Appendix B contains discussions of analytical procedures used in our engineering analyses. Appendix C contains a positioning report by Fugro Chance, Inc., of Lafayette, Louisiana.

For the purposes of discussion and presentation, "driven pipe pile" is used in this report to represent foundation piles, caissons and conductors, unless otherwise specified.

2.2 FIELD AND LABORATORY INVESTIGATIONS

The field investigation was performed on June 26 through 28, 2008, from the R/V *Seaprobe*. The soil conditions were determined by performing four exploratory borings, two at each SPM location with one boring at a selected anchor leg location, and one boring at the proposed PLET location. Enterprise Field Services selected the boring locations. These borings were drilled to a penetration of 131-ft below mudline. The water depths at the boring locations ranged from 110 to 113 ft. A chronological summary of field operations is presented in Appendix A.

2.2.1 Exploratory Borings

FMMG personnel drilled the soil borings with a DMX drill rig positioned over the centerwell of the R/V *Seaprobe*. The vessel was anchored at the boring location by a 4-point mooring system. Soil conditions at the site were explored by drilling a group of four soil borings to 131-ft penetration below the seafloor. The final coordinates for the boring locations are presented in Table 2-1. A plan of borings within Block A-36, of the Galveston Area is presented on Plate 2-1. Fugro Chance, Inc., of Lafayette, Louisiana, conducted surveying utilizing STARFIX and DGPS, and performed a 360-degree scanning sonar survey. The positioning report, prepared by Fugro Chance, is presented in Appendix C. The scanning sonar reports are available from Fugro Chance upon request.

Table 2-1: Final Boring Coordinates
(Texas South Central Zone Coordinates)

FMMG Boring Designation	Fugro Chance Boring Designation	Proposed Boring Coordinates	Final Boring Coordinates	Boring Termination Depth (ft)
SPM #1 PLET	Core 3	X = 3,276,605.26 ft Y = 265,296.65 ft	X = 3,276,615 ft Y = 265,270 ft	131
SPM #1 Anchor Leg #2	Core 1	X = 3,275,201.70 ft Y = 264,859.70 ft	X = 3,275,180 ft Y = 264,853 ft	131
SPM #2 PLET	Core 4	X = 3,283,609.94 ft Y = 269,139.12 ft	X = 3,283,617 ft Y = 269,118 ft	131
SPM #2 Anchor Leg #6	Core 2	X = 3,284,713.02 ft Y = 270,110.77 ft	X = 3,284,733 ft Y = 270,117 ft	131

Samples were obtained through 5.0-in.-OD, 4.5-in.-IF drill pipe at all the locations. Samples were spaced at 3-ft intervals to 20-ft penetration, at 5-ft intervals to 68-ft penetration, and at 10-ft intervals thereafter to the final boring depth at all the locations, except at the SPM #2 PLET location. Sampling intervals at the SPM #2 PLET location was completed as follows: 3-ft intervals to 23-ft penetration, 5-ft intervals to 71-ft penetration, and 10-ft intervals thereafter to the final boring depth. Additionally, a 5-ft

shallow boring, designated as Core 4A by Fugro Chance, was drilled at the SPM #2 PLET location to allow re-sampling. The drilling and sampling techniques used to complete these borings are explained in detail in Appendix A.

Two water depths were measured at each boring location using a seafloor sensor seated in the drill bit. The water depth measurements are tabulated in Table 2-2. These water depth measurements are intended for the purpose of the geotechnical investigation only, and are not corrected for tidal or other variations. If utilized for other purposes, the water depth measurement should be adjusted to account for meteorological tide and datum corrections. The water depth measuring procedures are explained in detail in Appendix A.

Table 2-2: Measured Water Depths

Boring Designation	Water Depth (ft)	Time and Date of Measurement	Supplemental Water Depth (ft)	Time and Date of Measurement
SPM #1 PLET	112	1630 hours on June 27, 2008	113	2245 hours on June 27, 2008
SPM #1 ANCHOR LEG #2	113	2400 hours on June 26, 2008	113	0605 hours on June 27, 2008
SPM #2 PLET	112	0250 hours on June 28, 2008	112	1030 hours on June 28, 2008
SPM #2 ANCHOR LEG #6	110	1450 hours on June 28, 2008	111	2105 hours on June 28, 2008

2.2.2 Field and Laboratory Tests

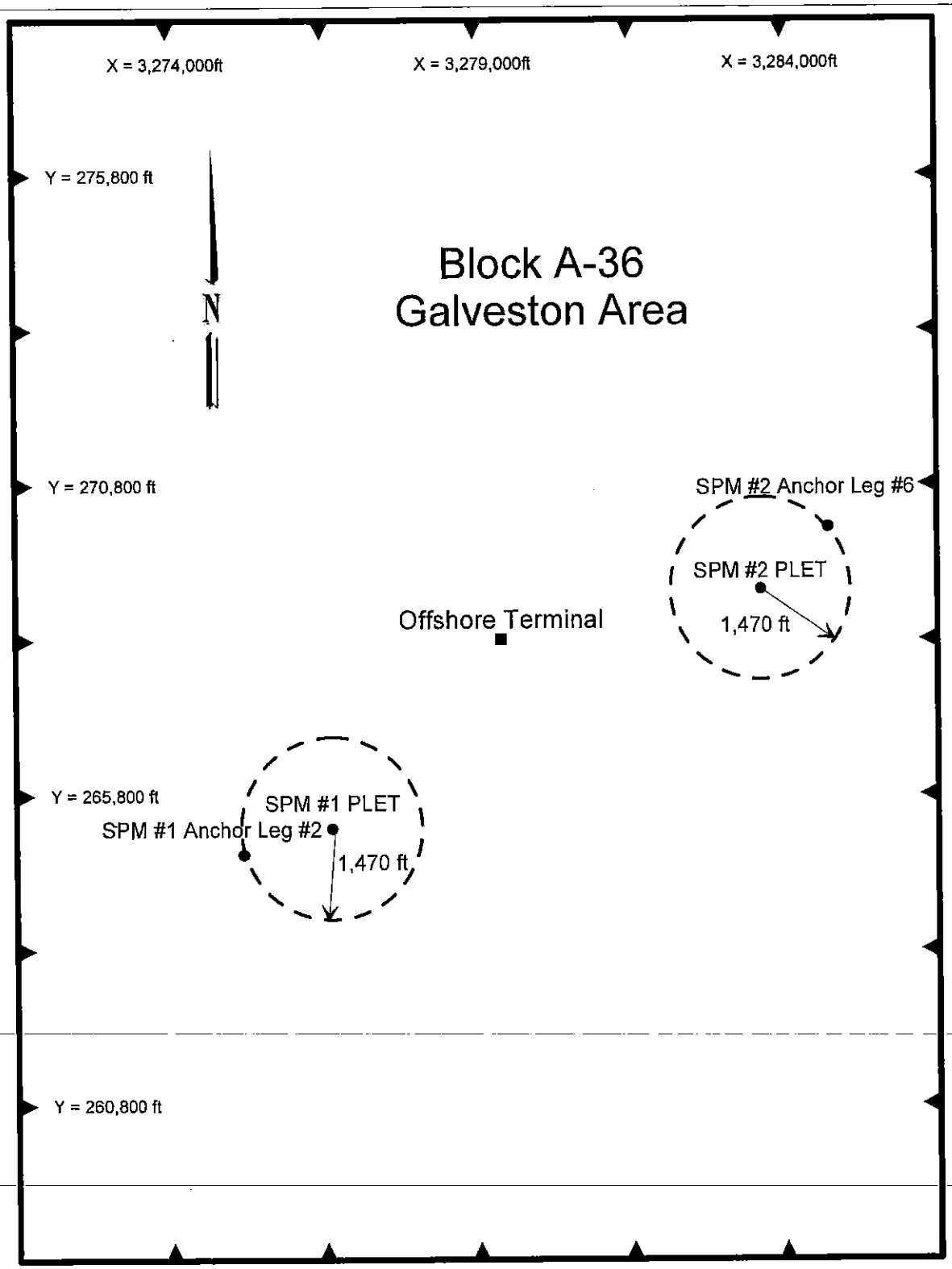
The soil testing program was designed to evaluate pertinent index and engineering properties of the foundation soils. During the field operation, all samples were extruded from the sampler and classified by the soil technician or field engineer. Unit weight, Torvane, pocket penetrometer, miniature vane and unconsolidated-undrained triaxial compression tests were performed in the field on selected cohesive samples. All of the samples were shipped to Fugro's Houston laboratory where Atterberg limit tests, water content tests, and grain-size analyses, as well as additional density tests, unconsolidated-undrained triaxial compression tests, and miniature vane tests, were performed.

A description of relevant laboratory procedures is provided in Appendix A. The strength and classification test results are presented graphically on the Logs of Boring and Test Results in Section 3. Grain-size distribution curves from sieve-analyses and stress-strain curves from triaxial compression tests are presented in Appendix A.

2.3 GENERAL SOIL CONDITIONS

2.3.1 Soil Stratigraphy

The soil stratigraphy at each of the boring locations disclosed by the field and laboratory investigation is presented in Section 3. The soil stratigraphy is based on the classification of soil samples



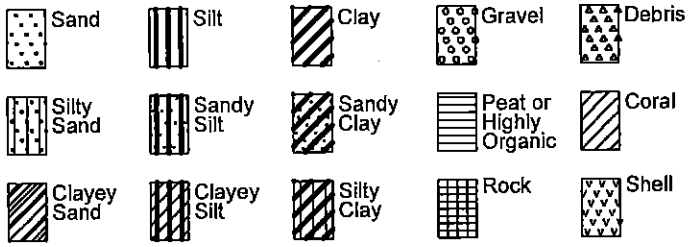
Projection: Texas South Central Zone Coordinates

PLAN OF BORINGS

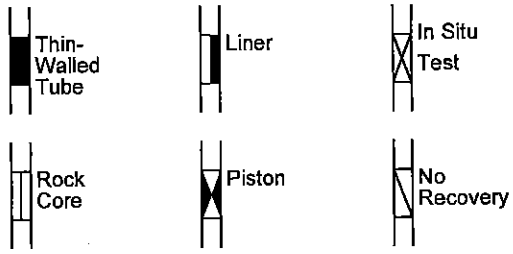
Texas Offshore Port System, Offshore Terminal Location
Block A-36, Galveston Area

TERMS AND SYMBOLS USED ON BORING LOG

SOIL TYPES

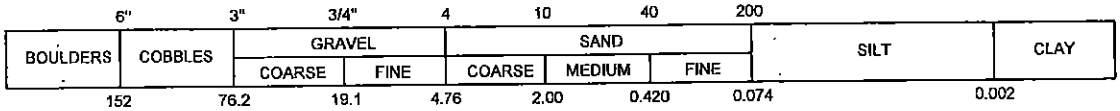


SAMPLER TYPES



SOIL GRAIN SIZE

U.S. STANDARD SIEVE



SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS[1]

Consistency	Undrained Shear Strength, Kips Per Sq Ft
Very Soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very Stiff	2.00 to 4.00
Hard	greater than 4.00

DENSITY OF GRANULAR SOILS[2,3]

Descriptive Term	*Relative Density, %
Very Loose	less than 15
Loose	15 to 35
Medium Dense	35 to 65
Dense	65 to 85
Very Dense	greater than 85

