APPENDIX II
LABORATORY TESTING RESULTS

APPENDIX II
LABORATORY TESTING RESULTS

INTRODUCTION

The contents of this appendix shall be integrated with the geotechnical engineering study of which it is a part. They shall not be used in whole or in part as a sole source for information or recommendations regarding the subject site.

The laboratory tests were performed in conjunction with the field exploration phase for this study. Laboratory tests were performed on selected relatively undisturbed and bulk samples to estimate engineering characteristics of the various earth materials encountered. Testing was performed in accordance with Caltrans or ASTM Standards for Soil Testing or the equivalent Caltrans Test Method in effect at the time that the testing was performed.

LABORATORY TEST RESULTS

Laboratory test results are summarized on Figures II-1a through II-1g.

Laboratory Moisture and Density Determinations

In accordance with ASTM D2937, moisture content and dry density determinations were performed on selected undisturbed samples to evaluate the natural water content and dry density of the various materials encountered. The results are presented on Figures II-1a through II-1g and the Logs of Test Borings (LOTBs) in Appendix I.

Maximum Wet Density Tests

Determination of maximum wet density for selected bulk samples were performed in accordance with California Test Method 216 (California Impact). Maximum wet density results are presented on Figures II-1a through II-1g.

Percent Fines

Percentages of material passing the No. 200 sieve/75-μm (fines content) were determined in accordance with test method ASTM D1140. Fines content percentages are summarized on Figures II-1a through II-1g.

Grain Size Distribution

The Distribution of particle sizes for selected soil samples were determined in accordance with ASTM D422. Grain size distributions are plotted on Figure II-2.

Atterberg Limits Tests

Atterberg limits tests were performed on selected samples. Liquid and plastic limits were determined in accordance with standard test method ASTM D4318. Test results are

plotted graphically on Figures II-3a through II-3e - Plasticity Chart, and summarized on Figures II-1a through II-1g and the LOTBs (Appendix I).

Direct Shear Tests

Direct shear tests were performed on selected samples to evaluate the shear strength of earth materials. The tests were performed on California liner ring samples in accordance with standard test method ASTM D3080. Summary plots of individual direct shear data are presented on Figures II-4a through II-4p - Direct Shear Test Results. Interpreted peak and ultimate shear strength parameters for the earth materials are presented on Figures II-4q through II-4x - Direct Shear Test Results Envelope.

Consolidation Tests

Consolidation tests were performed on selected samples of artificial fill to evaluate consolidation characteristics. The tests were performed on California liner ring samples in accordance with standard test method ASTM D2435. Graphic plots of the consolidation test data are presented on Figures II-5a and II-5b - Consolidation Test Results.

Unconfined Compression Tests

Unconfined compressive strengths were determined for selected samples of weathered bedrock. The tests were performed on relatively undisturbed cores extruded from California liner samples in accordance with standard test method ASTM D2166. Test results are summarized on Figures II-1a through II-1g. Photographs of extruded cores are presented as Plates II-1 through II-7.

Sand Equivalent Tests

Tests were performed on selected materials to estimate the sand equivalency in general accordance with ASTM D2419. The results of those tests are summarized on Figures II-1a through II-1g.

Soil Chemistry Tests/Corrosion Tests

Health Science Associates of Los Alamitos, California, tested selected earth material samples for resistivity, pH, sulfate, and chloride. Test results are summarized on Figures II-1a through II-1g.

Wall No.: 353R
Sample No.: 353R/LA/03
Depth: 12.2 m

SAMPLE PHOTOGRAPH
Route 15/56 Separation Managed Lanes, Stage 1
Task Order No. 284016
San Diego, California

Wall No.: 357R1
Sample No.: 357R1/LA/01
Depth: 9.3 m

SAMPLE PHOTOGRAPH
Route 15/56 Separation Managed Lanes, Stage 1
Task Order No. 284016
San Diego, California

2002\1394.003-2\1394.013photo02.dsf

Wall No.: 357R1
Sample No.: 357R1/LA/01
Depth: 11.1 m

SAMPLE PHOTOGRAPH
Route 15/56 Separation Managed Lanes, Stage 1
Task Order No. 284016
San Diego, California

2002\1394.003-2\1394.013photo04.dsf

Wall No.: 357R1
Sample No.: 357R1/LA/02
Depth: 17 m

2002\1394.003-2\1394.013photo07.dsf

SAMPLE PHOTOGRAPH
Route 15/56 Separation Managed Lanes, Stage 1
Task Order No. 284016
San Diego, California

Wall No.: 357R1
Sample No.: 357R1/LA/04
Depth: 8 m

2002\1394.003-2\1394.013photo06.dsf

SAMPLE PHOTOGRAPH
Route 15/56 Separation Managed Lanes, Stage 1
Task Order No. 284016
San Diego, California

2002\1394.003-2\1394.013photo08.dsf

Wall No.: 358L
Sample No.: 358L/LA/01
Depth: 3.7 m

SAMPLE PHOTOGRAPH
Route 15/56 Separation Managed Lanes, Stage 1
Task Order No. 284016
San Diego, California

2002\1394.003-2\1394.013photo09.dsf

Wall No.: 361L1
Sample No.: 361L1/LA/02
Depth: 13.7 m

SAMPLE PHOTOGRAPH
Route 15/56 Separation Managed Lanes, Stage 1
Task Order No. 284016
San Diego, California

DRILL HOLE	DEPTH, m	MATERIAL DESCRIPTION	UWW kN/m³	UDW kN/m³	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
							LL	PI	MAX DD kN/m³	OPT MC %	C kPa	PHI deg	Qu, kPa	S_u (Cell Prs.) kPa	R	pH	Cl	So_4				
331R/LA/01	0.9	Native Soil: Clayey SAND (SC)			14																	M
331R/LA/01A	0.9	Native Soil: Clayey SAND (SC)				34																FC
331R/LA/02	0.9	Native Soil: Sandy Lean CLAY (CL)	19	17	10										3448	7.63	319	63				T, Co
331R/LA/02	0.9	Native Soil: Sandy Lean CLAY (CL)			11	60																M, FC
335R/LA/01	1.4	Fill: Clayey SAND (SC)	19	16	14																	T
335R/LA/01	2.4	Fill: Clayey SAND (SC)				47																FC
335R/LA/01	4.4	Fill: Clayey SAND (SC)				43																FC
335R/LA/01	5.8	Fill: Clayey SAND (SC)			4																	M
335R/LA/02	0.3	Fill: Fat CLAY (CH)													3993	7.94	216	145				Co
335R/LA/02	1.1	Fill: Fat CLAY (CH)			14																	M
335R/LA/02	2.1	Fill: Fat CLAY (CH)			18	80																M, FC
335R/LA/03	0.9	Fill: Sandy Fat CLAY (CH)	20	16	22																	T
335R/LA/03	1.5	Fill: Sandy Fat CLAY (CH)				63	56	36														A, FC
335R/LA/03	2.6	Fill: Sandy Fat CLAY (CH)			19																	M
335R/LA/04	0.8	Fill: Sandy Fat CLAY (CH)			19																	M
335R/LA/04	1.5	Fill: Sandy Fat CLAY (CH)				58														119		FC, E
335R/LA/04	2.4	Fill: Sandy Fat CLAY (CH)			24																	M
335R/LA/05	0.9	Fill: Sandy Lean CLAY (CL)	21	18	14																	T
335R/LA/05	1.2	Fill: Sandy Lean CLAY (CL)				50	49	30														A, FC
335R/LA/05	2.4	Fill: Fat CLAY (CH)			33																	M
335R/LA/05	5.5	GRANITICS (Rx)				86																FC
346L/HA/01	1.5	Fill: Clayey SAND (SC)			12				20.2													M, P
346L/HA/01	3.0	Fill: Clayey SAND (SC)	20	17	14																	T
346L/HA/01	4.6	Native Soil: Sandy Lean CLAY (CL)			18	56	33	18														M, A, FC
346L/HA/01	5.3	VOLCANICS (Rx)	21	18	20	55																T, FC
346L/HA/01	6.1	VOLCANICS (Rx)	22	19	15																	T
346L/HA/02	1.5	Fill: Clayey SAND (SC)	18	17	9																	T
346L/HA/02	3.0	Fill: Clayey SAND (SC)			17	47																M, FC
346L/HA/02	3.4	Native Soil: Clayey SAND (SC)			13																	M
346L/HA/02	4.6	Native Soil: Clayey SAND (SC)	20	18	13	37	33	19														T, A, FC

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % Passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Direct Shear Test
C = Best Fit Peak Cohesion, ksf
PHI = Best Fit Peak Friction Angle, degrees

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-Value
SE = Sand Equivelant

SUMMARY OF LABORATORY TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-1a

DRILL HOLE	DEPTH, m	MATERIAL DESCRIPTION	UWW kN/m³	UDW kN/m³	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
							LL	PI	MAX DD kN/m³	OPT MC %	C kPa	PHI deg	Qu, kPa	S_u (Cell Prs.) kPa	R	pH	Cl	So_4				
346L/HA/02	5.2	Native Soil: Clayey SAND (SC)			12	25																M, FC
346L/HA/02	6.1	VOLCANICS (Rx)	23	22	7	11																T, FC
346L/HA/02	7.6	VOLCANICS (Rx)			26										9438	8.09	84	60				M, Co
346L/HA/02	9.1	VOLCANICS (Rx)	19	16	17						130	21										T, D
346L/HA/02	10.7	VOLCANICS (Rx)			26																	M
346L/HA/03	1.1	Fill: Sandy Fat CLAY (CH)	20	18	10																	T
346L/HA/03	1.5	Fill: Sandy Fat CLAY (CH)			14	51									14157	8.44	115	46				M, FC, Co
346L/HA/03	3.0	Fill: Sandy Fat CLAY (CH)			14		51	30														M, A
346L/HA/03	4.6	Native Soil: Sandy Lean CLAY (CL)			19																	M
346L/HA/03	5.3	VOLCANICS (Rx)													10890	8.32	45	28		54		Co, E
346L/LA/04	0.0	Fill: Sandy Lean CLAY (CL)				55	37	24														A, FC
346L/LA/04	1.0	Fill: Clayey SAND (SC)	21	18	19																	T
346L/LA/04	2.6	Native Soil: Clayey SAND (SC)	22	18	20						62	17										T, D
349L/HA/01	3.0	Native Soil: Sandy Fat CLAY (CH)			8	68																M, FC
349L/HA/01	4.6	VOLCANICS (Rx)				40																FC
349L/HA/01	6.1	VOLCANICS (Rx)			9		40	19														M, A
349L/HA/01	6.7	VOLCANICS (Rx)			5																	M
349L/HA/02	1.5	Fill: Sandy Lean CLAY (CL)			15																	M
349L/HA/02	3.0	Fill: Sandy Lean CLAY (CL)	15	14	10																	T
349L/HA/02	4.6	Fill: Sandy Lean CLAY (CL)			15	70	26	9														M, A, FC
349L/HA/02	6.1	VOLCANICS (Rx)	19	15	24	79	61	41														T, A, FC
349L/LA/03	0.0	Fill: Sandy Lean CLAY (CL)													1307	7.05	314	413				Co
349L/LA/03	1.1	Fill: Sandy Lean CLAY (CL)	20	18	10																	T
353R/LA/01	0.3	Native Soil: Sandy Lean CLAY (CL)			10																	M
353R/LA/02	0.3	Native Soil: Sandy Lean CLAY (CL)			9																	M
353R/LA/02	1.6	CLAYSTONE (Rx)					34	19														A
353R/LA/02B	1.9	Native Soil: Sandy Lean CLAY (CL)			32																	M
353R/LA/02B	3.1	VOLCANICS (Rx)			6	26									6897	8.39	<10	56			17	M, FC, Co, SE
353R/LA/03	0.3	Native Soil: Sandy Lean CLAY (CL)			14																	M
353R/LA/03	3.1	SANDSTONE (Rx)			17																	M

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
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Fines = % Passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Direct Shear Test
C = Best Fit Peak Cohesion, ksf
PHI = Best Fit Peak Friction Angle, degrees

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
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A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-Value
SE = Sand Equivelant

SUMMARY OF LABORATORY TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-1b

DRILL HOLE	DEPTH, m	MATERIAL DESCRIPTION	UWW kN/m³	UDW kN/m³	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
							LL	PI	MAX DD kN/m³	OPT MC %	C kPa	PHI deg	Qu, kPa	S_u (Cell Prs.) kPa	R	pH	Cl	So_4				
353R/LA/03	4.9	CLAYSTONE (Rx)			20																	M
353R/LA/03	6.1	CLAYSTONE (Rx)			18	96	58	36							2105	8.40	266	71			3	M, A, FC, Co, SE
353R/LA/03	7.7	CLAYSTONE (Rx)	21	18	13	95					53	23										T, D, FC
353R/LA/03	12.2	VOLCANICS (Rx)			17	90							877		1488	8.40	341	98				M, FC, Co
353R/LA/03	12.5	VOLCANICS (Rx)				82																FC
353R/LA/04	1.5	Native Soil: Sandy SILT (ML)	14	13	12	70	44	20														T, A, FC
353R/LA/04	3.0	SILTSTONE (Rx)/SANDSTONE (Rx)			21																	M
353R/LA/04	4.0	SILTSTONE (Rx)			18	25																M, FC
353R/LA/04	6.1	SILTSTONE (Rx)			20																	M
353R/LA/04	9.1	SANDSTONE (Rx)			11																	M
357R/HA/01	1.5	Fill: Fat CLAY with sand (CH)	19	16	22	73	84	66														T, A, FC
357R/HA/01	2.3	SANDSTONE (Rx)			18	23																M, FC
357R/HA/01	3.0	SANDSTONE (Rx)	21	17	21						5	43										T, D
357R/HA/01	4.6	SANDSTONE (Rx)			14										9801	8.60	44	25				M, Co
357R/HA/02	1.5	SANDSTONE (Rx)			15																	M
357R/HA/02	2.3	SANDSTONE (Rx)	21	18	16	34																T, FC
357R/HA/02	3.0	SANDSTONE (Rx)			15																	M
357R/HA/03	0.9	Fill: Sandy Lean CLAY (CL)													8894	8.14	80	24				Co
357R/HA/03	1.5	SANDSTONE (Rx)	22	19	14	22																T, FC
357R/HA/03	4.0	SANDSTONE (Rx)			12																	M
357R/HA/03	7.6	CLAYSTONE (Rx)			14																	M
357R/HA/04	1.5	SANDSTONE (Rx)	22	19	15	24																T, FC
357R/HA/04	2.3	SANDSTONE (Rx)			5	29	31	14														M, A, FC
357R/HA/04	3.0	SANDSTONE (Rx)	23	20	15	20					29	30										T, D, FC
357R/HA/04	6.1	SANDSTONE (Rx)	20	18	11	28																T, FC
357R/HA/05	1.5	SANDSTONE (Rx)	21	18	16	30	41	21														T, A, FC
357R/HA/05	3.0	SANDSTONE (Rx)			14																	M
357R/HA/05	4.6	SANDSTONE (Rx)			14																	M
357R1/LA/01	1.9	CLAYSTONE (Rx)	20	17	19																	T
357R1/LA/01	4.9	CLAYSTONE (Rx)	16	14	20	94									3376	8.43	32	146		141		T, FC, Co, E

Classification Tests
UWW = Unit Wet Weight
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LL = Liquid Limit
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Direct Shear Test
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Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Compressive Strength Tests
Qu = Unconfined Compression
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p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
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Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
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SUMMARY OF LABORATORY TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-1C

DRILL HOLE	DEPTH, m	MATERIAL DESCRIPTION	UWW kN/m³	UDW kN/m³	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
							LL	PI	MAX DD kN/m³	OPT MC %	C kPa	PHI deg	Qu, kPa	S_u (Cell Prs.) kPa	R	pH	Cl	So_4				
357R1/LA/01	8.0	CLAYSTONE (Rx)	21	17	19	100					19	25										T, D, FC
357R1/LA/01	9.3	CLAYSTONE (Rx)					39	18					699									A
357R1/LA/01	10.2	SANDSTONE (Rx)				24							57									FC
357R1/LA/01	11.2	SANDSTONE (Rx)				23							96									FC
357R1/LA/01	12.8	SANDSTONE (Rx)			11																	M
357R1/LA/02	3.4	SANDSTONE (Rx)			10	22																M, FC
357R1/LA/02	4.9	CLAYSTONE (Rx)	21	18	17																	T
357R1/LA/02	6.4	CLAYSTONE (Rx)			18																	M
357R1/LA/02	8.0	CLAYSTONE (Rx)	21	17	19	98	56	32			34	24										T, A, D, FC
357R1/LA/02	9.2	CLAYSTONE (Rx)				88									2360	8.04	153	66			7.8	FC, Co, SE
357R1/LA/02	9.5	SANDSTONE (Rx)			12																	M
357R1/LA/02	11.0	SANDSTONE (Rx)	20	18	14	28	33	13			24	30										T, A, D, FC
357R1/LA/02	12.5	SANDSTONE (Rx)			12																	M
357R1/LA/02	14.1	CLAYSTONE (Rx)				96	48	26			101	26										A, D, FC
357R1/LA/02	15.3	CLAYSTONE (Rx)			16	86									2840	8.39	59	<10			8.3	M, FC, Co, SE
357R1/LA/02	17.1	CLAYSTONE (Rx)				95							1113									FC
357R1/LA/02	17.7	CLAYSTONE (Rx)					60	40														A
357R1/LA/02	18.8	CLAYSTONE (Rx)				96																FC
357R1/LA/02	19.5	CLAYSTONE (Rx)					35	17														A
357R1/LA/02	20.6	CLAYSTONE (Rx)				92																FC
357R1/LA/02	21.7	CLAYSTONE (Rx)			17																	M
357R1/LA/03	3.1	CLAYSTONE (Rx)			16	94									1670	8.24	176	79		6		M, FC, Co, E
357R1/LA/03	3.4	CLAYSTONE (Rx)	21	18	16	97																T, FC
357R1/LA/03	6.4	CLAYSTONE (Rx)	19	16	16	97																T, FC
357R1/LA/03	8.0	CLAYSTONE (Rx)					50	30														A
357R1/LA/03	9.5	SANDSTONE (Rx)				36	37	18														A, FC
357R1/LA/03	12.5	CLAYSTONE (Rx)				97	56	33														A, FC
357R1/LA/04	0.3	Native Soil: Sandy Lean CLAY (CL)			15	92															10.8	M, FC, SE
357R1/LA/04	1.6	CLAYSTONE (Rx)													2251	7.76	56	271				Co
357R1/LA/04	3.1	CLAYSTONE (Rx)			17	95									4719	7.85	48	<10			4.5	M, FC, Co, SE

Classification Tests
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SO_4 = Sulfate, ppm

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SUMMARY OF LABORATORY TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-1d

