2-B3
Kg	10500	6480	4410	3240	2460	1990	1660	1210	950	780	H1-B3
m	2.57	4.40	6.15	8.00	10.00	12.00	14.20	16.50	18.85	20.95	
Lb	18520	11420	7780	5710	4340	3510	2930	2140	1680	1370	H2-B3
Lb	23150	14290	9720	7140	5420	4390	3660	2670	2090	1720	H1-B3
ft	8'5"	14'4"	20'1"	26'2"	32'9"	39'4"	46'6"	54'0"	61'10"	68'8"	

Appendix 2 – Example generic lifting plan for deck operations

JUB- GENERAL DECK LIFT PLAN

(To be completed by the Competent Person)

CONTRACT NUMBER: C1707	**LOCATION:** Alaska	
Lifts to commence : Through duration of contract	**LIFT PLAN NUMBER:** LP003 - Generic	**SHIP/BARGE/OTHER:** Skate 3A
WEIGHT OF LOAD: Varied.		

DESCRIPTION OF LIFTING OPERATION

Lift Supervisor – Barge Master

Rigging Crew – Appointed and authorised crew member/s

NOTE: All works run in accordance with guidelines set out in the associated RAS as applicable. Risk Assessments are stored in site file and are available upon request.

Crane to be used – Amco Veba 933 MF deck/pedestal crane.

Associated Documents – RAS007 – Boat lift from water, RAS 014 – Craneage, RAS067 – Launching and recovery of a RIB, RAS 071 - Mechanical Lifting Operations – Hiab and Deck Mounted Cranes, RAS 065 - Leg Connection, RAS 057 - Man Riding - Work Basket Activities

Main Summary of works

- Launch and recovery of RIB
- Movement of pallets/stillages and equipment on deck
- Lifting of equipment/samples to and from support vessel
- Lifting of Chemical Toilet to and from support vessel
- Lifting and positioning of work basket
- Lifting of fuel tanks to and from support vessel

Note:
Any equipment that needs to be put together/ dismantled should be correctly chocked/ braced and if necessary supported by the deck crane. No bolts should be inserted/ removed until this is completed.

Prior to all major operations/activities during the mobilisation/ de-mobilisation specific task/ toolbox talk briefings on the work/ operation being undertaken should be carried out either by the supervisor or by a competent person who is familiar with the task/ operation.

All documentation is to be reviewed, amended and updated throughout the course of the works to ensure the planned and current methodology is reflected in the project documentation.

If in doubt of any instruction or not familiar with a task/ operation stop and speak with your supervisor.

JUB- GENERAL DECK LIFT PLAN

POSSIBLE CONSIDERATIONS (not exhaustive) (Tick (✔) if relevant and address each point in 'step-by-step' below)							
Weight not verified		No certified suspension points for lifting equipment		Appropriate and correctly installed lifting equipment and accessories		Is the use of tag lines required? Then consider personnel positioning	
High Centre of gravity		Lifting of chemicals / gases		Conflicting tasks in area		Overhead obstructions or hazards e.g. Street lights	
Stability of load		Restricted headroom or confined work area		Dynamic factors involved		Sea fastenings removed	
Awkward size/shape		No lifting point directly above the load		Hazards to personnel in area		Sea state within acceptable limits?	
No dedicated lifting points on the load		Adequate lighting and visibility		Ground conditions e.g. stability, underground services, voids etc.		Weather conditions within acceptable limits?	

ROUTE TO BE TRAVELLED AND LAYDOWN AREA (If you cant answer either, address in the 'Step-by-Step' section)	**YES**	**N/A**
1) Are the route and lay down areas clear of obstructions?		
2) Is the laydown / landing area adequate in terms of size and load bearing ability?		
3) Is suitable packing available for protection for protection of the load, lifting equipment, slings etc?		
4) Have barriers been positioned to prevent access by unauthorised personnel?		
5) Have environmental conditions been considered with regards to the safety of the lifting operations?		
6) Will the Lifting Equipment Operator be able to see the Slinger / Signaller throughout the operation, or has another suitable, risk assessment means of communication been checked and made available (e.g. radios)		
7) Have you confirmed that the laydown area is within the operating limits/radius of the equipment?		
8) Are there hazardous process plant or materials in the area?		

Note: Consideration must given to each of the above, prior to each individual lift

STEP-BY-STEP DETAILS OF THE LIFTING OPERATION

Before a lift can take place the conditions must be suitable for lifting. This is to be approved by the Lift Supervisor and in line with crane operability limitations.

Before crane operations can begin the following must be checked;

- Crane Duty Charts (displayed on crane itself as well as within documentation)
- Operator certificate
- 12 month inspection certificate (6 month if man riding)
- Thorough inspection certificate
- Lifting certificates for all lifting accessories

Local hazards must also be taken into account including winds, communication methods, signalling. Any simultaneous operations in the area (eg. support vessel if at sea or delivery lorry if alongside quay) must be a safe distance away. Fixed hazards on board and/or quayside e.g. lamp posts, overhead power lines, drill mast, containers / buildings must be taken into account when planning a lift.

See below for the limits of the crane and max weights and radii. Operations will follow the following general procedures.

The lines of communication must be well understood before a lift can start. Ensure agreed hand signals and language is agreed prior to lifting.

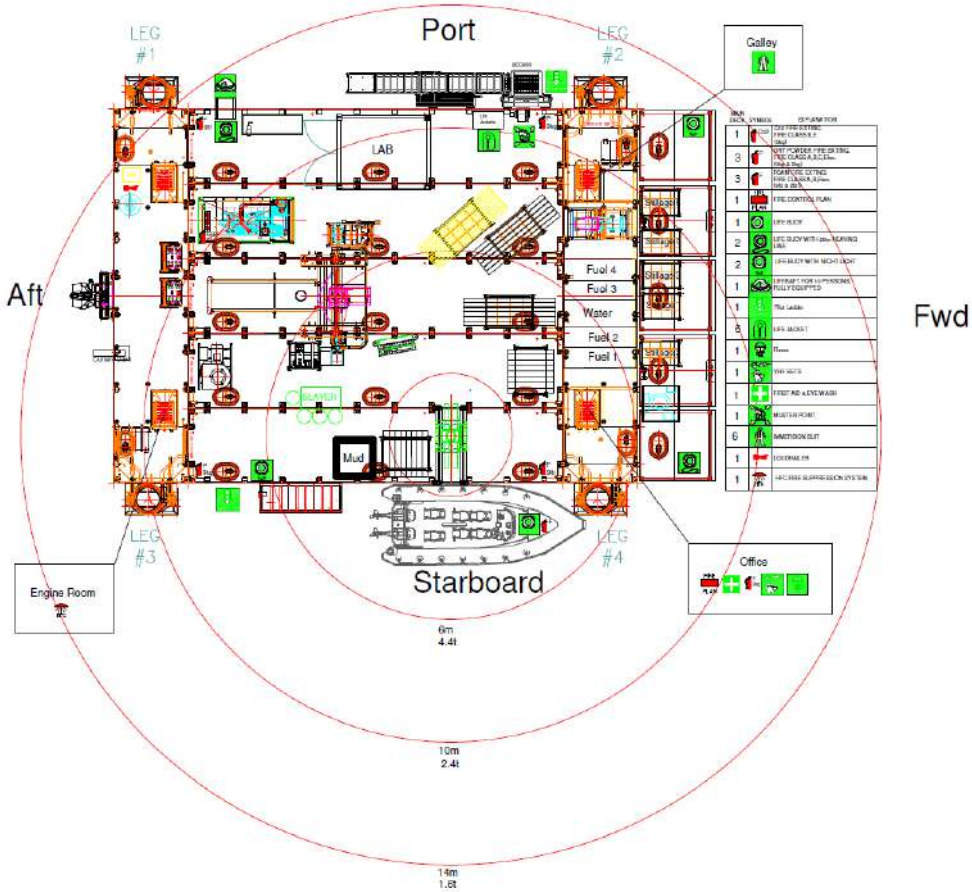
Any personnel working within 1m of the quay edges or overwater (outside hand rails) must be wearing life jackets.

LOAD/S MAX WEIGHTS & RADIUS

LOAD	WEIGHT	MAX RADIUS
Rib	**1.1t**	**(10m Man riding) 16m empty**
Fuel Cube	**1.1t**	**15m**
Leg (Main section)	**2.4t**	**6m**
Leg (Extension)	**2.0t**	**10m**
Stillage (7” casing)	**1.9t**	**10m**
Stillage (10” casing)	**1.9t**	**10m**
Stillage (Geo-bore)	**2.2t**	**10m**
Pallet (Drill mud	**1.1t**	**15m**
Pallet (Core samples)	**1.0t**	**16m**
Temp Toilet	**0.1t**	**22m**
Work Basket	**0.5t**	**22m**

STEP-BY-STEP DETAILS OF THE LIFTING OPERATION	(Responsible Person)
General lifting operation for all items:	
• Plan lifting operation/s	Lift Supervisor
• Brief lifting team and others effected	Lift Supervisor
• Select and connect the lifting accessories to load and crane.	Slinger/Banksman
• Ensure all fixings/sea-fastenings are removed or detached.	Slinger/Banksman
• Ease the item off the ground to see how it hangs. The item must not hang at an excessive angle (to be decided by the lift supervisor).	Crane Operator
• Lift the item clear keeping height to a minimum required for the lift path.	Crane Operator
• Bank the crane to where the item is to be landed.	Slinger/Banksman
• Land the item.	Crane Operator
• Secure the item if necessary.	Slinger/Banksman
• Remove lifting accessories.	Slinger/Banksman

SKATE 3A Deck Plan inc crane radius



Above: generic deck plan of Skate 3 with position of the deck crane shown.

Note: deck plan to be confirmed prior to each project. Equipment on deck can then be arranged so that the deck crane can access and lift them. Once the deck plan is confirmed, it can be displayed with an overlay of the crane load/radius limitations.