*Estimated from sampler driving record

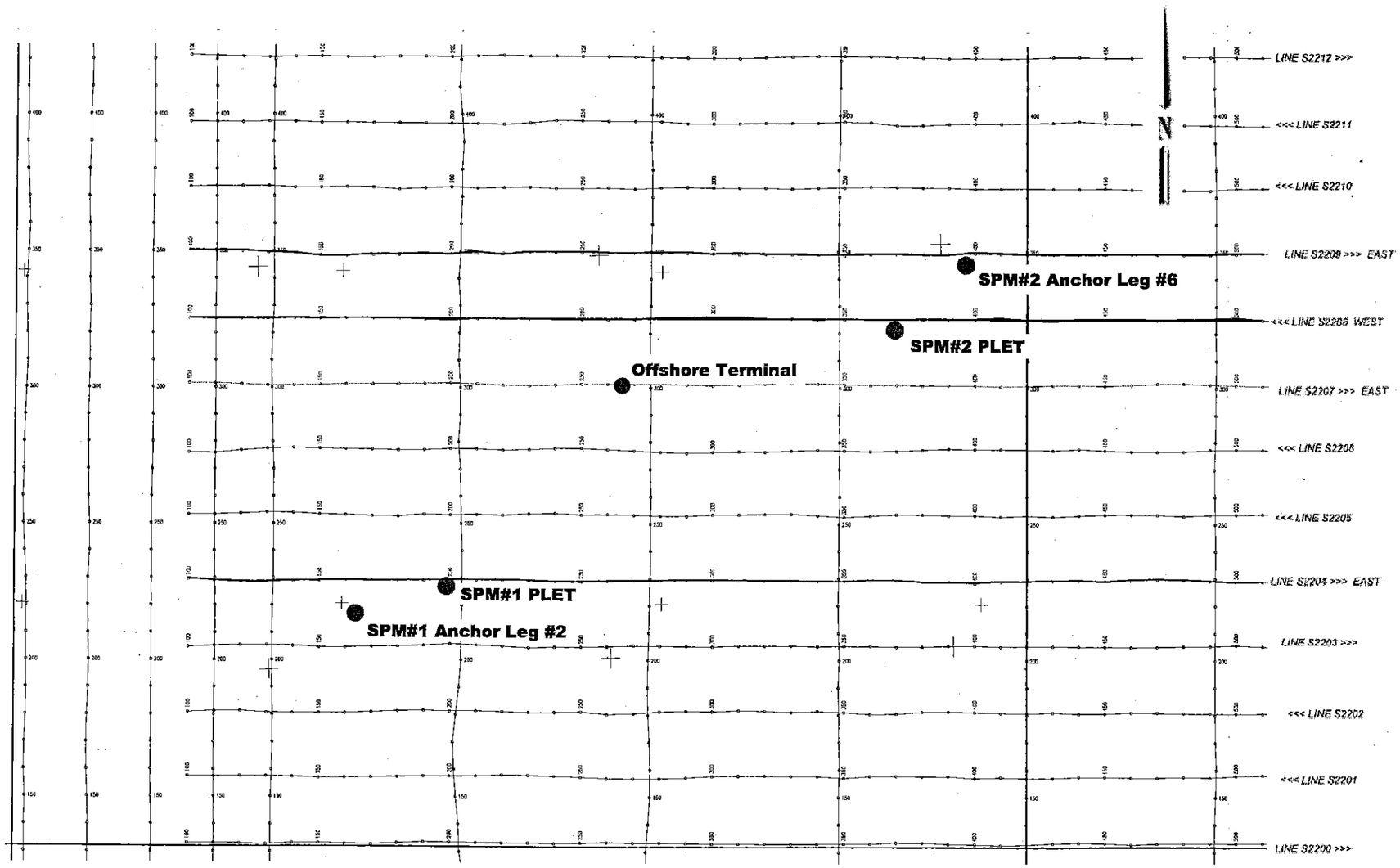
SOIL STRUCTURE[1]

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along these planes.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt, usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil types.
Interlayered	Soil sample composed of alternating layers of different soil types.
Intermixed	Soil sample composed of pockets of different soil types and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.

REFERENCES:

(1) ASTM D 2488
(2) ASCE Manual 56 (1976)
(3) ASTM D 2049

Information on each boring log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the log may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated in the text, and may vary with time, geologic condition or construction activity.



MAP OF SOIL BORINGS AND SUBBOTTOM PROFILE LINES

Texas Offshore Port System

Block A-36, Galveston Area

3 SITE SPECIFIC SOIL AND PILE DESIGN INFORMATION

3.1 SPM #1 PLET LOCATION

3.1.1 Introduction

The field investigation at the location designated as SPM #1 PLET was performed on June 27 and 28, 2008. Soil sampling was performed to 131-ft penetration at Texas South Central Zone Coordinates X = 3,276,615 ft and Y = 265,270 ft. The measured water depth ranged from 112 to 113 ft.

3.1.2 Soil Stratigraphy

The soil stratigraphy disclosed by the field and laboratory investigations is presented on the boring log, Plate 3-1. The soil stratigraphy is based on the classification of soil samples recovered from the boring and observations made during drilling operations. A generalized summary of the major soil strata is tabulated below.

Stratum	Penetration, ft From	To	Description
I	0	5	Very soft lean clay
II	5	28	Loose to medium dense sandy silt to silt with sand
III	28	43	Firm lean clay
IV	43	56	Medium dense silt to silty fine sand
V	56	131	Firm to very stiff clay

Detailed soil descriptions that include textural variations and inclusions are noted on the boring log. A key to the terms and symbols used on the boring log is presented on Plate 2-2. The Roman numeral representing each stratum is also shown on the boring log and on relevant plates. The variation in soil stratigraphy across this site is indicated in a comparison (integration) of the geophysical and geotechnical soil information presented on Plate 3-2.

3.1.2.1 Interpretation of Soil Properties

The shear strength and submerged unit weight profiles shown on Plates 3-3 and 3-4, respectively, best represent the assembled test results plotted on the boring log. These profiles were used in the engineering analyses.

3.1.3 Pile Design Information

The pile design information developed for this study includes ultimate axial capacities, axial load-pile movement data, and lateral soil resistance-pile deflection (p-y) characteristics. The analytical methods used to develop this information are presented briefly in Section 2.5 and in more detail in Appendix B.

3.1.3.1 Axial Pile Design

Ultimate Axial Capacity. The unit skin friction and unit end bearing values plotted on Plates 3-5 and 3-6, respectively were calculated using the API RP 2A methods described in Appendix B. These values were used to calculate the ultimate axial compressive and tensile capacities for 24-in.-diameter pipe piles,

driven to final penetration at the boring location. Axial capacity curves for driven pipe piles (conductors, caissons, anchor and foundation piles) are presented on Plate 3-7.

API RP 2A recommends that pile penetrations be selected using appropriate factors of safety or pile resistance factors. These factors are discussed in Section 2.5.1 of this report.

Axial Load Transfer Data. Axial load-pile movement analyses are usually performed using a computer solution based on methods developed by Reese (1964) or Matlock, et al. (1976). Plates 3-8 and 3-9 presents the results as side load-side movement (t-z) and tip load-tip movement (Q-z) data for 24-in.-diameter driven pipe piles, respectively. The presented Q-z data should be used for foundation piles and neglected for caissons and conductor design. In developing the axial load transfer data in the cohesive soils, a post-peak adhesion ratio of 0.90 was utilized.

3.1.3.2 Lateral Pile Design Data

The soil resistance-pile deflection (p-y) characteristics of the soils at the boring location were developed for individual 24-in.-diameter driven pipe piles. These data may be used in lateral load analyses of driven piles, conductors and caissons. The p-y data for cyclic loading were developed to 100-ft penetration using procedures that have been outlined in API RP 2A and briefly explained in Appendix B. The stratigraphy and parameters used to develop the p-y data are presented on Plate 3-10. The p-y data for 24-in.-diameter driven pipe piles are presented on Plate 3-11. P-y values presented at 100-ft penetration may be used for lateral load analyses at greater depths.

3.1.4 Seafloor Bearing Capacity

Ultimate bearing capacity equations for the near-surface soils were taken from a design method developed by Skempton (1951) based on undisturbed shear strength. The following equations can be used to determine the ultimate bearing capacity for horizontal tubular members and mud mats resting on the seafloor:

$q_u = 1000$ for tubular members and

$q_u = (1000)(1 + 0.2\ B/L)$ for mud mats for $B \leq 50$ ft

where: q_u = ultimate bearing capacity, psf;

B = width of mud mat, ft; and

L = length of mud mat, ft.

For horizontal tubular members penetrating less than one radius, the projected area at the mudline should be used to calculate the ultimate bearing capacity of the members. For members penetrating one radius or more, the diameter should be used. For triangular-shaped mud mats, B should be taken as 75 percent of the least altitude and L should be taken as the longest side.

API RP 2A recommends that appropriate factors of safety be applied to the capacity values. These factors are discussed in Section 2.6.1 of this report.

Checked By: AH Date: 8/11/08

Approved By: DA Date: 8/25/08

Drawn By: Tem el Date: 8/8/08

X = 3,276,615'
Y = 265,270'

Texas South Central Zone Coordinates
SEAFLOOR AT EL. - 112'

		BLOW COUNT
I	VERY SOFT OLIVE GRAY LEAN CLAY	WOH
	(5.0')	WOH
II	LOOSE TO MEDIUM DENSE GRAY SANDY SILT TO SILT WITH SAND	8
		20
		12
		8
		8
		10
	(28.0')	
III	FIRM OLIVE GRAY LEAN CLAY	12
		8
		10
	(43.0')	
IV	MEDIUM DENSE OLIVE GRAY SILT TO SILTY FINE SAND -with mica to 44' -with a few clay pockets and partings and pockets of organic matter at 48' -with a lean clay layer, with many silt and sand pockets and partings at 53'	23
		15
		15
	(56.0')	
V	FIRM TO VERY STIFF OLIVE GRAY CLAY -lean to 65' -with silt pockets, partings, and seams and a few wood fragments at 59' -with a few sand pockets, 63' to 68' -with a few sand seams at 63' -with silt pockets, partings, and seams at 67'	8
		8
		10
	-with a few silt pockets, 77' to 108' -with a few silt seams at 78'	PUSH
	-with a few silt partings at 88'	PUSH
	-expansive, 97' to 119' -with a few shell fragments at 98'	PUSH
	-with gas blisters, 107' to 131' -lean at 107'	PUSH
	-with a few shell fragments, 117' to 131' -blocky at 118'	PUSH
	-lean at 130' (131.0')	PUSH

Note: See PLATE 3-1b for detailed soil stratigraphy to 40-ft penetration.

IDENTIFICATION TESTS, [%]
20 40 60 80
SUBMERGED UNIT WEIGHT, [kcf]
0.03 0.04 0.05 0.06

UNDRAINED SHEAR STRENGTH [ksf]
0.5 1.0 1.5 2.0

Penetration Below Seafloor, [feet]
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

SAMPLING TECHNIQUES

Number of blows of a 175-lb weight (hammer) dropped approximately 5 ft to produce a maximum of 24 in. of penetration of a 2.25-in.-OD, 2.125-in.-ID thin-walled tube sampler. "PUSH" denotes a 3.00-in.-OD, 2.83-in.-ID thin-walled tube sampler was advanced 24 in. with the weight of the drill string. "WOH" denotes a 2.50-in.-OD, 2.125-in.-ID liner sampler was advanced 24 in. with the weight of the hammer.