DRILL HOLE	DEPTH, m	MATERIAL DESCRIPTION	UWW kN/m³	UDW kN/m³	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
							LL	PI	MAX DD kN/m³	OPT MC %	C kPa	PHI deg	Qu, kPa	S_u (Cell Prs.) kPa	R	pH	Cl	So_4				
357R1/LA/04	3.4	CLAYSTONE (Rx)			16																	M
357R1/LA/04	4.9	SANDSTONE (Rx)	18	16	15																	T
357R1/LA/04	6.4	CLAYSTONE (Rx)				97	50	27														A, FC
357R1/LA/04	8.1	CLAYSTONE (Rx)				84	54	30					381									A, FC
357R1/LA/04	9.0	CLAYSTONE (Rx)			7										5808	8.36	14	32				M, Co
357R1/LA/04	9.9	CLAYSTONE (Rx)			14																	M
357R1/LA/05	3.4	CLAYSTONE (Rx)				85																FC
357R1/LA/05	4.9	CLAYSTONE (Rx)	21	17	19																	T
357R1/LA/05	6.1	CLAYSTONE (Rx)				82	56	37														A, FC
357R1/LA/05	7.8	CLAYSTONE (Rx)	21	18	18																	T
357R1/LA/05	9.5	SANDSTONE (Rx)			1	51																M, FC
358L/LA/01	0.3	Native Soil: Fat CLAY with sand (CH)				73	68	49													16	A, S, SE
358L/LA/01	1.6	Native Soil: Fat CLAY with sand (CH)													1634	7.96	55	54				Co
358L/LA/01	1.9	Native Soil: Fat CLAY with sand (CH)	21	18	17																	T
358L/LA/01	3.7	SANDSTONE (Rx)				37	33	14					295									A, FC
358L/LA/01	4.6	SANDSTONE (Rx)			13																	M
358L/LA/01	6.1	SANDSTONE (Rx)	21	18	17	45																T, FC
358L/LA/02	0.9	Native Soil: Sandy Lean CLAY (CL)	18	15	17																	T
358L/LA/02	1.9	SANDSTONE (Rx)				70																FC
358L/LA/02	2.8	SANDSTONE (Rx)	21	18	16	31																T, FC
358L/LA/02	3.7	SANDSTONE (Rx)				60									3122	8.06	23	32		97	3	FC, Co, SE, E
358L/LA/02	4.6	CLAYSTONE (Rx)				32	48	24			38	33										A, D, FC
361L/HA/01	1.5	Fill: Clayey SAND (SC)			6	13																M, FC
361L/HA/01	3.0	Native Soil: Fat CLAY with sand (CH)	18	14	31	72	58	33														T, A, FC
361L/HA/01	4.6	Native Soil: Fat CLAY with sand (CH)			22		56	32														M, A
361L/HA/01	6.1	CLAYSTONE (Rx)				64																FC
361L/HA/01	7.6	CLAYSTONE (Rx)			19																	M
361L/HA/02	1.5	Fill: Clayey SAND (SC)			10	27	41	24														M, A, FC
361L/HA/02	3.0	Fill: Clayey SAND (SC)			17	34																M, FC
361L/HA/02	4.6	Native Soil: Sandy Lean CLAY (CL)			20		41	26														M, A

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % Passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Direct Shear Test
C = Best Fit Peak Cohesion, ksf
PHI = Best Fit Peak Friction Angle, degrees

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-Value
SE = Sand Equivelant

SUMMARY OF LABORATORY TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-1e

DRILL HOLE	DEPTH, m	MATERIAL DESCRIPTION	UWW kN/m³	UDW kN/m³	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
							LL	PI	MAX DD kN/m³	OPT MC %	C kPa	PHI deg	Qu, kPa	S_u (Cell Prs.) kPa	R	pH	Cl	So_4				
361L/HA/02	6.1	Native Soil: Sandy Lean CLAY (CL)			19																	M
361L/HA/02	7.6	Native Soil: Sandy Lean CLAY (CL)	20	17	21						38	28										T, D
361L/HA/03	1.5	Fill: Clayey SAND (SC)			8	25	42	26														M, A, FC
361L/HA/03	3.0	Fill: Clayey SAND (SC)	21	18	14	31	38	19			19	36										T, A, D, FC
361L/HA/03	3.5	Fill: Clayey SAND (SC)			12										11253	8.49	23	8				M, Co
361L/HA/03	4.0	Fill: Clayey SAND (SC)	20	17	17																	T, C
361L/HA/03	4.6	Fill: Clayey SAND (SC)			15	34	40	24														M, A, FC
361L/HA/03	6.1	Fill: Clayey SAND (SC)	21	17	18	33																T, FC
361L/HA/03	7.6	Fill: Clayey SAND (SC)			19																	M
361L/HA/03	9.1	Fill: Clayey SAND (SC)	20	16	20	34																T, FC
361L1/LA/01	1.9	CLAYSTONE (Rx)			11																	M
361L1/LA/01	3.1	CLAYSTONE (Rx)				86															7.2	FC, SE
361L1/LA/01	3.7	CLAYSTONE (Rx)			19																	M
361L1/LA/01	4.6	CLAYSTONE (Rx)	21	17	20	96	53	25			81	20										T, A, D, FC
361L1/LA/01	6.1	CLAYSTONE (Rx)			17																	M
361L1/LA/01	8.3	CLAYSTONE (Rx)				78														93	5.2	FC, SE, E
361L1/LA/01	8.6	CLAYSTONE (Rx)													3448	7.64	228	26				Co
361L1/LA/01	10.7	SANDSTONE (Rx)	22	19	16	28	33	10			24	34										T, A, D, FC
361L1/LA/02	3.1	CLAYSTONE (Rx)			17	80																M, FC
361L1/LA/02	5.2	CLAYSTONE (Rx)				88															3.2	FC, SE
361L1/LA/02	5.5	CLAYSTONE (Rx)													1670	7.98	166	61				Co
361L1/LA/02	6.1	CLAYSTONE (Rx)			15																	M
361L1/LA/02	9.2	CLAYSTONE (Rx)			18																	M
361L1/LA/02	12.5	SANDSTONE (Rx)				54	41	25							2831	7.78	116	61				A, FC, Co
361L1/LA/02	13.0	SANDSTONE (Rx)			14																	M
361L1/LA/02	13.7	SANDSTONE (Rx)				24	35	16					284									A, FC
361L1/LA/02	15.3	SANDSTONE (Rx)				23	36	17														A, FC
361L1/LA/03	0.3	Native Soil: Sandy Fat CLAY (CH)				73															3.3	FC, SE
361L1/LA/03	1.6	Native Soil: Sandy Fat CLAY (CH)	19	15	29										4719	8.17	<10	<10				T, Co
361L1/LA/03	3.1	SANDSTONE (Rx)				50																FC

Classification Tests
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SUMMARY OF LABORATORY TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-1f

DRILL HOLE	DEPTH, m	MATERIAL DESCRIPTION	UWW kN/m³	UDW kN/m³	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
							LL	PI	MAX DD kN/m³	OPT MC %	C kPa	PHI deg	Qu, kPa	S_u (Cell Prs.) kPa	R	pH	Cl	So_4				
361L1/LA/03	4.6	SANDSTONE (Rx)	20	18	11																	T
361R/HA/01	0.9	Fill: Sandy Fat CLAY (CH)				64			3.5		24	27									6.9	P, D, S, SE
361R/HA/01	1.5	Fill: Sandy Fat CLAY (CH)			19		52	33							8168	8.88	100	34				M, A, Co
361R/HA/01	2.3	Fill: Clayey SAND (SC)	18	15	13						29	31										T, D
361R/HA/01	3.0	Fill: Clayey SAND (SC)			17	45	40	22														M, A, FC
361R/HA/01	4.6	Native Soil: CLAY with sand (CL)	21	17	21	91	48	25														T, A, FC
361R/HA/01	6.1	Native Soil: CLAY with sand (CL)			18	72																M, FC
361R/HA/02	0.9	Native Soil: Clayey SAND (SC)																		36		E
361R/HA/02	2.3	Native Soil: Clayey SAND (SC)	19	17	9	17	37	17														T, A, FC
361R/HA/02	4.6	Native Soil: Clayey SAND (SC)	20	17	15	42																T, FC
361R/HA/02	6.1	Native Soil: Clayey SAND (SC)			19	40	42	26														M, A, FC
361R/HA/02	7.6	Native Soil: Sandy Lean CLAY (CL)	21	16	25		47	31														T, A, C
361R/HA/02	9.1	Native Soil: Sandy Lean CLAY (CL)			32																	M
361R/HA/02	10.7	Native Soil: Sandy Lean CLAY (CL)	20	16	24	64																T, FC
361R/HA/02	12.2	SANDSTONE (Rx)			22																	M

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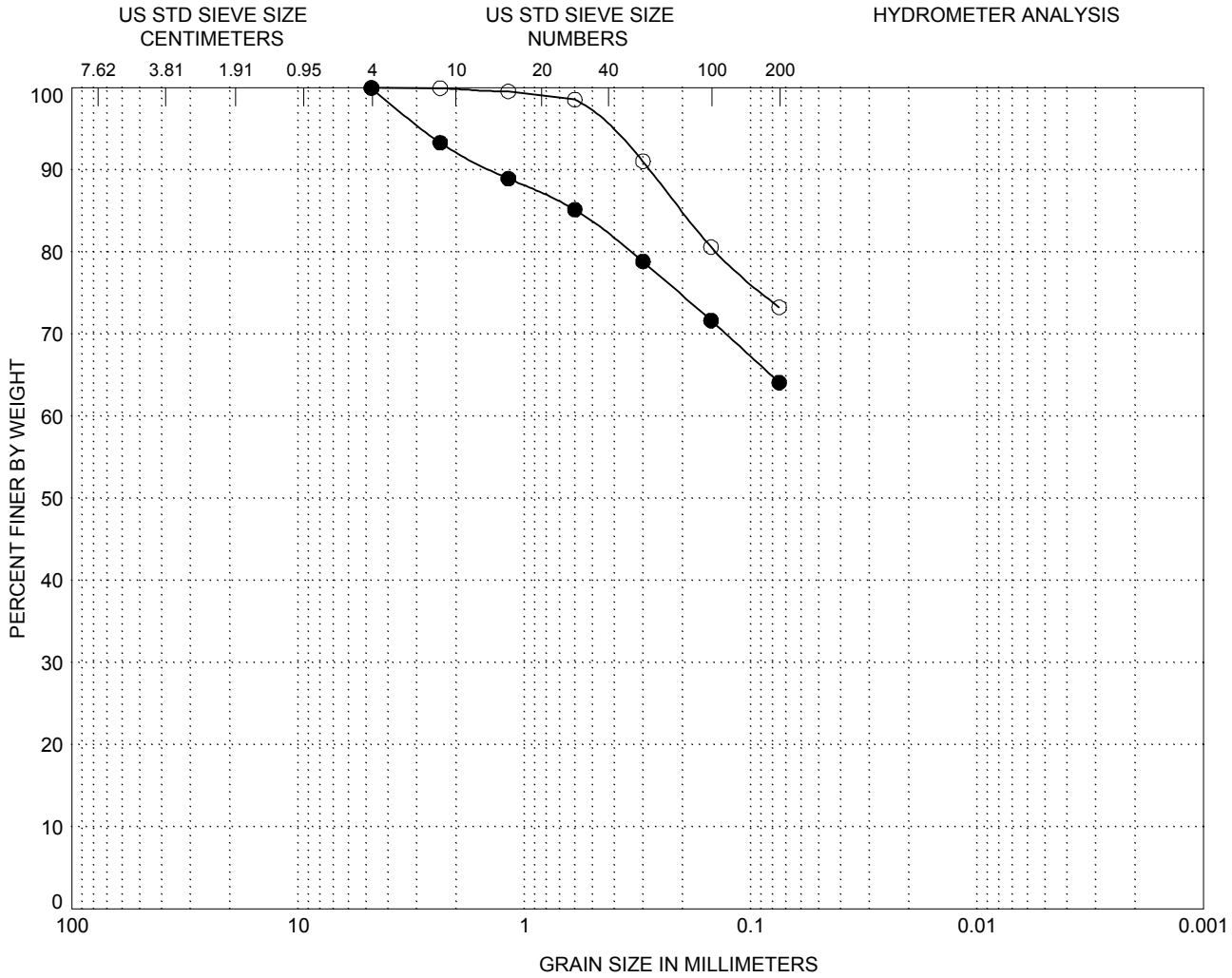
SUMMARY OF LABORATORY TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-1g



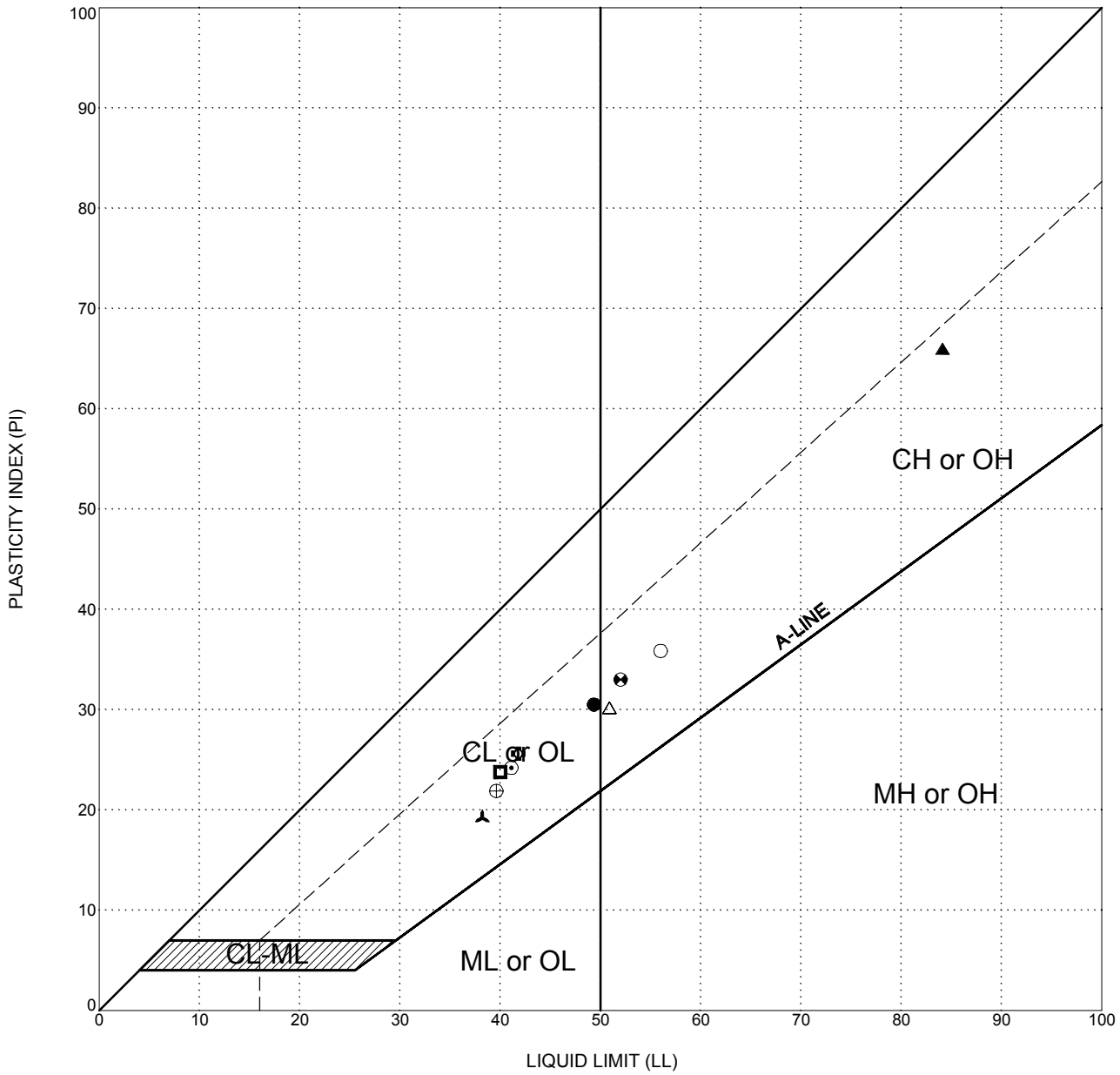
GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,m)	CLASSIFICATION	Cc	Cu
○	358L/LA/01	0.3	Native Soil: Fat CLAY with sand (CH)		
●	361R/HA/01	0.9	Fill: Sandy Fat CLAY (CH)		

GRAIN SIZE CURVES

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-2

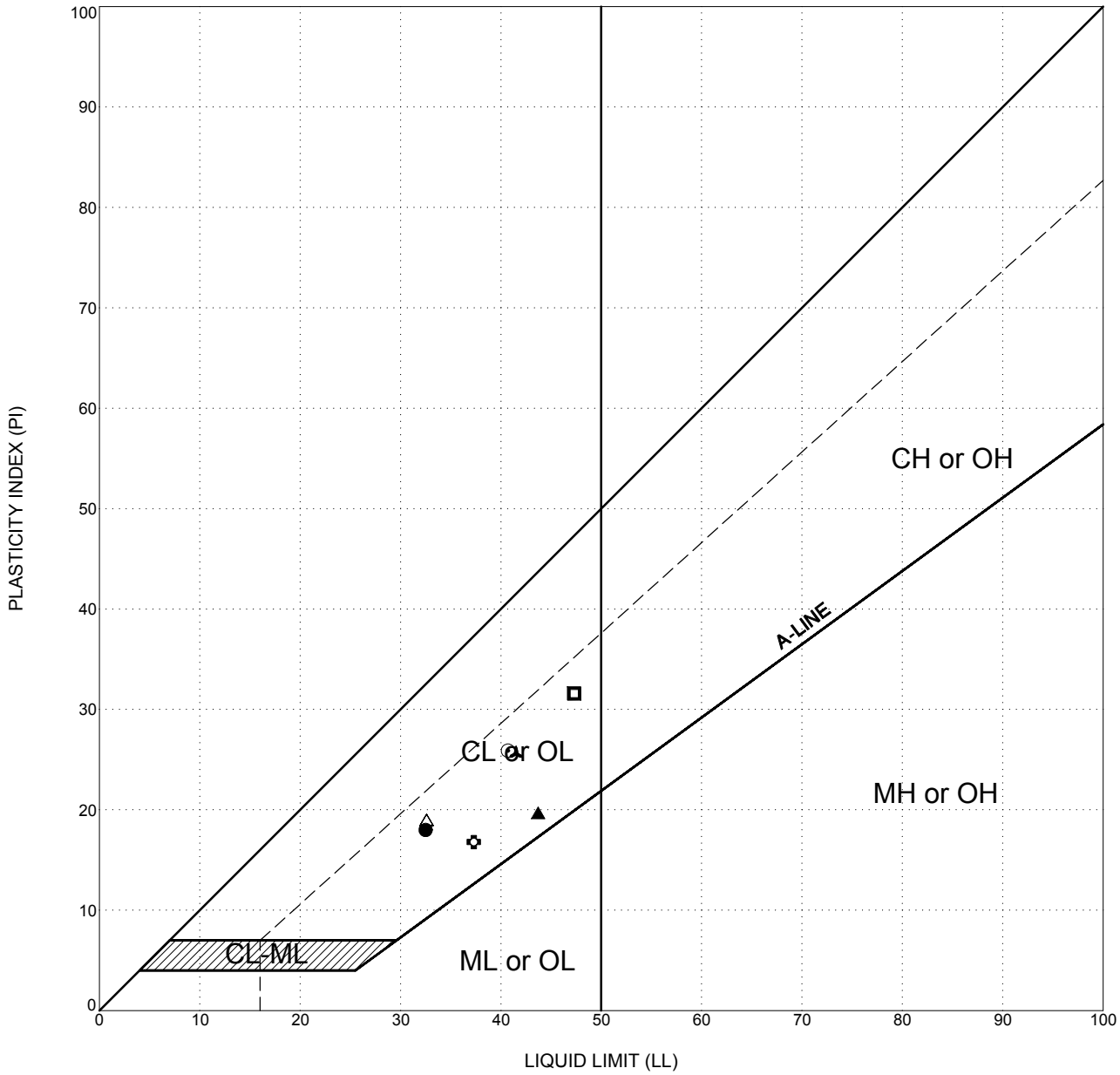


LEGEND location	depth, m	CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○ 335R/LA/03	1.5	Fill: Sandy Fat CLAY (CH)	56	20	36
● 335R/LA/05	1.2	Fill: Sandy Lean CLAY (CL)	49	19	30
△ 346L/HA/03	3.0	Fill: Sandy Fat CLAY (CH)	51	21	30
▲ 357R/HA/01	1.5	Fill: Fat CLAY with sand (CH)	84	18	66
⊙ 361L/HA/02	1.5	Fill: Clayey SAND (SC)	41	17	24
✿ 361L/HA/03	1.5	Fill: Clayey SAND (SC)	42	16	26
⅄ 361L/HA/03	3.0	Fill: Clayey SAND (SC)	38	19	19
◘ 361L/HA/03	4.6	Fill: Clayey SAND (SC)	40	16	24
⊗ 361R/HA/01	1.5	Fill: Sandy Fat CLAY (CH)	52	19	33
⊕ 361R/HA/01	3.0	Fill: Clayey SAND (SC)	40	18	22