TCH DETAILING THE RIGGING UP OF THE LIFTING EQUIPMENT AND LIFTING ACCESSORIES

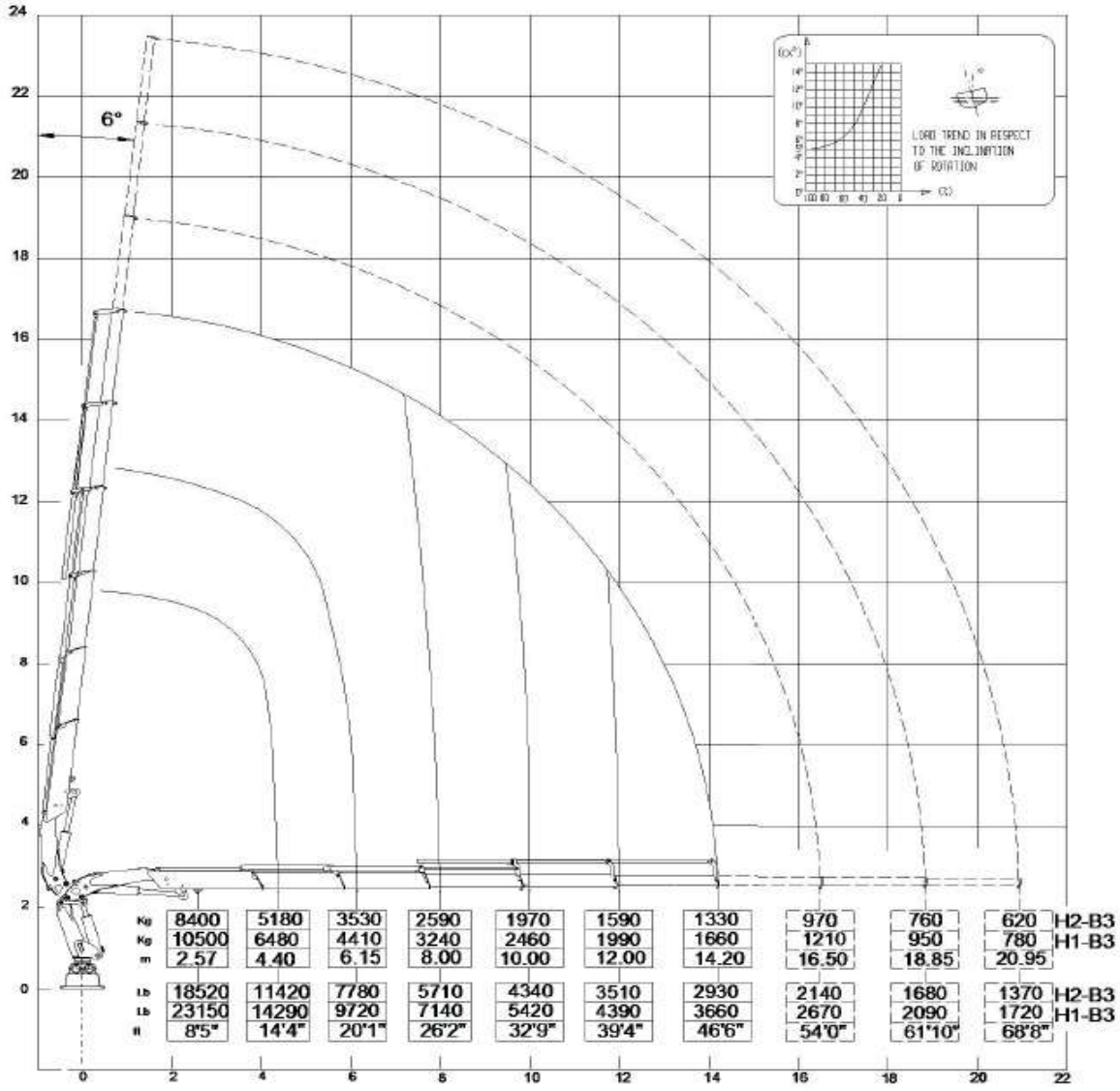
LIFTING CAPACITIES and CRANE SPECS

Amco Veba 933MF Deck/Pedestal Crane

AMCO VEBA gru modello 933 MF

933MF 5S

DIAGRAMMA PORTATE LOADING DIAGRAM
DIAGRAMME DE CAPACITÉ TRAGLASTDIAGRAMM
DIAGRAMA DE CARGAS



Kg	8400	5180	3530	2590	1970	1590	1330	970	760	620	H2-B3
Kg	10500	6480	4410	3240	2460	1990	1660	1210	950	780	H1-B3
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ft	8'5"	14'4"	20'1"	26'2"	32'9"	39'4"	46'6"	54'0"	61'10"	68'8"	

Load radius diagram and chart from crane specification

Note: max load to be lifted by crane is 10500Kg based on winch/wire capacity.

LIFTING EQUIPMENT AND LIFTING ACCESSORIES TO BE USED (Specify type and SWL)

All equipment / accessories to be checked and be within test period (12 or 6 months and colour coded accordingly). Lift supervisor to check equipment prior to use. If 3rd parties own lifting equipment is going to be used, check it has been inspected, with test and is in good condition.

Lifting Accessories available for use onboard:

10mm chain slings
Wire rope slings
Polyester round slings of various lengths and capacities
Lifting shackles with various capacities.
Ensure all accessories are suitable for the load and lift being conducted. If any soft strops are damaged, these are to be removed and dispose of immediately.

Note: All lifting equipment to be colour coded in line with FSCL coding systems and inspected before use. Any items that are not coloured with the current colour must be quarantined.

All lifting certificates will be available during all lifting operations.

Webbing & Round Slings

Sling Type							Colour	Working Load Limits				
Webbing						Round						
Simplex	Width mm	Duplex	Width mm	Endless	Width mm			M=1	M=0.8	M=2	M=1.4	M=1
S1	60	D1	30	E1	30	R1	VIOLET	1	0.8	2	1.4	1
S2	120	D2	60	E2	60	R2	GREEN	2	1.6	4	2.8	2
S3	180	D3	90	E3	90	R3	YELLOW	3	2.4	6	4.2	3
S4	240	D4	120	E4	120	R4	GREY	4	3.2	8	5.6	4
S5	300	D5	150			R5	RED	5	4	10	7	5
		D6	180			R6	BROWN	6	4.8	12	8.4	6
		D8	240			R8	BLUE	8	6.4	16	11.2	8
		D10	300			R10	ORANGE	10	8	20	14	10
						R12	ORANGE	12	9.6	24	16.8	12
						R15	ORANGE	15	12	30	21	15
						R20	ORANGE	20	16	40	28	20
						R25	ORANGE	25	20	50	35	25
						R30	ORANGE	30	24	60	42	30

Max Weight Calculation:

Max loads will generally be pallets of casing although these are generally positioned during the mobilisation phase and using a shore based mobile crane and do not require to be moved once positioned on the drill floor. The table below shows expected casing weights should such a lift need to take place. The weight of each pallet should be calculated by the Lift Supervisor (taking into account lifting accessories) and radius calculated prior to each lift to ensure the crane remains within its operational limits.

Load Chart
Contract:
Issue: 2 Rev:1
Date:

Casing pallet weights

Casing type	Casing length (m)	Ind. Casing weight (kg)	Quantity	Length/pallet (m)	Weight (kg)
SW	3.0	115	20	60	2300
Geobore	3.0	71.3	30	90	2200
6"	1.5	59	32	48	1900
8"	1.5	78	18	27	1400
10"	1.5	115	10	15	1200
12"	1.5	137	8	12	1200
NWY	3.0		30	90	500

Additional items

Item	Weight (kg)	Item	Weight (kg)	Item	Weight (kg)
12" bailer	118	Sinker bar	80	Bentonite pallet	1100
10" bailer	116	Outer barrel	55	Water cube	1000
8" bailer	86	Inner barrel	46		
6" bailer	57				

RIB Lift:

The barge RIB weighs approx 1000kg / when 2no crew and accessories are taken into account. Based on 50% de-rating for man riding operations, the crane is capable of lifting 2200kg (50% of 4410kg) at a radius of 6 metres. This is sufficient to safely lift the Rib and set onto its deck cradle therefore, the RIB can be lifted to/from the water safely but with maximum operating radius of 10m.

Onsite Amendments and Hazards *to be amended by site lift supervisor (to be approved by Appointed person)*

Competent Person (Lift Supervisor)	Print Name:	Signature:	Date:

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ALASKA LNG GI Fuelling Operations (Skate 3)			Issue: 0 Rev 0
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2. **Main Activity/Area of Work**
3. **Manpower and Supervision**
4. **Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)**
5. **Risk Assessments**
6. **Security - Barriers/Fences/Warning Signs**
7. **Constraints/Restrictions/Special Considerations**
8. **Plant and Equipment**
9. **Materials (handling/storage/disposal)**
10. **Preparation of Works/Location of Services**
11. **Emergency Procedures**
12. **Personal Protective & Safety Equipment**
13. **Methodology & Sequence of Work**

Appendices

A. Bunkering process plan

B. Spill response plan

C. Water pollution prevention toolbox talk

D. Storage of fuel/Hydrocarbon toolbox talk

E. Emergency responce plan

F. CoSHH Data for Diesel fuel

Issue details:	Issue 1 Rev 0	
Distribution:	Controlled copies: Contract File	Uncontrolled copies: Client
Originated from: Stefan Osman	Reviewed/authorised for issue by: Anai Hagan	

A METHOD STATEMENT IS ONLY A SAFE METHOD WORKING IF IT IS DISCUSSED AND AGREED BEFORE WORK BEGINS AND THEN FOLLOWED BY THOSE CARRYING OUT THE WORK.

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ALASKA LNG GI Fuelling Operations (Skate 3)		Issue:	0 Rev 0
		Date:	26/02/15

1. Introduction

Fugro conducting a geotechnical study for the ExxonMobil LNG Project in Nikiski, Alaska. The conceptual project design consists of construction of LNG terminal as well as improved port facilities.
The Nearshore geotechnical phase of the works shall be completed using Fugro Seacore Ltd's jack-up, Skate 3A, a four legged barge capable of working in water depths up to 20m (although this is highly dependant on ground and environmental conditions) . The jack-up provides a very stable working platform.

2. Main Activity / Area of Work

During the term of the contract it will be necessary to transfer between the shore and Skate 3, and vice versa, certain fuels and lubricants. The crew transfer boat and RIB will also require fuel to operate. When the jack up requires further fuel during the project, the support vessel will collect the four bunded fuel tanks onboard and return them to shore so that can be re filled. They will then be returned to the Jack Up.

The onboard power units including the generator, compressor & hydraulic power packs will be fuelled daily using the fuel stored in the onboard double bunded fuel tanks. Fuel will be transferred to the power units by means of a fuel pump with the appropriate hose & nozzle.

The onboard power units will all have individual bunds surrounding their fuel tanks to prevent any spillage into the environment. The purpose of this bund is to collect any fluid leaks that may occasionally happen. These bunds/drip trays may require emptying due to fluid build up – possibly through rain water. The drip trays will be emptied into an appropriate storage container using a 'barrel' pump and absorbent pads for future disposal. All waste from the spill trays and bunds will be stored on the JUB in sealed plastic bags and taken ashore for disposal by a licensed contractor

3. Manpower and Supervision

Nominated Person	Responsibility
Bargemaster/ Supervisor	Responsible for the transfer of fuels and lubricants from the quayside to the rig (and vice versa). To ensure that this operation is conducted safely and in accordance with the project management plan, the project environmental management plan, the company environmental policy. Responsible for the safety of the vessel and all onboard at all times.
Marine Site Works Manager/Project Engineer	Advise the Bargemaster on the project requirements to comply with this method statement and supply the appropriate information and instructions to enable this to be carried out safely.
Project Manager & Port Authority	Ensure fuel oils are made available to the jack-up and support vessels at the designated quayside.