CLASSIFICATION TESTS

- ▼ SOLUBILITY IN HCL, [%]
- ■ PERCENT PASSING -200 SIEVE, [%]
- ● WATER CONTENT (W), [%]
- □ SUBMERGED UNIT WEIGHT (SUW)

PLASTIC LIMIT (PL) +---------- LIQUID LIMIT (LL) +

STRENGTH TESTS

- ⊗ POCKET PENETROMETER (PP)
- ⊕ TORVANE (TV)
- ◈ REMOTE VANE (RV)
- ◆ MINIATURE VANE (MV) (◈ RESIDUAL (MVres) VALUE)
- ▲ UNCONSOLIDATED UNDRAINED TRIAXIAL (UU)

(Open symbols indicate remolded (r) tests)

LOG OF BORING AND TEST RESULTS

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

Report No. 0201-6501

PLATE 3-1a

Check Approved By: AL D 8/8/08 Date: 8/25/08 n By: 8/7/08

X = 3,276,615'
Y = 265,270'

Texas South Central Zone Coordinates
SEAFLOOR AT EL. - 112'

BLOW COUNT

I
VERY SOFT OLIVE GRAY LEAN CLAY
-with many sand pockets and few shell fragments to 2'
-with sand and silt pockets and a few silt seams at 3'
(5.0')

II
LOOSE TO MEDIUM DENSE GRAY SANDY SILT TO SILT WITH SAND
-greenish gray, with a few clay seams, 6' to 10'
-mottled with brownish yellow at 10'
-with mica and a few shell fragments at 13'
-with a few clay pockets and shell fragments below 15'
(28.0')

III
FIRM OLIVE GRAY LEAN CLAY
-with sand at 28'
-with many silt pockets to 35'
-with many sand pockets and a few wood and shell fragments and sand seams below 38'

Depth	BLOW COUNT
0	WOH
2	WOH
5	8
10	20
13	12
15	8
18	8
25	10
28	12
35	8
38	10

IDENTIFICATION TESTS, [%]
20 40 60 80
SUBMERGED UNIT WEIGHT, [kcf]
0.03 0.04 0.05 0.06

UNDRAINED SHEAR STRENGTH
[ksf]
0.2 0.4 0.6 0.8

Penetration Below Seafloor, [feet]
0 5 10 15 20 25 30 35 40

Penetration Below Seafloor, [feet]

SAMPLING TECHNIQUES

Number of blows of a 175-lb weight (hammer) dropped approximately 5 ft to produce a maximum of 24 in. of penetration of a 2.25-in.-OD, 2.125-in.-ID thin-walled tube sampler. "PUSH" denotes a 3.00-in.-OD, 2.83-in.-ID thin-walled tube sampler was advanced 24 in. with the weight of the drill string. "WOH" denotes a 2.50-in.-OD, 2.125-in.-ID liner sampler was advanced 24 in. with the weight of the hammer.

CLASSIFICATION TESTS

- ▼ SOLUBILITY IN HCL, [%]
- ■ PERCENT PASSING -200 SIEVE, [%]
- ● WATER CONTENT (W), [%]
- □ SUBMERGED UNIT WEIGHT (SUW)

PLASTIC LIMIT (PL) LIQUID LIMIT (LL)
+----------+

STRENGTH TESTS

- ⊗ POCKET PENETROMETER (PP)
- ⊕ TORVANE (TV)
- ◈ REMOTE VANE (RV)
- ◆ MINIATURE VANE (MV) (◈ RESIDUAL (MVres) VALUE)
- ▲ UNCONSOLIDATED UNDRAINED TRIAXIAL (UU)

(Open symbols indicate remolded (r) tests)

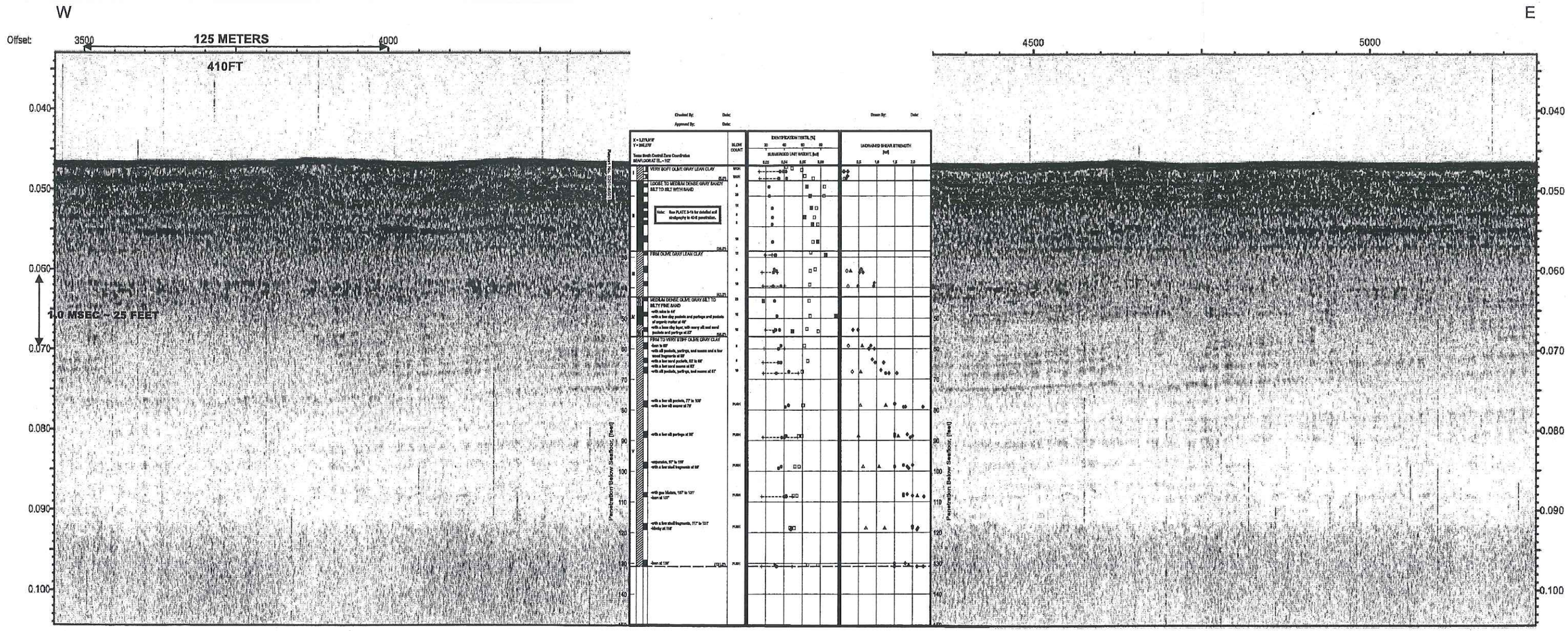
LOG OF BORING AND TEST RESULTS

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

Report No. 0201-6501

PLATE 3-1b

UGRO



CLASSIFICATION TESTS	STRENGTH TESTS
▼ SOLUBILITY IN HCL, [%]	⊕ POCKET PENETROMETER (PP)
■ PERCENT PASSING #200 SIEVE, [%]	✣ TORVANE (TV)
● WATER CONTENT (W), [%]	✣ REMOTE VANE (RV)
□ SUBMERGED UNIT WEIGHT (SUW)	◆ MINIATURE VANE (MV) (✣ RESIDUAL (MVres) VALUE)
PLASTIC LIMIT (PL) — LIQUID LIMIT (LL)	▲ UNCONSOLIDATED UNDRAINED TRIAXIAL (UU)
+———————————+	(Open symbols indicate remolded (r) tests)

GEOPHYSICAL AND GEOTECHNICAL INTEGRATION

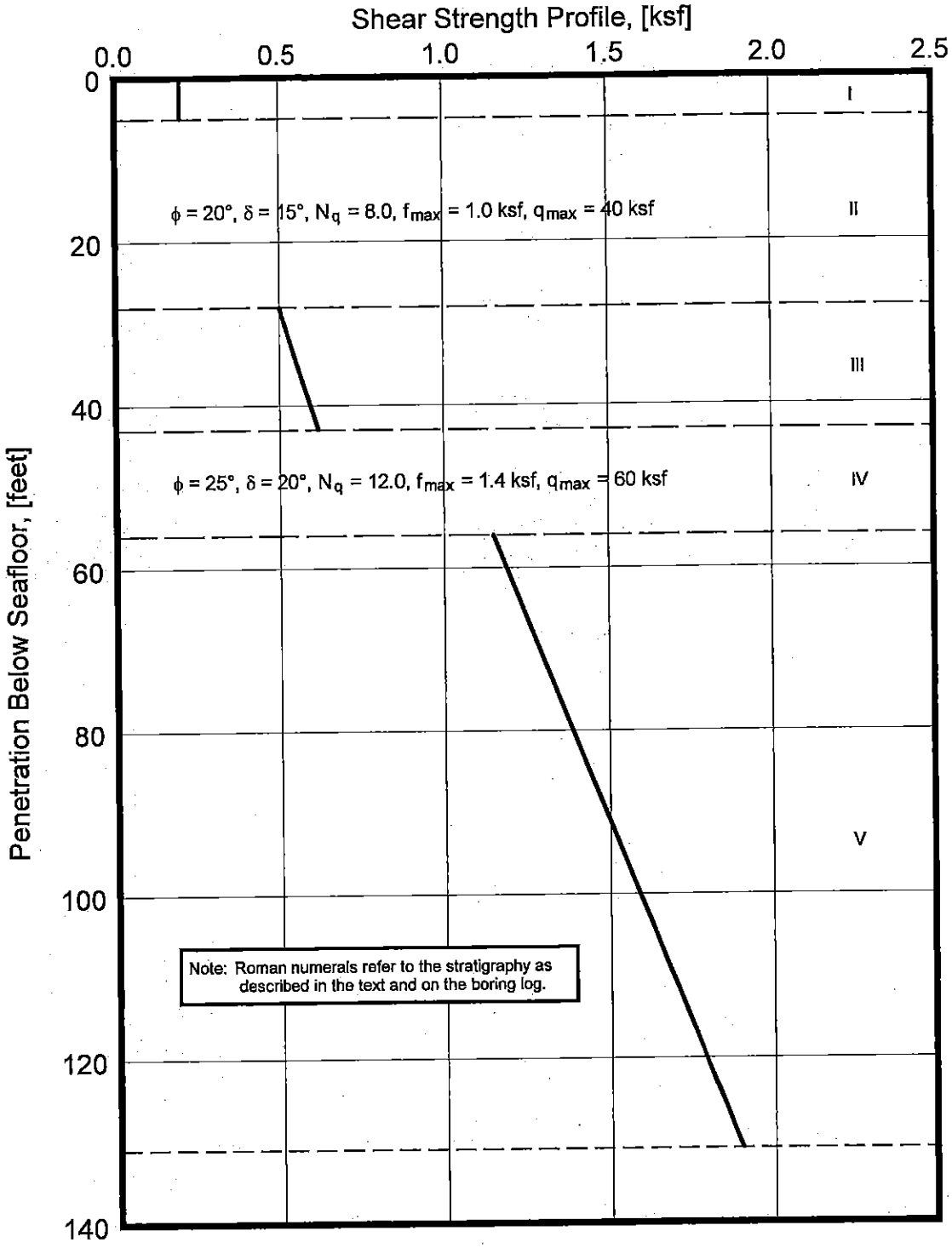
Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