PLASTICITY CHART

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

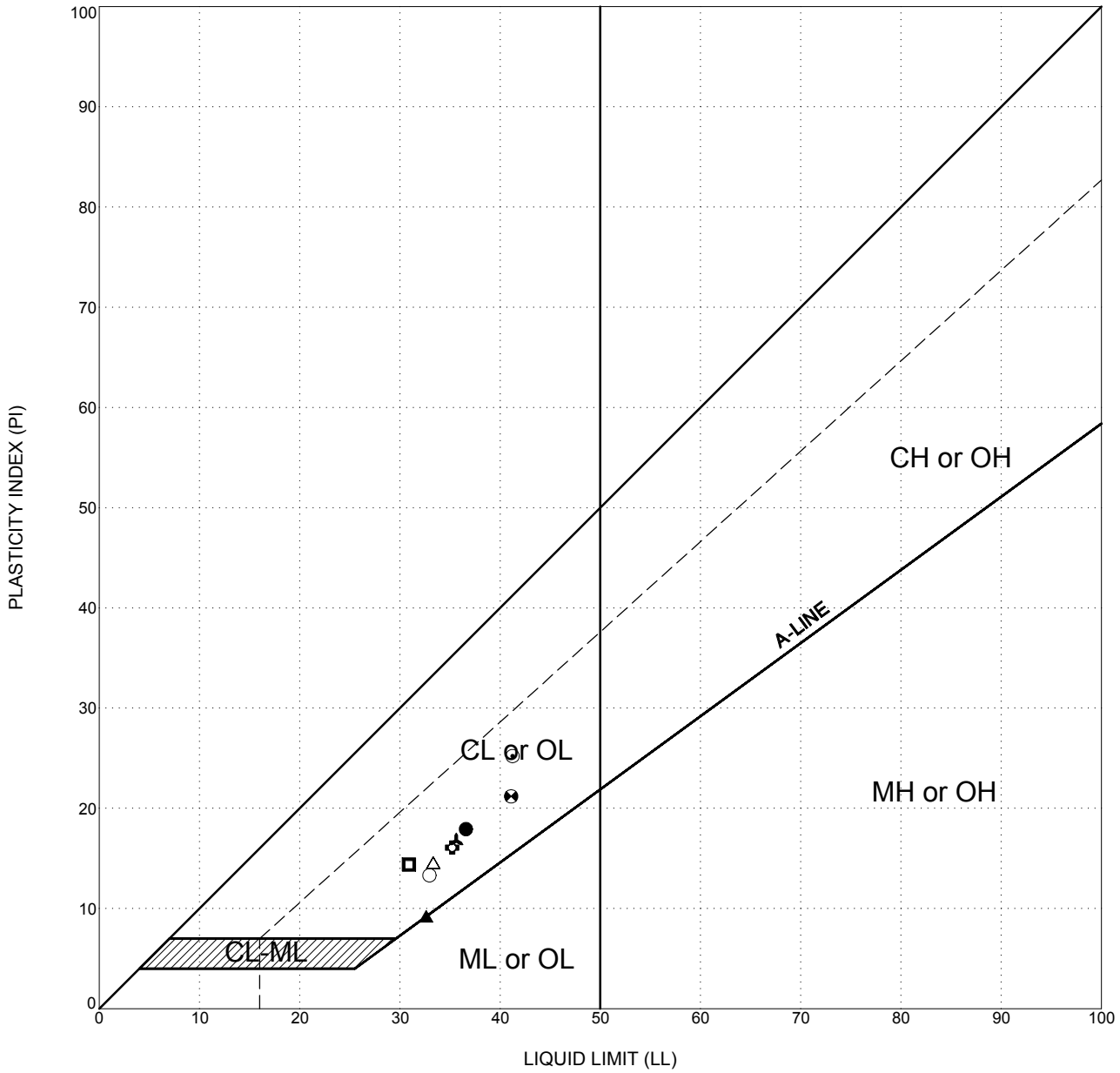
FIGURE II-3a



LEGEND location	depth, m	CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
● 346L/HA/01	4.6	Native Soil: Sandy Lean CLAY (CL)	33	15	18
△ 346L/HA/02	4.6	Native Soil: Clayey SAND (SC)	33	14	19
▲ 353R/LA/04	1.5	Native Soil: Sandy SILT (ML)	44	24	20
⊙ 361L/HA/02	4.6	Native Soil: Sandy Lean CLAY (CL)	41	15	26
✿ 361R/HA/02	2.3	Native Soil: Clayey SAND (SC)	37	21	17
⅄ 361R/HA/02	6.1	Native Soil: Clayey SAND (SC)	42	16	26
◘ 361R/HA/02	7.6	Native Soil: Sandy Lean CLAY (CL)	47	16	31

PLASTICITY CHART
Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

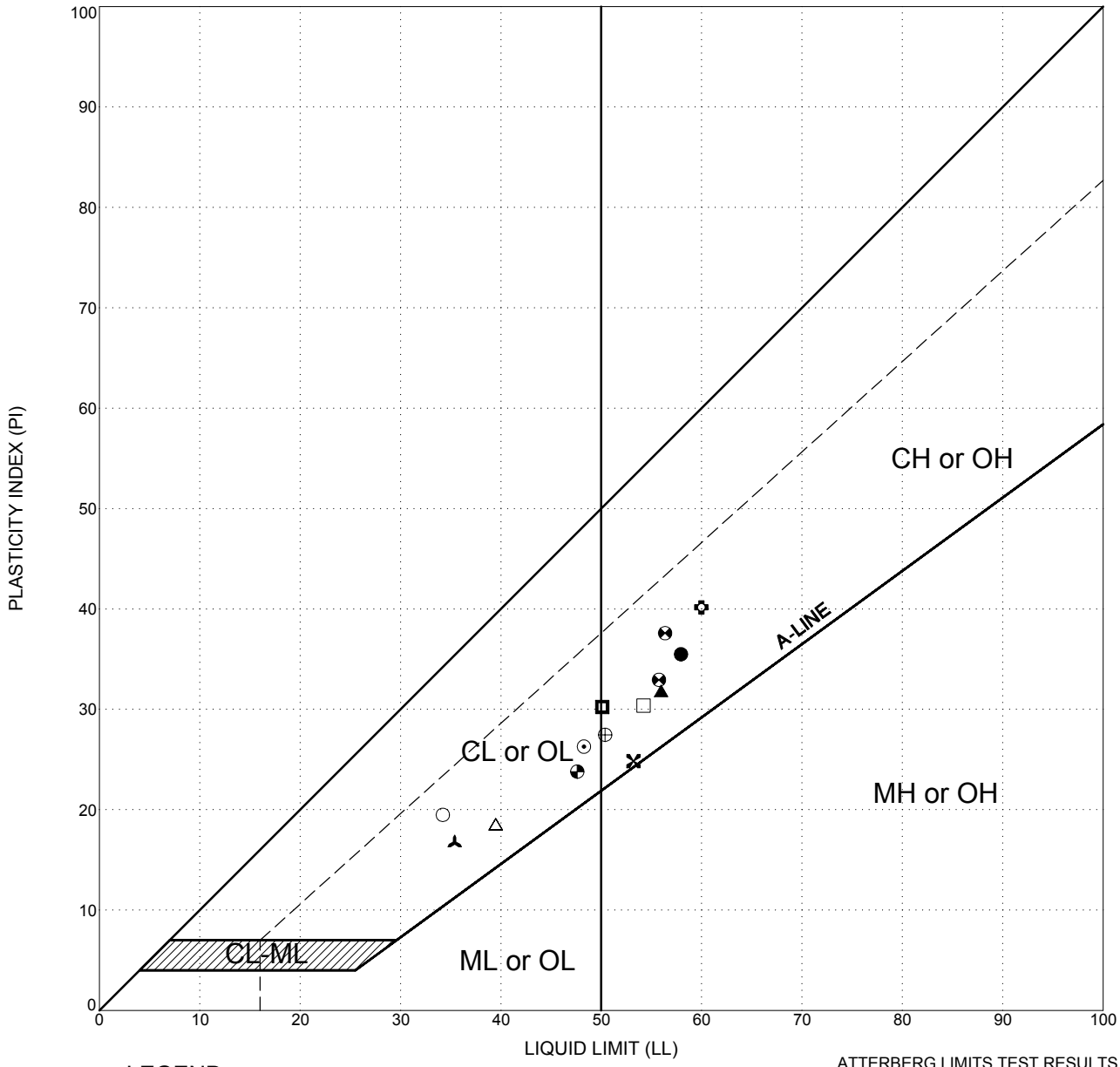
FIGURE II-3b



LEGEND location	depth, m	CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
357R1/LA/02	11.0	SANDSTONE (Rx)	33	20	13
357R1/LA/03	9.5	SANDSTONE (Rx)	37	19	18
358L/LA/01	3.7	SANDSTONE (Rx)	33	19	14
361L1/LA/01	10.7	SANDSTONE (Rx)	33	23	10
361L1/LA/02	12.5	SANDSTONE (Rx)	41	16	25
361L1/LA/02	13.7	SANDSTONE (Rx)	35	19	16
361L1/LA/02	15.3	SANDSTONE (Rx)	36	19	17
357R/HA/04	2.3	SANDSTONE (Rx)	31	17	14
357R/HA/05	1.5	SANDSTONE (Rx)	41	20	21

PLASTICITY CHART
Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-3c



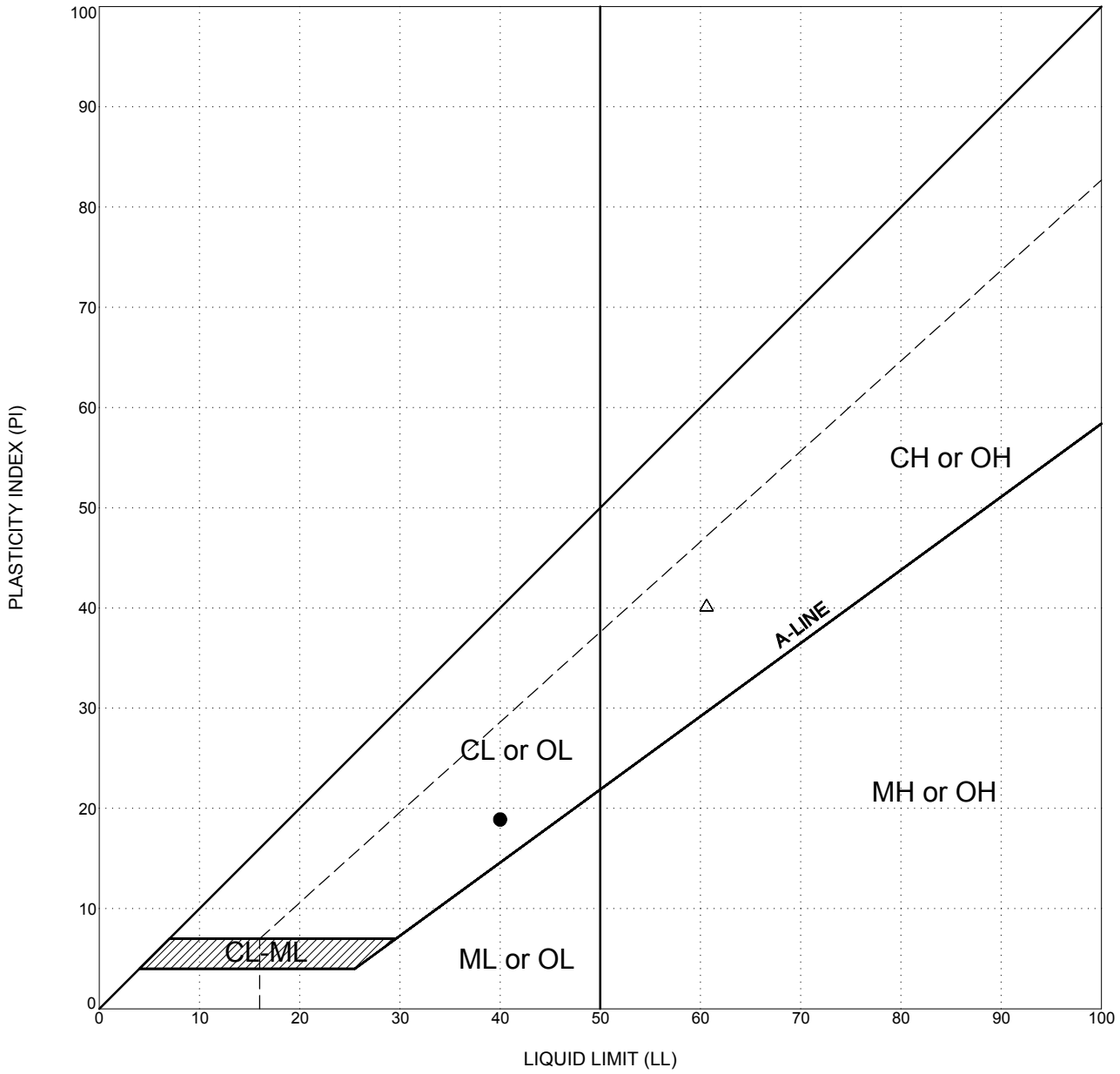
LEGEND

	location	depth, m	CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	353R/LA/02	1.6	CLAYSTONE (Rx)	34	15	19
●	353R/LA/03	6.1	CLAYSTONE (Rx)	58	22	36
△	357R1/LA/01	9.3	CLAYSTONE (Rx)	39	21	18
▲	357R1/LA/02	8.0	CLAYSTONE (Rx)	56	24	32
⊙	357R1/LA/02	14.1	CLAYSTONE (Rx)	48	22	26
✿	357R1/LA/02	17.7	CLAYSTONE (Rx)	60	20	40
⅄	357R1/LA/02	19.5	CLAYSTONE (Rx)	35	18	17
◘	357R1/LA/03	8.0	CLAYSTONE (Rx)	50	20	30
◓	357R1/LA/03	12.5	CLAYSTONE (Rx)	56	23	33
⊕	357R1/LA/04	6.4	CLAYSTONE (Rx)	50	23	27
□	357R1/LA/04	8.1	CLAYSTONE (Rx)	54	24	30
◓	357R1/LA/05	6.1	CLAYSTONE (Rx)	56	19	37
◕	358L/LA/02	4.6	CLAYSTONE (Rx)	48	24	24
✕	361L1/LA/01	4.6	CLAYSTONE (Rx)	53	28	25

PLASTICITY CHART

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

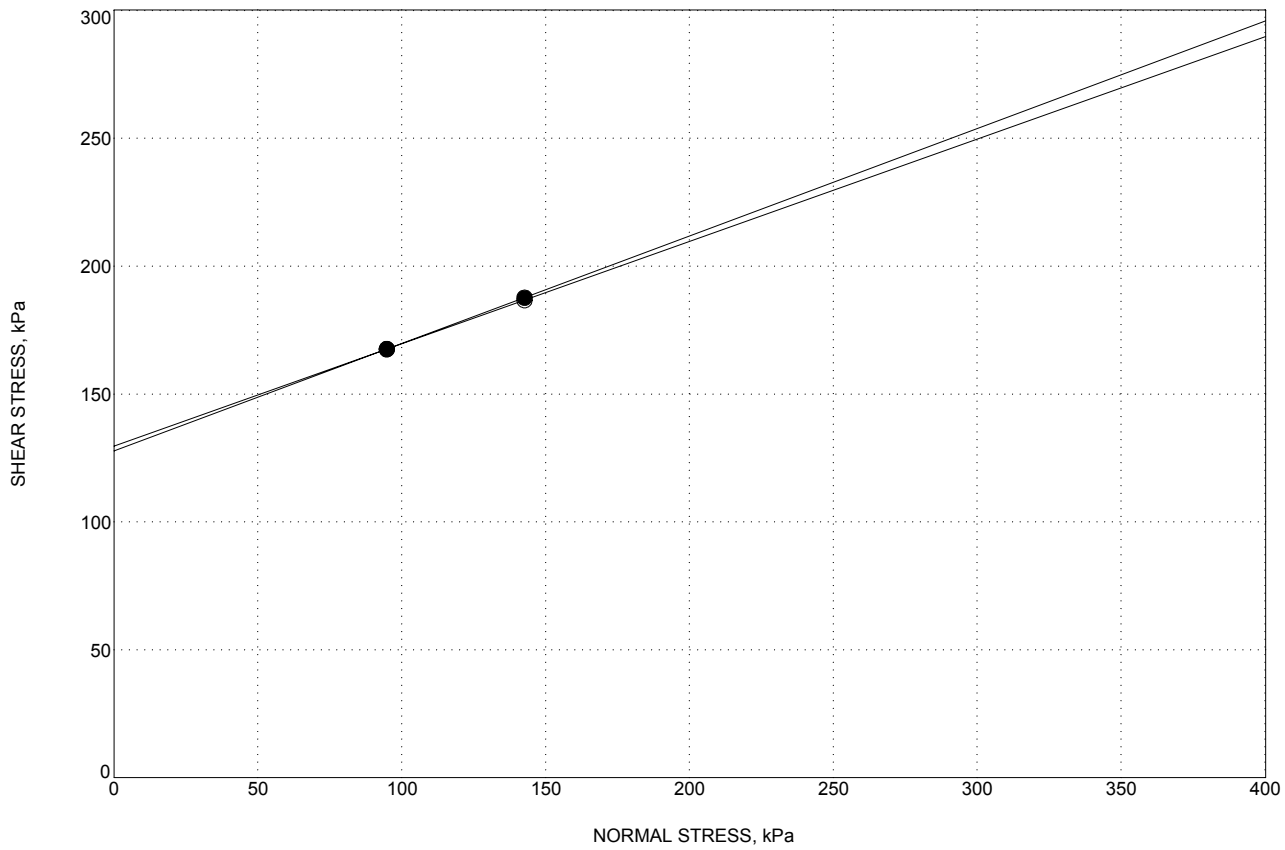
FIGURE II-3d



LEGEND	location	depth, m	CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
●	349L/HA/01	6.1	VOLCANICS (Rx)	40	21	19
△	349L/HA/02	6.1	VOLCANICS (Rx)	61	20	41