4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

Document(s)	Serial Number(s).
Jack up operations manual	Skate 3 operations manual
Project Management Plan	C1707 latest issue
Project COSHH Assessment File	Jack-up & Site COSHH Files
Project Emergency Response Plan	C1707- ERP
Project Environmental Management Plan	C1707 - EMP

5. Risk Assessments

Risk assessments relevant to the works:

RAS 001	Working Over water
RAS 015	Environmental Protection
RAS 027	Interaction with other marine traffic
RAS 030	Jack up Fire Risk assessment
RAS 033	Man over board
RAS 046	Storage of Flammable Material
RAS 071	Mechanical lifting operations – HiAB and deck crane

6. Security - Barriers/Fences/Warning Signs

Due to the confined space on the jack up it is not practical to erect barriers around the bunkering operations. The crew will be briefed by the Barge Master on the refuelling procedure and the individual roles of the crew prior to the commencement of the refuelling operations.

7. Constraints/Restrictions/Special Conditions

- **NO SMOKING onboard platform or in vicinity of any flammable liquids/gases while fuel transfer are taking place.**
- NO BUNKERING operations are to be carried out during hours of darkness
- Ensure fuel tanks/hoses are being moved by competent persons and are not interfering with other port users.
- Ensure there are suitable spill prevention measures are in place and checked in line with the operations manual.
- Ensure that a fully stocked spill kit is readily available in the event of an uncontrolled release.
- **Environmental Considerations**
  - Refuelling or bunkering activities increase the risks of fuel being released into the environment. The process of bunkering needs to be managed to ensure that the risk of water and land pollution is minimised.

  - Please see the attached refuelling Activities procedure **(Appendix A)** which will be placed in appropriate places on site so that employees are aware of the precautions required.

  - Training is also required in this area for all employees working on the jack-up platform to ensure that pollution prevention is possible and quick action is taken to minimise spills. Follow correct procedures to minimize risk.

- Environmental limitations that are relevant the fueling operations are;

Activity	**Limiting Sea state** (m)	**Limiting Wind Speed** (Knots at 50 m above MSL)
Personnel Transfer to/from JUB	1.0m H_{max}	17 Knots
Fuel transfer to/from another vessel	0.6m H_{max}	17 Knots
Lifting operations in connection with bunkering operations	0.6m Hmax	10 Knots

8. Plant and Equipment

- Skate 3A jack-up
- Fuel tank and accompanying hose
- Fuel delivery vehicle/vessel
- Hydraulic power packs
- Electric generator
- Various drip trays

- 'Barrel' pump
- Designated waste oil storage containers

9. Materials (handling/storage/disposal)

Please refer to COSHH booklet onboard vessel.

10. Preparation of Works/Location of Services

All Bunkering operations are to be planned. Bunkering with fuel will only take place during day light and never at night.

All other operations on board the Jack up will be suspended whilst refueling takes place.

The Barge Master will brief the crew on their individual roles.

Crew will be stationed along the delivery route to monitor for any leaks and deploy the spill kit if one develops

11. Emergency Procedures

Please refer to Emergency Response Plan

12. Personal Protective Equipment (PPE) & Safety Equipment

The following personal protective equipment will be worn:

Overalls	Mandatory - all sites/activities
Gloves	Mandatory for fuelling operations. Chemical resistant gauntlets to be used for fuelling operations.
Safety helmet	Mandatory - all sites/activities
Safety boots/shoes	Mandatory - all sites/activities
Safety glasses or goggles	Mandatory for fuelling operations.
Ear defenders/ear plugs	Mandatory - noise above the FAL – 80dB(A)
Lifejacket	Mandatory - working over water / outside the guardrails/ within 1m of quay edge
Safety Harness	Mandatory - working at height /outside a protected area (no other control measure in place e.g. guardrails etc)

13. Methodology & Sequence of Work

NOTE: Also refer to Appendix A

Primary fuel tank filling

Refuelling via a direct supply from quayside source to the rig:

1. During the mobilisation, Skate 3 will be alongside the quayside specified by the Harbourmaster.
2. Skate 3 will be jacked up and have undertaken standard preloading procedures to ensure stability
3. The fuel delivery vehicle will then be directed to set up away from the quay edge. A banksman will direct the driver at all times.
4. **A strict 'de-match/no smoking' policy is now in place within the vicinity.**
5. Once set up, the fuel transfer hose will be run out from the delivery lorry to the fuel tank onboard the jack-up.
6. A crew member will walk along the fuel hose to ensure that no kinks are present and the hose is safe from sharp objects.
7. Ensure that the onboard fuel bowser tap is shut.
8. Fuel nozzle directed into the fuel tank. This may be a bolted coupling.
9. A crew member is to attend to the nozzle at all times.
10. Tanker driver will attend to the pump at all times.
11. When both the nozzle attendant and tanker driver are ready, the Bargemaster will give clearance to start the pump process.
12. Regular reports of fuel levels/progress will be relayed to the tanker driver.
13. When 3/4 full the signal to stop pumping will be given.
14. The hose nozzle will be turned off as well.
15. The fuel hose will be carefully wound back to the delivery vehicle.
16. Fuel tank opening will be securely closed.
17. Tanker vehicle will exit when ready.

Fuelling onboard Tanks from bunker tanks on landing craft

1. Support vessel attends JUB at Planned time
2. Barge Master and Vessel skipper to evaluate and confirm that the weather/tide and sea conditions are within safe working levels.
3. Skate 3 will jack down to water level.
4. The crew deploy containment boom around both vessels.
5. Radio all marine traffic in area advice of refuelling process and ask for slow bow.
6. The Support vessel will tie alongside Jack-Up Rig
7. No operations will run concurrently with refuelling process
8. **A strict 'de-match/no smoking' policy is now in place within the vicinity.**
9. Once set up, the fuel transfer hose will be run across TBC to the fuel tank onboard the jack-up.
10. No Hose will be in the water
11. A crew member will walk along the fuel hose to ensure that no kinks are present and the hose is safe from sharp objects.
12. Ensure that the onboard fuel bowser tap is shut.
13. Fuel nozzle directed into the fuel tank. This may be a bolted coupling.
14. A crew member is to attend to the nozzle at all times.
15. Support Vessel Skipper will attend to the pump at all times.
16. When both the nozzle attendant and Inlet Express are ready, the Bargemaster will give clearance to start the pump process.
17. Regular reports of fuel levels/progress will be relayed to the Inlet Express.

18. When 3/4 full the signal to stop pumping will be given.
19. The hose nozzle will be turned off as well.
20. The fuel hose will be carefully wound back to the Inlet express with spill pads and portable drip tray.
21. Fuel tank opening will be securely closed.
22. Visual inspection of the deck area and water surface within the boom to confirm no spill.
23. Containment boom brought back to deck
24. Support Vehicle will then depart when ready.

Onboard Tanks from replacement from support vessel landing craft

- Support vessel attends JUB at Planned time
- Barge Master and Vessel skipper to evaluate and confirm that the weather/tide and sea conditions are within safe working levels.
- Skate 3 will jack down to water level.
- The crew deploy containment boom around both vessels.
- Radio all marine traffic in area advice of refuelling process and ask for slow bow.
- The Support vessel will tie alongside Jack-Up Rig
- No operations will run concurrently with refuelling process
- **A strict 'de-match/no smoking' policy is now in place within the vicinity.**
- The Deck crane operator will position the crane over the fuel tank to be replaced.
- The barge Master, after checking with the support vessel crew signals the commencement of the lifting operations.
- The empty fuel tank is lifted from the deck of the JUB onto the support vessel
- The full replacement fuel tank is lifted from the deck of the support vessel onto the JUB.
- Visual inspection of the deck area and water surface within the boom to confirm no spill.
- Containment boom brought back to deck
- Support Vehicle will then depart when ready.

Fuelling onboard units

1. Refueling operator must be properly trained and signed off on fuel handling and transfer procedures as well as the requirements under the Spill Contingency Plan prior to commencing work.
2. Conduct pre-shift inspection of all fuelling equipment before beginning re-fuelling operations. Include a refueling preparedness checklist for fuel transfer during each refueling and maintain a log.
3. Use of the mandatory PPE.
4. Ensure no hot work or smoking.
5. No hose couples or joints over the water.
6. Do not use radios or cell phones.
7. A minimum of two people are required to participate in all fuelling activities where the emergency shut off switch cannot be reached in case of an emergency.
8. Ensure spill response materials are readily available in the refueling area, with a spill kits.
9. Never leave fuel nozzle unattended while refueling.
10. Ensure a fire extinguisher is located within 20 ft from any fuelling operation.
11. Measure the quantity required to be able to anticipate when tanks are full.
12. The operator of the machine being refueled must turn their machine off.
13. Place drip tray/ pads under around fuelling area.
14. Remove fuel tank cover and set aside.
15. Wrap spill pads around the fuel nozzle while transferring the hose to the equipment being filled up and use portable drip tray.
16. Turn on the pump and begin fuelling.
17. The use of locking devices on fuel nozzles is forbidden.

18. Place nozzle into fuel input and begin fuelling.
19. When fuelling is complete, shut off pump and remove nozzle from fuel tank and allow excess fuel from nozzle to drain, wrap spill pad around end of nozzle to prevent drips from exiting nozzle.
20. Keep the nozzle upright when returning nozzle back to nozzle holder/container.
21. Place all hoses neatly back in the proper cabinet when complete.
22. Replace fuel tank cap
23. Remove drip tray from under equipment.
24. Place all soiled spill pads into Oil rags container/drum.
25. Dispose of soiled absorbents properly after fuel transfer. If spill kit supplies are depleted, replenish them immediately.
26. In the event of a spill to water, notify Supervision/ HSE immediately after the leak or spill is contained.

Emptying Drip trays

Regular checks on drip tray are required. It is good practise to empty the drip trays early to ease the draining process.

1. Place absorbent pads around the drip tray.
2. A hand driven barrel pump will be used in the process.
3. Place the bottom of the pump into the drip tray.
4. Place the discharge hose into a suitable sealable container.
5. Clamp the hose into the container.
6. Carefully and slowly turn the pump handle ensuring the discharge hose is in the container.
7. Observe the progress of the draining process.
8. When the drip tray is empty continue turning the pump to ensure the hose is empty, visually inspect the discharge hose.
9. Seal the waste fluid container and clean off the pump.
10. Transfer waste to main waste oil storage tank.

Oil Changes

Refer to procedures in Appendix A

1. Ensure that drip trays are placed under pumps and connection points during oil change.
2. Carefully follow maintenance routine and undertake the oil change. Only open 1 drain hole at a time.
3. Ensure that waste oil is stored in an appropriate container and with sufficient bunding – see Storage of Fuels & Hydrocarbons (Appendix D).
4. Ensure that drip trays are emptied of oil and stored in a secure place.
5. Make visual inspections of equipment and hoses are carried out to ensure any wear can be rectified.