Portion of Subbottom Profiler
Line 2204

Drawn By: MW Date: 8/20/08

Checked By: KB Date: 8/20/08

Approved By: DL Date: 8/26/08

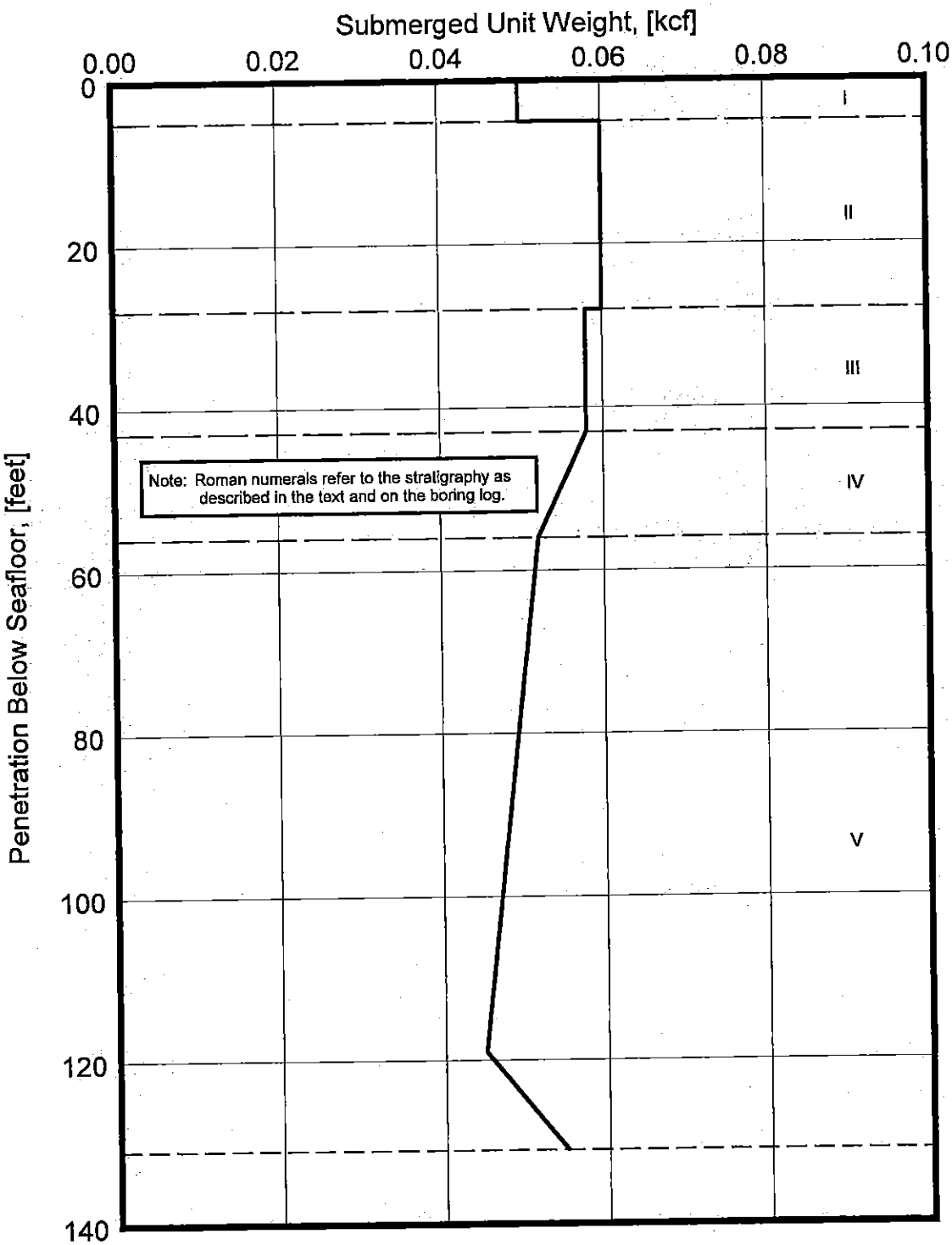


DESIGN STRENGTH PARAMETERS

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

Date: 8/20/08

Drawn By: MW



DESIGN SUBMERGED UNIT WEIGHT

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

Date: 8/20/08

Checked By: HB

Date: 8/20/08

Approved By:

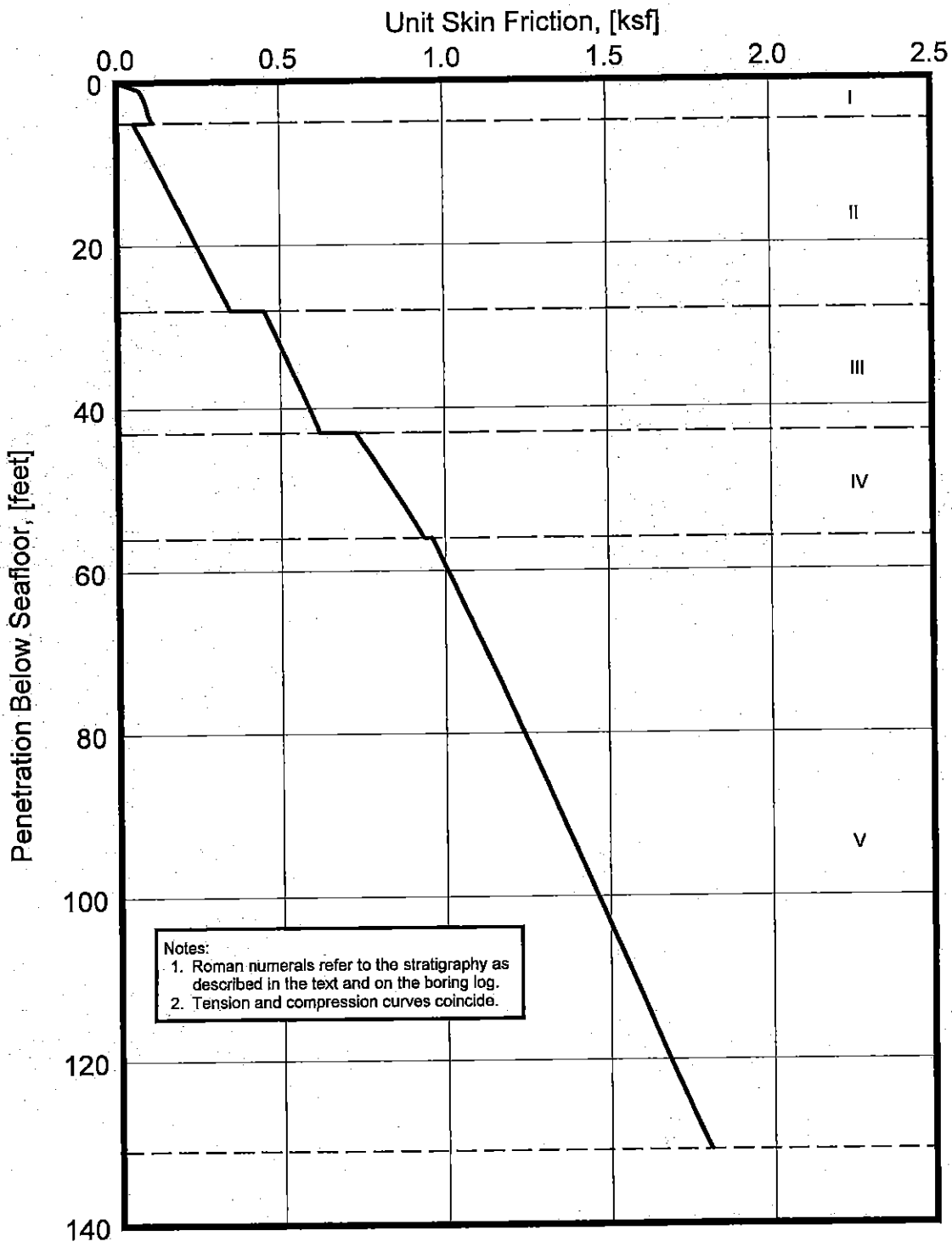
Report No. 0201-6501

PLATE 3-4

Drawn By: MW Date: 8/20/08

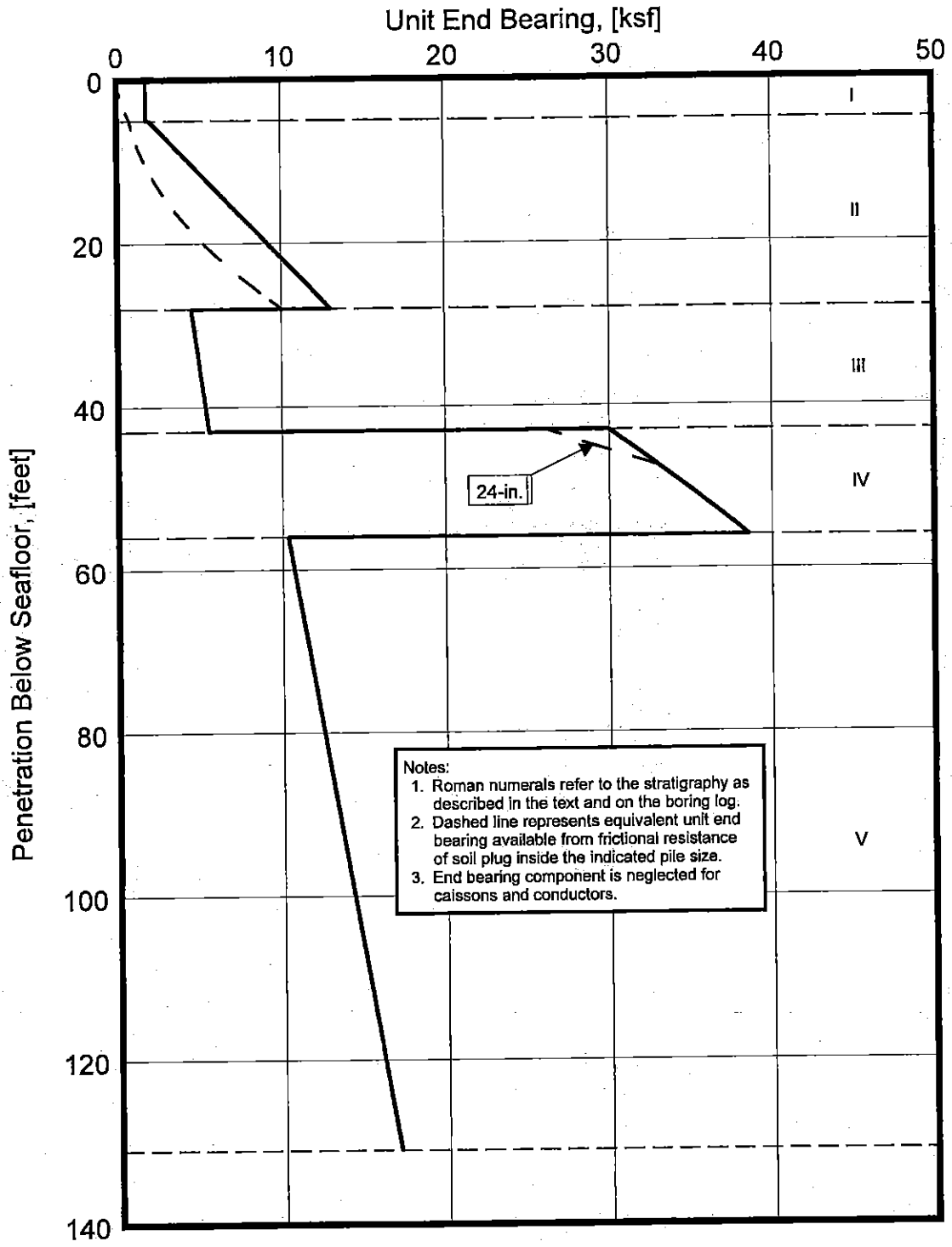
Checked By: HR Date: 8/20/08

Approved By: JM Date: 8/26/08



UNIT SKIN FRICTION
API RP 2A (2000) Method

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area



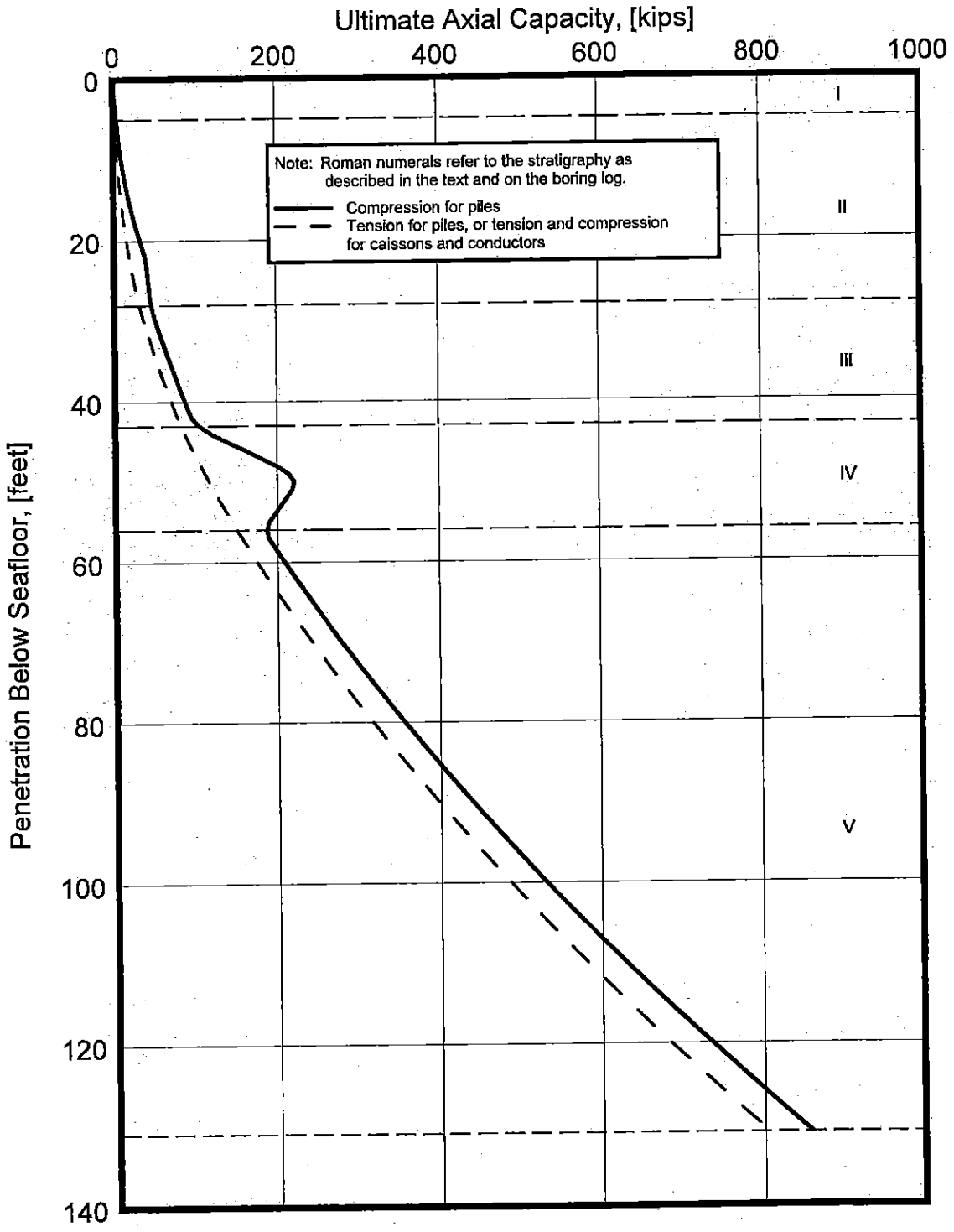
Drawn By: AW Date: 8/20/08

Checked By: MB Date: 8/20/08

Approved By: [illegible] Date: 8/20/08

UNIT END BEARING
API RP 2A (2000) Method

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area



ULTIMATE AXIAL CAPACITY
API RP 2A (2000) Method
24-in.-Diameter Driven Pipe Piles
Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

Drawn By: MU Date: 8/20/08
Checked By: JKS Date: 8/20/08
Approved By: DK Date: 8/26/08

PENETRATION BELOW MUDLINE (feet)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.0	t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
1.0	t	0.00	0.02	0.04	0.05	0.06	0.07	0.06	0.06
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
4.0	t	0.00	0.03	0.05	0.07	0.09	0.10	0.09	0.09
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
5.0	t	0.00	0.03	0.06	0.08	0.10	0.11	0.10	0.10
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
5.0	t	0.00	0.05	0.05					
	z	0.00	0.10	24.00					
28.0	t	0.00	0.35	0.35					
	z	0.00	0.10	24.00					
28.0	t	0.00	0.14	0.23	0.34	0.41	0.45	0.41	0.41
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
42.0	t	0.00	0.18	0.31	0.46	0.55	0.61	0.55	0.55
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
43.0	t	0.00	0.19	0.31	0.46	0.56	0.62	0.56	0.56
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
43.0	t	0.00	0.73	0.73					
	z	0.00	0.10	24.00					
56.0	t	0.00	0.94	0.94					
	z	0.00	0.10	24.00					
56.0	t	0.00	0.29	0.48	0.72	0.87	0.96	0.87	0.87
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
88.0	t	0.00	0.40	0.67	1.00	1.20	1.33	1.20	1.20
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
119.0	t	0.00	0.50	0.84	1.25	1.50	1.67	1.50	1.50
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00
131.0	t	0.00	0.54	0.90	1.35	1.63	1.81	1.63	1.63
	z	0.00	0.04	0.07	0.14	0.19	0.24	0.48	24.00

Notes: 1. "t" is mobilized soil-pile adhesion, [ksf].
2. "z" is axial pile displacement, [in.].
3. Data for tension and compression coincide.

Drawn By: MW Date: 8/20/08
Checked By: MB Date: 8/20/08
Approved By: JM Date: 8/26/08

AXIAL LOAD TRANSFER DATA
(T-Z DATA)
API RP 2A (2000) Method
24-in.-Diameter Driven Pipe Piles
Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

PENETRATION BELOW MUDLINE (feet)		CURVE POINTS						
		1	2	3	4	5	6	7
56.0	Q	0	8	16	24	29	33	33
	z	0.00	0.05	0.31	1.01	1.75	2.40	24.00
131.0	Q	0	13	27	40	48	54	54
	z	0.00	0.05	0.31	1.01	1.75	2.40	24.00

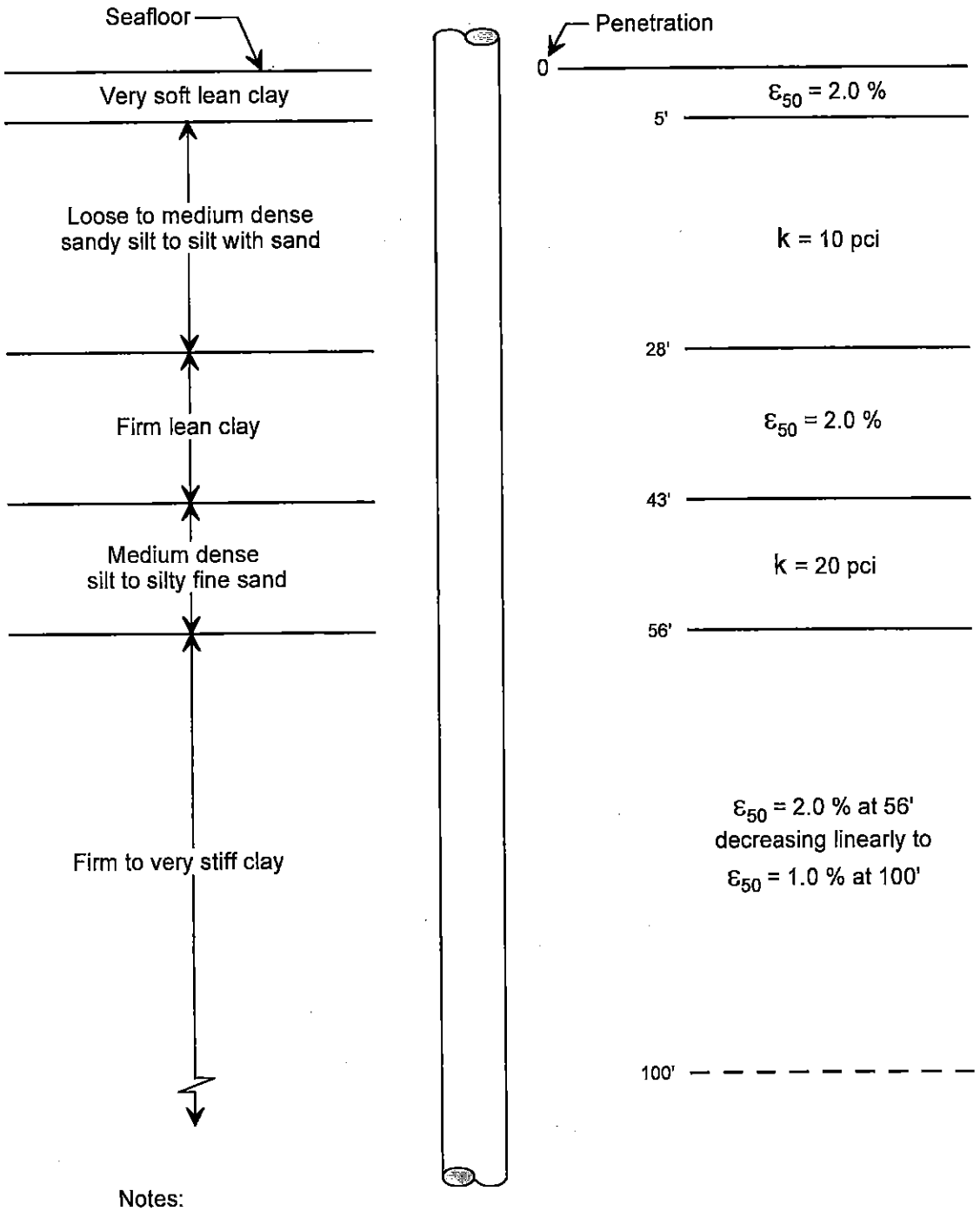
Notes: 1. "Q" is mobilized end bearing capacity, [kips].
2. "z" is axial tip displacement, [in.].

Drawn By: MW Date: 8/20/08

Checked By: MB Date: 8/20/08

Approved By: JK Date: 8/22/08

AXIAL LOAD TRANSFER DATA
(Q-Z DATA)
API RP 2A (2000) Method
24-in.-Diameter Driven Pipe Piles
Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area



Notes:

1. ε_{50} is axial strain at half of peak deviator stress for cohesive soils.
2. Soil strength parameters are shown on Plate 3-3.
3. Submerged unit weight profile is shown on Plate 3-4.
4. k is the modulus of horizontal subgrade reaction for granular soils.