PLASTICITY CHART
Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-3e



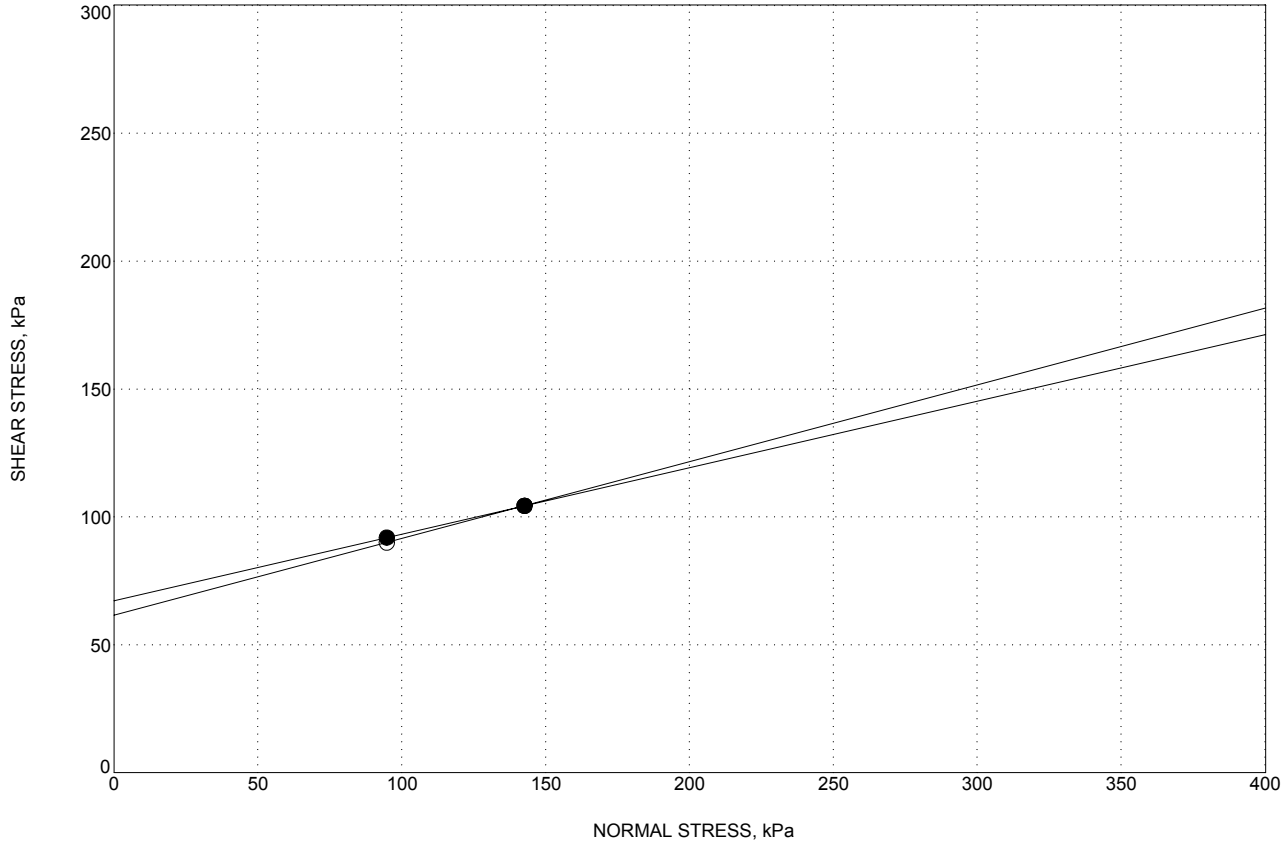
	○ ULTIMATE	● PEAK
COHESION, kPa	129.8	127.8
ANGLE OF INTERNAL FRICTION, deg	21	23

DRILL HOLE	346L/HA/02
DEPTH, m	9.1
MOISTURE CONTENT, %	17.1
UNIT DRY WEIGHT, kN/m^3	16.2
MATERIAL DESCRIPTION	VOLCANICS (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4a



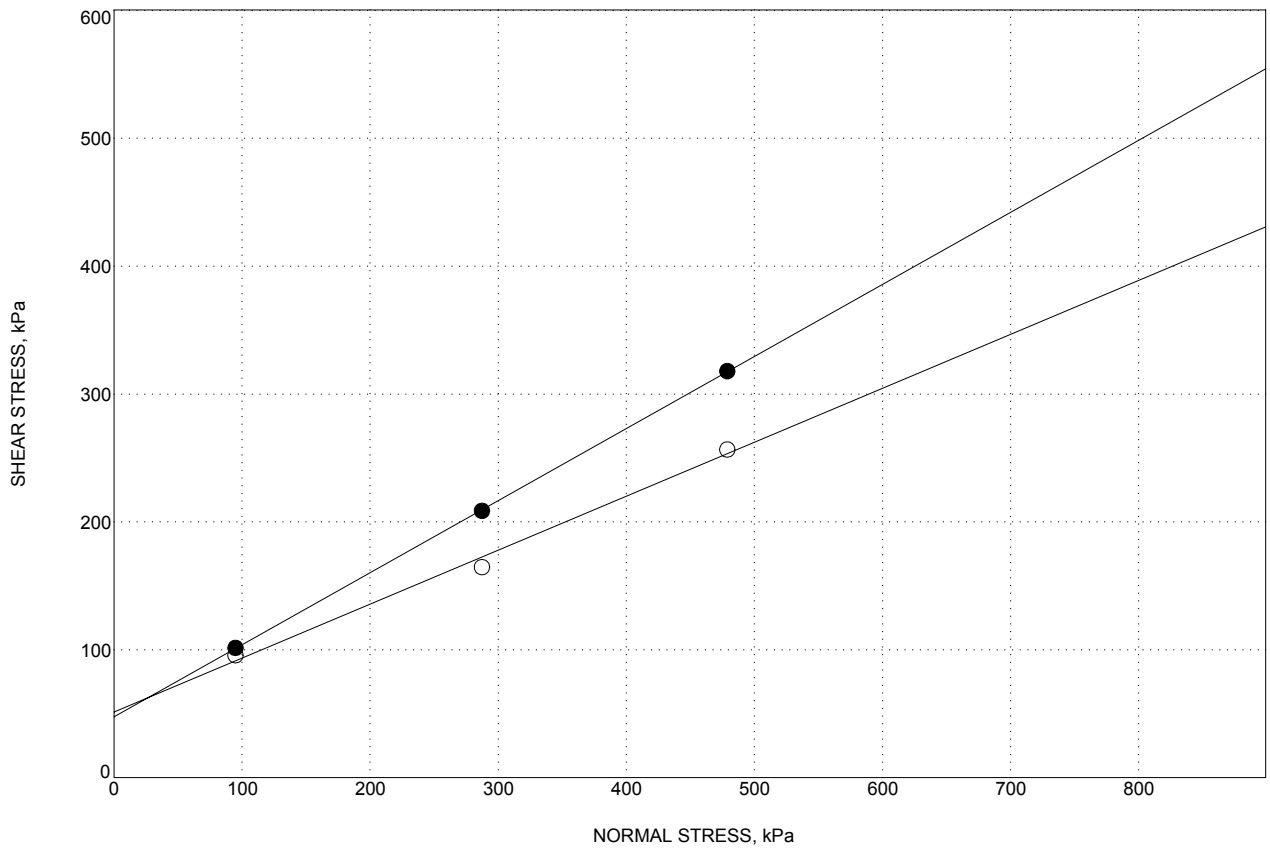
	○ ULTIMATE	● PEAK
COHESION, kPa	62.2	67.0
ANGLE OF INTERNAL FRICTION, deg	17	15

DRILL HOLE	346L/LA/04
DEPTH, m	2.6
MOISTURE CONTENT, %	20.8
UNIT DRY WEIGHT, kN/m^3	17.3
MATERIAL DESCRIPTION	Native Soil: Clayey SAND (SC)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4b



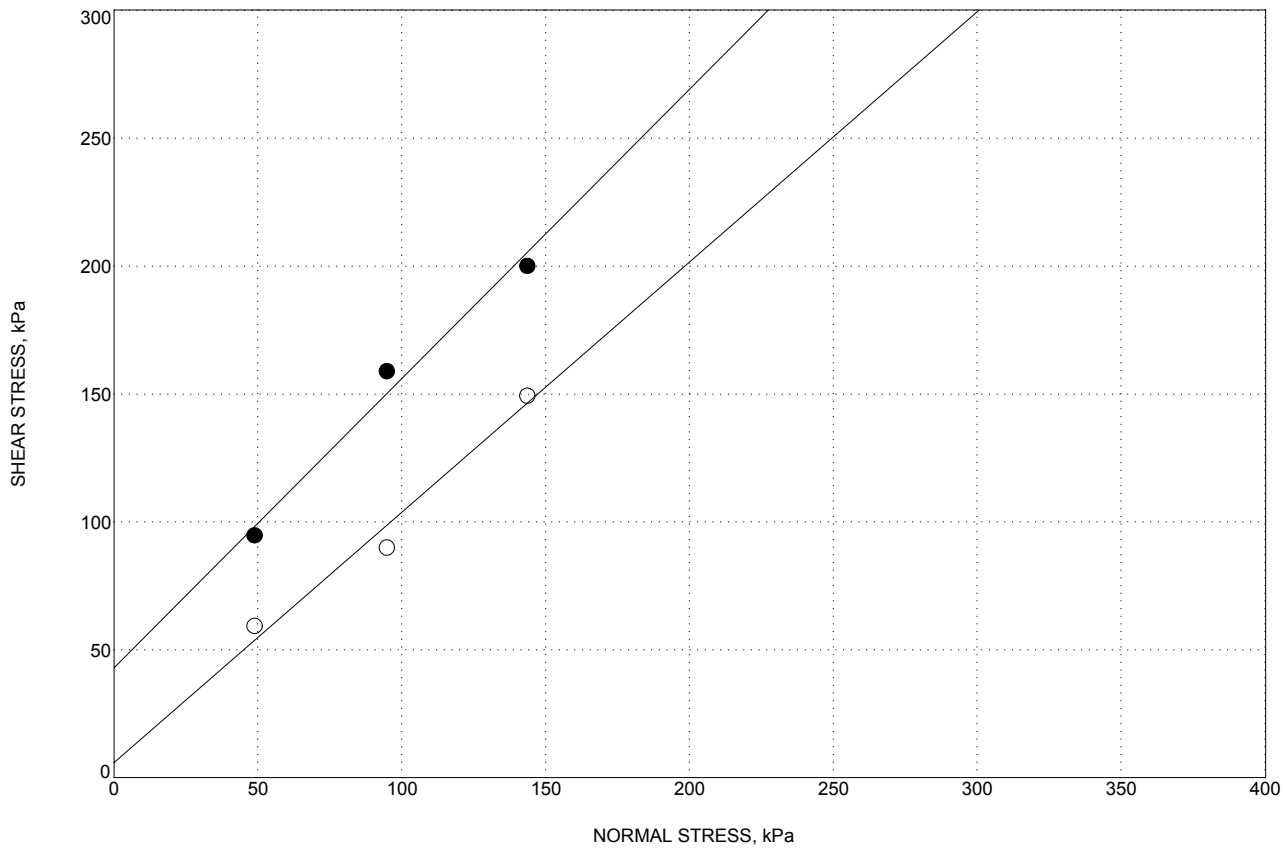
	○ ULTIMATE	● PEAK
COHESION, kPa	52.7	47.9
ANGLE OF INTERNAL FRICTION, deg	23	30

DRILL HOLE	353R/LA/03
DEPTH, m	7.7
MOISTURE CONTENT, %	13.0
UNIT DRY WEIGHT, kN/m^3	18.3
MATERIAL DESCRIPTION	CLAYSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4c



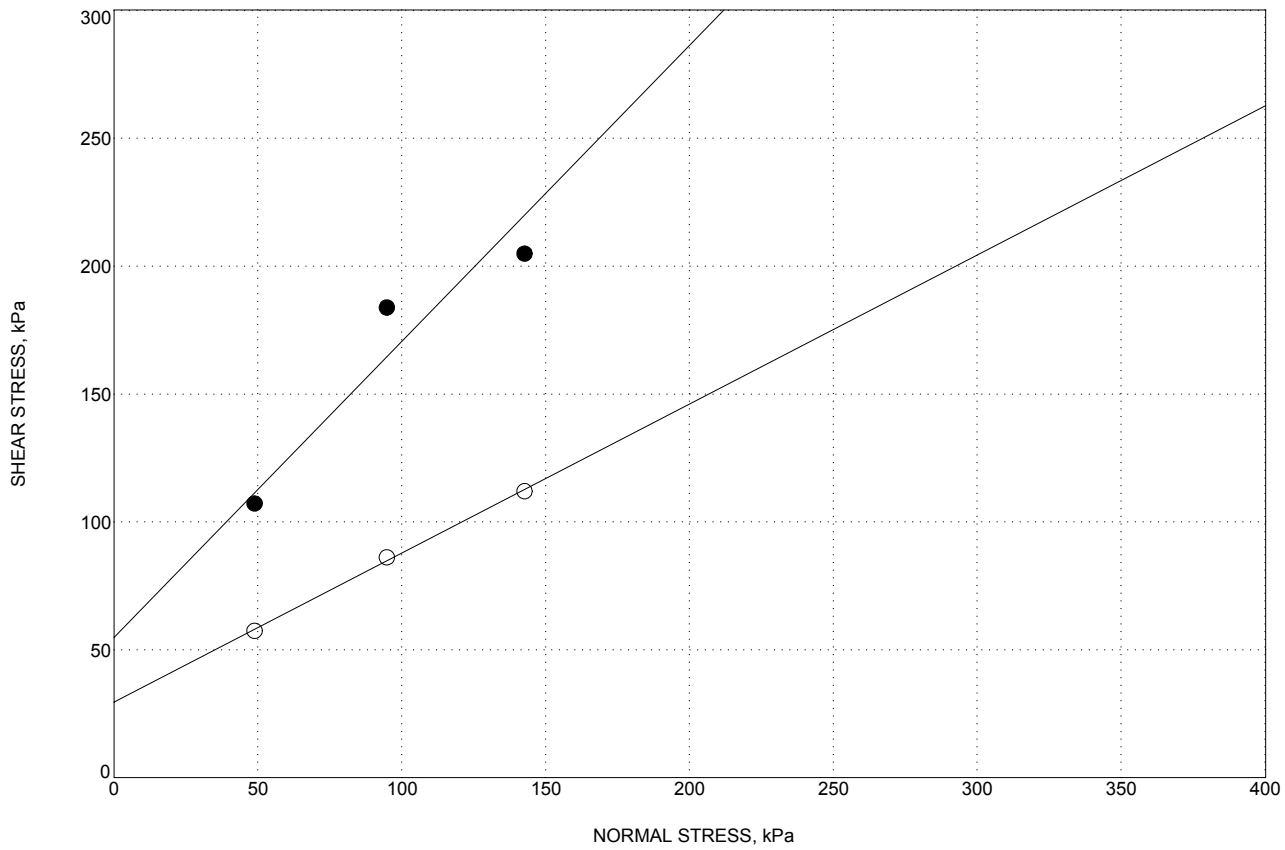
	○ ULTIMATE	● PEAK
COHESION, kPa	4.8	42.6
ANGLE OF INTERNAL FRICTION, deg	43	47

DRILL HOLE	357R/HA/01
DEPTH, m	3.0
MOISTURE CONTENT, %	21.1
UNIT DRY WEIGHT, kN/m^3	17.1
MATERIAL DESCRIPTION	SANDSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4d



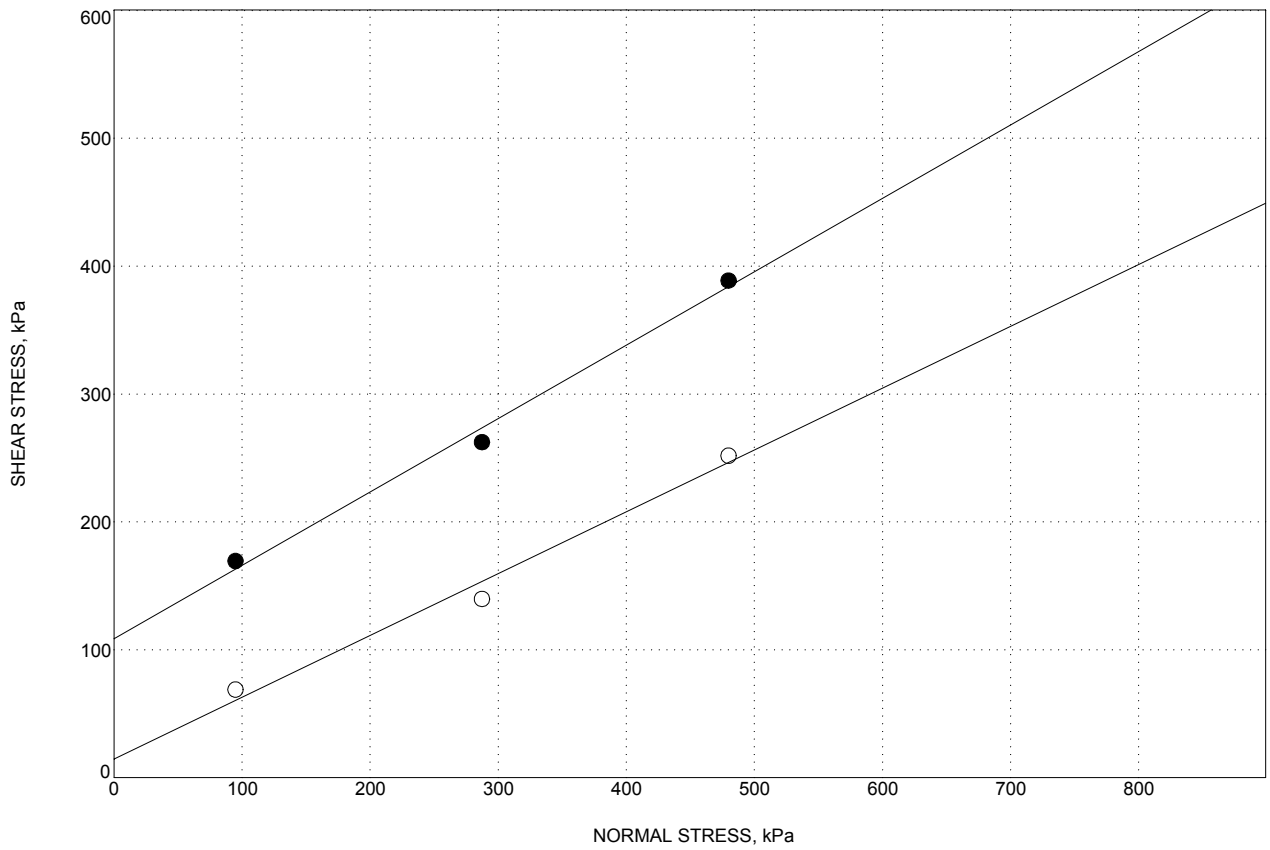
	○ ULTIMATE	● PEAK
COHESION, kPa	28.7	57.0
ANGLE OF INTERNAL FRICTION, deg	30	48

DRILL HOLE	357R/HA/04
DEPTH, m	3.0
MOISTURE CONTENT, %	18.4
UNIT DRY WEIGHT, kN/m^3	18.1
MATERIAL DESCRIPTION	SANDSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4e