Minimum Requirements

All lifting operations are to be carried out **ONLY** by a trained and competent crane operators, slingers and signallers.
Any person who is not directly involved in the fuel transfer operation is to stand clear of the operating area.
All barge crew and visitors are to be instructed that there will be **NO** smoking during fuel transferring operations

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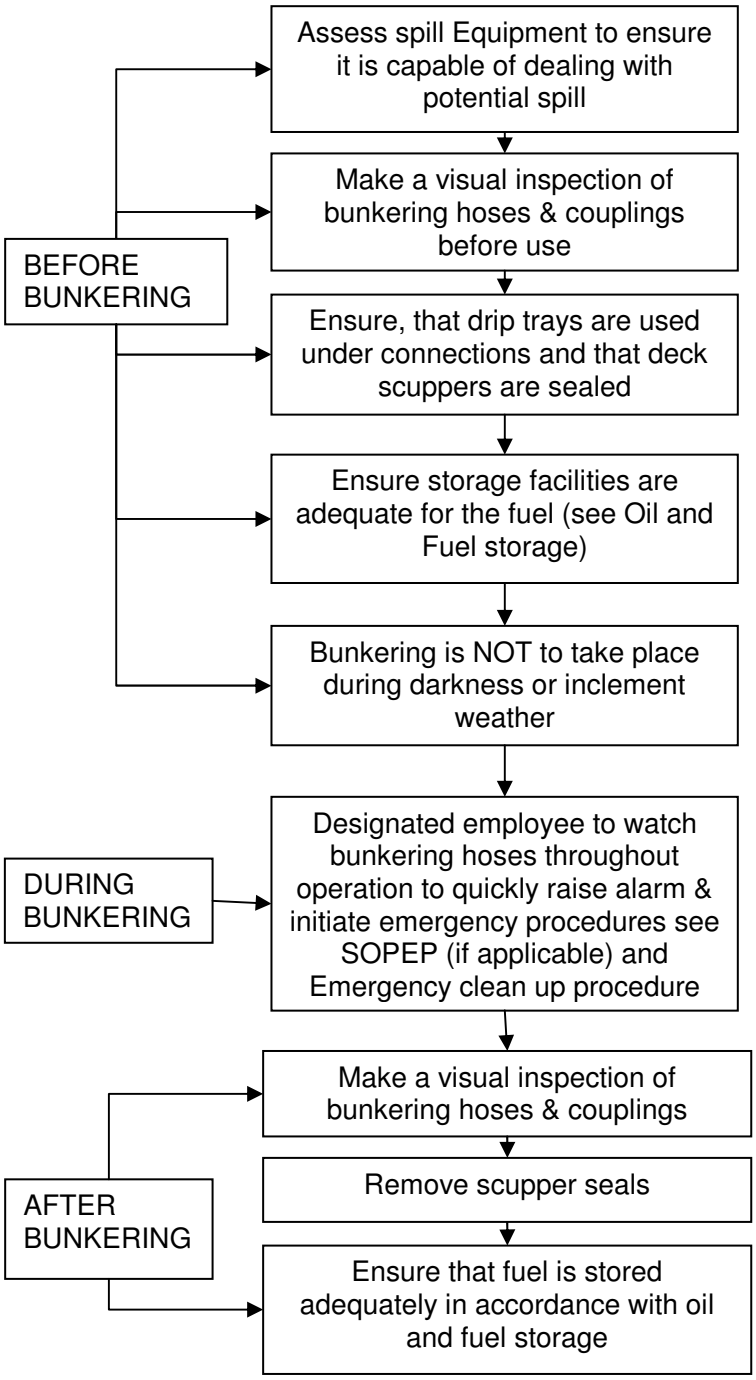
Appendix A - Bunkering Process plan



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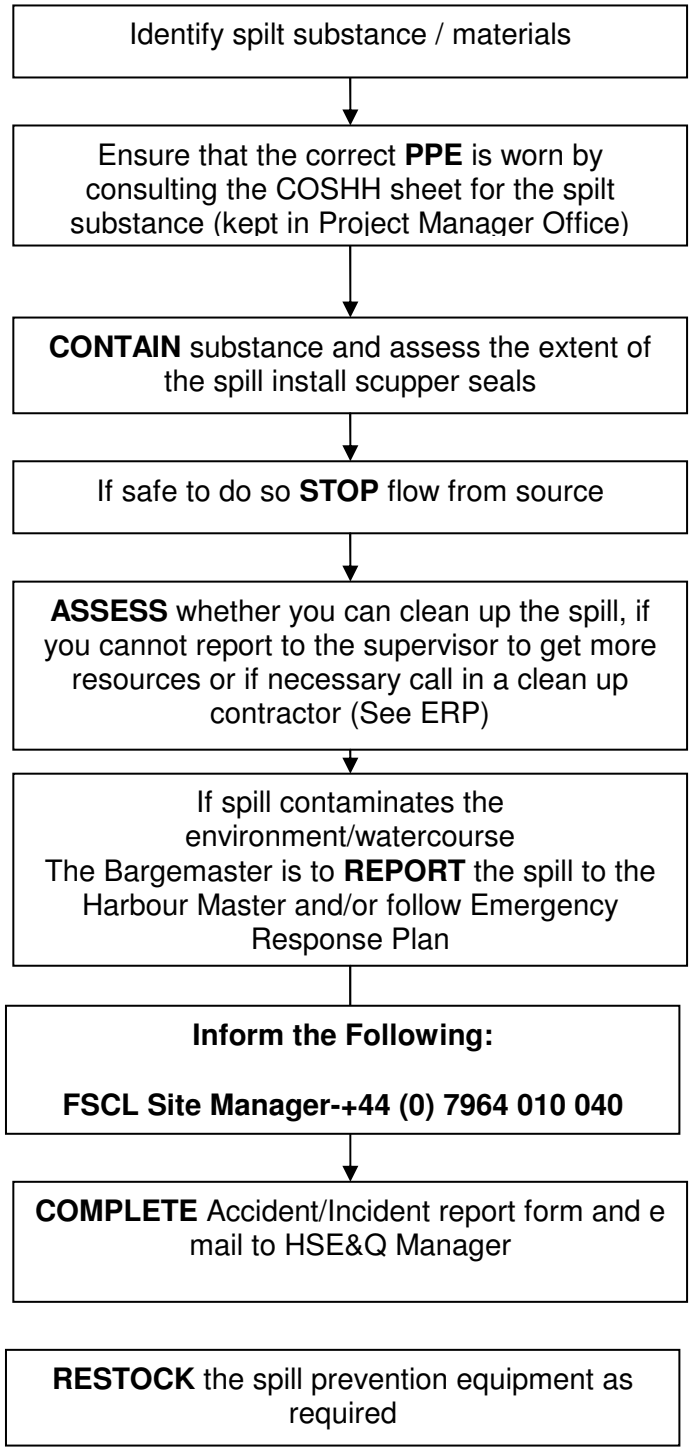
Appendix B - Spill Response Plan



Appendix C – Water pollution prevention Tool Box Talk

No. 4 Water pollution prevention (Fuel & Oil)

WHAT?

A large number of oil related water pollution incidents occur each year.

Discharging fuel or oil or water containing fuel or oil into drains or watercourses is illegal

Many pollution incidents are from unbunded tanks and can easily be avoided by following simple guidelines.

WHY?

- ***Avoid prosecution:*** Your employer or you as an individual can be prosecuted for causing water pollution
- ***Cost:*** The costs of clean up far exceed those to put control measures in place
- ***Damage to wildlife:*** Long-term damage to watercourses including fish kills. Oil spreads rapidly – one gallon of oil can completely cover a lake the size of two football pitches

DO

General

- ✓ Store oils away from drains or watercourses
- ✓ Return oil & fuels to storage areas after use
- ✓ Locate oil stores away from areas of high vehicular movement to prevent accidental damage
- ✓ Bund individual 205 litre drums to 25%
- ✓ Supervise all fuel deliveries
- ✓ Lock oil stores when not in use
- ✓ Use drip trays under all static plant & during refuelling from mobile plant.

Bulk Storage

- ✓ Bund tanks and bowsers to 110%
- ✓ Ensure bunds are free from cracks and leaks
- ✓ Regularly empty bunds & drip trays of rainwater, which should be treated as contaminated
- ✓ Keep all hoses and pipe work within bunded area after use
- ✓ Keep a spill kit near to fuel & oil storage areas & refuelling areas
- ✓ Report any irregularities or incidents.

DON'T

- X DON'T leave bunds & drip trays to overflow
- X DON'T leave refueling hoses outside of bunds after use
- X DON'T use high pressure delivery systems when refueling small containers
- X DON'T hose down spills
- X DON'T ignore spillages.

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Appendix D - Storage of Hydrocarbons Tool Box Talk

No. 5 Storage of lubes and fuel (hydrocarbons)

WHAT?

Petrol, diesel & oils inappropriately used, stored or disposed of can give rise to pollution of the environment.

Generally these substances are released into the environment through spillages during delivery or use through waste materials being poured directly to drains or gullies or being burned.

WHY?

- ***Avoid prosecution:*** If pollution is caused then prosecution may follow
- ***Avoid environmental harm:*** Petrol, diesel & oil are highly harmful to plants, animals & humans
- ***Cost:*** The cost of clean up & legal proceedings following a spillage incident far exceeds the cost of putting proper control measures in place.

DO

Storage

- Store bulk petrol, diesel & oil in bunded tanks & store smaller containers on drip trays that have 110% capacity of the largest container
- Keep a spill kit near to fuel and oil storage areas
- Store petrol, diesel & oil away from drains or surface watercourses
- Always put lids on containers after use
- Ensure that all containers are not damaged

Use

- Use the automatic shut off 'pistol grip' delivery systems when refuelling from tanks or mobile bowser – do not tamper with the shut off system at any time.
- Return spare fuels & oils to proper storage areas
- Ensure that all refuelling is constantly attended & only undertaken at least 10m away from watercourses and drains
- Lock the mobile bowser or storage tank after use
- Use drip trays under all static plant & during refuelling from mobile plant
- Clean up any minor spillages
- Use funnels when refuelling small plant & equipment to avoid spillages

Disposal

- Ask your manager what to do with waste oil, petrol & diesel prior to any disposal

DON'T

- DON'T leave bunds & drip trays to overflow
- DON'T leave refueling hoses outside bunds after use
- DON'T use high pressure delivery systems when filling small containers
- DON'T leave refueling operations unattended at any time
- DON'T leave containers in an area where they can be damaged
- DON'T ignore spillage
- DON'T pour petrol, diesel or waste oil down drains or gullies
- DON'T try to dispose of petrol, diesel or waste oils by setting fire to them.

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Appendix F CoSHH Data Sheet – Marine Diesel

FUGRO

COSHH Assessment

FUGRO

Product & process			
Product name:	Diesel	Assessment no.:	LF21A
State:	Liquid	Colour:	Amber
Contents/ingredients:	99% Petroleum hydrocarbons		
Supplier:	Various	Contact No.:	
Activity:	Refuelling		
Equipment used:	Double bunded tank, hose and nozzle		
Location:	Workshop / Excalibur / Deep Diver / Modular Jack Up / R100 Marine Drill		

Exposure			
Frequency of use:	Frequent	Duration of use:	Short (mins--)
Quantity used:	Large (Tonnes, Cubic Mtr)	Dust / Volatility:	Low
Ventilation:	General-- ventilation – do not use in a confined space unless using RPE as described in control measures		
Work practices / Hygiene:	No eating, drinking or smoking. All PPE and RPE is to be inspected prior to donning. Inhalation may cause anesthetic affects and asphyxiation in high concentrations.		