STRATIGRAPHY AND PARAMETERS FOR P-Y DATA

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

PENETRATION BELOW MUDLINE (feet)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.0	p	0	15	23	34	50	72	0	0
	y	0.00	0.03	0.12	0.36	1.20	3.60	18.00	24.00
2.0	p	0	20	31	45	67	96	16	16
	y	0.00	0.03	0.12	0.36	1.20	3.60	18.00	24.00
5.0	p	0	28	42	62	92	132	55	55
	y	0.00	0.03	0.12	0.36	1.20	3.60	18.00	24.00
5.0	p	0	39	64	85	107	123	128	129
	y	0.00	0.07	0.12	0.17	0.26	0.39	0.57	24.00
7.0	p	0	70	116	154	193	221	231	233
	y	0.00	0.09	0.15	0.22	0.33	0.51	0.73	24.00
11.0	p	0	157	261	345	434	496	517	522
	y	0.00	0.12	0.22	0.31	0.47	0.72	1.05	24.00
15.0	p	0	276	460	608	764	875	911	921
	y	0.00	0.16	0.28	0.41	0.61	0.94	1.35	24.00
19.0	p	0	422	703	928	1167	1336	1392	1406
	y	0.00	0.19	0.34	0.49	0.73	1.13	1.63	24.00
28.0	p	0	631	1051	1388	1745	1998	2082	2103
	y	0.00	0.19	0.34	0.50	0.74	1.15	1.66	24.00
28.0	p	0	113	173	255	375	540	540	
	y	0.00	0.03	0.12	0.36	1.20	3.60	24.00	
43.0	p	0	140	214	316	465	670	670	
	y	0.00	0.03	0.12	0.36	1.20	3.60	24.00	
43.0	p	0	1765	2941	3882	4882	5588	5823	5882
	y	0.00	0.18	0.31	0.45	0.68	1.04	1.51	24.00
56.0	p	0	2269	3782	4992	6278	7186	7488	7564
	y	0.00	0.17	0.31	0.45	0.67	1.03	1.49	24.00
56.0	p	0	259	397	587	863	1242	1242	
	y	0.00	0.03	0.12	0.36	1.20	3.60	24.00	
100.0 (and below)	p	0	358	549	811	1192	1717	1717	
	y	0.00	0.02	0.06	0.18	0.60	1.80	24.00	

Notes: 1. "p" is soil resistance, [lb/in.].
2. "y" is lateral deflection, [in.].

Drawn By: AW Date: 8/20/08
Checked By: MB Date: 8/20/08
Approved By: JM Date: 8/26/08

P-Y DATA
(CYCLIC LOADING)
API RP 2A (2000) Method
24-in.-Diameter Driven Pipe Piles
Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

4 CONCLUSIONS AND RECOMMENDATIONS

The TOPS geotechnical program was conducted to investigate soil conditions within the proposed SPM #1 and SPM #2 facilities located in Block A-36 of the Galveston Area in the Gulf of Mexico. The program consisted of four soil borings, field and laboratory testing, and engineering analyses. A summary of the pertinent conclusions and recommendations follows:

- Soil borings across the proposed facility locations indicate a significant degree of near-surface soil variability. Soil conditions above 65-ft penetration show channel features within the block. These channel features vary both in depth and width across the block and resulted in variable soil stratigraphy and properties. FMMG recommends that a site-specific soil boring be completed at each of the anchor and PLET locations prior to design of the foundation elements.
- A scanning sonar survey was performed at each boring location and is available upon request from Fugro Chance.
- The water depth ranged from 110 ft to 113 ft across the boring locations within Block A-36 in the Galveston Area.
- Final engineering design data are presented for 24- and 42-in.-diameter driven pipe piles for the PLET and anchor locations, respectively.
- The safety and load resistance factors should be carefully reviewed based on API RP 2A guidelines and appropriately applied to the engineering analyses presented in this report.
- Pile group effects and pile interaction with spud can depressions should be evaluated when the geometry and location of these elements are determined.
- Mud mat bearing capacities at the PLET locations should be reviewed when the final size and configurations and proximity to spud can depressions are determined.
- Pile driving problems are not expected based on the soil information presented in this study but a drivability study could be performed to select an appropriate hammer-pile combination.

FMMG would be pleased to assist in re-evaluations and additional analyses.

5 REFERENCES

American Petroleum Institute (1993), Recommended Practice for Planning, Designing, and Constructing Fixed Offshore Platforms-Load and Resistance Factor Design, API Recommended Practice 2A-LRFD (RP 2A-LRFD), 1st Ed., API, Washington, D.C.

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Dennis, N.D. and Olson, R.E. (1983), "Axial Capacity of Steel Pipe Piles in Clay," Proceedings of the Conference on Geotechnical Practice in Offshore Engineering, Austin, April, pp. 370-388.

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O'Neill, M.W. and Murchison, J.M. (1983), "An Evaluation of p-y Relationships in Sands," Report PRAC 82-41-1, Prepared for the American Petroleum Institute, Houston, May.

Quiros, G.W., Young, A.G., Pelletier, J.H., and Chan, J.H-C. (1983), "Shear Strength Interpretation for Gulf of Mexico Clays," Proceedings of the Conference on Geotechnical Practice in Offshore Engineering, Austin, April, pp. 144-165.

Reese, L.C. (1964), "Load vs Settlement of an Axially Loaded Pile," Proceedings, Symposium on Bearing Capacity of Piles, Roorkee, India.

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Date	Time From	Time To	Description of Activities
June 27, 2008	****	0750	Arrive in Block A-36, Galveston Area, SPM #1 PLET location aboard the *R/V Seaprobe*.
	0750	1250	Wait on weather. (Seas: 4-6/7 ft; Winds: SSE15-20 mph).
	****	1130	Conduct pre-shift safety and weekly HSE meetings (afternoon shift).
	****	1230	Conduct weekly HSE meeting (morning shift).
	1250	1410	Set 4-point anchor spread.
	1410	1515	Perform scanning sonar survey.
	1515	1530	Rig up to drill and sample.
	****	1530	Estimate water depth of 107 ft using echo sounder and 110 ft using wireline technique.
	1530	1630	Run drill pipe to mudline.
	****	1630	Measure water depth of 112 ft using pipe tally/bottom sensor and 110.8 ft using pressure transducer.
	1630	2210	Drill and sample. Boring terminated at 131-ft penetration.
	2210	2245	Pull drill pipe above mudline and reposition vessel.
	****	2245	Measure supplemental water depth of 113 ft using bottom sensor/pipe tally and 111.2 ft using pressure transducer.
	2245	2315	Pull drill pipe to deck and secure equipment for travel.
	2315	2400	Pull anchors.
	****	2345	Conduct pre-shift safety meeting.
June 28, 2008	0000	0015	Pull anchors.
	0015	****	Depart location.

SUMMARY OF FIELD OPERATIONS

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

Checked By: MB Date: 9/2/08
Approved By: [illegible] Date: 9/2/08

Drawn By: Tomo Date: 9/2/08

Summary of Test Results

Job No.: 0201-6501-2 02-Sep-2008 (Ver. #6)
Boring: Texas Offshore Port System, SPM #1 PLET
Block: A-36
Area: Galveston

Sample No.	Depth (ft)	Identification Tests						Strength Estimate (ksf)		Miniature Vane Tests (ksf)			Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Submerged Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer	Torvane	Undisturbed	Remolded	Residual	Type Test	Moisture Content (%)	Confining Pressure (psi)	Undisturbed Strength (ksf)	Remolded Strength (ksf)	ε_{50} Strain (%)	Submerged Unit Weight (pcf)	Failure Strain (%)	Type of Failure
1	0.50					41															
2	1.00					44															
3	1.50					50															
4	2.00	1.06	38	12	39																
4	2.00				35					0.20		0.10									
4	2.00				42						0.07										
5	3.50					51				0.19											
6	4.30										0.09										
6	4.30	1.06	33	13	34																
6	4.30				42	56				0.15											
7	7.00				23	62	65														
8	10.00				24	62	68														
9	14.00				27	58	70														
10	17.00				27	57	62														
11	19.30				27	58	71														
12	25.00				27	56	77														
13	28.50					55															
14	29.30				30		85														
14	29.30	1.50	27	19	31																
15	34.00								0.58				UU	29	120	0.55		2.7	57	19	A
16	34.50										0.17										
16	34.50												UU	32	40	0.27		3.0	54	14	A

NOTES:

TYPE OF TEST
U - Unconfined Compression
UU- Unconsolidated-Undrained Triaxial
CU- Consolidated-Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Plus Signs [+] denote tests which exceeded the capacity of the measuring device.

NP = Non Plastic Material

Report No. 0201-6501

PLATE A-5a

FUGRO

Checked By: MB Date: 9/2/08
Approved By: DM Date: 9/2/08

Drawn By: Tomol Date: 9/2/08

Report No. 0201-6501

Summary of Test Results

Job No.: 0201-6501-2 02-Sep-2008 (Ver. #6)
Boring: Texas Offshore Port System, SPM #1 PLET
Block: A-36
Area: Galveston

		Identification Tests						Strength Estimate (ksf)		Miniature Vane Tests (ksf)			Compression Tests								
Sample No.	Depth (ft)	Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Submerged Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer	Torvane	Undisturbed	Remolded	Residual	Type Test	Moisture Content (%)	Confining Pressure (psi)	Undisturbed Strength (ksf)	Remolded Strength (ksf)	ε_{50} Strain (%)	Submerged Unit Weight (pcf)	Failure Strain (%)	Type of Failure
17	35.00	.75	33	16	28				0.62	0.53											
18	38.50								0.94												
19	39.00					54															
20	39.50	.82	41	16	36																
20	39.50										0.20										
20	39.50				28				0.48	0.92											
21	44.30				30	54	17														
22	49.30				32	54	97														
23	53.50					52															
24	53.80				35				0.48	0.34											
24	53.80	1.16	29	20	31																
25	54.30				29	59	49														
26	59.00								0.84				UU	37	60	0.60		3.2	51	12	A
26	59.00										0.21										
27	59.50																				
28	60.00	.70	41	18	34				0.94	0.79											
29	63.50								0.88												
30	64.00					53															
31	64.50	1.23	33	17	37																
31	64.50				34				0.96	1.19											
32	67.00								1.12												
33	67.50												UU	45	123	0.56		2.9	50	14	AB

NOTES:

TYPE OF TEST
U - Unconfined Compression
UU- Unconsolidated-Undrained Triaxial
CU- Consolidated-Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Plus Signs [+] denote tests which exceeded the capacity of the measuring device.

NP = Non Plastic Material

PLATE A-5b

FUGRO

Checked By: RB Date: 9/2/08
Approved By: [illegible] Date: 9/2/08

Drawn By: Tonol Date: 9/2/08

Report No. 0201-6501

Summary of Test Results

Job No.: 0201-6501-2 02-Sep-2008 (Ver. #6)
Boring: Texas Offshore Port System, SPM #1 PLET
Block: A-36
Area: Galveston

		Identification Tests						Strength Estimate (ksf)		Miniature Vane Tests (ksf)			Compression Tests								
Sample No.	Depth (ft)	Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Submerged Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer	Torvane	Undisturbed	Remolded	Residual	Type Test	Moisture Content (%)	Confining Pressure (psi)	Undisturbed Strength (ksf)	Remolded Strength (ksf)	ε_{50} Strain (%)	Submerged Unit Weight (pcf)	Failure Strain (%)	Type of Failure
33	67.50										0.32										
34	68.00	.38	55	17	32			1.25	1.34	1.56											
35	78.00							1.50	1.50												
36	78.50												UU		119		0.55		50		
36	78.50												UU	45	122	1.25		2.5	51	7	AC
37	79.00				41			1.75	1.80	2.29											
38	88.00							1.50	1.85												
39	88.50					48		1.50	2.00				UU	41	120		0.50		48		
39	88.50												UU	42	120	1.60		1.1	50	4	AB
40	89.00				38					1.93											
40	89.00	.59	55	17	39																
41	98.00							1.75	2.00												
42	98.50							1.50	1.85				UU		122		0.63		48		
42	98.50												UU	37	122	1.07		0.7	46	4	C
43	99.00				34					1.89											
44	107.50							1.75	1.85												
45	108.00					47		1.75	2.00				UU	42	120	2.14		0.8	45	3	B
46	108.30				40					2.32											
46	108.30	.80	49	15	42																
47	118.00							2.00	2.00												
48	118.50							2.00	2.15				UU	48	121	1.23		0.5	43	3	B
48	118.50												UU		121		0.71		45		

NOTES:

TYPE OF TEST
U - Unconfined Compression
UU- Unconsolidated-Undrained Triaxial
CU- Consolidated-Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Plus Signs [+] denote tests which exceeded the capacity of the measuring device.