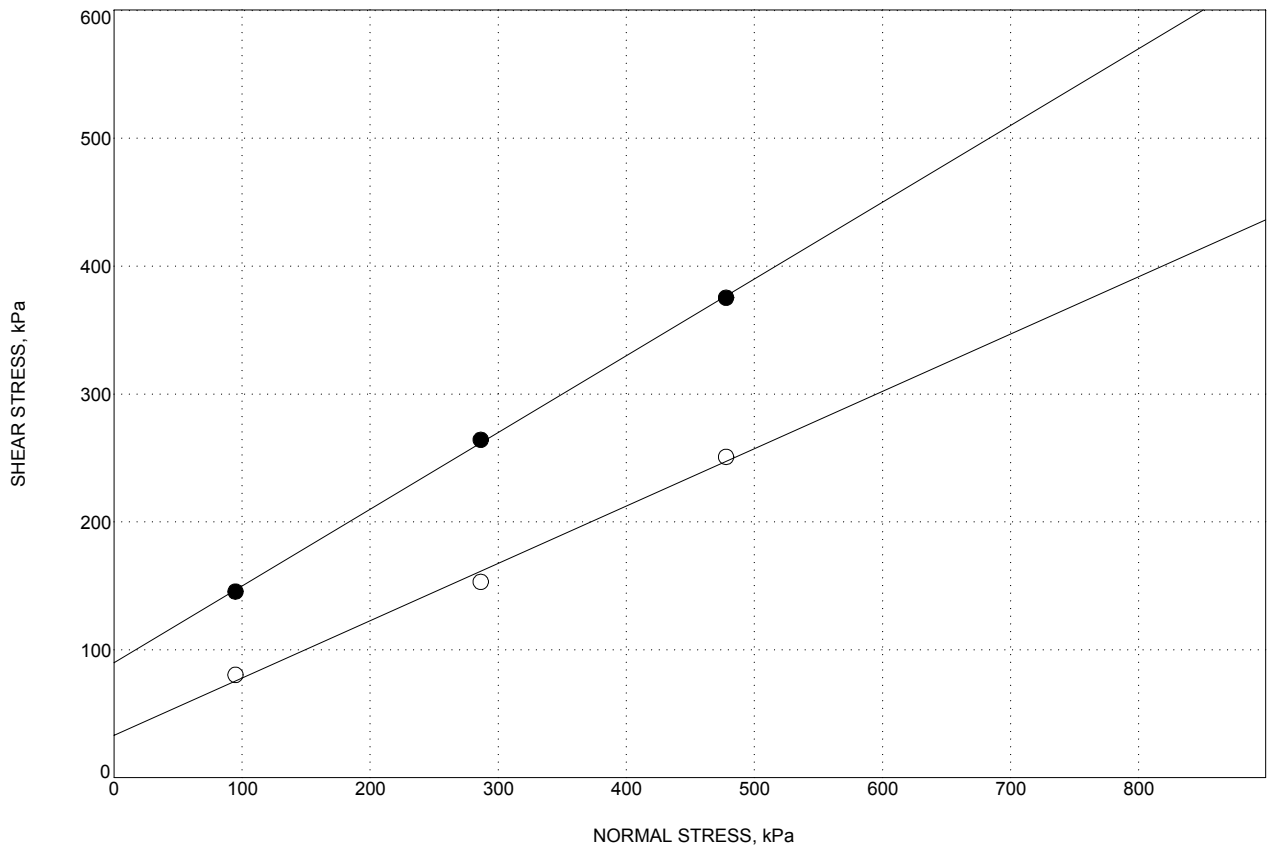
	○ ULTIMATE	● PEAK
COHESION, kPa	19.2	110.1
ANGLE OF INTERNAL FRICTION, deg	25	30

DRILL HOLE	357R1/LA/01
DEPTH, m	8.0
MOISTURE CONTENT, %	18.9
UNIT DRY WEIGHT, kN/m^3	17.6
MATERIAL DESCRIPTION	CLAYSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4f



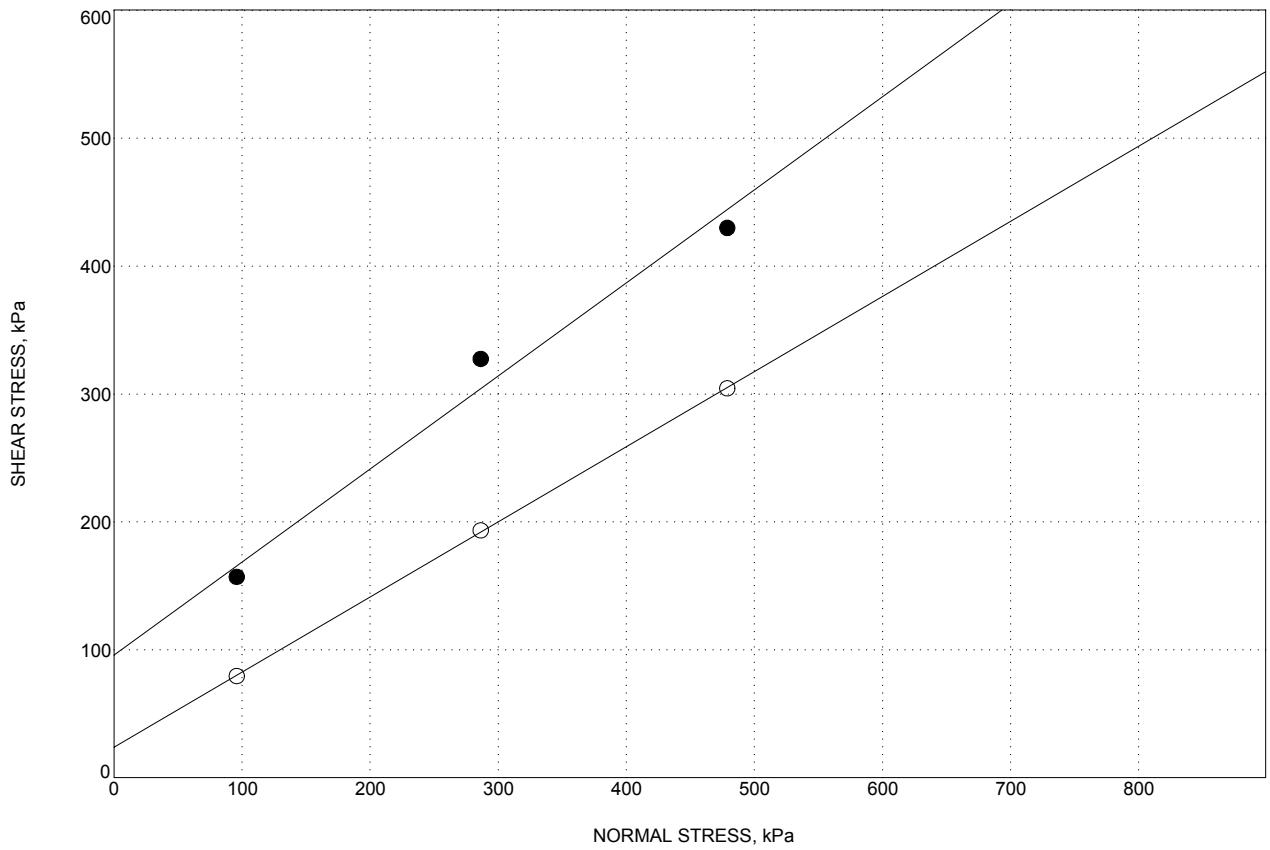
	○ ULTIMATE	● PEAK
COHESION, kPa	33.5	91.0
ANGLE OF INTERNAL FRICTION, deg	24	32

DRILL HOLE	357R1/LA/02
DEPTH, m	8.0
MOISTURE CONTENT, %	18.8
UNIT DRY WEIGHT, kN/m^3	16.9
MATERIAL DESCRIPTION	CLAYSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4g



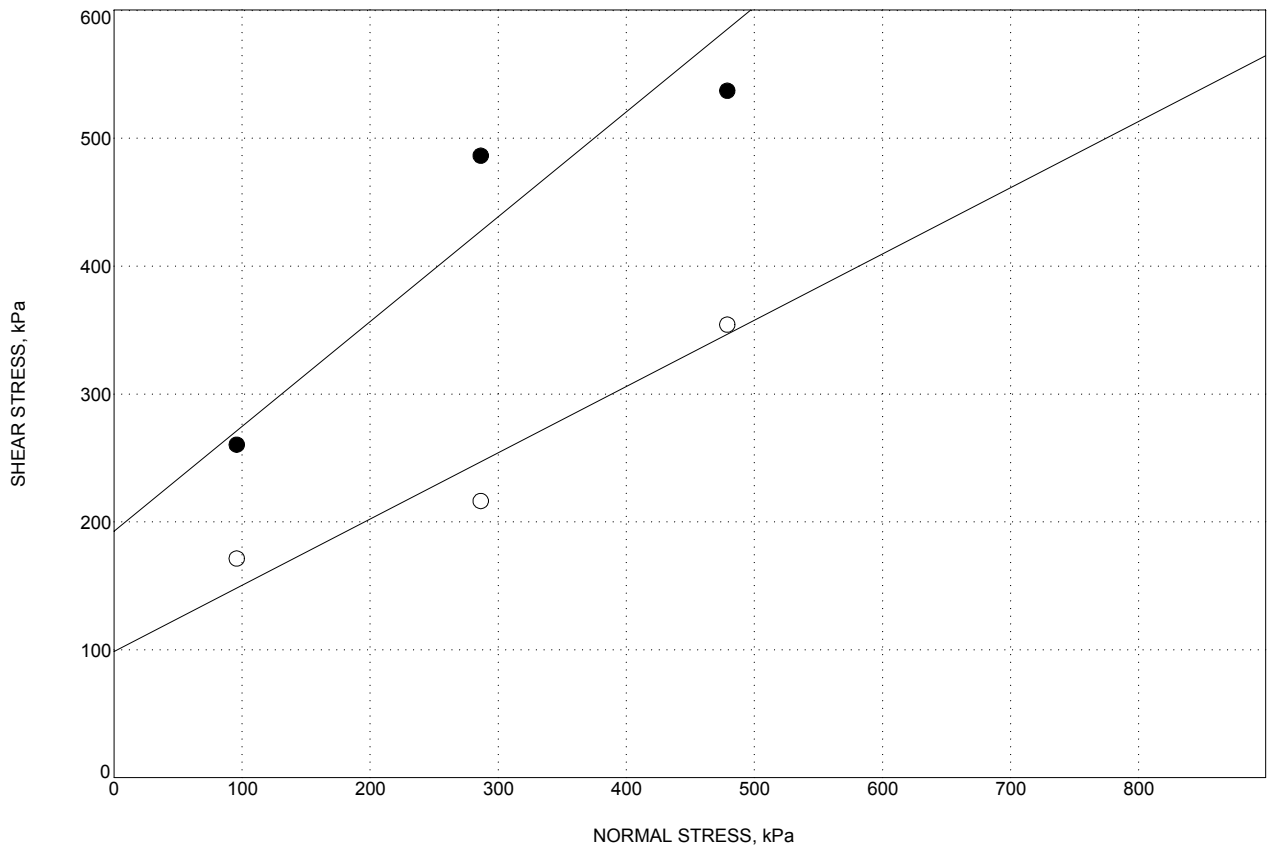
	○ ULTIMATE	● PEAK
COHESION, kPa	23.9	95.8
ANGLE OF INTERNAL FRICTION, deg	30	36

DRILL HOLE	357R1/LA/02
DEPTH, m	11.0
MOISTURE CONTENT, %	14.3
UNIT DRY WEIGHT, kN/m^3	17.8
MATERIAL DESCRIPTION	SANDSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4h



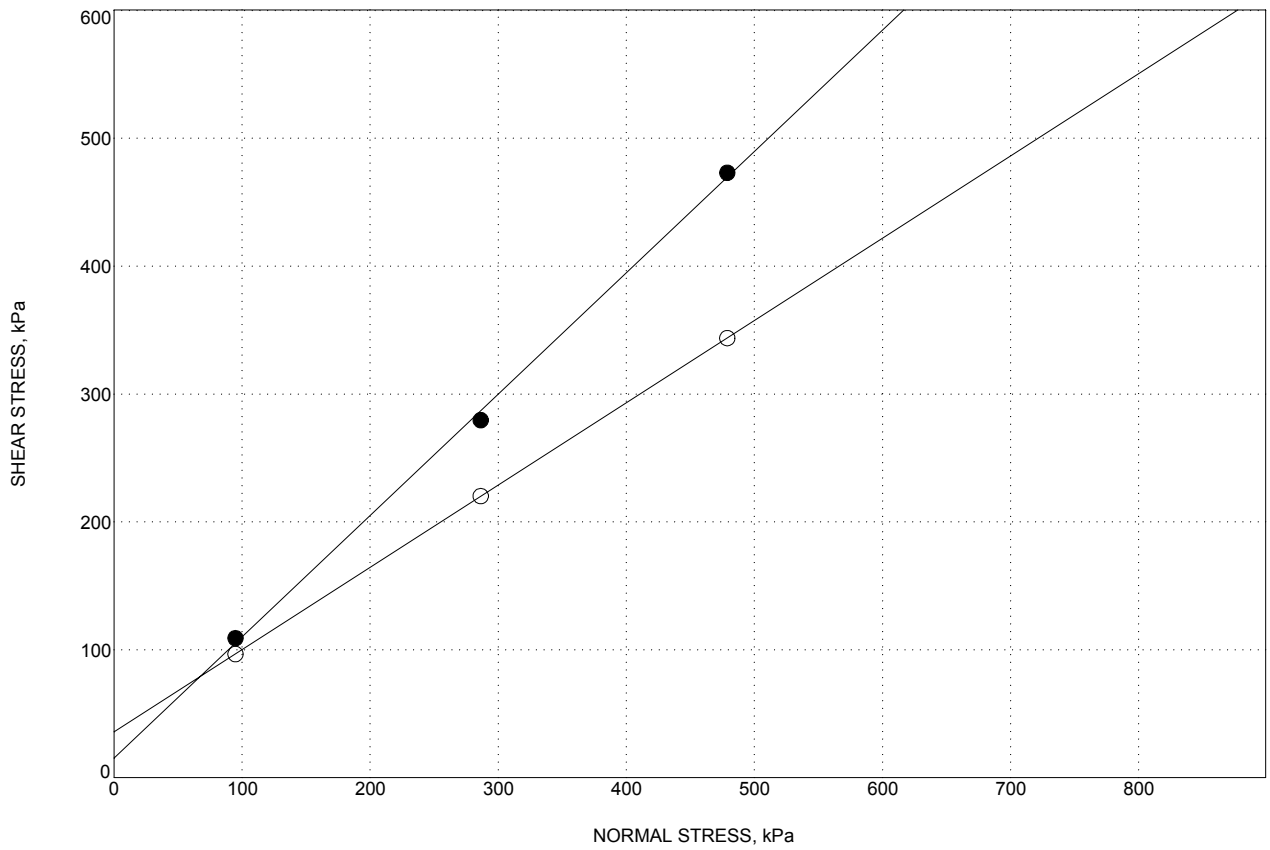
	○ ULTIMATE	● PEAK
COHESION, kPa	100.5	148.4
ANGLE OF INTERNAL FRICTION, deg	26	40

DRILL HOLE	357R1/LA/02
DEPTH, m	14.1
MOISTURE CONTENT, %	18.8
UNIT DRY WEIGHT, kN/m^3	16.9
MATERIAL DESCRIPTION	CLAYSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4i



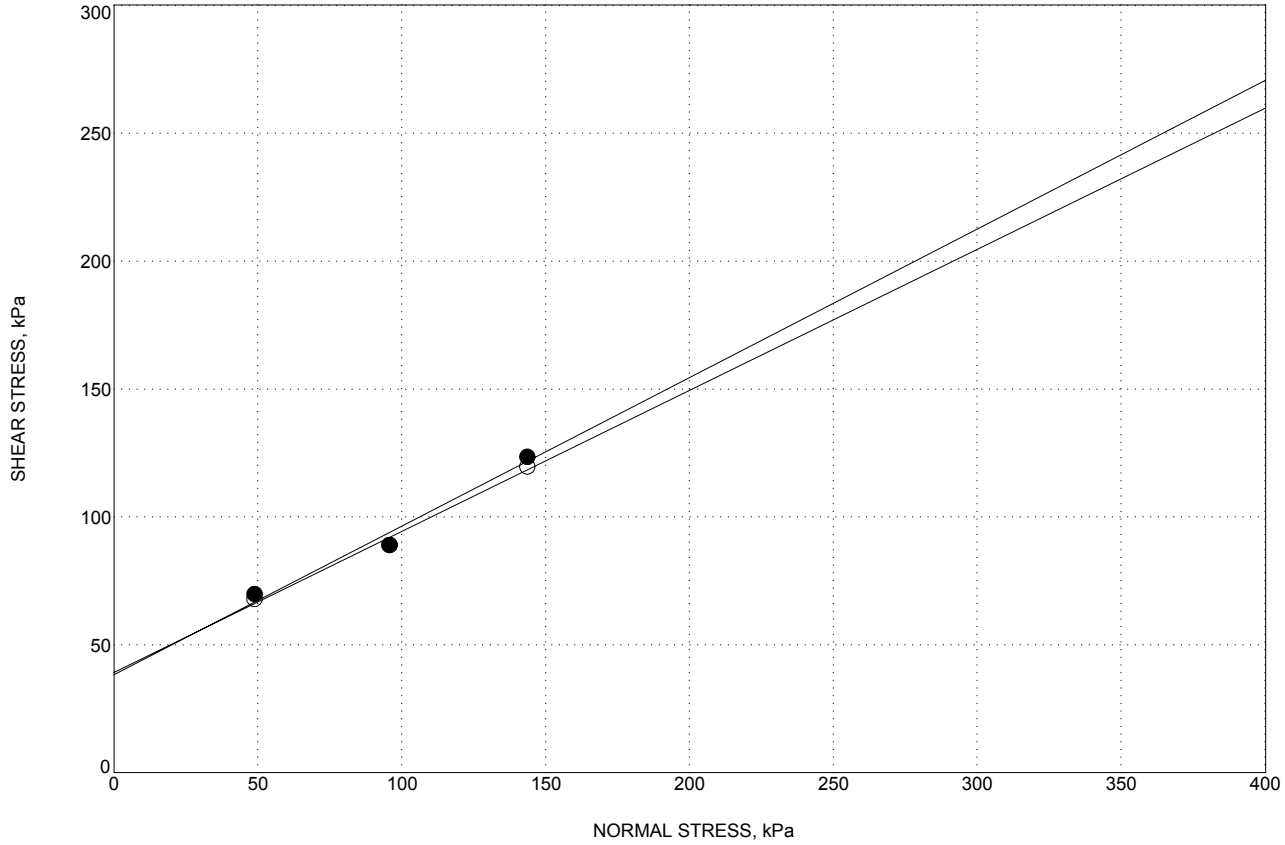
	○ ULTIMATE	● PEAK
COHESION, kPa	38.3	23.9
ANGLE OF INTERNAL FRICTION, deg	33	44

DRILL HOLE	358L/LA/02
DEPTH, m	4.6
MOISTURE CONTENT, %	12.8
UNIT DRY WEIGHT, kN/m^3	17.0
MATERIAL DESCRIPTION	CLAYSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4j