First aid	
Absorption (skin & eyes):	Wash contaminated skin with soap & water. If substance enters eyes wash immediately with clean water for at least 10 mins. If unsure seek medical attention
Ingestion:	Do not induce vomiting, keep at rest. Get immediate medical attention
Injection:	Injection: Seek immediate medical attention
Inhalation:	Inhalation: Remove to fresh air and seek medical advise if symptoms persist

Fire

Use a Carbon Dioxide Fire Extinguisher. Will produce toxic fumes when burning.

Spillage

Don appropriate PPE as per control measures and absorb spill into absorbent material. DO NOT ALLOW TO ENTER DRAINS OR UNMADE GROUND. Place in sealable container and dispose of as per disposal instructions below.

Disposal

Dispose of as hazardous waste EWC No 13 07 01. Use a licensed waste contractor.

Transport (UN No.)

UN No 1202 Diesel

Storage

Store in a well ventilated cool area in a double bunded facility. Protect from extremes of temperature

Health

Hazardous to the Environment Serious Health Effects

Control measures

Chemical resistant gloves (EN 374) Chemical resistant EN166 4

WEL:	No	WEL value:	Mineral Oil Mist TWA 5mg/m3 STEL 10mg/m3
MSDS reference:	LF21a Diesel fuel Nov 2011.pdf		
Relevant references / guidance:	If using-- in an enclosed space organic filter for respirator will be required filter A2. EN 405 .		

Hazard group: D

A	B	C	D	E	S
Least hazardous substances		More hazardous substances		Special cases	Additional Hazards

Completed by: HSEQ Advisor Stephen Dadd
Date: 2014-03-18
Reviewed by: HSEQ Manager David Pettigrew
Date: 2014-03-18

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2. Main Activity/Area of Work
3. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)
4. Constraints/Restrictions/Special Considerations
5. Methodology & Sequence of Work

Issue details:	Issue 1 Revision 1	
Distribution:	Controlled copies: Contract file	Uncontrolled copies: Client
Originated by: Andi Hagan	Reviewed/authorised for issue by: Andi Hagan	

A METHOD STATEMENT IS ONLY A SAFE METHOD WORKING IF IT IS DISCUSSED AND AGREED BEFORE WORK BEGINS AND THEN FOLLOWED BY THOSE CARRYING OUT THE WORK.

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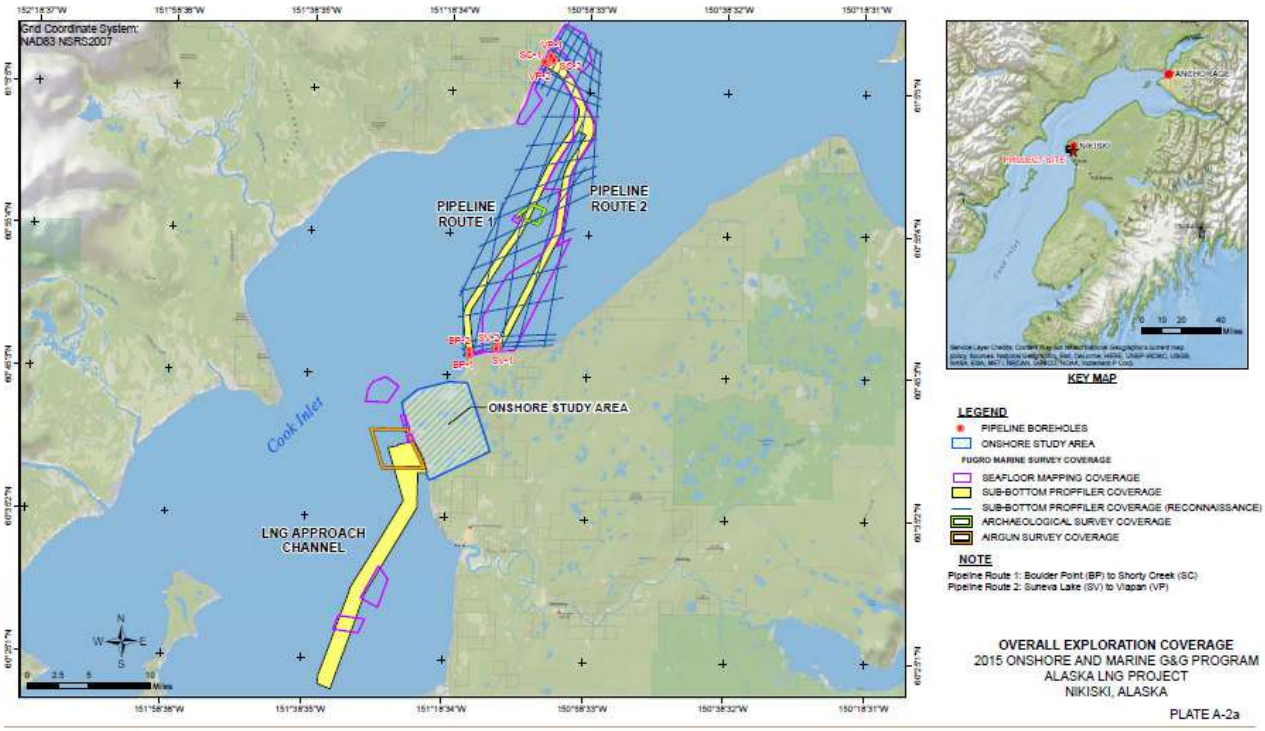
1. Introduction

This document has been produced to outline the steps that are followed prior to the Skate 3E Jack Up positioning on site. The location of the site is defined further in section 2 below.

2. Main Activity / Area of Work

The Main area of work is taken to include the following:

- Skate 3E Jack Up
- Work Site Areas, Cook Inlet, Alaska as defined below
  - Marine Terminal work site area – BH locations MB-1 to MB-34
  - Pipe Line Routes 1 & 2 – BP-1, BP-2, VP-1, VP-2, SV-1, SV-2, SC-1 and SC-2



Please refer to the Work Execution Plan for the most up to date version of the work site positions.

Main Activity of Work includes:

- Assessment of available environmental and geotechnical data
- Assessment of available seabed survey information (if required)
- Completion and review of Skate 3E Site Risk Assessment Calculator

This document should be read in conjunction with the Skate 3E operations manual.

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3. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

Document(s)	Serial Number(s).
Skate 3E Jack Up Barge – Operations Manual	Latest Issues
Skate 3E Stability book	240113/01/003A
Skate 3E Risk Assessment Calculator	Latest Issue
Alaska LNK Cook Inlet – Site A Marine Navigation Evaluation Report	7753RP0001 Rev A
http://tidesandcurrents.noaa.gov/	
Draft Marine Survey Report	04.10140094-5
Draft Marine Survey Report Route 2	04.10140094-4
Draft Marine Survey Report Route 1	04.10140094-3
Soil Foundation Investigation Report - Proposed LNG Dock Facility, Cook Inlet, Alaska	June 1967
Soil and Foundation Investigation Report - Construction Dock – Pacific Alaska LNG Project, Cook Inlet, Alaska	75-036-1 – 1975 and 75-093 - 1976

4. Constraints/Restrictions/Special Conditions

The operational limiting conditions of the JUB are as follows:

Item No	Description	Sea state (- Hmax (m and ft)	Wind speed Beaufort scale Force	Wind speed (m/s and mph)	Current (Knots)
1	Crew Evacuations	1.5m (5ft)	Wind Force 6	12m/s (27mph)	6
2	Crew Changes	1.0m (3.3ft)	Wind Force 6	12m/s (27mph)	4
3	Moving Between BH locations	0.70m (2.3ft) Hmax	Wind Force 4/5	10m/s (22mph)	2
4	Jacking Up/ Down	0.70m (2.3ft)	Wind Force 5	10m/s (22mph)	2
5	Drilling operations	1.5m (5ft)	Wind Force 6	12m/s (27mph)	6 note setting casing up to 1 knot
6	Towing Jack Up	0.70m (2.3ft)	Wind Force 4/5	10m/s (22mph)	4
7	Equipment/Sample transfer to/from jack Up	1m (3.3ft)	Wind Force 4	8m/s (18mph)	2 depending on orientation of vessel.
8	Fog	Visibility of less than 500m approximately			

These values are realistic limits based upon experience for when conditions are likely to become unworkable. They are indicative guidelines only and can vary up or down subject to compounding effects and other environmental conditions e.g. wave shape, wave period. At all times the decision of the Bargemaster, Tug Skippers or Supervisor is final in determining the suitability of the conditions for the operation.

The environmental limiting conditions (maximum allowable wind speed, wave height and current for a chosen location) for each exploratory location is calculated prior to the start of the project and checked before each rig move.

5. Methodology & Procedure of Assessment

The below methodologies and procedures have been completed during the tender stage and as further information has been received throughout the current life cycle of the project.

1. A review of the available environmental data is completed which includes but may not be limited to the following:
    - Wind data information – including speeds and direction
    - Wave data information – including heights, direction and percentage of time at certain levels.
    - Tidal/ Current information – including speed and variation
    - Water Depths
    - Sea Temperatures

In order to complete the above review, reference was made to the following document:

- Alaska LNK Cook Inlet – Site A Marine Navigation Evaluation Report 7753RP0001 Rev A
- http://tidesandcurrents.noaa.gov/

Additional sources of weather data were also studied for the area from local web sites but these have not been referenced.

2. A review of the available geotechnical data for the site is completed. This includes:
    - Summarising the ground conditions over the work area
    - Assessment of the sea bed conditions at the work site
    - Assessing possible leg penetration depths for Skate 3E
    - Assessing the risk for rapid punch through (RUP)

It should be noted that both of the reports used for this assessment are not located on the work site but to the south or north of the site.

The following reports were reviewed:

- Soil Foundation Investigation Report - Proposed LNG Dock Facility, Cook Inlet, Alaska – June 1967

- Soil and Foundation Investigation Report - Construction Dock – Pacific Alaska LNG Project, Cook Inlet, Alaska - 75-036-1 – 1975 and 75-093 – 1976

The geotechnical data that is available for the work site areas is used to build up a picture of the ground conditions at the sites and also give an estimate to leg penetration and RUP.

3. A review of the available geophysical seabed survey data is completed for the area of operations.

The following reports were reviewed:

- Draft Marine Survey Report - 04.10140094-5
- Draft Marine Survey Report Route 1 - 04.10140094-3
- Draft Marine Survey Report Route 1 - 04.10140094-4

All of the information and data that has been reviewed/ assessed in sections 1, 2 and 3 is used to build a conceptual model for the work site areas (Note not all information is available), which in turn feeds in to the Skate 3E risk assessment calculator.