NP = Non Plastic Material

PLATE A-5c

FUGRO

Checked By: MB Date: 9/2/08
Approved By: [illegible] Date: 9/2/08

Drawn By: Tlonal Date: 9/2/08

Report No. 0201-6501

Summary of Test Results

Job No.: 0201-6501-2 02-Sep-2008 (Ver. #6)
Boring: Texas Offshore Port System, SPM #1 PLET
Block: A-36
Area: Galveston

Sample No.	Depth (ft)	Identification Tests						Strength Estimate (ksf)		Miniature Vane Tests (ksf)			Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Submerged Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer	Torvane	Undisturbed	Remolded	Residual	Type Test	Moisture Content (%)	Confining Pressure (psi)	Undisturbed Strength (ksf)	Remolded Strength (ksf)	ε_{50} Strain (%)	Submerged Unit Weight (pcf)	Failure Strain (%)	Type of Failure
49	119.00				47					2.13											
50	130.00							1.50	1.80												
51	130.50					53							UU	30	120	1.90		0.6	59	3	AC
52	131.00				32			1.50	2.30	2.13											
52	131.00	.50	49	16	32																

NOTES:

TYPE OF TEST
U - Unconfined Compression
UU- Unconsolidated-Undrained Triaxial
CU- Consolidated-Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Plus Signs [+] denote tests which exceeded the capacity of the measuring device.

NP = Non Plastic Material

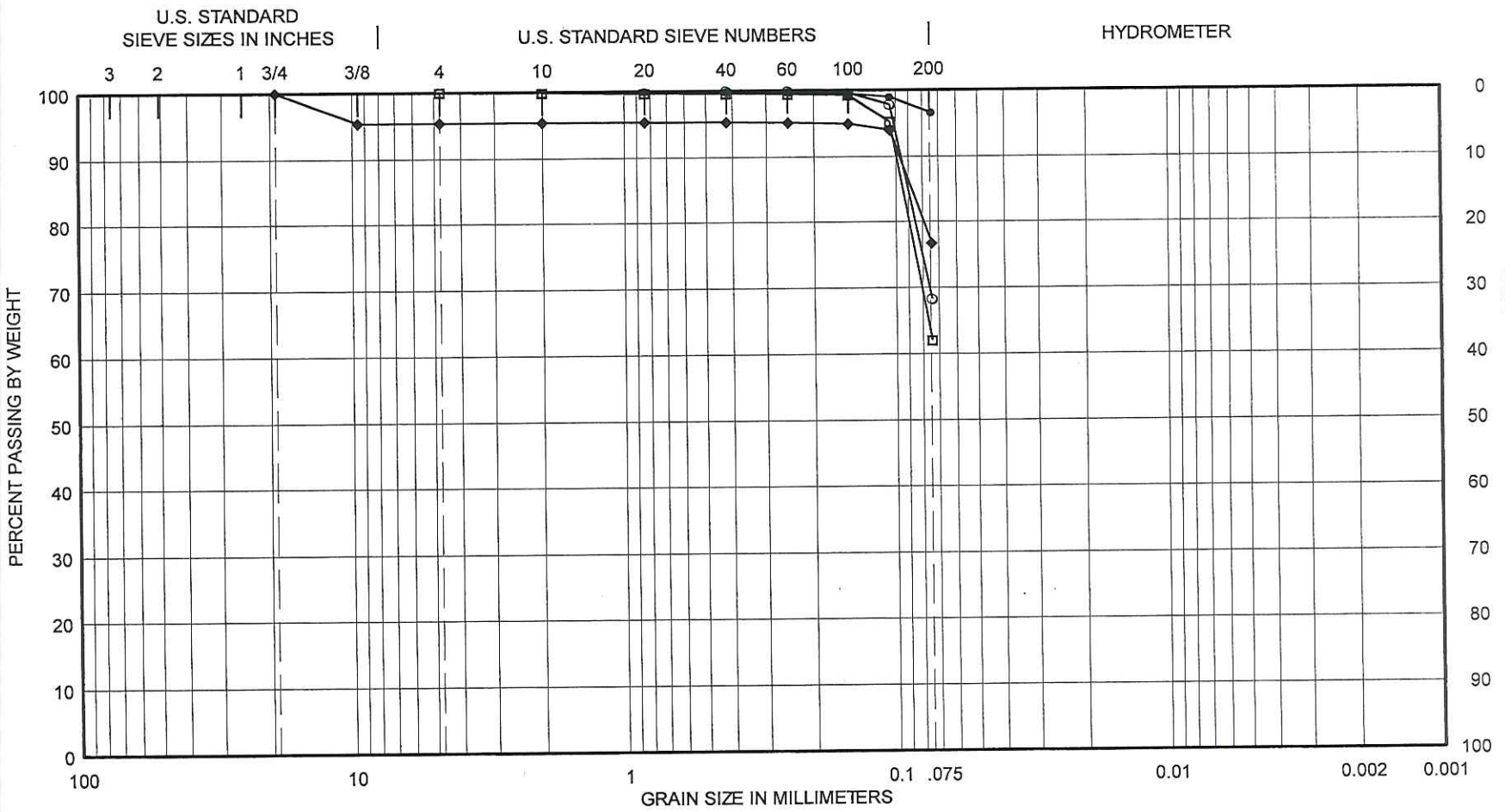
PLATE A-5d

Checked by: MB Date: 9/2/08

Approved by: DC Date: 9/2/08

Drawn by: Tlomd Date: 9/2/08

Report No. 0201-6501



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SAMPLE NO.	DEPTH, FT	SYMBOL	CLASSIFICATION
8	10.00	○	SANDY SILT (ML) with a few clay seams
10	17.00	□	SANDY SILT (ML) with a few clay pockets and shell fragments
12	25.00	◆	SILT (ML) with sand, a few clay pockets and shell fragments
22	49.30	●	SILT (ML) with a few clay pockets and partings and pockets oforganic matter

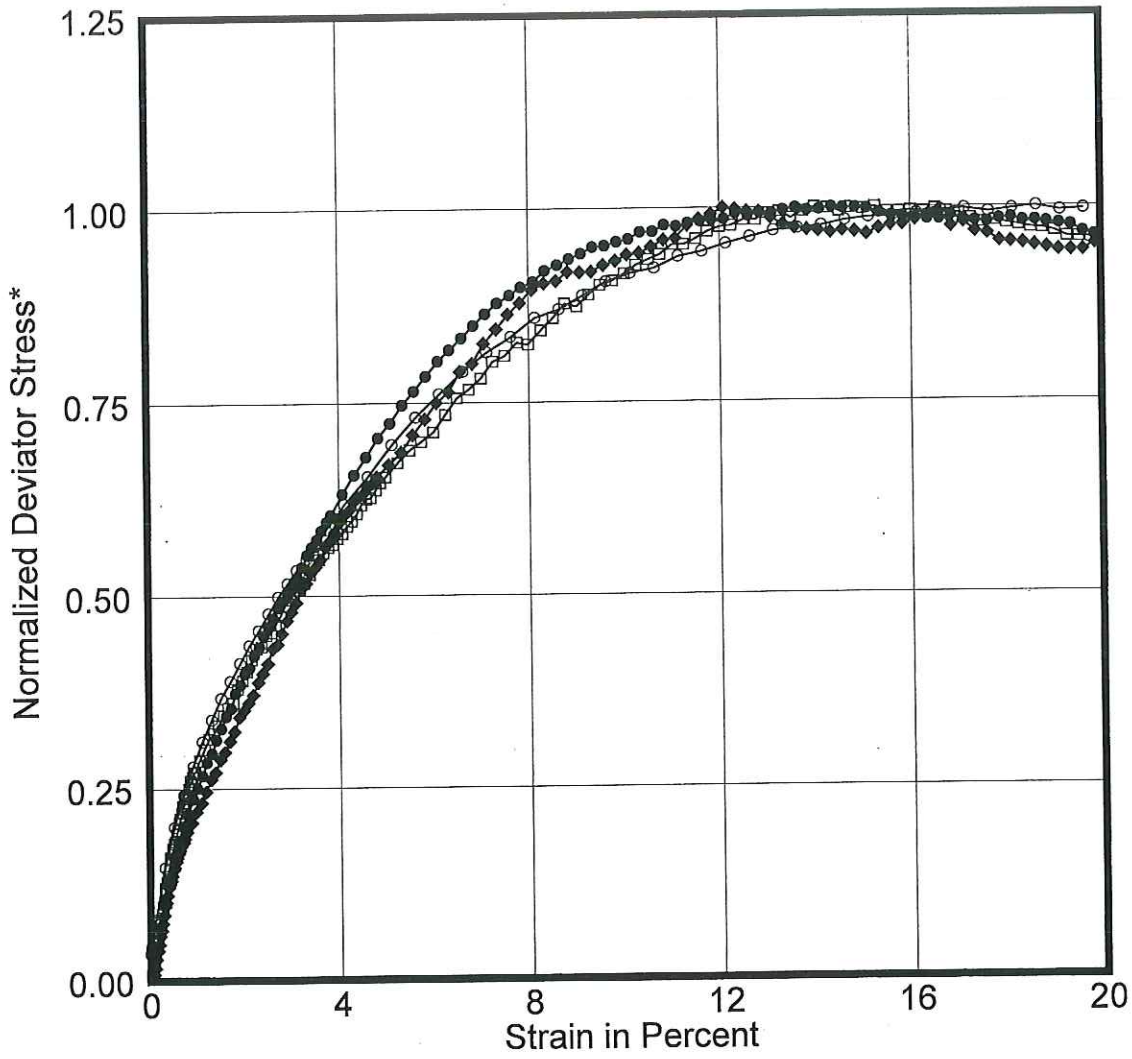
GRAIN-SIZE DISTRIBUTION CURVES

Texas Offshore Port System, SPM #1 PLET

Block A-36, Galveston Area

PLATE A-9

Drawn By: Tom-1 Date: 9/2/08



Curve	Sample No.	Depth [ft]	Test Type	Confining Pressure [psi]	Maximum Deviator Stress [ksf]	ε50 [%]
○—○	15	34.00	UU	120.2	1.10	2.7
□—□	16	34.50	UU	40.2	0.55	3.0
◆—◆	26	59.00	UU	60.0	1.20	3.2
●—●	33	67.50	UU	122.5	1.11	2.9