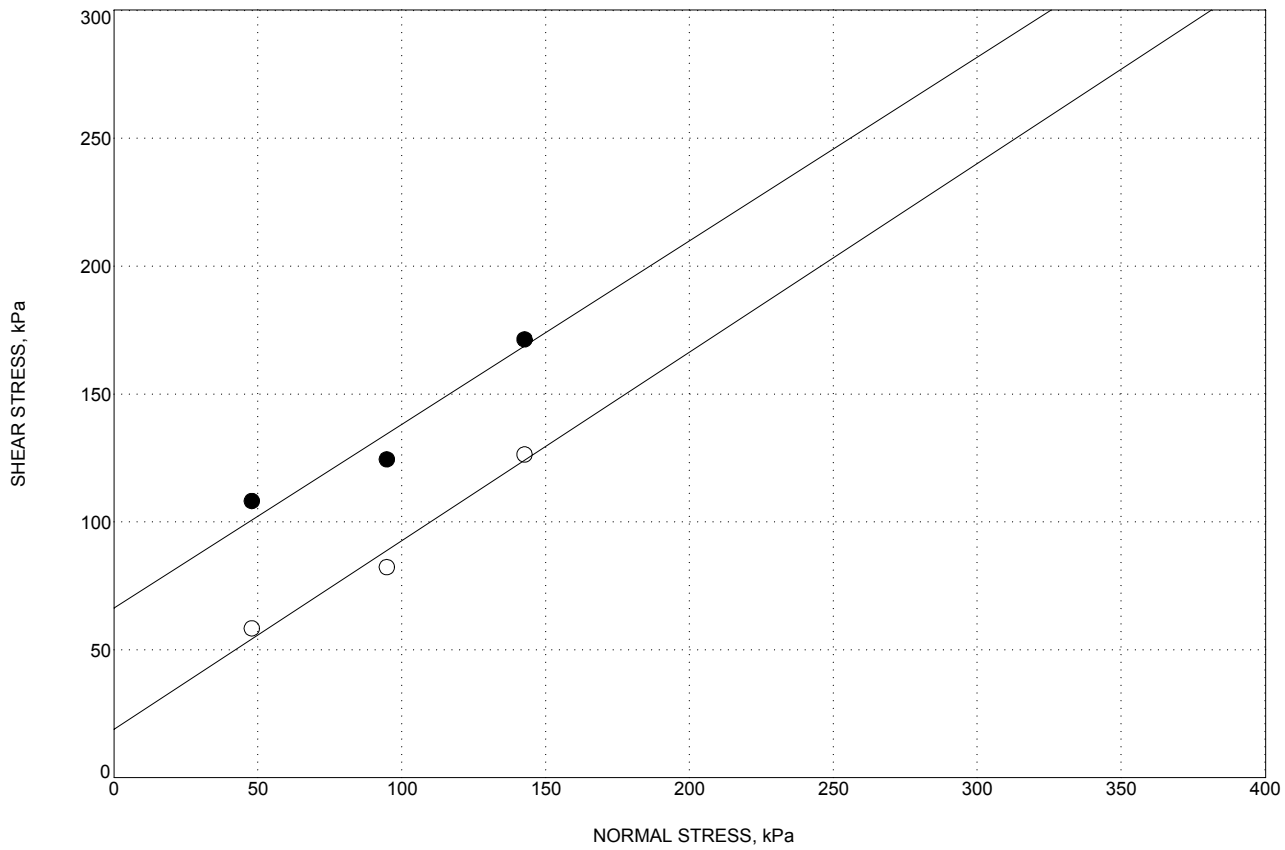
	○ ULTIMATE	● PEAK
COHESION, kPa	38.3	38.3
ANGLE OF INTERNAL FRICTION, deg	28	29

DRILL HOLE	361L/HA/02
DEPTH, m	7.6
MOISTURE CONTENT, %	24.4
UNIT DRY WEIGHT, kN/m^3	16.9
MATERIAL DESCRIPTION	Native Soil: Sandy Lean CLAY (CL)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4k



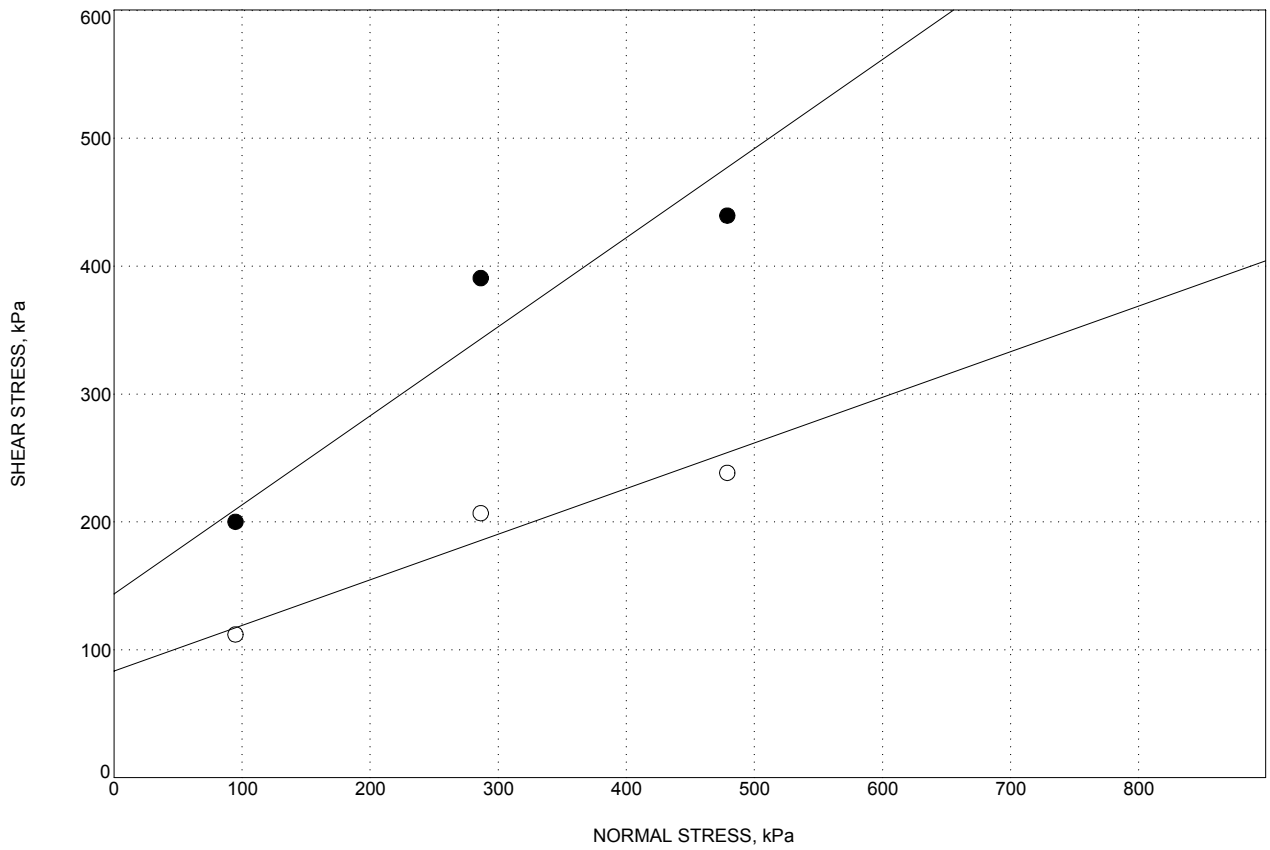
	○ ULTIMATE	● PEAK
COHESION, kPa	19.2	67.0
ANGLE OF INTERNAL FRICTION, deg	36	35

DRILL HOLE	361L/HA/03
DEPTH, m	3.0
MOISTURE CONTENT, %	18.8
UNIT DRY WEIGHT, kN/m^3	17.8
MATERIAL DESCRIPTION	Fill: Clayey SAND (SC)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4I



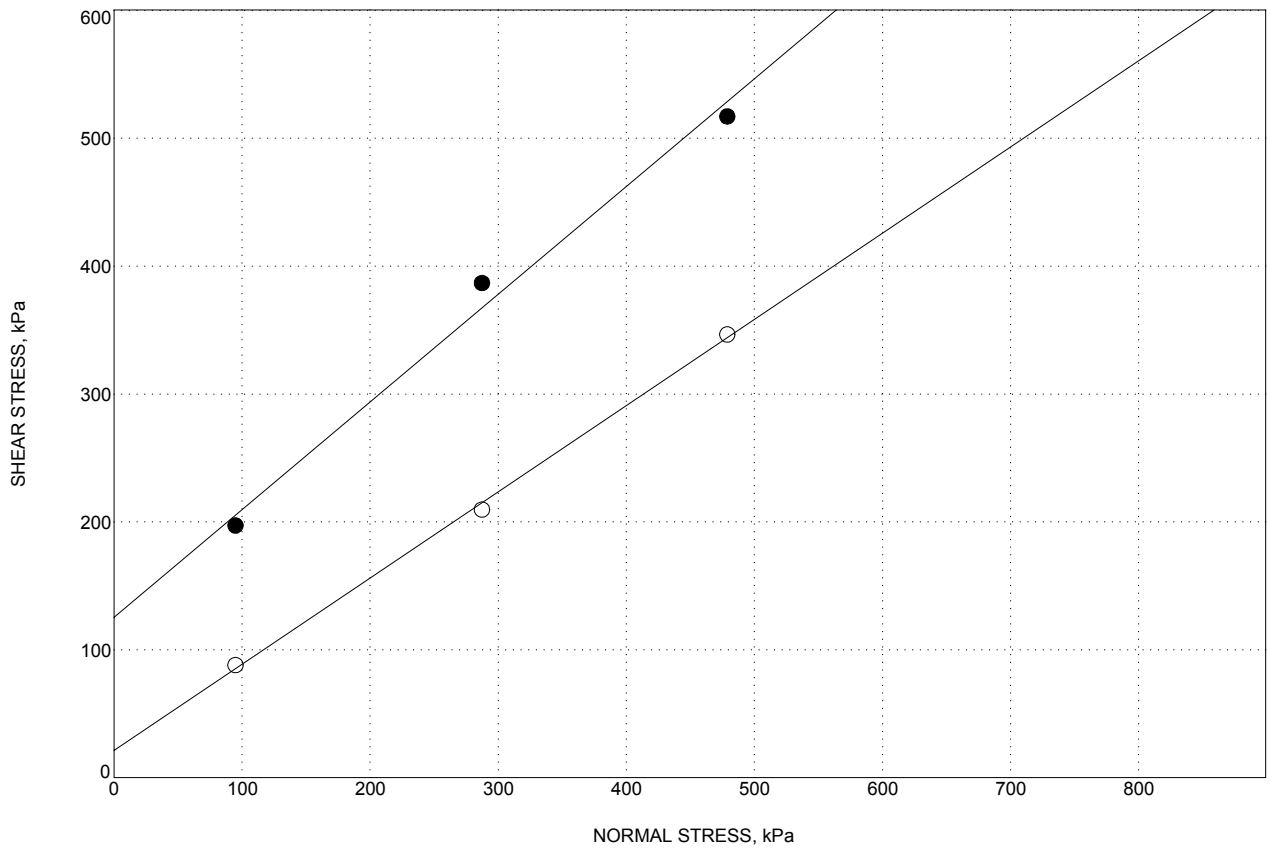
	○ ULTIMATE	● PEAK
COHESION, kPa	81.4	143.6
ANGLE OF INTERNAL FRICTION, deg	20	35

DRILL HOLE	361L1/LA/01
DEPTH, m	4.6
MOISTURE CONTENT, %	19.5
UNIT DRY WEIGHT, kN/m^3	17.3
MATERIAL DESCRIPTION	CLAYSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4m



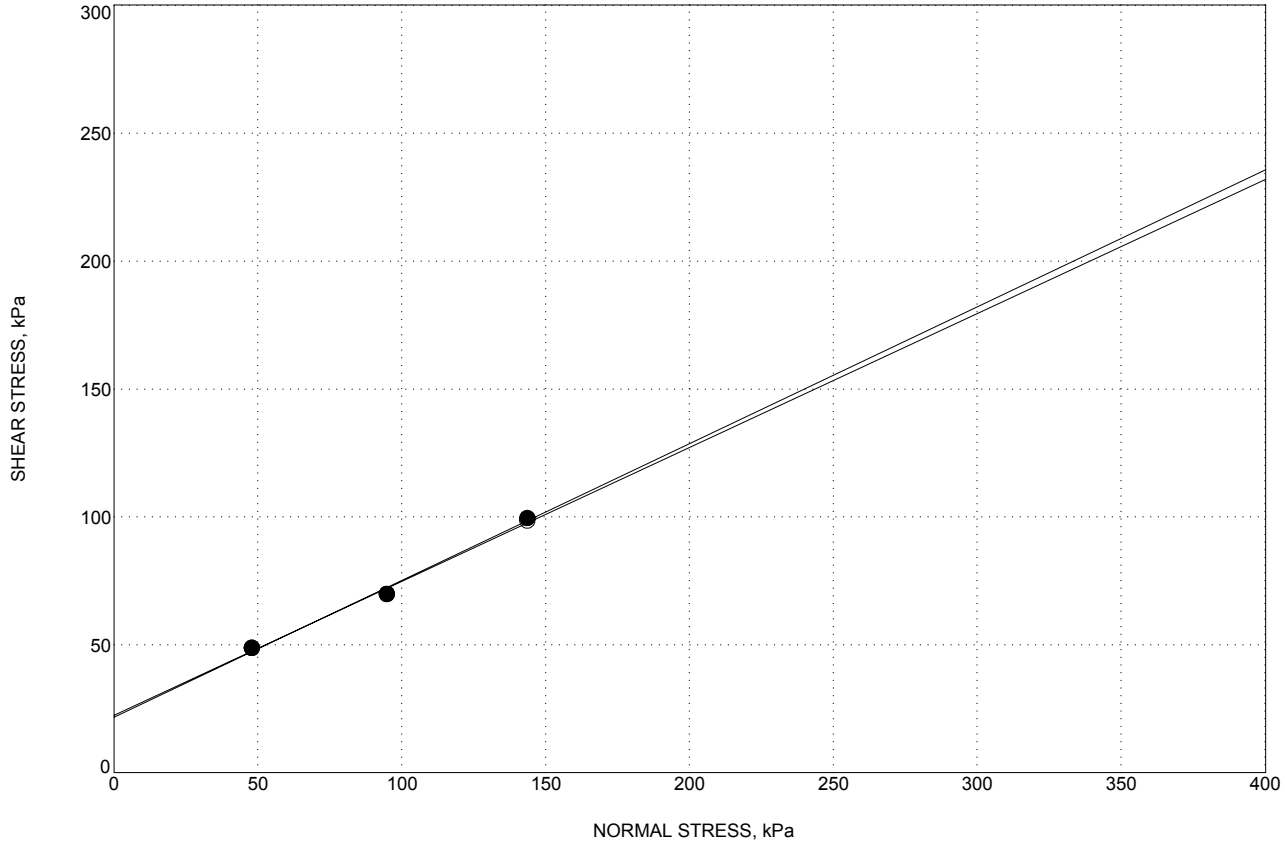
	○ ULTIMATE	● PEAK
COHESION, kPa	23.9	105.3
ANGLE OF INTERNAL FRICTION, deg	34	40

DRILL HOLE	361L1/LA/01
DEPTH, m	10.7
MOISTURE CONTENT, %	16.0
UNIT DRY WEIGHT, kN/m^3	18.7
MATERIAL DESCRIPTION	SANDSTONE (Rx)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4n



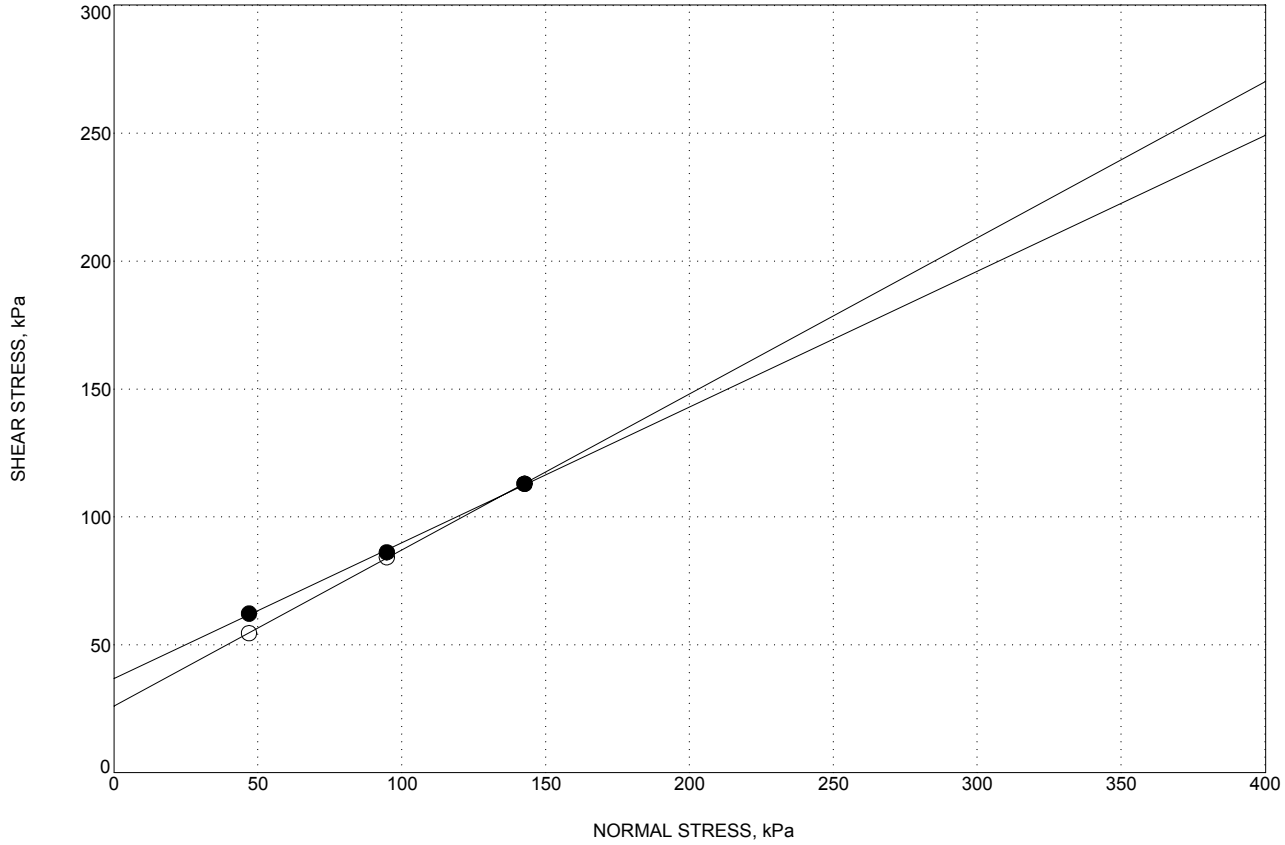
	○ ULTIMATE	● PEAK
COHESION, kPa	23.9	23.9
ANGLE OF INTERNAL FRICTION, deg	27	28

DRILL HOLE	361R/HA/01
DEPTH, m	0.9
MOISTURE CONTENT, %	11.6
UNIT DRY WEIGHT, kN/m^3	20.9
MATERIAL DESCRIPTION	Fill: Sandy Fat CLAY (CH)
SAMPLE CONDITION	Remolded