4. Completion of Skate 3E Risk Assessment Calculator

Once all of the available information has be collated for sections 1,2 and 3 as listed above, the Skate 3E risk assessment calculator can be used for an individual or a group of locations as required. The calculator uses the below nomograms as the basis for its calculations. If the water depth, current/ tide or wave heights exceed the limits defined on the nomogram the location will fail and the user must adjust the inputs until they are within the limits of the nomograms or the location must be moved or not completed.

Jack up operations can also be completed under the following criteria:

- Storm Survival Locations/ safe haven location – The JUB should be jacked out of the water to allow for maximum tidal range, plus a maximum wave height expend at the site at time of year (including storm surge). The JUB must always be able to reach Safe Haven where environmental conditions have the potential to exceed safe operational limits. Where possible a storm survival location is established on site as soon as possible based if water depth and leg penetrations allow.

- Risk Managed Locations - the barge will be jacked up to a height that will allow the maximum forecast wave over a 3 day period with a 1.5m air gap to pass beneath. Note that within a 3 day period the weather conditions must be such that the Jack up can move off site to a safe haven or storm survival location if required.

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5. Rig Capability

A full jack-up analysis is not run for every location.

Instead the calculator used in section 6.4 is based on an analysis that covers a range of environmental conditions. The basis of this analysis was SNAME, but as SNAME was not acceptable to Class (GL) the results were modified to comply with class requirements.

This analysis calculated the maximum achievable wave height for multiple water depths, currents, wind speeds and leg penetrations. All locations that fall within this envelope are then assessed using these performance curves using the Skate 3E Risk Assessment Calculator.

The limits for the original analysis were

Overturning Stability	A resistance factor of 0.95 as per SNAME 8.2.3 was applied
Foundation Capacity	The analysis assumed a preload of 110 tonnes (based on preloading on the diagonal) and a resistance factor of 0.9 as per SNAME 8.3.1.3
Leg Strength:	Leg strength is the limiting structural capacity for the jack-up as the class structural submission is based on static loads plus leg failure in bending.

Holding System	The analysis was based on a holding system with 110t capacity. This was factored by 1.15 to obtain an ultimate holding capacity (pessimistic as the ultimate strength is higher) and then a resistance factor of 0.85 was applied.

6. On Site Procedures

- Pre-loading

  The recommended method for preloading Skate 3E is by self weight preloading on diagonal pairs of legs. Using this method, pre-loading can only be carried out when the jack up is just clear of the water, ensuring maximum weight on the legs. Pairs of legs are preloaded by releasing the weight of the vessel on opposite diagonal legs by extending a pair of diagonally opposite collars until a slight movement is seen between the leg and collar. This confirms that all weight has been released. If the seabed is soft the hull may sink back into the water at this point. This process is to be repeated until sufficient end bearing has been obtained on the two load bearing legs.

  This process is then repeated on the opposite diagonal pair. Only when this process is completed can the rig be raised above the water

  As the above process pre-loads the jack-up on a pair of diagonal legs with its entire self weight, unlike conventional or 3 legged jack ups, the risk of RUP is greatly reduced due to the 2:1 factor of preload to static foundation load. Additionally the ability to support the entire jack-up on a diagonal pair of legs gives additional security should a RUP even occur.

  As mentioned previously the risk of RUP is also assessed using the available geotechnical data for the work site areas.

- Final deck level of Jack Up
  The final working level of the jack up is determined by:
  - Water depth at location
  - Maximum tidal range over the expected period at the drilling location
  - Maximum Wave height (Storm survival or risks managed)
  - 1.5m above crest elevation

- Methodology for checking leg penetration depth leg depth
  Once the Jack up has reached its final working height and the riser caser has been lowered to sea bed, a deck level to sea bed measurement is taken inside the riser casing, as well as a measurement to sea level from deck level. Using these measurements it is then possible to work out the following

  - Leg Penetration = Leg length above deck level – Deck level to Mud line
  - Water Depth = Deck level to Mud – Deck level to water level

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10. Emergency Procedures
11. Personal Protective Equipment/Safety Equipment
12. Photos
13. Methodology & Sequence of Work
14. Appendices

Developed by:	Reviewed/authorized for issue by:

A METHOD STATEMENT IS ONLY EFFECTIVE IF IT IS DISCUSSED AND AGREED BEFORE WORK BEGINS AND THEN FOLLOWED BY THOSE CARRYING OUT THE WORK.

1. Introduction

This document outlines the general procedure adopted by Fugro Consultants, Inc. (Fugro) for performing Geophysical Wireline Logging, using the PS Suspension Logging technique from a Jack Up Barge (JUB).

2. Main Activity / Area of Work

Geophysical Wireline Logging using the PS Suspension Logger will be performed on board the Skate III JUB during the nearshore site investigation for the AKLNG project located near Nikiski, Alaska. The PS Suspension Logger will be deployed within a total of 10 nearshore geotechnical borings. Scope of Work Drawings can be found in Appendix A of the Project Execution Plan.

Geophysical Wireline Logging surveys include, but are not limiting to the following activities;

- Mobilization and demobilization of survey equipment from shore to JUB
- Personnel transfer to and from JUB
- Data collection with a PS Suspension Logger on board JUB

3. Manpower and Supervision

Nominated Person	Responsibility
Project Geophysicist	• Provide specifications for the data acquisition • Advise Field Geophysicist on the project requirements and the requirement to comply with this method statement in order to enable the work to be carried out safely and obtain the required quality.
Field Geophysicist	• Overall responsibility for all site activities • Review method statement and associated Task Risk Assessments (TRA) with employees performing the task • Regularly inspect activity for compliance • Communications with the project manager, site manager and project SSHE staff during the data collection operations • Take custody of electronic data files and site notes

4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

Document	Reference Number
AKLNG Project Execution Plan, specifically; Field Exploration Plan (Part A, Section 4) Project Safety Management Plan (Part D) Scope of Work Drawings (Appendix A) Task Risk Assessment Register (Appendix M) Emergency Response Plan (Appendix O)	
Method Statement – Skate III Mobilization	MR-GT-MS-001
Method Statement – Crew Transfer	MR-GT-MS-003
Method Statement – Marine Drilling Operations	MR-GT-MS-005
Safety Data Sheet – 12v Lead Acid Batteries	

5. Task Risk Assessments

Number	Title
GEOPHY-101	Wireline Logging
ON-GN-TRA-310	Vehicle Usage
ON-GN-TRA-311	Material Handling and Moving
ON-GN-TRA-324	Battery Charging
RAS 001	Working over Water
RAS 004	Personnel Transit by RIB
RAS 005	Working Time
RAS 022	Access via Rope Ladder
RAS 033	Man Overboard
RAS 035	Emergency Abandonment & Evacuation of a Jack Up Barge

6. Security - Barriers/Fences/Warning Signs

Access to the JUB will be restricted to authorized Fugro employees and the Client Representative.

The PS Suspension Logging operations will be conducted from the drill floor of the JUB upon completion of drilling operations. The Driller will advise the Field Geophysicist when it is safe to access the drill floor

Although not required, warning signs / caution tape may be used to cordon off the wireline logging winch and the wireline to minimize potential trip hazards.

7. Constraints/Restrictions/Special Conditions

Drilling and wireline logging operations onboard the JUB will take place 24 hrs per day 7 days per week. Operations will be scheduled in such way that crew transfers will predominantly be carried out during daylight hours and time of suitable tide height and current flow.

8. Plant and Equipment

The following equipment may be used during the PS Suspension Logging surveys:

- OYO PS Suspension Logger Probe
    - Diameter : 54 mm
    - Length : 6.50 m with additional 0.83 m weight section
    - Weight : 9.2 kg (without weight section)
- Robertson Geologging 500m Winch (24v DC, 3/16th, 4 core cable)
- Robertson Geologging Micrologger II
- Robertson Geologging Digital Suspension Loggigng software on Laptop PC

It is anticipated that all equipment will be mobilized to the JUB while it is stationed at dock.

In addition to the equipment list above, the following spare parts should be available locally in the event of failure, damage or loss:

- Spare probe sections – source and hydrophone
- Spare spring for source section

Contact should also be made with equipment manufacturers and multiple third party equipment rental companies prior to the commencement of the project to ensure that replacement components, in addition to the spare parts list above, can be shipped to site at relatively short notice.

9. Materials (handling/storage/disposal)

No investigation derived waste or contaminated materials are expected to be generated.

The PS Suspension Logging equipment contains the following hazardous materials:

- 12v lead acid batteries – AGM sealed batteries (if locally available) are to be used over traditional "wet" lead acid batteries

Under normal operating conditions, personnel will not come in contact battery acid. In the event of unplanned events, refer to the accompany Safety Data Sheets for handling and first aid response if the integrity of the battery housing is suspected to be defective. For further guidance on the use and charging of batteries, refer to Risk Assessment ON-GN-TRA-324 Battery Charging. In addition, disposal of spent batteries is covered under the Routine Waste section of Project Safety Management Plan (Part D of Project Execution Plan) in which segregated recycling / waste disposal receptacles have been set up at the site office for collection and transportation onto the Kenai Peninsula Borough Waster Transfer Station.

The total weight of the equipment required to perform PS Suspension Logging surveys can be up to 300 – 450 lbs. In particular, the logging winch weighs 120 – 150 lbs – correct material handling is paramount. Where possible, equipment should be transported using mechanical assistance. It is anticipated that should the equipment be manoeuvred by crane, all lifting operations will be conducted by Fugro Seacore employees who are trained and certified riggers.

10. Emergency Procedures

The JUB emergency procedures shall be adhered to at all times. Details can be found in the project specific Emergency Response Plan in Appendix O of the Project Execution Plan.

11. Personal Protective Equipment (PPE) & Safety Equipment

The following personal protective equipment will be worn:

Item	Detail
Safety footwear Work gloves Safety glasses Hard hat	As per requirements for Task Risk Assessment ON-GP-TRA-104 Wireline Logging Surveys
Coveralls Ear defenders / ear plugs Personal flotation device Cold water transfer suit	As per requirements of Project Safety Management Plan (Part D of Project Execution Plan)

Additional personal protective equipment to comply with the accompanying SDS guidelines and for unplanned site operations should procured and readily available locally.

12. Methodology & Sequence of Work

12.1 Equipment Set Up

Pre-Task Activities
Prior to commencement of equipment set up, the logger shall follow the JUB's permit to work system and participate in tool box talks with other workers on the drill deck. Topics will include, but are not limited to:

- Environmental conditions e.g. wind speed and direction, sea state, currents, visibility, rain etc.
- Vessel motion and station keeping ability;
- Planned work scope / duration;
- Working area and any other simultaneous operations;
- Equipment status and conditions;
- Personnel protective equipment.

Wireline Tool Assembly
Assembly of the relevant wireline tools should ideally commence approximately 1 hour prior to the completion of borehole preparation so as to minimize any downtown. This is under the assumption that it is safe and practical to occupy the work area and authorization has been given by the driller / drill crew.

Prior tool assembly, all equipment will be visually inspected for any damage. Care should also be taken when connecting various subsections of the tools to maintain the integrity of the electrical connectors and condition of o-rings and seals.