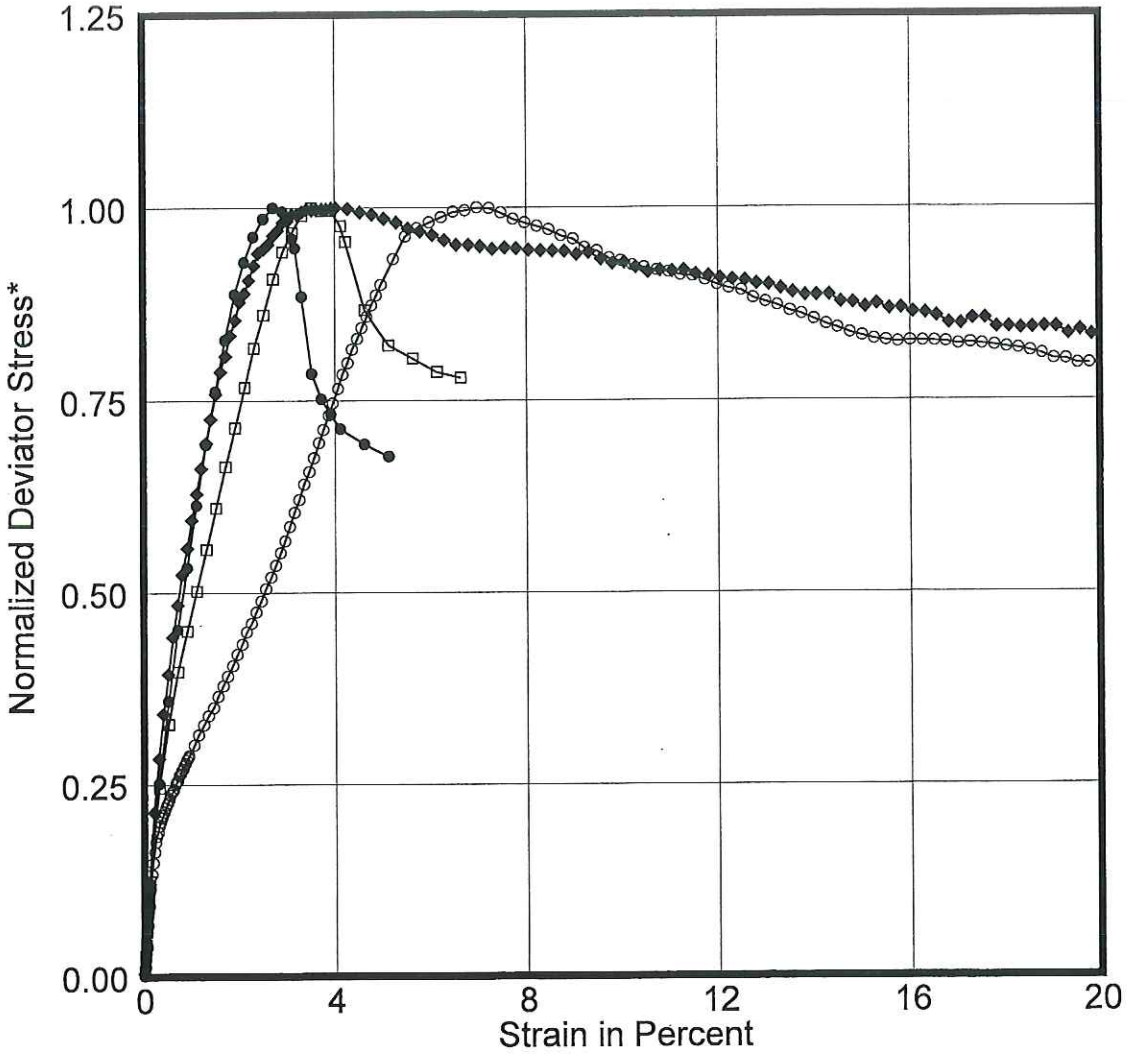
* Normalized with respect to maximum deviator stress.

Checked By: AB Date: 9/4/08

Approved By: JT Date: 9/4/08

STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Test

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area



Curve	Sample No.	Depth [ft]	Test Type	Confining Pressure [psi]	Maximum Deviator Stress [ksf]	ε50 [%]
○—○	36	78.50	UU	122.5	2.51	2.5
□—□	39	88.50	UU	120.2	3.20	1.1
◆—◆	42	98.50	UU	122.5	2.14	0.7
●—●	45	108.00	UU	120.0	4.27	0.8

* Normalized with respect to maximum deviator stress.

Drawn By: Tomel Date: 9/2/08

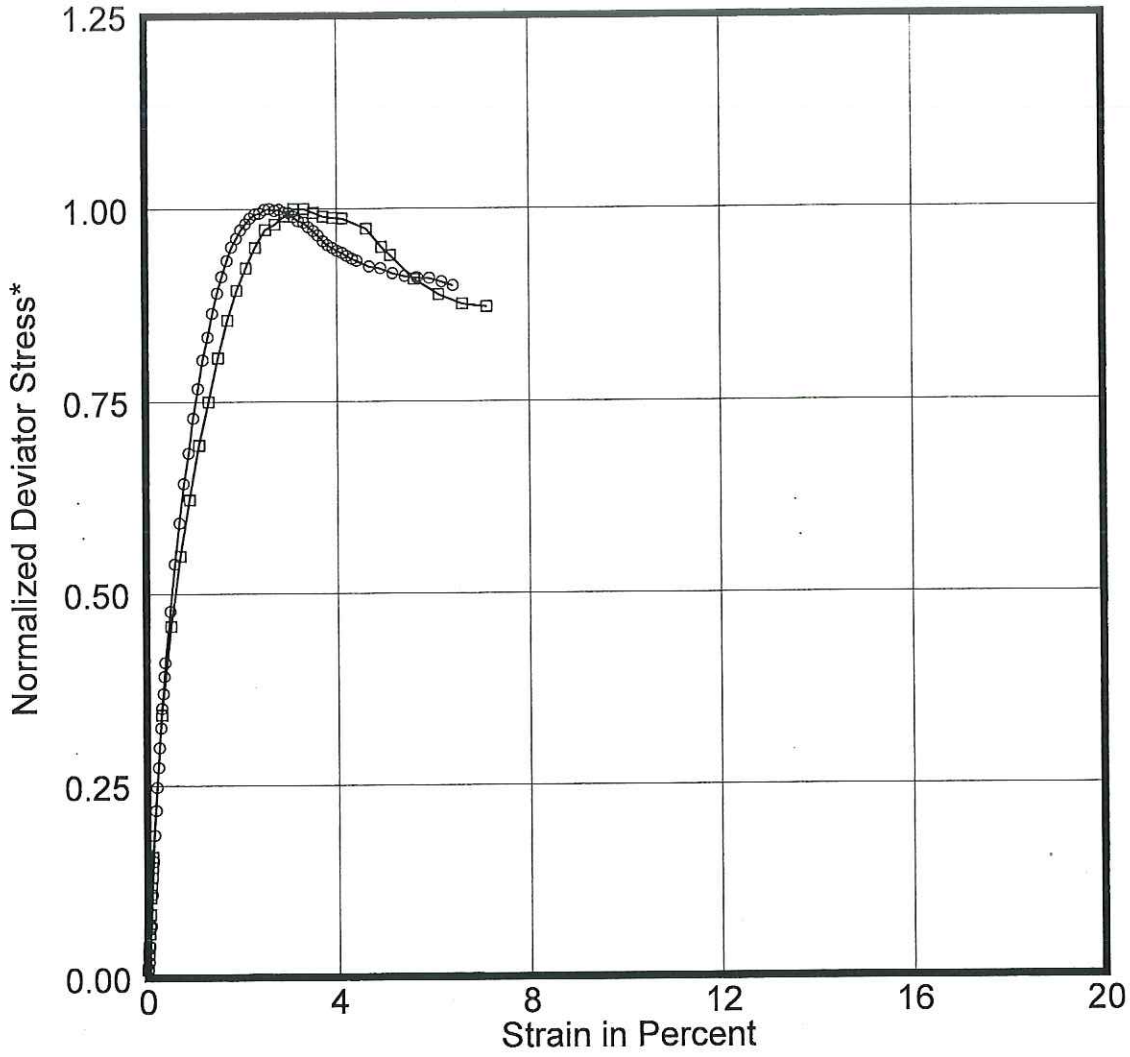
Checked By: MB Date: 9/2/08

Approved By: DR Date: 9/2/08

STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Test

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

Drawn By: TCM Date: 9/2/08



Curve	Sample No.	Depth [ft]	Test Type	Confining Pressure [psi]	Maximum Deviator Stress [ksf]	ε50 [%]
○——○	48	118.50	UU	121.2	2.46	0.5
□——□	51	130.50	UU	120.1	3.79	0.6

* Normalized with respect to maximum deviator stress.

Date: 9/2/08 Checked By: MB

Date: 9/2/08 Approved By: [illegible]

STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Test

Texas Offshore Port System, SPM #1 PLET
Block A-36, Galveston Area

CORE 3 (PLET #1)

Y = 265,270.45'
X = 3,276,615.21'

Latitude: 28° 30' 11.583" N
Longitude: 95° 01' 28.676" W

This location being 3910.45' FSL and 6739.40' FWL of Block A36, Galveston Area

CORE 4 (PLET #2)

Y = 269,117.95'
X = 3,283,617.17'

Latitude: 28° 30' 47.295" N
Longitude: 95° 00' 08.769" W

This location being 7757.95' FSL and 2098.64' FEL of Block A36, Galveston Area

CORE 4A (PLET #2 - Amended)

Y = 269,121.01'
X = 3,283,587.30'

Latitude: 28° 30' 47.335" N
Longitude: 95° 00' 09.102" W

This location being 7761.01' FSL and 2128.51' FEL of Block A36, Galveston Area

6. CONFIRMATION:

DGPS was used for confirmation.

The results were as follows:

CORE 1 (Leg #2 - West)	CORE 2 (Leg #6 - East)	CORE 3 (PLET #1)
Y = 264,853'	Y = 270,117'	Y = 265,271'
X = 3,275,181'	X = 3,284,733'	X = 3,276,615'

CORE 4 (PLET #2)	CORE 4A (PLET #2 - Amended)
Y = 269,118'	Y = 269,121'
X = 3,283,617'	X = 3,283,588'

7. HSE INCIDENTS:

No incidents.

FINAL SOIL BORINGS

LOCATION	CALLNS	CALLEW	X COORDINATE	Y COORDINATE	LATITUDE	LONGITUDE
CORE 1	3,493.21' FSL	5,304.63' FWL	3,275,180.44'	264,853.21'	28° 30' 07.937"N	95° 01' 44.907"W
CORE 2	7,083.00' FNL	982.63' FEL	3,284,733.18'	270,117.00'	28° 30' 56.803"N	94° 59' 55.883"W
CORE 3	3,910.45' FSL	6,739.40' FWL	3,276,615.21'	265,270.45'	28° 30' 11.583"N	95° 01' 28.676"W
CORE 4	7,757.95' FSL	2,098.64' FEL	3,283,617.17'	269,117.95'	28° 30' 47.295"N	95° 00' 08.769"W
CORE 4A	7,761.01' FSL	2,128.51' FEL	3,283,587.30'	269,121.01'	28° 30' 47.335"N	95° 00' 09.102"W

I HEREBY CERTIFY THAT THE ABOVE FINAL SOIL BORING POSITIONS ARE CORRECT.

STATE OF LOUISIANA
STEPHEN R. HENRY
REG. No. 4903
REGISTERED PROFESSIONAL LAND SURVEYOR

REG. PROFESSIONAL LAND SURVEYOR NO. 4903
STATE OF LOUISIANA 7-8-08

NOTES:

1) SURVEYED COORDINATES TRANSFORMED FROM NAD83 (GPS DATUM) TO NAD27 (CHART DATUM) USING NADCON VERSION 2.1.

Printed: 7/8/08

ENTERPRISE FIELD SERVICES, LLC

FINAL SOIL BORINGS
NO LEASE NUMBER (PROP. ANC & PLET)

BLOCK A36
GALVESTON AREA
GULF OF MEXICO

FUGRO CHANCE INC.
200 Dulles Dr. Lafayette, Louisiana 70506-3001 (337) 237-1300

GEODETIC DATUM: NAD27
PROJECTION: TEXAS SOUTH CENTRAL
GRID UNITS: US SURVEY FEET

SCALE IN FEET 0 2,000'

Job No.: 08-01930 | Date: 7/8/08 | Drwn: TCG | Chart: 1 Of: 1

Dwgfile: O:\WellPermit\TXsc\GA\Permit\A36_CORE_NoLease_0801930