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4o



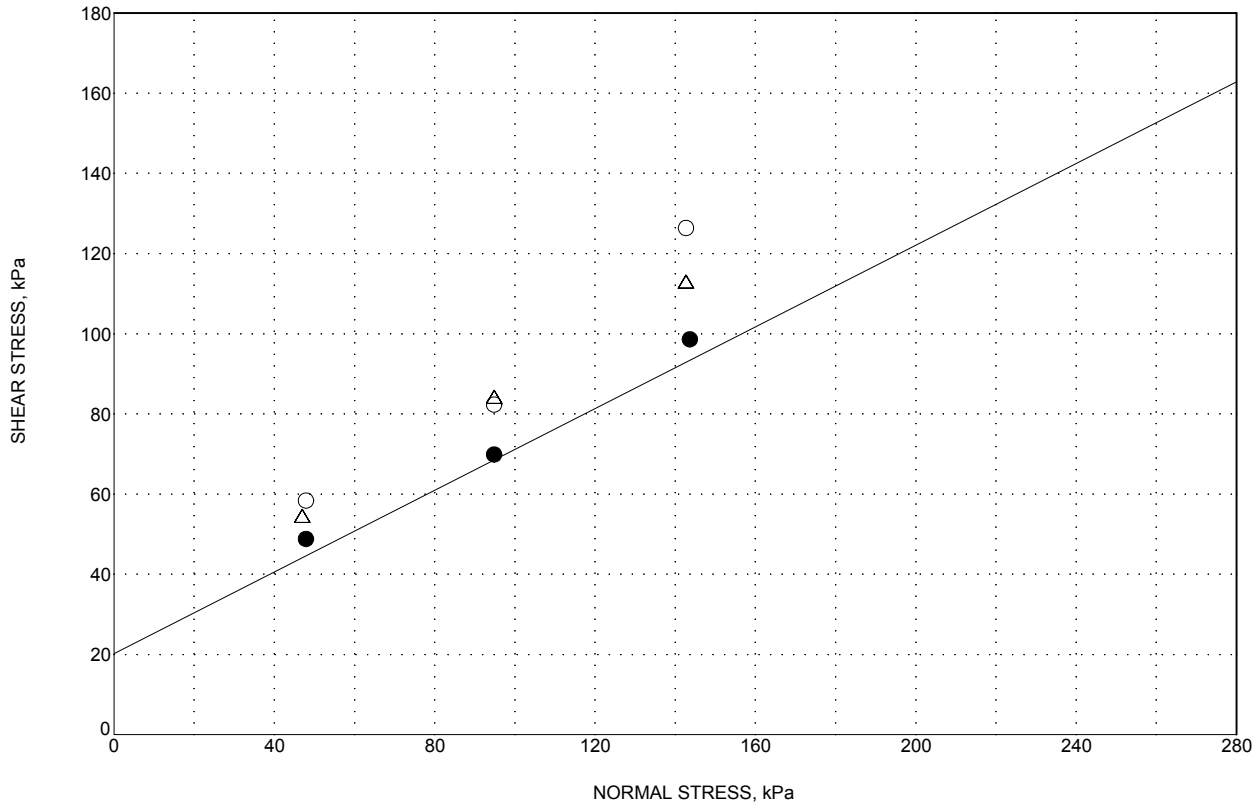
	○ ULTIMATE	● PEAK
COHESION, kPa	28.7	33.5
ANGLE OF INTERNAL FRICTION, deg	31	28

DRILL HOLE	361R/HA/01
DEPTH, m	2.3
MOISTURE CONTENT, %	24.1
UNIT DRY WEIGHT, kN/m^3	15.3
MATERIAL DESCRIPTION	Fill: Clayey SAND (SC)
SAMPLE CONDITION	Intact

DIRECT SHEAR TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-4p



	ULTIMATE
COHESION, kPa	20
ANGLE OF INTERNAL FRICTION, deg	27

LEGEND

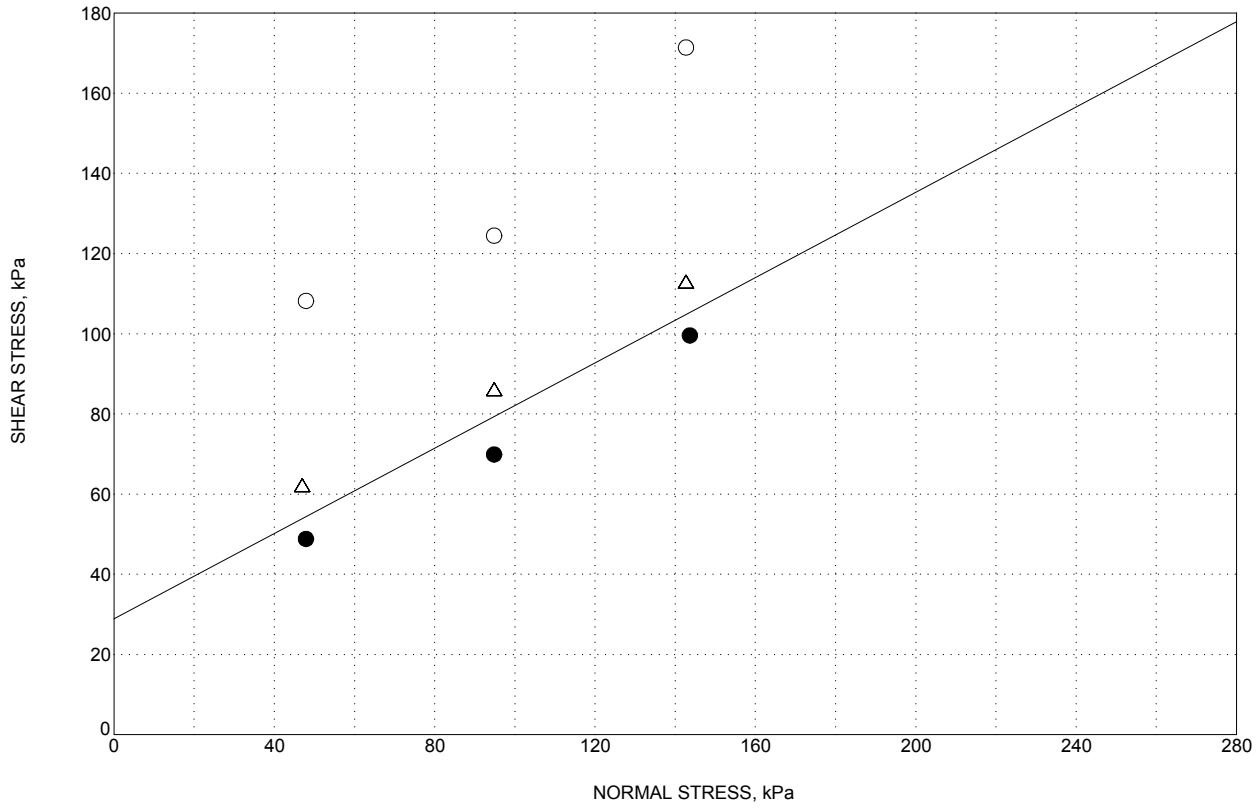
	location	depth, m
○	361L/HA/03	3.0
●	361R/HA/01	0.9
△	361R/HA/01	2.3

DIRECT SHEAR TEST RESULTS ENVELOPE (FILL)

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016

San Diego, California

FIGURE II-4q



	PEAK
COHESION, kPa	30
ANGLE OF INTERNAL FRICTION, deg	28

LEGEND

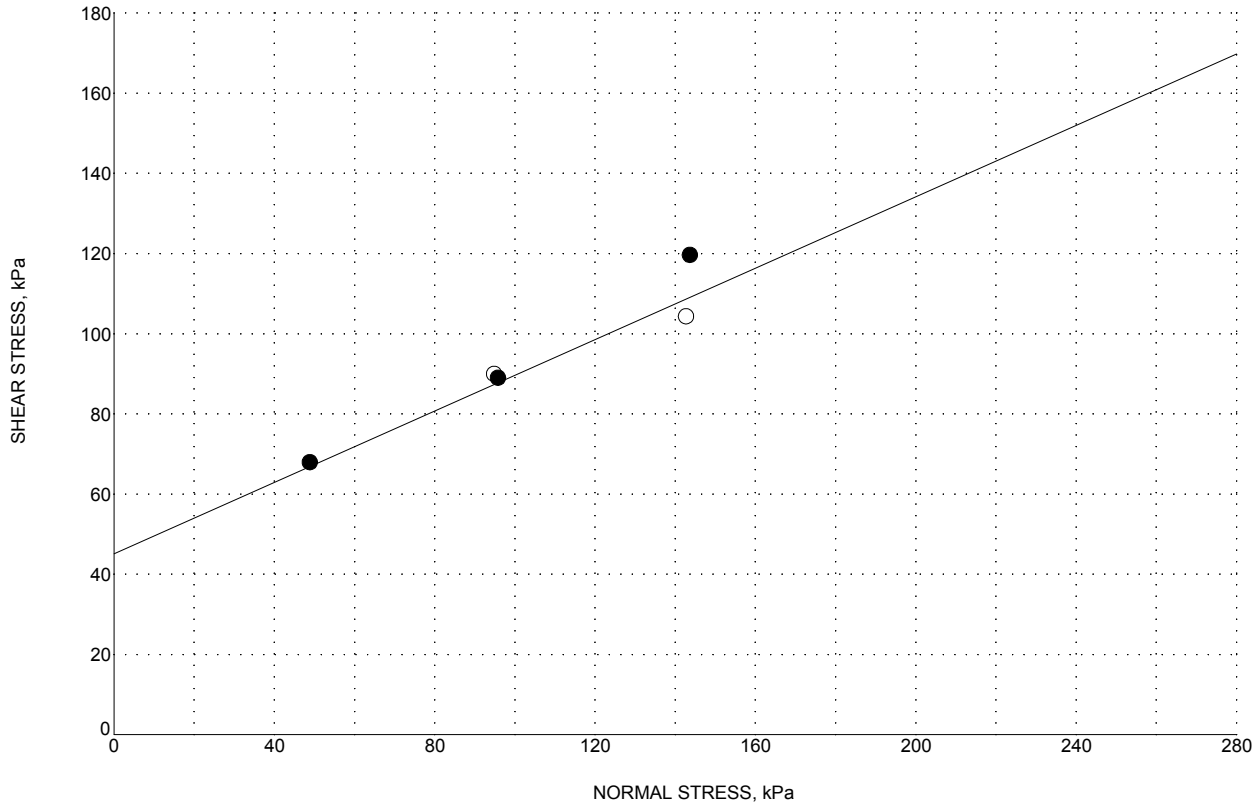
	location	depth, m
○	361L/HA/03	3.0
●	361R/HA/01	0.9
△	361R/HA/01	2.3

DIRECT SHEAR TEST RESULTS ENVELOPE (FILL)

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016

San Diego, California

FIGURE II-4r



	ULTIMATE
COHESION, kPa	45
ANGLE OF INTERNAL FRICTION, deg	24

LEGEND

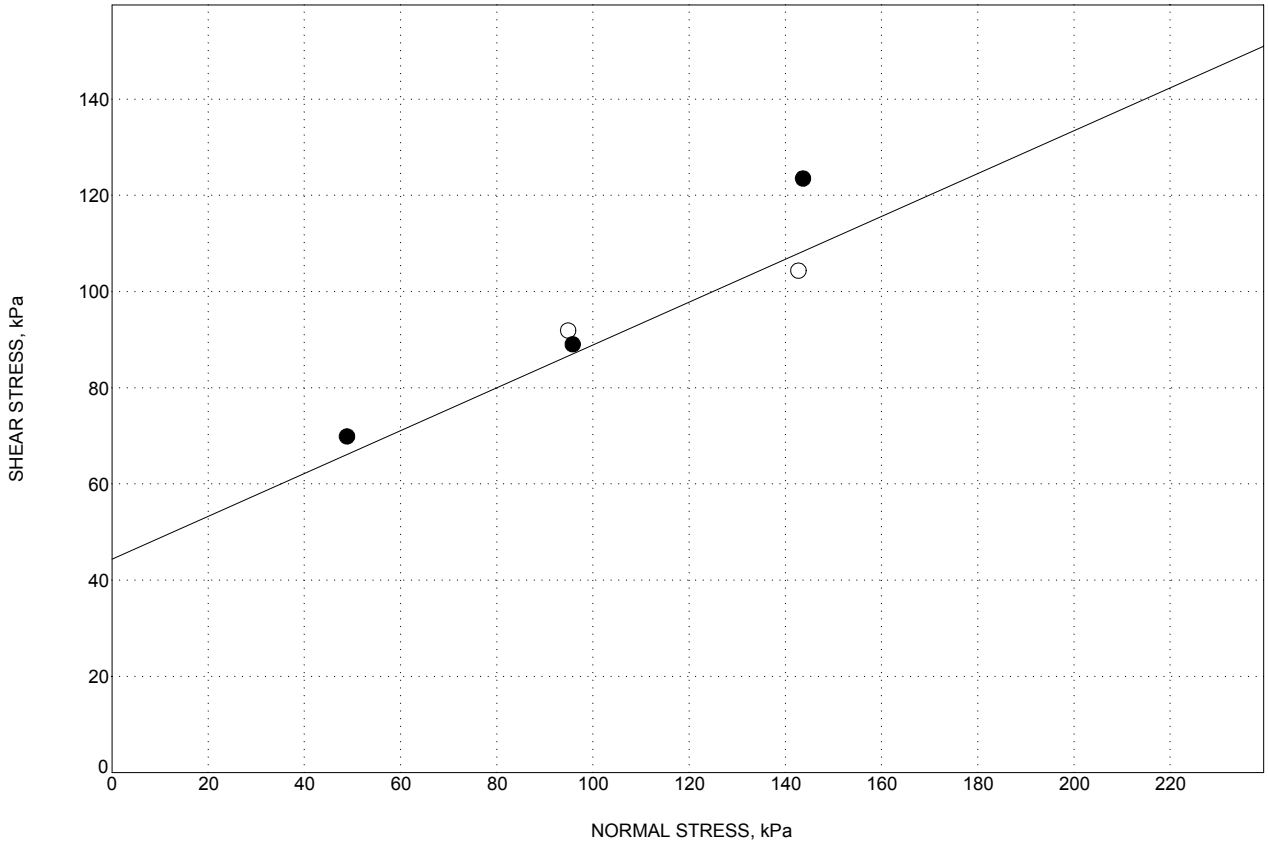
	location	depth, m
○	346L/LA/04	2.6
●	361L/HA/02	7.6

DIRECT SHEAR TEST RESULTS ENVELOPE (NATIVE SOIL)

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016

San Diego, California

FIGURE II-4s



	PEAK
COHESION, kPa	45
ANGLE OF INTERNAL FRICTION, deg	24

LEGEND

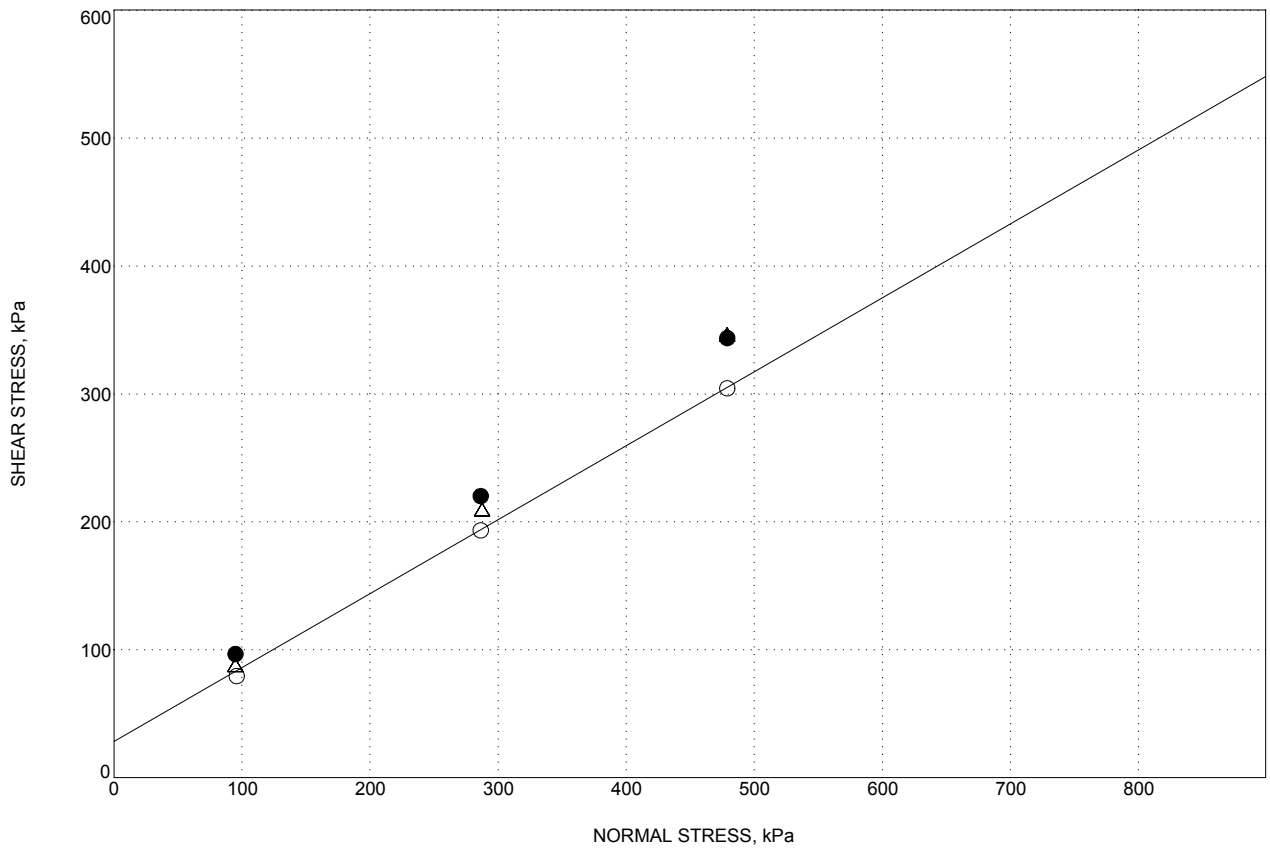
	location	depth, m
○	346L/LA/04	2.6
●	361L/HA/02	7.6

DIRECT SHEAR TEST RESULTS ENVELOPE (NATIVE SOIL)