All equipment should be assembled as per the Manufacturer's Instructions.

Depending upon sea conditions, assembled tools should be stored on work stands or chocked on the vessels deck, using caution to minimize any trip hazards. Barricades may be used as appropriate.

Once assembled, the wireline tools should be powered up to verify communication with the surface controls. If appropriate, a test data file can be recorded as an operational check.

Positioning of Wireline Winches and Sheaves
Wireline winches will be fastened to the vessel using welds and tag points or through the use of shackles and straps. It is preferable for the fastening system to have some degree of play to

both assist with re-spooling of cable, and to provide an indication of any potential snagging of the tools within the drill pipe.

The instrumented sheave will be fastened to the drill mast by the drill crew using shackles and straps. Care should be taken to ensure that it is aligned with the wireline winch. The pathway between the instrumented sheave and the winch should have unobstructed line of sight with ample lighting. If necessary, barricades can be used to demarcate the area to minimize the trip hazard of the wireline.

All sheaves, wires, shackles, hooks and connections will be checked by the drill crew to ensure they are fit for their purpose.

Pre-Deployment Checks

Prior to deploying any wireline tools, the logging engineer should collect the following information:

- A copy of the drillers log and preliminary geotechnical log to gain an understand of the subsurface conditions / stratigraphy;
- Water depth, sea level from deck and offset from deck to logging datum (top of drill pipe or power swivel);
- Total length of drill pipe, depth of drill bit, total depth of borehole; and
- Any other information regarding the borehole from the driller / geotechnical engineer.

This information should be readily available during logging in order to be able quickly determine where the wireline tools are (top, bottom and measurement point) with respect to the drill pipe, borehole and sea floor.

12.2 Wireline Logging Operations

Deployment of Wireline Tools – Drill Crew

The following outlines the procedure to be followed by the vessels drill crew when deploying the wireline tools:

- Position / attach / fix compensated sheave;
- Spool out wireline from winch and feed through the instrumented sheave and through the compensator and / or tool handler (if present). Care should be taken to ensure the wireline is under some tension at all times to avoid damaging / snagging the wireline and to ensure the wireline seats properly within the sheaves;
- In unison, raise logging sheave in derrick and spool out wireline from the winch maintaining some tension;
- Connect tool to wireline and raise from work stand or deck;
- Use tool handler or manually position tool over drill pipe;
- Lower tool into the drill pipe 3 - 4 m.

Operation of Wireline Tools – Wireline Logger

Once the wireline tool has been deployed within the drill pipe, control of the wireline winch will be passed to the geophysicist for data collection, using the following procedure;

- Raise the wireline tool until the top reaches the logging datum (top of drill pipe or power swivel);
- Zero tool depth;
- Lower probe 10 – 20 m inside the drill pipe
- Power up the tool and confirm communication and validity of data signals;
- Run the wireline tool to the bottom of the borehole at 20 – 30 m/min. When the tool is within 10 – 20 m of the drill bit or bottom of the boring, this speed should be lowered to less than 10 m/min. Note, to determine these depths, one must add the total length of the tool to the displayed depth;
- Stop the tool at the final depth – this will likely be at or slightly less than the drilled depth and will be accompanied by a reduction in tension on the wireline. Care must be taken to minimize this reduction in tension;
- Prepare tool for data collection and record data using collection parameters as per the project specifications;
- Extra care should be taken when the tool is re-entering the drill bit;
- Once inside the drill pipe, save data and create back-up on removable media;
- Raise tool at 20 – 30 m/min until it is 5 – 10 m from the top of the drill pipe and hand logging controls to drill crew.

Recovery of Wireline Tools – Drill Crew

The following outlines the procedure to be followed by the vessels drill crew when deploying the wireline tools:

- Raise wireline tool out of the drill pipe;
- Manually move or use the took handler to position the wireline tool to one side of the derrick and lower to deck;
- Disconnect tool from wireline and store on work stand or chocked on deck;
- In unison, lower logging sheave from derrick and spool in wireline on the winch maintaining some tension;
- Spool in wireline on winch whilst removing from tool handler, compensator and instrumented sheaves.

12.3 Post Site Work

At the earliest possible convenience after acquiring data, or at the end of every day or shift of acquisition, the electronic data files should be downloaded from the survey equipment and stored on a computer.

The Field Geophysicist should ensure that the data files are named or stored under directories with a logical naming convention to avoid accidental deletion or duplication and to ensure others can readily identify the nature of the contents of the files.

It is recommended that any site notes recorded in paper format be transferred to electronic files (scanning or data entry) and saved with the downloaded files.

The downloaded files should also be backed up to removable media, such as a floppy diskette, cd, or usb flash drive. The removable media should then be stored in a different location to the computer to avoid theft, loss or damage of both copies of the data.

For projects with a duration of more than three days, the data should also be transmitted (ideally) on a daily basis to Fugro's Houston office and transferred to the central server storage on a regular basis.

After demobilization, it is the Field Geophysicist responsibility to ensure that all electronic data files have been transferred to the central server, if not already done so.

The Field Geophysicist will be responsible for ensuring that all field logs, sketches and other paper records that we obtained on site are transferred to the project folder and scanned and saved on the central server.

The Field Geophysicist shall also be responsible for ensuring all equipment is demobilized, cleaned and stored. Should any faults, problems or non-conformances been observed during the site works, these will also be documented accordingly.

15. Appendices

Document	
AKLNG Project Execution Plan, specifically; Field Exploration Plan (Part A, Section 4) Project Safety Management Plan (Part D) Scope of Work Drawings (Appendix A) Task Risk Assessment Register (Appendix M) Emergency Response Plan (Appendix O)	
Method Statement – Skate III Mobilization	MR-GT-MS-001
Method Statement – Crew Transfer	MR-GT-MS-003
Method Statement – Marine Drilling Operations	MR-GT-MS-005
Safety Data Sheet – 12v Lead Acid Batteries	
GEOPHY-101	Wireline Logging
ON-GN-TRA-310	Vehicle Usage
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RAS 022	Access via Rope Ladder
RAS 033	Man Overboard
RAS 035	Emergency Abandonment & Evacuation of a Jack Up Barge

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A METHOD STATEMENT IS ONLY A SAFE METHOD WORKING IF IT IS DISCUSSED AND AGREED BEFORE WORK BEGINS AND THEN FOLLOWED BY THOSE CARRYING OUT THE WORK.

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1. Introduction

This method statement outlines the sample handling and transport procedures aboard the Skate 3 Jack Up Barge in Nikiski, Alaska for the Alaska LNG (AKLNG) Geophysical and Geotechnical Site Investigation Project. It covers the procedures for obtaining, processing, packaging, and transportation to shore of samples. It does not cover procedures for handling of samples by the onshore laboratory or shipment of samples to offsite laboratories.

2. Work Description

The marine geotechnical program consists of 42 marine borings to depths of 50 feet to 300 feet below mudline. Boring depths may be adjusted depending upon subsurface conditions, leg penetrations, and weather/sea conditions. The program will be performed in accordance with *LNG Facilities & Marine Pipeline Route Geophysical And Geotechnical Site Investigation 2015 Scope Of Service* (USAL-PL-GBZZZ-00-000001-000). Disturbed and undisturbed soil samples and cores will be collected at regular intervals at each planned borehole location. Drilling and sampling methodologies are addressed in Method Statement 004 - Drilling Operations and in Section 10 of this Method Statement.

Upon recovery, samples will be logged, photographed, packaged, labelled, stored, and transported to shore in general accordance with American Society for Testing and Materials (ASTM) Standards and internal Fugro guidelines, as outlined in this Method Statement.

3. Manpower and Supervision

Nominated Person	Responsibility
Marine Geotechnical Project Manager	Advises the crew on project instructions and requirements to comply with this Method Statement and complete work safely. Ensures projects specifications and requirements are met.
Shift Geotechnical Engineer (On-board)	Advises the drill crew and ensures boreholes are completed in alignment with project standards. Responsible for preparing field boring logs, sample chain of custody and other documentation. Ensures proper processing and packaging of samples for safe transfer to the onshore site laboratory.
Barge Master (Drill Supervisor)	Advises the drill crew and ensures boreholes are completed in alignment with project standards. Coordinates lift plans and operations to safely transfer samples off of the jack up barge and to shore. Ensures all crew members are suitably briefed on this Method Statement.
Drill Crew	Operates and maintains equipment for drilling and sampling operations. Prepares driller's logs and assists with transfer of samples off of the jack up barge.

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4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

Activity	Document(s)
SPT Sampling	ASTM D1586: Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils
Thin-Walled Tube (Shelby) Sampling	ASTM D1587: Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes
Soil Logging and Descriptions	ASTM D2488: Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
Preserving, Sampling, and Handling Samples	ASTM D4220: Standard Practices for Preserving and Transporting Soil Samples
Rock Coring	ASTM D2113: Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration
Rock Core Logging & Handling	ASTM D5079: Standard Practices for Preserving and Transporting Rock Core Samples ASTM D6032: Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core Association of Engineering Geologist, Core Logging Committee, South Africa Section, "A Guide to Core Logging for Rock Engineering," Bulletin of the Association of Engineering Geologist, Vol 15, No. 3, 1978, pp.295–328.
Scope Of Work & Project Specifications	*LNG Facilities & Marine Pipeline Route Geophysical And Geotechnical Site Investigation 2015 Scope Of Service* (USAL-PL-GBZZZ-00-000001-000)
Project Procedures	*Project Execution Plan, Pre-FEED Level 2015 Onshore And Marine Geotechnical & Geophysical (G&G) Program*
Drilling and Sampling Procedures	Method Statement 004 - Drilling Operations
Sample Transfer	Method Statement 005 – Lifting Operations on Site

5. Laboratory Testing

The only laboratory testing planned on-board the jack up barge is visual-manual classification and shear strength estimation for fine-grained soils using pocket penetrometers and torvanes.

6. Task Risk Assessments

Risk assessments relevant to this Method Statement include:

TRA Number	Activity
RAS 013	Drilling Operations
RAS 014	Craneage
RAS 031	Sample Preparation & Testing
RAS 038	Removing Core Sample from Inner Barrel
RAS 047	Transporting Materials by Barge or Boat
RAS 049	Manual Handling (Lifting Assessories)
RAS 070	Mechanical Lifting Operations – Mobile Crane
RAS 071	Mechanical Lifting Operations – Hiab and Deck Mounted Crane

7. Materials

Material on-board the jack up barge for sample handling and transport procedures include, but are not limited to:

- Containerized work area
- Table
- Laptop
- Printer w/ scanner
- Binders
- Paper
- Pens, pencils, and permanent markers
- Field notebook
- Tape measure
- Small hand tools
- Sample labels
- Plastic sample bags
- Plastic cling-wrap
- Aluminum foil
- Shelby tubes
- Shelby tube, seals, and caps
- Wax, wax pot, and ladle
- Sealing tape
- Core boxes
- Core divider (wood, foam, or plastic)
- Digital camera
- Colour strip chart
- Photo board
- Sample totes
- Pallets
- Rigging
- Rags
- PPE

8. Emergency Procedures

Emergency procedures are detailed in Appendix O – Emergency Response Plan of the Project Execution Plan. Emergency procedures will be communicated to project staff during project induction and throughout the program.

9. Personal Protective Equipment (PPE) & Safety Equipment

The following protective equipment will be worn as specified in the following table:

PPE Type	When to be used
Coveralls	mandatory - all sites/activities
Safety helmet	mandatory - all sites/activities except within container laboratory, galley, or other covered area.
Safety boots/shoes	mandatory - all sites/activities
Safety glasses or goggles	mandatory - as per risk assessment – working with cutting sample activities
High visibility vest/jacket	mandatory - vehicle movements & slinging
Ear defenders/ear plugs	mandatory - noise above the FAL – 80dB(A)
Lifejacket	mandatory - working over water / outside the guardrails
Safety Harness	mandatory - working at height /outside a protected area (no other control measure in place e.g. guardrails etc)
Gloves	mandatory - suitable hand protection worn at all times

10. Methodology & Sequence of Work

Sampling Program

Disturbed and undisturbed soil samples will be collected at each planned borehole location at the following intervals:

- 0 to 40 feet below seafloor: 2.5-foot intervals
- 40 to 100 feet below seafloor: 5-foot intervals
- Below 100 feet below seafloor: 10-foot intervals and at stratum changes

Soil samples will be collected using the following methods:

- Standard Penetration Test (SPT) to obtain disturbed (split spoon) samples in granular materials.
- Piston Sampling to obtain undisturbed Shelby tube samples in cohesive fine-grained materials.
- Push Sampling to obtain undisturbed Shelby tube samples in conditions not suitable for Piston Sampling (such as hard clays).

Additionally, cores of soil and rock can be obtained with the 4-inch (102-millimeter) Geobor-S wireline coring system. Coring can be attempted between standard soil sampling intervals to obtain additional information on stratigraphy and strata breaks. Recovery will vary depending on material

encountered. Coring can also be utilized to attempt sampling of material that result in SPT refusal (such as large gravel, cemented sands, or cobbles). If two successive sampling intervals result in refusal, SPT sampling will be suspended and substituted by Geobor-S coring. SPT or other suitable sampling methods will be resumed if a subsequent strata change occurs. SPT refusal is defined as 50 blows, or 10 successive blows with no observable advancement of the sampler, within the first 6-inch (seating) interval of the test.

Bedrock is not anticipated to be encountered at the site. If encountered, continuous Geobor –S coring will be performed until the end of the borehole. The same requirement of two successive SPT refusals will be utilized as criteria to suspend sampling.

Special attention will be given to the collection of intact samples if soft to medium-stiff fine-grained overburden soils are encountered within the upper 40 ft of each borehole. Such materials will preferably be sampled with the Piston sampler. If this is not feasible (such as due to sand/gravel content or lack of cohesiveness), the SPT sampler will be utilized. If no intact samples are collected under such conditions the upper portion of the borehole will be re-drilled to resample the missed interval.

In the event no sample is recovered from a sampling interval, an attempt will be made to resample the missed interval. Depending on anticipated soil type and the suitable sampling method, the resample will be performed at the same depth or immediately below the missed interval at the on-board engineer's discretion. Typically, disturbed samples of granular material will be resampled at the same depth to recover representative material with multiple attempts noted on boring log. Undisturbed samples of fine-grained material will be taken below the missed interval. In addition, SPT samples may be advanced an additional 6 inches beyond the standard 18-inch penetration to aid in recovery. Minimum recovery will be 6 inches for SPT samples and 12 inches for Shelby tube samples. All attempts will be made to achieve maximum recovery when coring, and adjustments will be made accordingly during drilling operations.

Sampling and coring will be performed in general accordance with American Society for Testing and Materials (ASTM) Standards, as outlined in Section 4 of this Method Statement.

Prior to commencement of drilling operations at each proposed borehole location, a Borehole Requirements form will be generated and a sampling program will be agreed upon with AKLNG's technical representative. If unexpected conditions are encountered, the program will be modified at the on-board engineer's discretion to ensure the most representative samples are obtained.

Upon recovery, samples will be logged, photographed, packaged, labelled, stored, and transported in general accordance with ASTM and internal Fugro procedures as outlined in Section 4 of this Method Statement and described below.

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Sample Logging

A field log will be prepared for each borehole location. Proposed locations and borehole numbers are presented in Appendix A of the Project Execution Plan. The field log will include general information for each borehole including but not limited to:

- Project Number and Name
- Location
- Borehole Number
- Project Manager
- Client
- Engineer (Logger)
- Driller
- Start and End Times
- Completion Depth
- Mudline Elevation
- Coordinates

Each sample will be logged and described on the boring log. At a minimum, the following information will be recorded:

- Top and bottom depth
- Sample type
- Sample number (see procedure below)
- Time of recovery to deck
- SPT blow counts and N-value
- Sample penetration length
- Sample recovery
- Material description
- Pocket pen and torvane readings
- Start and end time of core runs
- Driller's notes (such as rig behaviour, loss of circulation, depth of casing, etc.)
- Logger's notes (deviations from sampling program, cuttings observations, etc.)

Sample Numbering

Soil samples will be assigned sequential numbers with the designation S-#. If various material types are encountered in a single sampling interval, sub-samples will differentiated alphabetically (S-#a, S-#b, S-#c, etc.).

Cores will be assigned sequential numbers with the designation C-#. Numbering will be independent of soil samples (i.e. Start with C-1). Sub-samples from cores will be assigned sequential numbers with the designation R-# where the "#" corresponds with the core number (C-#). Multiple sub-samples will be differentiated alphabetically (R-#a, R-#b, R-#c, etc.).

Sample Labelling

Each sample will be labelled with stickers. Labels will include:

- Project number
- Borehole number
- Sample number
- Sample top and bottom depth

Label information will be written directly on core boxes, as well.

Sample Handling and Packaging

Sample handling and packaging procedures for each sample type are described below:

Sampling Method	Procedure
SPT / Split-Spoon Samples	1. Remove sampler from sampling rods. 2. Remove sampler head and shoe, being careful not to spill any sample. 3. Open split-spoon. 4. Measure recovery. 5. Photograph sample. 6. Perform pocket penetrometer and torvane on suitable fine-grained material. 7. Record sample information and material description on boring log. 8. Double-bag material into well-sealed plastic bags. Label should be filled out and affixed to the inner bag. 9. Place sample in plastic tote. 10. Record sample information on sample inventory sheet/chain of custody. 11. Clean sampler and reassemble for next sample interval.
Shelby Tube Samples (Piston or Conventional Push)	1. Remove Shelby tube from sampler head. 2. Clean and dry Shelby tube. 3. Remove cuttings from top of sample, if possible. 4. Measure recovery. 5. Perform pocket penetrometer and torvane on bottom of Shelby tube. 6. Remove approximately 3 inches of material from the bottom of the Shelby tube. Double-bag material into well-sealed plastic bags. Label should be filled out and affixed to the inner bag. 7. Photograph material removed from bottom of Shelby tube. 8. Record sample information and material description on boring log. 9. Affix label to Shelby tube and cover with clear packing tape to protect label. 10. Affix soil seals in each end of the sample tube flush with the soil surface. 11. Pour approximately 3 inches of melted wax into the bottom of the Shelby tube and allow to cool and solidify. 12. Affix cap to bottom of Shelby tube with tape. Flip tube

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Sampling Method	Procedure
	over and pour approximately 3 inches of melted wax into the top of the Shelby tube. Cover holes in sample tube with tape if necessary. Allow wax to cool and dry. 13. Affix cap to top of Shelby tube with tape. 14. Place Shelby tube in wooden shipping box and store in a vertical, upright orientation. 15. Record sample information on sample inventory sheet/chain of custody.
Core Samples	1. Remove plastic liner from core barrel. Mark top and bottom of core. 2. Slide core out of plastic liner into core box. If core will not slide out, liner may need to be split longitudinally. Arrange core from top to bottom starting in the upper left corner of the core box. 3. Measure recovery. 4. Use core dividers to label the top and bottom of the core run, as well as the top and bottom of zones of no recovery. 5. Label the core box. 6. Perform pocket penetrometer and torvane in suitable fine-grained material. 7. Record sample information and material descriptions on boring log. 8. Photograph the core box when full. 9. Select representative sub-samples from the core for preservation. Soil should be double-bagged into well-sealed plastic bags and placed into plastic sample tote. The label should be filled out and affixed to the inner bag. Intact rock core should be wrapped in plastic wrap and aluminium foil, and labelled. A core divider should be placed in the core box to indicate the location and depths of removed sub-samples. Record sub-sample information on boring log. 10. Close core boxes and stack on wooden pallets, taking care to ensure core boxes are stable and pallet is not overloaded. 11. Record sample and sub-sample information on sample inventory sheet/chain of custody.

Sample Photography

SPT, core samples, and the material removed from the bottom of Shelby tubes should be photographed in well-lit conditions, free of shadows. Samples will be oriented with the top to the

left. Photos will contain an identifying label, tape measure as a reference scale, and color strip chart. The photo should be taken without zooming and with the sample taking up as much of the frame as possible. Photos should be checked for quality and multiple photos taken if necessary. The background of the photo should be free of excessive clutter.

Sample Storage

Bag samples will be stored in plastic totes. The totes will be closed with plastic zip ties to ensure they are secure for transfer. Shelby tube samples will be stored vertically and upright in special-purpose wooden shipping boxes. Core boxes will be staged on a wooden pallet, with care taken to ensure the boxes are stable, and the pallet is not overloaded. When the pallet is full or at the completion of the borehole, the core boxes will be strapped and secured to the pallet. All samples will be stored in a location to minimize exposure to extreme weather conditions, and storage time on the jack up will be minimized as much as operationally possible.

Chain of Custody

All samples and associated information will be entered into a Chain of Custody/Sample Inventory Form to maintain a register of samples collected and for tracking of sample transfer.

Sample Transfer to Shore

Samples will be regularly transferred to shore, typically upon completion of each borehole or as soon as operations allow depending on weather conditions and other limitations. Sample totes, Shelby tube boxes, and rock core boxes will be loaded and secured on pallets or lifting crates. The landing craft vessel will be used for all sample transfers. Samples will be offloaded from the jack up barge to the landing craft vessel following the procedures outlined in Method Statement 005 – Lifting Operations on Site. Offloading will generally occur when the jack up barge is jacked down near the waterline to limit the distance of the lift. The landing craft vessel will bring the samples to shore at the Arctic Slope Regional Corporation (ASRC) Rig Tender's Facility. At the quayside, samples will be transferred from the landing craft vessel to shore following Method Statement 005 – Lifting Operations on Site. The samples will then be transferred by truck or forklift from the quayside to the onshore laboratory at ASRC for preliminary laboratory testing, short term storage, and packaging for shipment to offsite laboratories.