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016

San Diego, California

FIGURE II-4t



	● ULTIMATE
COHESION, kPa	25
ANGLE OF INTERNAL FRICTION, deg	30

LEGEND

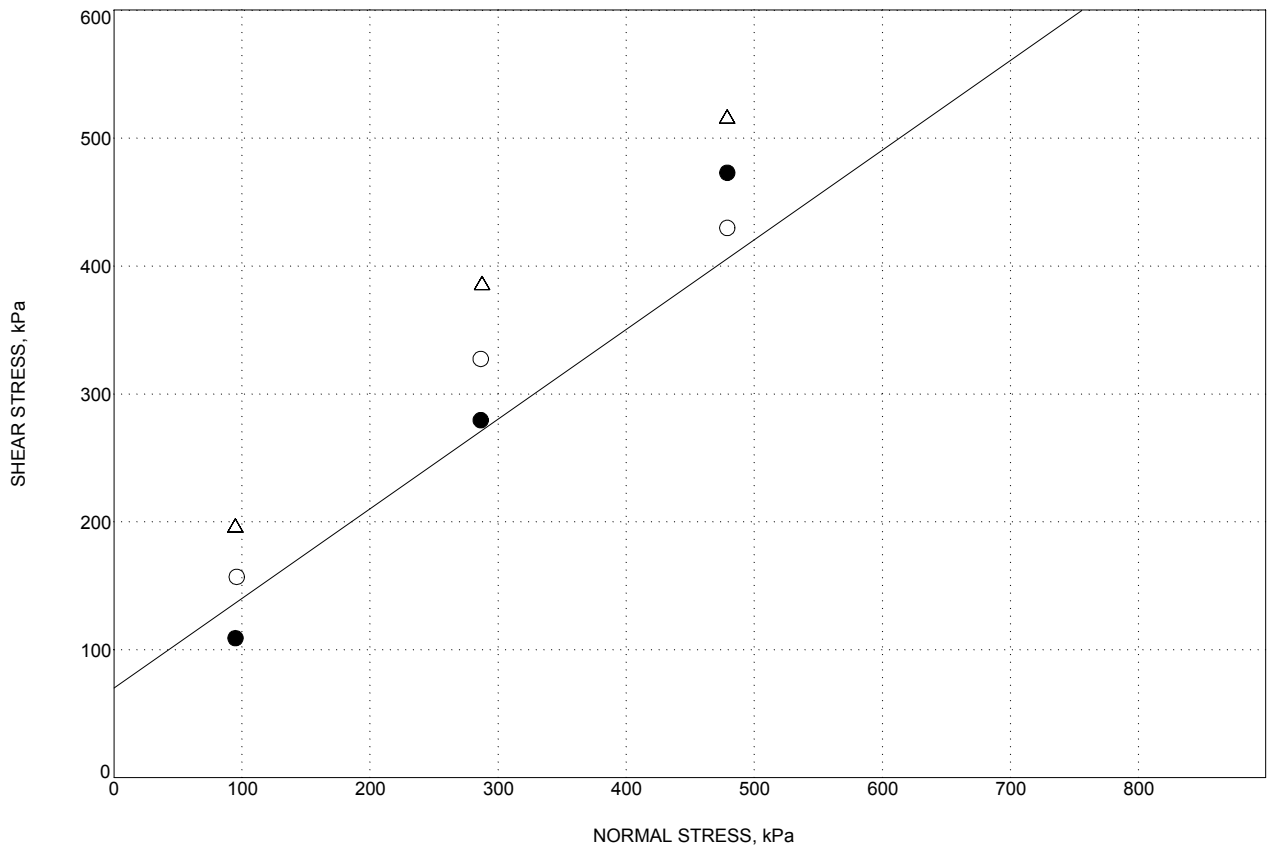
	location	depth, m
○	357R1/LA/02	11.0
●	358L/LA/02	4.6
△	361L1/LA/01	10.7

DIRECT SHEAR TEST RESULTS ENVELOPE (SANDSTONE)

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016

San Diego, California

FIGURE II-4u



	● PEAK
COHESION, kPa	75
ANGLE OF INTERNAL FRICTION, deg	35

LEGEND

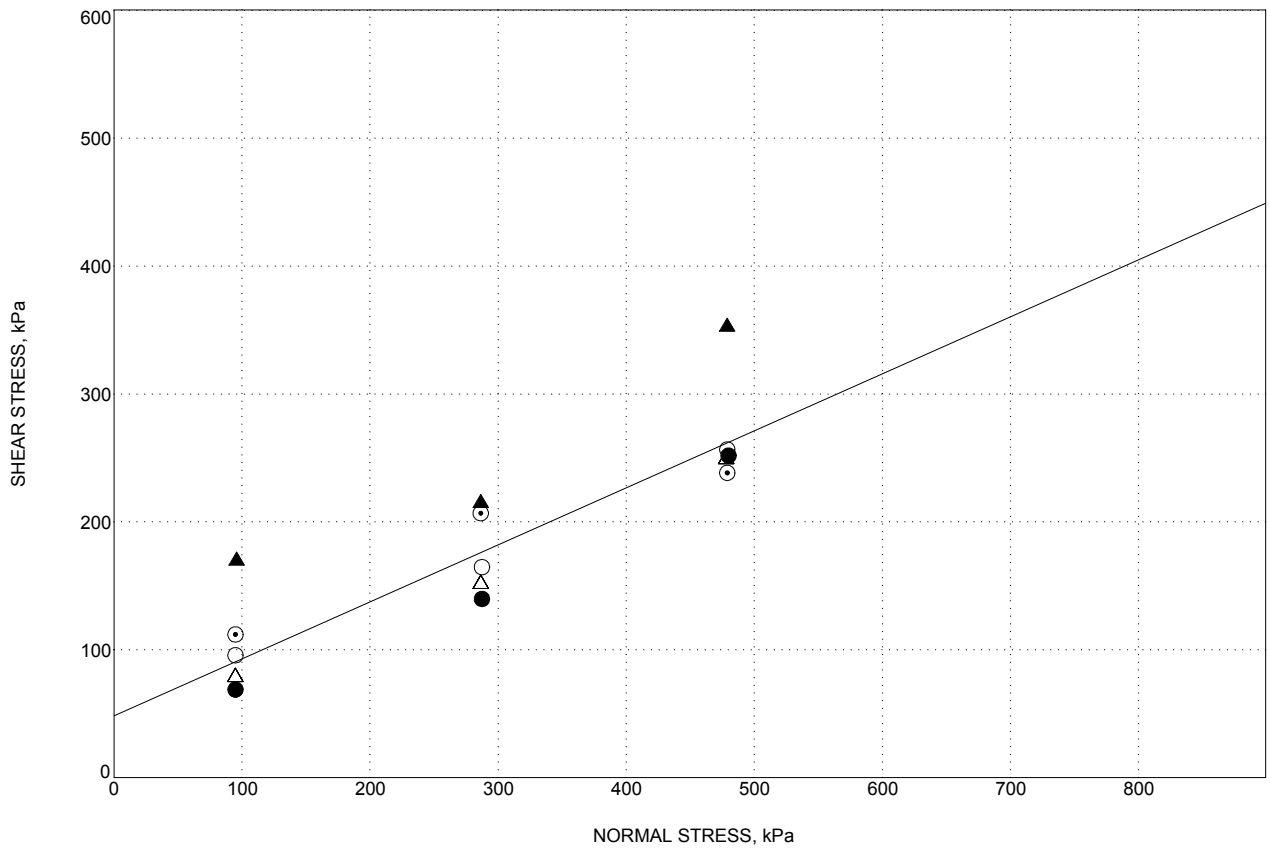
	location	depth, m
○	357R1/LA/02	11.0
●	358L/LA/02	4.6
△	361L1/LA/01	10.7

DIRECT SHEAR TEST RESULTS ENVELOPE (SANDSTONE)

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016

San Diego, California

FIGURE II-4v



	● ULTIMATE
COHESION, kPa	50
ANGLE OF INTERNAL FRICTION, deg	24

LEGEND

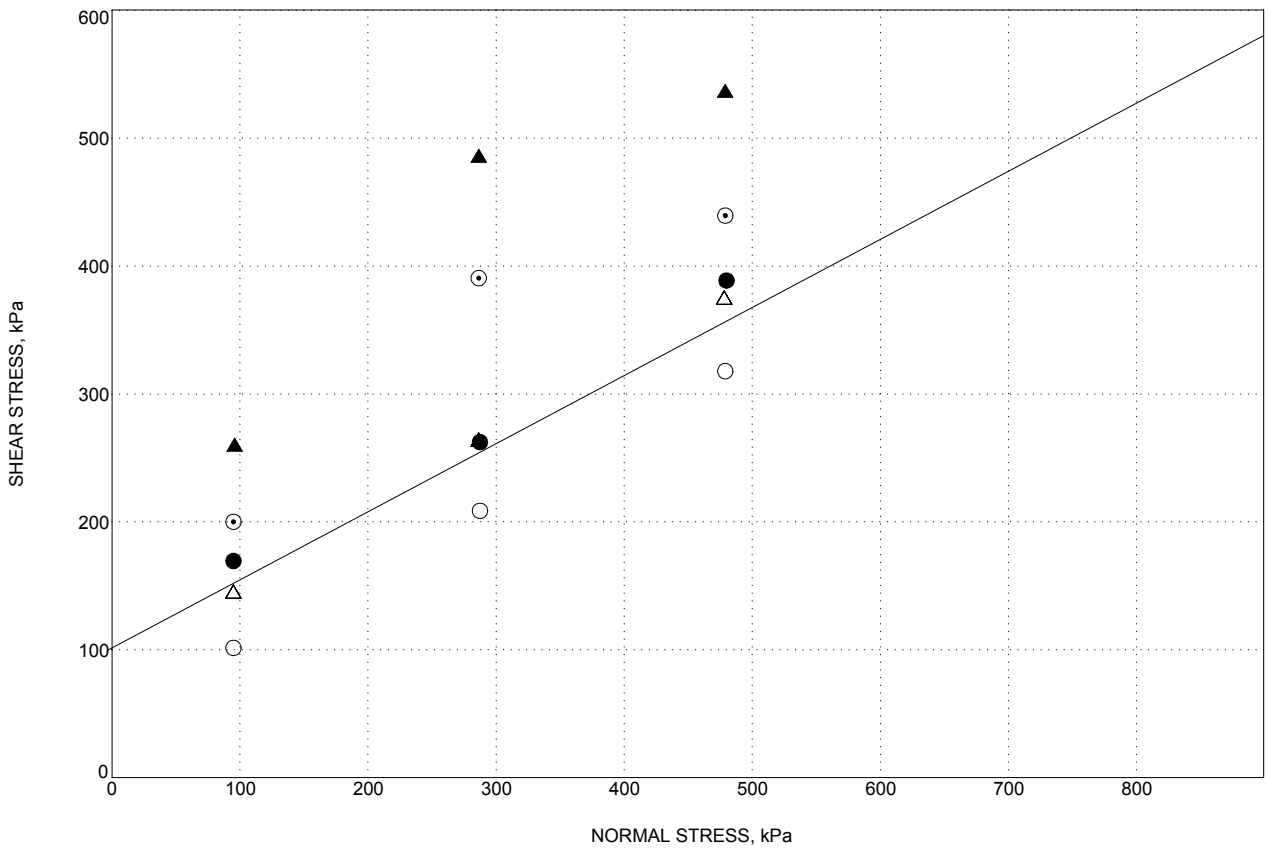
	location	depth, m
○	353R/LA/03	7.7
●	357R1/LA/01	8.0
△	357R1/LA/02	8.0
▲	357R1/LA/02	14.1
⊙	361L1/LA/01	4.6

DIRECT SHEAR TEST RESULTS ENVELOPE (CLAYSTONE)

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016

San Diego, California

FIGURE II-4w



	● PEAK
COHESION, kPa	100
ANGLE OF INTERNAL FRICTION, deg	28

LEGEND

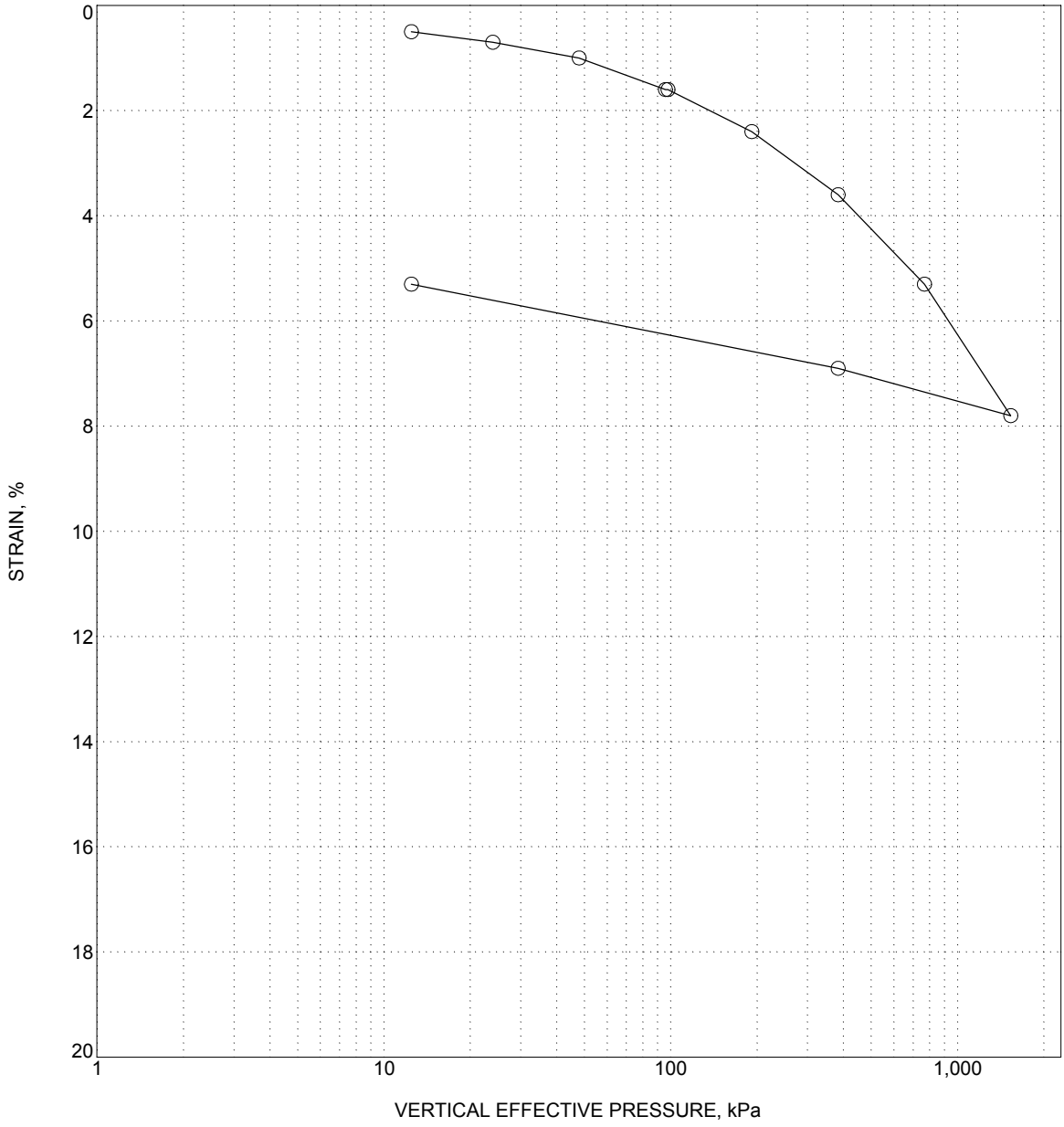
	location	depth, m
○	353R/LA/03	7.7
●	357R1/LA/01	8.0
△	357R1/LA/02	8.0
▲	357R1/LA/02	14.1
⊙	361L1/LA/01	4.6

DIRECT SHEAR TEST RESULTS ENVELOPE (CLAYSTONE)

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016

San Diego, California

FIGURE II-4x

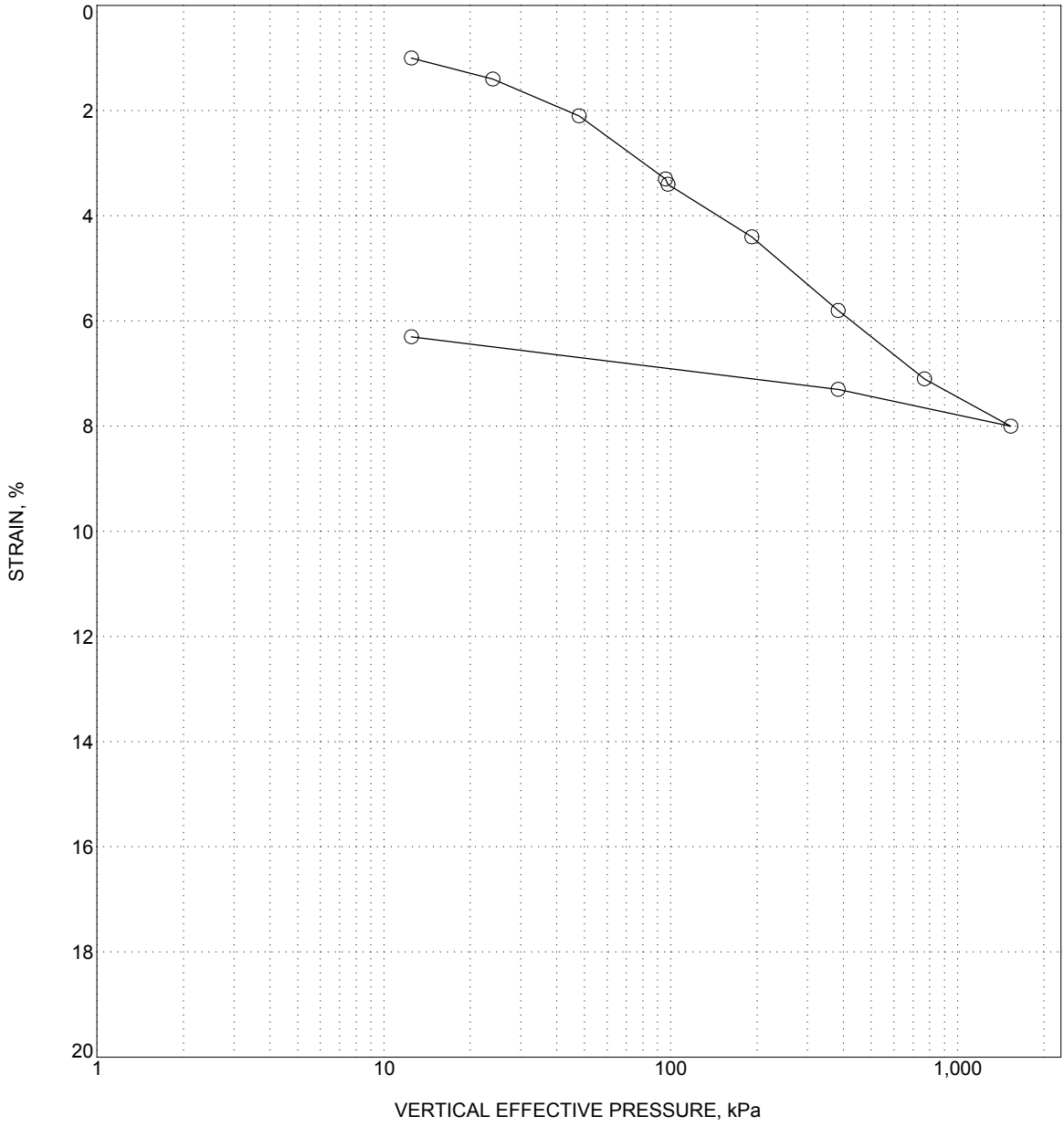


LOCATION	361L/HA/03
DEPTH, m	4.0
INITIAL MOISTURE CONTENT, %	17
UNIT DRY WEIGHT, kN/m^3	17
MATERIAL DESCRIPTION	Fill: Clayey SAND (SC)
SAMPLE CONDITION	

CONSOLIDATION TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-5a



LOCATION	361R/HA/02
DEPTH, m	7.6
INITIAL MOISTURE CONTENT, %	25
UNIT DRY WEIGHT, kN/m^3	16
MATERIAL DESCRIPTION	Native Soil: Sandy Lean CLAY (CL)
SAMPLE CONDITION	

CONSOLIDATION TEST RESULTS

Route 15/56 Separation Managed Lanes, Stage 1: Task Order No. 284016
San Diego, California

FIGURE II-5b